



Jijamata Mahavidyalaya, Buldhana

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भारतातील मानवी व्यंगाचा अचूक वेध घेणारे काव्य : भारत कधी कधी माझा देश आहे

डॉ. अनंत रायसिंग सिरसाठ

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Research Paper - Marathi

भारत देश हा विविध भाषा, संस्कृतीने नटलेला देश आहे. डॉंगरदऱ्या आणि विविध पीके घेण्याच्या पद्धतीमुळे येथे विविधता आढळून येते. छोट्या-मोठ्या नद्यांनी येथील सौंदर्य खुलवलेले आहे. विविध सण साजरे करण्यामध्येही येथे विविधता आढळून येते. पण या सर्वांमधून संस्कार हा महत्त्वाचा घागा पकडून सर्व काही चालते. जसे येथील नागरिकांमध्ये संस्कार आहेत तसे काही लोक संस्कारहीन आहेत. तर काही सर्व कळत असूनही नकळतेपणाचा बुरखा घेऊन जीवन जगत असतात. त्यांच्या स्वभावाचा, स्वार्थी वागण्याचा, नाटकी जगण्याचा पर्दाफास करण्याचे काम रामदास फुटाणे यांनी केले आहे.

रामदास फुटाणे यांचा 'भारत कधी कधी माझा देश आहे' कवितासंग्रह जानेवारी १९९७ ला प्रकाशित झाला. कविता जरी छोट्यानी वाटत असल्या तरी त्या कवितांनी वर्तमान आणि वर्धमान राजकारणाचा चांगला समाचार घेतलेला आहे. मलपृष्ठाने विवेचनात पु.ल. देशपांडे लिहितात, "वरवर हलक्या फुलक्या वाटणाऱ्या या कवितांचं पाणी खोल आहे. खुर्चीवर राजकारण्यांच्या लीलांनी हैराण झालेल्या जनमानसांची ही स्पंदने आहेत!" राजकारणामध्ये खुर्चीसाठी कसे राजकारण खेळले जाते. याचा इतिहास सर्वांना माहितीचा आहेच. खुर्चीसाठी कोलांटोड्ड्या मारणारे, ह्याची टोपी त्याला त्याची टोपी याला घालणारे, एखादा पक्षी एका झाडावरून दुसऱ्या झाडावर सहज जाऊन बसावा किंवा अंगावरचे कपडे बदलावे तसा पक्ष बदलणारे राजकारणी हे पूर्वीपासून चालत आलेले आहेतच. कुणाला पक्षाची आस्था नाही व जनतेचे देणे घेणे नाही. पण हे सर्व आम्ही जनतेच्या



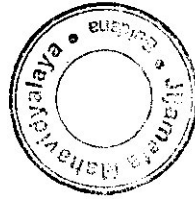


भल्यासाठी करतो आहोत हे वरुन आव आणण्याचा प्रयत्न या सर्व गोष्टीचे विडंबन विनोदी शैलीतून कवी करतात.

'भारत कधी कधी माझा देश आहे' या कवितासंग्रहातील काव्याबद्दल फ.मु. शिंदेंनी मलपृष्ठावरील विवेचनात असं म्हटलं की, "भारत कधी कधी माझा देश आहे हा वर्तमान आणि वर्धमान राजकारणाचा व्यंग्यशैलीनं नटलेला आलेख आहे. व्यक्ती, राजकारण आणि स्वभाव यांतून चित्रदिवित्र राजकारण पुढं येतं. पुढं येण्यात आणि पुढं आणण्यात ज्यांचा पायाभूत हातभार असतो ते पुढारी ! पुढार्यांच्या पोटात शिरून कविता विषय बाहेर काढण्यात कवी रामदास फुटाणे वाकबगार आहेत." राजकारणामध्ये आपण पाहतो नेत्याचे बोट धरून एक एक सिडी चढली जाते. पण पुढे असे होते की, कार्यकर्ताच नेत्यासारखा वागू लागतो, नेत्याला जाणीवपूर्वक टाळतो. ज्याच्या आघाराने शिडी चढली जाते त्याला ओव्हरटेक करून पुढे जायला लागतो. तेव्हा कधी कधी त्याची शिडी काढून घेतली जाते तर कधी तोच नेत्याची शिडी काढून घेतो. एकमेकांवर कुरघोडी होत राहते. शेवटी या जीवघेण्या खेळात एक जिंकतो एक हारतो. हा खेळ घरापर्यंत येऊन पोहोचला. बायकोची शिडी करून नवरा मोठा व्हायला लागला. या सर्व गोष्टीच्या व्यंगाचा परामर्श फुटाणे घेतात.

राजकारणामध्ये आरक्षण आले. पण त्याचा फायदा कोण घेतो हे सर्वश्रुत आहे. महिला आरक्षण सुटलं तर बायको उभी करून ती फक्त नामधारी, सयाजीराव म्हणून पण कारभार मात्र पतीच पाहतो. पती परमेश्वर या न्यायाने तीही वागते. दुसऱ्या बाजूला दलितांचे आरक्षण सुटले जाते. तिथेही आपल्या शेतातला गडी किंवा आपल्या ऐकण्यातला दलित उमा केला जातो. त्याचे राजकारण हाच हाताळतो. या सर्व गोष्टींचा व्यंग्यशैलीनं फुटाने समाचार घेतात. वास्तव उघड करणारी, लोक जाणिवेचे विषय हाताळणारी, वृत्ती-प्रवृत्तीचा शोध घेणारी, लोकभावनेचा आदर करणारी फुटाणे यांची कविता आहे. विडंबन करणे ही काही साधी बाब नाही. विडंबनाला विनोदाची धार असावी लागते. तेव्हा त्याचा किनाराही चांगलाच असतो.

बहुरूपी हे सर्वपरिचित आहेत. बहुरूपी अनेकांचे सोंगे घेतात. मिस्किलपणे त्यांचे विडंबन करतात. पण त्यांच्या विडंबनामध्ये सत्यता असते. इथे मात्र असत्याचा डाव मांडला जातो. मी सत्य कसा आहे, याचा खेळ खेळला जातो. संसारापासून ते राजकारणापर्यंत ही सोंगे खेळली जातात. त्यात दाखवायचे दात एक अन् खायचे दात निराळे अशी सोंगे वटवली जातात. प्रत्येकजण आपलं प्यादं सरकवत आहे. ते खोटं असतानाही खरं कसं आहे हे सांगण्याचा आटोकाट प्रयत्न करत आहे. ही माणसांची सोंगे करताना माणूस जवळचे-लांबचे माणसे, नाते याचाही विचार करत नाही. फसवा-फसवीचे राजकारण एवढे पुढे गेले की प्रत्येकाला दुसऱ्याला फसवत आहे. मी कसे फसवले हा म्हणतो तर कसा फसला तो म्हणतो. दोघांनीही फसवा डाव खेळलेला असतो. दोघेही जिंकल्याचा





आव आणतात. पण दोघेही फसलेले असतात याचा खरपूस समाचार विनोदीबुद्धीने कवी घेताना दिसतात. आपल्या भारताची प्रतिज्ञा 'भारत माझा देश आहे' अशी आहे. पण असे असतानाही ते फक्त प्रतिज्ञेपुरतेच चालते, याचा वेध घेताना कवी मानवी स्वभावाचे वेधक चित्रण करताना समाजातील खरी प्रतिज्ञा सांगतात. ती म्हणजे 'भारत कधी कधी माझा देश आहे' ही होय. खरे तर सर्व माणसे अशीच प्रतिज्ञा म्हणताना दिसतात. कारण इथे कोणाला कोणाला पायपोस नाही. म्हणून कवी म्हणतात,

'भारत कधी कधी माझा देश आहे
आम्ही सारे भारतीय
अलग अलग आहोत
माझं आयुष्य
हा काही राष्ट्रीय एकात्मतेचा प्रबंध नाही
त्यामुळे अन्य जाती-धर्माशी

माझा काडीचाही संबंध नाही.' (भारत कधी कधी माझा देश आहे)

हे अगदी खरे आहे. आम्ही सारे बांधव आहोत. हे फक्त प्रतिज्ञेपुरतेच उरलेले आहे. भरदिवसा माणसे माणसांना कापत आहेत. किड्यामुंग्याप्रमाणे चिरडून टाकत आहेत. जाती-पातीचे राजकारण खेळले जात आहे. इथे एकाच जातीतसुद्धा श्रेष्ठ-कनिष्ठ असा भेदभाव आहे. खाऊजीचे राजकारण चालत असल्यामुळे एकमेकांना लुटण्याचेच काम चालू आहे. नव्या सत्ता उदयाला येत आहेत. एकमेकांचे बदले घेत आहेत. नवे टिळक, नवे गांधी निर्माण होत आहेत. त्यांचेही पुतळे बांधले जात आहेत. आता खुर्चीवर बगळे बसत आहेत. पांढरे वस्त्र परिधान करणे एवढ्यापुरतीच शुभ्रता दिसत आहे. सर्वच जण मधून भ्रष्टाचाराने पोखरलेले आहेत. भ्रष्टाचार सिद्ध होऊन जेलची हवा खात आहेत. जेलमधून सुटल्यावर हार-तुरे घेऊन कार्यकर्ते बाहेर उभेच आहेत. इथे सगळ्यांची जात एकच आहे. म्हणूनच माझा भारत देश महान आहे, असा उपहास फुटाने व्यंगशैलीने येतात.

समाजाकडे कटाक्ष टाकला तर असे दिसते की, इथे धर्माच्या नावावर रान पेटत आहे. प्रत्येक राज्य आपले अस्तित्व टिकवण्यासाठी घडपडत आहे. प्रत्येक राज्य सीमांना पोखरण्याचा प्रयत्न करत आहे. प्रत्येकजण आपल्या धर्माचा, पंथाचा, प्रांताचा जयजयकार करत आहे. सोबत स्वतःचाही उदोउदो करत आहे. भारतापेक्षा मीच मोठा आहे याचे गानही गात फिरत आहे. तेव्हा कवीला प्रश्न पडतो कसे होईल या देशाचे म्हणून तो म्हणतो,

'सांगा देव! आता, कोण असे त्राता?

बुडविती भारता, स्व-पुत्रच!॥६॥' (ही आमुची भारतमाता)

भारताला बुडवायला आता कुणाची हिंमत नाही. आता भारताला भारतीयच बुडवत आहेत.





अशा वेळी भारताला तारण्यासाठी कोणीतरी त्राता निर्माण व्हावा असे कवीला वाटते.

'मराठी माणूस फेकला गेला
महाराष्ट्राला अवकळा आली
पाहता पाहता मुंबईची
पंचवीस वर्षात 'बम्बई' झाली' (बम्बई)

आता मराठी माणसाची निशाणी समाधी रुपामध्ये किंवा स्मारक रुपामध्ये तेवढी शिल्लक राहिल. स्मारकावर कोरलेल्या शिलालेखात तेवढा इतिहास दिसेल अन्

'उद्या या देशाचे नाव
भारत नसेल
शत्रूंच्या मनात आज
खरंच काय हो असेल?' (आज ना उद्या)

आज ना उद्या एकेक राज्य बळकावण्याचा प्रयत्न होईल. कधी आसाम जळेल, कधी दिल्ली पेटेल. कुठून कोणता दुश्मन घुसेल याचा भारतीयांना पत्ताही लागणार नाही. सत्ताधीश खुर्चीत बसून सत्तेची फळे चाखण्यात मशगूल आहेत. मराठी माणसाचे हाल पाहून कवी म्हणतो,

'मराठी माणूस, मागे पडला
तेव्हा शनिवारवाडा
पर्वतीजवळ जाऊन रडला' (व्यथा)

खरे तर कवी मराठी माणसाला आळस झटकायला सांगत आहे. कारण आळस हा माणसाचा शत्रू आहे. इथे तर परकीय राज्यातून माणसांची कामगंध्यासाठी धाव आहे. त्यांनी आळस झटकल्यामुळे तेच टिकतील. तुम्ही इथले असूनही त्यांच्या नावाचे खडे फोडत बसाल. आता शिक्षणाचे माहेरघर असणाऱ्या पुण्याबद्दल एक काळ असं म्हटलं जायचं की 'पुणे तिथे काय उणे' पण आज सर्व बदललं आहे.

'ज्ञानी सत्तेचे भाट झाले
पहिलवान बारमध्ये शिरले
लक्ष्मीच्या आक्रमणापुढे
सरस्वतीचे दास हरले' (पुणे)

आज सत्तेचे पाय चाटण्यात जो तो मशगूल आहे. सत्तेच्या पायथ्याशी बसण्यासाठी जीवघेणी स्पर्धा लागली आहे. पहिलवान आखाड्यात कमी अन् बारमध्येच जास्त आहे. हर एक जणाची धाव लक्ष्मी कमावण्याकडेच असल्यामुळे सरस्वती या विद्येच्या देवतेचाही विसर पडला आहे. शिक्षणाच्या माहेरघराचे महत्त्व आता फक्त गणेशोत्सवापुरतेच उरले आहे. माणूस आता जयजयकार





करत आहे. तो याचा व हा त्याचा जयजयकार करण्यात गुंग आहे. कोणत्याही कामासाठी एकमेकांला साथ आहे. दोघांच्याही गळ्यात एकमेकाचा हात आहे तेव्हा कवी म्हणतो,

'त्याने सिमेंटची थैली खाल्ली
याने खाल्ली घारावी
आम्ही आता आरशात पाहून
आमच्याच श्रीमुखात मारावी' (जयजयकार)

आजचा काळ फक्त उदोउदो करणारांचाच आहे. मग या देशात काँग्रेसचा, भाजपाचा, जनता, शे.का.प. सर्वांचा जयजयकार आहे. पैसे देणाऱ्या उमेदवारांचाही व पैसे घेणाऱ्या मतदारांचाही जयजयकार सर्वांचा जयजयकार कवी करताना दिसतात. काळ बदलला, माणसांच्या आशा आकांक्षा बदलल्या, तपश्चर्या बदलली. माणसे पळवाट शोधत आहेत. कशाने काय होईल हे कळूनही लोक उपास-तापास करत आहेत. त्याबद्दल कवी म्हणतात,

'मुलाच्या शाळेतील प्रवेशासाठी
आईने सोळा सोमवार केले
बापाने सोळा शनिवार केले' (गरज)

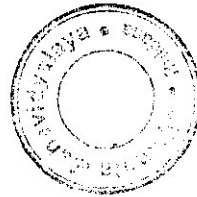
उपास-तापास करूनही प्रश्न सुटला नाही. पोराला शाळेत प्रवेश भेटला नाही. जेव्हा बापाने खिशात हात घातला, खिशातल्या नोटा काढून प्रिंसिपलच्या हातात घातला तेव्हा पोरगा वर्गात जाऊन बसला हे वास्तव घटनेचे दर्शन घडविले आहे.

अशा वातावरणामुळे कुणाला कशाची आस्था नाही. जयंत्या-पुण्यतिथीची आठवणही नाही. तारखा बघता बघताच,

'नऊ ऑगस्टमुळे
पंधरा ऑगस्टला दिसला
पंधरा ऑगस्टमुळे
सव्वीस जानेवारी दिसला
तरी चाळीस वर्षापासून
प्रजासत्ताक हरवला आहे.' (खंत)

पंधरा ऑगस्ट, सव्वीस जानेवारीला राष्ट्रध्वज फडकवला जात आहे. पण स्वातंत्र्याबद्दल, स्वातंत्र्यसैनिकाबद्दल, त्यांच्या बलिदानाबद्दल कोणालाच सोयरसुतक नाही. प्रत्येकजण एकमेकांचा घास पळवत आहे.

'महाराष्ट्रात सर्वत्र पाऊस पडला
तेव्हा एक पुढारी





सरकारी नोकराजवळ रडला

दुष्काळाचा त्रास गेला

पण

आपल्या तोंडचा 'घास' गेला' (घास)

राजकीय नेत्यांना दुष्काळ पडावा वाटतो. कारण त्या नावाने काही निधी काढता येतो. पण निसर्गाने शेतकऱ्याला साथ दिली. पुढारी घाबरले. आपला घास गेला. शेतकऱ्याच्या तोंडात घास पडला याचे मात्र समाधान कोणाला नाही. खरे तर

'शेतकऱ्यांच्या नावावर, जगणारा देश आहे

सत्तेच्या भोगासाठी संन्याशाचा वेष आहे.' (हारजीत)

शेती पिकली तरच सर्वांना सुखाने खाता येते. पोटभर खायला मिळते. तरीही इथे कुणाला त्याचे देणेघेणे नाही. प्रत्येकजण गटबाजीच्या द्वेषात आहे. माळ आपल्या गळ्यात पडते का? याच्या शोधात आहे. संन्याशाचा वेष परिधान करून लुबाडण्याचे काम चालू आहे.

आज ना उद्या काही बदल होईल असे वाटत होते. वार्डट विचार नव्या वळणाने जातील व पुन्हा संस्काराचे बोट धरतील तर झाले ते वेगळेच.

'परंपरेने डोक्यावरचे केस मागितले

व हळूच कानात सांगितले -

घाबरू नकोस 'नवे यतील'

मी म्हणालो, 'नवे येतील पण ते सुद्धा

याच श्रद्धा पुढे नेतील.' (परंपरा)

कारण सगळीकडे कावळे आहेत. कावळेच पिंडदानाच्या वेळी पिंडाला शिवतील. आजूबाजूचे थोडे रडतील, दुःख व्यक्त करतील, काही आठवणी काढतील पण पुन्हा सर्वच पांगतील, जिथे स्वार्थ आहे तिथेच फिरतील. पुन्हा परंपरेने चालत आलेले तेच करतील. कारण कोणी कोणासाठी थांबणार नाही. ही परंपरेची रीत आहे.

एकदा का पद गेले की होत्याचे नव्हते होते. इथे माणसाला कोणी विचारायला तयार नाही. खुर्चीला मुजरे मारण्याचे डाव रचले जातात. सत्तेवर असताना मात्र लोक मागेच असतात. सत्ता गेली तेव्हा,

'मंत्रीपदावरून दूर होताच

तो मंत्रालयाऐवजी दिवसा

घरी झोपायचा

बायकोने जरा हलविताच



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तिचीच रिबीन कापायचा.' (उद्घाटन)

सत्तेवर असताना सारखे कार्यक्रम अन् पाहुणचार व्हायचा. याच्या उद्घाटनाशिवाय कोणताही व्यवसाय, उद्योग सुरू व्हायचा नाही. यांनाही कार्यक्रमाशिवाय करमायचे नाही. पण पद गेलं की घरात बायकोसुद्धा नीट विचारत नाही हे वास्तव कवी रेखाटतात.

रामदास फुटाणे यांच्या संबंध कवितेचा विचार केल्यानंतर असे दिसते की, विडंबनाच्या, विनोदाच्या, व्यंगाच्या अंगानं त्या कविता सत्याचा शोध घेतात. बारीक-सारीक प्रसंगातून वास्तव शोधतात. यामध्ये चौफेरपणा आहे. जणू असे वाटते की, एखाद्या क्रिकेटच्या अष्टपैलू खेळाडूसारखे ते विडंबनातून धौके-छक्के मारतात. ही मांडणी करायला प्रगल्भ प्रतिभा लागते. ती रामदास फुटाणे यांच्याकडे आहे. एखाद्या व्यक्तीच्या वास्तव जीवनाला एकदम हात घालणे कठीण काम असते पण त्याला विनोदाची लंकेर दिली, त्यातून खिल्ली उडते. आपोआपच हास्याचे कारणे उडतात. ज्याला समजायला पाहिजे त्याला सर्व बोध कळतात. हसण्यातून विशिष्ट हेतूकडे नेण्याचे कार्य फुटाणे यांच्या काव्यशैलीने साध्य केले आहे.

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महाराष्ट्र ही संतांची आणि समाजसुधारकांची भूमी आहे. एक दैदिप्यमान अशी वैभवशाली परंपरा महाराष्ट्र होऊन गेलेली आहे. याच परंपरेतील शिरोमणीशोभावा असा एक फकिर होऊन गेला. त्याचे नाव आहे संत शिरोमणी गाडगेबाबा. ज्ञानेश्वर माऊली, नामदेव महाराज, एकनाथ, तुकाराम या संतांनी जो समाज प्रबोधनाचा मानसाच्या लौकिक व पारमार्थिक उन्नतीचा, प्रगतीचा जो मार्ग आपल्या अभंगवाणीतून व्यक्त केला, त्याविचारांना प्रत्यक्ष आचाराणात आणून दाखविला. समाज जीवनात ग्रामीण भागातील खेडयामध्ये कृतीतून रुजविला, तो गाडगेबाबांनी वास्तविक गाडगेबाबांनी समाज सुधारणेचे जे कार्य केले ते समाज सुधारकांचे आगरकांचा बुद्धीप्रामाण्यवाद असेल. महात्मा ज्यातिबा फुले, सावित्रीबाई फुले, शाहू महाराज, डॉ. बाबासाहेब आंबेडकर या समाजसुधारकांचे मात्र त्यांनी आपली वैचारिक नाळ जोडली, ती ज्ञानेश्वर महाराज, संत कबीर, तुकाराम महाराजांच्या विचारांशी व धगवान श्रीकृष्णांच्या व्यक्तित्वाशी म्हणूनच त्यांच्या कीर्तनाचे ध्रुवपदच होते "गोपाळा, गोपाळा, देवकीनंदन गोपाळा". बाबा कीर्तनात ज्ञानेश्वरीतील दृष्टांत, ओवी, कबीरांचा दोहा, तुकारामांच्या अभंगाचा दाखला देत देत निरूपण करीत असत. गाडगेबाबांनी कोणाच्याही श्रष्टेला धक्का लावला नाही. परंतु देवाधर्माच्या नावावर जी अंधश्रद्धा जोपासली जाते, ग्रामीण भागातील जनता देवाला काही तरी नवस बोलतात. नवस पूर्ण झाला की, देवाच्या

नावाने बोकड, कोंबडा अशा प्राण्यांचा बळी देतात. या बळी देण्याच्या प्रथेला, या पशुहत्येला बाबांनी विरोध केला. विदर्भातील जवळजवळ १०० ते १५० ठिकाणची पशुहत्येला बाबांनी बंद केली. त्यासोबतच मांसाहार किती वाईट हे सांगून शाकाहारचे महत्त्व समाजाला पटवून दिले. गाडगेबाबांच्या या कार्यामुळे विदर्भात हजारो गाव व हजारो माणसांनी मांसाहाराचा त्याग केला.

गाडगेबाबांनी आपल्या शेवटच्या किर्तनात सांगितले, खाना खराब कोणाचा झाला बंबईत ? मराठे, माळी, तेली, न्हावी, धोबी, चांभार, कोष्टी, कोळी, कुभार, लोहार, वडारी, बेलदार, कैकाडी, गोंड, गवारी, मांग आणि महार जनावरासारखे तीनच माणसं मजेशीर आहेत. गुजराती, मारवाडी, ब्राह्मण, दररोज तुपातला शिरा खातात. आज कोणाही मराठ्याले पुसा जेवला का ? होय. कालवण, आमटी. आज पंजापासून आमटी याच्या घरात घुसली साली बाहेर निघतच नाही.

“गोपाला गोपाला देवकीनंदन गोपाला हो ss” काही माणसं टाळी वाजवतात जसे लढाईतले वीर होयत. अन काही माणसावर कठीण वखत आहे. आपण एकदा बिनटाळीची. बिनमश्टुंगी टाळी वाजवू मात्र गडबड करू नका. आणि अशे अशे वाजवू नकाच सर्वांच्या टाळीचा एकच आवाज अगला पाहिजेच रप-रप. करा वर सरळ हात. सरळ हात वरत्र माझ्या हातावर ध्याय ठेवा बरोबर हा.

“गोपाला गोपाला देवकीनंदन गोपाला”

जातीभेदावर बाबांचे कार्य हे डोळस समाज सुधारकांचे कार्य आहे. जाती जातीमध्ये भेदाभेदनिर्माण करून, उच्चनिश्चिनेसारख्या अनिष्ट परंपरेला जन्म देवून काही लोकांनी आपला स्वार्थ साधला. वर्णव्यवस्थेचा चुकीचा अर्थ समाजात रुढ होता वास्तविक ही वर्णव्यवस्था गुणांवर आधारित होती. पुढे ती काही स्वार्थी लोकांनी जन्मावर आधारित केल्यामुळे याला अधोगती प्राप्त झाली. या जातीव्यवस्था अस्तित्वात आल्या शीत करतो म्हणून कुणबी, भाजीपाली पिकवतो विकतो म्हणून माळी, शेळयामेढयांचे पालन करतो म्हणून धनगर अशा जाती अस्तित्वात आल्या. त्यामुळे

एक श्रेष्ठतम अध्यात्कि शक्ती असणाऱ्या धर्माची व उज्वल अशा ऋषीमुनी, साधु, संतांची परंपरा खंडीत झाली. स्मृश्य – अस्मृश्य अशा घाणेरड्या विचारांना समाजात अधिष्ठान मिळाले. गाडगेबाबांनी यावर प्रखर हल्ला केला. मनुष्य जन्माने श्रेष्ठ नसतो. तरतो त्याच्या कर्मनि व गुणांनी श्रेष्ठ वा कनिष्ठ ठरत असतो. सर्व त्याच भगवंताची लेकरे आहेत. किर्तनात बाबा उदाहरण देत —

विष्णुमय जग वैष्णवांचा धर्म ।

भेदाभेद भ्रम अमंगळ ॥

शुध्द आचरण, श्रेष्ठ कर्म असेल तर कोणताही मनुष्य महान होऊ शकतो. यासाठी तो महात्मा गांधी, बाबासाहेब आंबेडकर यांचे उदाहरण देत. मनुष्य आपल्या कर्मनि नराचा नारायण होतो, यावर बाबांचा विश्वास होता. गाडगेबाबांचा लोकांशी संवाद साधण्याची एक अनोखी शैली होती. गाडगेबाबा कोणत्याही खेड्यात जात. आपली झोळी, फुटलेले गाडग, काठी कोणत्याही घराच्या अंगणात ठेवत. त्या घरातूनच एक खराट घेत आणि गाव स्वच्छ करायला लागत. गाडगेबाबा आपल्या गावात आले ते गाव स्वच्छ करत आहे, हे समजताच हा हा म्हणता २५ ते ३० लोक हातात झाडू घेऊन गाव झाडायला लागत आणि गाव स्वच्छ करून कचरा एका जागी टाकून गाव निर्मळ व स्वच्छ होत असे. श्रमप्रतिष्ठा जपणारा हा महामानव आहे. श्रमिकांचाही सन्मान व्हावा, श्रमालाही प्रतिष्ठा मिळवून देणारा हा संत आहे. बाबांनी काम केल्याशिवाय अन्न ग्रहण केले नाही. गाव स्वच्छ झाले की, बाबा कोणत्याही घरी जावून भिक्षा मागत. त्याच अंगणात बसून हातात घेऊन भाकरी खात. या गावात बाबा आले, अशा बातमी आजूबाजूच्या खेड्यामध्ये म्हणजे पंचक्रोशी ये पसतरत असे आणि आज रात्री बाबांचे की होणारच असा अलिखित नियमच होता. हजारोंच संख्येने लोक कीर्तनासाठी जमा होत. या देशात स्वच्छतेचा, खराट्याचा बादशहा म्हणजे संत गाडगेबाबा. या त्यांच्या कार्यामुळेच मागील १० वर्षांपासून महाराष्ट्र शासनाने निर्मळ ग्राम व स्वच्छ ग्राम योजना संत गाडगेबाबांच्या नावाने सुरू केली आहे. बाबा दिवसा गाव स्वच्छ करीत आणि रात्री कीर्तनातून लोकांना

❖ विद्यावार्ता: Interdisciplinary Multilingual Refereed Journal, Impact Factor 4.014 (IIJIF)

डोळयातील घाण स्वच्छ करीत असत. गाडगेबाबांचे आणखी महत्त्वाचे कार्य म्हणजे त्यांचे शिक्षणविषयक विचार व या संदर्भातील त्यांचे कार्य. शिक्षणाशिवाय म्हणजे ज्ञानाशिवाय कोणत्याही व्यक्तीचा, कुटुंबाचा, समाजाचा आणि पर्यायाने देशाचाही विकास होऊच शकत नाही.

विद्येविना मती गेली, मतीविना गती गेली
गतीविना वित्त गेले, वित्ताविना शुद्ध खचले
एवढे अनर्थ, एका अविद्येने केले

या उत्कीर्ण त्यांचा विश्वास होता. यासाठी बाबा किर्तनात सांगत मुलीमुलींच्या शिक्षणासाठी पैसा नाही म्हणता घरातील भांडे, ताट मोडा, हातावर भाखरी खा, पाहुण्यांना साखा पाहुणचार कर. कमी भावाचे कपडे घ्या, पण पोरांना शाळेत घातल्याशिवाय राहू नका. यासाठी बाबांनी वसतीगृहांची निर्मिती केली. शाळा काढल्या, आणि अनेक शाळा काढायला धनिकांना व समाजसुधारकांना प्रवृत्त केले. आपल्या स्वतंत्र भारताचे पहिले कृषीमंत्री डॉ. पंजाबराव देशमुख यांनी काढलेल्या संस्थेला फार मोठे बळ बाबांनी प्रदान केले. श्रध्दानंद वसतीगृहाला भरीव मदत केली. भाऊसाहेब देशमुखांची श्री शिवाजी शिक्षण संस्था, अमरावती ही संस्था भारतातीलच नव्हे तर आशिया खंडातील दोन नंबरची संस्था आहे. एक नंबरची संस्था आहे, कर्मवीर भाऊराव पाटीलांची "रयत शिक्षण संस्था" या संस्थेचा प्रचार व प्रसार करून त्यांना अर्थसहाय्याही मिळवून दिले. बाबासाहेब खैर हे मुख्यमंत्री होते. त्यांनी रयत शिक्षण संस्थेची ग्रींड (अनुदान) लोकांच्या सांगण्यावरून बंद केले. ही बातमी गाडगे बाबांना कळताच त्यांनी मुख्यमंत्री खैर यांची भेट घेऊन त्यांना विनंती केली व या संस्थेची ग्रींड सुरू झाली. शैक्षणिकदृष्ट्या हा महाराष्ट्र प्रगत करण्यामध्ये कर्मवीर भाऊराव पाटील व भाऊसाहेब पंजाबराव देशमुख या दोन भाऊंचे फार मोठे योगदान आहे. या कार्याला गाडगेबाबांसारख्या संताना परिसंस्पर्श लाभला आहे. गाडगेबाबांच्या अथज्ञतेला विरोध होता, श्रध्देला नाही. या त्यांच्या विचारातूनच त्यांनी प्रत्येक धार्मिक स्थळी धर्मशाहा बांधल्या. पंढरपूरला आपढी, कार्तिकी एकादशीला लाखोंच्या संख्येने माणसे जमतात, त्यांची गैरसोय

होते, यासाठी बाबांनी तिथे धर्मशाहा बांधल्या. खेड्यातील लोक मुंबईला उपचार करण्यासाठी जातात, तिथे त्यांची गैरसोय होते, म्हणून जे जे हॉस्पिटल, मुंबई या दवाखान्याच्या बाजूला त्यांनी धर्मशाळा बांधल्या, असा सेवाव्रती संत आहे. या सामाजिक कार्यासाठी आर्थिक बळ हवे होत. त्यासाठी बाबांनी ट्रस्टची म्हणजे संस्थेची स्थापना केली. बाबांच्या या संस्थेला त्या काळातील समाजातील दात्यांनी भरभरून मदत केली. लाखोच्या स्वरुपात बाबांना लोकांनी मदत केली. आजरोजी गाडगेबाबांच्या मिशनची संपत्तीचा आढावा घेतला तर १० ते १५ हजार कोटीच्या जवळ या ट्रस्टची संपत्ती आहे.

मात्र या संस्थेतील काडीलाही बाबांनी स्वतःसाठी, स्वतःच्या कुटुंबासाठी स्पर्श केला नाही. त्यांच्यातील एक पैसाही वापरला नाही. एखाद्या संस्थेचा ट्रस्टी म्हणजे अध्यक्ष वा विश्वस्त कसा असावा याचे मूर्तमंत उदाहरण म्हणजे गाडगेबाबा. बाबांची मुलगी एका गावात राहत होती. तिची घरची परिस्थिती हलाखीची होती. नवरा आजारी पडला त्यामुळे दोन दिवसापासून घरत अन्न शिजले नव्हते मुलबाळ, नवरा उपाशी होते. त्याच गावात बाबांची धर्मशाळा होती. बाबांची ही कलावती नावाची मुलगी धर्मशाळेत गेली. बाबा तिथे नव्हते तिने संचालकाला परिस्थिती जाणीव करून दिली व काही धान्य देण्याची विनंती केली. तेथील व्यवस्थापकाने तिला १५ किलो धान्य दिले. बाबांना जेव्हा हे कळले तेव्हा त्यांनी त्या व्यवस्थापकाला विचारले ५ किलो धान्य तू दिले, याचे पैसे किती होतो एखाद्या मजुराला हे कमवायला किती दिवस मजुरी करावी लागते, तयाने सांगितले तीन दिवस. गाडगेबाबांनी तीन दिस आश्रमातील लाकडे फोडून दिली, याला म्हणतात ट्रस्टीसुख दुःख सम मानणारा हा संत आहे. बाबा कोकणात खरिपाटण येथे कीर्तन करत होते. कीर्तनाच्या मध्येच बाबांना निरोप आला, बाबा तुमचा एकलता एक मुलगा गोविंद मरण पावला. बाबा एक मिनिट थांबले आणि दुराच्यान भिनिटाला बाबा म्हणाले

श्राम गेले, कृष्ण गेले

असे गेले कोटयाने कोटी

काय रडू एकासाठी

❖ विद्यावार्ता: Interdisciplinary Multilingual Refereed Journal Impact Factor 4.014 (IIJIF)

होय. बाबांचा कीर्तनात ग्रामीण भागातील लोकांना मुख्य संदेश आसायचा की कोणलाही जीवनात यशस्वी असेल तर त्याच्या जीवनाला शिस्त, हिशोब करण्याची सवय पाहिजे. आपले उत्पन्न किती आणि आपला खर्च किती याची जाणिव माणसाने ठेवावी. बाबा म्हणतात आमचे हे खेड्यातील शेतकरी लोक उत्पन्न ७५ रु आणि खर्च १०० ते १२५ रु कसा पुरेल. जानेवारीत मजा करा आणि फेब्रुवारीत बोंबलत बसा

आजच्या काळातही हा विचार तंतोतंत लागू पडाणारा आहे. शेतकऱ्यांनी, सर्वांनाची जर असा जमाखर्चाचा ताळेबंद अंमलात आणला तर शेतकऱ्यांच्या आत्महत्या थांबण्यालाही मदतच होईल. गाडगेबाबांचे मुंबई येथील ब्रांदा येथे झालेले किर्तन हे अखेरचे किर्तन आहे. बाबा म्हणतात, या मुंबई कोण चांगल जगत आहे. तर ब्राह्मण, भाटे, गुजराती, मारवाडी आणि मुंबईत खाना खराबा कोणाचा झाला. मराठे, कुणबी, तेली, माळी, कोळी या अठरा-पगड जातींचा कारण यांना हिशोब ठेवणे माहित नाही. शिवाय यांचा आहार मांसाहार. त्यामुळे दारूचे व्यसन या अनिष्ट चक्रात हे अडकले आहेत. या लोकांना म्हणतात, तुम्ही जेजूला जाता, तुळजापूरला जाता आणि तिथे बोकड कापून खाता. खानाखराबा होईल तुमचा, जेजूला जाणाऱ्यांचा, कोकणी लोक गोविंदा, गोविंदा म्हणून बळी देतोत, बाबा म्हणत तुमच कधीच भलं होणार नाही. एखाद्या प्राण्याचा बळी देऊन तुम्हाला फळ कसे मिळेल. स्त्रियांना बाबा सांगत, कोणतीही ब्राह्मण, मारवाडी, गुजराती, स्त्री कधीच मांसाहार करत नाही. बाबायान बोंबील असतात, त्याचा वास जरी या स्त्रियांना आला तर त्या वोकून वोकून मरतील आणि तुम्ही पातळल्या पातळ रिकाम. तुम्ही स्त्रिया नाही पूर्वजन्मीच्या राक्षसणी, चुडेलनी आहात. अशा प्रखर शब्दात बाबा लोकांची कान उघडणी करता मंदिरामध्ये, मस्जिदीमध्ये देव नाही, जनता-जनार्दनात देव पहा हा बाबांचा सिध्दांत होता

कबीर - नही मंज्जीत में, नही देवलमें

हिरा खोया कचरे में

अशी बाबांची शिकवण होती

ज्ञानेश्वर - वायुवसे सकळ ठायी

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परी त्याचे बिन्हाडच नाही।

तुकाराम- देवपाहावयासाठी गेलो

अन् देवच होऊनी गेलो ।

अशी त्यांची धारणा होती. या जनता जनार्दनाची सेवा हीच ईश्वरसेवा आहे हा त्यांचा प्रबोधनाचा केंद्रबिंदू होता. असा हा बुद्धीवादी, विज्ञानवादी, ज्ञानयोगी, कर्मयोगी संत होता. त्यांच्या या कार्याचा गौरव म्हणूनच बाबा लौकिक अर्थाने शाळेत गेले नाही तरी त्यांच्या कार्याकडे पाहूनच, विद्यापीठाला बाबांचे नाव दिले 'संत गाडगे बाबा अमरावती विद्यापीठ अमरावती'

मनुष्याची किर्तीच शिल्पक राहते

सुरत से किरत बडी, बिन पंख उडजाय

सुरती तो जाती रही । किर्ती कबुन जाय ॥

गाडगेबाबांची दशसूत्री

तहानलेल्यांना - पाणी

उघडयानागडयाना - वस्त्र

बेघरांना - घर

बेकारांना - रोजगार

दुःखी व निराशांना - हिंमत

गरीब मुलामुलींना - शिक्षण

गरीब तरुण - तरुणीचे लग्न

अंधपंगू रोग्यांना - औषध

मुक्या प्राण्यांना - अभय

असा हा संत आयुष्यभर समाजातील अन्यायाविरुद्ध काम करत राहिला. चंदनासारखा झिजत राहिला. या महान कर्मयोग्याला माझे विनम्र अभिवादन

संदर्भ ग्रंथ

गाडगेबाबा --प्रबोधनकार ठाकरे

गाडगेबाबा --वसंत पोतदार

संत गाडगे महाराज --पांडुरंग बाळ्याजी कवडे

श्री गाडगे महाराज --गो.नी. दांडेकर

मानवतेचे पुजारी संत गाडगेबाबा- डॉ. उद्भव

रसाळे

□□□



१. मराठीतील पहिल्या ग्रामीण विज्ञान कविता

प्रा. डॉ. अनंत सिरसाट

मराठी विभाग प्रमुख

जिजामाता महाविद्यालय

बुलढाणा

‘ऊनपाऊस’ हा ज्येष्ठ कवी प्रा. आ.य. पवार यांचा ५१ कवितांचा संग्रह. या संग्रहीतील संपूर्ण कविता नव्वद नंतरच्या बदललेल्या ग्रामीण जीवनाचे वास्तव चित्रण करतात. हया कविता संग्रहीतील सामाजिक, राजकीय आशय असलेल्या कवितांबरोबर ६ विज्ञान कविता ही आहेत हे या कवितासंग्रहाचे वेगळे वैशिष्ट्य नोंदवावे लागते. १९६० नंतर विज्ञान तंत्रज्ञानाची प्रगती झपाट्याने होत आहे. विज्ञानाच्या या प्रगतीचा परीणाम मानवी समाज व संस्कृतीवर होत आहे. या वैज्ञानिक प्रगतिमुळे माणूस आज आकाशातून विहार करतो आहे. प्रगतिचे नवनवे शिखर पादाक्रांत करित आहे. पण मनाने मात्र उद्विग्न झालेला आहे सामाजिक, सांस्कृतिकदृष्ट्या आणि मानसिकदृष्ट्या अदयापही आदिम काळातच आहे. ही राक्षसी प्रवृत्तीची माणसं आज मानवतेला नष्ट करायला निघाली आहेत. ही चिंता कवी ‘चिंता’ या कवितेतून व्यक्त करतात. वैज्ञानिक प्रगती आणि सांस्कृतिक अधोगती यांचा संबंध या कवितेतून छान व्यक्त झालेला आहे. ‘वेताळाचे असेच जुळते हडळी नाते’ पृ.३० या ओळीतून विज्ञान व संस्कृती यांच्यातील संघर्ष कवी व्यक्त करतात.

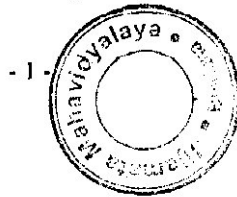
‘विज्ञानाची रेल धावते

संस्कृतीची वेल थरकते’ पृ.३०

या काव्यपंक्तीतून विज्ञानाची प्रगती ज्या झपाट्याने होत आहे. त्या वेगामुळे संस्कृतीची मातीचा आधार घेऊन वाढणारी नाजूक वेल मात्र थरथरते आहे.

‘दहशतवादी रावण गर्जे

खोदुनी खाईल कंदमुळांना’ पृ.३०



महिला
अकादमी
जिजामाता महाविद्यालय, बुलढाणा

कवितेचे या या शब्दे टच्या पंक्तीतून कवीला संस्कृतीविषयी, आपल्या मुलांविषयी वाटणारी चिंता व्यक्त होते. विज्ञानरूपी हा राक्षस केवळ मार्गात येईल त्या गोष्टींना नष्ट करणार नाही, तर आपली पाळेमुळे खोदून आपल्यातील माणूसपणही नष्ट करील ही चिंता कवीला आहे. आज मानवाने भौतिक प्रगती केली आहे, विकासाच्या नावाखाली निर्सगला गिळंकित करून आपल्याच पायावर त्याने धोंडा पाडून घेतला आहे. चकचकीत रस्ते, त्यावर धावणाऱ्या मोटारी सर्वत्र दिसत आहेत. पण त्यामुळे होणारे ध्वनी प्रदूषण व वायूप्रदूषण मात्र सोयीस्करपणे दुर्लक्षिले जात आहे.

‘पेटधेलच्या डिझेलच्या गाड्या पळती सुसाट
परि रिते राहिले घरी पाण्याचे माठ’ पृ.४०

या काव्यपंक्तीतून कवी सामाजिक विषमतेवर भाष्य करतात. श्रीमंतांच्या पेटधेलच्या डिझेलच्या गाड्या, त्या गाड्यांसाठी लागणारे रस्ते, त्यामुळे होणारे प्रदूषण जमीनीची धूप, इत्यादींचा संबंध कवी गरिबांच्या रिकाम्या राहिलेल्या माठाशी लावतात. जीवनावश्याक असलेले ‘पाणी’ त्यांच्यापासून हिरावून घेण्याचे पाप या विकासाने केल्याचे कवी ‘करणी’ या कवितेतून मार्मिकपणे सांगतात. केवळ माणसेच नव्हे तर संपूर्ण वसुंधराच आज व्याकुळ झाली आहे. विहिरींनी तळ गाठले आहेत. धरणामध्ये पुरेसा पाणीसाठा कुठेच नाही. वसुंधरेच्या माथी हा व्याकुळ भोग विकासरूपी राक्षसाने, मानवाच्या लोभी महत्वाकाक्षेने आणलेला आहे, असे कवी या कवितेतून सांगतात. ‘रहस्य’ या कवितेतून कवी विश्वनिर्मितीच्या रहस्यावर भाष्य करतात. सृष्टीच्या निर्मितीबद्दल अनेक पुराण कल्पना आहेत. पण या कल्पनांना छेद देणारा प्रयोग जगातील अनेक शास्त्रज्ञांनी एकत्र येऊन केला. या वैज्ञानिक प्रयोगात त्यांनी पृथ्वीच्या पोटात महाविस्फोट घडवून आणला. त्यातून प्रचंड आगीची व प्रकाशाची निर्मिती झाली. या वैज्ञानिक प्रयोगातून विश्वनिर्मितीच्या वेळी निर्माण होणाऱ्या ऊर्जेसारखी ऊर्जा निर्माण करून विश्वनिर्मितीचे रहस्य देवकणाचा शोध उलगडण्याचा दावा हे शास्त्रज्ञ करतात. कवी विज्ञानाला मदारीची समर्पक उपमा देऊन विज्ञानाच्या नित्य होणाऱ्या या नवनविन अविष्कारांवर भाष्य करतात. परंतु विज्ञानामुळे मानवाची मातीशी असलेली नाळ मात्र तुटत चालली आहे त्याविषयी

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जिजा
महाविद्यालय
बुलढना



खंतही व्यक्त करतात. कश्णविवर ही विज्ञानातील रहस्यमय अशी शक्ती आहे. या शक्तीबद्दल डॉ.जयंत नारळीकर यांनी विज्ञान कथा लिहिली आहे. कश्णविवराच्या वैज्ञानिक वैशिष्ट्यांविषयी कवीने 'फरक' या कवितेत एखाद्या वैज्ञानिकाच्या थाटात भाष्य केले आहे. या कश्णविवराची वैशिष्ट्ये कवी या शब्दात व्यक्त करतात.

‘प्रकाश किरणे न जाई त्यातून

महा आकुंचन असते गोदून’ पृ.५०

अतिशय गडद आणि आकुंचित असणाऱ्या कृष्णविवरातून प्रकाश किरणेसुद्धा जाऊ शकत नाहीत. या कृष्णविवरातून एखादी वस्तू गेली तर ती वस्तू अनंतकाळापर्यंत त्याच स्थितीत राहते. एक प्रकारे तिला अमरत्व प्राप्त होते. परंतु कवी या अमरत्वाला ‘शाप’ म्हणतात. कारण या शक्तीच्या अमरत्वापेक्षा जन्म मृत्यूच्या चक्रात अडकलेल्या पृथ्वीवरील मानवाचे जीवन कितीतरी पटीने चांगले आहे. त्यांचे जीवन वैविध्यपूर्ण भावनांनी नटलेले आहे. त्यामुळे शारीर मनाची स्थितीशिलता त्यांच्या जीवनात नाही. विज्ञानामुळे मिळणाऱ्या निरस, स्थितीशिल अमरत्वापेक्षा जन्म मृत्यू आणि सुख दुःखांनी युक्त मानवी जीवन कसे चांगले आहे हे या कवितेतून कवी सांगतात. ‘बदल’ या कवितेतून कवी विज्ञानामुळे बदललेल्या ग्रामीण जीवनाचे चित्रण करतात. विज्ञान तंत्रज्ञानामुळे आज झपाट्याने बदल होत आहेत. ह्या बदलांमुळे माणसांचे माणूसपण हरवून तो लांडग्यां गिधाडांप्रमाणे पशू झाला आहे. त्याची नीती भ्रष्ट झाली आहे. आपसातील नाती नष्ट झाल्यामुळे तो एकमेकांपासून दुरावला आहे. त्याची श्रद्धास्थानेही नष्ट झाली आहेत. हा ग्रामीण माणूस आज शहरांकडे धाव घेतोय. कवीच्या मते ग्रामीण जीवनात होणारा हा बदल विज्ञानामुळे निर्माण केलेल्या आकर्षक सोयी सुविधांमुळे झाला आहे. कवितेतील शेवटच्या कडव्यातून कवी अणुस्फोटाच्या कुरतेमुळे निसर्गावर होणाऱ्या परिणामावर भाष्य करतात.

‘अणुस्फोट आण घेई

देई निसर्ग जांभई

करतेची कानठाळी

बसे ऐकुनी अंगाई’

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अकांक्षा

‘अण्वस्त्रसज्जता’ हे विज्ञानाचे आणि महत्वाकांक्षी सत्तधिशिष्यांच्या मनोवश्टीचे विनाशकारी अंग आहे. अणुस्फोटाची कुरता जगाने हिरोशिमा आणि नागासाकी या दोन शहरांच्या राखरांगोळीतून अनुभवली आहे. त्या हल्ल्यामुळे माणसाला आणि निसर्गाला भोगाव्या लागणाऱ्या यातनांची विविध रूपं आज देखिल अस्तित्वात आहेत. अणुस्फोटासारख्या वैज्ञानिक आविष्कारांचा जपून वापर केला पाहिज. कविला असलेल्या या लोककल्याणकारी भूमिकेची जाणीव या कवितेतून व्यक्त होते. कवी आ.य.पवार यांच्या ‘ऊनपाऊस’ या कवितासंग्रहातील ‘विज्ञानयुग’ ही दीर्घ कविता विज्ञानाने पादाक्रांत केलेल्या जगाचा वेध घेते. अवकाश संशोधन, विश्वनिर्मितीचा सिद्धांत, मानवाने प्रयोगशाळेत लावलेले विविध शोध, संगणक क्रांती, मोबाईलचे सर्वव्यापकत्व, अत्याधुनिक पाणबुड्या, जगबुडीचे भाकित, कृष्णविवर इत्यादी विविध घटना घडामोडींचा वैज्ञानिक दृष्टिकोनातून या कवितेतून कवी वेध घेतात.

पेढे घ्या पेढे दया
आता जुने पाढे गेले
भले विज्ञान पुढे गेले
नवे नवे घडे आले’ पृ.५६

कवितेत योजलेल्या या पालुपदातून विज्ञानाने आणलेल्या नवनव्या शोधासाठी पेढे वाटून आनंद साजरा करण्याविषयी कवी सांगतात. पिटर हिग्न हया शास्त्राज्ञाने देवकणाचा सिद्धांत शोधून विश्वनिर्मितीविषयी असलेल्या आजपर्यंतच्या सर्व तर्कांना, सर्व वदंतांना, धर्मकल्पनांना धक्का दिला आणि ब्रह्मांडाचे नवीन ज्ञान जगाला अवगत करून दिले. पंचमहाभूतांनी व्याप्त ही पृथ्वी अणू रेणू व परमाणूंची बनलेली आहे. आयुष्यभर संशोधन चिंतन करून परमाणूचे रहस्य हया ऋषींनी शोधून काढले. अशी शास्त्रीय माहिती कवी नेमक्या शब्दात येथे देतात. आज मूळ पेशींवरील संशोधन खूप प्रगत झाले आहे. अगदी रक्तासहित माणसाचा कुठलाही अवयव प्रयोगशाळेत बनवणे शक्य झाले आहे. अशी मानवी उपयोगाविषयीची अदयावत माहिती कवी देतात. संगणकामुळे मानवी जीवनात आलेली क्रांती, संगणकाची न थकता काम करण्याची अफाट क्षमता, ईमेल, वाढलेली स्पर्धा, मोबाईलचे

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महत्वाकांक्षी
आनी विद्या अंगी घ्यावे.



सर्वव्यापकत्व कवी नेमक्या शब्दात व्यक्त करतात. तसेच मॉल, सेल, होलसेल या शब्दातून जागतिकीकरणाने दिलेल्या हया बाजारसंस्कृती वरही कवी नेमकेपणाने भाष्य करतात.

ज्योतिषशास्त्रातील मंगळ हा ग्रह कोपीष्ट, अनिष्ट असल्यामुळे मुला मुलांच्या पत्रिकेत असल्यास लग्न अवघड होते. पण प्रत्यक्षातील मंगळाचा वेध आज शास्त्रज्ञांनी घेउन २०१५ पर्यंत मंगळावर वसाहत करण्याची योजना ते आखत आहेत. 'नासाचे 'क्युरीसिटी रोव्हर' नावाचे यान २०१२मध्ये थेट मंगळावर उतरून प्रत्यक्षातील मंगळाचा शोध घेउन तेथील द.या खो.या, पर्वत खडक, खनिजे, वायू इत्यादीविषयीची शास्त्रीय माहिती आणि छायाचित्रे पृथ्वीवर पाठवित आहे. हया सृष्टित माणूस खरेतर टिचभर आहे, पण त्याला विज्ञानाची जोड मिळाल्यामुळे तो गुढ अंतराळाचा आणि सागराच्या तळाचाही ठाव घेत आहे. माया संस्कृतीच्या कालगणनेनुसार २१ डिसेंबर २०१२ रोजी माया संस्कृतीचे युग संपल्याने जगाचा अंत होईल असे भक्ति वर्तवले होते. जगबुडीच्या भक्तिामुळे मानवी मनात भविष्यविषयक अस्थिरता निर्माण होउन त्याचा कल आहे ते उपभोगण्याकडे, मौजमजेकडे वळतो हे कवी

'खाउन पिउन मौज करा

उदया काही खरं नाही'

अशा मोजक्या शब्दातून व्यक्त करतात जगबुडीच्या या भक्तिाबरोबरच अवकाशातील जगाला ओढमन घेईल अशा भाकड कथांना या विज्ञानयुगात वाव नाही असे कवी ठणकावून सांगतात. कारण आजपर्यंत पाचवेळा (इ.स. १०००, १४००, १५५३, १८५८, १९७२) जगबुडीच्या या खोट्या वलगना येउन गेल्या पण त्या साया 'काल्हेकुईच' ठरल्या. येथे कवीची विज्ञानाविषयक भूमिका स्पष्ट होते. कवी आ.य.पवार यांच्या या विज्ञानकवितांची काही ठळक वैशिष्टे सांगतात.

१. वैज्ञानिक प्रगती आणि तिचा समाजावरील परीणाम या कवितांमध ये ठळकपणे दिसतो.
२. विज्ञान साहित्य हे १०० टक्के शहरी साहित्य आहे. परंतु आ.य. पवार यांच्या विज्ञान कविता मात्र याला अपवाद आहेत. कारण



मराठीत प्रथमच त्यांच्या कवितांतून विज्ञानाचा ग्रामिण जीवनावर होणारा परिणाम अविष्कृत झाला आहे.

३. विज्ञानाचा समाजावर होणा.या विपरीत परिणामांचे चित्रण चिंता, करणी, रहस्य, फरक आणि बदल या कवितांतून येते. बहुतांशी विज्ञानसाहित्यामध्ये असलेले पलायनवादाचे प्राबल्य या कवितांमध् ये दिसते. परंतु 'विज्ञानयुग' ही कविता अपवाद आहे. कारण वैज्ञानिक सिद्धांतांच्या आविष्कारातून समाजामध्ये असलेल्या ज्योतिष, जगबुडी अशा घटपणे रूतून बसलेल्या अवैज्ञानिक समजुतींना एकप्रकारे उखडून टाकण्याचे काम ही कविता करते. कवी आ.य. पवार यांच्या विज्ञानकवितांच्या या समिक्षणाच्या निमित्ताने मराठी विज्ञानकविता या प्रकाराविषयी काहीनिरीक्षणे नोंदविता येतात. अमेरिकन साहित्यात एडगर ॲलन पोपासून आजपर्यंत अनेकांनी विज्ञानकविता लिहिल्यामराठी साहित्यात मात्र फार थोड्या कविंनी विज्ञानकाव्यनिर्मिती केली. 'परमाणूचे कार्य माहात्म्य' १९१६ ही 'मासिक मनोरंजन'मध्ये प्रसिध्द झालेली गोविंदाग्रजांची कविता मराठीतील पहिली कविता असल्याचे निरंजन घाटेचे मत आहे. पहिली कविता १९१६ ला प्रसिध्द होउनही २०१५ पर्यंतच्या या १०० वर्षांत विज्ञानकवितांची संख्या फारच कमी आहे. त्यात गोविंदाग्रज, विंदा करंदीकर, शिरीष देशपांडे, सुरेश कदम, शामकांत कुलकर्णी, दिपक शेडगे, प्रकाश देशपांडे, वसंत गुर्जर, देवानंद गोरडे, मर्ढेकर, कुसुमाग्रज, पु.शि.रेगे, फ.मु.शिंदे, चंद्रकांत पाटील, विश्वनाथ खैरे आदी कवींनी विज्ञानकविता लेखन करून मराठी विज्ञानकविता समध्द करण्याचा प्रयत्न केला व करत आहेत. असे असले तरी मराठी विज्ञानकविता संख्यात्मक व गुणात्मक दृष्टिने आशयाच्या व शैलीच्या दृष्टिने अदयापही बाल्यावस्थेत आहे हे नमूद करावे लागते. या पार्श्वभूमीवर कवी आ.य.पवार यांच्या 'ग्रामिण विज्ञानकवितांनी' एक नवा कविता प्रकार मराठी कवितेला दिला. त्याबद्दल त्यांचे मनापासून आभार व अभिनंदन.

संदर्भ—

आ.य.पवार 'ऊनपाऊस', रानजाई प्रकाशन, पुणे ३९



प्राक्त
अवकाश...
आज ही जगाची अवस्था



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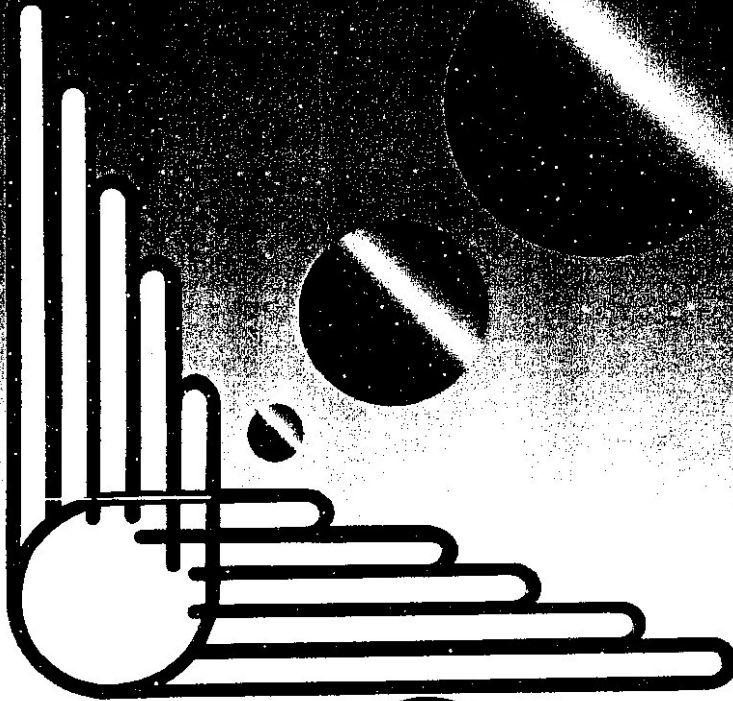
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■ Editor - In - Chief
Prof. Mayur Bandu Lahane



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© मासिकातील मते, संदर्भ, घटना, व अन्वयार्थ हे लेखकांचे स्वतंत्र संशोधन लेखन आहे. या बाबींशी प्रकाशक, मुख्य संपादक, संपादक मंडळ, सल्लागार समिती, समीक्षक मंडळ सहमत असेलच असे नाही.

© मुख्य संपादक — प्रा. मयूर लहाने का मानद पद एवं कार्य पूर्णतः अवैतनिक है। इस शोध पत्रिका के प्रकाशन, सम्पादन, एवं मुद्रण में पूर्णतः सावाधानी बरती गई है। किसी भी प्रकार की त्रुटि महज मानवीय भूल मानी जाए। त्रुटी हेतु सम्पादक, प्रकाशक एवं मुद्रक जिम्मेदार नहीं होगा।



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१. 'दलित कथेतील विद्रोह व नकार'

प्रा. डॉ. अनंत सिरसाट

मराठी विभाग प्रमुख

जिजामाता महाविद्यालय

बुलढाणा

प्रस्तावना —

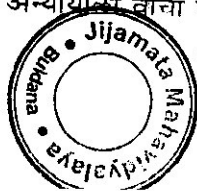
भारतामध्ये पूर्वपार चाल आलेल्या चातुर्वर्ण व्यवस्थेमध्ये ज्यांनी समाजातील अनुभवलेला प्रत्यक्ष अनुभव व ज्यांचे संपूर्ण जीवन अन्याय अत्याचारांमुळे नष्ट झाले असा समाजातील एक षटक म्हणजे अस्पृश्य समाज होय. चोखामेळा यांच्या पत्नी सोयराबाई यांनी 'देहीचा विटाळ, देहीच जन्माला। सोहळा तो जाहला कवण धर्म?' त्या समाजातील उच्चभू असलेल्या लोकांना पंडितांना परखडपणे प्रश्न विचारतात. तसेच चोखामेळा यांचा मुलगा कर्ममेळा देवालाच प्रश्न विचारतो, 'जन्म गेला उष्टे खाता। लाज न ये तुमच्या चित्ता?' यावरून असे माहिती पडते की, चातुर्वर्ण समाजामध्ये भोगाव्या लागणाऱ्या त्रासाची समाजाला कल्पना होती.

१) दलित साहित्य प्रेरणा —

तत्कालीन समाजातील या जाचक व्यवस्थेविषयी दाद मागण्याची जाण पीडितांना होती. अस्पृश्यतेच्या प्रश्नांना अत्यंत तर्कपणे वाचा फोडण्याचे काम महात्मा फुले यांनी केले. 'त्यांनी सामाजिक जीवनाच्या सर्व अंगांचा स्थूलभावाने व पक्षपातीवृत्ती परखडपणे दाखवून दिली.' त्यांची कृती समाजमनावर विशेष प्रभाव टाकून गेली. तसेच डॉ. बाबासाहेब आंबेडकरांच्या प्रयत्नाने अधिक व्यापक बनले. डॉ. बाबासाहेब आंबेडकर यांनी मानवजातीच्या प्रतीष्ठेसाठी आंदोलने करून दलित समाजाला भाषा आणि लेखणी दिली. त्यांनी म्हटले, 'वाचा चार भिंतीपुरती राखू नका. तिचा विस्तार होऊ तिच्या तेजामुळे संपूर्ण अंधार दुर होईल. आपल्या भारत देशामध्ये दलितांचे फार मोठे जग आहे, हे विसरू नका. समाजातील दुःख, व्यथा नीट समजावून घ्या. आणि आपल्या साहित्यातून जीवन उन्नत करण्याचा प्रयत्न करा. त्यातच खरी मानवता आहे.'

२) दलित वाङ्मयाचे स्वरूप —

भारतातील दलित हे सामाजिक शोषणा विरुद्ध सतत लढा देत आहेत. देशामध्ये धर्म, वंश, जात, वर्ण यातून शोषण चालत असे व सोबतच आर्थिक व राजकीय शोषण होत असे. वरिष्ठ समाज कनिष्ठांचा पिढ्यांपिढ्या शोषण करित असे. व या अन्यायाला वाचा फोडण्यासाठी अस्पृश्य समाजामध्ये वरिष्ठ



मराठी
महाविद्यालय
बुलढाणा



समाजाविषयी चिड ही त्यांनी आपल्या कृतीतून व लेखणीतून व्यक्त केली. भारतामध्ये पीडितां जीवण जगण्याची परंपरा असल्यामुळे त्यांच्यावर चालत आलेल्या परंपरेने समाजामध्ये विद्रोह निर्माण झाला. पीडितां जीवण जगणे हा एक ज्वलंत अनुभव असून त्यांच्या केंद्रबिंदूशी माणूस हा मध्यवर्ती आहे. विद्रोही साहित्य शेवटी इथल्याच मातीतून आकारास आले व तेही मराठी भाषेतून. संस्कृतीला व भाषेला तिची स्वयंपूर्णता प्राप्त करून देण्यासाठी कथेतील विद्रोहाची भावना ही एकाचवेळी पीडितांना स्पर्शून जाते. विषमता, द्वेष गुलामगिरी यांनी जखडलेल्या समाजाची अस्मिता जागवून त्याला प्रकाशांशी बनविते. या समाजमनामध्ये वैचारिक चळवळ उभारून आणावेत. परंपरागत समाजाच्या मानसिकतेत बदलाचा आग्रह धरावे. 'अखंड बदल' हा शब्द बौद्ध तत्त्वज्ञानातील मुख्य आशय आहे. मनुष्य हा युगधर्म बनून त्याच्या प्रतिष्ठेसाठी देव-देवता येतात, जन्म नि पूर्वजन्म या सारख्या कथा दलित कथांमध्ये दिसून येतात.

विद्रोही दलित कथांमध्ये वर्ण-वर्गविरहीत समाजाचे शोषण, त्यातील 'स्वत्वे' उज्ज्वल परंपरेचा वारसा सांगणारे दलित वाङ्मय आहे. महात्मा फुले, डॉ. बाबासाहेब आंबेडकर, मार्क्स यांचा तर्क वैचारिकतेतून झालेल्या मनुष्यत्वाच्या प्रतिष्ठेशी त्याचे अतूट नाते आहे. दलितांचा मुक्तिसंग्राम दलित कथा साहित्यातून भिन्न नाही. विद्रोही कथा हे साहित्य चळवळीचे प्रतिबिंब असून विद्रोही कथा साहित्यात उमटलेले आहे. यामध्ये अनुभव व नवचैतन्यवादी विचार असल्यामुळे हे सामाजिक बदलाचे साहित्य आहे.

आज समाजामध्ये अनेक दलित लेखक आहेत परंतु त्यांनी लिहीलेले जे साहित्य आहे. त्यास दलित साहित्य म्हणता येणार नाही. दलित साहित्य वेदनेची आच ज्यांना लागलेली असते, जीवनात निर्माण होणाऱ्या समस्यांचा अनुभव पीडित, गरीब लोकांचा मिळतो आणि त्यांनी अनुभवलेल्या अनुभवांची दाहकता त्यांच्या लिखाणातून संपूर्ण समाजास प्रेरणा देते अशा कथांना दलित विद्रोही कथा म्हणता येईल. दलित साहित्यामध्ये मनुष्य हा अद्य, मध्य आणि अंत्य असतो. दलित कथांमधील अधिकाधिक पात्रे पोटभरण्यासाठी संघर्ष करतात. परंतु पोटभरण्यासाठी कितीही संघर्ष केले तरी दोनवेळची पोटाची आग विजविण्यासाठी सोय होत नाही इतके ज्वलंत प्रश्न दलित साहित्यात सांगण्यात आलेले आहे. दलित कथांमध्ये शृंगाराची अनेक रूपे असून त्या उघड्या-नागड्या, अश्लील आहेत असे काही विचारवंतांची मते आहेत. यांच्या कथांमध्ये सुरक्षित जीवन नाही. दारिद्र्याने वेढलेल्या गलिच्छ वस्त्यांतून, दुष्काळात सापडलेल्या, पशूहून हीन पातळीवरचे जीवन जगणाऱ्याला या माणसांच्या गरजा कितीही असल्या तरी त्या पूर्ण होऊ शकत नव्हत्या. ही माणसे जगण्याच्या इच्छे पोटी



आशावादी असल्याचे दिसते अण्णाभाऊ साठेच्या 'विष्णुपंत कुलकर्णी' या कथेतील विष्णुपंत म्हातारा मांगांना अशावाद दाखवितांना म्हणतो, 'जा, तुम्ही कुठ्यासारखे मरू नका. उकिरड्याचा पांग फिटतो. तुम्ही तर माणसं आहात' असे दलित साहित्य आहे.

दलित कथेतील विद्रोह ही वेदनेतून जन्माला आला आहे. या वेदनेला पुर्वीपार झालेल्या अनुभवांचा संदर्भ असतो. दलित कथेमध्ये जेवढे नाविण्य असते तेवढेच ते आव्हान देणारे ही असते. वाचकाला विचारकरण्यास भागपाडण्याचे सामर्थ्य दलित साहित्यातून दिसून येते. 'मराठी साहित्याच्या आरंभ काळापासून विषमतेविरुद्ध चढाई करणारी बंडखोर प्रवृत्ती प्रथमच दलित वाङ्मयाच्या रूपात पुढे आली'

शंकरराव खरात यांनी जे जीवन जगले व जगतांना जे अतिजवळून पाहिले ते त्यांनी आपल्या साहित्यामार्फत मांडले. त्यांनी विपुल प्रमाणात कथालेखन केले. आपल्या जातीजमातीबद्दल समाजाची असलेली भावना व त्यामधून वाटयाला आलेल्या अपमानित जिव जीवणाविषयी त्यांनी लिखान केलेले आहे. अस्पृश्यांच्या प्रश्नाकडे ते समाजशास्त्रीय दृष्टिकोणातून पाहतात. अस्पृश्य हे भोगता येईल तेवढे दुःख भोगून अजूनही संयमाने ते आपल्या पुढे येणाऱ्या दुःखाला सामोरे जातात. भूक आणि अत्याचार यामुळे शरीराची प्रतिकार शक्ती कमी होत जाते परंतु मनाची उभारी कायम राहते. शंकरराव खरात यांच्या कथेमध्ये पात्र नेहमीच संयमी व आशावादी वाढळतात. वाचक कथा वाचून विचार करण्यास भाग पाडण्याचे सामर्थ्य यांच्या कथेमध्ये आहे. स्वातंत्र्यपूर्व कालखंडात संशयित गुन्हेगार समजून अस्पृशांना वस्तीभोवती असलेले तारेचे कुंपण स्वातंत्र्यप्राप्ती बरोबर नाहीसे झाले. त्यांच्याही जीवनात स्वातंत्र्याची पहाट उगवली. परंतु स्वातंत्र्यप्राप्ती नंतर या अस्पृश्य लोकांना फुकटचे खायला देत नव्हते. तसेच त्यांना त्यांच्या प्रतिष्ठेची कामे मिळनाशी झाली. शिक्षणाच्या प्रभावाने व डॉ. बाबासाहेब आंबेडकरांच्या विचारांच्या प्रभावामुळे दलितांनी गावकीची कामे नकारली.

'सांगावा' ही एक खरातांची प्रभावी कथा आहे. रामाल गावकीच्या नात्याने वेळोवेळी स्पृश्यांनी सांगितलेली कामे करावी लागूनही त्याला त्याचा मोबदला मागण्याची उजागीरी नव्हती. शंकरराव खरात यांनी रामा नावाच्या पात्राचे चित्र रेखाटले व त्याच्या घरची परिस्थिती अत्यंत दयनीय स्वरूपाची असून केलेल्या कामाचा मोबदला अत्यल्प मिळत असूनही तो मागण्याचा अधिकार नव्हता. त्यांची दलित कथा ही ग्रामीणतेशी जवळचे नाते सांगणारी आहे. ग्रामीण व शहरी यांची तुलना त्यांच्या कथेमध्ये दिसून येते.

बाबूराव बागूल यांनी १९६३ मध्ये 'जेव्हा मी जात चोरली होती' व

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अक्कांक्षा
नवी देवा आहे अजून



१९६९ मध्ये 'मरण स्वस्त होत आहे' या कथामध्ये त्यांच्या लेखणीचे वेगळेच वैशिष्ट्य जाणवल्या शिवाय राहत नाही. सामाजीक वास्तवाचे दर्शन घडवणारी त्यांची 'सूड' ही कथा विशेष गाजलेली आहे. त्यांची कथा ही सर्वाहून भिन्न आहे. डॉ. बाबासाहेब आंबेडकरांच्या चळवळीतून त्यांचे विद्रोही व्यक्तिमत्व साकारले आहे. जे जीवन वाटयाला आहे ते त्यांनी लेखनास प्रमाण मानले. ते म्हणतात, 'येथे मी जन्म घेतला म्हणून मला जात मिळाली, पण जेव्हा मी लिहू लागलो, माणसांचा विचार करू लागलो तेव्हाच मी देशातल्या आणि जगातल्या सर्वदलित वंचितांचा झालो.'^४ बाबूराव बागुलांची कथा म्हणजे वेदनेचा विस्फोट होय. ती दलितांच्या गुलामगिरीला कारणीभूत ठरलेल्या वर्णव्यवस्थेच्या मुळावरच झेप घातले. म्हणून त्या भावनिक पीळ लवकर जाणवतात. बाबूराव बागुलांची कथा म्हणजे दलितांच्या अस्मितेचे मुक्त प्रकटन आहे. हा एक भोगल्या गेलेल्या वेदनेचा स्फोट आहे. स्वातंत्र्योत्तर कालखंडातील झालेल्या जनजागरणातून दलितांना आपल्या हरवलेल्या स्वत्वाची जाणीव होऊन शतकांच्या वर्णव्यवस्थेला जन्म देणाऱ्या समाजव्यवस्थे विरुद्ध बंड पुकारते.

बाबूराव बागूल यांच्या 'विद्रोह' कथेत मॅट्रिकच्या वर्गात एक जय नावाचा विद्यार्थी असतो. तो केवळ भंग्याच्या पोटी जन्माला आला म्हणून मन मारून भंग्याची घृणास्पद नोकरी करण्याची वेळ त्यावर येते. यातील वर्णन वाचूनच वाचकांच्या अंगावर शहारे येतात. मेहतराचे काम करणारी त्याची आई जेव्हा आपल्या मुलाला पाहून हे काम तुझ्यासाठी नाही. ते आमच्या सारख्या अडाणी मुडद्यांसाठी आहे.... नका, डोळ, मन तोडून पडलेल्यासाठी आहे. 'विद्रोह' या कथेमध्ये एकाच कुटूंबातील नायक, त्याची पत्नी, आई-वडील यांचे वेगळे वर्णन केलेले आहे.

कादंबरी, कथा, लोकनाटय, प्रवासवर्णन इत्यादी साहित्य लिहले असून अण्णाभाऊ साठे दलित साहित्याचे उद्गाते आहे. अण्णाभाऊ साठे यांचे शिक्षण इयत्ता दुसरीपर्यंत झाले. ते म्हणतात, 'जे जीवन जगलो. जे जीवन अनुभवले तेच मी लिहित आहे.' नारायण सुर्वे म्हणतात, 'अण्णाभाऊ समाजाच्या अत्यंत खालच्या थरातून आले होते. या समाजाचे दुखणे, त्यांच्या वेदना त्यांनी अनुभवल्या होत्या'^५ अण्णाभाऊ साठेच्या कथा गावातील वास्तवशी नाते सांगणाऱ्या आहेत. जीवनातील कटू अनुभवाची सांगळ त्यांनी आपल्या कथेमधून केली आहे. माणूस भाकरीच्या तुकड्यासाठी आयुष्यभर भटकंती करतो. शरीर जगविण्यासाठी पोटाची खळगी भरण्याकरिता माणूस काहीही करण्यास तयार होतो. काहीही करण्यासाठी समाजामध्ये त्याला गुन्हा, पाप अशा संज्ञा दिल्या जातात. 'स्मशानातील' या कथेमध्ये अंगात रेड्याच बळ असणाऱ्या भीमाला मुंबईमध्ये काम मिळत



नाही म्हणून कधी अर्धपोटी तर कधी उपाशी राहून जीवन जगावे लागत असे. एक दिवस स्मशानात भटकत असताना मढ्याच्या राखेत दिसलेल्या सोन्यात त्याला जीवन जगण्यासाठी भार मिळविण्याचा मार्ग सापडतो. मग रात्र झाली की भीमा नित्यनेमाने स्मशानात जातो. रात्री-बेरात्री नेहमी स्मशानात जाणे त्याच्या बायकोला असह्य झालेले होते. ती त्याला याबाबत विचारत असे यावर उद्गारलेल्या 'अंग ही मुंबई भुताचा बाजार आहे. खरी भुत घरात राहताता आणि मेलेली मसण वट्यात कुजतात. भुताची पैदास गावात होते रानात नाही.' या भिमाच्या उद्गारामध्ये प्रचलित समाजरचनेविषयीचे जळजळीत सत्य स्पष्ट होते.

अण्णाभाऊ साठेंच्या कथासृष्टीत काही अद्भुत व लोकविलक्षण पात्रे आहेत. त्यांच्या कथेमध्ये पात्रे एकामधून एक येत जातात. व त्यातून एक सारखा परिणाम साधण्याचा प्रयत्न केल्या जातो. एखाद्या स्वाभिमाना, सामर्थ्यावान माणसाचे वर्णन करताना त्यात अद्भुततेचा रंग भरल्या जाते. या विषयी अण्णाभाऊ साठे म्हणतात, 'माझी जीवनावर फार मोठी निष्ठा असून मला माणसं फार आवडतात त्यांची श्रवणशक्ती आहे. ती जागतात जगाला जगवतात. त्यांच्या बळावरच हे जग चाललं त्यांची झुंज नित्याचे यश यावर माझा विश्वास आहे.'^{१६} अण्णाभाऊ साठेंच्या कथेत कुठेही कृत्रीमता दिसून येत नाही. त्यांचे शब्द ग्रामीण असून ते अत्यंत रसाळ वाटतात. आपले दुःख हसत हसत सहन करतात. त्यांच्या कथेमध्ये खून, दरोडा, धाडसीपणा, कुन्हाडीने वार करणे, मरण्याची तमा न बाळगणे इत्यादी घटनांचा अंतर्भाव होतो.

शंकरराव खरात, बाबूराव बागूल व अण्णाभाऊ साठे यांनी कथा लिहायची म्हणून लिहिलेल्या नाहीत. त्या कथेमध्ये आपणच आपला व समाजाचा उध्दार करू ही जाणीव मनाशी बाळगून त्यांनी दलित साहित्य निर्मिती केली. दुसऱ्यांच्या मर्जीनुसार जीवण जगणे नकोत, सहानुभूती नको, अधिकार हवा या प्रकारचे विचार त्यांनी कथेमध्ये मांडलेत. कथेच्या माध्यमातून समाजामध्ये नवचैतन्य व आत्मविश्वास निर्माण केला. दलित कथांमध्ये आशय विषयाप्रमाणेच ग्रामीण भाषा व प्रतिमानही घेतलेले आहे. दलित वाङ्मय हे उघडया, नागडया जीवनाचे चित्र जसेच्या तसे रेखाटल्या जाते. ग्रामीणकथेत व दलित कथेत खुपमोठे अंतर आहे. ग्रामीण कथेत लोक गावाच्या अवतीभवती किंवा गावात राहून त्यांना जीवन जगावे लागते. ग्रामीण जीवनात शोषणाचे स्वरूप अत्यल्प आहे. तर दलितांना गावाबाहेरील जीवन जगावे लागते. ग्रामीण जीवनात दैन्य, दारिद्र्य, दुःख आहे तर दलित जीवनात दैन्य, दारिद्र्य तसेच सामाजिक गुलामगिरीबरोबर राजकीय व आर्थिक शोषणही आहे. समाजातील सर्व दलितच जीवन सारखेच आहे. त्यांना समाजातील अनेक समस्यांना तोंड द्यावे लागते. यातून



अनंत शिरसाट
अनंत शिरसाट



शारीरिक व मानसीक दुर्बलता त्यांच्यात निर्माण होते. तरीही दलित लेखक नव्या संघर्षाला उभे राहतात. तुकाराम महाराजांनी म्हटले आहे. 'रात्रदिन आम्हा युद्धाचा प्रसंग' असे दलितांचे नित्याचे जीवन झालेले आहे. दलित साहित्यामध्ये वेदनांचे दर्शन प्रत्येक क्षणी झाल्यावाचून राहत नाही. दलित कथा नि संपूर्ण दलित साहित्याचे विविध प्रकार आणि प्रवाह यांची प्रेरणा डॉ. बाबासाहेब आंबेडकरांच्या शोषणाविरूद्ध चळवळीतून दिसून येते. प्रत्येक दलित कथांचे स्वरूप लेखकानुसार वेगवेगळे असले तरी त्यात समाजातून दलितांना मात्र त्रास, वेदना, अवहेलनाच मिळतात. त्यातूनच त्यांना समाजाविषयी चिड, संताप, विद्रोहाची भावना निर्माण होते.

मराठी दलित कथेवर अनेक प्रकारचे आक्षेप घेतले जातात. दलित कथा हया अश्लील, वर्णनात्मक, त्यांचे अश्लील वाक्प्रचार, त्यांचे अस्वच्छ राहणीमान या विषयी अनेक टिकाकारांनी टिका केलेल्या आहेत. परंतु दलित लेखकांनी प्रत्यक्ष अनुभवलेले गोष्टी जसेच्या तसे आपल्या कथामध्ये मांडण्याचा प्रयत्न केला. प्रवाहाच्या उलट दिशेने जाणाऱ्याच्या वाट्याला निराशा येण्याचीच शक्यता जास्त असते. दलित साहित्या विषयीही नेमके हेच घडत आहे. अण्णाभाऊ साठेचे 'स्मशानातील सोने.' बाबूराव बागूल यांचे 'विद्रोह' या कथामध्ये दलितांच्या जीवनाची दाहकता दाखवली आहे. ही कथा लिखानापूर्वी ज्यांच्यावर ही प्रत्यक्ष अनुभूती घेतली ती किती भीषण असेल याची कल्पना करतांना अंगावर शहारे येतात. बाबूराव बागूलांच्या कथेतील आगडोंब मनाचा थरकाव उडविणारा आहे. मध्यम वर्ग प्रस्थापितांविरूद्ध संताप त्यांच्या शब्दाशब्दातून प्रत्यक्ष दिसतो. त्यांची पात्रे बेधडक आपले कार्य करीत राहतात. त्यांच्या कथेतील, 'माणसे सामर्थ्यशाली आणि आपल्या श्रेयाच्या शोधासाठी जीवनाचा आटापीटा करणारी, समाज, निसर्ग, नियती, यांच्याशी उभादावा मांडणारी आढळतात' आजच्या दलित कथेमध्ये धग आणि राग बरेचदा असाहय होते.

निष्कर्ष —

समाजामधील दलित लोकांचे जीवन एक सारखेच आहे. सर्व दलितांमध्ये दारिद्र्य, दुःख, मानहानी, आक्रोश, छळ, उपेक्षा, अस्पृश्यतेपोटी आलेली भग्नता यांचे अंतिम नाते वेदनेशी जुळतांना दिसते. दलितांची ही कथाच त्यांची कथा रूपी साहित्य बनते. दलितांचे जीवन जगण्यात एक सहजता असते. कधीकधी जीवनातील भीषण वास्तवाचे रूप इतके प्रभावी असते की कलावंत व वाचक अंतर्मुख होवून जातो. 'जातीवर्चस्वाला' आव्हान देणारा विचार अतिशय मूलभूतपणे मांड्याचा प्रयत्न महात्मा फुले व डॉ. बाबासाहेब आंबेडकर यांनी तो विचार वैश्विक पातळीवर नेला हा वारसा समर्थपणे पेलण्याचे कार्य दलित

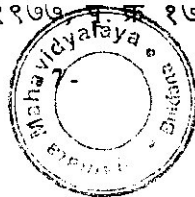


लेखकांनी केला. दलित कथा ही विविध घटनांची बनलेली आहे. त्यावेळचे शोषित नव्या रूपात पुढे येत आहे. परंपरेने अडाणी व गरीब असलेल्या सामान्य माणसाच्या अज्ञानाचा वापर करून प्रतिगामी शक्ती जोर धरू लागली. भारतामधील चातुर्वर्ण्यव्यवस्था पूर्णतः नामशेष झालेली नाही. परंतु आजच्या परिस्थितीत समाजातील अत्यंत दुर्बल घटकालाही शिक्षणाच्या माध्यमातून 'स्वत्वाची' जाणीव निर्माण झालेली आहे. डॉ. बाबासाहेब आंबेडकरांनी दिलेल्या वाणी व लेखणी नुसार तो आपल्यावरील अत्याचाराचे लिखाण करून समाजातील जो घटक आपल्यावर अन्याय करतो त्यावर तो व्यक्ती, संघटना, संस्था यांच्या माध्यमातून हल्ले करीत आहे. समाजातील विशिष्ट वर्गांनी 'स्व' पुरतेच जीवन आहे असे माणून ते इतरांवर अन्याय करतात. हा अन्याय शोषितांचा वर्ग आपले हात सर्वत्र पसरवित आहेत. यातून नविन आत्मविद्रोह निर्माण होवून दलित कथाकार समोर आलेल्या परिस्थितीत अत्यंत धैर्याने सामोरे जात आहेत.

दलित साहित्यामध्ये सामाजाविषयी विद्रोह व नकार निर्माण झालेला आहे. स्वातंत्र्योत्तर काळामध्ये दलित साहित्यीक बऱ्याच प्रमाणामध्ये विद्रोही झाले. दलित साहित्यात दुःख हे केंद्रस्थानी आहे. पुर्वी निर्मित झालेल्या दलित कथांमध्ये संपूर्ण समाज ढवळून निघण्याचे सामर्थ्य होते परंतु आजच्या दलित साहित्यामध्ये ते आढळून येत नाही. यावरून दलितांमध्ये स्वातंत्र्योत्तर काळामध्ये परिवर्तन झाले आहे.

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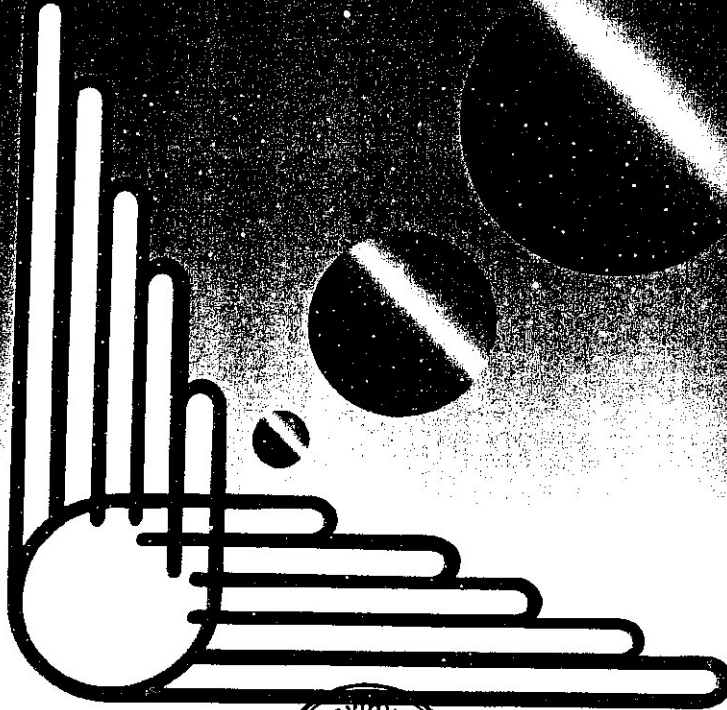
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© मासिकातील मते, संदर्भ, घटना, व अन्वयार्थ हे लेखकांचे स्वतंत्र संशोधन लेखन आहे. या बाबींशी प्रकाशक, मुख्य संपादक, संपादक मंडळ, सल्लागार समिती, समीक्षक मंडळ सहमत असेलच असे नाही.

© मुख्य संपादक — प्रा. मयूर लहाने का मानद पद एवं कार्य पूर्णतः अवैतनिक है। इस शोध पत्रिका के प्रकाशन, सम्पादन, एवं मुद्रण में पूर्णतः सावाधानी बरती गई है। किसी भी प्रकार की त्रुटि महज मानवीय भूल मानी जाए। त्रुटि हेतु सम्पादक, प्रकाशक एवं मुद्रक जिम्मेदार नहीं होगा।



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प्रा. डॉ. अनंत सिरसाट

मराठी विभाग प्रमुख

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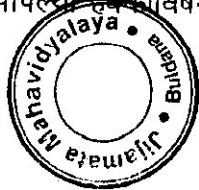
बुलढाणा

सारांश :

कवी विठ्ठल वाघ सर्व महाराष्ट्राला ग्रामीण कवी, गीतकार म्हणून सर्व परीचित आहेत. त्यांच्या 'काया मातीत मातीत' या गीताने त्यांना अधिक लोकप्रियता मिळवून दिली. आधुनिक काळात कवितांच्या आशय, विषय याबाबतीत बरेच परिवर्तन झाले. जागतिकीकरण, उदारीकरण, विविध स्पर्धा, झगमगाटी जग कवितेत व्यक्त झाले, मात्र विठ्ठल वाघांची कविता ग्रामीण परिसरात अधिक प्रमाणात रममाण झाली. ग्रामीण परीसर, निसर्ग, सण—उत्सव, परंपरा, रितीभाती, कृषीजीवन, त्यातील फेरबदल, विविध समस्या, बलुतेदारी पद्धत, संघर्षमय जीवन यांतच अधिक त्यांची कविता एकवटून गेली. नवीन आगळा वेगळा विषय त्यांनी घेतला नाही. त्यामुळे त्यांच्या काव्यातील 'देशीयता' हा विषय लेखनासाठी महत्त्वाचा वाटला. कवीचे लेखन, चिंतन, मनन कसे देशीय स्वरूपाचे आहे हे त्यांच्या काव्यांच्या आधारे सिद्ध करून घेवटी निश्कर्श नोंदवले आहेत. 'ज्ञानपीठ पुरस्कार' प्राप्त मराठी साहित्यिक भालचंद्र नेमाडे यांचा देशीवाद इतर कवीपेक्षा विठ्ठल वाघांच्या काव्याला पूर्णतः लागू पडतो असे म्हणायला काहीच हरकत नाही.

प्रस्तावना :

१९६० नंतर मराठी काव्यप्रांतात गाजलेले ग्रामीण कवी म्हणजे विठ्ठल वाघ हे होत. त्यांनी 'काया मातीत मातीत', 'साय', 'वैदर्भी', 'कपाशीचे चंद्रफुले' असे विविध आशयाचे काव्यसंग्रह लिहिले. मात्र ग्रामीण परिसराशी असलेली नाळ त्यांनी तुटू दिली नाही. ग्रामीण कविता आणि विठ्ठल वाघ यांचा अन्योन्य संबंध निर्माण झाला. या काळात काव्यगायनाला विशेष महत्त्व असल्याने कवीने गावोगावी जाऊन आपल्या काव्यातून शेतकऱ्यांचे दुःख व्यक्त केले. त्याचबरोबर समाजप्रबोधन करून शेतकऱ्यांना आपल्या कष्टाविषयी जागृत करण्याचा प्रयत्न केला. त्यासाठी



- 1 -

अनंत सिरसाट



त्यांनी संपूर्ण महाराष्ट्र पालथा घातला. कवी विठ्ठल वाघ यांचे काव्य मनाला भिडणारे असल्याने त्यांचा प्रभाव सर्वसामान्यांवर नक्कीच झाला. त्यांनी फक्त काव्यच केले नाही तर प्रत्यक्ष कापसाच्या भावासाठी आंदोलनात सहभाग घेऊन स्वतः तुरुंगवास देखील भोगला. अशाप्रकारे कृती आणि उक्ती यांचा समन्वय म्हणजे ग्रामीण कवी विठ्ठल वाघ होत. त्यांचे काव्य प्रामुख्याने ग्रामीण परिसराचे चित्रण करते. ग्राम हाच त्यांच्या काव्याचा प्रमुख गाभा असल्याने भालचंद्र नेमाडे यांनी मांडलेली देशीयता संकल्पना पूर्णतः यांच्या साहित्याला, काव्याला लागू पडते. आज आधुनिकतेच्या नावावर सगळीकडे परीवर्तनाची लाट आली आहे. घरी जेवणासाठी नसले तरी चालेल मात्र पाहण्यासाठी रंगीत टि.व्ही. हवी. ऑनलाईन सेवा, भ्रमणध्वनी, महागडे कपडे या सर्व गोष्टीला अधिक महत्त्व आले. अशाही काळात कवी विठ्ठल वाघ आपली संस्कृती, आपले जगणे, लोकजीवन, वास्तव समस्या, रितीरिवाज, परंपरा, रूढी, कृशीजीवन काव्यातून व्यक्त करतात. वास्तव परीस्थितीचा वेध घेवून योग्य दिशेने परीवर्तनाची आशा धरतात. जूने हे टाकाऊ नसून ते सोने पण आहे. हे त्यांनी काव्यातून व्यक्त केले आहे. ते वरवरच्या झगमगाटी जगाने हरवून जात नाही, तर वास्तव परीस्थितीतील वाईट परंपरेवर आघात करतात. सुभाशितातून जीवनाचे तत्त्वज्ञान मांडतात. वन्हाडी बोलीतून भाशेतील गोडवा सर्वांना चाखायला देतात. येथे विठ्ठल वाघांच्या काव्यातील देशीयता स्पष्ट करण्यापूर्वी प्रथमतः 'देशीयता' ही संकल्पना येथे स्पष्ट रूपात मांडणे गरजेचे वाटते.

देशीयता संकल्पना :

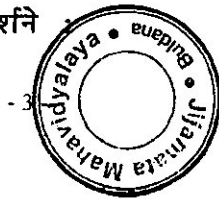
ज्ञानपीठ पुरस्कार प्राप्त 'मराठी साहित्यिक भालचंद्र नेमाडे यांनी 'देशीयता' या संकल्पनेला एक स्वयंभू मूल्य देण्याचा प्रयत्न केला. त्यांच्या मते 'देशी असणे म्हणजे या एकदंर भूमित्वाचे भान, त्यातील सर्व जाती, वंशाचे समूह, संप्रदाय, धर्म, परंपरा, स्थलकालाचे उभे आडवे छेद या सर्वासकट येणारे एकजिनसीपणाचे भान होय.'१ अशी व्याख्या केली आहे. जागतिकीकरणाला प्रत्युत्तर देण्यासाठी

देशीवादाचा पुरस्कार प्रभावीपणे उपयुक्त ठरू शकतो. असा आशावाद त्यांनी या संकल्पनेतून मांडलापाश्चात्य देशातील प्रत्येक विचार, कृती, वस्तू प्रमाण मानने चुकीचे असून आपल्या स्वतःचे स्वतःच प्रमाण असणे गरजेचे आहे. जागतिकीकरण अटळ आहे. मात्र त्याची भयावह वाईट परीणाम देशीयतेच्या ढालेवर नक्कीच काही प्रमाणात अडविता



येतील असे त्यांना वाटते. देशीयतेतील एकजिनसीपणाचे भान कवी विठ्ठल वाघ यांच्या काव्यात आढळून येते. त्यांनी जागतिकीकरण, उदारीकरण यांचे भयावह चित्रण काही प्रमाणात मांडले असले तरी देशीयता, कृषीजीवन, ग्रामपरीसर, धर्म परंपरा, स्थळकाळाचे उभे आडवे छेद व्यक्त केले आहे. आपली संस्कृती ही टाकाऊ नसून ती टिकाऊ आहे असे भान ते काव्यातून व्यक्त करतात. शेतकरी जगाचा पोशिंदा आहे. त्यांच्यामध्ये जग जगविण्याची उमेद आहे. परंपरा, एकता, संस्कृतीचे भान ठेऊन तो समाजात वावरतो आणि हे सर्व देशीयता या संकल्पनेला धरूनच आहे. चंगळवाद, बाजारीकरण आणि वस्तूकरण या तिन्ही प्रक्रियांचा अटळ परिपाक होऊन मूल्यांचा न्हास होत आहे. शहरी भागात हा मूल्यांचा न्हास अधिक प्रमाणात आहेत. यामानाने अजून ही ग्रामीण भागात खेड्यांच्या वस्तीवस्तीत निष्ठा, त्याग, प्रेम, बंधुता, आपुलकी मानवता जिवंत रूपात असून संस्कृती, विवाह, कुटुंब, संयुक्त समाज अस्तित्वात आहे. त्यांचे स्वरूप कवीने विविध कवितेच्या माध्यमातून चित्रित केले आहे. मग ते शेत असो, खेडे असो की त्या खेड्यातील संघर्षमय जीणे असो या सर्वांचा आढावा त्यांच्या काव्यात आला आहे. स्त्री रूपाचे उत्कट चित्रण, वऱ्हाडी बोलीचा साज, जीवनाचे तत्त्वज्ञान, राजकारण व समाजकारण, लोकपरंपरा जागोजागी कवितेत प्रत्ययास येते. विठ्ठल वाघांची कविता ग्राम संस्कृतीच्या परिवर्तनाचा आलेख मांडणारी आहे. एकीकडे देश विकासाच्या मार्गावर अग्रेसर होत असतांना ग्रामीण परिसर मात्र, अनेक समस्यांनी, उणीवांनी भरून पडला आहे. शेतकऱ्यांचा शेतीमातीशी कायम ऋणानुबंध आहे. शेती, माती, निसर्ग, झाडेझुडपे, पशुपक्षी, जनावरे प्राणी तर यात आहेत. शेतकरी यांच्या वेदना, संघर्ष पराभव, दुःख, हर्ष अवकाळी स्थिती या कवितेतून समर्थपणे व्यक्त झाली आहे. ग्रामीण रितीभाती, सण, उत्सव, जत्रा, देवळे, वारी, अशा ग्रामसंस्कृतीच्या अनेक घटकांचे वर्णन त्यांच्या काव्यात आले आहे. कवी विठ्ठल वाघ यांनी खेड्यातील भेदक वास्तव आपल्या काव्यात टिपले आहे. सूक्ष्म व उत्कट चित्रण त्यांच्या काव्यात येत असल्याने त्यांची कविता अस्सल ग्रामीण कविता ठरते. येथे त्यांच्या काव्यातील 'देशीयता' स्पष्ट करणे महत्त्वाचे वाटते ते खालीलप्रमाणे :-

ग्रामीण जीवनातील विविध दर्शने
खेड्यातील दैनंदिन जीवन :



महिला
अकादमी

शेतकरी जगाचा पोशिंदा आहे. तो नित्यनियमित अपार कष्ट उपसून धान्याच्या राशी निर्माण करतो. मात्र त्यांचे जगणे आजच्या काळात अत्यंत खडतर असे बनले आहे. त्यांच्या कष्टाला काळ-वेळ यांचे बंधन नसते. सूर्योदयापूर्वीपासून रात्र होईतो पर्यंत तो अविरत घाम गाळून आपल्या संसाराचा व जगाचा गाडा रेटत असतो. त्यांचे अविरत श्रम हेच त्यांचे जगणे होऊन बसते. दोन वेळचे अन्न, आसरा, अंग झाकायला कपडे आणि आपल्या कुटूंबाची सुखरूपता एवढे सुद्धा त्यांच्या नशिबी नसते. म्हणूनच कवी विठ्ठल वाघ 'कपाशीचे चंद्रफुले' या काव्यसंग्रहातील कवितेत म्हणतात.

“कर्जपाणी फिटायचं उरल्याचं तेलमीठ

जाय वशावर पुन्हा नव्या लुगड्याची गोठ”

(‘कपाशीचे चंद्रफुले’ काव्यसंग्रह पृ.क. २०)

शेतकऱ्यांच्या कुटूंबियांच्या किमान अपेक्षा एवढ्यातरी पूर्ण होतील की नाही असा प्रश्न कवीला पडतो. कवीची कविता शेती, शेतकरी आणि त्यांचं कुटूंब या आसाभोवती फिरते. त्यांची तिफन’ ही अतिशय गाजलेली कविता शेतकऱ्यांची कष्टाची आरती वाटते. कवितेत वेदनेने कासावीस होणारा, रक्ताची आहुती देणारा शेतकरी हिरवं स्वप्न पाहण्याचा आशावाद सोडत नाही. म्हणून कवी ‘तिफन’ या कवितेत म्हणतो—

पानी भिजलं ठेकूल लेनी पायाले वाटते

काया ठेकलात डोया हिर्व सपन पाहेते (तिफन, पृ.क. ३७)

त्याची किती कष्ट उपसण्याची तयारी असून फक्त श्रमाचे चीज व्हावे, अशी आशा त्याला नक्कीच लागली आहे. ‘वावर’, ‘ढगामूचूक अभाय’, ‘पानी’, ‘गाव’, ‘खापराचे दिवे’, ‘आजून’ अशा विविध कविता मधून शेतकऱ्यांचे जीणे, त्याचे कष्ट, त्यांच्या समस्या, त्याचे कुटूंब त्यांच्यातील प्रेम अधोरेखित केले आहे. कवी विठ्ठल वाघांच्या कवितेतील महत्त्वाचा विषेश म्हणजे ग्रामीणत्व त्यांनी आजवरच्या ज्या काही कविता लिहील्या त्या केवळ ग्रामीणच डॉ. अक्षयकुमार काळे यांच्या मते “ग्रामीण निसर्गाइतके किंबहुना थोडे जास्तच ग्रामीण वास्तवाचे भान वाघांना आहे”^२ ही प्रतिक्रिया योग्यच म्हणावी लागेल. विठ्ठल वाघ यांचा ‘वैदर्भी’ काव्यसंग्रह वैदर्भीय राहणीमानाचे, जीवनाचे चित्र रेखाटते. ‘वृषभसूक्त’ काव्यसंग्रहातून बैलांविषयीची कृतज्ञता व्यक्त केली आहे. तर ‘गावशिव’ व पंढरीच्या वाटेवर या काव्यसंग्रहातून ग्रामसंस्कृती, ग्रामदेवता, पंढरीची वारी, साध्याभोळा वारकरी

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अकांक्षा
नवी उदय घाले प्रगल्भ



व्यक्त झाला आहे. तर 'पाऊसपाणी' काव्यसंग्रहात पावसाचे शेतकऱ्यांच्या दृष्टीने असलेले महत्त्व स्पष्ट केले आहे. कधी पाऊस जीवनाचा आधार बनतो तर कधी तोच पाऊस कमी जास्त प्रमाणात येऊन शेतकऱ्यांच्या जीवनात संकटाचे पहाड उभे करतो. या सर्वांचा उल्लेख 'पाऊसपाणी' काव्यसंग्रहात कवी करतात. एकूणच त्यांच्या सर्वच काव्यसंग्रहात ग्रामजीवन व कृषिव्यवसाय याची इत्यंभूत माहिती आली असून त्यातून शेतकऱ्यांचे दैनंदिन जीवन व्यक्त झाले आहे.

ग्रामीण भागातील समाजकारण व राजकारण :

विठ्ठल वाघ निसर्गात रममाण होणारे कवी असले तरी समाजाचेही त्यांना भान आहे. आपल्या कवितेतून ते ग्रामीण भागातील गरीब—श्रीमंत, पीडीत—शोषित, सामान्य—राजकारणी, शासन—प्रशासन या सर्वांचा त्यांची कविता वेध घेते. आज समाजातील माणूसकी फार लयाला जात असल्याचे ते स्पष्ट करतात. स्वातंत्र्योत्तर काळात सर्व वस्तूचे भाव दुपटी—चौपटीने वाढले मात्र शेतकऱ्यांच्या मालाचा साधा लागवड खर्च सुध्दा निघत नसल्याचे कवी काव्यातून स्पष्ट करतात. उन्हातून आमी निघालो, आजून सावली नाही बाभुईच्या आलो बनात, काटेच सावली नाही (आजून, पृ. क्र. ३०) शेतकऱ्याला कधी सुखाचे दिवस येतील याबद्दल कवी मन साधक आहे. ग्रामीण भागातील राजकारण इरेस पेटलेले दिसून येते. ग्रामपंचायतची निवडणूक असो वा सोसायटीची मतभेद वाढत जाऊन माणूस माणसापासून दुरावत चालल्याचे दुःख कवीला आहे. राजकारणी लोक आपल्या स्वार्थापोटी सर्वसामान्यांचे बेहाल करीत आहे. म्हणून आपल्या मिळालेला मतदानाचा अधिकार जाणिवपूर्वक बजावून समाजात परीवर्तन घडवून आणले पाहिजे. तसेच आपल्यावर होणाऱ्या अन्यायाविरुद्ध द जोरकसपणे आवाज उठविला पाहिजे असे कवी सुचवितात. आरे बदला पुढे बदला चाळ मातर फिरतं ठेवा धुरकरी व्हा कोणी राजा गाळं मातर चालत ठेवा (रगता भांबयकृपा.क्र.२९) अशी कवीला योग्य दिशेने परीवर्तनाची आस अपेक्षित आहे, असे लक्षात येते. राजकारण व समाजकारण हितासाठी झाले पाहिजे असे त्यांना वाटते. कवी मनाला समाजमन नीट कळले, समजले असल्याने त्यांनी आपल्या सामाजिक कवितेत ते यथार्थपणे शब्दबद्ध करू शकले, असे म्हणता येईल. महाराष्ट्रातील शेतकरी संघटनांच्या आंदोलनात त्यांनी हिरीरीने घेतलेला सहभाग त्यांची समाजाभिमुखता स्पष्ट करते. त्यांच्या काही कवितेत सामाजिक व राजकीय वास्तवाचे प्रखर चित्रण



अकांक्षा
आमि श्रम मात्रे कर्मणि



आलेले आहे. तसेच त्याचा निषेध ही व्यक्त झाला असल्याचे लक्षात येते एकूणच घेतकरी जीवनाचे सगळे संदर्भ त्यांच्या काव्यात आलेले आहेत. वऱ्हाड बोलीचा साज :

कवी विठ्ठल वाघांनी आपल्या संपूर्ण कविता वऱ्हाडी बोलीतून लिहिल्या आहेत. वऱ्हाडी बोलीतील जोमदारपणा, रांगडेपणा व तिच्यात असलेली नादाकुलता त्यांच्या कवितेत ओतप्रोत भरलेली आहे. त्यांच्या वऱ्हाडी बोलीचा बाज विषयी प्रा. चंदकुमार नलगे म्हणतात, “विठ्ठल वाघ (साय) आणि शंकर बढे (इरवा) यांच्या कवितेत ग्रामीण बोलीचा बाज जीवनानुभवाला अस्सलतेचे परिमाण प्राप्त करून देणारा ठरला”^३ एकूणच वऱ्हाडी बोलीतील विठ्ठल वाघांचे काव्य दर्जेदार व जीवनानुभवी बनले आहे. त्यांची कविता वऱ्हाडी बोलीतून ग्रामीण माणसांच्या जगण्याचा वेध घेते. त्यांच्या काव्याबाबत रेखा जगदाळे आपल्या समिक्षात्मक ग्रंथात म्हणतात. “बोली भाषेतील शब्द, म्हणी, वाक्प्रचार यांचा वापर ते कवितेतून करतात, त्यामुळे वाघांच्या कवितेच्या रूपाने ग्रामीण कवितेचे एक नवे रूप आपल्याला पाहावयास मिळते. त्यांची कविता म्हणजे लोकानुभवाला, लोकभाषा, लोकजीवन, लोकसंस्कृती, लोकगीत यांच्या अंगाने आविष्कृत करणारी लोककविता आहे.”^४ वऱ्हाडी बोलीतील असलेल्या त्यांच्या कवितेचे विषयी असलेले वरील मत यथोचित वाटते.

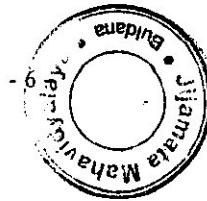
“अखाळीले जारे तुमी माहा वावर पंदरी

हाले भळाच्या पानात झेंडी इठोबाची खरी (वावर पृ.क.०२)

वरील ‘वावर’ कवितेतील कडव्यात माहा, अखाळी, भळ, तुमी, इठोबा अशाप्रकारची शब्द वऱ्हाडी बोली प्रकर्षाने दर्शविते तुम्हाला, आम्हाला किंवा तुला, मला यांची वरील कवितेत वऱ्हाडी रूपे तुले, मले तुमी अशी होतात. विठोबाच्या ‘वि’ ऐवजी ‘ई’ अक्षराचा वापर होतो, असे दिसून येते. एकूणच वऱ्हाडी बोली वाचकाचे लक्ष वेधून घेते.

ग्रामीण काव्यातून जीवनाचे तत्त्वज्ञान :

कवी विठ्ठल वाघ यांच्या सुरवातीच्या ‘साय’ ‘वैदर्भी’ ‘काया मातीत मातीत’ या काव्यसंग्रहात सुभाषित सदृश्य रचना असलेले मुक्तके आली आहेत. सुभाषितातून (मुक्तकातून) कवीने जीवनाचे तत्त्वज्ञान उलगडले आहे. मानवी स्वभाव, संगतीचा परीणाम, अहंकारी व्यक्तीची दुर्दशा, प्रयत्नाचे फळ, नात्यासंबंधीची जवळीकता, दुरावा व्यक्त करून समाजाला



माहिती
अकांक्षी
जिजमाता महाविद्यालय, बुल्हाना



दिशा देण्याचे कार्य त्यांनी केले आहे. उदाहरणादाखल 'साय' 'वैदर्भी' काव्यसंग्रहातील मुक्तकांचा येथे विचार करता येईल.

भेला कष्टाले माणूस
होते मंहाग ताकाले
वाट तपोल्या बिगर

नाही बसत चाकाले ('साय' काव्यसंग्रह पृ.क्र. ३७)

येथे संत तुकारामाच्या, संत रामदासाच्या प्रयत्नवादाच्या विचारांची आठवण आल्याशिवाय राहत नाही. अवघ्या चार ओळीच्या मुक्तकातून प्रभावी असा विचार कवी देतात. तसेच नागपंचमीच्या रोजी दुध सर्पाले पाजावं पण दोगल्या माणूस दारी उभा ना करावं (वैदर्भी काव्यसंग्रह पृ.क्र. ०३) येथे परक्या, परपुरूषाला त्यातल्या त्यात दोन्ही बाजूने बोलणाऱ्या (दुतोंड्या) व्यक्तिला घरासमोर देखील उभे करू नये. कारण—अशी माणसे हिताची नसतात, असे कवी आपल्या मुक्तकातून आवर्जून सांगतो. मुक्तके सुभाषितासारखी असून जीवनाचे तत्त्वज्ञान मांडतात. हे वाघांच्या कवितेचे विशेष म्हणावे लागेल.

ग्रामीण लोकजीवन, लोकपरंपरा, लोकसंस्कृती (सण, उत्सव) :

कवी विठ्ठल वाघांच्या कवितेचे आगळेपण म्हणजे त्यांनी आपल्या कवितेतून लोकजीवन, लोकपरंपरा, लोकसंस्कृती जपण्याचे काम केले आहे. ग्रामातील शेतकरी जीणं, सण, उत्सव साजरे करण्याची प्रथा, परंपरा, रितीरीवाज तपशिलवारपणे त्यांच्या कवितेत आले आहे. 'काया मातीत मातीत' काव्यसंग्रहात माळीभोळणी, दिवाळी, दसरा, कार्तिक महिन्याचा उल्लेख तसेच लोकजीवनातील भावभावना—कल्पना, संकेताने समजून घेण्याचा प्रघात त्यांच्या काव्यात आला आहे. त्यांच्या मनावर लोककलांचा कळत—नकळत संस्कार झालेला असल्याने त्यांच्या कवितेतून लोकतत्त्वाचा पायरव ऐकू येतो. लोकगीताचा भरणा, औचित्यपूर्ण शब्दयोजना, नादाकुलता, लयबद्धता त्यांच्या काव्यात आहे. परंपरागत जीवनमूल्ये, जीवनविषयक तत्त्वज्ञानात समाजाला दिशा देण्याचे काम येथे झाले आहे. लोकजीवनातील राघू—मैना जोडी, भुलाईचे गाणे, उचकी लागणे, चिळी—भोरी, कवठाचा वास येणे, हिरवाकंच चुळा, या सर्वांतून लोकपरंपरा, लोकगीत, समजूतीचा सुगंध दरवळत राहतो. लोकगीतातील लयबद्धता, नादमयता प्रासाचा प्रभाव, औचित्यपूर्ण शब्दयोजना, गतिमानता, त्यांच्या काव्यात जागोजागी प्रत्ययास येते.



- 7 -

अविनाश
अविनाश...



सद्य काळात देशीयतेची गरज :

आधुनिक काळात जागतिकीकरण, खाजगीकरण याने सर्व जग ढवळून निघाले. इतर राज्याप्रमाणे महाराष्ट्रावर देखील त्यांचा परीणाम झाला. भौतिक राहणीमान सुधारले, निम्माहून अधिक लोक शहरी भागात जाऊन आपल्या मुलांना कॉन्व्हेंटचे शिक्षण देऊ लागले. ग्रामीण परिसरातील संयुक्त कुटूंबपद्धती विस्कळीत होऊन एकल कुटूंबपद्धती जोर धरू लागली. त्यातून स्वार्थी प्रवृत्ती बळावली. जागतिकीकरणाच्या या प्रक्रियेचे सामाजिक आणि सांस्कृतिक परिणाम भयावह होऊ लागले. गरीब-श्रीमंती यांची दरी वाढून चंगळवादाची वृत्ती समाजात निर्माण झाली. सगळ्याच गोष्टींचे बाजारीकरण होऊन बाजारातील षोभेच्या वस्तू बनल्या. मानसिकता बदलून प्रत्यक्ष आचार-विचार अवतारू लागली आणि माणूस माणसापासून दुरावत जाऊन एकलकोंडा बनला. त्यांच्यात केवळ स्वार्थ शिल्लक राहिला. अशाकाळात देशीयता असणे गरजेचे वाटते. ग्रामीण भागातील पूर्वीचा आपुलकीपणा, जिझाळा प्रेम, बलुतेदारी पद्धत, समता, एकता, सद्य काळात महत्वाची वाटत आहे. जीवनाचे तत्त्वज्ञान सांगणाऱ्या लोककला, लोकपरंपरा, सण उत्सव यांची व्यक्तिच्या जीवनात गरज असल्याचे जाणवते. केवळ पाश्चात्य संस्कृतीच्या मागे न जाता आपली संस्कृती सुध्दा उत्कृष्ट असल्याचे भान सर्वांमध्ये येणे गरजेचे आहे. असे न झाल्यास त्यांचे वाईट पडसाद आपल्याला पुढच्या काळात अधिकाधिकच जाणवतील. जागतिकीकरण व्यक्तीच्या प्रगतीसाठी, सुखसमृद्धीसाठी महत्वाचे असले तरी आपण देशीयतेचे भान विसरून चालणार नाही. देशीयतेचे महत्त्व आपण समजून घेणे गरजेचे आहे. आपली संस्कृती, संत साहित्य, आपले तत्त्वज्ञान आपल्या प्रगतीचा टप्पा आहे, त्याला विसरून चालत नाही.

निष्कर्ष :

१. कवी विठ्ठल वाघ यांचे आधुनिक मराठी काव्यप्रवाहात स्वतंत्र असे स्थान असून त्यांची कविता वास्तवतेचे भान राखून आहे.
२. त्यांची कविता ग्रामीण मातीशी, संस्कृतीशी, परंपराशी नातं सांगणारी असून भविष्याची चिंता वाहणारी आहे.
३. डॉ. भालचंद्र नेमाडे यांची देशीवादाची संकल्पना व विठ्ठल वाघाची कविता निकटचा संबंध दर्शविणारी आहे. त्यांच्या काव्यातून देशीवादाचा पुरस्कार आहे.

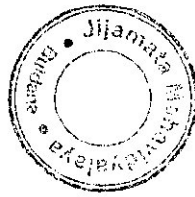


४. गावातील एकसंघपणा, विविध परंपरा, रितीरिवाज, सण उत्सव, लोकसमाज लोकसंस्कृती देशीवादाला पूरक आहेत.

५. कविला परिवर्तनाची आस असली तरी जुन्या परंपरा, विचार, तत्त्वज्ञान, संस्कृती याला त्यांचा विरोध नाही. तर त्यांच्याविषयी, त्यांच्या मनात आदरभाव आहे.

संदर्भ:

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 ३. नलगे चंद्रकुमार — ग्रामीण वाङ्मयाचा इतिहास, प्रकाशक—गुलाबराव माकारले सुरेश एजन्सी २५०, पुणे—०२ प्र.आ. १९९६, पृ.क. १२६
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23. Study of Different Ligands in Different Concentrations of Dioxane-Water and DMF-Water Mixtures at 29°C in terms of Viscosity and β -Coefficient

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Abstract

Viscosities are measured in several ways. In the Ostwald viscometer, the time taken for the solution to flow through the capillary is noted. Care was taken to ensure that the temperature is both constant and uniform. The method is very suitable for determining γ , because the ratio of the viscosities of the solution and the pure solvent is proportional to the drainage time 't'. This is the principle of the Ostwald viscometer routinely used for measurements on liquids and solutions, in which capillary flow is induced by gravity.

Key words :- Ligands, β - coefficient, viscometry, viscosities and Densities.

Introduction

Every liquid offers some resistance to flow. This resistance to flow is called viscosity. It is developed in liquids because of sharing effect of moving one layer of liquid past another motion of liquid can be visualized as a movement of one layer over another. A layer move quickly then second and so on. This type of flow is called laminar flow or streamlined flow. The unit of viscosity is dynes per centimeter (dynes/cm.) or poise and in Nsm^{-2} or Kg/ms .

Methodology

Useful information about solute-solute and solute-solvent interaction provides when the behavior of electrolytes are studied by viscometry. Many workers¹⁻³ have been studied these interactions in aqueous and non-aqueous solutions.

Ikhe⁴ has studied the viscosity of [HBMPP], [AHBMPPP], [PHNMPMPP] and captopril in 70% dioxane water mixture at different concentrations. Molecular interactions of electrolyte in binary mixture of two liquids in terms of viscosity, β - coefficient have been studied by Mehrotra et al⁵, Das et al⁶, Nikam⁷, Kalra et al⁸, Pandey et al⁹ and Raut et al¹⁰.

Gadpayle M.R.¹¹ have studied the β - coefficient value of some substituted chalcones in 70% DMF-water mixture while Tambatkar G.D.¹² have studied viscosity and β - coefficient value of some heterocyclic and non-heterocyclic drugs in 70 % Dioxane-water mixture solution.

The present study deals with the study of molecular interactions in terms of viscosity, β -coefficient of different ligands in different concentrations of Dioxane-water and DMF-water mixtures in different concentrations.

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Experimental

The viscosities were measured by means of Ostwald's Viscometer ($\pm 0.11\% \text{Kgm}^{-1}\text{s}^{-1}$) which was kept in equilibrium with elite thermostatic water bath ($\pm 0.1^\circ\text{C}$). Ligand solutions of different concentrations were prepared in 70 % Dioxane -water and DMF- water.

The ligands used are Ligand₁ - Allopurinol, Ligand₂ - Acenocoumarol and Ligand₃ - Warfarin.

The relative viscosity of each solution is determined by following empirical formula

$$\eta_r = (ds \times t_s) / (dw \times t_w) \quad (1)$$

Where η_r = relative viscosity of ligand solution, ds = density of ligand solution, dw = density of distilled water, t_s = time of flow for solution, t_w = time of flow for distilled water

The relative viscosity and density data for ternary mixture at different concentrations are presented in Tables 1 to 6

The relative viscosities have been analysed by Jones -Dole equation

$$(\eta_r - 1) / \sqrt{c} = A + B \sqrt{c} \quad (2)$$

Where C = molar concentration of the ligand solution, A = Falkenhagen coefficient, B = Jones-Dole coefficient

A is the measure of solute - solute interactions and B is the measure of solute - solvent interaction.

The graphs are plotted between $(\eta_r - 1) / \sqrt{c}$ Vs. $\sqrt{c}$. The graph for each system gives linear straight line showing validity of Jones - Dole equation. The slope of straight line gives value of B - coefficient.

In the present study, relative viscosity of ligand solutions decreases with increase in the concentration of ligand may be attributed to increase in solute - solvent interactions.

From the graph of $(\eta_r - 1) / \sqrt{c}$ versus $\sqrt{c}$, 'A' which is the measure of solute - solute interactions and 'B' which is the measure of solute - solvent interactions has been calculated.

Observations and Calculations:**Table -1**

Densities and viscosities of systems in Dioxane at $29^\circ\text{C}(\pm 0.1^\circ\text{C})$

System: Ligand -L₁(Allopurinol)

Sr. No.	Concentration C (mole/liter)	$\sqrt{c} \times 10^{-2}$ (mole ^{1/2} /liter ^{1/2})	Density (gm./c.c.)	Time (sec.)	η_r	$\eta_r - 1/\sqrt{c}$
1	50×10^{-4}	7.0711	0.996	70	1.5589	2.4436
2	40×10^{-4}	6.3246	0.996	63	1.6564	10.3860
3	30×10^{-4}	5.4772	0.990	57	1.4896	8.0317
4	20×10^{-4}	4.4721	0.987	51	1.3288	7.3557
5	10×10^{-4}	3.623	0.984	44	1.1429	4.5220



Table -2

Densities and viscosities of systems in Dioxane at 29°C(±0.1°C)

System: Ligand -L₂(Accnocooumarol)

Sr. No.	Concentration C (mole/liter)	$\sqrt{c} \times 10^{-2}$ (mole ^{1/2} /liter ^{1/2})	Density (gm./c.c.)	Time (sec.)	η_r	$\eta_r - 1/\sqrt{c}$
1	50 x 10 ⁻⁴	7.0711	1.006	70	2.0203	14.4314
2	40 x 10 ⁻⁴	6.3246	0.997	63	1.8020	12.6899
3	30 x 10 ⁻⁴	5.4772	0.991	56	1.5921	10.8047
4	20 x 10 ⁻⁴	4.4721	0.987	50	1.4158	9.3020
5	10 x 10 ⁻⁴	3.623	0.984	43	1.2139	5.7690

Table -3

Densities and viscosities of systems in Dioxane at 29°C(+0.1°C)

System: Ligand-L₃(Warfarin)

Sr. No.	Concentration C (mole/liter)	$\sqrt{c} \times 10^{-2}$ (mole ^{1/2} /liter ^{1/2})	Density (gm./c.c.)	Time (sec.)	η_r	$\eta_r - 1/\sqrt{c}$
1	50 x 10 ⁻⁴	7.0711	1.006	69	1.8331	11.7863
2	40 x 10 ⁻⁴	6.3246	0.997	62	1.6324	10.0063
3	30 x 10 ⁻⁴	5.4772	0.991	55	1.4394	8.0182
4	20 x 10 ⁻⁴	4.4721	0.987	49	1.2772	6.2013
5	10 x 10 ⁻⁴	3.623	0.984	42	1.0914	2.8924

Table -4

Densities and viscosities of systems in DMF at 29°C(±0.1°C)

System: Ligand -L₁(Allopurinol)

Sr. No.	Concentration C (mole/liter)	$\sqrt{c} \times 10^{-2}$ (mole ^{1/2} /liter ^{1/2})	Density (gm./c.c.)	Time (sec.)	η_r	$\eta_r - 1/\sqrt{c}$
1	50 x 10 ⁻⁴	7.0711	0.970	83	2.2450	17.6096
2	40 x 10 ⁻⁴	6.3246	0.973	73	1.9806	15.5158
3	30 x 10 ⁻⁴	5.4772	0.977	65	1.7708	14.0657
4	20 x 10 ⁻⁴	4.4721	0.981	55	1.5045	11.2864
5	10 x 10 ⁻⁴	3.623	0.982	46	1.2596	8.2152



Table -5

Densities and viscosities of systems in DMF at 29°C(±0.1°C)

System: Ligand -L₂ (Acenocoumarol)

Sr. No.	Concentration C (mole/liter)	$\sqrt{c} \times 10^{-2}$ (mole ^{1/2} /liter ^{1/2})	Density (gm./c.c.)	Time (sec.)	η_r	$\eta_r - 1/\sqrt{c}$
1	50 x 10 ⁻⁴	7.0711	0.972	81	2.1953	18.8360
2	40 x 10 ⁻⁴	6.3246	0.975	71	1.9303	16.8339
3	30 x 10 ⁻⁴	5.4772	0.979	62	1.6925	12.6369
4	20 x 10 ⁻⁴	4.4721	0.982	54	1.4786	10.7069
5	10 x 10 ⁻⁴	3.623	0.984	45	1.2347	7.4272

Table -6

Densities and viscosities of systems in DMF at 29°C(±0.1°C)

System: Ligand -L₃ (Warfarin)

Sr. No.	Concentration C (mole/liter)	$\sqrt{c} \times 10^{-2}$ (mole ^{1/2} /liter ^{1/2})	Density (gm./c.c.)	Time (sec.)	η_r	$\eta_r - 1/\sqrt{c}$
1	50 x 10 ⁻⁴	7.0711	0.962	79	2.1191	15.8289
2	40 x 10 ⁻⁴	6.3246	0.969	69	1.8643	13.6756
3	30 x 10 ⁻⁴	5.4772	0.972	61	1.6533	11.5250
4	20 x 10 ⁻⁴	4.4721	0.974	52	1.4123	9.2237
5	10 x 10 ⁻⁴	3.623	0.975	47	1.2778	8.7913

Result and discussion

The large and small values of 'A' show the stronger and weaker solute - solute interactions respectively as listed in following tables 7 to 8.

Table-7

A and B coefficient values in Dioxane Medium

Sr. No.	System	A	B (lit/mole)
1	Ligand-L1	0.360	1.892
2	Ligand-L2	0.600	1.924
3	Ligand-L3	4.069	2.235



Table-8

A and B coefficient values in DMF Medium

Sr. No.	System	A	B (lit/mole)
1	Lgand-L1	-2.0705	2.383
2	Lgand-L2	-2.387	2.957
3	Lgand-L3	-1.974	1.855

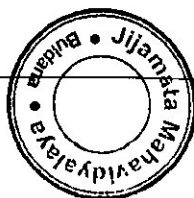
Solutes with positive viscosity β -coefficient are characterized as "Structure formers" and will impose a new order by reorientation of the adjacent water molecules indicating strong solute- solvent interactions.

Solutes with negative viscosity β - coefficient is characterized as "Structure Breakers" indicating weak solute - solvent interactions.

Such type of results is also shown by Pandey et al¹³.

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9. To Study the Metal-Ligand Stability Constants of Lanthanide (III) Chelates with some Substituted Heterocyclic Drugs

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Abstract

The study of proton-Ligand Stability constant pK and metal-Ligand stability constant $\log K$ of binary complexes (1:1) of Sm(III), Gd(III) and Dy(III) metalions with Amoxicillin(Ligand-1), Loperamide (Ligand-2) and Lorazepam(Ligand-3) have been investigated by pH-metric technique at 0.1 M ($HClO_4$) ionic strength at $290^\circ C \pm 0.10^\circ C$ in 70 % DMF-Water mixture. The data obtained were used to estimate the values of proton-Ligand stability constants (pK) and metal Ligand stability constants ($\log K$). It is observed that Sm(III), Gd(III) and Dy(III) metalions formed 1: 1 and 1: 2 complexes with all the ligands.

Keywords: Stability constant, heterocyclic drugs, chelates, ligands, half integral, point wise etc.

Introduction

Metal complex formation may be due to displacement of a proton from the ligand causing a drop in the pH-value of the solution. pH- metric studies of metal complexes of a large variety of polycarboxylic acids, Phenols, oximines, carboxylic acids etc have been carried out by many workers¹. Irving and Rosotti² have been given a method for calculation of stability constants of complexes by pH metry. Stability constants of complexes of Th(IV) with some substituted pyrazolines have been studied by Narwade et.al³ potentiometrically. Mahajan et.al⁴ have been studied Cu(II) complexes with sulphonic acid potentiometrically. Meshram et. al⁵ have studied the stability constants of complexes of Pr (III), Nd (III) and Sm (III) with some substituted pyrazolines pH-metrically.

Reseantly Shivaji Jadhav et.al⁶ studied the stability constant of metal-ligand equilibria with special reference to Schiff base and transition elements. Arvind Sing et.al⁷ also studied the stability constant of Fe(III) and Mn(II) with chloramphenicol by paper electrophoretic technique. Meshram et.al⁸ also studied the Metal-Ligand stability constant of Co(II), Ni(II), Cu(II) metalion complexes with substituted ketones and simple ketones at 0.1 M ionic strength pH metrically.

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The study of stability constants of Sm (III), Gd (III) and Dy (III) complexes with substituted heterocyclic drugs are still lacking. It was therefore thought of interest to study the chelating properties of some substituted drugs under suitable conditions potentiometrically.

Methodology

Metal nitrates (BDH) were dissolved in perchloric acid and their concentrations were estimated by standard methods⁹. Heterocyclic drugs are insoluble in water and hence 70 % DMF-water (v/v) was used as a solvent. Ethanol was purified by standard method¹⁰ and its purity was checked. pH-measurements were carried out with ELICO pH-meter (accuracy ± 0.05 unit) using glass and calomel electrodes at 29.0°C ($\pm 0.10^\circ\text{C}$). The β -values (pH-meter readings in 70 % DMF-water mixture) were converted to (H+) values by applying the corrections proposed by Van Uitert and Hass¹¹. The overall 0.1 M ionic strength of solution was calculated by the expression

$$\mu = \frac{1}{2} \sum \frac{C_i Z_i^2}{i=1}$$

The contribution of the other ions in addition to Na+ and ClO4- was also taken into considerations.

Experimental

Proton- Ligand stability constants :

Used heterocyclic drugs may be considered as monobasic acids having one replaceable H+ ion from OH group and can therefore be represented as HL i.e.



The titration data were used to construct the curves between volume of NaOH Vs pH.

It was observed from the titration curves that the ligand curves start deviating from the free acid curves at about pH 3.86 for ligand-1, about pH 4.18 for ligand-2 and for ligand-3 pH 4.20. The deviation increased continuously upto pH 11.25 to 12.60. It indicates that OH group starts to dissociate at 4.10 and complete its dissociation at about pH 11.25.

The average number of protons associated with the ligand (nA) was determined from ligand titration curves employing the equation of Irving and Rossotti¹². The pk values were estimated from formation curve (nAVs pH) by noting the pH at which nA = 0.5. The accurate values of pk were estimated by pointwise calculation which are presented in Table-I.



Table-I

**Determination of proton- ligand stability constant (pK)
of some substituted hetrocyclic drugs at 0.1M ionic strength.**

System	Constants pK	
	Half integral	Point wise
ligand-1	11.35	11.40(± 0.05)
ligand-2	11.65	11.70(± 0.05)
ligand-3	11.70	11.75(± 0.05)

Metal-Ligand stability constants

Metal ligand stability constants of Sm(III),Gd(III) and Dy(III) complexes with some substituted hetrocyclic drugs were determined by employing Bjerrum-Calvin pH -titration technique adopted by Irving and Rossotti.

The formation of chelates between Sm (III),Gd (III) and Dy(III) and the substituted hetrocyclic drugs was indicated by

- I. The significant departure, starting from pH 2.85 for Sm(III), pH 2.65 for Gd(III) and pH 2.75 for Dy(III) complex system.
- II. The change in colour from brown to dark brown and then faint brown as pH raised from pH 3.00 to pH 11.50.

The log K values were directly read from the formation curves (nVs pL) using half integral method.

The most accurate log K values were calculated by pointwise calculation methods are presented in Table-II for all the systems.

Table -II

Metal-ligand stability constants (log K) of Sm (III),Gd (III) and Dy(III)

Complexes with substituted hetrocyclic drugs at 0.1 M ionic strength.

System	Constants	
	Log K ₁	Log K ₂
Sm (III) ligand-1	11.30	11.05
Sm (III) ligand-2	11.85	11.25
Sm (III) ligand-3	11.35	10.77
Gd (III) ligand-1	11.05	9.82



Gd (III) ligand-2	11.35	9.42
Gd (III) ligand-3	11.97	10.32
Dy (III) ligand-1	9.85	7.65
Dy (III) ligand-2	11.25	10.45
Dy (III) ligand-3	11.95	11.42

Result and discussion

Table III

Metal-ligand stability constant at 0.1 M ionic strength :

System	Constants	
	Log K_1 - log K	Log K_1 /Log K
Sm (III) ligand-1	0.25	1.02
Sm (III) ligand-2	0.60	1.05
Sm (III) ligand-3	0.58	1.05
Gd (III) ligand-1	1.23	1.13
Gd (III) ligand-2	1.93	1.21
Gd (III) ligand-3	1.65	1.16
Dy (III) ligand-1	2.20	1.29
Dy (III) ligand-2	0.90	1.08
Dy (III) ligand-3	0.53	1.05

The result shows that the ratio $\log K_1 / \log K_2$ is positive in all cases. This implies that there is little or no steric hindrance to the addition of second ligand molecule.

Validity of $\log K = a \text{pK} + b$ relation

The linear relationship $\log K = a \text{pK} + b$ has been found out by some workers¹³ to hold for transition metal complex of series of closed related ligands.

The stability of the metal complexes of substituted heterocyclic drugs are $\text{Sm(III)} < \text{Gd(III)} < \text{Dy(III)}$.

The plot of $\log K_1 / \log K_2$ Vs pK shows satisfactory linear relationship giving slope values of 1.00 & 1.05 respectively. The partial free energies of metal - ligand & proton-ligand complexes exactly compensate each other, when $\log K$ Vs pK plot is linear with a slope of unity.

Such results are also found by Narwade et.al.³ and Meshram et.al.⁵

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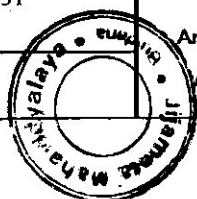
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LRS Bianchi Type-I Cosmological model in Creation Field Theory of Gravitation with a Special Form of Deceleration Parameter

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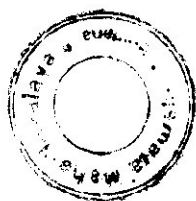
ABSTRACT

LRS-Bianchi type-I cosmological model has been studied in Hoyle-Narlikar's Creation field theory of gravitation. The field equations have been solved by applying a special form of deceleration parameter proposed by Singha and Debnath (IJTP, 48:351, 2009). The physical aspects of the models are also discussed.

Keywords: Creation-Field Cosmology, Special form of deceleration parameter.

1. Introduction:

The Deceleration parameters (q) are useful in studying expansion of the universe. We know that the universe has (i) Decelerating expansion if $q > 0$, (ii) An expansion with constant rate if $q = 0$ and (iii) Accelerating expansion if $q < 0$. In order to obtain exact solution of the field equations, many authors assume various physical and mathematical conditions. Berman [1] proposed a special law of variation for Hubble's parameter to obtain the cosmological solutions called the models with Constant Deceleration Parameter (CDP) by



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assuming the deceleration parameter q as constant. Many relativists Berman and Gomide [2], Singh and Desikan [3], Akarsu and Kilinc [4] have extended this law for Bianchi type models with constant deceleration parameter. Akarsu and Dereli [5] have modified Berman's special law of variation for Hubble's parameter by setting $q = -kt + m - 1$, where k and m are constants which yields Linearly Varying Deceleration Parameter (LVDP) models of universe. They have investigated accelerating cosmological solutions for Robertson-Walker space-time by considering LVDP. These models may have big rip type of future singularity. Adhav et al. [6], Singh et al. [7], have investigated cosmological models with LVDP. But both CDP and LVDP cosmological models are either decelerating or accelerating. Also there is Big Rip type singularity in LVDP. According to Riess et al. [8] and Amendola [9], for a universe which was decelerating at past and accelerating in present, the deceleration parameter must show signature flip. By analyzing three SNe Type Ia samples, Cunha and Lima [10] favors recent acceleration and past deceleration with high degree of statistical confidence. To match this observation, Singha and Debnath [11] have investigated the quintessence model with a minimally coupled scalar field by taking a special form of deceleration parameter q in such a way that the model behaves early decelerating and late time accelerating for barotropic fluid and Chaplygin gas dominated models. The special form

of Deceleration Parameter is defined as $q = -1 + \frac{k}{1+R^k}$, where k is a constant and R is average scale factor. Adhav et al. [12-13] have investigated Bianchi cosmological models by using special form of Deceleration Parameter with different context. Recently, Ghate and Sontakke [14] have investigated in $F(R,T)$ theory of gravity.

The phenomenon of expanding universe, Primordial Nucleosynthesis & the observed isotropy of Cosmic Microwave Background Radiations (CMBR) are the three important observations in astronomy which were successfully explained the big-bang cosmology based on Einstein field equations called as big-bang model. This model is described by Friedman-Robertson-Walker line element and a matter density source which obeys equation of state $p = 3p$,





where p and ρ are the fluid pressure and matter density respectively. In the late eighties, the astronomical observations revealed that the predictions of the big-bang model do not always exactly meet our expectations as was believed earlier [15]. So, alternative theories of gravitation were proposed by the researchers. The most popular theory was put forward by Bondi & Gold [16] called steady state theory. The remarkable approach of this theory is that the universes neither have any singular beginning nor an end on the cosmological background and statistical properties of large scale features of the universe do not change. To maintain the constancy of matter density, they contemplate a very slow but continuous creation of matter in contrast to explosive creation at $t=0$ of standard model. The theory fails for not giving any physical justification for continuous creation of matter and the principle of conservation of matter was violated in this formalism. To overcome this difficulty, Hoyle & Narlikar [17] adopt a field theoretical approach by introducing a massless and chargeless scalar-field C in the Einstein-Hilbert action to account for matter creation. The theory proposed by Hoyle and Narlikar called as C -field theory which has no big-bang type singularity as in Bondi & Gold steady state theory. It is pointed out by Narlikar [18] that matter creation is accomplished at the expense of negative energy C -field. Chatterjee & Banerjee [19] have investigated higher dimensional cosmology in C -field theory. Singh & Chaubey [20] have studied Bianchi type I, III, V, VI0 and Kantowski-Sachs universes in C -field Cosmology. Adhav et al. [21] have investigated Bianchi type-I string cosmological models in Creation field cosmology. Katore [22] has studied plane symmetric universe in C -field cosmology. Recently, Panigrahi et al. [23] have investigated five dimensional spherical symmetric universe in Creation field theory of gravitation. In this paper, we have investigated LRS Bianchi type-I space-time in creation field theory of gravitation. By using special form of deceleration parameter, the solutions of field equations are obtained. This work is organized as follows. In Section 2, the model and field equations have been presented. The field equations have been solved in Section 3. The physical aspects of the model have been discussed in Section 4. In the last Section 5 concluding remarks have been expressed.





2. Metric and Field Equations:

We consider the LRS Bianchi type-I metric in the form of

$$ds^2 = dt^2 - A^2 dx^2 - B^2 (dy^2 + dz^2),$$

(1)

where metric potentials A, B are functions of time t only and $\sqrt{-g} = AB^2$.

It is assumed that creation field C is a function of time t only

$$\text{i.e. } C(x, t) = C(t) \quad \text{and} \quad {}^m T^j_{(m)} = \text{diag}(\rho, -p, -p, -p)$$

(2)

The Einstein field equations modified by Hoyle and Narlikar [4, 5, 6] by introducing a massless scalar field called as creation field viz. C -Field were given by

$$R^j_i - \frac{1}{2} R g^j_i = -8\pi G \left(T^j_{(m)} + T^j_{(c)} \right), \quad (3)$$

where $T^j_{(m)}$ is matter tensor of Einstein's theory given by

$$T^j_{(m)} = (\rho + p) v_i v^j - p g^j_i \quad (4)$$

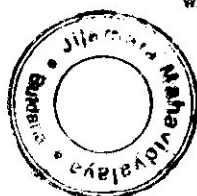
Here ρ is the energy density of massive particle and p is the pressure. v_i are co-moving four velocities which obeys the relation $v_i v^i = 1$.

$T^j_{(c)}$ is matter tensor due to creation field given by

$$T^j_{(c)} = -f \left(c_i c^i - \frac{1}{2} g^j_i C^a C_a \right)$$

(5)

where $f > 0$ is the coupling constant between matter and creation field.





The Hoyle-Narlikar field equations (3) for the metric (1) with the help of equations (4) and (5) given by

$$\frac{\dot{B}^2}{B^2} + 2 \frac{\dot{A}\dot{B}}{AB} = 8\pi G \left(\rho - \frac{1}{2} f C^2 \right), \quad (6)$$

$$2 \frac{\dot{B}}{B} + \frac{\dot{B}^2}{B^2} = 8\pi G \left(-p + \frac{1}{2} f C^2 \right), \quad (7)$$

$$\frac{\dot{A}}{A} + \frac{\dot{B}}{B} + \frac{\dot{A}\dot{B}}{AB} = 8\pi G \left(-p + \frac{1}{2} f C^2 \right), \quad (8)$$

where overhead dot (·) denotes differentiation with respect to time t .

3. Solution of the Field Equations:

The field equations (6)-(8) is a system of three equations with five unknown parameters

A , B , ρ , p and C . In order to solve this system completely, we use a special form of deceleration parameter.

$$q = -\frac{R\ddot{R}}{\dot{R}^2} = -1 + \frac{k}{1+R^k}, \quad (9)$$

where R is mean scale factor of the universe and k is positive constant.

This form has been proposed by Singa and Debnath for Friedman-Robertson-Walker metric.

Integrating equations (9), we obtained Hubble parameter as

$$H = \frac{\dot{R}}{R} = \alpha_1 (1+R^{-k})$$

(10)

where α_1 is an arbitrary constant of integration.





Again integrating equation (10), we get

$$R = (\alpha_2 e^{\alpha_1 k} - 1)^{\frac{1}{3}} \quad (11)$$

where α_2 is an arbitrary constant of integration.

The Spatial Volume is given by

$$V = R^3 = AB^2 \quad (12)$$

i.e.

$$V = (\alpha_2 e^{\alpha_1 k} - 1)^{\frac{3}{3}} \quad (13)$$

The mean Hubble parameter H for LRS Bianchi type-I metric may give by

$$H = \frac{\dot{R}}{R} = \frac{1}{3} \sum_{i=1}^3 H_i = \frac{1}{3} \left(\frac{\dot{A}}{A} + 2 \frac{\dot{B}}{B} \right) \quad (14)$$

where the directional Hubble parameter $H_i (i=1, 2, 3)$ in the direction x , y and z , respectively defined as

$$H_x = \frac{\dot{A}}{A} \quad \text{and} \quad H_y = H_z = \frac{\dot{B}}{B}$$

(15)

Subtracting equation (7) from equation (8), we get

$$\frac{d}{dt} \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) + \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) \left(\frac{\dot{A}}{A} + 2 \frac{\dot{B}}{B} \right) = 0 \quad (16)$$

Now, using equation (13), equation (16) becomes

$$\frac{d}{dt} \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) + \frac{\dot{V}}{V} = 0$$

(17)

Integrating, which gives





$$\frac{\dot{A}}{A} \frac{\dot{B}}{B} = \frac{X}{V},$$

(18)

where X is constant of integration.

Simplifying equation (18), we get

$$\frac{A}{B} = D \exp \left(X \int \frac{dt}{V} \right),$$

(19)

where D is constant of integration.

Using equation (12), we get

$$A = D^{2/3} V^{1/3} \exp \left[\frac{2X}{3} \int \frac{dt}{V} \right],$$

(20)

$$B = D^{-1/3} V^{1/3} \exp \left[-\frac{X}{3} \int \frac{dt}{V} \right].$$

(21)

Using equation (17) and equation (18), the differential Hubble parameters found as

$$H_x = \frac{\alpha_1 \alpha_2 e^{\alpha_1 t}}{(\alpha_2 e^{\alpha_1 t} - 1)} + \frac{2X}{3} (\alpha_2 e^{\alpha_1 t} - 1)^{-\frac{2}{3}},$$

$$H_y = H_z = \frac{\alpha_1 \alpha_2 e^{\alpha_1 t}}{(\alpha_2 e^{\alpha_1 t} - 1)} - \frac{X}{3} (\alpha_2 e^{\alpha_1 t} - 1)^{-\frac{2}{3}} \quad (22)$$

(23)

To obtain energy density (ρ), add equation (6) and equation (8), we get

$$\frac{\dot{A}}{A} + \frac{\dot{B}}{B} + 3 \frac{\dot{A}\dot{B}}{AB} + \frac{B^2}{B^2} = 8\pi G(\rho - p)$$

(24)



Now we consider the equation of matter as

$$P = YP$$

(25) using equation (25), equation (24) reduces to

$$\rho = \frac{1}{4\pi G(1-\gamma)} \left[\frac{3(3-k)\alpha_1\alpha_2\alpha_3 e^{2\tau_1 u}}{(\alpha_1 e^{\tau_1 u} - 1)^2} - \frac{3\alpha_1\alpha_2 k e^{\tau_1 u}}{(\alpha_1 e^{\tau_1 u} - 1)} \right] \quad (26)$$

From equation (25) and (26), we obtained the pressure (p) as

$$\rho = \frac{\gamma}{4\pi C(1-\gamma)} \left[\frac{3(3-k)\alpha_1^2 \alpha_2^2 \cdot e^{2\alpha_1 h}}{(\alpha_1 \cdot e^{\alpha_1 h} - 1)^2} - \frac{3\alpha_1 \alpha_2 k \cdot e^{\alpha_1 h}}{(\alpha_1 \cdot e^{\alpha_1 h} - 1)} \right] \quad (27)$$

Using equations (20), (21) and (26) in equation (6), we get

$$C^2 = \frac{1}{4\pi Gf} \left[\frac{(3\gamma - 2k + 3)\alpha_1 \alpha_2 e^{2\alpha_1 k}}{(1-\gamma)(\alpha_2 e^{\alpha_1 k} - 1)^2} - \frac{2\alpha_1 \alpha_2 k e^{\alpha_1 k}}{(1-\gamma)(\alpha_2 e^{\alpha_1 k} - 1)} - \frac{1}{3}(\alpha_1 e^{\alpha_1 k} - 1)^{-\frac{2}{3}} \right], \quad (28)$$

$$\begin{aligned} \bar{c} &= \sqrt{\frac{3\gamma-2k+3}{4\pi Gf(1-\gamma)}} \cdot \frac{\alpha_1 \alpha_2 \cdot e^{\alpha_1 k}}{(\alpha_2 \cdot e^{\alpha_2 k} - 1)} \\ &\times \left[1 + \frac{(1-\gamma)(\alpha_2 \cdot e^{\alpha_2 k} - 1)^2}{(3\gamma-2k+3)\alpha_1 \alpha_2 \cdot e^{2\alpha_1 k}} \left[\frac{2\alpha_1 \alpha_2 k \cdot e^{\alpha_1 k}}{(1-\gamma)(\alpha_2 \cdot e^{\alpha_2 k} - 1)} - \frac{1}{3}(\alpha_2 \cdot e^{\alpha_2 k} - 1)^{\frac{2}{k}} \right] \right]^{\frac{1}{2}} \end{aligned}$$

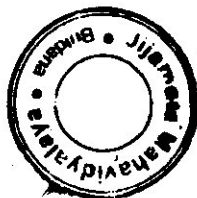
(29)

$$\dot{C} = \sqrt{\frac{3\gamma - 2k + 3}{4\pi G f(1-\gamma)}} \frac{\alpha_1 \alpha_2 \cdot e^{s_1 k}}{(\alpha_2 \cdot e^{s_1 k} - 1)} \times \left[1 + \frac{(1-\gamma)(\alpha_2 \cdot e^{s_1 k} - 1)}{2(3\gamma - 2k + 3)\alpha_1 \alpha_2 \cdot e^{s_1 k}} \left[\frac{2\alpha_1 \alpha_2 k \cdot e^{s_1 k}}{(1-\gamma)(\alpha_2 \cdot e^{s_1 k} - 1)} - \frac{1}{3}(\alpha_2 \cdot e^{s_1 k} - 1)^{-\frac{2}{3}} \right] \right]$$

(30)

(to the first order)

$$\dot{c} = \sqrt{\frac{3\gamma - 2k + 3}{4\pi G f(1-\gamma)}}$$





$$\times \left[\frac{\alpha_1 \alpha_2 e^{\alpha_1 k}}{(\alpha_2 e^{\alpha_1 k} - 1)} + \frac{\alpha_1 \alpha_2 k e^{\alpha_1 k}}{(3\gamma - 2k + 3)(\alpha_2 e^{\alpha_1 k} - 1)} - \frac{(1-\gamma)}{6(3\gamma - 2k + 3)} (\alpha_2 e^{\alpha_1 k} - 1)^{-\frac{6}{k}} \right] \quad (31)$$

$$C = \sqrt{\frac{3\gamma - 2k + 3}{4\pi G(1-\gamma)}} \times \left[\frac{1}{k} \log(\alpha_2 e^{\alpha_1 k} - 1) + \frac{\alpha_1}{(3\gamma - 2k + 3)} \log(\alpha_2 e^{\alpha_1 k} - 1) - \frac{(1-\gamma)}{6(3\gamma - 2k + 3)} \int (\alpha_2 e^{\alpha_1 k} - 1)^{-\frac{6}{k}} dt \right] \quad (32)$$

Thus creation field C is proportional to time t .

4. Physical Aspects of the Model:

The cosmological model using equation (20) and (21) in equation (1) written as

$$ds^2 = dt^2 - \left[D^{\frac{2}{3}} V^{\frac{1}{3}} \exp\left(\frac{2X}{3} \int \frac{dt}{V}\right) \right]^2 dx^2 - \left[D^{-\frac{1}{3}} V^{\frac{1}{3}} \exp\left(-\frac{X}{3} \int \frac{dt}{V}\right) \right]^2 (dy^2 + dz^2) \quad (33)$$

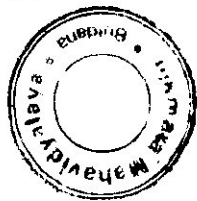
The physical parameters of model (33) such as the Hubble Parameter (H), Expansion Scalar (θ), the mean anisotropic parameter (Δ) and Shear Scalar (σ^2) are defined as

$$H = \frac{1}{3} [H_x + H_y + H_z] = \frac{\alpha_1 \alpha_2 e^{\alpha_1 k}}{(\alpha_2 e^{\alpha_1 k} - 1)}, \quad (34)$$

$$\theta = 3H = \frac{3\alpha_1 \alpha_2 e^{\alpha_1 k}}{(\alpha_2 e^{\alpha_1 k} - 1)}, \quad (35)$$

$$\Delta = \frac{1}{3} \sum_{i=1}^3 \left(\frac{H_i - H}{H} \right)^2 = \frac{2X^2 (\alpha_2 e^{\alpha_1 k} - 1)^{-\frac{2(k-3)}{k}}}{9\alpha_1 \alpha_2 e^{2\alpha_1 k}}, \quad (36)$$

$$\sigma^2 = \frac{3}{2} \Delta H^2 = \frac{X^2}{3} (\alpha_2 e^{\alpha_1 k} - 1)^{-\frac{2}{k}} \quad (37)$$



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8. Conclusion:

LRS Bianchi type-I cosmological models have been investigated in Hoyle-Narlikar's creation field theory of gravitation. It is observed that in early phase of universe, the value of deceleration parameter is positive while as $t \rightarrow \infty$, the value of $q = -1$. Hence the universe had a decelerated expansion in the past and has accelerated expansion at present which is in good agreement with the recent observations of SN Ia. The creation field C is directly proportional to time t . Hence the creation of matter increases as time increases which follows the results as obtained by Hoyle and Narlikar.

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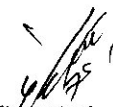
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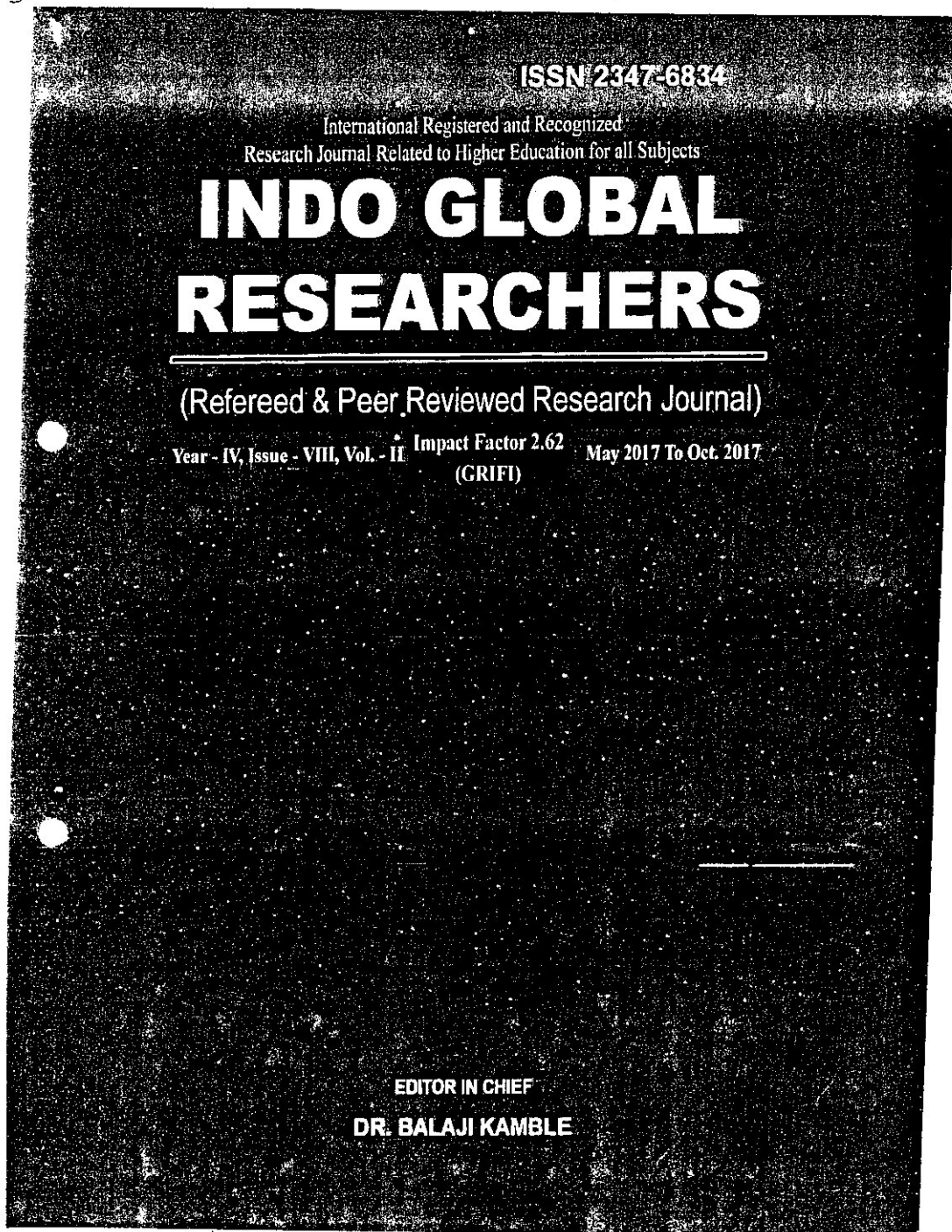
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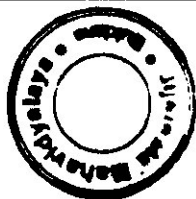
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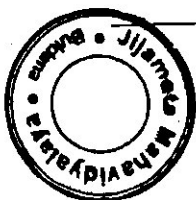
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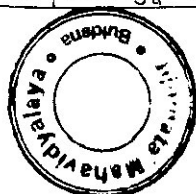
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बारोमास ग्रामीण जीवनाचे वास्तव

डॉ. अनंत आर. सिरसाठ

मराठी विभाग प्रमुख,
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आधुनिकीकरणाने शहराचा जसा झपाट्याने विकास होत गेला आणि आधुनिक तंत्रज्ञानाचा अंमल सर्वत्र बळावला तसाच तो बहुतांशी महाराष्ट्रातल्या खेड्यापाड्यामध्येही पोहोचला आहे. दृकश्राव्य माध्यमांच्या प्रसारामुळे तर नागरी जीवनातील सूक्ष्म बारकावेही खेड्यापाड्यांनी टिपल्याचे दिसते. खेड्यातले जीवनमान आणि शहरातले नागरी जीवनमान अलीकडच्या काळात समानतेच्या पातळीपर्यंत पोहोचण्याची स्पर्धा करताना दिसत आहेत. जीवनमानाच्या ह्या उलथापालथीत होणाऱ्या सांस्कृतिक आणि आर्थिक अभिसरणामुळे माणसाचे माणूसपण हरवत चालले आहे. दिखाऊ आणि चमकदार जीवनशैली स्विकारून जुने सर्वच नाकारणाऱ्या नव्या पिढीपुढे अनेक समस्या निर्माण झाल्याचेही दिसते. नव्या पिढीच्या तरुणांना जीवनात तुटलेपण येते. जगण्याच्याही अनेक समस्या त्यातून निर्माण होतात. खेड्यातल्या आजच्या

तरुणांच्या बदलत्या वास्तवाचे चित्रण करण्याचा प्रयत्न सदानंद देशमुख यांनी 'बारोमास' या कादंबरीतून केला आहे.

सदानंद देशमुख यांनी 'बारोमास' या शीर्षकापासूनच शेतजमिनीशी आपली नाळ बारोमास जुळवून ठेवत शेतीच्या जीवनातील बारोमास सतावणाऱ्या वेदना आणि समस्यांचे प्रत्ययकारी चित्रण आपल्या कादंबरीतून केलेले आहे. शेतीशी आणि मातीशी ज्या सज्जनाचे आणि नवनिर्मितीचे दरवर्षीचे उत्सव वाहतात कधी शेतकऱ्याच्या डोळ्यातून दुःखाचे अश्रू वाहतात तर कधी आनंदाश्रू वाहतात. शेतकऱ्याच्या जीवनाचे सोने करणारी शेती, बेभरवशाचा निसर्ग आणि सरकारच्या धोरणामुळे तसेच विश्वव्यापारामुळे - गॅट करारामुळे किंवा बदलत्या समाजव्यवस्थेमुळे संपूर्ण उजाड झालेली आहे. ज्यांच्या घरात बारोमास अन्नधान्याने भरलेल्या कणग्या

असायच्या, बारोमास दुधाची गंगा वाहायची, बारोमास शेतीचं वैभव घरात नांदायच आणि बारोमास घरात पैसाही खुळखुळायचा ती सर्वच सधन घराणी आता कर्जबाजारी झाली आहेत. भारतीय शेती आणि शेतकरी आता पुरेपूर कंगाल आणि सर्पेच्या बाजारपेठेत कायमचा दिवाळखोर झालेला आहे.

शेतकऱ्याची सर्वदूर विपन्न अवस्था झाल्यामुळे शेती विकणे, ओसाड पडणे, खेड्याची शहरं होणे आणि शेती विकून नौकऱ्या मिळविण्यासाठी देणग्या देणे, शेतीचे कायम असुरक्षित जीवन त्यागून किंवा शेती करणाऱ्या बापाचे हाल पाहून शेतीचा तिटकारा करणे किंवा त्यागच करणे ही भावना नव्या पिढीच्या मनात खोलवर रुजलेली आहे. हा सर्व परिस्थितीचा रेटा शेतीवर जीव लावणाऱ्या सुभानला आणि रावसाहेबांना आत्महत्या करण्यास प्रवृत्त करते. बारोमास ही आजच्या शेतीयुगाशी निगडित असलेल्या शेतकऱ्याची आणि खुद्द शेतीचीही करूण शोकगाथा आहे.

'बारोमास' कादंबरीच्या सुरुवातीलाच व्याकुळ असलेली केवीलवाणी उदास असणारी सांज एकनाथच्या मनाच्या उदासिनतेची कल्पना देऊन जाते. एका उदास मानसिकतेतून आकाराला आलेली ही कादंबरी वाचताना दुःखानुभव देत एक भयानक वास्तव मांडते. एकनाथ हा एम.ए. बी.एड. असून नौकरी मिळत नाही म्हणून शेती करण्यासाठी घडपडतो. या एकनाथच्या रूपाने शिक्षित तरुणाची मानसिकता या कादंबरीतून टिपली आहे.

उच्च शिक्षित असूनही एकनाथला केवळ डोनेशन देण्यासाठी एक लाख रुपये नसतात म्हणून शेती करावी लागते. शिक्षणामुळे त्याला सुखाचे आयुष्य मिळत नाही तर उलट शिक्षणच त्याच्यासाठी शाप ठरलेले दिसते.

सव्वीस एकर शेत असूनही तो त्याला पाहिजे तेवढी रक्कम उभी करू शकत नाही.

एकनाथ शिकलेला असल्यामुळे शहरी संस्कृतीत वाढलेल्या अलकाचे लग्न एकनाथशी होते; परंतु इथेही शहरी आणि ग्रामीण संस्कृतीतील अंतरातुळे एकनाथचा संसार सुखाचा होत नाही. एकनाथ बरोबरचे देहसंबंधही ती नाकारते. एकनाथला वाटतं आपल्या मामाच्या अडायी मुलीसोबत लग्न केलं असतं तर आपण सुखी झाल असतो ही घुसमट दोघांच्याही मनात आहे. अलका माहेरी निघून जाते, पुन्हा परत येते; परंतु आपल्या भावाशी लग्न केलं नाही म्हणून शेवंतामाईचा सुनेवर राग असतो. त्या दोघीचं पटत नाही, त्याचा परिणाम अलका पुन्हा माहेरी जाते. 'माझं करियर मी निवडणार आहे' हे अलकाचं वाक्य चूक वाटत नाही. एकनाथही तिला दोष देत नाही. त्याची तिच्याबद्दल सहानुभुतीच जाणवते.

या विवेचनातून आजच्या ग्रामीण संस्कृतीतील यास्तव लेखकाने रेखाटलेलं आहे. या संदर्भात चंद्रकांत बांदीवडेकरांनी सुंदर विवेचन केलेले आहे. ते म्हणतात "भारतीय शेतकऱ्याचं सर्वांगिन चित्र एकनाथ आणि त्याच्या कुटुंबाच्या आधारे लेखकाने केले आहे. लेखक शेतीचं वेगवेगळ्या पिकाचं, शेतीसंबंधी सर्व बाबीचं जे विराट चित्र उभा करतो ते त्याच्या प्रत्यक्ष अनुभवाचं, विलक्षण निरीक्षण शक्तीचं, भाषेवरील प्रभुत्वाचं द्योतक आहे. या शेतीचा प्रमुख सहाय्यक निसर्ग, जमीन, खेड्यातील लोकजीवन, कुटुंब व्यवस्था, आई विषयी प्रेम वास्तवाच्या आगीत खाक होऊन जाते. शिकलेल्या एकनाथचे विनइस्त्रीचे कपडे, तेलाशिवाय केलेल्या भाज्या, पाहुणा आला की दरवेळी साखर, चहा आणून प्रसंग निभावण्याची मजबुरी, जीना चढताना माती ढासाळण्याची भिती, मजूराला

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मजुरी देताना होणारी प्रचंड तगमग, वाढतं कर्ज, सावकाराने केलेली फसवणूक, झाडतोडी, मध्यान केलेल्या चोऱ्या आणि पराकाष्ठेच्या स्वार्थातून विकलेली झाडं ही कादंबरी वाचताना जाणवते, मराठी ग्रामीण साहित्य सर्व स्तरावरच्या भावूक, कृतक मोहरबंदातून बाहेर पडून विदारक वास्तवाचं दर्शन घडवीत आहे. माझ्या अल्पमतीप्रमाणे इतरत्र सर्वकष ग्रामीण जीवन दर्शन कुठल्याही एका कृतीतून मराठीत आलेलं नाही".

चंद्रकांत बांदीवडेकरांच्या या विवेचनावरून 'बारोमास'चे सर्वकष स्वरूप लक्षात येते. १९४५ पूर्वी ग्रामीण साहित्यात येणारे रंजन या कादंबरीत कुठेही दिसत नाही. र.वा. दिवेंच्या 'सराई'तून देणारी 'लाडी' येथे कुठेही दिसत नाही. ग्रामीण साहित्यातून मनोरंजन होते ही संकल्पना मागे पडली आहे. आजच्या ग्रामीण साहित्यात येते ते भयावह वास्तव. शेतकऱ्याचा कर्जबाजारीपणा, त्यांच्यापेक्षा रोज मजुरी करून खाणारा मजूर चांगल्या पध्दतीने जीवन जगतो हे वास्तव आहे. शासन दरबारीही याची दखल घेतली जात नाही. नवनवीन योजना येतात; पण त्या शेतकऱ्यापर्यंत पोहचत नाहीत आणि त्या योजनांचा लाभ घेताना हजार अडचणींना सामोरे जावे लागते. त्यापेक्षा त्या सवलती नकोत अशी अवस्था शेतकऱ्याची होते. या सर्वच प्रश्नांना घेऊन बारोमास येते. एकनाथ सारखे तरुण प्रत्येक खेड्यात आहेत, प्रत्येकाची जीवनपध्दती एकनाथसारखीच आहे. शिक्षणामुळे शेती करू शकत नाही अशी अवस्था या तरुणांची आहे. चंगळवादी संस्कृतीच्या आहारी बंधू, जात आहे.

एकनाथच्या जीवनाची ही शोकांतिका अनेक पदरी आहे. त्याचा कल्याणीचा मळा, दगडू महाकाळ

बळकावतो, हायब्रीड पेरल्यानंतर त्याचा आजोबा गावरान ज्वारी खाण्यासाठी हट्ट करतो व उपवास करून मरण जवळ करतो. हातचा मळा गेल्याने सुभानराव एंड्रील पितो. त्यात त्यांना यश येत नाही म्हणून आत्महत्या करायला जांभूळखोऱ्याच्या कुडाकडे जातो. शेवंतामाईचा जावाई कर्जबाजारीपणामुळे आत्महत्या करतो.

शेतकरी जीवनाचं हे विदारक चित्रण उदारपणे रेखाटले आहे. ग्रामीण जीवनासोबत निसर्ग, आजूबाजूचा परिसर अतिशय सुंदर रीतीने लेखकाने रेखाटला आहे. कादंबरीची भाषा अस्सल ग्रामीण ठसक्याची आहे. प्राणी, पक्षी यांच्या वर्तनात प्रतिकात्मकता आहे. निसर्ग वर्णन चित्रमय स्वरूपात आलेले आहे. एकनाथला नागरी भाषा येत असली तरी त्याच्या भाषेतही ग्रामीणता आहे.

एकंदरीत शेतकऱ्याच्या जीवनाचे आजचे समकालीन वास्तव आणि शेतकऱ्याच्या आत्महत्येच्या शोधाची करुण कहाणी 'बारोमास' या कादंबरीतून सदानंद देखमुखांनी मांडली आहे. ग्रामीण जीवनाशी समरस झालेल्या आणि शेतकऱ्याचा मुलगा असल्यामुळे आपल्या शेतकरी बापाची दुर्दशा पाहून अस्वस्थ झालेल्या लेखकाने आपल्याच लोकांचं आणि मातीचं दुःख बारोमासमधून समर्थपणे मांडले आहे. या कृतीला लेखकाची खास नैतिक बाजू मिळाल्यामुळे बारोमास ही एकूणच मराठी कादंबरीत लक्षणीय सामाजिक कृती ठरावी. शेतीच्या आणि मातीच्या अंगाखांद्यावर जगणाऱ्या लोकांचं आजचं भयावह समकालीन वास्तव किती जीवघेणं आहे याचा प्रत्यय देणारी कादंबरी आहे.

खेड्यातील शिकलेल्या मुलाच्या मृत शेतीविषयी तिटकारा वाढतो आहे. शेती हा आतबद्धाच्या व्यापार करण्याची नव्या पिढीची उमेदही आता संपली आहे.

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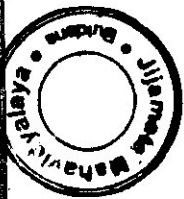
शेती करणारा बाप आणि शेती करणारा मुलगा दोघांही आत्महत्येची पायवाट धरत आहेत. समाजव्यवस्थेच्या आणि देशाच्या अर्थव्यवस्थेचा मुळ आधार असलेल्या शेतीच्या जीवनाची ससें होलपट कुठवर होणार आहे? शेतकऱ्याच्या आत्महत्येचे सत्र कुठवर चालणार आहे? शेतकरी संघटना, सरकार, राजकीय नेते शेतकऱ्यांच्या मल्याचा विचार केव्हा करणार आहेत? शेतकऱ्यांचा आणि शेतीचं मळ तिरडीवर बांधून झालं तरी समाजाला, सरकारला जाग तरी का येत नाही. असे अनेक प्रश्न बारोमास या कादंबरीनं अत्यंत कळवळ्यानं उपस्थित केलेले आहेत. म्हणूनच बारोमास ही ग्रामीण जीवनाचे वास्तव मांडणारी एक सामाजिक कृती आहे.

निष्कर्ष :

- १) ग्रामीण भागात सुशिक्षित बेकारांची संख्या वाढली आहे.
- २) ग्रामीण सुशिक्षित तरुण शेतात राबण्यास तयार नाही आणि त्याची राबण्याची इच्छा असली तरी परिस्थिती साथ देत नाही.
- ३) शिक्षणाच्या खाजगीकरणाने सुशिक्षित तरुणांची निराशा होत आहे.
- ४) सुशिक्षित मुलींची अपेक्षा वाढली आहे.
- ५) निसर्गाचा लहरीपणा, विदारकता या कादंबरीत येतो.

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- १) 'बारोमास', सदानंद देखमुख, कॉन्टिनेन्टल प्रकाशन, पुणे, प्रथम आवृत्ती, १९९८.
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- ४) 'मराठी ग्रामीण कादंबरी', डॉ. रविंद्र ठाकूर, मेहता पब्लिशिंग हाऊस, १२१६, सदाशिव पेठ, पुणे, प्रथम आवृत्ती, १९९३.
- ५) 'साहित्य : ग्रामीण आणि दलित', (डॉ. मदन कुलकर्णी गौरवग्रंथ) संपा. डॉ. ईश्वर नंदपुरे, विजय प्रकाशन, हनुमान गल्ली, सीताबर्डी, नागपूर - ४४००१२.



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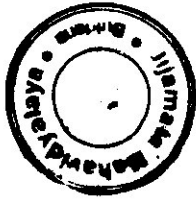
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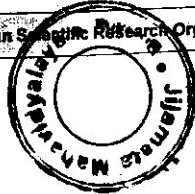
नव्वदोत्तर मराठी ग्रामीण कवितेतील दुष्काळाच्या दाहकतेचे चित्रण

डॉ. अनंत आर. सिरसाठ

मराठी विभाग प्रमुख
जिजामता महाविद्यालय,
बुलढाणा, जि. बुलढाणा

महाराष्ट्रात सातत्याने दुष्काळ भेडसावत आहे. पर्यावरणाचा समतोल ढासळला आहे. इ.स. १९९० नंतर भारताने 'खाऊजा' धोरणाचा स्वीकार केला आहे. त्यामुळे संपूर्ण जीवनमान व्यवहारवादी बनत चालले आहे. अशा व्यवहारवादी मूल्यांच्या स्वीकारामुळे बऱ्यावाईट गोष्टींचा विचार होत नाही. पारंपरिक जीवनातील माणसाने निसर्गाशी जपलेले आपले स्वाभाविक नाते आता न्हास पावत चालले आहे. बेसुमार वृक्षतोड, अत्यल्प जंगले, औद्योगिकीकरणातून हवा, पाण्याचे झालेले प्रदूषण, खेड्यातील उद्योग व कारखान्यांचे वाढते प्रमाण, शहरी जीवनशैली यासारख्या सुमार कारणांच्या परिणामातून भारतातील वर्ज्यमान कमी होत आहे. त्यामुळे शेती आणि शेतकरी जीवनमान उद्ध्वस्त झाले आहे. शाश्वत विकास साधण्याच्या धोरणाकडे दुर्लक्ष केल्यामुळेच पर्यावरणाचा न्हास होत आहे. याचा गांभिर्याने विचारच कोणी करत नाही. राष्ट्राच्या प्रगतीसाठी लागणारा धोरणात्मक आणि शाश्वत विकास आराखडा शासनाकडे आज तयार नाही. परिणामी अलिकडच्या वीस वर्षांच्या काळात खेडे दुष्काळामुळे उद्ध्वस्त होत आहेत. दुष्काळ ही पावसाच्या लहरीवर अवलंबून असलेली अस्मानी आपत्ती आहे. मात्र पर्यावरणाचा होत असलेला न्हास दुष्काळाचे मुख्य कारण आहे.

मराठी ग्रामीण कवितेतून दुष्काळाचे चित्रण विपूल प्रमाणात आले आहे. दुष्काळाच्या मा-यामुळे शेती, शेतकरी, कष्टकरी, कामगारांना हालाकीचे जीवन जगावे लागत आहे. पावसाचे प्रमाण घटत चालले आहे. ऋतुमानात बदल होत चालला आहे. त्यामुळे खेड्यात पाण्याचा प्रश्न उग्र रूप धारण करत आहे. थेंब थेंब पाण्यासाठी अनवाणी पायाने फिरणारे खेड्यातील लोक, शेतीसाठी उपलब्ध नसलेले पाणी, वाढते तापमान यामुळे खेडे उद्ध्वस्त होत आहेत. याबाबत ना.धों. महानोर यांनी मांडलेले मत अतिशय बोलके आहे. ते लिहितात, "खेड्यांच्या जीवनाला बरे दिवस होते सुध्दा, या दहावीस वर्षात खूप खूप बदलले. पाणी पावसाचे, नक्षत्रांचे ओहोळ आभाळातच नष्ट होत चालले. आले ते अवेळी, नको त्यावेळी, नको तसे. शेतीचं सगळं संपन्नपणानं उभं राहणच संपलं. फार कष्टानं कुठे तरी बेटं मिळत ती सुध्दा



काही काळ. प्रचंड खर्च, रोगराई व लहरी पावसाळे, कमी पावसाळे खेड्यांना, शेतकऱ्यांना थेट ओरबाडून टाकणारे झाले. संसार अवघ्या दुःखांनी काळपटून वेढला जातो आहे. त्याची ही कविता आहे. लोकसंख्या वाढली, पाणी राक्षसी पद्धतीने बाहेर काढलं. शासनानं खेडी व शेती तिथले प्रश्न योग्य पध्दतीनं अग्रक्रमानं घेतले नाहीत, म्हणून परवड झाली.”” अशा या स्वार्थी व मतलबी आत्मकेंद्री मानसिकतेमुळे जमिनीतील खोलवरच्या पाण्याचा अतिरिक्त उपसा झाला. अतिउच्च उत्पादकतेसाठी शेतीतही नवीन प्रयोग झाले. जमीण नापिक झाली. शहरातील औद्योगिक वसाहतीतील विषारी द्रव्ये नदीपात्रात सोडले आहेत. पीण्यायोग्य पाणी आता नदीपात्रात राहिलेले नाही. आजच्या दिखाऊ बेगडी संस्कृतीने हवा, पाणी, माती प्रदूषित झाले आहे. मात्र या सर्वांचा दुष्परिणाम खेड्यातील समाज जीवनावर झाला आहे. याचे प्रभावी चित्रण नव्वदोत्तर ग्रामीण कवितेतून आले आहे. दुष्काळाच्या झळा ग्रामीण भागात कशा सोसाव्या लागत आहेत. आज खेडे दुष्काळामुळे स्थलांतरीत होत आहेत. गुरे-ढोरे पाण्याभावी स्वरस्तात विकले जात आहेत. या एकूणच परिस्थितीचे चित्रण गांधार्याने अभिव्यक्त केले जात आहे.

सततच्या कोरड्या दुष्काळामुळे जमिनीतील पाण्याची पातळी खोल गेली आहे. नदी, नाले, विहिरी आटले आहेत. जमिनीतील पाण्याचा ओलावा आटत चालला आहे. याचे प्रभावी चित्रण नव्वदोत्तर ग्रामीण कवी संदिप जगताप आपल्या कवितेतून मांडताना म्हणतात की,

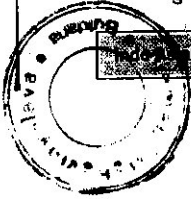
“कित्येक केले बोरवेल्स
कित्येक खोदल्या विहिरी
मातीच्या काळजाला बोगदेच बोगदे
पण सापडत नाही, पाण्याची नाळ
त्याच्या डोळ्यात , आसवांचा जाळ....” २

अशा सततच्या दुष्काळामुळे नदी, नाले, ओढे, विहिरी कोरडेठाक पडले. गुरा - ढोरांना पुरेसा चारा नाही , पिण्याचे पाणी नाही. पशु-पक्षांची संख्या घटली आहे. काही नष्टही झालू आहेत. दुष्काळामुळे हताश माणसांचे जगणे आणि उजाड शेत शिवाराचे चित्रण कवी करतो. पाण्याभावी खेड्यातील जिवाबाचे हाल कविने मांडले आहेत.

पावसाच्या लहरीपणामुळे शेतकरी, कष्टकऱ्यांना जगणेच महाकठीण झाले आहे. दुष्काळाचे सामर्थ्य दिवसेंदिवस वाढतच चालले आहे. दुष्काळाच्या झळा शेतकरी सोसतो आहे. त्याच्या कविते सर्व खेडूत सापडला आहे. पेरणीसाठी पुरेसा पाऊस पडत नाही. कोंब फुटण्याआधीच मातीत बियाणे करपून जाते. त्याचे प्रभावी चित्रण कवी प्रकाश होळकर यांनी आपल्या कवितेतून मांडले आहे.

“डोळां उन्हाचे कुसळ
आणि झळाया रानाला
कोंब फुटण्याच्या आधी
माती जाळते दाण्याला” ३

दुष्काळाच्या दाहकतेचे चित्रण कवीने केले आहे. मृग संपून गेला तरी पुरेसा पाऊस पडत नाही. दुबार पेरणीचे संकट त्याच्या वाट्याला येते. असा चिंतेत सापडलेला शेतकरी कवीने चित्रित केला आहे. दुष्काळामुळे एकेकाळी सुसंपन्न आणि स्वावलंबी असलेले खेडं आज उद्ध्वस्त होत आहे. दुष्काळाच्या



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भीषणतेमुळे संपूर्ण खेडे ओस पडत चालले आहे. हजारो वर्षांची भारतीय खेड्याची ग्रामव्यवस्था आज उद्ध्वस्त झाली आहे. शेतकरी, बलुतेदार, आलुतेदार हा आपल्या मूमीपासून व खेड्यापासून दुरावत आहे. याचे वास्तव चित्रण मांडताना कवी लक्ष्मण महाडिक लिहितात,

"सालामागं साल सारे, दुष्काळाचे आले गेले
माझ्या गाव पंढरीचे, लोक परागंदा झाले
असं दुष्काळाचं इख, साऱ्या गावाला झोंबलं
माझ पुण्यभूमी गाव, गंगघडीला पांगलं."

दुष्काळाच्या दाहकतेमुळे संपूर्ण खेडे ओस पडत आहेत. गावपंढरीतील लोक परागंदा झाले. जगण्याचा मार्ग शोधण्यासाठी खेड्यातील माणसांची पांगापांग झाली, गुरदोरे स्वस्तात विकली गेली, गाव सोडून लोक शहराकडे धाऊ लागले, कोणी ऊसतोड कामगार झाले, कोणी मजूर झाले, कारखान्यात कामास गेले. जगाचा पोशिदा शेतकरी बाप दुष्काळामुळे स्वतःच अन्नधान्याच्या व पाण्याच्या शोधात गाव सोडून भटकू लागला. गावाची पांगापांग झाली तशी दुष्काळाच्या विषामुळे सारा गावा लुळा पांगळा झाल्याचे चित्रण कवीने केले आहे.

दुष्काळातून निर्माण झालेली पाण्याची भीषणता, कडक उन्हाळ्याने उजाड झालेली शिवार, बांधावरील वाळलेली झाडे, शेत - शिवारातून परागंदा झालेली माणसं आणि पशुपक्षी, शेतकऱ्यांच्या आत्महत्येच्या याचे प्रभावी चित्रण नव्वदोत्तर मराठी ग्रामीण कवितेतून मांडले आहे. कधी कोरड्या तर कधी ओल्या दुष्काळात खेडे उद्ध्वस्त होते. कोरड्या दुष्काळामुळे पिके सुकून जातात, बागा वाळून जातात. तसेच ओल्या दुष्काळामुळे पिकाचे नुकसान होते. खुप मोठा खर्च करून उभी केलेली बाग दुष्काळामुळे उद्ध्वस्त होते. याचे वास्तवचित्रण मांडताना कवी एकनाथ पाटील लिहितात,

"करपूनी गेली, डाळिंबाची बाग
कर्जाचा नाग, पुढे उभा
झुलनिया गेली, झाड्यांची बाग
जगण्याचा माग, बंद झाला."

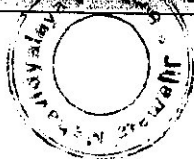
अशा या रोगराई, गारपीठ, वादळीवारे, दुष्काळामुळे हाती आलेली बाग उद्ध्वस्त होते. शेतकरी हा कर्जबाजारी होतो. परिणामी आत्महत्येकडे वळतो याचे वास्तव चित्रण आले आहे.

आजच्या प्रगत समाजाल्या गेलेल्या काळात हवा, पाणी, अन्नद्रव्य शुध्द मिळत नाहीत. शेती नापीक बनली. कितीही खर्च केला तरी ती पिकत नाही. शेवटी शेकऱ्यांवर उपासमारीची वेळ येते. याचे प्रभावी चित्रण कवी बालाजी इंगळे आपल्या कवितेतून मांडताना लिहितात,

"हवामानाचा विचार केला तर
उत्तरोत्तर पाऊस कमी कमी होत असून
मोसमी वारे बिगर मोसमात वाहत आहेत
परिणामी कमी उत्पन्नामुळे,
धान्य अडतीपर्यंत जात नाही."

हवामान बदलामुळे व पर्यावरणाच्या होत असलेल्या न्हासामुळे तापमान वाढले आहे. पाऊस वेळेवर

Indo Asian Scientific Research Organization (IASRO) (A Division of Indo Asian Publication)



पडत नाही. पुरेसा पाऊस न पडल्यामुळे पिके करपून जातात. अतिवृष्टीमुळे पिकाचे नुकसान होते, पिके वाहून जातात, ओल्या दुष्काळामुळे हाती आलेल्या पिकाचे नुकसान होते. त्यामुळे पीक बाजारात नेण्याइतके निघत नाही. डोक्यावर असलेला कर्जाचा बोजा त्यातून उद्ध्वस्त झालेली मानसिकता व आत्महत्येकडे निघालेला प्रवास प्रभावीपणे मांडण्याचे कार्य नव्वदोत्तर मराठी ग्रामीण कवींनी प्रभावीपणे केले आहे. म्हणून ही कविता आता एका नव्या टप्प्यावर येऊन पोहोचली आहे असेच म्हणावे लागेल.

संदर्भ सूची :-

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प्रमुख
श्रीरामपूर



Potentiometric Studies In Some Binary and Ternary Complexes of Praseodymium (III)

S.R.Ingale¹, K.N.Sonune²

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Abstract:

Stability Constant of binary and Ternary complexes of praseodymium (III) with N-Hydroxy ethyl ethylene diamine-triaceticacid (HEDTA) and Azelic acid (AE) in solution were determined. Metal ligand stability constant of complexes were determined at three different temperature 25°C, 35°C and 45°C and 0.1M(HClO₄) ionic strength. It was observed that Praseodymium (III) ion form 1:1 binary complex. It was also observed that praseodymium (III) ion forms 1:1:1 ternary complexes with HEDTA & AE.

Key words : Stability constant, Binary complex, ternary complex

Introduction :

Potentiometric study involving the use of pH-metric technique has been proved to be one of the most reliable and useful methods. The stepwise attachment of ligand to central metal ion yields stepwise complexes, the stability constants of which may be conveniently evaluated by Bjerrum- Calvin titration method using the method of Irving and Rossotti. A considerable amount of work on the evaluation of the stability constant of binary complexes has been reported. However the studies on the formation of polynuclear and mixed ligand complexes has not been studied with the same interest as that of binary complexes. In recent years, however the formation of complexes containing two different type of ligands has become a matter of interest for the coordination chemists and hence formation constant of some of these complexes have been determined [1-3]. Good amount



of work on pH-metric study of Pr(III) complexes have been done by many workers[4-6]. Dutta and co-workers[7] reported the formation constants of ethyl acetoacetate complex of Pr(III). The stability constant and thermodynamic parameters of Pr(III) propionate and isobutyrate have been determined by Paterson and Haight[8]. Sonar et.al.[9] have been studied the spectrophotometric and pH-metric studies of Ce(III), Dy(III), Gd(III), Yb(III) and Pr(III) metal complexes with rifampicin. Ammar et.al.[10] have been studied the determination of the stability constants of mixed ligand complexes of phenytoin sodium drug and glutamine by potentiometric method. Arvind Singh et.al.[11] have been studied the stability constant for binary complexes of Fe(III) and Mn(III) with chloramphenicol by paper electro-phoretic technique.

In present work, investigation of the complexation behavior of Presodymium(III) with organic acid acting as bidentate ligand like azelic acid (AZ), proton ligand stability constant & metal ligand stability constant and thermodynamic parameters like ΔH (Enthalpy), ΔG (Change in free energy) and ΔS (Entropy) of binary & ternary complexes at three different temperatures have been attempted.

Methodology:

In this research work Calvin-Bjerrum pH titration technique as adopted by Irving Rossotti has been employed. All reagents used were A.R. Grade and prepared by using double distilled water. The ligand (HEDTA) & (AE) were synthesized in the laboratory by reported methods. pH-meter (model pH 821) (Accuracy ± 0.05 units) having glass calomel electrode was used.

General procedure of titrations for Binary Complexes.

- I) Free acid (0.01M)
- II) Free acid+ligand (0.01M)
- III) Free acid+Ligand+Metal ion (0.01M)

General procedure of titrations for Ternary Complexes

- I) Free acid (0.01M)
- II) Free acid+ primary ligand (0.01M)
- III) Free acid + Secondary ligand (0.01M)
- IV) Free acid + primary ligand + metal ion (0.01M)
- V) Free acid + primary ligand + metal + secondary ligand (0.01M)

The ionic strength of all the solutions was maintained constant 1M by adding appropriate amount of KNO_3 solution.



For binary complexes, Titration curves are used to estimate the values of nA (proton-ligand formation number), formation curve are constructed between nA & pH $\log k_1$, $\log k_2$ & $\log k_3$ at $nA = 0.5, 1.5, \& 2.5$ respectively. These values of constants ($\log k_1^H$, $\log k_2^H$ & $\log k_3^H$) are summarised in Table 1&2. Metal ligand stability constant $\log k_1$ and $\log k_2$ were read at $n=0.5$ & 1.5 respectively. These values are summarised in table 3&4. Thermodynamic Parameters ΔH , ΔG , & ΔS are summarised in Table-5. Stability constant values of ternary complex are summarized in Table-6 while thermodynamic parameter values of ternary complex are summarized in Table-7. These thermodynamic parameters calculated directly from formation constants of chelates in binary complex.

For monobasic acid we know



By the law of mass action we have

$$K = \frac{[H^+][L^-]}{[HL]} \text{-----1}$$

and for ternary complex



By law of mass action

$$K_{MAL}^{MA} = \frac{[MAL]}{[MA][L]} \text{-----2}$$

Calculations of different parameters from the obtained data were done by using different equation as follows

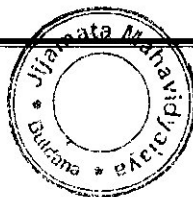
$$\bar{n}A = \gamma - (V_2 - V_1)(N + E^0) / (V_0 + V_1) T_{CL}^0 \text{-----3}$$

Where $\bar{n}A$ = Average number of proton attached to ligand, γ = Number of replaceable proton in ligand. N = Initial strength of alkali, E^0 = strength of acid in system. V_0 = Initial volume of the system, $(V_2 - V_1)$ = Difference of alkali required between acid and ligand titration, T_{CL}^0 = Total concentration of ligand solution in system.

$$\bar{n} = (V_3 - V_2)(N + E^0) / (V_0 + V_2) \bar{n}A T_{CM}^0 \text{-----4}$$

where $\bar{n}$ = average number of secondary ligands bound to primary complex, T_{CM}^0 = initial concentration of metal ion in system.

$$\Delta G = -4.576 T \log k \text{-----5}$$



where ΔG = change in free energy, T-temperature, Log k= stability constant

$$\Delta H = -4.576 \times \text{slope} \text{-----} 6$$

where ΔH =Enthalpy

$$\Delta S = (\Delta H - \Delta G)/T \text{-----} 7$$

where ΔS =Entropy

Observation Tables

Table-1 Proton-Ligand Stability Constant of HEDTA

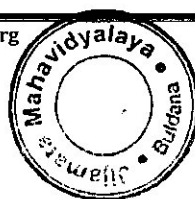
Sr.No.	Constants	Temperatures		
		25°C	35°C	45°C
1	Log k_1^H	10.10	09.90	09.75
2	Log k_2^H	05.33	05.30	05.00
3	Log k_3^H	02.63	02.50	02.30

Table-2 Proton-Ligand Stability Constant of AE

Sr.No.	Constants	Temperatures		
		25°C	35°C	45°C
1	Log k_1^H	05.25	05.15	05.12
2	Log k_2^H	04.15	04.08	04.02

Table-3 Metal-Ligand Stability Constant of AE Complexes

Sr.No.	Constants	Temperatures		
		25°C	35°C	45°C



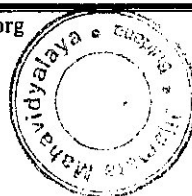
1	Log k_1	02.62	02.32	02.18
2	Log k_2	02.14	02.01	01.83
3	Log k_3	04.66	04.33	04.01

Table-4 Metal-Ligand Stability Constant of HEDTA Complex [Pr(III)-HEDTA]

Sr.No.	Constants	Temperatures		
		25°C	35°C	45°C
1	Log k_1	13.70	13.55	13.20

Table-5 Values of Thermodynamic parameters for Binary Complexes.

Sr.No	System	Temp.	Thermodynamic parameters		
			ΔH	ΔG	ΔS
1	Pr(III)-AE	25°C	-	-04.58	+03.90
		35°C	-03.03	-04.33	+03.20
		45°C	-	-04.11	+02.70
2	Pr(III)-HEDTA	25°C	-	-24.90	+56.60
		35°C	-02.40	-25.29	+56.10
		45°C	-	-25.24	+54.60



**Table-6 Stability Constant of Ternary Complex of Azelic Acid
[Pr(III)-(HEDTA)-(AE)]**

Sr.No.	Constants	Temperatures		
		25°C	35°C	45°C
1	$\log k_{MAL}^{HEDTA}$	03.32	03.15	02.95

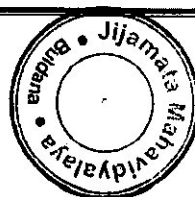
Table-7 Values of Thermodynamic parameters for Ternary Complex.

Sr.No	System	Temp.	Thermodynamic parameters		
			ΔH	ΔG	ΔS
1	Pr(III)- HEDTA AE	25°C	-	-06.20	+06.30
		35°C	-03.60	-05.90	+05.40
		45°C	-	-05.60	+04.70

Result and discussion:

In the formation of binary complex, more room is available for ligand than that of ternary complex which results in lowering the value of $\log k$. In case of HEDTA system, the expansion of coordination number to more than six by secondary ligand is quite obvious, because HEDTA acts as pentadentate ligand and azelic acid as bidentate ligand. If coordination number of Pr(III) is more than six, secondary ligand would displace the coordinated water instead of displacing coordinated group of HEDTA. If it is valid, these mixed ligand chelates would not hydrolyze before pH=10.5. In fact they behave similarly. Therefore, here ternary system of HEDTA the possibility of expansion of coordination number of Pr(III) larger than six is considered. In view of above discussion it is concluded that the coordination number of Pr(III) ion is seven in this ternary system.

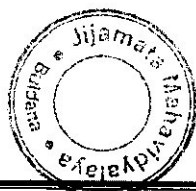
The thermodynamic parameters ΔH , ΔS and ΔG for ternary chelates formation is calculated directly from formation constants of these chelates. In the mixed ligand complex of azelic acid, the value of enthalpy is negative and that the entropy is positive. Both these factors help in the



formation of stable complex. In addition it must be mention here that the ternary complex formation [Pr(III)-HEDTA-AE] results in a greater entropy increases through displacement of more coordination water molecules than in the formation of analogous Pr(III) binary chelate.

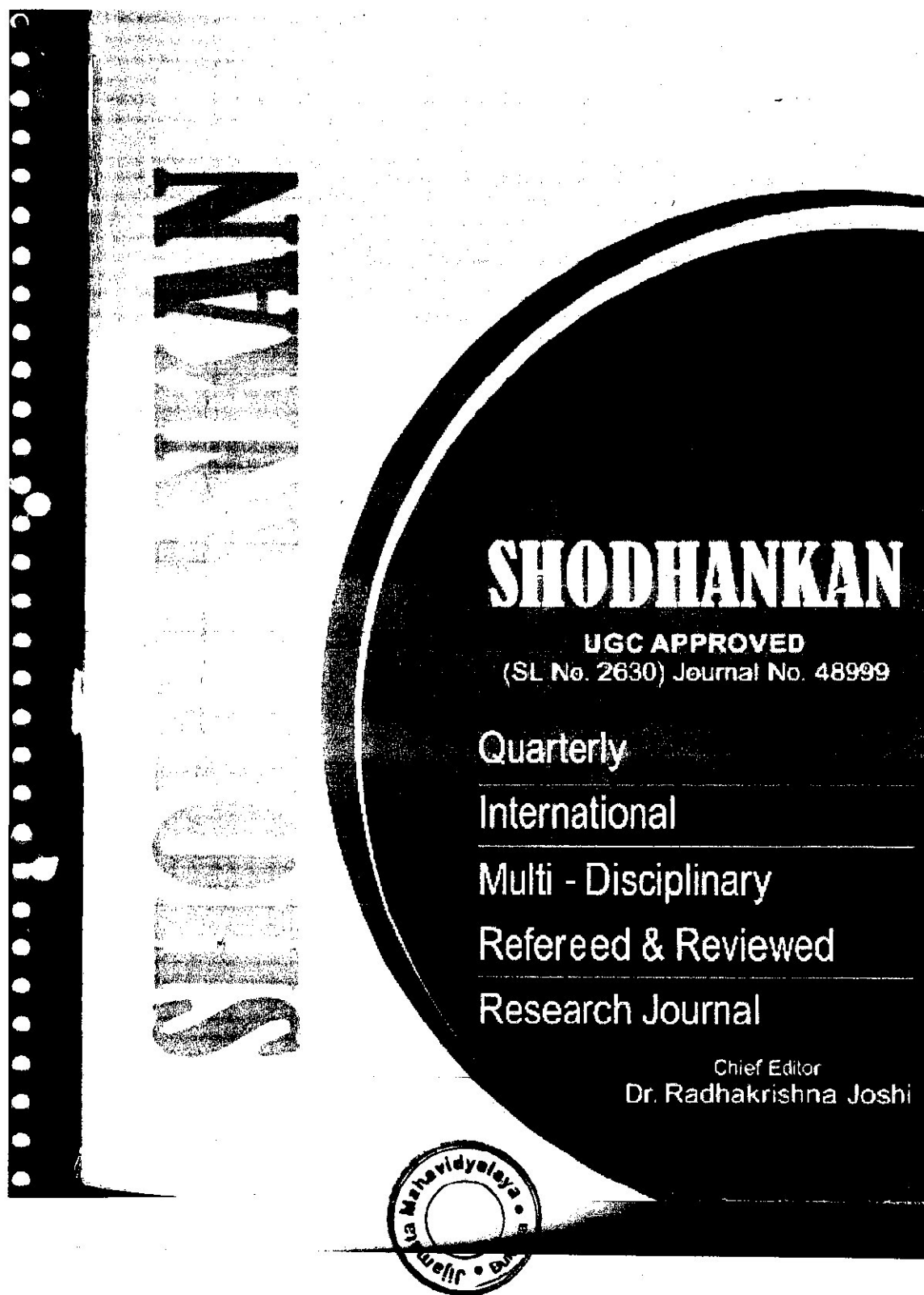
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FDI IN RETAIL SECTORY IN INDIA: CHALLENGS AND OPPORTUNITIES

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INTRODUCTION

Generally speaking FDI refers to capital inflows from abroad that invest in the production capacity of the economy and are "usually preferred over other forms of external finance because they are non-debt creating, non-volatile and their returns depend on the performance of the projects financed by the investors. FDI also facilitates international trade and transfer of knowledge, skills and technology." It is furthermore described as a source of economic development, modernization, and employment generation, whereby the overall benefits (dependant on the policies of the host government)...triggers technology spill overs, assists human capital formation, contributes to international trade integration and particularly exports, helps create a more competitive business environment, enhances enterprise development, increases total factor productivity and, more generally, improves the efficiency of resource use.

HISTORY OF FOREIGN DIRECT INVESTMENT (FDI) IN INDIA

Foreign direct investments (FDI) are a major driving force behind the growth of Indian financial markets. Post liberalization in 1990s, the country is being viewed as a strategic destination by foreign majors to park their investments and benefit from the economic growth. In India, FDI is considered as a developmental tool, which can help in achieving self-reliance in various sectors of the economy. With the announcement of Industrial Policy in 1991, huge incentives and concessions were granted for the flow of foreign capital to India. India is a growing country which has large space for consumer as well as capital goods. India's abundant and diversified natural resources, its sound economic policy, good market conditions and highly skilled human resources, make it a proper destination for foreign direct investments.

India remains the world's third most attractive destination for investment by transnational corporations (TNCs) during 2013-15, stated a recent survey by UNCTAD. The country was ranked after china and the US in the survey based on responses of 159 companies. As per the recent survey done by the United National Conference on Trade and Development (UNCTAD), India will emerge as the third largest recipient of foreign direct investment (FDI) for the three-year period ending 2012 (World Investment Report 2010). As per the study, the sectors which attracted highest FDI were services, telecommunications, construction activities, and computer software and hardware. In 1991, India liberalized its highly regulated FDI regime. Along with the virtual abolition of the industrial licensing system, controls



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- 1) जिल्हा आर्थिक व सामाजिक समालोचन - अहमदनगर जिल्हा
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- 4) निवडणूक आयोग अहवाल - 2016
- 5) द. लोकसत्ता- 29 नोव्हेंबर 2016.



over foreign trade and FDI were considerably relaxed. The reforms did result in increased inflows of FDI during the post reform period. The volume of FDI in India is relatively low compared with that in most other developing countries.

Moreover, this economic segment enjoys high attention from top officials of the Government, owing to its strategic importance. The Government keeps making efforts to provide impetus to FDI flows in the country and hence undertakes numerous reform initiatives. FDI norms were further liberalized after September 2012 in sectors like civil aviation, power exchanges and retail. The Ministry of Finance has also suggested modifications in FDI caps for various sectors, including tea, media, natural gas and petroleum.

In political economy terms, the entry of foreign retailers affects different stakeholders on the demand and supply side. Improvement in supply chain, especially for food items, across the country benefits low income groups because their major part of the consumption basket is food. Secondly, it will increase surplus to small and medium farmers. Low income consumers on the demand side and small and medium scale farmers on supply side are less cohesively organized in influencing government policies than wholesalers, middlemen, and Indian large retailers. Indian large retailers (such as the newly entrenched interests like the Reliance fresh) may block the entry of foreign players with short-term calculations of their interests. However, they can benefit from externalities arising out of the entry of foreign players if the foreign players invest significant resources in developing the supply chain and improve the know-how of large number of vendors. This took place in the case of the automobile sector. Some of the wholesalers and small Kirana stores adopted innovative practices in procuring and selling goods in response to competition from the large retailers which will improve the overall organization of the markets. The main losers would be the middlemen rather than small traders. Small traders retain the advantage of low overhead costs and take advantage of geographic distribution and density of consumers. Any technological and organizational changes have disruptive effects - some losers in the short run and larger number of gainers in the long run. As the presence of large retailers increases, government tax revenues will increase which can be used to compensate the losers. The main role of government is to establish and implement effective and autonomous regulatory institutions- restraining anti-competitive conduct by firms, labor and environmental regulation. The government has to make credible commitments of its policies

Types of Retailing in India

(a) **Single Brand-** Single brand implies that foreign companies would be allowed to sell goods sold internationally under a „single brand“, viz., Reebok, Nokia and Adidas. FDI in „Single brand“ retail implies that a retail store with foreign investment can only sell one brand. For example, if Adidas were to obtain permission to retail its flagship brand in India, those retail outlets could only sell products under the Adidas brand and not the Reebok brand, for which separate permission is required. If granted permission, Adidas could sell products under the Reebok brand in separate outlets.



(b) **Multi Brand-** FDI in Multi Brand retail implies that a retail store with a foreign investment can sell multiple brands under one roof. Opening up FDI in multi-brand retail will mean that global retailers including Wal-Mart, Carrefour and Tesco can open stores offering a range of household items and grocery directly to consumers in the same way as the ubiquitous "kirana" store. The approval for single and multi brand includes a set of riders for the foreign investors, aimed at ensuring that the foreign investment makes a genuine contribution to the development of Indian infrastructure and logistics, at the same time facilitating integration of small retailers into the upgraded value chain.

While the minimum capital requirement of US\$ 100 million is unlikely to be an issue for the large foreign players vying to enter India in the supermarket/hypermarket segment, it could make it difficult for foreign investors planning to enter specialty formats such as music, mobile, electronics goods, among others, as these formats require relatively lower investments. Further, the approval requirements from State Governments could limit the cities that FDI backed retailers can operate in. The current opposition raised by a number of political parties, if persists, may pose a major roadblock in the entry of the foreign retailers in India. Besides restricting the number of cities these retailers can operate in, it could also lead to problems in creating supply chain efficiency.

Opportunities of FDI :

Opportunities to Indian Economy

FDI in retail would have been an opportunity to attract inflow of funds which would have resulted in major benefits for the Indian economy:

1. **Growth in allied industries:** The inflow of funds into retailing would have simultaneously led to the growth of allied industries as happened in the case of automobiles, which led to the growth of auto components sector. Likewise FDI in retail would assist growth in supplier industries such as food-processing and textiles moreover, growing demand for retail space, construction of real estate would have also taken place.

2. **Improvement of Government Revenues:** Another significant advantage of organized retailing is its contribution to government revenues. Organized retailers, by virtue of their being corporate entities need to file tax returns periodically whereas in the unorganized sectors there have been leakages in the collection of central and state taxes.

3. **Supports the growth of Indian small industries:** If the consumers in India buy goods at foreign single-brand outlets, established in India and enjoy the shopping experience, in reality, they would be actively contributing towards significant money transfer to a multinational based out of the USA, which after retaining profits, would end up sending majority of this money to China, where most goods are being manufactured. The government appears to be cognizant of this very issue, which is why they proposed that at least 30 per cent of the procurement of manufactured / processed products shall be from "small industries" (presumably this refers to "small industries" in India). This aspect will lead to support the growth of the small industries in the country.

4. **Supports Improved Standard of Living:** Allowing FDI in Indian Single-Brand Retail will certainly bring in more sophisticated and luxurious goods and services to



the country. Availability of such goods backed with good promotional support will definitely motivate / induce the Indian buyers to buy and consume them. It will be certain that the standard of living of the consumers will be improved. In addition to the above, the people who shall be employed in the multi-national retail enterprises will be paid attractive salaries and wages that will also stand for their increased affordability. The organised retail also provides other add-on services along with the products sold. All these new changes, that shall be resulted by allowing FDI in single-brand retail will surely support improved standard of living.

5. Enhanced Competition and Reduced Prices: Entry of the many other multi-national corporations will obviously promise intensive competition between the different companies offering their brands in a particular product market. When the manufacturing companies will take efforts to increase their market share or to accomplish their other marketing objectives, competition among them will be activated. Such a competition will result in the availability of many varieties, reduced prices, and convenient distribution of the marketing offers.

6. Enhanced Shopping Environment and Experience: Consumers in India mostly suffer from unhygienic

Experiences, erratic price and irregular availability in daily food and FMCG products. Many established foreign retail giants that are known for low pricing, creation of pleasant shopping environment, maintenance of hygienist, better customer care, effective inventory management and storage facilities shall efficiently contribute for eradicating the said problems and make the shopping very productive and a happy experience to the customers in India.

7. Efficient Enforcement of Laws: The presence of International companies in Indian Retail will facilitate effective enforcement of Tax Laws and increase in tax revenue. Tax evasion could be stopped when more of the retail is in organised format.

8. Overall Growth of The Country: FDI in Indian retail will obviously result in the growth and expansion of the market and change in consumer spending pattern and also increase in their spending that eventually lead to higher GDP in the country.

9. Efficient Supply Chain Systems: The Government believes that FDI in retail is the silver bullet solution to all issues regarding the inefficient supply chain system in India. This belief rests on the premise that a component of the capital inflow into the retail sector will go into developing an extremely efficient and organised supply and logistic system that will take care of collection, storage and transportation of food produce, seamlessly. The government cannot

Expect the Wal-Mart's and the Tesco's to build good roads, without which the supply systems cannot be optimized. This is one of the constraints that Indian retail players are already struggling with. Globally, logistics account for around five per cent of total cost retail players incur, while it is as high as ten per cent in India, thus making a dent in its attractiveness.

10. Higher Profits for Farmers: The section in the Indian Government that supports foreign investments in retail, believes that such a move has the potential to boost up the lives of our farmers. The underlying rationale is that with the giant retailers setting up shops and investing in fully integrated supply chain from farm



gates to supermarket shelves, middlemen in the chain will be cut out. Without the intermediaries, food producers would get higher prices for their produce.

11. **Large-Scale Employment Generation:** Proponents of FDI in retail have declared that there will be large-scale job creation in the economy. Union Minister for Commerce and Industry Anand Sharma went one step further by quoting a figure of 10 million as the number of new jobs to be created, with bulk of that supposedly coming from the logistics sector. For example, the Wal-Mart, whose global turnover is close to size of India's entire retail industry, employs only 2.1 million people. Assuming that the Wal-Mart and other retailer giants will extend their highly profitable model in the Indian retail sector as well, it is highly unlikely that 10 million jobs will be created. On the other hand, there is a possibility of loss of employment for several small retailers once foreign retailers establish themselves in the market, as seen in developed nations. In the Indian context, a study conducted by the Indian Council for Research on International Economic Relations in 2008 observed that unorganized retailers operating in and around organised retailers have witnessed a drop in business turnover and profits after the entry of organised retailers. The entry of foreign players into the Indian retail market may or may not result in huge loss of jobs, but income reduction of marginal retailers and intermediaries is highly likely.

12. **Elimination of Food Wastage:** Presently the highly unorganized and inadequate supply chain in India is considered responsible for the wastage of about a quarter of the total produce between the harvest and the consumption stages. In theory, development of an efficient end-to-end cold chain will make it possible to eliminate this wastage during the collection, storage and transportation of fresh produce from farms to supermarket shelves. The increase in supply base of food items due to elimination of waste will supposedly translate into higher income for farmers and lower prices for consumers. However, data from countries where retail is highly organised convey a different story. In the US and UK, anywhere between 20 and 30 percent food is wasted by retail giants between the stages of production and consumption. A huge quantity of fresh produce is thrown away by the supermarkets during the sorting process since they have a policy of accepting products that conform to strict standards in shape, size and appearance. Hence, fresh fruits and vegetables which are otherwise edible are thrown away from supermarket shelves for their unappealing looks. The Environment Agency estimates that the total UK retail food waste is 1.6 million tons per year.

Opportunities to consumers:

- Consumers have increased the competitiveness of domestic players.
- The growth in the sector assisted the development of the auto component industry which not only produces products of global standards but has also resulted in increased employment.
- The productivity levels within the sector have improved as a result of following globally recognized models of manufacturing.
- The technological capability of Indian firms has also seen improvements over the years.



- FDI brought the required capital into the sector which assisted players in scaling up their supply thereby assisting their overall efficiency and growth.
- Consumer choices have increased by many folds both in terms of product range within a price range as well as across price range.
- The Indian consumer today has access to global brands
- The quality of products in terms of customer experience as well as other parameters such as safety, accessories have improved tremendously.

Over the years there have been new product categories that have been created keeping in mind the change in customer preferences. The recent surge in demand for luxury and high end automobiles has been noticed by various international brands which have now started looking at India as a future growth driver

CHALLENGES OF FDI IN INDIAN RETAIL:

Foreign direct investment (FDI) in the retail sector in India is restricted. In 2006, the government eased retail policy for the first time, allowing up to 51 per cent FDI through the single brand retail route. Since then, there has been a steady increase in FDI in the retail sector, and the cumulative FDI in single-brand retail stood at \$195 million by the middle of 2010 (DIPP, 2010).

According to the Department of Industrial Policy and Promotion (DIPP) of the Government of India, single-brand retail comprises those retailers selling products "of a 'single brand' only, such that products should be sold under the same brand internationally; and single-brand product retailing covers only products which are branded during manufacturing. In this category, FDI is allowed to the extent of 51 per cent. In contrast, no FDI is allowed in the multi-brand retail category. This includes all firms in organized retail that seek to stock and sell multiple brands, such as large international retailers like Wal-Mart and Carrefour. This is the sector that is most under dispute.

CHALLENGES IN RETAIL

The industry is facing a severe shortage of talent, especially at the middle management level. Most Indian retail players are under serious pressure to make their supply chain more efficient in order to deliver the level of quality and service that consumer are demanding. Long intermediation chain would increase the cost by 15 per cent. The retailer does not have industry status yet making it difficult for retailers to raise finance from Bank to fund has expansion plan; governments restrictions on the FDI are leading to an absence of foreign players resulting in to limited exposure to best practice. India's retail sector remains off-limits to large international chains especially in multi-brand retailing.

The first concern is the potential impact of large foreign firms on employment in the retail sector. A second related concern raised in the DIPP's report is that opening up FDI would lead to unfair competition and ultimately result in large-scale exit of incumbent domestic retailers, especially the small family-owned business. A third concern raised by domestic incumbent firms in the organized retail sector is that this sector is under-developed and in a nascent stage. Here the potential benefits from allowing large retailers to enter the Indian retail market may outweigh the costs. Evidence from the United States suggests that FDI



in organized retail could help tackle inflation, particularly with wholesale prices. It is also expected that technical know-how from foreign firms, such as warehousing technologies and distribution systems, will tend itself to improving the supply chain in India and added benefit of improved distribution and warehousing channels may also come from enhanced exports. India's experience between 1990-2010, particularly in the telecommunications and IT industries, showcases the Various benefits of opening the door to large-scale investments in these sectors. Arguably, it is now the turn of retail.

CHALLENGES FACING FDI

The challenges facing FDI in India are in spite of the fact that more than 100 of Fortune 500 companies are already investing in India. These FDIs are already generating employment opportunities, income, technology transfer and economic stability. India is focusing on maximizing political and social stability along with a regulatory environment. In spite of the obvious advantages of FDIs, there are quite a few challenges facing larger FDIs in India, such as:

1. RESOURCE CHALLENGE:

India is known to have enormous amounts of resources. There is manpower and significant availability of fixed and working capital. At the same time, there are some underexploited or unexploited resources. The resources are well available in the rural as well as the urban areas. The focus is to increase infrastructure 10 years down the line, for which the requirement will be an amount of about US\$ 150 billion. This is the first step to overcome challenges facing larger FDI.

2. EQUITY CHALLENGE:

India is definitely developing in a much faster pace now than before but in spite of that it can be identified that development has taken place unevenly. This means that while the more urban areas have been tapped, the poorer sections are inadequately exploited. To get the complete picture of growth, it is essential to make sure that the rural section has more or less the same amount of development as the urbanized ones. Thus, fostering social equality and at the same time, a balanced economic growth.

3. POLITICAL CHALLENGE: The support of the political structure has to be there towards the investing countries abroad. This can be worked out when foreign investors put forward their persuasion for increasing FDI capital in various sectors like banking, and insurance. So, there has

to be a common opinion between the Parliament and the foreign countries investing in India. This would increase the reforms in the FDI area of the country.

4. EXECUTION CHALLENGE:

Very important among the major challenges facing larger FDI, is the need to speed up the implementation of policies, rules, and regulations. The vital part is to keep the accomplishment of policies in all the states of India at par. Thus, asking for equal speed in policy implementation among the states in India is important.

5. India must also focus on areas of poverty reduction, trade liberalization, and banking and insurance liberalization. Challenges facing larger FDI are not just restricted to the ones mentioned above, because trade relations with foreign investors will always bring in new challenges in investments.

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CONCLUSION:

In light of the above, it can be safely concluded that allowing healthy FDI in the retail sector would not only lead to a substantial surge in the country's GDP and overall economic development, but would also help in integrating the Indian retail market with that of the global retail market in addition to providing not just employment but a better paying employment, which the unorganized sector (kirana and other small time retailing shops) have undoubtedly failed to provide to the masses employed in them. Thus, as a matter of fact FDI in the buzzing Indian retail sector should not just be freely allowed but should be significantly encouraged. Allowing FDI in multi brand retail can bring about Supply Chain Improvement, Investment in Technology, Manpower and Skill Development, Tourism Development, Greater Sourcing from India, Up-gradation in Agriculture, Efficient Small and Medium Scale Industries, Growth in market size and Benefits to Government through greater GDP, tax income and employment generation.

Despite the current policy and regulatory environment not being 'perfect' for foreign investors, there are clearly moves towards improving the current position and facilitating FDI inflows without having a detrimental impact on various sectors of the economy. The current policy is trying to encourage Joint Ventures in multi-brand retailing so as to boost the domestic retailer's growth in this area. However, there is also the risk that some foreign retailers will not be interested in investing unless they have 100% ownership and that the current policy will prevent them from choosing India as a Retail destination. In our view, the advantages outweigh the disadvantages of allowing unrestrained FDI in the retail sector, as successful experiments in countries like Thailand and China demonstrate. In both countries, the issue of allowing FDI in the retail sector was first met with incessant protests, but allowing such FDI led to GDP growth and a rise in the level of employment.

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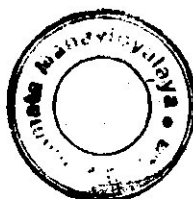
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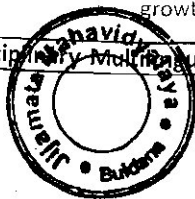
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Introduction :

Our first Prime Minister Shri J. L. Nehru visited Soviet Russia in 1927. He was impressed by the Five Year Plans of Russia. In 1938, he proposed to adopt the Five Year Plans in India. On the recommendations of the Advisory Planning Board constituted in 1946, under the Chairmanship of K. C. Neogi, the Planning Commission was established in March 1950 by an executive resolution of the Government of India for implementation of the five year plans. The Deputy Chairman of the Commission is responsible for the formulation and submission of the draft Five-Year Plan to the Central Cabinet. Present time twelfth five year plan is continuing prior this 11 five year plans, three annual plans (1966-69) and one rolling plan (1978-80) already implemented in our country. In all plans, there are many programmes and schemes were existed for agricultural and rural development. Those have not reached to the target groups up to a satisfactory level. Therefore, by using proper methods attempts should be made to motivate them through an emphasis on the deprived need areas. We know that Indian economy is based on agriculture with a vast segment of its population engaged in agriculture and allied pursuits; growth of the Indian agricultural determines the overall growth rate of the national economy.

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• **First Five year Plan (1951 - 56):** The First 5-Year Plan gave a predominant importance to the development of agriculture and irrigation out of a total actual investment of Rs. 1960 crores made in the first plan. Rs. 601 crores i.e. 31% was allocated for agriculture. There were two components of agricultural investment in the public sector, (i) Rs. 291 crores (15% of the total) was allocated to agriculture & C.D.P. and the balance of Rs. 310 crores (or 16% of total) was the share of irrigation? It was expected that the index of farm output would increase from about 100 in 1949-50 to 114 in 1955-56.

Table No. 01: Targets and Achievements of the various agricultural products

Crop.	Unit	Target	Actual Production	Over-Achievement(+) or Underachievement (-)
Food grains	Million tons	61.6	65.8	+4
Oilseeds	Lakh Tons	55	56	+1
Sugarcane	Lakh Tons	63	60	-3
Cotton	Lakh Tons	42	40	-2
Jute	Lakh Tons	54	46	-12

• **Second Five year Plan (1956-61) :** In money terms, however, the outlay in the Second Plan was higher. It was Rs. 1050 crores as compared to only Rs. 758 crores in the First Plan. The targets originally fixed for the Second Plan which were much lower were revised upward and they were given as in the following table. These targets were to be achieved by the same measures as those in the First Plan. The actual progress in agricultural front was quite substantial but fell far short of targets fixed earlier, e.g. against 21 mn. acres of additional land to be brought under irrigation, the actual achievement was about 16 mn. acres only. The poor development of agriculture during Second Plan led to a good number of difficulties in the Indian economy. The most important effect was the rise in the price level. During this Plan, the wholesale price index of all commodities increased by 35%.

Table No. 02: Targets and Achievements of the various agricultural products

Crop.	Unit	Target	Actual Production	Over-Achievement(+) or Underachievement (-)
Food grains	Million tons	80.5	78.7	-1.8
Oilseeds	Million tons	7.6	6.5	-1.1
Sugarcane	Million tons	7.8	10.4	+2.6
Cotton	Million bales	6.5	6.5	-1.0
Jute	Million bales	5.5	4.0	-1.5
Tea	Million lbs.	700	725	+25

• **Third Five year Plan (1961-66):** Third 5 year Plan gave a Predominant emphasis to agriculture. One of the major objectives of the Plan was to achieve self-sufficiency in food grains and to increase agricultural production for exports. Agricultural production has therefore, to be increased to the largest extent feasible, and adequate resource have to be provided under the Third Plan for raising the agricultural production. With this end in view, the Plan allocated almost 10% of the total public sector outlay of the Plan i.e., Rs. 1310 crores out of Rs. 6300 crores. Actual expenditure worked out to be Rs. 1754 crores.

The targets and actual production of the major agricultural crops were as follows:

Crop.	Unit	Target	Actual Production	Over-Achievement(+) or Underachievement (-)
Food grains	Million tons	100	72.3	-27.3
Oilseeds	Million tons	9.8	6.1	-3.7
Sugarcane	Million tons	10.0	11.8	+1.8
Cotton	Million bales	7.0	4.7	-2.3
Jute	Million bales	6.2	4.5	-1.7

• **Forth Five year Plan (1969-74) :**

The Fourth Plan had the following two main objectives in the agricultural sector:

(i) To provide the conditions necessary for a sustained increase of about 5 per cent per annum over the next decade.

(ii) To enable as large a sector of the rural population as possible, including the small farmer, the farmer in dry areas and agricultural labourers to participate in development and share its benefits.

(iii) The strategy of agricultural development was based largely on the further expansion of the high yielding varieties (HYV)

and multiple cropping programmes.

(iv) The Fourth Plan envisaged an expenditure of Rs. 3814 crores on Agriculture which was 24% of the total expenditure of Rs 15902 crores. But the actual outlay was less.

• **Fifth Five year Plan (1974-79):** During the Fifth Plan, Rs. 7,411. crores will be spent on the development of agriculture and irrigation which accounts for 20% of the total Plan outlay. Beside this, investments by the private sector shall be of the order of Rs. 2,950 crores.

Taking public and private, sectors, together, total outlay on agriculture, will be of the order of Rs. 10,361 crores. With this level of outlay, the Fifth Plan has targeted a growth rate of 4.2% for food-grains as a whole. This is distinctly, less ambitions as than the target set out in the Fourth Plan.

• **Sixth Five year Plan (1980-85):** The Sixth Five Year Plan (1980-85) was started in an extremely different circumstances as the year of 1979-80 witnessed a worse drought. It affected agricultural production adversely. However, the achievements of the plan were satisfactory.

Table: Agricultural Production

Crop.	Unit	Target	Actual Production	Progress
Food grains	Million tons	127.86	153.60	150.5
Oilseeds	Million tons	10.20	13.00	11.4
Sugarcane	Million tons	175.80	215.00	175.1
Cotton	Million bales	7.34	9.20	75.
Jute	Million bales	7.54	9.08	6.2

• **Seventh Five year Plan (1985-90):** The outlay for agriculture and allied sector including forestry and wild life was Rs. 10524 crore in Seventh Plan against Rs.6440 crores in Sixth Five Year Plan Period. The average level of annual production of food grains during the plan period was around 155 millions tonnes. In 1990-91 food grain production reached to the level of 176-92 million tonnes against the production of 140.35 million tonnes in 1987-88.

• **Eighth Five year Plan (1992-97):** Eighth Plan envisages to spend Rs. 22,467 crore

on agricultural development. For rural development a total sum of Rs. 34,425 crore has been fixed whereas Rs. 6,750 crore on special area programme and Rs. 35,525 crore on irrigation and flood control have been proposed in the draft of the plan.

• **Ninth Five year Plan (1997-2002):** Ninth Five Year Plan was developed in the context of four important dimensions: (i) Quality of life, (ii) generation of productive employment, (iii) regional balance and (iv) self-reliance. Target growth was 6.5% but 5.35% actual growth achieved. It was formulated from 1997-2002 with the prime objectives like drastic industrialization human development, poverty eradication, self-reliance in economy, increase employment, to provide basic infrastructure of life like education for all, safe drinking water, provide primary health care, food security, women empowerment etc. During 1999-2000 the IRDP, TRYSEM, DWCRA, SITRA, MWS were merged to form a new self-employment program called rename as Swarna Jayantri Gram Swarajgar Yojana (SJGSY) with effect from 1st April, 1999.

• **Tenth Five year Plan (2002-2007):** Although the draft Tenth Plan had set a target to attain annual average growth rate of 3.97 per cent in Agriculture and allied sector, but during the Tenth Plan it has attained (-) 7.2 per cent in 2002-03 and then to 10 per cent in 2003-04 and 6.0 per cent in 2005-06 and is expected to attain only 2.7 per cent in 2006-07. Total production of food grains increased from 179.4 million tonnes in 2002-03 to 212.4 million tonnes in 2003-04 and then to 208.3 (P) million tonnes in 2006-07. The index of agricultural production in 1981-82 = 100) increased from 150.4 in 2002-03 to 181.0 in 2003-04 and then to 197.1 in 2006-07. Thus the agriculture and allied sector has been showing a mixed performance.

• **Eleventh Five year Plan (2007-12):**

Analysis of broad sectoral growth rates for the 11th Plan period reveal mixed trends. As



outlined above, the Agriculture sector, which on the average accounts for about 12% of the overall GSDP, managed a relatively better performance during the 11th Plan period (average growth of 5.28%) as compared to the 10th Plan (3.98%). Interestingly, agriculture sector, which continues to provide employment and livelihood to a large population despite its shrinking share in the economy, remained a growth pointer. This is evident from the fact that during the 11th Plan period, whenever the agriculture sector fared well, the economy as a whole put up an encouraging performance. The food grain production which accounts for nearly 35% of the agricultural GSDP, continues to remain vulnerable to the vagaries of monsoon. Several Forestry programmes to protect and develop existing forest area and bring back tree cover to desired levels are being implemented. More than 5 lakh hectares of degraded forest is being protected, developed and managed by Vana Samrakshna Samithis in the State. The Forestry & Logging sub-sector which on average contributes 5.57% of the Agri-GSDP and 1.2% of the overall GSDP has grown at 1.9% during the 11th Plan period. Overall during the 11th Plan period, the Agriculture sector on average contributed 21.27% of the GSDP and grew at 5.28%.

• **Twelfth Five year Plan (2012-17):**

Twelfth Five Year plan is devoted to agricultural and rural development and committed to all round development of the country. The following seven major flagship programmes are operating in rural areas. MGNREGA, NFRLM, IAY, NRDWP, TSP, IWDP, PMGSY, RGGVY (GOI, 2012). Besides these, the Government of India launched the other programmes for uplift of the poor classes like village self-sufficiency scheme, Member of Legislative Assembly Constituency Development Scheme, Integrated Sanitary Complex for Women, Clean Village Campaign and Rural Sanitation, Capital programme of Infrastructure

Development by rural local Bodies, Construction of village Administrative Officers Office Buildings, Rejuvenation of water Bodies and Rain Water Harvesting in Rural Areas etc.

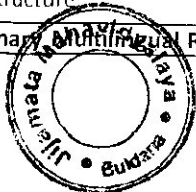
Conclusion:

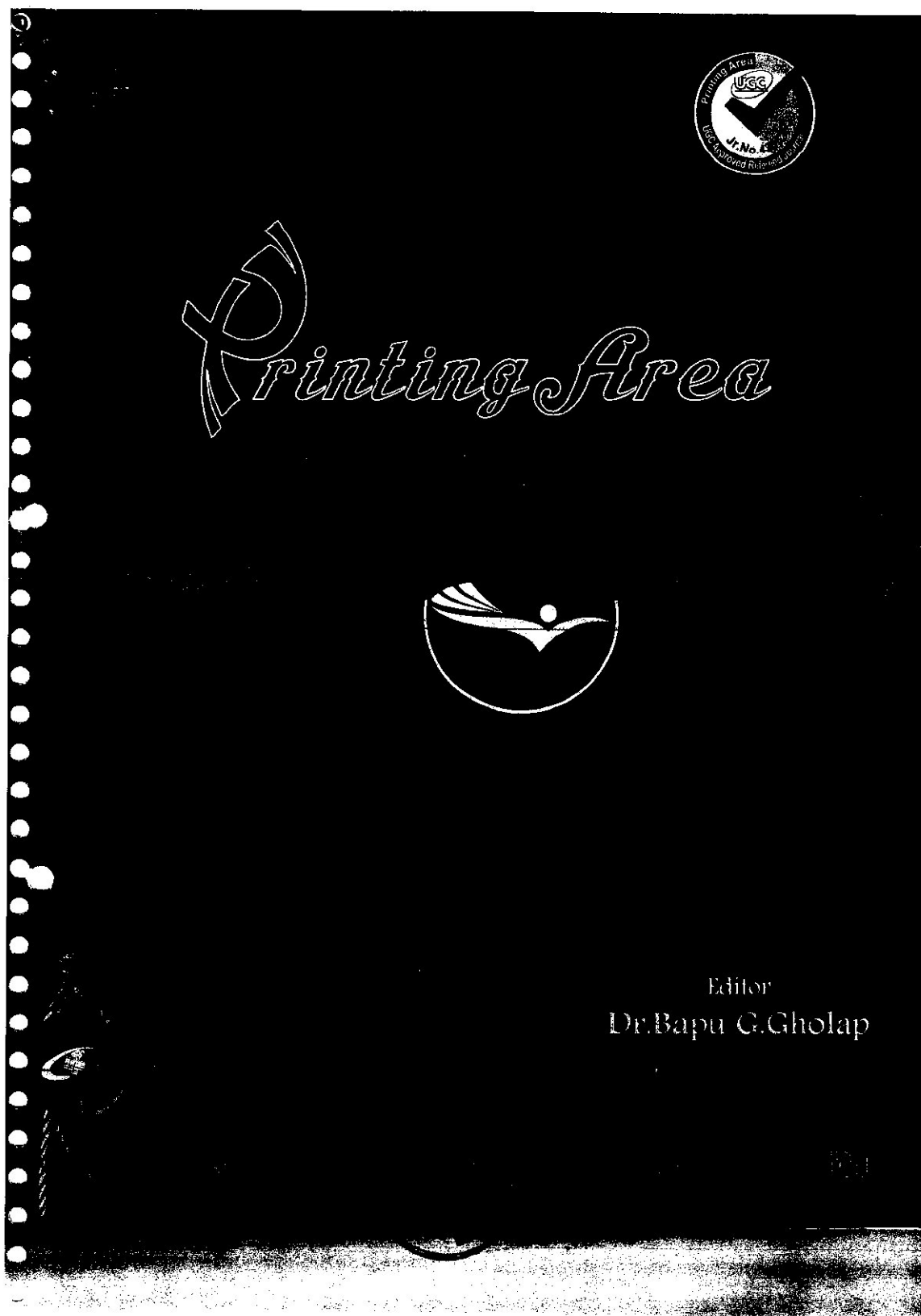
Agriculture is an integral part of the rural life and agricultural and rural development programmes should be devised in order to meet the needs of the rural community. Efforts should be made during next planning five year plan to bring science and technology closer to the farmers in order to utilize the limited available resources efficiently to increase the productivity of the land. The other important aspects like supply of agricultural inputs, farm machinery, irrigation facilities, cropping pattern, agricultural processing and general aspects like health, housing facilities, sanitation, welfare programmes for people should be given due importance.

Agricultural and rural development is a continuous process for which Ministry of Agriculture and Ministry of Rural Development both are primarily responsible for planning, implementation and monitoring of various centrally sponsored programmes and schemes designed by the planning commission of India for rural poverty alleviation.

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कृषी क्षेत्र — शेतकरी हित

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भारत हा देश कृषीप्रधान देश म्हणून देशाची ख्याती जगभरात प्रसिध्द झालेली आहे. भारतातील ७०: जनता ही ग्रामीण भागामध्ये राहते व कृषी व्यवसायावरच आपला उदरनिर्वाह करीत आहे. भारत स्वातंत्र्य झाल्यानंतर सन १९५१ पासून भारत सरकारने विकासाच्या दृष्टीकोनातून पंचवार्षिक योजनांचा अवलंब केलेला आहे या पंचवार्षिक योजनांमध्ये कृष क्षेत्राला सुध्दा प्राधान्य देण्यात आलेले आहे. भारत स्वातंत्र्य झाल्यानंतर भारत सरकार समोर कृष क्षेत्राबाबत अनेक समस्या अडचणी समोर होत्या भारतातील जवळ-जवळ ८५: शेती ही पावसाच्या पाण्यावरच अवलंबून असल्याने भारतात सरासरी दर तीन वर्षांनंतर एकदाच जोरदार पाऊस येत असल्याने कृषी विषयक भोरणे ठरवितांना शासनासमोर अनेक अडचणी येतात दिसून यातून गेल्या दशकात पावसाचे नियोजन कोलमडल्यामुळे कृषी विषयक भोरणात बरेच बदल शासनाकडून केले गेले आहे.

महाराष्ट्र राज्याच्या विकासामध्ये कृषी क्षेत्राचे मोलाचे योगदान आहे सुमारे ५०:पेक्षा जास्त लोकसंख्या कृषी क्षेत्राशी निगडीत आहे. महाराष्ट्रातील एकूण ३०८ लाख हेक्टर भौगोलिक क्षेत्रापैकी सुमारे सुमारे २२५.५७ हेक्टर क्षेत्र पिकाखाली आहे. जमीन व हवामानाची महाराष्ट्र राज्यातील वेगवेगळ्या विभागात मोठ्या प्रमाणात असमानता दिसून येते. महाराष्ट्रातील एक तृतीयांश क्षेत्र हे अवर्षणग्रस्त क्षेत्राखाली आहे. पिकाखालील क्षेत्रापैकी १७.५०: क्षेत्र बागाईत आहे. पिकाखालील क्षेत्रापैकी १४९.४२ लाख हेक्टर क्षेत्र खरीप हंगाम पिकाखाली तर रब्बी पिकांची लागवड ५४.७५ लाख

हेक्टर क्षेत्रावर केली जाते. उन्हाळी पिकांची लागवड राज्यात १.६७ लाख हेक्टर क्षेत्रावर केली जाते.

कृषी क्षेत्राच्या विकासासाठी व शेतकरी हितासाठी शासनाने विविध योजना व सवलती दिल्या आहेत त्या पुढील प्रमाणे :-

(१) पंतप्रधान पिक विमा योजना :-

खरीप हंगाम २०१६ पासून पंतप्रधान पिक विमा योजना लागू करण्यात आली. महाराष्ट्र राज्यातील सर्व कर्जदार शेतकऱ्यांना पंतप्रधान पिक विमा योजना बंधनकारक करण्यात आली आहे. बिगर कर्जदार शेतकऱ्यांना ही योजना ऐच्छिक ठेवण्यात आली आहे. शेतकऱ्यांनी विमा काढल्यानंतर शेतकऱ्यांना विमा हप्ता दर हा खरीप हंगामासाठी २:तर रब्बी हंगामासाठी १.५:तसेच नगदी पिकासाठी ५:इतका मर्यादित ठेवण्यात आलेली आहे फलोत्पादन पिकासाठी हा दर ५:इतका हप्ता ठेवण्यात आला. नैसर्गिक आपत्तीमुळे शेतकऱ्यांना नुकसान झाल्यास या योजनेनुसार विमा दाण्यांची संपूर्ण रक्कम देण्यात येते नैसर्गिक आपत्ती, किड आणि रोगांमुळे पिकांचे नुकसान झाल्यास शेतकऱ्यांना विमा संरक्षण देण्यात येते पंतप्रधान पिक विमा योजनेमध्ये पुढील पिकांना समावेश करण्यात आलेला आहे.

अन्नधान्य :- गहु, बाजरी, ज्वारी, तुर, मूंग, उडीद, हरभरा, नाचणी, भात.

नगदी पिके :- कापूस, कांदा,

गळीत धान्य :- तीळ, सोयाबिन, सुर्यफुल, करडई, भुईमुग.

(२) गोपीनाथ मुंडे शेतकरी अपघात विमा योजना

अपघातामुळे शेतकऱ्यांना अपंगत्व अथवा मृत्यू आल्यास अपघातग्रस्त शेतकऱ्यास अथवा त्याच्या कुटुंबास मदतीचा हात देण्यासाठी गोपीनाथ मुंडे शेतकरी अपघात विमा या योजनेतर्गत अपघातग्रस्त शेतकऱ्यांना दोन लाख रूपय विमा संरक्षण देण्यात येते. या विमा योजनेचा लाभ घेण्यासाठी शेतकऱ्याच्या वतीने कुठल्याही संस्थेने विमा कंपनीकडे विमा हप्त्याची रक्कम भरण्याची आवश्यकता नाही. तसेच विमा योजना लागू केली असल्यास या योजनेशी त्याचा काहीही



पार विस्कळित झाले होते. या आक्रमणांमुळे भारतीय संस्कृतीवर, कला, भाषा आणि विचार यावर खूप प्रभाव झाला होता. यातून संगीत देखिल सुटले नाही. सुरुवातीचा भारतीय संगीतातील आध्यात्मिक भाव नष्ट होवून त्यात मनोरंजन व श्रृंगारिकता जास्त प्रमाणात दिसू लागली. अनेक गीत प्रकारांचा समावेश झाला. संगीत हे केवळ राजा-महाराजा यांच्या पुरतेच मर्यादित राहू लागले. केवळ राजांच्या मनोरंजनासाठी ही कला सादर होवू लागली. एकमात्र उद्देश मनोरंजन होता. त्यामुळे सहाजिकच स्त्रियांचा संगीताकडे पाहण्याचा दृष्टीकोन बदलला जावू लागला. उच्च घरातील स्त्रीया संगीत शिकवण्यासाठी तयार होत नसत. परंतु अशा परिस्थितीतही अनेक स्त्रियांनी आपले बहुमोल योगदान भारतीय संगीतास दिले आहे.

सा) तानीबाई घोरपडे :

यांना आधुनिक काळातील पहिली गायिका मानले जाते. हया राज घराण्याशी संबंधित होत्या तरीही त्या परिस्थितीत त्यांनी संगीत कला अवगत केली. त्यांना उ. उल्लादियाँ खाँ साहेब यांच्याकडून जयपूर घराण्याची तालीम प्राप्त झाली होती. त्यांचे गायन अत्यंत प्रेरणादायी होते. तानीबाई यांनी स्त्रियांसाठी संगीताचे शिक्षणाचे दालन खुले करून दिले.

रे) बाबलीबाई साळगावकर :

यांनी नथ्यन खाँ यांच्याकडून आपण घराण्याची तालीम घेतली होती. मोगूबाई कुडीकर यांच्या आईने त्यांना बाबलीबाई साळगावकर यांचा आदर्श घ्यायला सांगितले होते. बाबलीबाईंचे गायनातील कर्तृत्व पाहून अनेक गोमंतकिय कलाकार आश्चर्य चकित होत असत.

ग) जोहराबाई आप्तेवाली :

हया आप्ता घराण्याच्या आदरभावपूर्ण असे व्यक्तिमत्व होते. त्या काळात जोहराबाईंचे अनेक जलसे होत असत. त्यांच्या अनेक ध्वनिमुद्रिका ही प्रसिद्ध होत्या त्यात मारवा, गौडसारंग, सोहनी, तोडी, जोगिया, जोनपूरी, भैरवी इ. रागांचा उल्लेख आढळतो.

म) अंजनीबाई मालपेकर :

हया एक सौंदर्यवान, बुद्धिकन गायिका होत्या. अंजनीबाई यांनी गायिकांना सन्मान मिळवून दिला. त्या काळात कलाकार उभे राहून गायक पेश करत असत तर अंजनीबाईंनी ती पद्धतच नष्ट केली. त्यांच्या शिष्यांमध्ये पं.कुमार गंधर्व, लता मंगेशकर, किशोरी अमीणकर आदींचा समावेश आहे.

प) वि. केसरबाई केरकर :

केसरबाईंनी उ.अल्लादियाँ खाँ साहेब यांच्याकडून जयपूर घराण्याची तालीम घेतली होती. त्यांचा आवाज पहाडी. खुला व भारदस्त होता. केसरबाईंना सुरश्री पदवी प्राप्त झाली होती. प्रमुखाचार्य हा भारत सरकारचा पुरस्कार प्राप्त झाला. त्यांना महाराष्ट्र शासनाचा राज्य गायिका हा पुरस्कार प्राप्त झाला होता. त्याच प्रमाणे पद्मभूषण आणि शारंगदेव फेलोशिप प्राप्त झाली होती.

ध) वि. मोगूबाई कुडीकर :

विलायत हुसेन खाँ हैदर खाँ आणि अल्लादियाँ या गुरूंकडून त्यांनी जयपूर घराण्याची तालीम प्राप्त केलेली होती त्यांचा आवाज अत्यंत गोड होता. त्यांनी घराण्याच्या आदर्श घेवून आपली गायकी विकसित केली होती. मोगूबाईंनी वि. किशोरीताई अमीणकर यांच्या सारखा संगीतरत्न भारतीय संगीताला दिला.

नी) रोशन आरा बेगम :

उ.अब्दुल करीम खाँ यांच्याकडून शिक्षा प्राप्त केली होती बेगम साहेबांचा आवाज अत्यंत सुटेल होता. त्या किराणा घराण्याची एक वेगळी ओळख होत्या.त्यांच्या गायकीत मदिनापन आणि जोश होता. त्यांच्यावर उ.बडे गुलाम अली खाँ यांच्या गायकीचा प्रभाव होता.

या सर्व गायिकांबरोबरच भारतीय संगीताला हिरबाई पेडणेकर, सिद्धेश्वरी देवी, हिराबाई बडोदेकर, सरस्वती राणे, गंगूबाई हनगल, लक्ष्मीबाई जाधव इ. गायिकांचे योगदान प्राप्त आहे.

□ □ □



सबध असणार नाही. या योजनेचा लाभ स्वतंत्र राहील. या योजने मार्फत सन २०१६ - २०१७ या वर्षात २७६ प्रस्ताव आलेली आहेत. त्यापैकी ३५ प्रस्ताव मंजुरात झालेले आहेत.

(३) शेतमालाचा दर्जा व भाव :-

शेतकऱ्यांना पिकविलेल्या मालाला योग्य भाव देण्यासाठी व शेतकऱ्यांना दुष्काळाच्या चक्रातून बाहेर काढण्याकरिता शासनाकडून प्रयत्न करण्यात आलेले आहेत. शेतमाला विक्री व्यवस्थेत स्पर्धा निर्माण करण्यासाठी शेत पणन व खाजगी बाजाराला चालना देण्यात येत आहे. राज्यात ग्री मार्केट उभारणे, आठवडी बाजार अभियानाची व्याप्ती वाढविणे, शेतमालाची वाहतुक योग्य व्हावी यासाठी कोल्ड स्ट्रॉन योजना शासनाकडून प्रस्तावित करण्यात आलेली आहे.

(४) हवामान माहितीचा प्रसार :-

शेतकऱ्यांनी शेतीमध्ये मशागतीची पेरणीची कामे योग्य वेळी करण्यासाठी योग्य हवामानाची माहिती असणे आवश्यक असते. अवकाळी पाऊस किंवा पावसाचा विश्राम अशा घटनांमुळे शेतकऱ्यांचे फार मोठे नुकसान होते अशा प्रकारचे नुकसान टाळण्यासाठी शासनाकडून हवामानाचा अंदाज आणि कृषी संदेश प्रसारण रेडीओ, दूरदर्शन, ईलेक्ट्रॉनिक आणि प्रिंट माध्यम इत्यादींद्वारे केले जाते. महाराष्ट्रात जवळ-जवळ ७० लाख शेतकऱ्यांना विविध यंत्रणांद्वारे हवामानावर आधारित कृषी संदेश पाठवले जातात.

भारत देश हा कृषी लागवड क्षेत्रात जगात पहिल्या क्रमांकाचा देश आहे देशातील कृषी व्यवस्था सुधारण शेतकऱ्यांना आर्थिक विकास होऊन सर्व शेतकरी वर्ग सदन होऊन कृषी क्षेत्राकडे वाटचाल होताना दिसून येत आहे. पारंपारिक कृषी क्षेत्राला व कार्याला फाटा देत शेतकऱ्यांनी आधुनिक कृषी घटकांना पसंती देण्यास सुरुवात केली आहे व याकरिता राज्य शासनाचे विविध उपक्रम, योजना व सवलती सुध्दा त्यासाठी संजीवनी ठरत आहेत. आज माहिती तंत्रज्ञानाचे जाळे सर्व ग्रामीण भागापर्यंत पोहचलेले आहेत. शेतकरी माहिती तंत्रज्ञानाद्वारे स्मार्ट होण्यासाठी शेतकऱ्यांनी

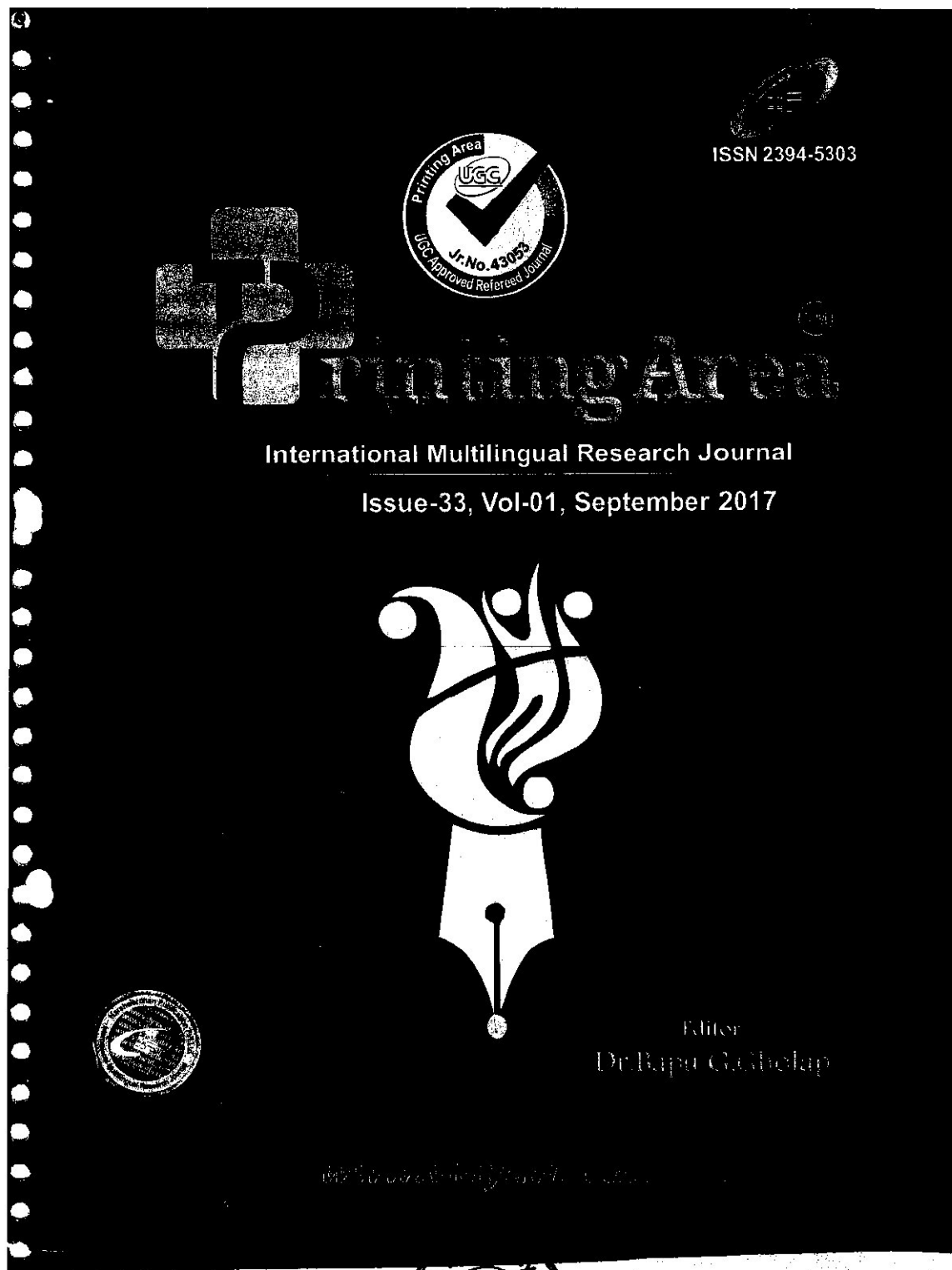
अ. क्र.	मोबाईल ॲपचे नाव	ॲपद्वारे उपलब्ध माहिती	ॲप डाऊनलोड सुविधा
१	शेतकरी प्रतिक	शेतीविषयक लेख, मंडळ, तालुका, जिल्हा, विभागात आज पर्यंतचा सर्वसाधारण पाऊस	गूगल प्ले स्टोअर, महाराष्ट्र
३	काप मित्र	शेतीविषयक कापस मात कृषी व हसनरा अशा विषयक किड व रोग व त्याच्या उपचारयोजना	Mahaagriac.gov.in
४	कृषी मित्र	तासल्यातील खोबियाणे औषधी किड्या व यादी	Mahaagriac.gov.in
५	एम किसान भास	कृषी हवाला विषयक शेतीसाठी उपयुक्त तत्वे	एम किसान पोर्टल
६	काप इ-कृषक	पिक विभागीय	गूगल प्ले स्टोअर
७	डिजिटल पड्डे भास	राज्यभर विविध राज्य वारीय बाजारपेठांची वेळापत्रके	गूगल प्ले स्टोअर
८	पड्डे पोषण	जनावरांचे अहारविषयक तत्वे	गूगल प्ले स्टोअर
९	कपास	कपास लागवड मार्गदर्शन	गूगल प्ले स्टोअर
१०	पिक पोषण	पिक अन्नद्रव्य विषयक माहिती	गूगल प्ले स्टोअर

ऑनलाईन आपल्या मालाचे भाव पाहण्यासाठी, हवामानाचा अंदाज घेण्यासाठी, कृषी विषयक सल्ला घेण्यासाठी विविध ॲप तयार करण्यात आले आहेत. शेती संदर्भातील माहिती देणाऱ्या अशा मोबाईल ॲपची माहिती पुढील प्रमाणे

संदर्भ ग्रंथ सुची :-

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EFFECTS AND IMPACT OF GST ON INDIAN ECONOMY

Dr. D. J. Kande

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Buldhana, (Maharashtra)

INTRODUCTION:

India's historic approval of GST marked a benchmark in the development of the economy of the country but impact of GST on Indian economy may disrupt the economy for a short-term. Till now, an introduction of VAT (Value Added Tax) at the state level and CENVAT at central level are considered to be largest Indirect Tax reforms in the country and GST is the next logical step towards making India a unified market. The GST is arguably one of India's most significant and ambitious reforms ever attempted. Hence, the impact of GST on Indian economy is going to be very significant. However, determine the exact economic effect hinges on the GST Rates. Now we will discuss in details in detail about the impact of GST on Indian Economy.

Meaning of GST:

It is a combined indirect tax levied on sale, consumption of goods and services throughout India. GST will not affect export tax and direct taxes like income tax, corporate tax, and capital gain tax. Taxes are divided between centre and states by the constitution. This has been one of the most important agendas of Narendra Modi's government which can affect us all the Rajya Sabha cleared the constitutional amendment in 2016 and would be implemented of 1st July 2017. GST is governed by GST council and the chairman of GST council is union Finance Minister of India- Arun Jaitley.

Positive Effects of GST in India or Benefit of GST :

- 1) The death of all taxes : with the unified tax regime we said good bye to a big pile of indirect taxes making India one Nation one Market one tax Country. Now, businesses don't need to worry about the plethora of taxes.
- 2) GDP Growth : With exemption benefits on some goods and services it will increase productions, lessen the prices and equivalently increase the demand helping GDP growth. More imports and exports will flow generating decent revenue, but according to experts, it will take two years for the economy to be stable.
- 3) Market Competition : Due to reduced cost in FMCG (Fast Moving Consumer goods sector) products like biscuits, tooth past may become cheaper and will be manufactured in high Volumes Creating Competition in the domestic and international market.
- 4) Price reduction as credit of input tax is available against output tax.
- 5) Simplified and cost saving system as procedural cost reduces due to uniform accounting for all types of taxes. Only three accounts : CGST, SGST, IGST have to be maintained. GST is structured to simplify the current indirect system. It is a long term strategy leading to a higher output. More employment opportunities. And economic boom.
- 6) GST is beneficial for both economy and corporations. The reduced tax burden on companies will reduce production cost making exporters more competitive.
- 7) GST will be levied only at the final destination of consumption based on VAT principle and not at various points (from manufacturing to retail outlets) this will help in removing economic distortions and bring about development of a common national market.
- 8) No filing of Income tax returns without Aadhaar : The government has made it compulsory to mention Aadhaar for the filing of income tax return. Without Aadhaar you won't

be able to file your return after July 1. Linking of Aadhaar with PAN becomes mandatory. The government has also made it compulsory to link Aadhaar with PAN to stop people using multiple PANs to evade taxes. If a person does not link PAN and Aadhaar as mandated by section 139 AA of the Income tax Act, his PAN could become invalid. To link Aadhaar to PAN card go to Income tax India filling.

9) It will also help to build a **transparent and corruption-free** tax administration. Presently, a tax is levied on when a finished product moves out from a factory, which is paid by the manufacturer, and it is again levied at the retail outlet when sold. It can bring more transparency and better compliance. Number of departments will reduce which in turn may lead to less corruption.

10) The **tax structure** will be made lean & simple **Benefit the Centre and the States**

- Government of India will gain \$15 billion a year contributing to rise of GDP between 0.9% and 1.5% as this measure will promote more exports and boost employment. This is because; it will promote more exports, create more employment opportunities and boost growth.
- It will divide the burden of tax between manufacturing and services.
- Besides, a simple tax system is very welcoming for all foreign investors looking to set up factories in India.

Impact of GST on Indian Economy :

1) Impact of GST on Agricultural Sector :

GST is essential to improve the transparency, reliability, timeline of supply chain mechanism. A better supply chain mechanism would ensure a reduction in wastage and cost for the farmers/retailers. GST would also help in reducing the cost of heavy machinery required for producing agricultural commodities. Under the model GST law, dairy farming, poultry farming, and stock breeding are kept out of the definition of agriculture. Therefore these will be taxable under the GST.

Fertilizers an important element of agriculture was previously taxed at 6% (1% Excise + 5% VAT). In the GST regime, the tax on fertilizers has been increased to 12%. The same impact is on Tractors. Wavier on the manufacture of Tractors is removed and GST of 12% has been imposed. This is beneficial as now the manufacturers will be able to claim Input Tax Credit

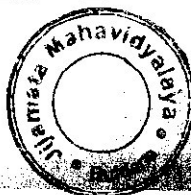
India's milk production in 2015-16 was 160.35 million ton, increased from 146.31mt in 2014-15. Currently, only 2% VAT is charged on milk and certain milk products but under GST the rate of fresh milk is NIL and skimmed milk is kept under 5% bracket and condensed milk is going to be taxed at the rate of 18%. Tea is probably one of the most crucial items in an Indian household. The price of tea might also increase due to the tax rate of 5% under GST rate from the current average VAT rate of 4-5% with Assam and West Bengal with the exception of 0.5 & 1%

Conclusion: An increase in the cost of few agricultural products is anticipated due to the rise in inflation index for a brief period. Though, implementation of GST is going to benefit a lot, the farmers/distributors in the long run as there will a single unified national agriculture market. GST would ensure that farmers in India who contribute the most to GDP, will be able to sell their produce for the best available price.

2) GST impact on under contraction properties – Real Estate Redefined:

Goods and Services Tax or GST is a combination of all kinds of indirect taxes Under on comprehensive tax. There are four different tax slabs in GST-5%, 12%, 18% and 28%. Majority of daily consumable items have been kept under 5% tax slab while the luxury items will attract 28% GST. Everything in between will be taxed at either 12% or 18%. Now, before we get into the effect of GST, let us understand how real estate is taxed in the current tax regime.

Real estate sector is the most pivotal sector of Indian economy. Its importance can be



understood with its average 5-6% GDP contribution. The Goods and Services Tax (GST) Council has defined the work contracts under 12 percent slab, whereas the ready to move in properties still remain out of the new tax system. GST would bring transparency in the real estate sector and would minimize unscrupulous transactions. GST for the sale of buildings and land has not yet been fixed but is to be done within a period of 1 year. The rates declared for cement, bricks and iron under GST would benefit the real estate taxation.

Cement will be taxed at the rate of 28% under GST. It is higher than the current average rate of tax by 23-24%, but a lot of additional taxes charged over the average rate would be subsumed under GST. Iron rods and pillars used in the construction of buildings are charged at the rate of 18% which is similar to the current average rate of 19.5%. Bricks used in the construction of buildings and houses are taxed under GST at the rate of 28% except for the rate of ceramic building bricks which is kept under 5%. Currently, all kinds of bricks except the ceramic ones are charged an average tax rate of 25-26% including all the state as well as central level taxes. Also, the logistics cost of construction materials will experience a reduction through subsuming of taxes. Despite higher rates, the sector is likely to benefit from the availability of input tax credit. As under the current tax regime, the benefit of input tax paid is not fully available under the GST regime would result in an over all neutral tax incidence for construction services.

Raw Materials	Current Tax Rate	GST Rate
Cement	23.00%	28.00%
Steel	19.5%	18.00%
Iron rods & pillars	19.5%	18.00%
Ceramic Bricks	5.00%	5.00%
Non-Ceramic Bricks	25.26%	28.00%

Under GST, majority of construction contracts

fall under work contracts. The service tax applicable to construction companies is generally 6 percent assuming 40 percent service portion of the contract. Although many activities like construction of roads, dams, and irrigation are exempted from service tax.

2) Impact on GST on Life Insurance & Health Insurance

a) **Life Insurance:** There are 3 types of life insurance:

- Term insurance plans- basic life insurance policies
- ULIPs- insurance and investment under a single integrated plan
- Endowments (including money-back)- life insurance policies that pay a lump sum on maturity/death or a fixed sum every month (sort of like a pension)

Service tax applicable on each type is different- For example, ICICI Prudential Life Insurance applies service tax at the following rates:

Category	Service Tax With SBC & KKC	After GST
Term insurance premium	15%	18%
ULIP charges	15%	18%
Health insurance premium	15%	18%

All these rates will be replaced by 18% which will result in increase in premiums.

The value of supply of services in relation to life insurance business shall be:

a) The gross premium minus the amount allocated for investment, or savings on behalf of the policyholder, if such amount is informed to the policyholder. For example,

Particulars	Under Service Tax	Under GST
Gross Premium	1000	1000
Investment Portion	600	600
Life Insurance portion	400	400
Service tax @ 15% on 400	60	-----
GST @ 18% on 400	-----	72



- b) Single premium annuity policies- 10% of the premium
- c) All other cases- 25% for 1st year and 12.5% for 2nd year onwards on the premium charged.

Gross Premium p.a.	Under Service Tax
1st Year	1000
25% of value	250
GST @18% on 250	62.50
2nd year	
12.5% of value	125
GST @18% on 125	22.50

- d) If the entire premium is for life insurance, GST @18% will apply on the entire premium

Impact

Both existing and new policyholders will face an increase in the premium amounts due to increase in rates.

For insurers, the increase in taxes will be passed on to the consumers. The insurers expect higher compliance and administrative costs due to the increased number of GST returns and also effect of taxability of inter-branch services.

b) General Insurance

General insurance includes fire insurance, marine insurance, car insurance, theft insurance etc. The GST rate will also be 18% on general insurance.

Impact

For policyholders, the general insurance premium will rise as tax has increased from 15 to 18%.

Corporate policyholders, who have taken general insurance, can enjoy input tax credit on the GST paid on their policies (it was available to them even under service tax).

Life and health insurance will not have input tax credit as it is not available for life and health insurances (as they are for personal purposes). Even corporate policyholders with group life and health insurance for their employees will not enjoy any input tax credit.

Life insurance provided by Government schemes are exempted from GST:

1. Janashree Bima Yojana (JBY)

2. Aam Aadmi Bima Yojana (AABY)
3. Life micro-insurance product as approved by the Insurance Regulatory and Development Authority, having maximum cover of Rs. 50,000

4. Varishtha Pension Bima Yojana
5. Pradhan Mantri Jeevan Jyoti Bima Yojana
6. Pradhan Mantri Jan Dhan Yojana
7. Pradhan Mantri Vaya Vandana Yojana

4) Impact of GST on Banking

Banking companies will pass on the tax liability to their customers. However, their administrative and compliance work will increase tremendously. Branches give services to each others which will be taxable under GST (they can later claim input tax credit). This will increase the paperwork and therefore the operating costs.

Good news for business consumers. They can now claim input tax credit on the banking services paid on their business accounts.

Conclusion: All policyholders will have to pay higher premiums on their insurance due to increase in GST rates. An average family with life, health and car insurance will find an increase of 3% on their insurance expenses. Assuming they spend a total of Rs. 30,000 per year on insurance excluding service tax their expenses will increase by 3% i.e., Rs. 900.

5) Impact of GST on Automobile Industry Current Tax Laws on Automobiles

Table showing the different types and rate of taxes levied on the passenger

{table.....}

Presently, sales of used cars attract VAT, and in some states, a composite rate and Excise/VAT are not applicable on advance received for supply of goods. Many states provide the Original Equipment Manufacturers (OEMs)/ component makers with different investment-linked incentive schemes. The two main components of this scheme are subsidies and interest-free loans allied with VAT/CST payable on sale.



Segment	Excise	*Nccd +auto cess	VAT	*Road tax	*Motor vehicle tax	Total	CST	SGST	Total	Diffe- rence
Small Cars <1200cc	12.50%	11%	14%	State based	State based	28% (approx)	9%	9%	18%	10%
Mid-Size Cars from 1200cc to 1500cc	20%	11%	14%	State based	State based	39%	9%	9%	18%	21%
Luxury Cars >1500cc	27%	11%	14%	State based	State based	42%	14%	14%	28%	14%
SUV's >1500cc, >170mm ground clearance	30%	11%	14%	State based	State based	45%	14%	14%	28%	17%

Sale of goods/service without any form of consideration is currently exempted from being taxed under VAT and Service tax. Importers and dealers currently are ineligible for the CVD and excise duty paid by OEMs (Original Equipment Manufacturer). When goods are transferred from the factory, excise duty has to be paid but no VAT/CST is applicable under current tax laws. These vehicles are exempted from the Nccd/auto cess: electrically operated vehicles, three-wheeled vehicles, hydrogen

vehicles based on fuel cell technology, vehicles used solely as taxis, the ones used by physically handicapped persons, hospital ambulances.

Impact of GST on the Automobile Industry:

The two taxes charged to the end consumer on car and bikes currently are excise and VAT, with an average combined rate of 26.50 to 44% which is higher than the expected rates of 18 and 28% under GST. Therefore, there will be less burden of tax on the end consumer under GST. There is good news for the importers/dealers as they would be able to claim the GST paid on goods imported/sold whereas currently, they are ineligible to claim the excise duty and VAT paid. Excise paid on stock transfer will be covered by IGST under the GST law. Advance received for supply of goods will also be taxed under GST. GST would help the manufacturers in procuring auto parts at a cheaper cost due to an improved supply chain mechanism under GST. The final GST rates have been announced for the different kind of automobiles. As expected the GST on car and bikes are kept under the 28% bracket and a list of cess to be levied on a different kind of automobile has also been declared by the Indian government. Cess has been levied on different kind of automobiles ranging from 1 to 15%. We have created an infographic for an understanding of different cess rates applied on different kind of automobiles. GST will be beneficial for the people in the market for small family cars like Alto, Santro, Nano, Datsun Go as a minimum cess of 1% has been charged over and above the GST rate of 28%. Bikes which have an engine of greater than 350CC like Enfield 500CC or Harley Davidson etc would be charged GST at the rate of 28% and an additional 3% cess would be levied. It is difficult to understand the placement of yachts, aircraft, personal jets under the 3% cess bracket along with the small cars having engine >1200CC and <1500CC instead of the 15% cess.

Currently, there are a lot of free services/warranties offered by the car manufacturers due



to the competitive nature of the industry. These free goods/services are not taxed under current tax laws. Under GST, the free services/warranties would also be eligible for taxation. Conclusion : Implementation of GST would reduce the cost of manufacturing of cars and bikes due to the subsuming of different taxes levied currently. Under GST, the taxes would be charged on consumption state rather than the origin state, which would give a boost to the growth rate of the automobile industry.

6) Impact of GST on Consumers:

So, GST is finally here and so is the headache to decide a new budget for your self. From big corporate houses to small businesses and regular chaiwallahs, everyone is gearing up to get used to this new tax regime. GST is the biggest economic reform since India's Independence so it is certainly going to affect your day to day life as well. The government has tried to ensure no shocks result from its move and the changeover to the new tax regime is smooth. Here's how GST will impact your daily budget:

1. Cabs

If going to work or college has put a hole in your pocket, GST will bring slight relief to that. Under the current system, 6% tax was imposed on cab rides which will now be reduced to 5%. Even though it is a marginal difference, you may end up saving a bit by the end of the month.

2. Personal care

Ever desired to buy those fancy grooming products but decided against it since the price was too high? Well, your time has come. Tax on personal care products like soaps, hair oil, detergent, kajal, tissue paper and toothpaste has been brought down from 24-28% to 18% which certainly help you save a lot of amount.

3. Clothing

Not just grooming but getting ready for parties, college and work will also get cheaper. While silk and jute have been exempted from taxes, cotton and natural fibers will be taxed at

5%, man-made fibers at 18%, and apparel costing below Rs 1,000 at 5%. Apart from this, GST rate of 5% will be imposed on footwear below Rs 500.

4. Electronic items

Now you can depend more on electronic items in your daily life as prices of geysers, static converters (UPS) and electric transformers will be lowered. Mobile phones will also get cheaper as the tax levied on them will be reduced to 12% from 13.5%. Apple has already slashed the prices of iPhones by 7.5%. To know the latest prices

5. Automobiles

The automobile industry will get a major boost as the prices of entry-level cars are expected to drop significantly. Two-wheelers with engine capacity below 350 cc, SUVs and three-wheeler commercial vehicles will now be cheaper.

7) Impact of GST on Small businesses:

Small scale industries play a significant role in the overall growth of an economy. This industry is mainly specialized in the production of consumer commodities. SSIs generate huge employment due to the utilization of labour power for the production of goods. In a developing country like India where unemployment is a major problem; these industries pave the way for employment of skilled and non-skilled persons. The implementation of GST is certainly going to affect this sector and the employees associated with it.

Any tax-regime should ensure such an environment in which the proper growth of small scale industries may be assured. The First Discussion Paper (FDP) produced by the Empowered committee of state finance ministers and report of the thirteenth finance commission's Task Force have provided some important suggestions with respect to this sector.

Imposition of CGST & SGST as per above



said reports on turnover of goods and services are as under:

Turnover of goods	Turnover of services	Applicable taxes (according to FDP)
Below 10 lakhs	Below 10 lakhs	Both SGST and CGST are not applicable
Between 10 lakhs & 150 lakhs	Between 10 lakhs and 'Y' figure	Only SGST
Above 150 lakhs	Above 'Y' figure	Both SGST and CGST

But the Task Force is of the view that the small dealers (including service providers) and manufacturers should be exempted from the purview of both CGST and SGST if their annual aggregate turnover (excluding both CGST and SGST) of all goods and services does not exceed Rs.10 lakhs. However, those below the threshold limit may be allowed to register voluntarily to facilitate sales to other registered manufacturers / dealers, so that the cascading effect or tax may be avoided, if desired.

Further, the Task Force has suggested that to reduce administrative and compliance burden, small dealers with annual aggregate turnover of goods and services between 10 lakhs to 40 lakhs may be allowed to opt for a compounded levy of one percent, each towards CGST and SGST. However, no input credit should be allowed against the compounded levy or purchases made from exempt dealers. Although the compound levy scheme will make the day to day working easier, yet the cascading effect of tax will not be removed by the compounded levy. So the compound levy scheme should not be compulsory.

At present the small scale industries are entitled to exemptions from payment of CENVAT in respect of their turnover up to 1.5 crore. However, there is no such threshold exemption in respect of state level VAT. As per the recommendations of Department of Revenue (DOR), the threshold for goods and services

should be common between the Centre and the State, on one hand and between goods and services, on the other. Also the DOR has suggested that the annual turnover threshold could be Rs. 10 lakhs or even more than that. This threshold exemption should not apply to dealers and service providers who undertake inter-state supplies. This would not be in the favor of small dealers, as it will restrict their growth or force them to get registered. Hence a provision of threshold limit should be there to allow the small dealers to indulge in inter-state sale.

Conclusion: Based on the above discussion, we can say that the different bodies have not reached on any consensus while the DOR seems nearer to the suggestions of the task force. As SSIs absorb surplus amount of labor in the economy and helps the system in scaling down the extent of unemployment as well as poverty; every measure should be taken in the forthcoming GST to protect it.

8) Impact of GST on Gold Jewellery : will attract 3% goods and services tax (GST). Though it is higher than the current applicable taxes, including 1% excise duty and 1.5% VAT, it is below the anticipated GST of 5%. Customs duty will continue to be 10% and processing charges will be taxed at 5%. Approximate industry average processing charges are around 12% of gold price. Prior to GST, total tax and duties are nearly 12.4%. After the implementation of GST, it will marginally increase to approximately 14%. Larger players such as Titan, owner of brand 'Tanishq', would be the biggest beneficiaries as the cost gap between the organized and unorganized players will come down.

Conclusion:

Tax policies play an important role on the economy through their impact on both efficiency and equity. A good tax system should keep in view issues of income distribution and, at the same time, also Endeavour to generate tax revenues to support government expenditure



on public services and infrastructure development. Cascading tax revenues have differential impacts of firms in the economy with relatively high burden on those not getting full offsets. This results in loss of income and welfare of the affected economy. The ongoing tax reform son moving to a goods and services tax would impact the national economy, International trade, firms and the consumers. There has been a good deal of criticism as well as appraisal of the proposed Goods and Services Tax regime. It is considered to be a major improvement over the pre-existing central excise duty at the national level and the sales tax system at the state level, the new tax will be a further significant breakthrough and the next logical step towards a comprehensive indirect tax reform in the country. GST is not simply VAT plus service tax, but a major improvement over the previous system of VAT and disjointed services tax- a justified step forward. India is a federal republic, and the GST will thus be implemented concurrently by the central and state governments as the central GST and the State GST respectively and it appears that there will be different rates of taxes.

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Factors influencing learning English language writing among Jatapu tribal Secondary level students of A.P. Residential School; Salur

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English language is the most popular and sought after language all over the world. English language bridges technological advancements and main stream education. The advent of English language in India brought about many unforeseen positive changes in the history of India. Many educational commissions and policies were setup and the recommendations were implemented, and in a long run brought about many changes in the educational stream of India.

Language policies and ideologies are often the product of political manipulations and the resultant curriculum and the syllabus intended for study and the nature of teaching learning transactions are the products of these ideologies and policies (Patnaayak, 2009). Education and curriculum are designed based on needs of the students. Needs analysis is to be considered and taken into consideration before curriculum setting. Educational space thus becomes and remains the "site of monolithic/ monoglossic ideologies" (Garcias, 2009: 4, 2010) where various cultural, social, economic and political fronts are engaged in a constant struggle (Pennycook, 1994).

When taken a closer look at the educational



DISTRIBUTION OF ANTS (FORMICIDAE) DIVERSITY FROM GHATBORI FOREST REGION OF MEHKAR, BULDHANA DISTRICT (M.S.), INDIA

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ABSTRACT: - The distribution of ant's diversity in Ghatbori forest region of Mehkar, Buldhana District has been studied. Ghatbori forest is located to the south-east of Buldhana city. In this forest we are collecting and an identified different type of ant's belonging to family formicidae. This study was tried to analyze distribution of ant diversity. In Ghatbori forest ten different species of ant's were identified namely *Camponotus pennsylvanicus*, *Paratrechina longicornis*, *Tapinoma melanocephalum*, *Tapinoma sessile*, *Technomyrmex albipes*, *Crematogaster*, *Pheidole*, *Monomorium minimum*, *Monomorium pharaonis*, *Solenopsis* were observed. Out of these *Camponotus pennsylvanicus* and *Tapinoma sessile* was most abundant in study region.

KEYWORDS: formicidae, *tapinoma sessile*, Ghatbori forest, ant diversity

INTRODUCTION

The ant family contains more than 4,500 described species that can be found in a tropical and temperate area around the world. Ants are member of family of the social insects meaning that they live in organized colonies. Ants make up the family of Formicidae of the order Hymenoptera. Most of the described and unknown species are found in the forest, however, due to the distribution of those forest most of them will probably never be categorized. Ants are found on all continents except Antarctica, and only a few large islands. (Jones and Alice S. 2008; Thomas and Philip 2007).

According to Shabina A. Nagariya and Santosh S. Pawar 2012 three species of ant was dominant and abundantly found. Most ant build some sort of nest under and above the ground, in trees and houses where they live and bring their food to, but are generally omnivorous, but some need special food. Myrmecology (Prons; m3rmi, from Greek; myrmex: ant and >logos, study) is the scientific study of ants, branch of entomology. Some early myrmecologist considered ant society as the ideal forms of sociality and shout to find solution to human problems by standing them.

MATERIALS AND METHODS :

Study area

The Ghatbori forest is situated about 65Km south-east of Buldhana city at a latitude of 20°-15'-05". The Mun dam lies on 76°-56'-76". Longitude and covers an area of the forest is fulfilling with diversity of different insects, animals and plant species. Ghatbori forest faces extreme variation in climatic condition with very hot summer and very cold winter as well as average rainfall. The annual average rainfall in the forest ranges between 800mm to 850mm and temperature ranges between 18°C to 45°C.

Collection of ants of family formicidae:-

Various methods of collection of ants are as per different studies. The type of vegetation determines the kind of ants, (Formicidae) were collected from the different locations of forest. The capture and collected ant species kept into dry container or directly transfer into absolute alcohol. Methods suggested by Koh (1989) namely refer for the collection and preservation of ants.

Identification of ants: - Ants (Formicidae) collected from the Ghatbori forest region was identified by using identification key (Mathews R. N. and Tiwari 2000; Bolten B, 1994; and Krebs C.J. 1999)

RESULT AND DISCUSSION

Ants are social insect of the family Formicidae. The family Formicidae belongs to the order Hymenoptera, which also include sawflies, bees and wasps. Fossil evidence indicates that ants were present in the late Jurassic, 150 millions year ago. Ants are distinct in their morphology from their insects in having elbowed antennae, metapleural glands. Ant societies have division of labour communication between individual and an ability to solve complex problems. Ant bodies, like other insects, have an exoskeleton, and external covering that provides a protective casing around the body and a place to attached muscles.



Identified Species:-

1. Camponotus pennsylvanicus:-



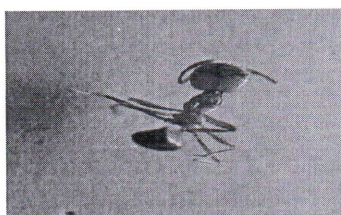
Vertex of head is indented, non with a deep groove. Antenna is 10 segmented. Two Numbers of teeth present on the front of head. Eyes are large and black in colour. Spines are absent on the thorax and thorax is smooth and evenly rounded when viewed from the side. One node is present. Abdomen is divided in to four segments. Small spiny hairs present on the abdomen.

2. Paratrechina longicornis:-



Vertex of head is with deep groove head pattern with foveolet punctures. Mandible is with distinct teeth and triangular shape. Two numbers of teeth present on the head. Eyes are large and black in colour. Ten segmented antenna are present. Spines are absent on the thorax. Thorax is uneven when viewed from the side. One node is present. No circle of hairs at the tip of the abdomen. Small spiny hairs are present on the abdomen and it divided into five segments.

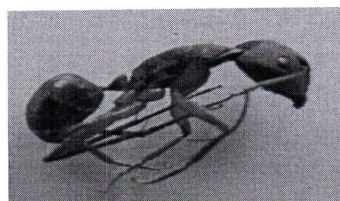
3. Tapinoma melanocephalum:-



Vertex of head indented, non with a deep groove. Head pattern is without foveolet punctures. Mandible are triangular and with distinct teeth. Two teeth present on

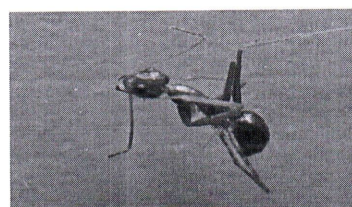
head. Eye is large in size and reddish to orange brown in colour. Ten segmented antennae are present on the head with two segmented club. Spines are absent on the thorax. Thorax is uneven when viewed from the side. One node is present. Abdomen divided into four segments. Small spiny hairs present on the abdomen. No circle of hairs at the tip of the abdomen. Stinger are absent on the abdomen.

4. Tapinoma sessile:-

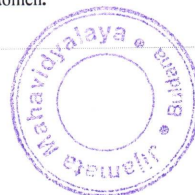


Vertex of head indented, non with a deep groove. Head pattern is without foveolet punctures. Mandible is with distinct and teeth with triangular in shape. Two teeth present on the front of the head. Eye is large with reddish to orange brown in colour. Twentieth segmented antennae are present on head without club. One pair of spine present on the thorax. Small spiny hairs present on the body. One node is present. Abdomen divided into four segment small spiny hairs present on the abdomen. Circle of the hairs at the tip of the abdomen are present. Stinger is absent.

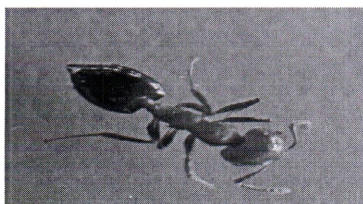
5. Technomyrmex albipes:-



Vertex of hair is with deep groove head pattern without foveolet punctures. Mandible is without teeth and elongated and linear. Numbers of teeths are absent. Eye is large in size. Body colour is reddish to orange brown. Twentieth segmented antennae are present on the head without club. Thorax is uneven when viewed from the side. Two pair of spine present on thorax. One node is present. Abdomen divided into five segments. Small spiny hair present on the abdomen. No circle of hair at the tip of the abdomen. Stinger are absent on the abdomen.

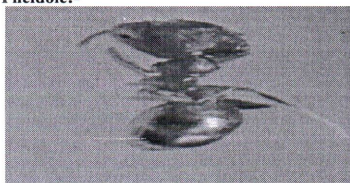


6. *Crematogaster*:-



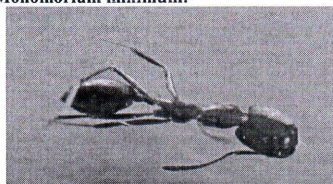
Vertex of head is with a deep groove. Head pattern is without foveolet punctures. Mandible is without teeth and triangular in shape small spiny hair present on the hair. Two teeth present on the front of the head. Eye is large in size with yellow to light brown in colour. Three segmented club are present. One pair of spine present on the thorax. Thorax is uneven when viewed from the side. Small spiny hairs present on the thorax. Two nodes are present on the petiole. Circle of hair present at the tip of the abdomen. Abdomen is divided into four segments. Small spiny hairs present all over the body. Stingers are present on the abdomen.

7. *Pheidole*:-



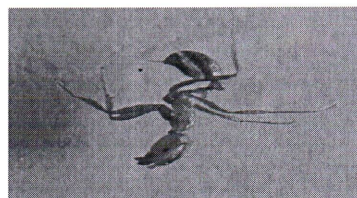
Vertex of head is with deep groove. Head pattern is with foveolet punctures. Mandible are without teeth and triangular in shape. Eye size is small with reddish to orange brown in colour. Twentieth segmented antennae are present on the head with three segmented club. No teeth are present on the front of head. One pair of spine present on the thorax. Thorax is uneven when viewed from the side. Small spiny hairs present all over the body. Two nodes are present. Abdomen divided into four segment and small spiny hair present on the abdomen. Circle of hairs are present at the tip of the abdomen and stinger are absent.

8. *Monomorium minimum*:-



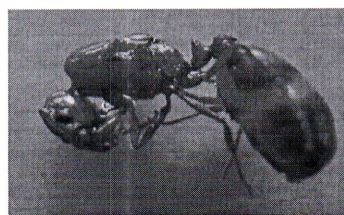
Vertex of head with a deep groove and head pattern is foveolet punctures mandible with distinct teeth, elongated and linear in shape two teeth are present on the front of head. Eyes are large and black in colour. 10 segmented antennae are present with three segment club. Spines are absent on the thorax. Thorax is smooth and evenly rounded when viewed from the side. Small spiny hairs are present on the thorax. Two nodes are present on petiole. Circle of hair present at the tip of abdomen. Abdomen is divided into four segment and stinger are present on the abdomen. Small spiny hairs present all over the body.

9. *Monomorium pharaonis*:-

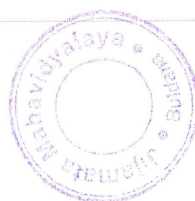


Vertex of head is indented, non with a deep groove. Head pattern is with foveolet punctures and mandible is with a distinct teeth. Mandible shape is elongated and linear. Eyes are small in size. Eye colour is black. Twentieth segmented antennae are present on head. Two teeth are present on the front of head. Spine are absent on the thorax. Thorax is smooth and evenly rounded when viewed from the side. And two nodes are present on petiole. Abdomen is divided in to four segmented and circle of hair present at tip of abdomen. Small spiny hairs are present all over the body. Stringers are present on the abdomen.

10. *Solenopsis*:-



Vertex of head is indented, non with a deep groove. Head pattern is without foveolet punctures mandible is with distinct teeth. Mandible shape is elongated and linear. One pair of teeth present on front of the head. Eyes are small in size. Eye colour is reddish to orange brown. Ten segmented antennae are present on head is with a two segmented club. Spine are absent on the



thorax. Thorax is uneven when viewed from the side. Abdomen is divided in to four segmented and circle of hair present at tip of abdomen. Small spiny hairs are present all over the body.

CONCLUSION

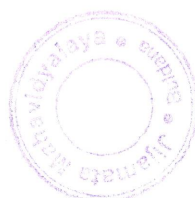
The present study has been focused on diversity of ants and its environmental associations. Our results will help for assessing the richness and diversity of ants. This investigation also focuses on reducing the number of ant species due to human activity and helps in improve social and cultural importance of forest and its scenario.

ACKNOWLEDGEMENT

Authors are thankful to the Interdisciplinary Research Laboratory of Department of Zoology Jijamata Mahavidyalaya, Buldhana for providing research facilities. A special thanks to Dr. N. E. Warghat and Miss. Suvarna P. Bobade for kindly support us for identification of different ant species. Also thankful to local peoples of Ghatbori forest helped us in collection of ants from different spots and regions and gratefully acknowledged.

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Role Of Bat Guano In The Development Of Agricultural Ecoland-Ecosystem And Formulation Of Universal Bio-Compost

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Abstract:

This study aimed at assessing the microbial, physicochemical characteristics, and manure quality of guano of an insectivorous bat *Rousettus leschenaulti*. The role of bat guano in agricultural field was also assessed. Results indicated that organic matter, total carbon, total nitrogen and phosphate were high in humus guano. Calcium, magnesium, bacteria, actinomycetes and fungi were higher in humus guano. All characteristics of humus guano significantly differed than other animal guano. The results clearly indicated that incorporation of low amount of bat guano into the soil for enhances crop production and our investigation also reveals that bat guano act as a soil-builder, cleanser, activator, fungicidal, nematocidal, insecticidal and excellent organic compost. Importance of conservation of insectivorous bats in agricultural ecoland-ecosystem development and their guano have been emphasized.

Key words: *Rousettus leschenaulti*, insectivorous bat, bat guano, organic manure, crop production, ecoland-ecosystem.

INTRODUCTION

Although agricultural chemicals drastically increase food production, it leads to impaired soil health, depletion of organic matter and microbes and persistence of heavy metals and pesticides. Organic farming has been promoted to restore soil health and fertility status. Application of farmyard manure (FYM), compost, green manure and bioinoculants are the most important management practices in organic farming (Thampan, 1993).

Improvement of soil fertility through the application of vermicompost is becoming more popular. In contrast to chemical fertilizers, application of FYM meets one half of nitrogen, one sixth of phosphate and about one half of potassium requirements of crops during the first season.

On equivalent nitrogen basis, FYM or compost is 40-60% efficient as chemical nitrogenous fertilizers to increase crop production. Even though long-term (>5 years) application of organic manure overcome such disparity, efficient application of organic matter for self-sustenance in agriculture has not reached the farming community. Several organic manures of animal origin are available for use (e.g. night soil, bovine dung and urine, sheep manure, poultry manure, silkworm wastes and vermicompost). Availability of such manures for crop production is restricted due to many constraints such as geographical region, awareness of manure value, extent of manure production and management. There is ample scope to assess and utilize non-conventional organic manures in agriculture.

No other fertilizer possesses the qualities and properties of Bat Guano. It is the ultimate in Organic Fertilizer containing all the essential elements necessary to grow healthy plants. The word "guano" originated from the Quichua

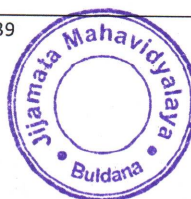
language of the Inca civilization and means "the droppings of sea birds". Bat guano has been used in agriculture in many regions for hundreds of years. In the 1600s in Peru, the Incas valued guano so highly that the punishment for harming the animals that produced it was death. In 1856, The United States also recognized the value of guano, by passing an Act that gave protection to any citizen that discovered a source of guano. The discoverer was able to take possession of unclaimed land that contained guano, and was entitled to exclusive rights to the deposits. By the end of the nineteenth century, artificial fertilizers made guano less important. Now that the risks of synthetic gardening products are becoming widely known, more and more growers are realizing that this dark, rich manure is indeed one of nature's treasures, ably serving as plant fertilizer, soil builder, soil cleanser, fungicide, nematocide, and compost activator.

Features and Benefits:

Bat guano can be safely used as an organic fertilizer, both indoors and outdoors and will benefit vegetables, field crops, herbs, flowers, fruit and nut trees. Because guano is rich in bioremediation microbes, which help clean up toxic substances, it will act as a purifier in areas in transition from chemical to organic practices. Bat guano is the most highly refined organic fertilizer, guano starts out as plant life, and insects eat from the plant then fly into the air and are eaten by the bats. The bats droppings fall to the cave floor and then the guano beetles and decomposing microbes attack the bat droppings and use it as food. The result of this natural process is that guano contains powerful decomposing microbes, which help control soil-borne diseases.

Properties of Guano:

Bat guano contains all the macro and micronutrients that plants require in a natural



form whereas inorganic fertilizers are manufactured to have particular characteristics. This results in multiple applications of various inorganic fertilizers in order to remedy deficiencies that exist in the soil. Soil Builder - improves the texture of the soil, Soil cleanser - microbes help to clear any toxins in the soil, Fungicide - when fed to the plants through the leaves, Nematocide - decomposing microbes help control nematodes (worms) and Soil activator - microbes speed up the decomposition

Organic vs. Inorganic:

Proponents of organic farming maintain that the advantages of organic fertilizers are that it will not upset the natural balance of the soil in the applied area. What this means is that you can apply lots to the area, but only small quantities of the nitrogen and other useful minerals and elements will leach out of the soil.

Whereas with inorganic fertilizers there is considerable leaching of the soil and these elements end up in rivers and streams where the ecosystem is destroyed. A process called eutrophication, where the competition between plant life and fish life for oxygen results in the destruction of marine life and the growth of algae. The best example is to use is the destruction caused by DDT in the 1960's.

In essence guano as a fertilizer forms an integral part of organic farming which is the move away from the synthetic fertilizers and insecticides, favoring crop rotation over monoculture i.e. one crop farming in order to preserve or in many cases reestablish the biodiversity of farm.

There is a 10%-15% annual increase in the amount of agricultural land being converted to organic methods

Application of Guano:

Applied as a top dressing and worked into the soil or mixed with water and applied, guano will have a dramatic influence. Hydroponics growers, in contrast to normal fertilization, are finding that guano and water are a natural alternative to chemical solutions. Use nitrogen guano for growth, phosphorus guano for budding and all guano for your plants general health and well-being. Guano can be blended with topsoil before laying sod or grass seed and while planting trees and shrubs add guano to water dispenser.

Formulated guano - 10 mg to 1000 ml of water (1:100) mix well, sufficient for more than 100 acres.

Formulated guano - 1 mg to 1 kg of soil (1:100) mix well and wet it, sufficient for more than 100 acres.

CONCLUSIONS AND OUTLOOK

Investigations on the possibilities of using nonconventional organic manures (e.g. vermicompost, millipede compost, bat guano) (Kale et al., 1992; Ashwini and Sridhar, 2002, 2006) in agriculture are becoming popular. Further studies are essential to investigate the occurrence of plant-promoting microbes in bat guano and their application in agriculture.

Production of seedlings of plantations in nurseries with sufficient vigor is an essential prerequisite than mass propagation of seedlings in the field. If bat swarming and roosting sites are preserved, their guano may become low cost natural manure for pot mixtures, gardens, nurseries, green houses and landscapes. Studies on the efficiency of combinations of insectivorous bat guano in crop production need to be addressed as they are rich in nitrogen and phosphorus respectively. Our investigation reveals that the bat guano act as a one of the universal organic compost because it has great immense properties like Soil Builder - improves the texture of the soil, Soil cleanser - microbes help to clear any toxins in the soil, Fungicide - when fed to the plants through the leaves, Nematocide - decomposing microbes help control nematodes (worms), Soil activator - microbes speed up the decomposition and insecticide - kill the pest.

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Table 1: Physico-chemical and microbiological characteristics of bat guano.

Characteristics	Other animal (rodents)	Humus guano
Fresh weight (kg/m ²)*	2.8±0.3 (2.5-3.5)	5.8±0.2 (4.9-5.5)
Dry weight (kg/m ²)*	2.6±0.2 (2-3)	3.9±0.4 (1.5-3.7)
pH	7.8±0.1 (7.4-7.6)	6.9±0.2 (6.2-6.8)
Conductivity (m mhos/cm)	2.7±0.2 (2.5-3.1)	3.9±0.6 (2.8-4.8)
Organic matter (%)	78.3±5.2 (70.2-86)	81.6±15.5 (24-61)
Total carbon (%)	46±3.1 (38.7-46.9)	56.4±11.4 (12.5-45.4)
Total nitrogen (%)	7.9±0.7 (8.7-9.5)	5.7±1.5 (4.5-8.7)
C/N ratio	5.9±0.6 (6-7.9)	6.6±1.6 (2.9-7.8)
Phosphate (%)	2.4±0.3 (3-4)	2.2±1.1 (0.9-4.7)
Potassium (%)	1.12±0.1 (1-1.3)	2.9±0.3 (0.5-2.3)
Calcium (%)	1.2±0.1 (1-1.8)	2.5±0.4 (1.6-2.6)
Magnesium (%)	2.6±0.1 (2.9-3.9)	4.1±0.6 (2.9-4.7)
Bacteria (cfu/g dry wt)	0.43±0.3x10 ⁷ (0.08-0.9)	1.22±0.7x10 ⁷ (3.5-4.5)
Actinomycetes (cfu/g dry wt)	1.82±0.5x10 ³ (1.6-2.8)	9.98±5.9x10 ³ (4.8-24)
Fungi (cfu/g dry wt)	0.4±0.2x10 ⁵ (0.2-0.9)	5.1±1.4 x10 ⁵ (0.6-8.5)
Organochlorine compounds	Organochlorine, Organophosphate, Carbamate compounds and many more	
Elements	108 elements reported	

(n = 5; mean ± SD; range in parentheses) *Accumulation in many years duration resulted into hip (humus) bat guano.

Table2: Comparison of N, P, K content in different animal wastes which are used as manures.

Manure	%N	%P	%K	Release speed
Cattle	0.5 to 2	0.2 to 0.7	0.4 to 2	Medium
Duck	2.6	0.8 to 1.4	0	Medium
Goat	4	0.6	1 to 2.8	Medium
Goose	3.3	0.4	0.6	Medium
Pig	0.4 to 2	0.5 to 1	0.4 to 1.2	Slow
Pigeon	6.3 to 6.5	2.5	2.5	Medium
Poultry	1.5 to 6	1 to 4	0.5 to 3	Medium to fast
Sheep	2.2 to 3.6	0.3 to 0.6	0.7 to 1.7	Medium
Turkey	5	0.5	0.6 to 0.9	Medium to fast
Vermi-cast	1.86	3.61	1.60	Medium
Bat Guano*	5.5 to 12.3	5.62 to 14.8	1.68 to 2.94	Medium to fast
Bat Guano**	1.9 to 3.82	4 to 11	1.48 to 2.86	Medium to fast

*Bat guano from Lonar crater, ** Insectivorous bat

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Kantowski-Sachs Ghost Dark Energy Cosmological Model with Specific Hubble Parameter in $f(R, T)$ Gravity

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Abstract Kantowski-Sachs cosmological model is studied in the framework of $f(R, T)$ gravity proposed by Harko et al. (Phys Rev D 84:024020, 2011). The source for energy momentum tensor is non-interacting two fluids viz. matter and ghost dark energy. The field equations have been solved using a specific form of Hubble parameter proposed by Singh (Astrophys. Space Sci. 318, 2008). Then some physical and mathematical properties of the model are also discussed.

Keywords $f(R, T)$ gravity · Ghost dark energy · Kantowski-Sachs metric · Specific Hubble parameter

1 Introduction

Most remarkable observational discoveries have shown that our universe is currently accelerating. This was first observed from high redshift supernova Ia (Riess et al. 1998, 2004; Perlmutter et al. 1999; Spergel et al. 2003; Astier et al. 2006; Wood-Vasey et al. 2007) and confirmed later by cross checks from SNe Ia with high level of confidence (Tonry et al. 2003; Clocchiatti et al. 2006). In addition, measurements of the cosmic microwave background (CMB) anisotropies (Bennett et al. 2003; de Bernardis et al. 2000; Hanany et al. 2000), large-scale structure (Tegmark et al. 2004a, b), the Sloan Digital Sky Survey

(SDSS) (Seljak et al. 2005; Adelman-McCarthy et al. 2006), the Wilkinson Microwave Anisotropy Probe (WMAP) (Knop et al. 2003) and the Chandra X-ray observatory (Allen et al. 2004) strongly indicate that our universe is dominated by a component with negative pressure, called dark energy (DE), which constitutes $\approx 3/4$ of the critical density. Today, the nature of DE is one of most challengeable problems before astrophysicist and cosmologist. A variety of possible solutions for DE such as cosmological constant (Weinberg 1989; Peebles and Ratra 2003), quintessence (Sahni and Starobinsky 2000; Sahni 2004; Padmanabhan 2008), phantom field (Caldwell 2002; Nojiri and Odinstov 2003a, b), tachyon field (Sen 2002; Padmanabhan 2002; Padmanabhan and Chaudhary 2002), quintom (Feng et al. 2005; Guo et al. 2005) and the interacting DE models like Chaplygin gas (Kamenshchik et al. 2001; Bento et al. 2002), holographic models (Wang et al. 2005; Setare 2006, 2007; Hu and Ling 2006; Kim et al. 2006) and braneworld models (Li 2004; Deffayet et al. 2002), etc. have been proposed to interpret accelerating universe.

In recent years, there has been a lot of interest in modified theories of gravity in view of the direct evidences of late time accelerated expansion of the universe. Several modified theories of gravity have been developed to study the late time acceleration of the universe, the existence of dark energy and dark matter.

Among various models of DE, the ghost dark energy (GDE) has attracted a lot of interest in recent years. The GDE model is motivated from the Veneziano ghost chromo dynamics (QCD) (Veneziano 1979). Veneziano ghost field explains the $U(1)$ problem in low-energy theory. The ghost field contributes to the vacuum energy density proportional to Λ_{QCD}^3 (Zhitnitsky 2010, 2011; Hogan et al. 2011),

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where Λ_{QCD} is QCD mass and H is the Hubble parameter. The advantage of the GDE over the other DE models is that it is free from the fine tuning and cosmic coincidence problems. Moreover, it can be explained within the standard model and general relativity without introducing new degrees of freedom or new symmetries or modification to general relativity (Rahman and Ansari 2014). Number of researchers (Urban and Zhitnitsky 2010; Cai et al. 2011; Sheykhi and Sadegh 2012; Sheykhi et al. 2012; Ebrahimi and Sheykhi 2011; Sheykhi and Badheri 2011; Rozas-Fernandez 2012; Karrami et al. 2013; Malekjani and Khodam-Mohammadi 2013; Feng et al. 2013) have studied GDE in different contexts. Alvirad and Sheykhi (2014) have studied cosmological constraints on ghost dark energy in the Brans-Dicke theory by using MCMC approach. Recently, Das and Sultana (2015) have investigated magnetized anisotropic ghost dark energy cosmological model.

The deceleration parameter q and Hubble parameter H are important observational quantities to study cosmological models. The present day value H_0 of Hubble parameter sets the present time scale expansion while q_0 , the present day value of deceleration parameter, tells that expansion of present universe is accelerating. The above fact indicates that a physically relevant model should have deceleration in past and acceleration at present. For this, the deceleration parameter q must be positive in early epoch and negative at late times. This condition is preserved in the paper by considering the specific form of Hubble parameter in the form $H(a) = l(a^{-n} + 1)$, where $l (> 0)$ and $n (> 1)$ are constants, such a way that the resulting decelerating parameter q and Hubble's parameter H are consistent with the desired behaviour of the universe. With this specific form of Hubble parameter and scale factor, a new class of cosmological models which leads to the scenario of accelerated expansion has been set. Singh (2008, 2009) has investigated Bianchi type-I and V cosmological model using specific Hubble parameter. Recently, Rahman and Ansari (2014) have studied interacting generalized ghost polytropic gas model of dark energy with specific Hubble parameter in LRS Bianchi type-II universe.

Besides the Bianchi type metrics, the Kantowski-Sachs models are also describing spatially homogeneous universes. For a review of Kantowski-Sachs of metrics one can refer Ellis et al. (2012). These metrics represent homogeneous but anisotropically expanding (or contracting) cosmologies and provide where the effects of anisotropic can be estimated and compared with all well-known Friedmann-Robertson-Walker class of cosmologies. Wang (2005) has obtained Kantowski-Sachs string cosmological model with bulk viscosity in general relativity. Reddy et al. (2014) have obtained Kantowski-Sachs bulk viscous string cosmological model in $f(R, T)$ gravity. Samanta (2013a)

has investigated Kantowski-Sachs Universe filled with perfect fluid in $f(R, T)$ theory of gravity.

Motivated by this study about the specific Hubble's parameter, an attempt is made to study Kantowski-Sachs space-time when universe is filled with Ghost DE in $f(R, T)$ gravity. This work is organized as follows: in Sect. 2, formulization of $f(R, T)$ gravity is discussed. In Sect. 3, the metric and field equations have been presented. The field equations have been solved in Sect. 4 by choosing specific form of Hubble parameter. The physical and geometrical behaviours of the models have been discussed in Sect. 5. In the last, Sect. 6, concluding remarks have been expressed.

2 $f(R, T)$ Theory of Gravity

In past decade, most of the researchers have actively worked on various modified theories of general relativity viz. $f(R)$ (Sotiriou 2010), $f(T)$ (Ferraro and Fiorini 2007) $f(R, T)$, (Harko et al. 2011) $f(G)$ (Nojiri and Odinstov 2005; Noiri and Odinstov 2006), etc. Harko et al. proposed another extension of standard general relativity to $f(R, T)$ theory of gravity wherein the gravitational Lagrangian is given by an arbitrary function of the Ricci scalar R and trace of the stress-energy tensor T . In $f(R, T)$ theory of gravity, the field equations are obtained from the Hilbert-Einstein type variation principle.

The action for this modified theory of gravity is given by

$$S = \int \sqrt{-g} \left(\frac{1}{2\pi\kappa^2 G} f(R, T) + L_m \right) d^4x, \quad (1)$$

where $f(R, T)$ is an arbitrary function of the Ricci scalar curvature R and the trace T of the stress-energy tensor of the matter $T_{\mu\nu}$. L_m is the matter Lagrangian density.

In the present paper, we use the natural system of units with $G = c = 1$, so that the Einstein gravitational constant is defined as $\kappa^2 = 8\pi$.

Thus Eq. (1) modifies to

$$S = \int \sqrt{-g} \left(\frac{1}{16\pi G} f(R, T) + L_m \right) d^4x \quad (2)$$

The stress-energy tensor of matter source is defined as (Landau and Lifshitz 1973)

$$T_{\mu\nu} = - \frac{2}{\sqrt{-g}} \frac{\delta(\sqrt{-g} L_m)}{\delta g^{\mu\nu}}, \quad (3)$$

and its trace by $T = g^{\mu\nu} T_{\mu\nu}$, respectively. We consider that the Lagrangian density L_m of matter depends only on the metric tensor components $g_{\mu\nu}$ and not on its derivatives. Therefore, Eq. (3) simplifies to



$$T_{\mu\nu} = g_{\mu\nu} L_m - 2 \frac{\partial L_m}{\partial g^{\mu\nu}}. \quad (4)$$

Variation of action (1) with respect to metric tensor $g_{\mu\nu}$ results in the field equations of $f(R, T)$ gravity in the form (Harko et al. 2011)

$$f_R(R, T)R_{\mu\nu} - \frac{1}{2}f(R, T)g_{\mu\nu} + (g_{\mu\nu} - \nabla_\mu \nabla_\nu)f_R(R, T) = 8\pi T_{\mu\nu} - f_T(R, T)(T_{\mu\nu} + \Theta_{\mu\nu}), \quad (5)$$

where f_R and f_T denote the derivatives of $f(R, T)$ with respect R and T , respectively. As usual notation ∇_μ is the covariant derivative, $\square \equiv \nabla^\mu \nabla_\mu$ is the D'Alembert's operator and $\Theta_{\mu\nu}$ is defined by

$$\Theta_{\mu\nu} = g^{\alpha\beta} \frac{\delta T_{\alpha\beta}}{\delta g^{\mu\nu}}. \quad (6)$$

Generally, the field equations also depend through the tensor $\Theta_{\mu\nu}$, on the physical nature of the matter field. Hence, in the case of $f(R, T)$ gravity, depending on the nature of the matter source, we obtain several theoretical models corresponding to each choice of $f(R, T)$. Consequently, most of the works in $f(R, T)$ gravity are carried out by assuming a number of suitable forms of $f(R, T)$, such as $f(R, T) = R + 2f(T)$, $f(R, T) = \mu f_1(R) + \nu f_2(T)$, ($f_1(R)$ and $f_2(T)$ are arbitrary functions of R and T and μ and ν are real constants), $f(R, T) = Rf(T)$, etc. (Harko et al. 2011; Jamil et al. 2012; Houndjo 2012; Houndjo and Piatella 2012; Houndjo et al. 2013; Chakraborty 2013). In this paper we consider the following simplest particular form (Harko et al. 2011):

$$f(R, T) = R + 2f(T), \quad (7)$$

i.e. the action is given by the same Einstein-Hilbert of GR plus a function of T . The term $2f(T)$ in the gravitational action modifies the gravitational interaction between matter and curvature. It is to be noted that Jamil et al. (2012) have reconstructed the same form of $f(R, T)$ described in (7) by treating R as a constant.

Using (7) into (5), we get

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 8\pi T_{\mu\nu} - 2(T_{\mu\nu} + \Theta_{\mu\nu})f'(T) + f(T)g_{\mu\nu}, \quad (8)$$

which is considered as the field equations of $f(R, T)$ gravity. Here, a prime denotes derivative with respect to the argument. We present the field equations for a spatially homogeneous and isotropic model in the presence of scalar field to reconstruct $f(R, T)$ given in (7) with two known models.

If the matter source is a perfect fluid, $\Theta = -2T_{\mu\nu} - pg_{\mu\nu}$ (Shamir and Raza 2015; Hossienkhani et al. 2014) then the above Eq. (8) reduces to

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 8\pi T_{\mu\nu} + 2f'(T)T_{\mu\nu} + [2pf'(T) + f(T)]g_{\mu\nu} \quad (9)$$

Adhav (2012) has constructed LRS Bianchi type-I cosmological model in $f(R, T)$ theory. Shamir et al. (2012) have constructed Bianchi type-I and Bianchi type-V cosmological models in $f(R, T)$ gravity. Chaubey and Shukla (2013) found a new class of Bianchi cosmological models in $f(R, T)$ gravity by using a special law of variation for the average scale factor when the deceleration parameter is linear with negative slope. Ram and Priyanka (2013) have presented some Kaluza-Klein cosmological models in $f(R, T)$ gravity theory. Samanta (2013b) has studied the Bianchi type-V universe filled with dark energy from a wet dark fluid in $f(R, T)$ gravity. Reddy et al. (2013) have investigated Bianchi type-III dark energy model with EoS parameter in $f(R, T)$ gravity. Naidu et al. (2013) have studied Bianchi type-V cosmological model in $f(R, T)$ gravity when the source for energy momentum tensor is a bulk viscous fluid containing one-dimensional cosmic strings. Ahmed and Pradhan (2014) have constructed a new class of cosmological models in $f(R, T)$ gravity by considering time-dependent deceleration parameter for a specific choice of $f(R, T) = f_1(R) + f_2(T)$. Sahoo et al. (2014) have constructed an axially symmetric cosmological model in $f(R, T)$ gravity in the presence of a perfect fluid source. Recently, Ghate and Sontakke (2015a, b) have investigated Bianchi type-IX cosmological model with bulk viscosity string minimally interacting and Holographic DE in $f(R, T)$ theory of gravity with special form of deceleration parameter.

3 Metric and Field Equations

Kantowski-Sachs metric is considered in the following form:

$$ds^2 = dt^2 - A^2 dr^2 - B^2 (d\theta^2 + \sin^2 \theta d\varphi^2), \quad (10)$$

where A, B are scale factors and are functions of cosmic time t .

The energy-momentum tensor for the matter energy density $(^{(m)}T_i^j)$ together with ghost dark energy density $(^{(G)}T_i^j)$ of fluid is in the form

$$T_i^j = (^{(m)}T_i^j + ^{(G)}T_i^j), \quad (11)$$

where $(^{(m)}T_i^j) = [-\rho_m, 0, 0, 0]$ and $(^{(G)}T_i^j) = [-\rho_G, p_x, p_y, p_z]$. Here ρ_m is the matter energy density of the fluid. ρ_G is the ghost energy density of the fluid.

Hence, from (11) we get

$$T_i^j = \text{diag.}(-\rho_m - \rho_G, p_{Gx}, p_{Gy}, p_{Gz}) \quad (12)$$



p_{Gx} , p_{Gy} , p_{Gz} are the pressures on x -, y - and z -axes, respectively. The anisotropic fluid is characterized by the equation of state $p_G = \omega_G \rho_G$, where ω_G is not necessarily constant (Carroll et al. 1992).

From Eq. (12) we have

$$T_i^j = \text{diag.}(-\rho_m - \rho_G, (\omega_G + \delta)\rho_G, (\omega_G + \gamma)\rho_G, (\omega_G + \gamma)\rho_G) \quad (13)$$

Here $\omega_G + \delta$, $\omega_G + \gamma$ and $\omega_G + \gamma$ are the directional equation of state (EoS) parameters along x , y and z axes, respectively. ω_G is the deviation free EoS parameter of ghost dark energy. δ and γ are skewness parameters along x , y and z axes, respectively.

$f(T)$ is an arbitrary analytic function of T ; the function $f(T)$ may be represented by a polynomial function in T . For simplicity,

$$f(T) = \xi T + \gamma T^m \quad (14)$$

where ξ and γ constants (Debnath and Paul 2015). We choose the function $f(T)$ of the trace of the stress-energy tensor of the matter so that

$$f(T) = \mu T, \quad (15)$$

where μ is a constant.

In the co-moving coordinate system, using the Eqs. (13–15), the field Eq. (9), for the metric (10) can be written as

$$2\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}^2}{B^2} + \frac{1}{B^2} = \rho_m(8\pi + \mu) + \rho_G(8\pi + \mu + 3\mu\omega_G + 2\mu\delta) + 2p\mu \quad (16)$$

$$2\frac{\ddot{B}}{B} + \frac{\dot{B}^2}{B^2} + \frac{1}{B^2} = \mu\rho_m + (\mu - 8\pi\omega_G - 5\mu\omega_G - 2\mu\delta)\rho_G - 2p\mu \quad (17)$$

$$\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\dot{A}\dot{B}}{AB} = \mu\rho_m + (\mu - 8\pi\omega_G - 5\mu\omega_G - 4\mu\delta - 8\pi\delta)\rho_G - 2p\mu \quad (18)$$

$$\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\dot{A}\dot{B}}{AB} = \mu\rho_m + (\mu - 8\pi\omega_G - 5\mu\omega_G - 4\mu\gamma - 8\pi\gamma)\rho_G - 2p\mu, \quad (19)$$

where the overdot ($\dot{}$) denotes the differentiation with respect to t .

From Eqs. (18, 19), we get

$$\gamma = \delta \quad (20)$$

The energy conservation equation is

$$T_{ij}^{ij} = {}^{(m)}T_{ij}^{ij} + {}^{(G)}T_{ij}^{ij} = 0, \quad (21)$$

which on simplification gives

$$\dot{\rho}_m + 3H\rho_m + \dot{\rho}_G + 3H(1 + \omega_G)\rho_G + 2\frac{\dot{B}}{B}\delta\rho_G = 0. \quad (22)$$

4 Solutions of Field Equations

The field Eqs. (13–15) are a system three highly non-linear differential equations in six unknowns A , B , ρ_m , ρ_G , ω_G and δ . The system is thus initially undetermined. In order to obtain an explicit solution of the system we need three additional constraints:

1. The non-interacting matter and ghost dark energy components are considered, where both components conserve separately (Sarkar 2014; Kiran et al. 2015)

$$\dot{\rho}_m + 3H\rho_m = 0 \quad (23)$$

and

$$\dot{\rho}_G + 3H(1 + \omega_G)\rho_G + 2\frac{\dot{B}}{B}\delta\rho_G = 0 \quad (24)$$

2. The energy density of GDE is $\rho = \alpha H$ (Ohta 2011), where α is constant. Cai et al. (2012) proposed an extended version of GDE, called generalized ghost dark energy (GGDE), by adding H^2 in GDE given by

$$\rho_G = \alpha H + \beta H^2, \quad (25)$$

where α and β are constants. The constant α is of order A_{QCD}^3 , where A is QCD mass scale. In the GGDE, β is a free parameter and can be adjusted for better agreement with observations.

3. The variation of Hubble parameter H as a one-parameter function is (Singh 2008)

$$H(a) = l(a^{-n} + 1), \quad (26)$$

where $l(>0)$ and $n(>1)$ are constants and a is the average scale factor.

For this choice, the deceleration parameter q comes out to be

$$q = \frac{n}{a^n + 1} - 1 \quad (27)$$

A similar form of q has also been proposed by Banerjee and Das (2005) in case of Robertson-Walker space-time. From Eq. (27), it is observed that, for $a = 0$, $q = n - 1 > 0$, for $a^n = n - 1$, $q = 0$ and for $a^n > n - 1$, $q < 0$. Therefore, the universe begins with a decelerating expansion and the expansion changes from decelerating phase to accelerating one. This cosmological

scenario is in agreement with SNe Ia astronomical observations and presents a unified picture of the expansion history of the evolving universe.

Solving Eq. (26), the average scale factor a is given by

$$a = (e^{nl t} - 1)^{\frac{1}{n}} \quad (28)$$

For the metric (10), the average scale factor a is given by

$$a = (A B^2)^{\frac{1}{3}} \quad (29)$$

Using Eqs. (28) and (29), the spatial volume is given by

$$V = a^3 = A B^2 = (e^{nl t} - 1)^{\frac{2}{n}} \quad (30)$$

Subtracting Eq. (18) from Eq. (17), we get

$$\frac{d}{dt} \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) + \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) \left(\frac{\dot{A}}{A} + 2 \frac{\dot{B}}{B} \right) = \frac{1}{B^2} - (8\pi + 2\mu)\delta\rho_G \quad (31)$$

Using Eqs. (28) and (31) reduces to

$$\frac{d}{dt} \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) + \frac{\dot{V}}{V} = \frac{1}{B^2} - (8\pi + 2\mu)\delta\rho_G \quad (32)$$

On integration Eq. (32) gives

$$\left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) \frac{V}{C} = e^{\int \left(\frac{1}{B^2} - (8\pi + 2\mu)\delta\rho_G \right) dt} \quad (33)$$

In order to solve Eq. (33), we use the condition

$$\delta = \frac{\frac{1}{B^2} - \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) n l}{(8\pi + 2\mu)\rho_G} \quad (34)$$

Using Eqs. (30) and (29) reduces to

$$\left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B} \right) \frac{V}{C} = e^{nl t} \quad (35)$$

Integrating (35) and then using (29), the scale factors are comes out to be

$$A = (e^{nl t} - 1)^{\frac{1}{n}} e^{\frac{2e}{3(n-3)}(e^{nl t} - 1)^{\frac{n-3}{n}}} \quad (36)$$

$$B = (e^{nl t} - 1)^{\frac{1}{n}} e^{\frac{2e}{3(n-3)}(e^{nl t} - 1)^{\frac{n-3}{n}}} \quad (37)$$

With the help of Eqs. (36) and (37), the metric (10) takes the form

$$ds^2 = dt^2 - (e^{nl t} - 1)^{\frac{2}{n}} e^{\frac{4e}{3(n-3)}(e^{nl t} - 1)^{\frac{n-3}{n}}} dr^2 - (e^{nl t} - 1)^{\frac{2}{n}} e^{\frac{2e}{3(n-3)}(e^{nl t} - 1)^{\frac{n-3}{n}}} (d\theta^2 + \sin^2 \theta d\varphi^2) \quad (38)$$

Equation (38) represents Kantowski-Sachs ghost dark energy cosmological model in $f(R, T)$ gravity with specific Hubble parameter (Figs. 1, 2).

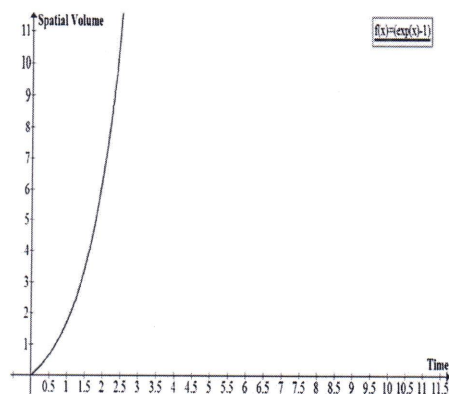


Fig. 1 Plot of spatial volume (V) versus time (t) with $n = 3$, $l = 0.33$

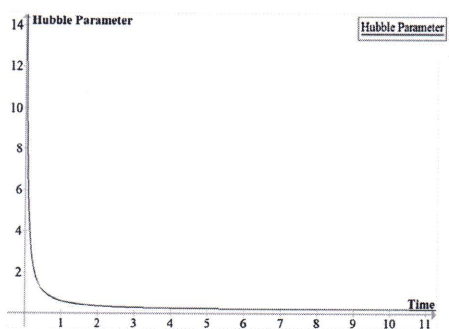


Fig. 2 The plot of Hubble parameter (H) versus time (t) with $n = 1.99$, $l = 0.2$

5 Some Physical Properties of the Model

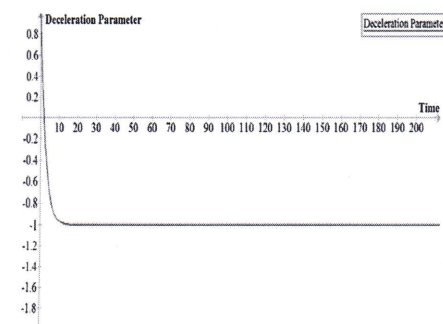
For the cosmological model (38), the physical quantities such as the spatial volume V , Hubble parameter H , expansion scalar θ , mean anisotropy parameter A_m , shear scalar σ^2 , matter energy density ρ_m , ghost energy density ρ_G , EoS parameter ω_G , Skew-ness parameter δ and deceleration parameter q are represented in the Table 1.

From Figs. 1 and 2, we observe that at $t = 0$, the Hubble parameter, expansion scalar the shear scalar all diverge and the spatial volume vanish. Hence the present model exhibits point type singularity. The universe evolves with zero volume at time $t = 0$. At $t \rightarrow \infty$, $q = -1$ and $\frac{dH}{dt} = 0$



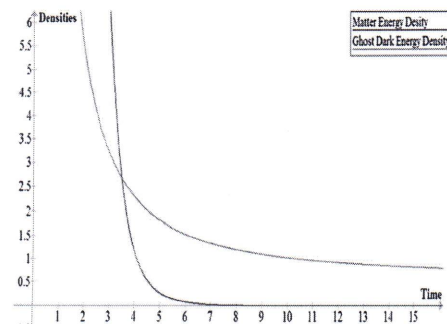
Table 1 Physical parameters

Spatial volume	$V = (e^{nlt} - 1)^{\frac{3}{n}}$
Hubble parameter	$H = l(1 - e^{-nlt})^{-1}$
Expansion scalar	$\theta = 3H = 3l(1 - e^{-nlt})^{-1}$
Mean anisotropy parameter	$A_m = \frac{2}{9l} e^{-nlt} (e^{nlt} - 1)^{\frac{2n-3}{n}}$
Shear scalar	$\sigma^2 = \frac{5}{3} e^{nlt} (e^{nlt} - 1)^{\frac{2}{n}}$
$\lim_{t \rightarrow \infty} \frac{\sigma^2}{\theta^2}$	0
Matter energy density	$\rho_m = C_1 (e^{nlt} - 1)^{-\frac{3}{n}}$
Ghost energy density	$\rho_G = l e^{nlt} (e^{nlt} - 1)^{-1} [\alpha + \beta l e^{nlt} (e^{nlt} - 1)^{-1}]$
Skew-ness parameter	$\delta = \frac{(e^{nlt} - 1)^{-\frac{3}{n}} e^{\frac{2}{n} nlt} - n l C_1 e^{nlt} (e^{nlt} - 1)^{-\frac{3}{n}}}{(8\pi + 2\mu) l e^{nlt} (e^{nlt} - 1)^{-1} [\alpha + \beta l e^{nlt} (e^{nlt} - 1)^{-1}]}$
EoS parameter	$\omega_G = -1 - \frac{\left\{ \frac{2(e^{nlt} - 1)^{-\frac{3}{n}}}{(8\pi + 2\mu)} \left[l - \frac{C}{3} (e^{nlt} - 1)^{\frac{2n-3}{n}} \right] \left[e^{\frac{2}{n} nlt} (e^{nlt} - 1)^{\frac{2n-3}{n}} - n l C e^{nlt} (e^{nlt} - 1)^{-\frac{3}{n}} \right] \right\}}{3 l^2 e^{nlt} (e^{nlt} - 1)^{-1} [\alpha + \beta l e^{nlt} (e^{nlt} - 1)^{-1}]}$
Deceleration parameter	$q = n e^{-nlt} - 1$

**Fig. 3** The plot of Deceleration parameter (q) versus time (t) with $n = 1.99$, $l = 0.2$

which implies the greatest value of the Hubble parameter and fastest rate of expansion of the universe.

Figure 3 shows the variation of deceleration parameter with time t . The deceleration parameter (DP) decreases rapidly and approaches -1 asymptotically which exhibits de-sitter like expansion at late time, whereas the model of the universe gives power law expansion. In this model, the DP gives a transition from a decelerating expansion phase to the present accelerating phase of the universe. From Fig. 3, it is clear that the value of DP is positive at the early stage of the universe and becomes negative at late time. The negative value of DP indicates the accelerating expansion of the universe.

**Fig. 4** The plot of matter energy density (ρ_m) and Ghost dark energy density (ρ_G) versus time (t) with $C_1 = 0.1$, $n = 0.6$, $l = 0.2$, $\alpha = 2.5$, $\beta = 3.5$

Thus the derived model is suitable to describe the late time evolution of the universe.

In Fig. 4, the matter energy density ρ_m and ghost dark energy density (ρ_G) are plotted versus time (t). In early phase of time, the universe is in radiation-dominated era but at a later time there is transition to matter-dominated era. Recent results suggest that we have already entered into an era dominated by dark energy. Thus, our model is in good agreement with the present observations.

We have obtained the matter energy density parameter (Ω_m) and ghost dark energy density parameter (Ω_G) as

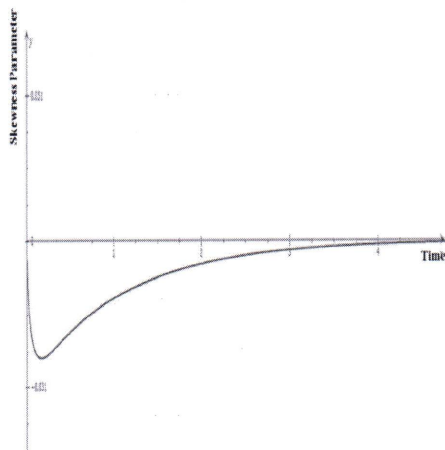


Fig. 5 The plot of Skewness parameter (ω) versus time (t) with $C_1 = 0.1$, $n = 0.6$, $l = 0.2$, $\alpha = 2.5$

$$\Omega_m = \frac{\rho_m}{3H^2} = \frac{C_1 (e^{nlt} - 1)^{2-\frac{3}{n}}}{3l^2 e^{2nlt}}$$

$$\Omega_G = \frac{\rho_G}{3H^2} = \frac{[\alpha + \beta l e^{nlt} (e^{nlt} - 1)^{-1}] (e^{nlt} - 1)}{3l e^{nlt}}$$

The total energy density parameter denoted by (Ω) is given by

$$\Omega = \Omega_m + \Omega_G$$

$$= \frac{C_1 (e^{nlt} - 1)^{2-\frac{3}{n}} + l e^{nlt} [\alpha + \beta l e^{nlt} (e^{nlt} - 1)^{-1}] (e^{nlt} - 1)}{3l^2 e^{2nlt}}$$

In Fig. 5, the plot of skew-ness parameter versus time is given. It is seen that the skew-ness parameter tends to zero at late time. Thus at later age of the universe, the anisotropy of the ghost dark energy becomes isotropy.

6 Conclusions

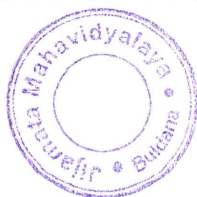
Kantowski-Sachs cosmological model has been discussed in the frame work of $f(R, T)$ gravity proposed by Harko et al. when the source for energy momentum tensor is non-interacting ghost dark energy. The solution of the field equations has been obtained by choosing the specific form of Hubble parameter $H(R) = l(a^{-n} + 1)$. It is observed that in early phase of universe, the value of deceleration parameter is positive, while as $t \rightarrow \infty$, the value of $q = -1$. Hence the universe had a decelerated expansion in the past and has accelerated expansion at present, which is

in good agreement with the recent observations of SN Ia. It is seen that the anisotropy of the universe and the skewness parameter of the ghost dark energy tend to zero at later age of the universe. Hence our results are in favour of the recent observational data which suggest the present day isotropic behaviour of the universe. The model approaches to isotropy monotonically and the anisotropy of the fluid also isotropizes at later times. This shows that our model strongly agrees with the present day observations.

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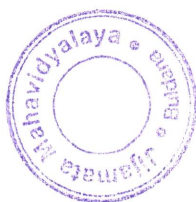
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Bounce Behavior of Kantowski-Sach Cosmological Model in General Relativity

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Keywords: kantowski-sach space-time, bouncing universe.

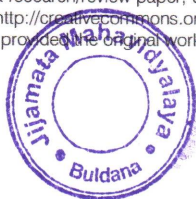
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Bounce Behavior of Kantowski-Sach Cosmological Model in General Relativity

H. R. Ghate ^a & Yogendra D. Patil ^a

Abstract: Kantowski-Sach cosmological model has obtained in the general theory of relativity. The source for energy-momentum tensor is assumed a perfect fluid. The field equations have solved by using special form of the average

scale factor $R(t) = \left((t - t_0)^2 + \frac{t_0}{1 - \beta} \right)^{\frac{1}{1 - \beta}}$ proposed by Cai

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1. INTRODUCTION

Astronomical observational data obtained from high red shift surveys of Supernovae (Snl) by Riess et al. [1], Perlmutter et al. [2] and Bennett et al. [3] indicated that our universe is expanding with acceleration. Also, observations such as Cosmic Microwave Background Radiations [4] and Large-scale structure [5] provide indirect evidence for the late time accelerated expansion of the universe. The accelerating expansion of the universe is driven by a mysterious component with high negative pressure known as dark energy (DE). In spite of all these attempts, DE is still the open question to the theoretical physicists because its nature is unknown. According to the astronomical observations, the DE currently accounts for about 73% of the total mass/energy of the universe and only 27% of a combination of dark matter and baryonic matter [6]. The DE universe may have very interesting implications for the future [7,8]. A different way of accounting for the Ω^E without any extra components is the modification of gravity [9,10].

The idea that instead of originating from a Big Bang singularity, the universe has emerged from a cosmological bounce has a long history [11]. Novello et al. [12,13] realized that a bouncing cosmology with a matter-dominated phase of contraction during which scales which are probed today, a cosmological observations exit a Hubble radius can provide an alternative to the current inflationary universe paradigm of cosmological structure formation. According to Cai et al. [10], the solution of the singularity problem of the standard Big Bang cosmology is known as bouncing

universe. A bouncing universe with an initial contraction to a non-vanishing minimal radius and then subsequent an expanding phase provides a possible solution to the singularity problem of the standard Big Bang cosmology. Moreover, for the universe entering into the hot Big Bang era after the bouncing, the equation of state (EoS) of the matter content ω in the universe must transit from $\omega < -1$ to $\omega > -1$. In the contracting phase, the scale factor $R(t)$ is decreasing, this means $\dot{R}(t) < 0$ and in the expanding universe, scale factor $\dot{R}(t) > 0$. Finally at the bouncing point, $\dot{R}(t) = 0$ and near this point $\ddot{R}(t) > 0$, for a period of time. It is also discussed with other view that in the bouncing cosmology, the Hubble parameter H passes across zero ($H=0$) from $H < 0$ to $H > 0$. Cai et al. have investigated bouncing universe with quintom matter. He showed that a bouncing universe has an initial narrow state by a minimal radius and then develops to an expanding phase. This means for the universe arriving to the Big-Bang era after the bouncing, the EoS parameter should crossing from $\omega < -1$ to $\omega > -1$. Sadatian [14] have studied rip singularity scenario and bouncing universe in a Chaplygin gas dark energy model. Recently, Bamba et al. [15] have investigated bounce cosmology from $f(R)$ gravity and $f(R)$ bi-gravity. Astashenok [16] has studied effective energy models and dark energy models with bounce in frames of $f(T)$ gravity. Solomans et al. [17] have investigated bounce behavior in Kantowski-Sach and Bianchi cosmology. Silva et al. [18] have studied bouncing solutions in Rastall's theory with a barotropic fluid. Brevik and Timoshkin [19] have obtained inhomogeneous dark fluid matter leading to a bounce cosmology. Singh et al. [20] have studied k-essence cosmologies in Kantowski-Sach cosmological Sachs and Bianchi space-times.

In this paper, Bouncing behavior of Kantowski-Sachs cosmological model has been obtained in the general theory of relativity. This work is organized as follows: In section 2, the metric and field equations have presented. The field equations have solved in section 3 by using the physical condition that the expansion scalar θ is proportional to shear scalar σ and the special form of average scale factor $R(t) = \left((t - t_0)^2 + \frac{t_0}{1 - \beta} \right)^{\frac{1}{1 - \beta}}$ proposed by Cai et al. [10]. The physical and geometrical behavior of the model have been discussed

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in section 4. In the last section 5, concluding remarks have been expressed.

II. METRIC AND FIELD EQUATIONS

Kantowski-Sachs metric is considered in the form

$$ds^2 = dt^2 - a^2 dr^2 - b^2 (d\theta^2 + \sin^2 \theta d\psi^2), \quad (1)$$

where $A(t)$ and $B(t)$ are functions of cosmic time t .

The energy-momentum tensor when the source for energy is assumed a perfect fluid given by

$$T_i^j = (\rho + p)u_i u^j - p\delta_i^j, \quad (2)$$

where u^i is the flow of vector satisfying $g_{ij}u^i u^j = 1$. Here ρ is the total energy density of perfect fluid and p is the corresponding pressure. For the perfect fluid, p and ρ are related by and equation of state

$$p = \omega\rho, \quad 0 \leq \omega \leq 1. \quad (3)$$

In co-moving system of co-ordinates, using equation (2), one can find

$$T_0^0 = \rho \text{ and } T_1^1 = T_2^2 = T_3^3 = -p. \quad (4)$$

The Einstein's field equations are given by

$$R_i^j - \frac{1}{2}g_i^j R = -T_i^j, \quad (5)$$

where R_i^j is a Ricci tensor, R is the Ricci scalar.

Using equation (2), for the metric (1), the field equations are given by

$$2\frac{\dot{a}\dot{b}}{ab} + \frac{\dot{b}^2}{b^2} + \frac{1}{b^2} = \rho \quad (6)$$

$$2\frac{\ddot{b}}{b} + \frac{\dot{b}^2}{b^2} + \frac{1}{b^2} = -\omega\rho \quad (7)$$

$$\frac{\ddot{a}}{a} + \frac{\ddot{b}}{b} + \frac{\dot{a}\dot{b}}{ab} = -\omega\rho, \quad (8)$$

where an overhead dot $\left(\dot{}\right)$ denotes differentiation with respect to t .

The average scale factor R and volume scalar V are given by

$$R^3 = V = ab^2. \quad (9)$$

The generalized mean Hubble's parameter H is defined by

$$H = \frac{\dot{R}}{R} = \frac{1}{3}(H_r + H_\theta + H_\psi), \quad (10)$$

where the directional Hubble parameters H_r , H_θ and H_ψ are given by

$$H_r = \frac{\dot{a}}{a}, \quad H_\psi = H_\theta = \frac{\dot{b}}{b}, \quad (11)$$

The expansion scalar θ and shear scalar σ are given by

$$\theta = 3H = \left(\frac{\dot{a}}{a} + 2\frac{\dot{b}}{b}\right), \quad (12)$$

$$\sigma^2 = \frac{1}{2} \left[\sum_{i=1}^n H_i^2 - 3H^2 \right]. \quad (13)$$

The deceleration parameter (DP) q is defined by

$$q = -1 + \frac{d}{dt} \left(\frac{1}{H} \right).$$

III. THE SOLUTION OF FIELD EQUATIONS

The field equations (6) to (8) are a system of three highly non-linear differential equations in four unknowns A, B, ρ and ω . The system is thus initially undetermined. We need one extra physical condition to solve the field equations completely.

We assume that the expansion scalar (θ) is proportional to the shear scalar (σ). This condition leads to

$$\frac{1}{\sqrt{3}} \left(\frac{\dot{a}}{a} + \frac{\dot{b}}{b} \right) = \alpha_0 \left(\frac{\dot{a}}{a} + 2\frac{\dot{b}}{b} \right),$$

which yields

$$\frac{\dot{a}}{a} = m \frac{\dot{b}}{b}$$

where α_0 and m are constants.

Above equation, on integration, reduces to

$$a = \eta (b)^m,$$

where η is an integration constant.

Here, for simplicity and without loss of generality, we assume that $\eta = 1$.

Hence, we have

$$a = (b)^m, \quad (m \neq 1). \quad (15)$$

Collins et al. [21] have pointed out that for spatially homogeneous metric, the normal congruence



to the homogeneous expansion satisfies that the condition $\frac{\sigma}{\theta}$ is constant.

In cosmology, the constant deceleration parameter is commonly used by several researchers [22-26], as it duly gives a power law for metric function or corresponding quantity.

The motivation to choose time-dependent deceleration parameter (DP) is behind the fact that the expansion of the universe was decelerating in the past and accelerating at present as observed by recent observations of Type Ia Supernova [1,2, 27-29] and CMB anisotropies [3,31]. Also, the transition redshift from deceleration expansion to accelerated expansion is about 0.5. Now for a Universe which was decelerating in past and accelerating at the present time, the DP must show signature flipping [31-33]. So, in general, the DP is not a constant but time variable. The motivation to choose the following scale factor is that it provides a time-dependent DP.

Under above motivations, we use a special form deceleration parameter as

$$q = -\frac{R\ddot{R}}{R^2} = -1 + \frac{d}{dt}\left(\frac{1}{H}\right) = -1 + \frac{1}{2}\left[(1-\beta) - \frac{t_0}{(t-t_0)^2}\right], \beta < 1 \quad (16)$$

where R is average scale factor of the universe.

This form is proposed by Cai *et al.* [10] and then modified by Sadatian [11].

Using above two equations (18) and (19), the metric (1) takes the form

$$ds^2 = dt^2 - \left[(t-t_0)^2 + \frac{t_0}{1-\beta}\right]^{\frac{6m}{(1-\beta)(m+2)}} dr^2 - \left[(t-t_0)^2 + \frac{t_0}{1-\beta}\right]^{\frac{6}{(1-\beta)(m+2)}} (d\theta^2 + \sin^2\theta d\psi^2). \quad (20)$$

Equation (20) represents Kantowski-Sachs cosmological model with time-dependent scale factor.

IV. PHYSICAL PROPERTIES OF THE MODEL

The physical quantities such as special volume V , Hubble parameter H , expansion scalar θ , mean anisotropy A_m , shear scalar σ^2 , energy density ρ , equation of state parameter ω are obtained as follows : The average scale factor is

$$R(t) = \left[(t-t_0)^2 + \frac{t_0}{1-\beta}\right]^{\frac{1}{1-\beta}}.$$

From fig. 4.1 (a), in the earlier stage, the scale factor is strictly decreasing ($\dot{R}(t) < 0$) and in the expanding phase the scale factor increases rapidly ($\dot{R}(t) > 0$). Hence our model is bouncing at $t = t_0$ ($\dot{R}(t) = 0$).

After integration of (16), we obtain the Hubble parameter as

$$H = \frac{\dot{R}}{R} = \frac{2(t-t_0)}{(1-\beta)(t-t_0)^2 + t_0}.$$

Again integrating, the average scale factor which is time dependent given by

$$R(t) = \left[(t-t_0)^2 + \frac{t_0}{1-\beta}\right]^{\frac{1}{1-\beta}}, \quad (17)$$

where t_0 is initial time and $\beta < 1$ is constant.

Solving the equations $a = b^m$ and $R(t) = (ab^2)^{\frac{1}{3}}$ and using (17), we get

$$a = \left[(t-t_0)^2 + \frac{t_0}{1-\beta}\right]^{\frac{3m}{(1-\beta)(m+2)}} \quad (18)$$

With the help of equation (17), equation (15) takes the form

$$b = \left[(t-t_0)^2 + \frac{t_0}{1-\beta}\right]^{\frac{3}{(1-\beta)(m+2)}}. \quad (19)$$



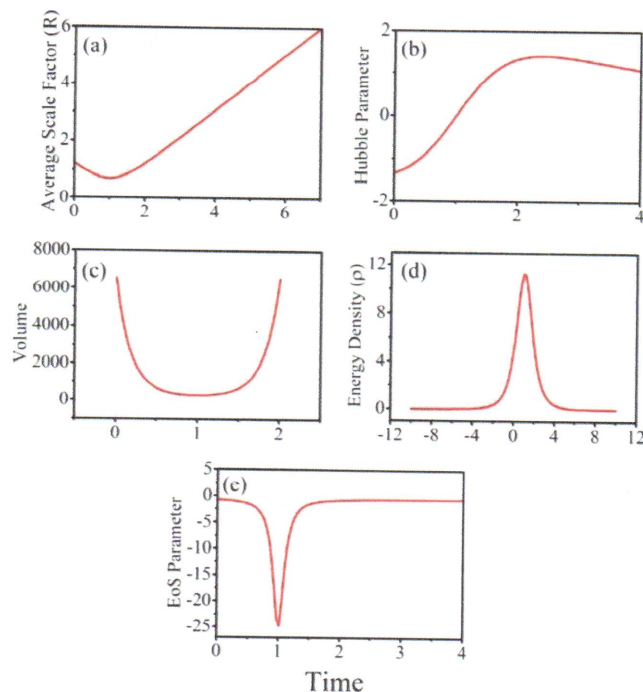


Fig. 4.1: Plots of time versus (a) Average scale factor (b) Hubble parameter (c) Spatial Volume (d) Energy density (e) EoS parameter for the values $\beta = 0.5$, $t_0 = 1$

The spatial volume is in the form

$$V = R^3 = \left[(t - t_0)^2 + \frac{t_0}{1 - \beta} \right]^{\frac{3}{1 - \beta}}. \quad (21)$$

The spatial volume is finite at time $t = 0$ and increases with increasing value of time hence the model is expanding with finite volume.

The Hubble parameter is given by

$$H = \frac{2(t - t_0)}{(1 - \beta) \left[(t - t_0)^2 + \frac{t_0}{1 - \beta} \right]}^{-1}. \quad (22)$$

From fig. 4.1 (b) the Hubble parameter $H < 0$ for $t < 1$ and $H > 0$ for $t > 1$ indicating that H passes across zero ($H = 0$) at $t = 1$, which represents that the universe is bouncing at $t = 1$.

The expansion scalar is

$$\theta = 3H = \frac{32(t - t_0)}{(1 - \beta)(t - t_0)^2 + \frac{t_0}{1 - \beta}}. \quad (23)$$

The mean anisotropy parameter is

$$A_m = 2 \frac{(m - 1)^2}{(m + 2)^2} = \text{const} \tan t (\neq 0, \text{form} \neq 1). \quad (24)$$

The shear scalar is

$$\sigma^2 = 12 \frac{(m - 1)^2 (t - t_0)^2}{(m + 2)^2 (1 - \beta)^2} \left[(t - t_0)^2 + \frac{t_0}{1 - \beta} \right]^{-2}. \quad (25)$$

We observe that

$$\lim_{t \rightarrow \infty} \frac{\sigma^2}{\theta^2} = \frac{(m - 1)^2}{3(m + 2)^2} (\neq 0, \text{for } m \neq 1). \quad (26)$$

The mean anisotropy parameter A_m is constant and $\lim_{t \rightarrow \infty} \frac{\sigma^2}{\theta^2} \neq 0$ is also constant. Hence the model is anisotropic throughout the evolution of the universe except at $m = 1$ i.e the model does not approach isotropy.

The matter energy density is given by



$$\rho = \frac{36(2m+1)(t-t_0)^2}{(1-\beta)^2(m+2)^2} \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{-2} + \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{\frac{-6}{(1-\beta)(m+2)}} \quad (27)$$

From fig. 4.1(d), the energy density decreases at the early stage of evolution when $t < 1$ and goes into the hot Big Bang era. The model bounces at $t=1$ and after bouncing the energy density rapidly increases for $t > 1$.

The equation of state (EoS) parameter ω is given by

$$\omega = - \frac{\frac{108(t-t_0)^2}{(1-\beta)(m+2)^2} \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{-2} - \frac{24(t-t_0)^2}{(1-\beta)(m+2)} \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{-2} + \frac{12}{(1-\beta)(m+2)} \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{-1} + \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{\frac{-6}{(1-\beta)(m+2)}}}{\frac{36(2m+1)(t-t_0)^2}{(1-\beta)^2(m+2)^2} \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{-2} + \left[(t-t_0)^2 + \frac{t_0}{1-\beta} \right]^{\frac{-6}{(1-\beta)(m+2)}}} \quad (28)$$

A bouncing universe model has an initial narrow state by a non-zero minimal radius and then develops to an expanding phase. For the universe going into the hot Big Bang era after the bouncing, the equation of state parameter of the universe crosses from $\omega < -1$ to $\omega > -1$. From fig. 4.1 (e), before bouncing point at $t=1$, we see that the EoS parameter $\omega < -1$ and after the bounce, the universe enter into the hot Big Bang era and occurs the Big rip singularity. Further the EoS parameter $\omega > -1$ for $t > 1$. Hence our model is bouncing at $t=1$.

V. CONCLUSION

Kantowski-Sachs cosmological model has been investigated in the general theory of relativity. The source for energy-momentum tensor is a perfect fluid. The field equations have been solved by using time-dependent deceleration parameter. The mean anisotropy parameter A_m is constant and $\lim_{t \rightarrow \infty} \frac{\sigma^2}{\rho^2} (\neq 0)$ is also constant, hence the model is anisotropic throughout the evolution of the universe except at $m=1$ i.e. the model does not approach isotropy. It is interesting to note that the behavior of the model is bouncing as the Hubble parameter H passes across zero ($H=0$) from $H < 0$ to $H > 0$, for some finite time $t=t_0$. Also the energy density decreases at the early stage of evolution and rapidly increases showing big bounce at $t=t_0$. The Hubble parameter $H < 0$, for $t < t_0$ and $H > 0$, for $t > t_0$ indicating that H passes across zero ($H=0$) at $t=t_0$. ($t \neq t_0$) which represents the model is bouncing at $t=t_0$. The skew-ness parameter $\omega < -1$ before the bounce at $t=t_0$ and $\omega > -1$ after the bounce.

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Article

Kaluza-Klein Bouncing Cosmological Model with Viscous Fluids

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Abstract

Bouncing behavior of Kaluza-Klein cosmological model has studied with viscous fluid by considering different forms of scale factors. Some physical properties of the fluids which realize them and the possibility to have acceleration after the bounce have discussed.

Keywords: Kaluza-Klein spacetime, scale factor, viscous fluid, bounce, energy conditions.

1. Introduction

According to the modern cosmological picture, our universe experiences the cosmic acceleration in the presence of strong repulsive force dubbed as dark energy (DE). The presence of this type of force has been predicted through various cosmological and astrological data. [19-20, 31-35]. However, its nature is still unknown which need further attention. The cosmological constant is the pioneer candidate of dark energy. The observations also indicate that the dark energy fluid in the universe is not a perfect fluid [21] and the viscosity plays a role in the evolution of the universe [5, 8, 13].

Various cosmological models for the evolution of the universe have been presented by number of researchers. They aim at explaining the acceleration era of the universe and they include future singularity phenomenon such as the dramatic Big Rip [11, 26-27], the other little Rip [4, 16-17], the pseudo Rip [18], The Quasi Rip [39], the bounce cosmology [1-2, 7, 10, 30]. Brevik *et al.* [6-7] has studied the little Rip and the pseudo Rip phenomenon, and also the bounce universe induced by an inhomogeneous dark fluid coupled with dark matter. Myrzakul *et al.*, Myrzakulov and Sevatiani and Elizalde *et al.* [15, 24-25] have studied cosmological models in modified theory of gravitation with viscous fluids.

In this paper, we discuss different bounce solutions and the features of the related viscous fluids, taking into account the necessity to have a cosmic (inflationary) acceleration after the bounce. The paper is organized as follows. In section 2, the formalism of inhomogeneous viscous fluid in

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Kaluza-Klein universe is presented. In section 3, we analyze the bounce solutions in fluids cosmology. In section 4, the same investigations are carried out for the bounce solutions, conclusions and remarks are given in section 5.

2. Metric and Field Equations

Five-dimensional Kaluza-Klein space-time is considered in the form

$$ds^2 = dt^2 - A^2(t)(dx^2 + dy^2 + dz^2) - B^2(t)d\psi^2, \quad (1)$$

where $A(t)$ and $B(t)$ are scale factors which are functions of cosmic time t . The fifth coordinate ψ is taken to be space-like.

The energy-momentum tensor for the viscous fluid is given by

$$T_{ij} = \rho u_i u_j + p(u_i u_j - g_{ij}), \quad (2)$$

where u_i are the four co-moving velocity vectors, ρ is the energy density and g_{ij} is the metric tensor.

The fluid in the universe is inhomogeneous viscous fluid with equation of state [12, 28-29] given by

$$p = \gamma(\rho) - B(a, H, \dot{H}, \dots), \quad (3)$$

where the equation of state parameter γ may depend on ρ . B is a bulk viscosity which is general function of a, H and its derivatives. a is the average scale factor.

From the equations (2) and (3), the energy-momentum tensor for the viscous fluid is given by

$$T_{ij} = \rho u_i u_j + \gamma(\rho) - B(a, H, \dot{H}, \dots)(u_i u_j - g_{ij}). \quad (4)$$

The Einstein's field equations in general theory of gravitation are

$$R_j^i - \frac{1}{2} R g_j^i = -T_j^i. \quad (5)$$

With the help of equation (4), the field equations (5) for the metric (1) are

$$3 \frac{\dot{A}^2}{A^2} + 3 \frac{\dot{A}\dot{B}}{AB} = \rho, \quad (6)$$

$$2 \frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\dot{A}^2}{A^2} + 2 \frac{\dot{A}\dot{B}}{AB} = -p, \quad (7)$$

$$3 \frac{\ddot{A}}{A} + 3 \frac{\dot{A}^2}{A^2} = -p, \quad (8)$$

where an overhead dot $\left(\dot{}\right)$ represents differentiation with respect to t .

The energy-conservation equation, which is the consequence of the field equations is given by,

$$T_{ij}^{;j} = 0,$$



where

$$T_{;j}^{ij} = \frac{1}{\sqrt{-g}} \frac{\partial}{\partial x^j} (T^{ij} \sqrt{-g}) + T^{jk} \Gamma_{jk}^i$$

which simplifies to

$$\dot{\rho} + 4H(\rho + p) = 0 \quad (9)$$

Using equation (3), equation (9) reduces to

$$\dot{\rho} + 4H(1 + \gamma(\rho))\rho = 4HB(\rho, a, H, \dot{H}, \dots) \quad (10)$$

From the thermodynamic point of view, for positive entropy change in an irreversible process, the bulk viscosity must be a positive quantity [5, 8].

The cosmological parameter Ω is defined as:

$$\Omega = 1 + \frac{1}{a^2 H^2} \quad (11)$$

The quantity Ω in general, may be different from.

By a bouncing universe, we mean a universe that undergoes a collapse, attains a minimum and then subsequently expands. For a successful bounce in Kaluza-Klein model, during contraction phase the scale factor $a(t)$ is decreasing i.e. $\dot{a}(t) < 0$ and then in the expanding phase, the scale factor is increasing i.e. $\dot{a}(t) > 0$. At the bounce point (i.e. at $t = t_b$), the minimal necessary conditions are

- i) $\dot{a}(t_b) = 0$ and
- ii) $\ddot{a} > 0$ for $t \in (t_b - \epsilon, t_b) \cup (t_b, t_b + \epsilon)$, for small $\epsilon > 0$.

For non-singular bounce $\dot{a}(t) \neq 0$. These conditions may not be sufficient for a non-singular bounce. This is well explained by Singh et al. [36-38].

The bounce behavior of cosmological model is also realized using energy conditions as mentioned in Molina-Paris & Visser and Singh *et al.* [22, 38]. In terms of energy density ρ and pressure p , the energy conditions can be stated as:

Null Energy Condition (NEC) is satisfied when $\rho + p \geq 0$.

Weak Energy Condition (WEC) is satisfied when $\rho \geq 0$ and $\rho + p \geq 0$.

Dominant Energy Condition (DEC) is satisfied when $\rho \geq |p|$.

Strong Energy Condition (SEC) is satisfied when $\rho + p \geq 0$ and $\rho + 4p \geq 0$.

It is clear that violation of SEC will lead to a violation of other energy conditions.

3. Solution of the Field Equations

The field equations (6) to (8) are a system of three highly non-linear differential equations in four unknowns A, B, ρ and γ . The system is thus initially undetermined. We need one extra condition



for solving the field equations completely. We assume that the expansion scalar (θ) is proportional to shear (σ). This condition leads to

$$\frac{1}{\sqrt{3}} \left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B} \right) = \alpha_0 \left(3 \frac{\dot{A}}{A} + \frac{\dot{B}}{B} \right),$$

which yields

$$\frac{\dot{B}}{B} = m \frac{\dot{A}}{A},$$

where α_0 and m are arbitrary constants.

Above equation on integration reduces to

$$B = \eta(A)^m,$$

where η is an integration constant.

Here, for simplicity and without loss generality, we assume that $\eta = 1$.

Hence, we have

$$B = A^m. \quad (12)$$

Collins *et al.* [14] have pointed out that for spatially homogeneous metric, the normal congruence to the homogenous expansion satisfies the condition $\frac{\sigma}{\theta}$ is constant.

4. CASE I: FLUID MODEL WITH $a(t) = \sqrt{a_0^2 + \beta^2 t^2}$

The bouncing cosmological model has obtained by choosing the average scale factor $a(t)$ of the form [23]

$$a(t) = \sqrt{a_0^2 + \beta^2 t^2}, \quad (13)$$

where a_0, β are non-zero positive constants.

The above scale factor is the temporal analogue of the toy model traversable wormhole [23]. One may get phenomenological quintom bouncing model with proper renormalization of a_0, β [9].

The Hubble parameter is given by

$$H(t) = \frac{\dot{a}}{a} = \frac{\beta^2 t}{a_0^2 + \beta^2 t^2}. \quad (14)$$

In terms of geometrical quantities, we have

$$\frac{\ddot{a}}{a} = \dot{H} + H^2 = \frac{(\beta a_0)^2}{(a_0^2 + \beta^2 t^2)^2}. \quad (15)$$

For the metric (1), the average scale factor is given by

$$a(t) = (A^3 B)^{\frac{1}{4}}. \quad (16)$$

From equations (13) and (16), we have



$$\Rightarrow A^3 B = (a_0^2 + \beta^2 t^2)^2 . \quad (17)$$

With the help of equation (12), it reduces to

$$A = (a_0^2 + \beta^2 t^2)^{\frac{2}{(m+3)}} \quad (18)$$

Using equation (18) in equation (12) therein

$$B = (a_0^2 + \beta^2 t^2)^{\frac{2m}{m+3}} . \quad (19)$$

With the help of equations (18) and (19), the metric (1) becomes

$$ds^2 = dt^2 - (a_0^2 + \beta^2 t^2)^{\frac{4}{m+3}} (dx^2 + dy^2 + dz^2) - (a_0^2 + \beta^2 t^2)^{\frac{4m}{m+3}} d\psi^2 . \quad (20)$$

Equation (20) represents Kaluza-Klein bouncing cosmological model with viscous fluid in general theory of relativity.

Some physical properties of the model

For the cosmological model (20), the physical quantities such as spatial volume V , Hubble parameter H , expansion scalar θ , mean anisotropy A_m , Shear scalar σ^2 , energy density ρ are obtained as follows;

The spatial volume is in the form

$$V = a^4 = (a_0^2 + \beta^2 t^2)^2 . \quad (21)$$

The Hubble parameter is

$$H = \frac{1}{4} \left(3 \frac{\dot{A}}{A} + \frac{\dot{B}}{B} \right) = \frac{\beta^2 t}{(a_0^2 + \beta^2 t^2)} . \quad (22)$$

The expansion scalar is

$$\theta = 4H = \frac{4\beta^2 t}{(a_0^2 + \beta^2 t^2)} . \quad (23)$$

The mean anisotropy parameter A_m is

$$A_m = \frac{3(m-1)^2}{(m+3)^2} = \text{Constant} \neq 0, \text{ for } m=1. \quad (24)$$

The shear scalar is

$$\sigma^2 = \frac{6(m-1)^2 \beta^4 t^2}{(m+3)^2 (a_0^2 + \beta^2 t^2)^2}. \quad (25)$$

It is observed that

$$\lim_{t \rightarrow \infty} \frac{\sigma^2}{\theta^2} = \frac{3(m-1)^2}{8(m+3)^2} \neq 0, \text{ for } m \neq 1. \quad (26)$$

The mean anisotropy parameter A_m and $\lim_{t \rightarrow \infty} \frac{\sigma^2}{\theta^2} = \text{constant} \neq 0$. Hence, the model is anisotropic throughout the evolution of the universe, except at $m=1$. (i.e. the model does not approach isotropy.)

The matter-energy density is given by

$$\rho = \frac{48(m+1)\beta^4 t^2}{(m+3)^2 (a_0^2 + \beta^2 t^2)}, \quad (27)$$

$$\rho + p = \frac{24(3m+1)\beta^4 t^2}{(m+3)^2 (a_0^2 + \beta^2 t^2)} - \frac{12\beta^2}{(m+3)(a_0^2 + \beta^2 t^2)}, \quad (28)$$

$$\rho - p = \frac{24\beta^4 t^2}{(m+3)(a_0^2 + \beta^2 t^2)^2} - \frac{12\beta^2}{(m+3)(a_0^2 + \beta^2 t^2)}, \quad (29)$$

$$\rho + 4p = \frac{48(3m-1)\beta^4 t^2}{(m+3)^2 (a_0^2 + \beta^2 t^2)} - \frac{48\beta^2}{(m+3)(a_0^2 + \beta^2 t^2)}. \quad (30)$$

The cosmological parameter for the closed universe takes the form,

$$\Omega = 1 + \frac{1}{a^2 H^2}.$$

$$\Omega = 1 + \frac{1}{\beta^2} + \frac{a_0^2}{\beta^4 t^2}. \quad (31)$$



Figures (4.1) (a), (b), (c), (d), (e), (f) represent the plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho + p$ (e) $\rho - p$ and (f) $\rho + 4p$ which are as shown below.

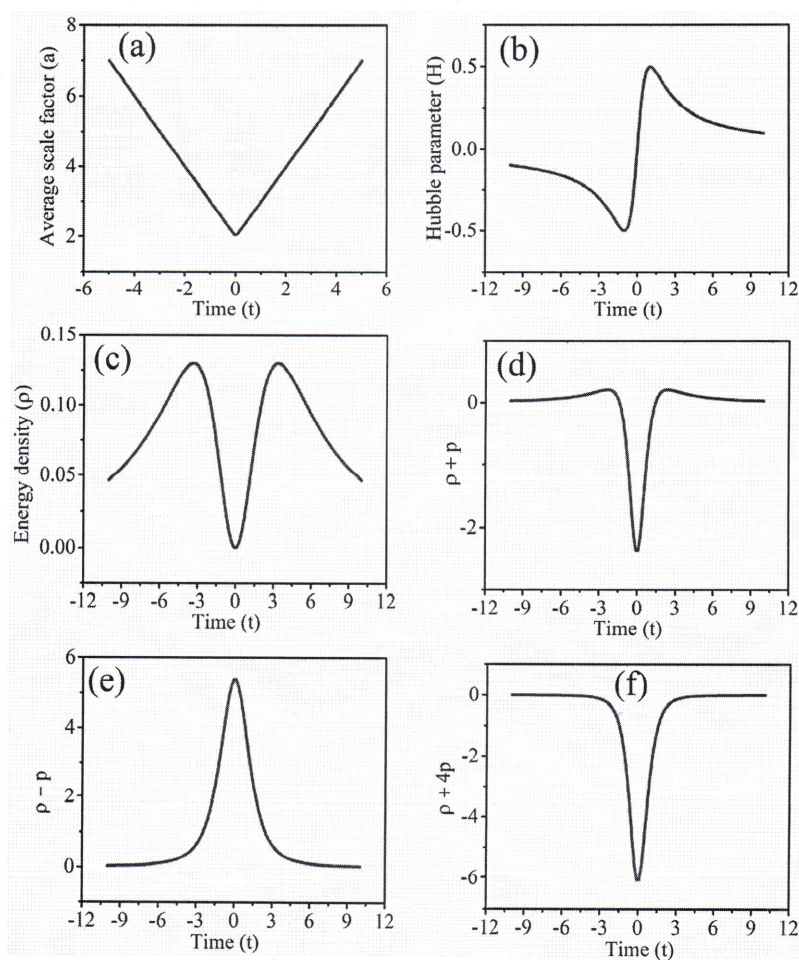


Fig. 4.1 Plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho + p$ (e) $\rho - p$ (f) $\rho + 4p$ for the values of constants $a_0 = 1$ and $\beta = 1$.

Discussion: Fig. (4.1) (a) is the plot of time versus average scale factor. It is seen that, during contraction phase, the average scale factor $a(t)$ is decreasing (i.e. $\dot{a}(t) < 0$) and then in the expanding phase $a(t)$ is increasing (i.e. $\dot{a}(t) > 0$). Hence, the minimal necessary conditions (i) and (ii) for the bounce at time $t=0$ are satisfied [38].

$$(i) \dot{a}(t) = 0 \text{ at } t=0$$

and (ii) at $t=0$, $\ddot{a}(t) > 0$ for $t \in (0-\epsilon, 0) \cup (0, 0+\epsilon)$, where ϵ is very small.

Fig. (4.1) (b) is the plot of time versus Hubble parameter. At $t=0$, $H=0$ and $a(0)=a_0$ with $\dot{H} > 0$ in small neighborhood of $t=0$. Thus it satisfies the necessary conditions of bounce [36-37].

To realize the bounce in our model, let we obtain the values of ρ , $\rho+p$, $\rho-p$ and $\rho+4p$ for $m=2$.

$$\begin{aligned}\rho &= (5.76)\beta^4 t^2 (a_0^2 + \beta^2 t^2)^{-2}, \\ \rho+p &= (6.72)\beta^4 t^2 (a_0^2 + \beta^2 t^2)^{-2} - (2.4)\beta^2 (a_0^2 + \beta^2 t^2)^{-1} \\ \rho-p &= (4.8)\beta^4 t^2 (a_0^2 + \beta^2 t^2)^{-2} + (2.4)\beta^2 (a_0^2 + \beta^2 t^2)^{-1} \\ \rho+4p &= (9.6)\beta^4 t^2 (a_0^2 + \beta^2 t^2)^{-2} - (9.6)\beta^2 (a_0^2 + \beta^2 t^2)^{-1}\end{aligned}$$

Figs. (4.1) (c), (d), (e) and (f) are the plots of time versus energy density (ρ), $\rho+p$, $\rho-p$ and $\rho+3p$. It is observed that WEC, NEC and DEC energy conditions are satisfied at $t=0$ but SEC is violated at $t=0$. Hence, the bounce is realized in our model at $m=2$. The result is also true for $m=4, 6$.

The bulk viscosity is

$$B(a, H, \dot{H}, \dots) = 4H\zeta. \quad (32)$$

In this specific case, equation (9), takes the form

$$\rho = -p + 4H\zeta. \quad (33)$$

From equation (33), we have

$$4H\zeta = \frac{24(3m+1)}{(m+3)^2} H^2 - \frac{12\beta^2}{(m+3)a^2} \quad (34)$$

Dividing by $4H$

$$\zeta(H, a) = \frac{6(3m+1)H}{(m+3)^2} - \frac{3\beta^2}{(m+3)Ha^2}. \quad (35)$$

When the scale factor becomes large, $\zeta(H) \approx \frac{6(3m+1)H}{(m+3)^2}$ and then we can treat it as a fluid with a bulk viscosity of $o(H)$. Therefore, with $\zeta(H, a)$ we can recognize bouncing universe with the scale factor in equation (13).



In another example, we take $\gamma(\rho) = \gamma$ (constant) and $B(a, H, \dot{H}, \dots) = 4H\zeta$ with $\zeta = \epsilon\rho$, where ϵ is a constant.

From equation (9), we have

$$\dot{\rho} = -4H(\rho + p).$$

Using equation (3), we get

$$\dot{\rho} = -4H(\gamma(\rho)\rho - B(a, H, \dot{H}, \dots)).$$

Since, $\zeta = \epsilon\rho$ and $B(a, H, \dot{H}, \dots) = 4H\zeta$, we have $\rho = \frac{a_1}{(a_0^2 + \beta^2 t^2)^{\frac{3(1+\gamma-\epsilon)}{2}}}$

$$\rho = \frac{a_1}{(a_0^2 + \beta^2 t^2)^{\frac{3(1+\gamma-\epsilon)}{2}}} \quad (36)$$

where, a_1 is a constant of integration.

Also, from equation (3) we get

$$p = \gamma(\rho)\rho - B(a, H, \dot{H}, \dots)$$

Using $\gamma(\rho) = \gamma$ = constant and $B(a, H, \dot{H}, \dots) = 4H\zeta$, we get

$$p = (\gamma - 4H\epsilon)\rho.$$

The scenario with γ = constant, $\zeta = \epsilon\rho$ the energy density of the bouncing universe will decrease with increasing time (provided, $(1 + \gamma > \epsilon)$ and also the bulk viscosity. For the large time t , p will become negative.

5. CASE II: FLUID MODEL WITH $a(t) = a_1(e^t + e^{-t})$

The bouncing cosmological model has been obtained by choosing the average scale factor $a(t)$ of the form [1]

$$a(t) = a_1(e^t + e^{-t}), \quad (37)$$

where the a_1 , α are non-zero positive constants.

The Hubble parameter is given by

$$H(t) = \frac{\dot{a}}{a} = \frac{\alpha(e^{\alpha t} - e^{-\alpha t})}{(e^{\alpha t} + e^{-\alpha t})}. \quad (38)$$

For the metric (1), the average scale factor is given by

$$a(t) = (A^3 B)^{\frac{1}{4}}. \quad (39)$$

From equations (37) and (39) we have

$$A^3 B = a_1^4 (e^{\alpha t} + e^{-\alpha t})^4 \quad (40)$$

With the help of equation (12), equation (40) reduce to



$$A = a_1^{\frac{4}{m+3}} (e^{at} + e^{-at})^{\frac{4}{m+3}}. \quad (41)$$

Using equation (41), equation (12) leads to

$$\Rightarrow B = a_1^{\frac{4m}{m+3}} (e^{at} + e^{-at})^{\frac{4m}{m+3}}. \quad (42)$$

With the help of equations (4) and (42), the metric (1) can be written as

$$ds^2 = dt^2 - a_1^{\frac{8}{m+3}} (e^{at} + e^{-at})^{\frac{8}{m+3}} (dx^2 + dy^2 + dz^2) - a_1^{\frac{8m}{m+3}} (e^{at} + e^{-at})^{\frac{8m}{m+3}} d\psi^2. \quad (43)$$

The equation (43) represents Kaluza-Klein viscous fluid cosmological model in general theory of relativity.

SOME PHYSICAL PROPERTIES OF THE MODEL

For the cosmological model (43), the physical quantity such as spatial volume V , Hubble parameter H , expansion scalar θ , mean anisotropy A_m shear scalar σ^2 , energy density ρ are obtained as follows.

The spatial volume is in the form

$$V = a_1^4 (e^{at} + e^{-at})^4. \quad (44)$$

The Hubble parameter is

$$H = \frac{1}{4} \left(3 \frac{\dot{A}}{A} + \frac{\dot{B}}{B} \right) = \frac{\alpha(e^{at} - e^{-at})}{(e^{at} + e^{-at})}. \quad (45)$$

The expansion scalar is given by

$$\theta = 4H = \frac{4\alpha(e^{at} - e^{-at})}{(e^{at} + e^{-at})}. \quad (46)$$

The mean anisotropy parameter is given by

$$A_m = \frac{3(m-1)^2}{(m+3)^2} = \text{Constant} \neq 0, \text{ for } m \neq 1. \quad (47)$$

The shear scalar is

$$\sigma^2 = \frac{6\alpha^2(m-1)^2}{(m+3)^2} \frac{(e^{at} - e^{-at})^2}{(e^{at} + e^{-at})^2}. \quad (48)$$

It is observed that

$$\lim_{t \rightarrow \infty} \frac{\sigma^2}{\theta^2} = \frac{3(m-1)^2}{8(m+3)^2} = \text{Constant} \neq 0, \text{ for } m \neq 1. \quad (49)$$

The mean anisotropy parameter A_m is constant and $\lim_{t \rightarrow \infty} \frac{\sigma^2}{\theta^2} \neq 0$ is also constant. Hence the model is anisotropic throughout the evolution of the universe, except at $m=1$ i.e. the model does not approach isotropy.

The matter-energy density is given by

$$\rho = \frac{48\alpha^2(m+1)(e^{at} - e^{-at})^2}{(m+3)^2(e^{at} + e^{-at})^2}, \quad (50)$$

$$\rho + p = \frac{12\alpha^2(5m-1)(e^{at} - e^{-at})^2}{(m+3)^2(e^{at} + e^{-at})^2} - \frac{12\alpha^2}{(m+3)}, \quad (51)$$

$$\rho - p = \frac{36\alpha^2(e^{at} - e^{-at})^2}{(m+3)(e^{at} + e^{-at})^2} + \frac{12\alpha^2}{(m+3)}, \quad (52)$$

$$\rho + 4p = \frac{96\alpha^2(m-1)(e^{at} - e^{-at})^2}{(m+3)^2(e^{at} + e^{-at})^2} - \frac{48\alpha^2}{(m+3)}. \quad (53)$$

The cosmological parameter for the closed universe takes the form:

$$\Omega = 1 + \frac{1}{a^2 H^2}.$$

Using (37) and (38), it simplifies to

$$\Omega = 1 + \frac{1}{a_1^2 \alpha^2 (e^{at} + e^{-at})^2}. \quad (54)$$

As t increases, after the bounce Ω decreases due to the acceleration of the universe.

Figures (5.2) (a), (b), (c), (d), (e), (f) represents the plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho + p$ (e) $\rho - p$ (f) $\rho + 4p$ which are as shown below.

Discussion: Fig. (5.2) (a) is the plot of time versus average scale factor. It is seen that, during contraction phase, the average scale factor $a(t)$ is decreasing (i.e. $\dot{a}(t) < 0$) and then in the expanding phase $a(t)$ is increasing (i.e. $\dot{a}(t) > 0$). Hence, the minimal necessary conditions (i) and (ii) for the bounce at time $t = 0$ are satisfied [38].

(i) $\dot{a}(t) = 0$ at $t = 0$

and (ii) at $t = 0$, $\ddot{a}(t) > 0$ for $t \in (0 - \epsilon, 0) \cup (0, 0 + \epsilon)$, where ϵ is very small.

Fig. (5.2) (b) is the plot of time versus Hubble parameter. At time $t = 0$, $H = 0$ and $a(0) = 2a_1$ with $\dot{H}(t) > 0$ in small neighborhood of $t = 0$. Therefore, the above scale factor satisfies necessary conditions for a non-singular bounce. With the above scale factor, we have $\ddot{a} > 0$ before and after the bounce. [36-37].

To realize the bounce in our model, let we obtain the values of ρ , $\rho + p$, $\rho - p$ and $\rho + 4p$ for $m = 2$.

$$\rho = (5.76)\alpha^2 \frac{(e^{at} - e^{-at})^2}{(e^{at} + e^{-at})^2},$$

$$\rho + p = (4.32)\alpha^2 \frac{(e^{at} - e^{-at})^2}{(e^{at} + e^{-at})^2} - (2.5)\alpha^2,$$

$$\rho - p = (7.2)\alpha^2 \frac{(e^{at} - e^{-at})^2}{(e^{at} + e^{-at})^2} + (2.4)\alpha^2,$$

$$\rho + 4p = (3.84)\alpha^2 \frac{(e^{at} - e^{-at})^2}{(e^{at} + e^{-at})^2} - (9.6)\alpha^2.$$

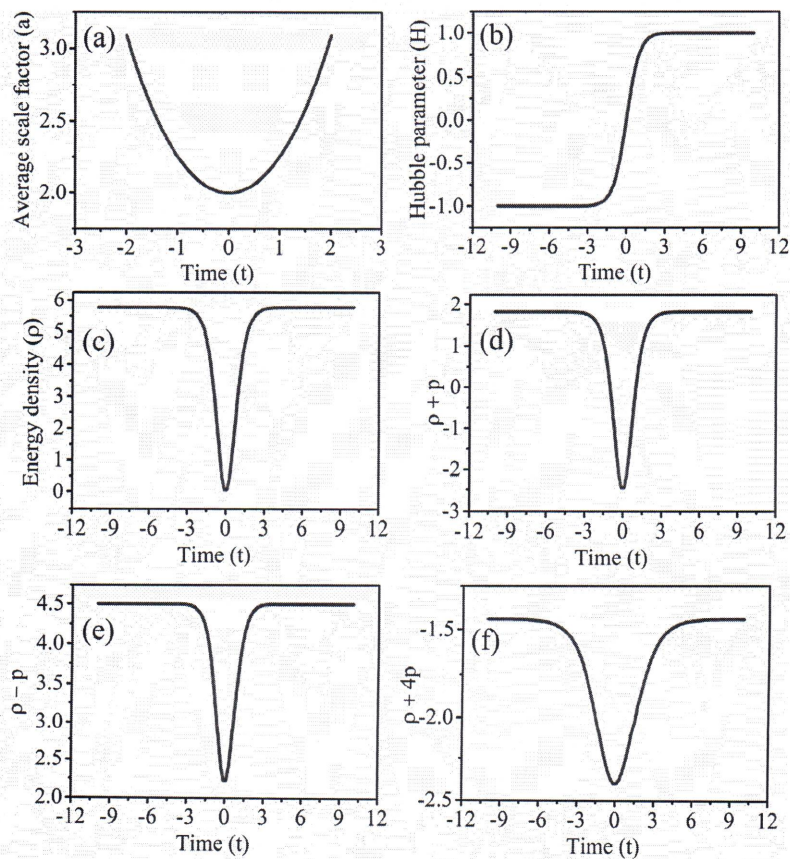


Fig. 5.2 (a), (b), (c), (d), (e), (f) represents the plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho + p$ (e) $\rho - p$ (f) $\rho + 4p$ for the values of constants $\alpha = 0.5$ and $a_1 = 1$.



Figs. (5.2) (c), (d), (e) and (f) are the plots of time versus energy density (ρ), $\rho + p$, $\rho - p$ and $\rho + 3p$. It is observed that WEC, NEC and DEC energy conditions are satisfied at $t=0$ but SEC is violated at $t=0$. Hence, the bounce is realized in our model at $m=2$.

As an example of viscous fluid realizing bounce scenario, we take $\gamma = -1$ and bulk viscosity is given by

$$B(a, H, \dot{H}, \dots) = 4H\zeta, \quad (\zeta \text{ being coefficient of bulk viscosity}), \text{ we have}$$

$$p = -\rho + 4H\zeta, \quad (55)$$

From equation (51), we have

$$4H\zeta = \frac{12(5m-1)H^2}{(m+3)} - \frac{12\alpha^2}{(m+3)}$$

Dividing by $4H$

$$\zeta(H) = \frac{3(5m-1)H}{(m+3)^2} - \frac{3\alpha^2}{(m+3)H}. \quad (56)$$

As another example, we take $\gamma(\rho) = \gamma = (\text{constant})$ and $B(a, H, \dot{H}, \dots) = 4H\zeta$ with $\zeta = \epsilon\rho$, where ϵ is a constant.

From equation (9), we have

$$\dot{\rho} = -4H(\rho + p).$$

Using equation (3) we get,

$$\dot{\rho} = -4H(\gamma(\rho)\rho - B(a, H, \dot{H}, \dots)).$$

Since, $\zeta = \epsilon\rho$ and $B(a, H, \dot{H}, \dots) = 4H\zeta$, we have

$$\rho = \frac{a_1}{(a_0^2 + \beta^2 t^2)^{\frac{3(1+\gamma-\epsilon)}{2}}}, \quad (57)$$

where, ρ_0 is a constant.

Also, from equation (3) we get

$$p = \gamma(\rho)\rho - B(a, H, \dot{H}, \dots). \quad (58)$$

Using $\gamma(\rho) = \gamma = \text{constant}$ and $B(a, H, \dot{H}, \dots) = 4H\zeta$, we get

$$p = (\gamma - 4H\epsilon)\rho.$$

Therefore, the scenario with $\gamma = \text{constant}$, $\zeta = \epsilon\rho$, the energy density of bouncing universe will decrease with increasing time (provided $1 + \gamma > \epsilon$).

6. Conclusion

Kaluza-Klein cosmological model has investigated with viscous fluid by considering two specific forms of the scale factors proposed by Morris & Thorne [22] and Bamba *et al.* [1]. In



both the cases, we have realized the bounce behavior of the model. The bounce behavior has been proposed as an alternatives scenario for the Big Bang. Our investigation has taken into consideration necessity to have an acceleration after the bounce in the context inflation.

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Production and Characterization of Metalloenzyme Protease from *Bacillus* Sp.

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Abstract:

The bacterium was Gram positive, aerobic, motile, sporulating and rod-shaped bacterium and optimal growth temperature was found to be 37°C. The cells were able to grow well at a pH range of 8-10 which indicate that *Bacillus* sp DS2 was alkaliphilic. The protease exhibited its optimal activity at 90°C and optimum pH 10.5. The enzyme activity was enhanced by Ethanol, Methanol, Chloroform, Benzene, Hexane, Propanol, Acetone, Xylene and Acetic acid. However, the protease activity was inhibited by Ethyl acetate. The optimum protease activity was enhanced in presence Chloroform (208.07%). The enzyme activity has enhanced by FeCl₃, BaCl₂ and CaCl₂ and optimum enhanced by MgCl₂ indicating it was a metalloenzyme with a potential to be a candidate for the biotechnological potential.

(Key words: Lonar Lake, Alkaliphiles, *Bacillus*, Protease)

INTRODUCTION

Generally the most concentrated and widespread occurrence of the microorganism is observed in moderate environments. It has been believed that there are extreme environment on the earth which was thought to be the controversial about the existence of life. In this habitat, environmental condition such as pH, temperature and salinity concentration are extremely high or low. Extreme environments are a populated groups of organisms that are specifically adapted to these extreme conditions and these types of microorganism are usually referred as alkaliphiles, halophiles and thermophiles which are reflected the extreme environment (Horikoshii and Akiba, 1982).

The high alkaline condition which accesses naturally or artificially on the basis of extreme condition is referred to as alkaline environments and bacteria survive in this environment is called as alkaliphiles. In the naturally occurring alkaline environments, soda Lake are the most stable with pH values generally higher than 10 and occasionally reaching at 12 (Jones *et al.*, 1998). These alkaline environments are naturally made by a combination of geological, geographical and climatic conditions (Grant and Tindall, 1980). At the time of alkalinity formation, other salts also accumulate, giving rise to haloalkaliphilic environment in which the native microflora is

subjected to a number of extreme ecological pressure (Joshi *et al.*, 2007; Wani *et al.*, 2006).

The microbial diversity of saline lakes has been studied primarily acting on the isolation and characterization of organisms with biotechnological potential (Horikoshi 1999; Jones *et al.* 1998). Martin *et al.* (2001) were found both alkali tolerant and obligate alkaliphiles were found and identified by phylogenetic analysis as the microbial species found in Ethiopian soda lake microbial population and known for being good enzyme producers. As far as Indian soda lakes are concerned, a culture-dependent approach has not been yet applied to analyze bacterial diversity and alkaliphilic protease producing microorganisms isolated from Lonar Lake (Joshi *et al.* 2007). In view of the above facts, the present study focused on the optimization of alkaline protease production from a haloalkaliphilic bacterial strain isolated from Indian Soda Lake.

MATERIALS AND METHODS

Isolation of Alkaliphiles:

The 1.0 g of soil sample was transferred to 100 ml sterilized distilled water in 250 ml conical flask and agitated (200 rpm) at 37°C for 15 min in shaker. The suspension was then diluted to 10⁻⁷ dilutions. One ml of each diluted sample was spread by spread plate technique into petri plates containing Horikoshii medium and nutrient agar medium (A, B, C and D) and inoculated at 37°C for 24 hrs (Tambekar and Dhundale, 2012)



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Screening of bacterial alkaliphiles:

Individual bacterial colonies were screened for proteolytic activities on Skim milk agar medium. The pH of the medium was adjusted to pH 10 with 1N NaOH before and after sterilization. The inoculated plates were incubated at 37°C for 48 hrs and observed for zones of clearance, indicating proteolytic activities.

Identification of the proteolytic isolates:

The bacterial isolates with prominent zones of clearance on casein agar medium were processed for identifications based on morphology, Gram characteristics, motility, oxidase, catalase tests and acid production from dextrose, fructose, sucrose, xylose, arabinose, maltose and mannitol. The isolates were also tested for their growth at different temperatures and pH. These isolates were identified in accordance with the methods recommended in Bergey's Manual of Determinative Bacteriology and Diagnostic Microbiology. The identified strains were maintained on nutrient agar slants having pH 10 at 4°C.

Preparation of crude enzyme extracts:

The 100 ml Casein nutrient broth (Casein 1gm, Peptone 0.5 gm, Yeast Extract 0.15 gm, Beef extract 0.15 gm, Sodium Chloride 0.5 gm, pH 10) was prepared. The sterile broth was inoculated with culture and incubated for 48 hrs at 37°C. After 48 hrs incubation, centrifugation of the broth at 5000 rpm for 15 min was carried out. The supernatant served as crude enzyme source.

Partial characterization of protease:

Partial characterization of protease from *Bacillus* species was carried out by effect of pH, temperature, substrate, enzyme, metal ions and organic solvents on alkaline protease activity was then measured as per assay procedure (Joo *et al*, 2002).

Effect of pH on alkaline protease activity:

The effect of pH on alkaline protease was determined by assaying the enzyme activity at different pH values ranging from 7.0 to 12.0 using the phosphate (PO₄) buffer systems with concentration of buffer as 0.2 M. The activity of the protease was then measured as per assay procedure.

Effect of temperature on alkaline protease activity:

The effect of temperature on alkaline protease activity was determined by incubating the reaction mixture (pH 10) for 10 min at different temperature ranging from 35°C to 100°C. The activity of the protease was then measured as per assay procedure.

Effect of substrate concentration on alkaline protease activity:

The effect of substrate concentration on alkaline protease activity was determined by incubating the reaction mixture for 10 minutes with different substrate concentration, ranging from 0.5 mg/ml to 5 mg/ml. The activity of the protease was then measured as per assay procedure.

Effect of enzyme concentration on alkaline protease activity:

The effect of enzyme concentration on alkaline protease activity was determined by incubating the reaction mixture (pH 10) for 10 minutes at different enzyme concentration ranging from 0.5 ml to 5 ml. The activity of the protease was then measured as per assay procedure.

Effect of different metal ions on protease activity:

The effect of different metal ions on alkaline protease activity was determined. The enzyme assay was performed in the reaction mixture as described above in the presence of various metal ions at a final concentration of 1 mM. The activity of the enzyme without any additives was taken as 100 %. The influence of various metal ions such as Potassium chloride, Sodium chloride, Ferric chloride, Barium chloride, Cupric chloride and Magnesium chloride (1 mM each) on protease activity was studied by pre-incubating the enzyme with the compounds for 15 min at 37°C. Then, the remaining activity was measured under the enzyme assay conditions.

Organic solvent stability of the protease:

Stability of the protease enzyme was determined in the presence of various organic solvents such as Ethanol, Methanol, Chloroform, Benzene, Hexane, Propanol, Acetone, Ethyl acetate, Xylene and Acetic acid (10 mM each). 0.25 ml of organic solvent was added to 1 ml of the protease solution in a 1.5 ml micro centrifuge tube with a screw cap. The mixture was shaken at 150 rpm for 100 min at 37 °C. Then, the remaining activity was measured under the enzyme assay conditions.

RESULTS AND DISCUSSION:**Screening of bacterial isolates, identifications and characterization of bacterial cultures:**

In the present study, total one hundred and fourteen isolates obtained in the isolation exercise from different sediment samples and water samples of Lonar Lake. Out of one hundred and fourteen, thirty two bacterial cultures were found with proteolytic activity. All the bacterial strains were found alkaliphilic (7-12). The selected



isolates were studied morphologically and biochemically. According to Bergey's Manual of Systematic Bacteriology, the isolates were identified as *Bacillus* sp. All the bacterial cultures were found gram positive and spore forming bacilli. Out of these thirty two, one bacterial culture was selected for the further production and characterizations on the basis of their maximum proteolytic activity of *Bacillus* sp. DS-2.

Effect of pH on activity of enzyme protease:

The effect of pH on protease activity of *Bacillus* sp. DS-2 was determined by incubating the enzyme in different pH buffers ranging from 7.0-12.0 for 10 minutes at 37° C. The optimum pH of *Bacillus* sp. DS-2 protease was found to be 10.5. The enzyme was active between pH ranging from 10-12. Protease activity was relatively low at pH 7, 8 and 9; the enzyme has relative activities found to be 58.82%, 64.71% and 76.47% respectively. The optimum activity of this enzyme was at pH 10.5 with 2.83 Units/ml, which considered as 100%. Earlier studies have shown that proteases were active up to the pH of 5-10. It is comparatively less and the enzyme of *Bacillus* sp. DS-2 strain has still wider ranges of tolerances than the previously reported for proteases.

Effect of temperature on activity of enzyme protease:

Influence of temperature on *Bacillus* sp. DS-2 protease activity was observed by incubating the enzyme at different temperature ranging from 35-100°C and residual activity were determined under enzyme assay condition. The optimum activity of enzyme was taken as 100%. The temperature profile of protease activity of *Bacillus* sp. DS-2 were showed maximal enzymatic activity of 1 Unit/ml (100%) at 90°C, which indicated that the enzyme was thermostable at high temperature. The protease retained more than 75% of the highest activity between 70-80°C. Subsequently, the enzyme activity progressively decreased at 100°C. While the proteolytic activity of the crude supernatant was thermo sensitive at 80°C and high activity was detected at 90°C.

Effect of substrate concentration on activity of enzyme protease:

The influence of different concentrations of substrate was assayed ranging from 0.5-9 ml under constant assay conditions. The activity at 7.5 ml of substrate concentration was 2.33 Units/ml and it was considered as 100%. However, the activity was retained more than 75%

with the substrate concentration from 4.5-7 ml. There was very less activity at 0.5 ml of substrate concentration (0.25 Units/ml).

Effect of enzyme concentration on activity of enzyme protease:

The effects of different enzyme concentrations ranging from 0.5-9 ml was carried out under assay conditions. The enzyme shows maximum enzymatic activity (6.25 Units/ml) at 7.5 ml of enzyme concentration and it was considered as 100%. The activity of protease decreases as the enzyme concentration increases more than 8 ml. There was very less activity at 0.5 ml of enzyme concentration (0.17 Units/ml).

Table 1: Composition of Skim milk Agar

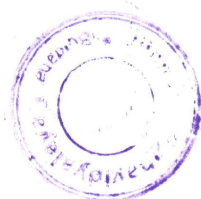
Nutrient	Quantity
Casein	1.0 gm
Peptone	0.5 gm
Yeast extract	0.15 gm
Beef extract	0.15 gm
Sodium chloride	0.5 gm
Agar – agar	2.0 gm
D.W.	100ml
pH	10

Influence of different metal ions on activity of enzyme protease:

Table 2 : Effect of different metal ions on activity of enzyme protease

Metal ions	Relative activity (%)
Control	100
KCl	183.33
NaCl	175
FeCl ₃	125
BaCl ₂	275
CaCl ₂	133.33
MgCl ₂	341.67

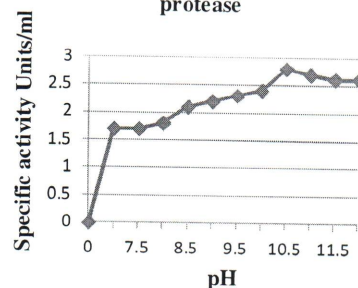
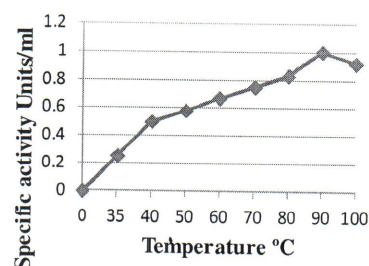
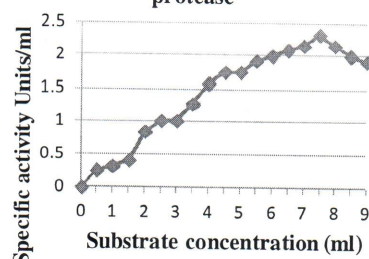
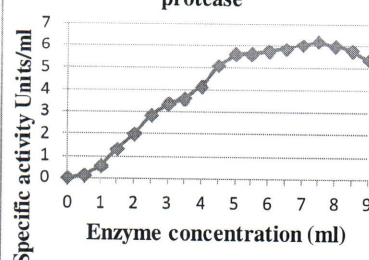
The influence of different metal ions on activity of *Bacillus* sp. DS-2 protease was carried out under the assay conditions. Metal ions have different effects on activity of protease. The enzyme activity without any additives was taken as 100%. The enzyme activity was enhanced by KCl, NaCl, FeCl₃, BaCl₂, CaCl₂ and MgCl₂. The optimum protease activity (341.67%) was enhanced in presence of MgCl₂. The enzyme activity has enhanced by KCl, NaCl, FeCl₃, BaCl₂ and CaCl₂, these activity indicating it was a metalloenzyme. The dissimilar results obtained from bacterium L21, protease enzyme retained 93% of its activity after 1 h of incubation with EDTA and was completely inhibited by 0.01 M PMSF (Genckal and Tari, 2006).



Influence**of various organic solvents on activity of enzyme protease:**

Organic solvents	Relative activity (%)
Control	100
Ethanol	175.81
Methanol	127.42
Chloroform	208.07
Benzene	188.71
Hexane	198.39
Propanol	101.61
Acetone	106.45
Ethyl acetate	95.16
Xylene	125.81
Acetic acid	109.68

The effect of organic solvents on the activity of *Bacillus* sp. DS-2protease was determined. Organic solvents have different effects on activity of protease. The enzyme activity without any additives was taken as 100%. The enzyme activity was enhanced by Ethanol, Methanol, Chloroform, Benzene, Hexane, Propanol, Acetone, Xylene and Acetic acid. However, the protease activity was inhibited by Ethyl acetate. The optimum protease activity (208.07%) was enhanced in presence Chloroform.

Fig 1: Effect of pH on activity of protease**Fig 2 : Effect of temperature on activity of protease****Fig 3 : Effect of substrate concentration on activity of protease****Fig 4 : Effect of enzyme concentration on activity of protease**

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51. Quality in Higher Education in India and the Global Scenario

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Abstract:

The higher education in India is facing unprecedented challenges in the wake of Globalization and Privatization. With a considerable spread of education in the country, millions of young graduates are churned out every year from colleges and universities and standing in the unending queues for employments. Contrary to this the private service sector and industry is facing a great scarcity of suitable employable candidates and is in constant want of young graduates with desirable level of knowledge and skills fit for their purposes. In this way, there exists a kind of paradox about education and employment market. In the midst of these pressing demands from job market it is quite mandatory for all those involved in higher education to take initiatives to bridge the gap between academic knowledge and practical wisdom and employability skills of our graduates. Various regulatory and controlling bodies from union and state governments have taken initiatives in this respect. This paper attempts to touch upon certain key points in respect to enhancement of quality of higher education and employability of the students. A sincere effort is done to put forth for due discussion some measures pertaining to quality enhancement in the context of the global job market.

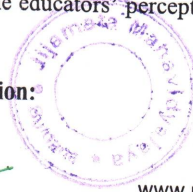
Introduction:

The higher education worldwide is at crossroads where the whole education system is called upon to rethink and redefine its motives and invent for it better tools to meet the rapidly changing demands of the new hi-tech universe. At present 'globally, 73 million young people are looking for work. Yet, millions of vacancies remain unfilled. In May 2015, five million posts were in the US while more than eight million were looking for jobs there'¹. The statistics offer a grim picture of the world job market. Universities around the world are producing qualified young graduates but employers say there is an acute shortage of skilled workers. For employers, a college or university degree and certification is no longer the only criterion that counts. So the question arises what "quality" are employers really looking for? What is their definition of employability? And what are the educators' perceptions of the quality in higher education?

Conceptualizing Quality in Higher Education:

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Quality, as a measure of level of standards and degree of excellence in anything, calls attention to certain desirables so far unattained. In fact, it is rather difficult to define the quality in educational institutions. Such measures in education naturally differ from industry and other service sector. In an educational institute quality implies a quite different set of desirables assuring the expected out-put at all levels- individual, social, national and universal. University Grants Commission and National Assessment and Accreditation Council have laid down various norms and measuring tools for the quality of HEIs across the country. Their initiatives so far have reaped really appreciable results in creating awareness about quality in all respects in the education institutions and the stakeholders at large. However, the traditional determiners of quality like internal resources, learning infrastructure, rich libraries, good passing percentage of students, research output of the faculty etc. are found no more useful in the new scenario.

Shifting Paradigms:

The UGC has acknowledged, quite in time, the need to emphasize vocational education and industry training when it published its 12th Five-Year-Plan in November 2011. The Chapter 8 'Vocationalisation of Higher Education' states -

'Complaints are often heard that universities are not sufficiently vocational. In particular, that educated university graduates do not fit easily into the developmental activities of the state and the society; the courses that are taught are not relevant to the requirements of the productive sector.'²

The Government, on its part, has increased the budgetary provisions during recent decade for implementation of several technology initiatives like National Mission for Education through ICT (NMEICT), National Programme on Technology Enhanced Learning (NPTEL), National Knowledge Network (NKN) and establishment of new Model Degree Colleges in educationally backward districts (EBDs). As a result of extensive incorporation of ICT enabled learning resources '(T)he Indian higher education system has undergone a massive expansion to become the largest in the world enrolling over 70 students. Such expansion would have been unimaginable without the extensive use of ICT tools. ...Online platforms and ICT tools have helped take higher education to millions of deserving students in far-flung areas who would otherwise have no access to university education.'³

Therefore, a new set of quality measures are to be applied to assess the quality of the academic output of the colleges and universities in terms of 'Skills and Competencies' developed by students through the courses offered. The modern global job market and world of trade and commerce expect these developed competencies which need to be addressed in the curricula of the degrees.

At the same time, an assured and set mechanism to monitor and execute it with an expected 'Academic Excellence' acquires more importance as a measure of quality in higher education. Each factor involved in the field need to acknowledge it and make collaborative efforts to achieve this academic excellence.



Increased 'Participation of Students' in the quality management systems of may help the education institutions improve their quality and make them more and more transparent and student oriented.

A newly initiated and more specific tool of quality assessment is stakeholders' feedback. The National Assessment and Accreditation Council, in its new methodology, has introduced 'students satisfaction survey' (SSS) to be carried out online for the more realistic and objective assessment of the institutional performance.

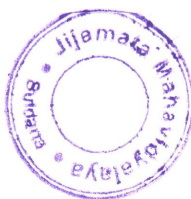
Other quality measures like ISO, QMS are equally desirable and may add to the quality of services provided to the stakeholders in the institutions of higher education.

Conclusion:

With added impetus of technology the Indian higher education is rapidly expanding itself. The National Assessment and Accreditation Council have adopted many new quantitative and qualitative metrics in their revised assessment and accreditation methodology. This is a more welcome move in motivating and leading the higher education institutions in the country towards raised quality standards and thereby achieve the national goal of creating not only more skilled and globally employable graduates but inspired entrepreneurs too.

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आकांक्षा..... नवी दिशा आणि आव्हाने

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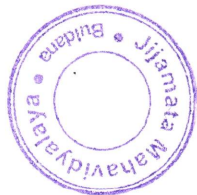
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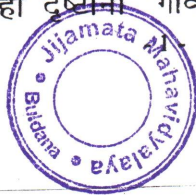


१. गावगाडा शतकानंतर : एक आकलन

प्रा. डॉ. अनंत सिरसाट
मराठी विभाग प्रमुख
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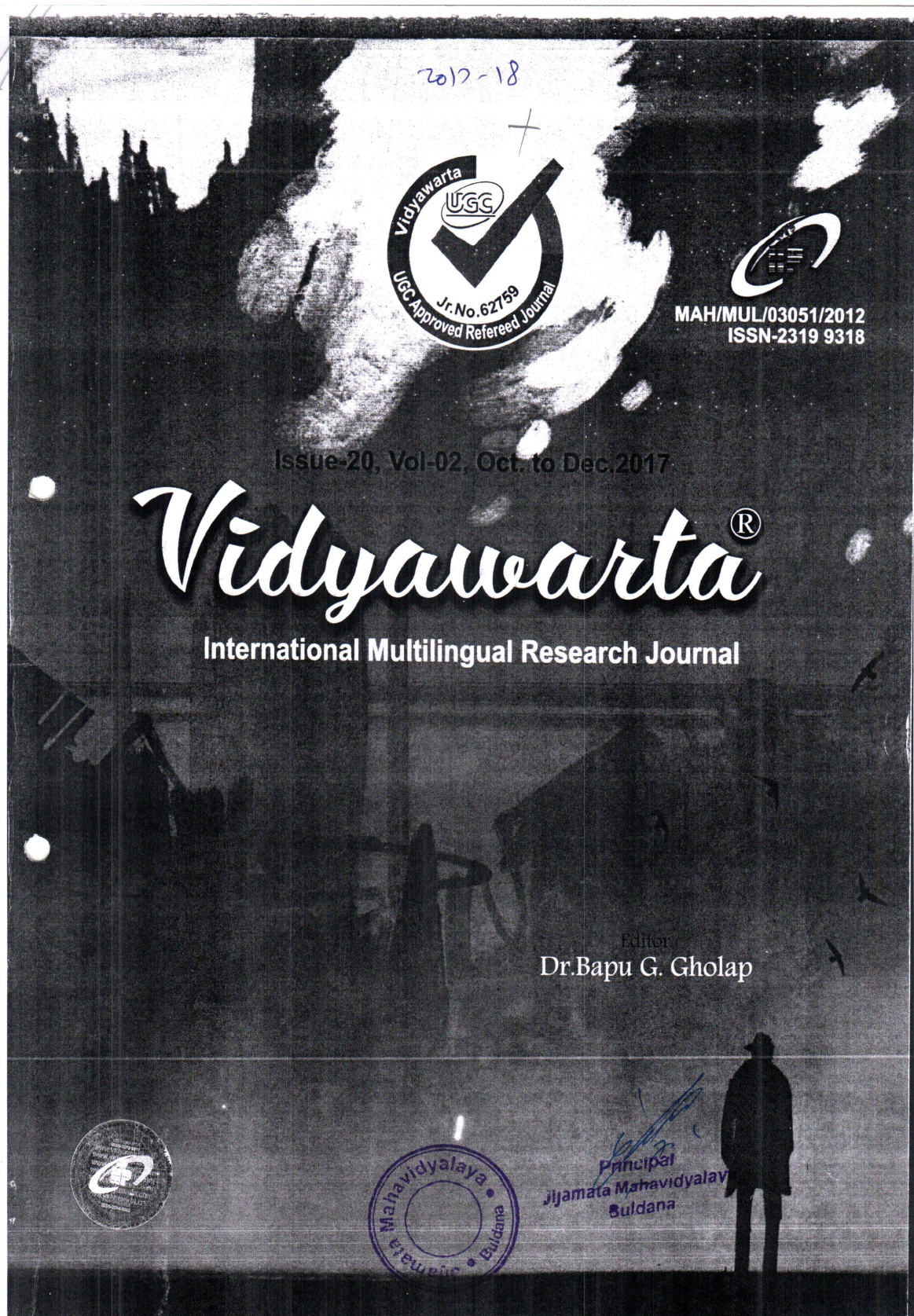
त्रिं. ना. आत्रे लिखित गावगाडा :

आपल्या कृषीप्रधान देशात 'गांव—गाडा' या एका शब्दात प्राचीनकाळी संपूर्ण भारतीय समाजव्यवस्था सामावलेली होती. गाव—गाड्याविषयी, कृषिजन संस्कृतीविषयी इत्यंभूत माहिती देणारे सर्वोत्कृष्ट साधन म्हणजे त्रिंबक नारायण आत्रे यांनी १९१५ साली लिहिलेले 'गांव—गाडा' हे पुस्तक होय. या पुस्तकातून ग्रामीण अर्थव्यवस्था, ग्रामीण माणसाचे जगणे समूर्त साकार होते. आत्रे लिहितात, "खेडे म्हटले की, पांढरीच्या अगोदर चटकन काळीव डोळ्यापुढे उभी राहते. शेते, पिके, गवत, झाडे, गुरेढोरे, शेळया—मेंढ्या, मेंढके, शेतकरी, गुराखे, पाट, भुडक्या, विहीरी, नांगर, कुळव, मोट, माळा, गोफण वगैरे बळिराजाचे वैभव. खेड्याचे नाव काढताच इतके मन व्यापून टाकते की, खेड्यात शेती खेरीज दुसरा रोजगार चालत असेल किंवा शेतकऱ्यांखेरीज दुसरे कोणी राहत असेल, असे एकाएकी मनातदेखील येत नाही"१ आत्रे यांनी 'शेतीची अर्थव्यवस्था' हा ग्रामरचनेचा कणा मानून गांव—गाड्याचे तपशीलवार वर्णन केले आहे. गावाचे स्वायत्त, स्वयंसिद्ध प्रशासन, बलुतेदारी, वतनपद्धती आणितत्कालीन गावगाड्याची कोसळू लागलेली अवस्था यांची साधार सप्रमाण चिकित्सा या पुस्तकात केली आहे. मिलिंद बोकील लिहितात, "माणसांनी एकमेकांशी आपलेपणाने, समतेने, बंधुभावाने राहावे, ही आत्रे यांची धारणा आहे. ही धारणा कोणा एका काळाशी किंवा प्रदेशाशी निगडीत नाही. सगळ्या मानवजातीसाठी सार्वकालिक आवश्यक अशी ती धारणा आहे. अशी धारणा जो मनाशी जपतो त्याच्या लिखाणाला एक वेगळेच मोल प्राप्त होते. आत्रे यांच्या लिखाणाला तसे मोल प्राप्त झाले आहे." माहिती, विश्लेषण आणि भाषा या तिन्ही दृष्टींनी 'गावगाडा' हा मराठीतला अद्वितीय



प्रमुख
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06

Impact of GST on Various Sectors in India

Suresh Namdeo Gawai

Associate Professor in Commerce
Jijamata Mahavidyalaya, Buldana

Introduction:

GST is destination-based consumption tax levied at multiple stages of production and distribution of goods and services. It combines various other taxes such as state and local tax, entertainment tax, excise duty, surcharges, octroi and others. The tax is applicable on transaction value which includes packaging, commission and other expenses incurred during sales. It allows full tax credit from inputs and capital goods on procurement which can later be set off against the GST output liability.

A salient feature of GST would be that goods and services are considered alike and within the supply chain, they are taxed at a flat single rate till the customers can access them. The tax reform thus gives equal footing to large enterprises and SMEs and taxes the stock transfers uniformly.

Another salient feature of the GST rollout in India is that it will be dual based—that is, both center and various state governments will levy GST separately. The central government will levy CGST and the state governments will levy SGST respectively. However, the basis for classification of taxes, measure of levy and chargeability of taxes will be same for both. This is necessary keeping in mind the federal structure of the government, provided the governments at both levels have the liberty to administer their own taxes. In addition, GST will be levied on import of goods and services into India.

Another key feature of GST that needs mention is the elimination of the cascading effect of various state and central taxes. State taxes that will be subsumed with in the GST are VAT, entertainment tax, entry tax, luxury tax, tax on betting and gambling. Various central taxes that will be subsumed are Central Excise Duty, Additional Excise Duty, Service tax, Additional Custom Duty, Special Additional Duty and Central Sales tax.

Positive Impact of GST on SMEs and Startups As per industry experts, SMEs and startups will be affected the most with the rollout of the GST and the impact will be favorable in ways more than one. Some of the ways GST will benefit SMEs and startups are:

- **Ease of starting business:** A business having operations across different state needs VAT registration. Different tax rules in different states only add to the complications and incur high procedural fees. GST enables a centralized registration that will make starting a business easier and the consequent expansion an added advantage for SMEs.
- **Reduction of tax burden on new business:** As per the current tax structure, businesses with a turnover of more than rupees 5 lakh need to pay a VAT registration fee. The government mulls the exemption limit under GST to twenty five lakh giving relief to over 60% of small dealers and traders.
- **Improved logistics and faster delivery of services:** Under the GST bill, no entry tax will be charged for goods manufactured or sold in any part of India. As a result, delivery of goods at interstate points and toll check posts will be expedited. According to an estimate by CRISIL, the logistics cost for manufacturers of bulk goods will get reduced significantly—by about 20%. This is expected to boost ecommerce across the nation.
- **Elimination of distinction between goods and services:** GST ensures that there is no ambiguity between goods and services. This

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will simplify various legal proceedings related to the packaged products. As a result, there will no longer be a distinction between the material and the service component, which will greatly reduce tax evasion.

• **Impact on Manufacturing Sector**

• According to Deskera, a leading cloud-based business management software provider catering to SMEs in South East Asia, the GST will enhance competitiveness of enterprises in the manufacturing sector by mainly mitigating the cascading effect of various taxes. Headquartered in Singapore, the company offers GST ready Enterprise Resource planning software to global SME markets, with small and medium enterprises contributing over 70% of the company's business across the world. A prominent provider of cloud ERP solutions, Deskera has been extensively working with various organizations in countries such as Singapore and Malaysia with their GST requirements. The company offers Deskera MRP, a fully GST compliant MRP solution in India to help manufacturers and traders to seamlessly migrate to the new regime once the GST law is implemented across the nation.

• India is a global manufacturing hub and SMEs form around 90% of the industrial units in the country, according to IBEF. The 'Make In India' campaign promoted by the Indian government will get a boost with the rollout of the GST. Currently, excise duty on pre-packaged products for retail consumption is levied not on the transaction value at the ex-factory but on a fixed percentage of the maximum retail price (MRP) on the package. This leads to a higher MRP, which indicates a higher cost burden for the consumers. Under the GST regime, tax is paid by the manufacturers while purchasing raw materials for the products. The amount can be credited for subsequent resellers till the product reaches the final consumer. This will ease the tax burden significantly. Read Deskera becomes the first GST compliant cloud-based enterprise

in India to know more about GST impact on manufacturing sector.

• **GST Impact on Banking Sector**

• **Positive Impact**

• Public and private banking industry is the reflection of mixed economy. After GST implementation, increase in credit pool is witnessed due to availability of GST credits on purchase of goods. Also, banks witness a rise in operating expenses from this.

• **Negative Impact**

• The banking sector's net tax rate is 14% and by the effect of GST, the rate increased from 18% to 20%. The effective tax rate for free-based services at banks raised to 18% from the 15%. This moderately increased costs for loan processing and credit card charges. For every transaction in GST, the bank needs to determine the place of consumption where GST will be paid.

• **GST Impact on Manufacturing Sector**

• **Positive Impact**

• The manufacturing sector endures to gain more than losing with the GST implementation of India. Overall reduction in the cascading effect of taxes should have a positive impact on the price of manufactured products. Read to know more about Impact of GST on Indian Manufacturing.

• **Negative Impact**

• Concerns still arise on specific issues such as the additional 1% original tax, increased cash flow issues and increased costs owing to exclusion of petroleum fuels from the GST realm. Although Input Tax Credit will be available to be claimed but its realization will only occur once the final supply is concluded. This impacts manufacturing segment due to disruptions in cash flow.

• **GST Impact on Logistics**

• **Positive Impact**

• The priority for Layered Service Provider (LSP) has remained on tax and administration optimization, mostly compromising on achieving

higher operational efficiency through structured large warehouses planned in centralized geographic locations that gives better connectivity. FMCGs that are currently paying around 24-25% of tax, including excise duty, VAT, etc. will only shell out 17-19% with GST, therefore generating lot of potential for progress and open doors for investment in the industry. The border checkpoints reduce transport hassles and enable logistics companies to deliver goods more efficiently and optimize delivery time. This leads to a reduction in distribution costs by 10-15%, thereby lowering the final price of the goods.

- **Negative Impact**

- State-border checkpoints negatively impact the overall production and logistics time. This accounts for approximately 60% of a truck's transit time. These sterile transit hours coupled with regulatory impediments reduce the efficiency of Indian manufacturers compared to their international counterparts.

- GST Impact on Entertainment (5-Star Hotels, Casinos, Multiplexes and Cinemas)

- **Positive Impact**

- Well, the industry for sure doesn't see a positive impact with the highest tax rate of 28%. It is being said that this will directly hit the service provided.

- **Negative Impact**

- With the highest tax rate slab of 28%, the sector looks the most upset and says the government has probably categorized watching movies a 'sin'.

- **GST Impact on Banking Sector**

- **Positive Impact**

- Public and private banking industry is the reflection of mixed economy. After GST implementation, increase in credit pool is witnessed due to availability of GST credits on purchase of goods. Also, banks witness a rise in operating expenses from this.

- **Negative Impact**

- The banking sector's net tax rate is 14%

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GST Benefits for Businesses and Industries

- **Reduce hassle and expense:** Not only, GST replaces various indirect taxes, the new system also makes it easier for businessmen to pay taxes. Currently, a businessman has to pay various taxes, file returns and reply for the scrutiny. The GST would put an end to all these hassles in tax payment. There would be an

advanced IT platform for the GST. It makes the entire system of GST payment and return filing

easy and transparent.

- **One GST rate and one mechanism:** GST ensures that all indirect tax rates are uniform and a product has one GST rate across the country. Hence the tax rate won't vary from state to state.
- **No overlapping of taxes:** If a product is produced and sold to the consumer, there would be a single indirect tax. There is no overlapping of taxes. As a result, seamless 'tax-credits' occurs which reduces any hidden cost in doing business.
- **GST improves competitiveness:** GST ensures significant reduction in transaction costs of doing business and hence increases competitiveness for trade and industries. The GST would help those businesses which have been paying right taxes. Since GST would greatly reduce the tax evasion, the goods business will become more competitive.

Conclusion The GST is a landmark amendment in the indirect tax regime in India that attempts to kill multiple birds with one stone. Designed to avoid the cascading of taxes, it implements a smoother tax structure in order to encourage better tax compliance. The important rule of GST is destination-based taxation that aims to subsume various existing indirect taxes like the excise duty, service tax, countervailing duty, etc. at the Central level and Value Added Tax (VAT), Octroi tax, Purchase tax, etc. at the state level. The GST is a landmark amendment in the indirect tax regime in India that attempts to kill multiple birds with one stone. Designed to avoid the cascading of taxes, it implements a smoother tax structure in order to encourage better tax compliance. The important rule of GST is destination-based taxation that aims to subsume various existing indirect taxes like the excise duty, service tax, countervailing duty, etc. at the Central level and Value Added Tax (VAT), Octroi tax, Purchase tax, etc. at the state level.

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- <http://www.deskera.in>
- www.google.co.in



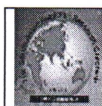
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Indian Diaspora: An Overview

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Abstract:

The phenomenon of diaspora, with its roots in the Old Testament and its obvious connotations to the Jewish expulsion, has assumed today altogether a new form and features. After a long ongoing debate and controversies and having a number of definitions and theories the diaspora studies remain one of the most intimate concerns for every individual living today. The experiences of migrancy and life of exile feature in the writings of immigrant writers of all countries. Indian immigrant writers too have given vent to their lived experiences in their literature portraying the diasporic lives in the new lands of adaptation and settlement. Indian diaspora counts to be the second largest overseas community in the world and Indian diaspora writers too have brought laurels by merit of their excellent writings- creative and critical- on various aspects of diaspora.

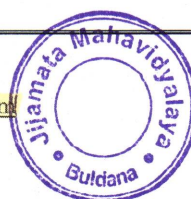
Key words: diaspora, Indian diaspora, exile, migration, immigrant.

Introduction:

The phenomenon of human migration is centuries old and has been noted in the annals of all human histories. People leaving their homelands and settling in the foreign lands are to be found in histories, however, this leaving has not always been voluntary but often forced and traumatic caused due to expulsions or banishments. The settlement of migrant groups in the new lands form diasporas with its members having a shared history, common language, religious and ethnic similarities and believing in a common land of origin or homeland. This Diaspora, with its different connotations and theoretical perceptions, has engaged the thinkers and scholars of most varied fields like Economics, Sociology, International Politics, Literature and many others for several decades. Apart from its mention in the Old Testament and obvious allusions to the Jewish experience of dispersal, the term diaspora has been defined and redefined over and again by modern critics in the context of the globalization and post-globalization world scenario. Twenty First Century has been remarkable for the sweeping tide of globalization accelerated by the ultra-modern hi-

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speed communication and transportation technologies. This has also opened up new avenues of opportunities for the people all around the world setting them on move in search of better prospects. Stepping out of the state territories and freeing themselves from nation-states these globe trotters have ventured on creating a new world- a curious amalgamation of languages, cultures, traditions, religions, ethnicities and identities hitherto unimagined. However, this phenomenon has not been much smoother and simple but rather it has deeply affected more than a generation of these travelers influencing every aspect of their lives, both at home and abroad.

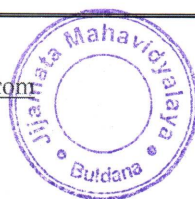
Indian Diaspora:

Emigration from India and the subcontinent has taken place through centuries due to a variety of reasons. During the British colonial period a large number of indentured labourers were taken to various places as per the colonial needs by the owners of sugarcane plantations and other industries. Many of these bonded labourers settled at their workplaces permanently as there were no means of return. Also sometimes returning to homes was impossible due to circumstances or sometimes meaningless as they had nothing to live upon in the homelands. However, in later period some Western educated Indians immigrated to the developed countries of Europe and America either for further academic pursuits or to grab some better opportunities in careers. The number of this type of emigrants was very less during the colonial period which increased tremendously after Indian independence. The scholars of Indian diaspora studies have identified different trends of migration and proposed a division of the history of the Indian diaspora in three phases. This division is not based only on the time period but also on the reasons for the migration.

First Phase: It began at the end of the 19th century during the British colonization with the movements of Indians in search of wages. Many Indians shifted from their native places to the British colonies for work and wages as labourers on the sugarcane plantations or railroad constructions.

Second Phase: It is noted during the mid-20th century with the migration of the people from Indian sub-continent to European countries in order to get good education and economic development.

Third Phase: This phase includes the mass movements of people to the developed countries of Europe and America to seek higher education and more lucrative



employments and a better living. After mid-twentieth century this type of migration increased in quantity and frequency not limiting to single or twice but extending to multiple migrations and border crossings.

Jha and Naik in their book *Indian Diasporic Literature in English* (2014) have studied these migratory movements of Indians and divided them in following three stages:

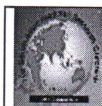
- a) The ancient and the medieval,
- b) The colonial, and
- c) The post-colonial phase (Jha and Naik 12).

In ancient times India had trade and religious exchanges with other ancient civilizations like the Greek and the Mesopotamian as well as during Buddhist time the religious thinkers and philosophers travelled to far south and southeast of Asia. During the British regime a large number of Indians moved outside her national territories for various reasons such as the unemployment among the deprived working class people on one hand and the growing demand of man power on plantations and factories on the other hand. This gave birth to the indentured labour system. After completion of the contract of indenture most of the labourers chose to continue their contracts and a few of them preferred to return to their homelands. These new settlers in the British colonies are the first emigrants and the first Diasporas.

The post-colonial phase, however, is entirely different in its causes and nature. In post-independence India a class of newly educated and skilled youths emerged who was looking forward for better employments. However, the country didn't have sufficient employments for this newly emerging class of youths. As a result, they looked at the developed countries in Europe and America for better career opportunities.

In a situation dominated by underemployment and unemployment, the prospective migrants were attracted with available opportunities abroad. This led to a kind of professional migration, often termed as 'brain drain', facilitated with the rapid transformations in the transformation and communication (Jha and Naik 16).

With a considerable spread of educational opportunities in India during 1980s and 1990s the number of graduates from science and technology streams kept increasing with every passing year. Other fields of opportunities like cinema, music, fashion, literature, education and other rapidly growing service sectors in the developed countries kept attracting eligible youths from all over the world. India has been the



largest country providing this new skilled and trained human resource since the dawn of the present century.

A long term or permanent settlements of the Indians immigrants abroad constitute what we term broadly as the Indian diaspora(s) worldwide. A recent UN Report on international immigration has stated that of all immigrants worldwide, Indians are the largest overseas community. The number of immigrants counts more that fifteen million residing in various countries in all continents of the world. The International Migration Report published by the United Nations too has noted that 'two thirds (67 per cent) of all international migrants were living in just twenty countries. The largest number of international migrants (50 million) resided in the United States of America' and 'India was the largest country of origin of international migrants counting as many as 17 million (UN Report, 2017).

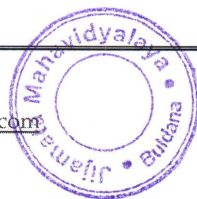
The Indian diaspora, however, is not a uniform and singular body of diaspora community as it is constituted by different ethnic groups having their own distinct social, religious and territorial orientations. These include diaspora groups like Bengali diaspora, Sikh diaspora, Telugu diaspora, Tamil diaspora, Sindhi diaspora, Gujarati diaspora etc. Indian culture at home has numerous regional languages, religions, castes and sub-castes, different cultural practices, rites and rituals and so on. As a result the Indian communities abroad also show the same diversity and yet look back at India as a common land of origin, the *Bharatmata*. As Latha Varadarajan has pointed out in her book *The Domestic Abroad: Diasporas in International Relations* (2010):

Rather it is socially as well as politically constructed through the interactions among members of a community, through their being marked as different in their host societies, and through the institutionalization of their relationship with the homeland (Varadarajan 9).

Yet what is most noteworthy about Indian diaspora is the fact that though all these diverse diaspora groups look at India as motherland, they envision not the whole country but their specific regions, languages and cultures as their 'homes' and 'roots'. This adds a curious and equally interesting hue and flavour to the Indian diaspora literature. Writers of Indian decent like Salman Rushdie, Rohinton Mistry, Chitra Banerjee Divakaruni, Uma Parameswaran, Bharati Mukherjee, Meena Alexander, Amitav Ghosh, Jhumpa Lahiri, Anita Rau Badami Anita Desai, Kiran Desai, Shauna Singh Baldwin, and others have all greatly contributed and enriched the corpus of

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diaspora literatures. Their literary output includes a variety of literary genres like fiction, drama, poetry, short stories, autobiographies and memoirs, and cinema.

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55. ENHANCING TEACHING-LEARNING BY ICT TOOLS, LMS AND E-RESOURCES

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Abstract: The main purpose of this article is to reflect significant changes in teaching and learning enhanced by constantly emerging new information and communication technologies (ICT). It also focuses on, how the use of Learning Management System (LMS) and e-resources has effect on altering common approaches to teaching and learning. It explores blended learning as a new methodology exploiting all the phenomena is examined. Besides that it also specifies several LMSs and e-resources that are useful to enhance the quality of teaching-learning process.

Introduction:

The use of information and communication technology (ICT) such as Internet applications, CD-ROMs, video technology and various computer attachments and software programs have caused many changes in society. These changes have not just been of a technical nature but more importantly of a structural nature. ICT are mostly useful for collection, recording, reserving, processing, researching, transfer & receipt of information led to teaching/ learning scope. By changing the computer software and hardware and information technologies there are some changes in teaching especially from instructor tendency into learner one with focusing on transactions, independency and self-learning of students. Only learning has changed by manner of learning and learning process out of applying of new information technology.

ICT Tools:

ICT tools and resources help to improve further relations, creation, distribution, reservation and information management. Educational ICT tools can be divided into 3 categories: Input source, Output source and others.

Input Source: Visualizer/ Document Camera, PC, Slate/Tablet, Application Software, Student response system.

Output Source: Projector, Interactive White Board, Display: Monitor, Tv, etc.

Other Source: Digital Camera, Digital Recorder, Switcher, other technology

Worldwide research has shown that ICT can lead to improved student learning and better teaching methods. Many reports proved that an increase in use of ICT tools in teaching-learning has a significant and positive impact on students achievement, especially in terms of



"Knowledge Comprehension", "Practical skill" and "Presentation skill" in subject areas such as Engineering technology, Science, and social study.

However, there are many education technology solutions provided in the world which may cause confusion among educators about how to choose the right ICT solution. Let's have a look at the advantages and disadvantages of ICT tools for education and discover what kind of education ICT solution is suitable to cater the needs.

Main advantages of ICT tools for teaching-learning:

1. Through ICT, images can easily be used in teaching and improving the retentive memory of students.
2. Through ICT, teachers can easily explain complex instructions and ensure students' comprehension.
3. Through ICT, teachers are able to create interactive classes and make the lessons more enjoyable, which could improve student attendance and concentration.

Main disadvantages of ICT tools for education are:

1. Setting up the devices can be very troublesome.
2. Too expensive to afford
3. Hard for teachers to use with a lack of experience using ICT tools

After considering the above points, it is easy to see that the visualiser/ document camera can be the most effective and efficient ICT tool for education. Because, Visualiser's/Document Camera's is Cost-Effective, Easy-To-Use, and Time-Saving. It decreases a teachers' preparation time, increases interactivity with students, and increases student concentration and comprehension of complex instructions.

Changes in Teaching and Learning Enhanced by ICT make Teaching and learning is becoming more: learner-centered, interactive, and mobile [20]. However, all the three characteristics require new learning approaches out which the best seems blended learning [20].

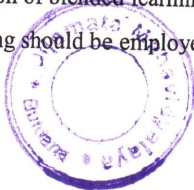
Blended Learning

As Sorden [20] states, blended learning is not a mere combination of face-to-face and online learning. It is a combination of training methodologies, which uses the best delivery method for the successful achievement of the learning objective[22]. It requires not only a flexible and experienced teacher/ tutor, but also a self-regulated/ autonomous learner [6].

Based on the literature review [9], there have been identified four main principles of the blended learning methodology so far:

- a thoughtful integration of face-to-face and fully online instructional components;
- innovative use of technology;
- reconceptualization of the learning paradigm; and
- sustained assessment and evaluation of blended learning.

The main reasons why blended learning should be employed in teaching is as follows:



- it contributes to pedagogy because it supports more interactive strategies, not only face-to-face teaching [10];
- it thus encourages collaborative learning; students or educators can work together on some projects from anywhere and at any time [2];
- it deepens intercultural awareness since it puts together researchers, educators, and students from anywhere in the world;
- it reduces costs of teaching and learning since students do not have to undertake so many frequent travels to complete their education [9]; and
- it might match student's learning style although there is no clear consensus on this issue [4][11][18].

However, there are also drawbacks of blended learning [3]. Blended learning is time-consuming and demanding in terms of creating materials and preparation and evaluation. Furthermore, both students and teachers sometimes have limited knowledge regarding the use of technology, and technical glitches are liable to happen at any moment. Finally, students' study skills are often not sufficiently developed to enable them to benefit maximally from blended learning.

Learning Management System (LMS):

A learning management system (LMS) is an application software for the administration, documentation, tracking, reporting and delivery of educational courses or training programs. They help the instructor deliver material to the students, administer tests and other assignments, track student progress, and manage record-keeping[12]. LMSs are focused on online learning delivery but support a range of uses, acting as a platform for fully online courses, as well as several hybrid forms, such as blended learning and flipped classrooms[5].

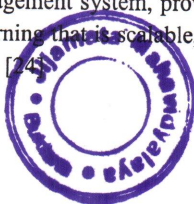
Most LMSs are web-based, to facilitate access. Most LMSs facilitates the teaching staff to:

- Manage basic subject administration such as announcements, class lists and group management
- Provide online versions of class materials and readings
- Offer extended content such as multimedia files
- Allow electronic submission of assignments
- Download, mark and return assignments and feedback
- Conduct online tests and surveys
- Offer students the opportunity to participate in online communication activities such as blogs, journals and wikis.

Some of the most popular LMS available are: Moodle, CANVAS, Edmodo, Blackboard, WizIQ Inc, etc.

Moodle LMS:

By 2012 and 2013, most learning management systems were qualified as Moodle LMSs. Moodle is a free online learning management system, providing educators around the world with an open source solution for e-learning that is scalable, customizable and secure with the largest selection of activities available. [24]



By 2014 and 2015, customizable LMSs were produced which provides users to create their personal learning environment, add/remove functions, store materials, and connect their database with social networks. The LMS providers also started producing mobile-friendly systems and dedicated apps for Android and iOS users [25].

During 2015-16, new type of LMS which are characterized by their modern user interface (UI) and user experience (UX) became more prominent. They include features, such as, gamification, personalization to specific companies, social integration and mobile ready feature sets.[23]

In 2017 and 2018, learning management systems are expected to become even more personalized, and to offer advanced functionality such as 3D learning.[18] Experts also agree that modern learning management systems will offer more collaborative and social features, and will be delivered exclusively as cloud-hosted services. It is expected that gamification will continue to increase in prominence as will virtual learning.

E-resources: Several Digital resources available as part of various MHRD supported programmes are:

1. **NPTEL** is a joint initiative of the IITs and IISc. NPTEL is an acronym for National Programme on Technology Enhanced Learning. The mission of NPTEL is to enhance the quality of Engineering education in the country by providing free online courseware. It offers E-learning through online Web and Video courses in Engineering, Science and humanities streams.
2. **Virtual Labs** – The major objective is to provide remote-access to Labs in various disciplines of Science and Engineering. This would help them in learning basic and advanced concepts through remote experimentation. These Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars.
3. **Spoken Tutorial** - An initiative of the National Mission on Education through ICT, launched by the Ministry of Human Resources and Development, Government of India. It is open source software that contains a variety of audio-video spoken tutorials freely available to learn by the users.
4. **The Consortium for Educational Communication (CEC)** - is one of the Inter University Centres set up by the University Grants Commission of India. It has been established with the goal of addressing the needs of Higher Education through the use of powerful medium of Television along with the appropriate use of emerging ICT.
5. **e-Yantra** - An initiative to incorporate Robotics into engineering education with the objective of engaging students and teachers through exciting hands-on application of math, computer science, and engineering principles
6. **e-ShodhSindhu** - Consortium for Higher Education Electronic Resources - Provides access to e-resources to Universities, Colleges and Centrally Funded Technical Institutions in India.e-
7. **E-Shodganga** is a reservoir of Indian Theses, available at INFLIBNET. It provides a platform for research students to deposit their Ph.D. theses and make it available to the



entire scholarly community in open access. The repository has the ability to capture, index, store, disseminate and preserve ETDs submitted by the researchers.

8. FOSSEE (Free and Open Software in Education) - A project promotes the use of FOSS tools to improve the quality of education in our country. It aims to reduce dependency on proprietary software in educational institutions.
9. e-Content on Vocational educational programmes
10. T&D Module - Managerial & Non-Managerial Personnel

4. Conclusion

Thus teachers inevitably must adjust their teaching to these new challenging computer-mediated teaching conditions and explicitly instruct their students how to make their learning most effective with the help of ICT, LMS and e-resources. Therefore teachers should provide their students with a study guide which would explain to them how to proceed in their studies. Furthermore, teachers should show their students that it is them who are responsible for their studies in this new computer-mediated environment and who can enormously profit from networking with their peer and their teacher/tutor.

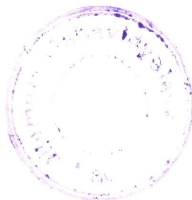
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3 Identification of Aspirin and Determination of Hardness, Friability Disintegration Time of Aspirin Tablets

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Abstract

Aspirin, also known as **acetylsalicylic acid (ASA)**, is a medication used to treat pain, fever, or inflammation. Specific inflammatory conditions in which aspirin is used include kawasaki, pericarditis, and rheumatic fever. Aspirin given shortly after a heart attack decreases the risk of death. Aspirin is also used long-term to help prevent heart attacks, ischaemic strokes and blood clots in people at high risk. It may also decrease the risk of certain types of cancer, particularly colorectal cancer. For pain or fever, effects typically begin within 30 minutes. Aspirin is a nonsteroidal anti-inflammatory drug (NSAID) and works similar to other NSAIDs but also suppresses the normal functioning of platelet.

Keywords: Aspirin, Determination of purity, UV-Vis spectroscopy, chromatography, Coffine, experimental

Introduction

Aspirin is used in the treatment of a number of conditions, including fever, pain, rheumatic fever and inflammatory diseases, such as rheumatoid arthritis, pericarditis, and Kawasaki disease. Lower doses of Aspirin have also been shown to reduce the risk of death from a heart attack, or the risk of stroke in some circumstances. There is some evidence that Aspirin is effective at preventing colorectal cancer, though the mechanisms of this effect are unclear. In the United States low dose Aspirin is deemed reasonable in those between 50 and 70 years old who have a more than 10% risk of cardiovascular disease and are not at an increased risk of bleeding who are otherwise healthy.

Methodology

Tablet hardness testing is a laboratory technique used by the pharmaceuticals industry to test the breaking point and structural integrity of a tablet. For compression testing the analyst generally aligns the tablet in a repeatable way and the tablet is squeezed by 2 jaws Press "ON/OFF" switch to switch ON the instrument. Now instrument is ready either for calibration or use. During the test, parts of the body like fingers etc. can be squeezed between the movable test jaw and fixed jaw. Please put in the samples by tweezers or a similar tool. To remove remaining tablet debris use the supplied brush. During breaking the test samples fragments of the



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samples can spring off. Use Acrylic tray to collect the crushed tablet. Ensure that, the instrument is calibrated & Start-up procedure is followed.

The make of the machine is Labindia Analytical Instrument Pvt. Ltd. Tablet Hardness Tester. Press 2 to run the machine and enter the programme number. Enter the batch no. of the tablet and the stage is to be entered i.e. whether it is finished product or in process product. Then enter the details of the product and comment if any and finally press enter. Place the sample to measure hardness and press enter. Wait till the measurement is done. The value will appear in the Hardness field. After all the measurements have been done, a message appears asking you whether you want to print the results. Tap OK to print. Tap No to reject. To stop the test at any time, press the Stop/Reset button on the instrument front panel. To guarantee the disturbance-free operation of the instrument, it is recommended to clean the instrument daily. To avoid adulterated measuring results, clean the fixed and movable test jaws from remaining tablet pieces. Do not use any detergents.

Table No. 1: Hardness of Aspirin Tablets

Sr. No.	Tablet Wt. in mg	Hardness in Newton	Width	Length in mm
1	101.03	78.1	6.54	
2	101.2	76.0	6.51	
3	101.4	74.7	6.49	
Average	101.3	76.3	6.51	

Determination of Friability

The mechanical strength of tablet can be determined by its hardness and through friability test. Friction and shock are the forces that most often cause tablets to chip, cap or break. The friability test is closely related to tablet hardness and is designed to evaluate the ability of the tablet to withstand abrasion in packaging, handling and shipping. In friability test the tablets are prone to abrasion hence enabling us to check for the tablet strength under application of force in different manner. Clean the instrument and surroundings. Switch the instrument on by means of the on/off switch located on the rear panel.

Before operation the instrument must be at the correct operation temperature. Switch-on the instrument approximately 10 minutes before starting a test. The instrument used is made by LABINDIA FT1020 TABLET FRIABILATOR, should be ON and then press 2 to run the programme and enter programme no. Enter identity and press enter. Initialized to HOME. Then load weighed sample 1 and press ENTER. Enter the weight of sample 1. Initialized to HOME the again load weighed sample 2 and press ENTER.

The instrument should display and run the program Tablets dropped should be displayed after complete program. Final weight of the sample 1 was noted. Collected sample and entered as final weight and Pressed ENTER. Final weight of the sample 2 was noted. Collected sample and entered as final weight of the sample 2 and Pressed ENTER.



Touch-sensitive Keypad

Operation will be done by an alpha-numeric touch-sensitive foil-keypad with LCD display located in the front of the instrument. Follow the function keys as indicated on the LCD-Display. To correct actual settings in the input field move to the appropriate position with the key. All data inputs are supported by a beep tone. The beep tone confirms that the command has been accepted and carried out. The pre-set time is permanently retained in the memory until a new time setting is input. Enter a test run time by means of the numeric keys starting with hours e.g. test run time is 1 hour, 15 minute. Press Enter key and confirm.

Number of revolutions is entered by means of the numeric keys. Confirm the settings with ENTER. On completion of the test run time the instrument stops. Press key to adjust a speed value. Enter the requested speed by means of the numeric keys and press ENTER to confirm.

The instrument returns to the main menu. Press key to start the emptying function whereupon the drum runs three revolutions in reverse automatically emptying the contents of the drum into a collecting vessel.

Routinely check drums for signs of cracks or chips. Inspect electrical connections for signs of corrosion and damage. Immediately wipe any spills from the exterior of the equipment using a moistened clean cloth. Clean drums thoroughly after each use using distilled water and dry with a soft cloth. For tablets with a unit mass equal to or less than 650mg, a sample of tablets corresponding as near as possible to 6.5g is to be used whilst for tablets with a unit mass greater than 650mg, a sample of 10 whole tablets is to be used. According to the British Pharmacopoeia, 100 rotations are considered to be the standard number of rotations to be used for each test. According to the British Pharmacopoeia, a maximum loss of mass not greater than 1.0 per cent is considered acceptable for most types of tablets.

Calculations

Initial wt. of 10 tablets-(W1) = 1.0103 gm

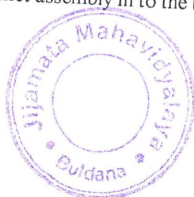
Wt. of tablets after 100 revolutions- (W2) = 1.0100 gm

Loss in wt. of tablets (W3) = W1-W2 = 0.0003 gm

% Friability = $\frac{W3 \times 100}{W1} = \frac{0.0003 \times 100}{1.0103} = 0.03\%$

Determination of Disintegration Time

Ensure the calibration status is valid and make sure that the instrument (LABINDIADT1000 TABLET DISINTEGRATION) is clean and free from dust. Switch on the main switch and put on the Power switch at the rear panel to 'ON' position. The LED above TEMP key will start glowing. The volume of the water should be such that the wire mesh of the moving basket at its highest point is at least 25mm below the surface of the liquid and at its lowest point is at least 25mm above the bottom of the beaker. Place the beaker in the disintegration test apparatus. Suspend the basket assembly in to the beaker by fixing it in to the moving



shaft. Put one tablet in each of the six tubes of the basket of the assembly and place the disc on each. Run the instrument for required period and switch off. Lift the basket and observe for completion of disintegration

Table No. 2: Disintegration Time for Aspirin Tablets

Sr. No.	Sample Name	Results (Time)
1	Aspirin Tablet (6 Tablets)	35 Minutes and 15 seconds

Result and Discussion

The drug obtained was evaluated for its physical properties, description, and identification. The drugs were found in form of white crystalline powder. For the identification tests two tests were performed A) Melting point and B) By spectrophotometric analysis. Melting point was found to be 132.4°C, well within the range. The spectrophotometric analysis carried on solution prepared in methanol, scanned between 200- 400 nm and the ϵ max was found at 226 nm, which matches with the reported value. Aspirin tablets were analysed for Hardness, Friability and Disintegration time. Results obtained are summarised as below.

Table No.3: Results for Hardness, friability and disintegration of Aspirin tablets

Sr. No.	Name of the Product	Tests	Results
1	ASPIRIN TABLET	Hardness	76.2 Newton
2		% Friability	0.03%
3		Disintegration Time	35 min and 15 sec

Conclusion

The Identification tests A & B are carried out for identifying the drug, which were found to be satisfactory and comply with the Pharmacopoeial requirements.

Melting point of Aspirin sample was complying with standard reported value.

In spectrometric analysis sample solution was scanned between 200-400 nm and ϵ max was found to be 226 nm.

Results obtained from tests performed for Hardness, Friability and Disintegration time of Aspirin tablets also comply as per requirements.

Hence the Project work carried out for identification of Aspirin and determination of Hardness, Friability and Disintegration tests performed on Aspirin tablets yield satisfactory results.



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Identification and Determination of Percent Purity of Ethionamide by HPLC Method

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Abstract

Ethionamide is an antibiotic used to treat tuberculosis. Specifically it is used, along with other antituberculosis medications, to treat active multidrug-resistant tuberculosis. It is no longer recommended for leprosy. It is taken by mouth.

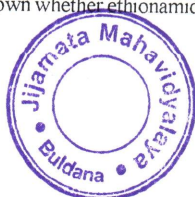
Ethionamide has a high rate of side effects. Common side effects include nausea, diarrhea, abdominal pain, and loss of appetite. Serious side effects may include liver inflammation and depression. It should not be used in people with significant liver problems. Use in pregnancy is not recommended as safety is unclear. Ethionamide is in the thioamides family of medications. It is believed to work by interfering with the use of mycolic acid.

Ethionamide was discovered in 1956 and approved for medical use in the United States in 1965. It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system.

Keywords: Determination of purity, UV-Vis spectroscopy, chromatography, Coffine, experimental

Introduction

Ethionamide is used in combination with other antituberculosis agents as part of a second-line regimen for active tuberculosis. Ethionamide is well absorbed orally with or without food, but is often administered with food to improve tolerance. It crosses the blood brain barrier to achieve concentrations in the cerebral-spinal fluid equivalent to plasma. The antimicrobial spectrum of ethionamide includes *M. tuberculosis*, *M. bovis* and *M. segmatis*. It also is used rarely against infections with *M. leprae* and other nontuberculous mycobacteria such as *M. avium* and *M. kansasii*. While working in a similar manner to isoniazid, cross resistance is only seen in 13% of strains, since they are both prodrugs but activated by different pathways. Resistance can emerge from mutations in *ethA*, which is needed to activate the drug, or *ethR*, which can be over expressed to repress *ethA*. Mutations in *inhA* or the promoter of *inhA* can also lead to resistance through changing the binding site or over expression. The FDA has placed it in pregnancy category C, because it has caused birth defects in animal studies. It is not known whether ethionamide is excreted into breast milk.



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Methadology

Melting point is one of the key parameter to identify the drug and its crystalline state. Moreover, variation in melting point gives the clue of drug substance purity. Melting point of Ethionamide is determined by open capillary tube method. Ethionamide is placed in separate capillary tubes closed at one end that inserted into different channels of furnace after attaining the desired set temperature.

The progress in temperature is monitored. The point at which drug melting starts is noted. The experiment is carried out in duplicate. The mean melting point is considered as the melting point of the drug.

Table No. 1: Melting point of Ethionamide

Sr. No.	Observed Melting Points	Average Melting Point	Limit
1.	161.6°C	161.8°C	158°C to 164°C
2.	162.0°C		

Identification by UV-Visible Spectrophotometry

The power of radiant beam decreases in relation to the distance that, it travels through an absorbing medium. It also decreases in relation to concentration of absorbing molecule or ions encountered in that medium. These two factors determine proportion of the total incident energy that emerge. The decrease in power of monochromatic light passing through the homogeneous medium is stated quantitatively by Beer's law,

$$\log (1/T) \text{ or } A = abc.$$

The instrument used for spectroscopic analysis is an optical device suitable for measuring the UV and visible monochromatic light in the range to 200-800 nm and a device suitable for measuring the absorbance.

Operation of the Instrument: As the system Turn "ON" and clicked the icon on the instrument, instrument automatically connected to computer software. The cuvettes are hold from the top to prevent tampering with the measurements, and wiped the sides with a lab tissue. Then the panel door is opened and placed the cuvette with blank solution in the cuvette holder. The appropriate orientation for the cuvette before reusing is ensured. Filled an empty cuvette with about 2-ml of the sample solution. Cleaned the cuvette with a lab tissue. Pressed START key to take reading. Saved the Spectrum. Opened panel door and removed test sample from front cuvette holder.

Preparation of solution: Accurately weighed 10.0 mg of Ethionamide and dissolved in 10 ml of methanol. Solution is sonicated for 2.0 minutes. (Stock solution). Further 1ml of above stock solution is diluted to 10 ml with methanol.

1ml of this solution is diluted to 10 ml with methanol. This solution is scanned in Spectrum mode in the UV range of 400-200 nm. Spectra is observed as below:



Sr.No	P V	Wavelength (nm)	Abs
1	Peak	220	1.202
2	Peak	290	0.707

Determination of Purity by HPLC

High-performance liquid chromatography (HPLC; formerly referred to as **high-pressure liquid chromatography**, is a technique in analytical chemistry used to separate, identify, and quantify each component in a mixture. It relies on pumps to pass a pressurized liquid solvent containing the sample mixture through a column filled with a solid adsorbent material.

Each component in the sample interacts slightly differently with the adsorbent material, causing different flow rates for the different components and leading to the separation of the components as they flow out the column.

HPLC has been used for manufacturing (e.g. during the production process of pharmaceutical and biological products), legal (e.g. detecting performance enhancement drugs in urine), research (e.g. separating the components of a complex biological sample, or of similar synthetic chemicals from each other), and medical (e.g. detecting vitamin D levels in blood serum) purposes.

Chromatography can be described as a mass transfer process involving adsorption. HPLC relies on pump to pass a pressurized liquid and a sample mixture through a column filled with adsorbent, leading to the separation of the sample components. The active component of the column, the adsorbent, is typically a granular material made of solid particles (e.g. silica polymers, etc.), 2–50 μm in size.

The components of the sample mixture are separated from each other due to their different degrees of interaction with the adsorbent particles.

The pressurized liquid is typically a mixture of solvents (e.g. water, acetonitrile and/or methanol) and is referred to as a "mobile phase". Its composition and temperature play a major role in the separation process by influencing the interactions taking place between sample components and adsorbent. These interactions are physical in nature, such as hydrophobic (dispersive), dipole–dipole and ionic, most often a combination.

HPLC is distinguished from traditional ("low pressure") liquid chromatography because operational pressures are significantly higher (50–350 bar), while ordinary liquid chromatography typically relies on the force of gravity to pass the mobile phase through the column. Due to the small sample amount separated in analytical HPLC, typical column dimensions are 2.1–4.6 mm diameter, and 30–250 mm length.



Also HPLC columns are made with smaller adsorbent particles (2–50 μm in average particle size). This gives HPLC superior resolving power (the ability to distinguish between compounds) when separating mixtures, which makes it a popular chromatographic technique.

Apparatus and Chromatographic Conditions

The equipment used is High Performance Liquid Chromatography Equipped with Auto Sampler and UV Detector. The RP 18 column (250 mm x 4.6 mm; 5 μm) is selected for analysis. The flow rate is set at 1.0 mL/min. The detection is carried out at 290 nm. The run time is set as 10 min.

Preparation of mobile phase: 250 ml of mobile phase was prepared by mixing Methanol and water in the proportion of 70:30 ratio.

Preparation of Sample Solution

Accurately weighed 10.0 mg of Ethionamide and dissolved in 10 ml of methanol. Solution is sonicated for 2.0 minutes. (Stock solution). Further 1 ml of above stock solution is diluted to 10 ml with methanol.

Injection Sequence

10 μl of Blank solution i.e. mobile phase was injected into the system, the chromatogram obtained was showed in fig. no 10. The sample solution were injected in duplicate, the Chromatograms are recorded and shown in fig. No. 11 and

12. Percent (%) area of unknown impurity and % area of Ethionamide are tabulated in table no. 2 and 3. Similarly system suitability parameters like tailing factor and number of theoretical plates are also reported in the table.

Table No. 2: Results Obtained from Injection No. 1

Sr. No.	Retention time in min	Name	Area	% Area	Asymmetry	Theoretical plates
1	2.593	UNK. IMP.	17394	0.71	1.01	4602
2	3.797	ETHIONAMIDE	2437272	99.29	1.10	6738

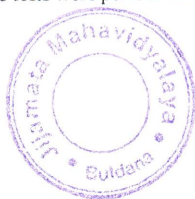
Table No. 3: Results Obtained from Injection No. 2

Sr. No.	Retention time in min	Name	Area	% Area	Asymmetry	Theoretical plates
1	2.595	UNK. IMP.	17290	0.71	1.01	4602
2	3.813	ETHIONAMIDE	2433066	99.29	1.08	6811

Result and Discussion

The drug obtained was evaluated for its physical properties, description, identification and percent purity. The drug was found in the form of a yellow crystalline powder.

For the identification tests two tests were performed. i.e. A) Melting point and



B) By spectrophotometric analysis.

Melting point was found to be 170.5°C, which is well within the range. The spectrophotometric analysis carried out as per I.P. Spectrum was scanned between 200- 400 nm and the ϵ max was found at 290 nm, which matches with the reported value. The percent purity was determined by HPLC method. Where 10 μ l sample solutions were injected in duplicate and the average value was considered for %Purity as reported in Table no 4.

Table No. 4: Percentage Purity of Drug Observed

Sr. No.	Name of the drug	Particulars	(Inj. 1)	(Inj. 2)	Avg.
1	ETHIONAMIDE	% Area of Unknown impurity	0.71	0.71	0.71
2		% Purity	99.29	99.29	99.29

Conclusion

The Identification tests A & B carried out for identifying the drug found to be satisfactory and comply with the Pharmacopoeial requirements. Melting point of Ethionamide sample is complying with standard reported value. In spectrometric analysis sample solution was scanned between 200-400 nm and ϵ max was found to be 290 nm. Percent purity of Ethionamide by HPLC is found to be satisfactory and also complies with the standard requirement. Hence the Project work carried out for identification and determination of percent Purity of Ethionamide by HPLC yield satisfactory results.

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Bianchi Type-III Two Fluids Cosmological Models in Saez-Ballester Theory of Gravitation with Special Forms of Deceleration Parameter

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Research Paper - Mathematics

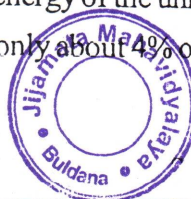
ABSTRACT

Bianchi type-III two fluids cosmological model have been investigated in Saez-Ballester theory of gravitation with special form of deceleration parameter. To get deterministic solution, the shear scalar is assumed to be proportional to scalar expansion. The physical and geometrical behaviors of the model are also discussed.

Keywords: Bianchi type-III universe, Saez-Ballester theory of gravitation.

Introduction:

Recent observations such as distant Supernovae (SNe Ia) [1]-[10], fluctuation of cosmic microwave background radiation (CMBR) [11, 12], large scale structure (LSS) [13, 14], Sloan Digital Sky Survey (SDSS) [15, 16], Wilkinson Microwave Anisotropy Probe (WMAP) [17] and Chandra X-ray Observatory [18] have shown that our Universe is spatially flat and expanding with acceleration. It is the most accepted idea that a mysterious dominant component, dark energy (DE), with negative pressure, leads to this cosmic acceleration which occupies about 73% of the energy of the universe, and dark matter about 23%. The usual baryon matter, occupies only about 4% of the total energy.



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of the universe.

Bianchi space-times provide spatially homogeneous and isotropic models of universe as against the homogeneous and isotropic FRW models. Bianchi type-III models play an important role in current modern cosmology, for simplification and description of the large scale behavior of the actual universe. Inspiring from the discovery of CMBR, many researchers have investigated the Friedmann-Robertson-Walker models with two fluids source which contain both matter and radiation (Davidson [19], McIntosh [20], Coley and Tupper [21] etc.). In two-fluid models, one fluid represents the matter content of the universe and another fluid is chosen as CMB radiation. Coley and Dunn [22] have studied Bianchi type-VI₀ model with two fluids source. Pant and Oli [23] have investigated two fluid cosmological models using Bianchi type-II space-times. Oli [24] has presented anisotropic, homogeneous two fluid cosmological models in a Bianchi type-I space times with a variable gravitational constant G and cosmological constant. Recently Adhav et al. [25] examined two fluid cosmological models in Bianchi type-V space-times. Pawar et al. [26] have studied two-fluid model in Kantowski-Sachs space times. Amirhashchi et al. [27] have investigated two-fluid dark energy models in Bianchi type-III universe with variable deceleration parameter. Mete et al. [28] have studied two fluid cosmological models in Bianchi type-V space-times in higher dimensions. In the last few decades, there has been much interest in alternative theories of gravitation, especially the scalar tensor theories proposed by Brans and Dicke [29], Nordvedt [30], Wagoner [31], Rose [32], Dun [33], Saez and Ballester [34], Barber [35], Lau and Prokhovnik [36] are most important among them. Saez-Ballester theory of gravitation is a well known modified version of Einstein's general theory of gravitation. It is a scalar tensor theory in which metric is coupled with dimensionless scalar field in a simple manner. This coupling gives a satisfactory description of the weak fields. Number of authors Singh and Agrawal [37], Reddy et al. [38], Mohanty et al. [39-40], Reddy and Naidu [41-42], Rao et al. [43-44], Adhav et al. [45] have studied cosmological models within the framework of Saez-Ballester scalar-tensor theory of gravitation with different contexts. Ram et al. [46] obtained Bianchi type-V cosmological models with perfect fluid and heat flow in Saez-Ballester





theory by considering a variation law for Hubble's parameter. Naidu et al. [47] have studied Bianchi type-III dark energy model in a Saez-Ballester scalar-tensor theory. Ghate and Sontakke [48] have studied Bianchi type-IX magnetized dark energy model in Saez-Ballester theory of gravitation. Rahmann and Ansari have studied Anisotropic Bianchi type-III dark energy models with time-dependent deceleration parameter in Saez-Ballester theory. [49] Motivated by the above investigations and discussions, in this paper, we investigate two fluid anisotropic dark energy cosmological model in Bianchi type-III space-times when universe is filled with DE with time dependent DP in general relativity. This work is organized as follows: In Section 2, the model and field equations have been presented. In section 3, the field equations have been solved using the fact that the scalar expansion is proportional to shear scalar and by applying special form of deceleration parameter proposed by Singha and Debnath [50] in the form , $q = -\frac{R\ddot{R}}{\dot{R}^2} = -1 + \frac{k}{1+R^k}$,

where is average scale factor, $k > 0$ is constant. The physical and geometrical behaviors of the models have been discussed in Section 4. In the last Section 5, concluding remarks have been expressed.

2. Metric and Field Equations :

Bianchi type-III space-times is considered in the form,

$$ds^2 = dt^2 - A^2(t)dx^2 - B^2(t)e^{2x}dy^2 - C^2(t)dz^2, \quad (1)$$

where $A(t)$, $B(t)$, $C(t)$ are scale factors and are functions of cosmic time t only.

The energy-momentum tensor for two fluids source is given by

$$T_{ij} = T_{ij}^m + T_{ij}^r, \quad (2)$$

where T_{ij}^m is energy-momentum tensor for matter field given by ,

$$T_{ij}^m = (\rho_m + p_m)u_i u_j - p_m g_{ij}, \quad (3)$$



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with ρ_m is energy density for matter, p_m is pressure for matter and g_{ij} is metric tensor with u_i as four co-moving velocity vector satisfying condition

$$u_i u_j = 1, \quad i=j=0 \quad \text{and} \quad u_i u_j = 0, \quad i=j=1, 2, 3.$$

(4)

and the energy-momentum tensor for radiation field is given by,

$$T_{ij}^r = \frac{4}{3} \rho_r u_i^r u_j^r - \frac{1}{3} \rho_r g_{ij}, \quad (5)$$

where ρ_r is energy density for radiation field.

The Saez-Ballester's field equations for combined scalar and tensor fields are,

$$R_{ij} - \frac{1}{2} g_{ij} R - \omega \phi^n \left(\phi_i \phi_j - \frac{1}{2} g_{ij} \phi_k \phi^k \right) = T_{ij}, \quad (6)$$

where R_{ij} is a Ricci tensor, R is a Ricci scalar, ω and n are arbitrary dimensionless constants. (In the relativistic units, $8\pi G = c = 1$)

Also, the scalar field ϕ satisfies the equation

$$2 \phi^n \phi_{,i}^{,i} + n \phi^{(n-1)} \phi_{,k} \phi^{,k} = 0.$$

(7)

With the help of equations (2), (3) and (4), the field equations (6), for the metric (1), can be explicitly given by

$$\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + \frac{\dot{C}\dot{A}}{CA} - \frac{1}{A^2} + \omega \phi^n \frac{1}{2} \dot{\phi}^2 = (\rho_m + \rho_r), \quad (8)$$

$$\frac{\ddot{B}}{B} + \frac{\ddot{C}}{C} + \frac{\dot{B}\dot{C}}{BC} - \frac{1}{2} \omega \phi^n \dot{\phi}^2 = \left(p_m + \frac{1}{3} \rho_r \right), \quad (9)$$





$$\frac{\ddot{A}}{A} + \frac{\ddot{C}}{C} + \frac{\dot{C}\dot{A}}{CA} - \frac{1}{2}\omega\phi''\dot{\phi}^2 = \left(\rho_m + \frac{1}{3}\rho_r\right), \quad (10)$$

$$\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\dot{A}\dot{B}}{AB} - \frac{1}{A^2} - \frac{1}{2}\omega\phi''\dot{\phi}^2 = \left(\rho_m + \frac{1}{3}\rho_r\right), \quad (11)$$

$$\frac{\dot{A}}{A} - \frac{\dot{B}}{B} = 0, \quad (12)$$

$$\frac{\ddot{\phi}}{\phi} + \frac{\dot{\phi}}{\phi} \left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B} + \frac{\dot{C}}{C} \right) + \frac{n}{2} \frac{\dot{\phi}^2}{\phi^2} = 0. \quad (13)$$

3. Solution of the Field Equations:

Solving equation (12), we get

$$A = lB, \quad (14)$$

where l is a constant of integration, which can be taken as unity without any loss of generality so that we have

$$A = B. \quad (15)$$

Using equation (15), the field equations (8)-(13) reduces to

$$\frac{\ddot{A}^2}{A^2} + 2\frac{\dot{A}\dot{C}}{AC} - \frac{1}{A^2} + \omega\phi''\frac{1}{2}\dot{\phi}^2 = (\rho_m + \rho_r), \quad (16)$$

$$\frac{\ddot{A}}{A} + \frac{\ddot{C}}{C} + \frac{\dot{C}\dot{A}}{CA} - \frac{1}{2}\omega\phi''\dot{\phi}^2 = \left(\rho_m + \frac{1}{3}\rho_r\right), \quad (17)$$



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$$2 \frac{\ddot{A}}{A} + \frac{\dot{A}^2}{A^2} - \frac{1}{A^2} - \frac{1}{2} \omega \phi^n \dot{\phi}^2 = \left(\rho_m + \frac{1}{3} \rho_r \right), \quad (18)$$

$$\frac{\ddot{\phi}}{\phi} + \frac{\dot{\phi}}{\phi} \left(2 \frac{\dot{A}}{A} + \frac{\dot{C}}{C} \right) + \frac{n}{2} \frac{\dot{\phi}^2}{\phi^2} = 0. \quad (19)$$

There are four independent equations in five unknowns A , C , ϕ , ρ_r and ρ_m . To obtain a determinate solution, we use the condition that the scalar expansion θ is proportional to shear scalar σ^2 , so we have [51]

$$C = A^m, \quad (20)$$

where m is a constant ($m \neq 1$).

The field equations are solved by applying special form of deceleration parameter proposed by Singha and Debnath [50] in the form $q = -\frac{R\ddot{R}}{\dot{R}^2} = -1 + \frac{k}{1+R^k}$, where R is an average scale factor, k is a positive constant. ($k \neq 0$)

The average scale factor R comes out to be

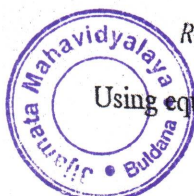
$$R = (\alpha_1 e^{\alpha_2 t} - 1)^{\frac{1}{k}}. \quad (21)$$

For Bianchi-type -III space-times, the average scale factor is defined as

$$R(t) = (ABC)^{\frac{1}{3}}. \quad (22)$$

With the help of equation (21), equation (22) leads to

$$R(t) = (ABC)^{\frac{1}{3}} = (\alpha_1 e^{\alpha_2 t} - 1)^{\frac{1}{k}}. \quad (23)$$



Using equations (15) and (20), equation (23) leads to





$$A = (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{3}{k(m+2)}} \quad (24)$$

$$B = (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{3}{k(m+2)}} \quad (25)$$

and

$$C = (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{3m}{k(m+2)}} \quad (26)$$

Using equations (19), (24), (25) and (26), the scalar field ϕ in the model can be written as

$$\phi^{\frac{n+2}{2}} = \frac{\phi_0}{\alpha_2} \frac{1}{(k-2)} \left(\frac{n+2}{2} \right) (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{(k-3)}{k}} + \psi_0 \quad (27)$$

With the help of equations (24), (25) and (26), the metric (1) can be written as

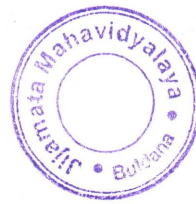
$$ds^2 = dt^2 - (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{6}{k(m+2)}} dx^2 - (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{6}{k(m+2)}} e^{-2x} dy^2 - (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{6m}{k(m+2)}} dz^2 \quad (28)$$

and the scalar field ϕ is in the model is

$$\phi^{\frac{n+2}{2}} = \frac{\phi_0}{\alpha_2} \frac{1}{(k-3)} \left(\frac{n+2}{2} \right) (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{(k-3)}{k}} \quad (29)$$

where the constant ψ_0 is omitted.

Equation (28) represents Bianchi type-III two fluid cosmological model in Saez-Ballester theory of gravitation.



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$$V = R^3 = ABC = (\alpha_1 e^{\alpha_2 k t} - 1)^{\frac{3}{k}} \quad (30)$$

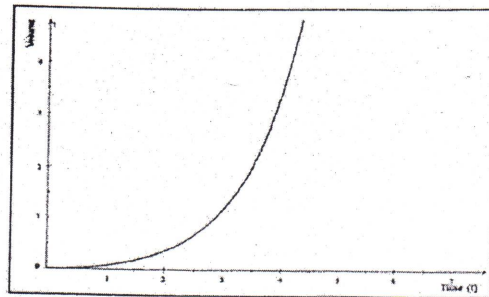


Fig. 1 The plot of volume versus time

The average Hubble's parameter is

$$H = \frac{1}{3} \frac{\dot{V}}{V} = \frac{1}{3} \left(2 \frac{\dot{A}}{A} + \frac{\dot{C}}{C} \right) = \alpha_1 \alpha_2 e^{\alpha_2 k t} (\alpha_1 e^{\alpha_2 k t} - 1)^{-1}, \quad (31)$$

where $H_1 = \frac{\dot{A}}{A}$, $H_2 = \frac{\dot{A}}{A}$ and $H_3 = \frac{\dot{C}}{C}$ are the directional Hubble's parameter along x, y, z directional respectively.

The scalar expansion θ is

$$\theta = 3H = \left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B} + \frac{\dot{C}}{C} \right) = 3\alpha_1 \alpha_2 e^{\alpha_2 k t} (\alpha_1 e^{\alpha_2 k t} - 1)^{-1}. \quad (32)$$

The average anisotropic parameter A_h is

$$A_h = \frac{1}{3} \sum_{i=1}^3 \left(\frac{\Delta H_i}{H} \right)^2 = 2 \left(\frac{m-1}{m+2} \right)^2 = \text{Constant } (m \neq 1). \quad (33)$$





where $\Delta H_i = H_i - H$ and H_i ($i = 1, 2, 3$) represent the directional Hubble parameters.

The shear scalar σ^2 is

$$\sigma^2 = \frac{3}{2} A_{ij} H^2 = \frac{1}{3} \left(\frac{m-1}{m+2} \right)^2 \alpha_1^2 \alpha_2^2 e^{2\alpha_2 k t} (\alpha_1 e^{\alpha_2 k t} - 1)^2. \quad (34)$$

We observe that $\lim_{t \rightarrow \infty} \frac{\sigma^2}{H^2} = \frac{(m-1)^2}{3(m+2)^2} \neq 0 \quad (34a)$

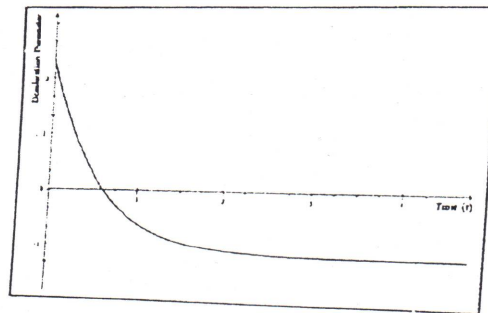
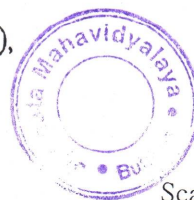


Fig. 2 The plot of deceleration parameter versus time

We assume γ -law for the equation of state

$$p_m = (1 - \gamma)\rho_m, \quad 1 \leq \gamma \leq 2 \quad (35)$$

From equations (16) and (18), with the help of Equations (24), (25), (26) and equation (29) gives energy density for matter as (for $k=1$),



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$$P_m = \frac{3}{(2-3\gamma)} \left[\frac{12(1-m)}{(m+2)^2} \alpha_1^2 \alpha_2^2 e^{2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-2} + \frac{6}{(m+2)} \alpha_1 \alpha_2^2 e^{\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-1} \right. \\ \left. - \frac{2}{3} (\alpha_1 e^{\alpha_2 t} - 1)^{-\frac{6}{m+2}} - \frac{2}{3} \omega \phi_0^2 (\alpha_1 e^{\alpha_2 t} - 1)^{-6} \right]$$

(36)

Using equation (35), P_m pressure for matter (for $k=1$) is given by,

$$P_m = \frac{3(1-\gamma)}{(2-3\gamma)} \left[\frac{12(1-m)}{(m+2)^2} \alpha_1^2 \alpha_2^2 e^{2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-2} + \frac{6}{(m+2)} \alpha_1 \alpha_2^2 e^{\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-1} \right. \\ \left. - \frac{2}{3} (\alpha_1 e^{\alpha_2 t} - 1)^{-\frac{6}{m+2}} - \frac{2}{3} \omega \phi_0^2 (\alpha_1 e^{\alpha_2 t} - 1)^{-6} \right]$$

(37)

From equation (25), with the help of equations (24), (25), (27), (29) and equation (36), the energy density for radiation field is given as (for $k=1$)

$$\rho_r = \frac{27(\gamma-2m\gamma+2)}{(2-3\gamma)(m+2)^2} \alpha_1^2 \alpha_2^2 e^{2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-2} - \frac{3\gamma}{(2-3\gamma)} (\alpha_1 e^{\alpha_2 t} - 1)^{-\frac{6}{m+2}} \\ + \frac{18}{(2-3\gamma)(m+2)} \alpha_1 \alpha_2^2 e^{\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-1} + \frac{3(3-2\gamma)}{2(2-3\gamma)} \omega \phi_0^2 (\alpha_1 e^{\alpha_2 t} - 1)^{-6}$$

(38)

The matter density parameter Ω_m given by

$$\Omega_m = \frac{\rho_m}{3H^2} \\ = \frac{12(1-m)}{(2-3\gamma)(m+2)^2} + \frac{6}{(2-3\gamma)(m+2)} \alpha_1^{-1} e^{-\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1) \\ - \frac{2}{(2-3\gamma)} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} \left[(\alpha_1 e^{\alpha_2 t} - 1)^{\frac{2(m-1)}{(m+2)}} - \omega \phi_0^2 (\alpha_1 e^{\alpha_2 t} - 1)^{-4} \right]$$



(39)





and

the radiation dark energy density parameter Ω_r is

$$\Omega_r = \frac{\rho_r}{3H^2}$$

$$= \frac{9(\gamma - 2m\gamma + 2)}{(2 - 3\gamma)(m + 2)^2} - \frac{\gamma}{(2 - 3\gamma)} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{\frac{2(m-1)}{(m+2)}}$$

(40)

Overall density parameter is given as

$$\Omega = \Omega_m + \Omega_r$$

$$= \frac{(30 - 12m + 9\gamma - 18m\gamma)}{(2 - 3\gamma)(m + 2)^2} + \frac{(10 - 3\gamma)}{6(2 - 3\gamma)} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-3} m \phi_0^2$$

$$+ \frac{12}{(2 - 3\gamma)(m + 2)} \alpha_1^{-1} e^{-\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1) - \frac{(2 + 3\gamma)}{3(2 - 3\gamma)} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{\frac{2(m-1)}{(m+2)}}$$

(41)

Case I : Dust model In order to investigate the physical behaviour of the fluid parameters we consider the particular case of dust i.e. when $\gamma = 1$.

The scalar of expansion, shear scalar and deceleration parameter are given by

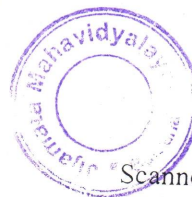
$$\theta = 3\alpha_1 \alpha_2 e^{\alpha_2 k t} (\alpha_1 e^{\alpha_2 k t} - 1)^{-1}$$

$$\sigma^2 = \frac{1}{3} \left(\frac{m-1}{m+2} \right)^2 \alpha_1^{-2} \alpha_2^{-2} e^{2\alpha_2 k t} (\alpha_1 e^{\alpha_2 k t} - 1)^{-2}$$

$$q = 0$$

Substituting $\gamma = 1$ in equations (39, 40, 41)

matter density parameter Ω_m given by



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$$\Omega_m = \frac{\rho_m}{3H^2}$$

$$= -\frac{12(1-m)}{(m+2)^2} - \frac{6}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1) + \frac{2}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{\frac{2(m-1)}{(m+2)}}$$

$$- \frac{2}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} \omega \phi_0^2 (\alpha_1 e^{\alpha_1 t} - 1)^{-1}$$

the radiation dark energy density parameter Ω_r is

$$\Omega_r = \frac{\rho_r}{3H^2}$$

$$= -\frac{9(3-2m)}{(m+2)^2} + \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{\frac{2(m-1)}{(m+2)}} - \frac{6}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1)$$

$$- \frac{1}{2} \omega \phi_0^2 \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{-1}$$

Overall density parameter is given as

$$\Omega = \Omega_m + \Omega_r$$

$$= -\frac{(39-30m)}{(m+2)^2} - \frac{7}{6} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{-1} \omega \phi_0^2 - \frac{12}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1)$$

$$+ \frac{5}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{\frac{2(m-1)}{(m+2)}}$$

Case II : Radiation universe (when $\gamma = \frac{4}{3}$)

The scalar of expansion, shear scalar and deceleration parameter are given by

$$\theta = 3\alpha_1 \alpha_2 e^{\alpha_2 k t} (\alpha_1 e^{\alpha_1 k t} - 1)^{-1}$$

$$\sigma^2 = \frac{1}{3} \left(\frac{m-1}{m+2} \right)^2 \alpha_1^2 \alpha_2^2 e^{2\alpha_2 k t} (\alpha_1 e^{\alpha_1 k t} - 1)^{-2}$$

$$q = 0$$





On substituting $\gamma' = \frac{4}{3}$, in equations (39, 40, 41)

The matter density parameter Ω_m given by

$$\begin{aligned}\Omega_m &= \frac{\rho_m}{3H^2} \\ &= -\frac{6(1-m)}{(m+2)^2} - \frac{3}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1) + \frac{1}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{2(m+1)} \\ &\quad - \frac{1}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} \omega \phi_0^2 (\alpha_1 e^{\alpha_1 t} - 1)^{-1}\end{aligned}$$

the radiation dark energy density parameter Ω_r is

$$\begin{aligned}\Omega_r &= \frac{\rho_r}{3H^2} \\ &= -\frac{3(5-4m)}{(m+2)^2} + \frac{2}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{2(m+1)} - \frac{3}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1) \\ &\quad - \frac{1}{6} \omega \phi_0^2 \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{-1}\end{aligned}$$

Overall density parameter is given as

$$\begin{aligned}\Omega &= \Omega_m + \Omega_r \\ &= -\frac{(21-18m)}{(m+2)^2} - \frac{1}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{-1} \omega \phi_0^2 - \frac{6}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1) \\ &\quad + \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_1 t} - 1)^{2(m+1)}\end{aligned}$$

Case III : Hard universe $\gamma' \in \left[\frac{4}{3}, 2 \right]$ Let the $\gamma' = \frac{5}{3}$

The scalar of expansion, shear scalar and deceleration parameter are given by



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$$\theta = 3\alpha_1 \alpha_2 e^{\alpha_2 k t} (\alpha_1 e^{\alpha_2 k t} - 1)^{-1}$$

$$\sigma^2 = \frac{1}{3} \left(\frac{m-1}{m+2} \right)^2 \alpha_1^2 \alpha_2^2 e^{2\alpha_2 k t} (\alpha_1 e^{\alpha_2 k t} - 1)^{-2}$$

$$q = 0$$

On substituting $\gamma = \frac{5}{3}$, in equations (39, 40, 41)

$$= -\frac{4(1-m)}{(m+2)^2} - \frac{2}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1) + \frac{2}{9} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{\frac{2(m-1)}{(m+2)}} \\ - \frac{2}{9} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} \omega \phi_0^2 (\alpha_1 e^{\alpha_2 t} - 1)^{-4}$$

the radiation dark energy density parameter Ω_r is

$$\Omega_r = \frac{\rho_r}{3H^2} \\ = -\frac{(11-10m)}{(m+2)^2} + \frac{5}{9} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{\frac{2(m-1)}{(m+2)}} - \frac{2}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1) \\ - \frac{1}{18} \omega \phi_0^2 \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-4}$$

Overall density parameter is given as

$$\Omega = \Omega_m + \Omega_r \\ = -\frac{(15-14m)}{(m+2)^2} - \frac{5}{18} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{-4} \omega \phi_0^2 - \frac{4}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (\alpha_1 e^{\alpha_1 t} - 1) \\ + \frac{7}{9} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_2 t} (\alpha_1 e^{\alpha_2 t} - 1)^{\frac{2(m-1)}{(m+2)}}$$





Case IV: Zeldovich Universe $\gamma = 2$

The scalar of expansion, shear scalar and deceleration parameter are given by

$$\theta = 3\alpha_1 \alpha_2 e^{a_1 t} (\alpha_1 e^{a_1 t} - 1)^{-1}$$

$$\sigma^2 = \frac{1}{3} \left(\frac{m-1}{m+2} \right)^2 \alpha_1^2 \alpha_2^2 e^{2a_1 t} (\alpha_1 e^{a_1 t} - 1)^{-2}$$

$$q = 0$$

On substituting $\gamma = 2$, in equations (39, 40, 41)

The matter density parameter Ω_m given by

$$\begin{aligned} \Omega_m &= \frac{\rho_m}{3H^2} \\ &= \frac{3(1-m)}{(m+2)} - \frac{3}{2(m+2)} \alpha_1^{-1} e^{-a_1 t} (\alpha_1 e^{a_1 t} - 1) + \frac{1}{6} \alpha_1^{-2} \alpha_2^{-2} e^{-2a_1 t} (\alpha_1 e^{a_1 t} - 1)^{\frac{2(m-1)}{(m+2)}} \\ &\quad - \frac{1}{6} \alpha_1^{-2} \alpha_2^{-2} e^{-2a_1 t} m \phi_0^2 (\alpha_1 e^{a_1 t} - 1)^{-1} \end{aligned}$$

the radiation dark energy density parameter Ω_r is

$$\Omega_r = \frac{\rho_r}{3H^2}$$

$$= -\frac{9(1-m)}{(m+2)} + \frac{1}{2} \alpha_1^{-2} \alpha_2^{-2} e^{-2a_1 t} (\alpha_1 e^{a_1 t} - 1)^{\frac{2(m-1)}{(m+2)}} - \frac{3}{2(m+2)} \alpha_1^{-1} e^{-a_1 t} (\alpha_1 e^{a_1 t} - 1)$$

Overall density parameter is given as

$$\Omega = \Omega_m + \Omega_r$$



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$$= -\frac{12(1-m)}{(m+2)^2} - \frac{1}{6} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_1 t} (a_1 e^{\alpha_2 t} - 1)^{-4} \omega \phi_0^2 - \frac{3}{(m+2)} \alpha_1^{-1} e^{-\alpha_1 t} (a_1 e^{\alpha_2 t} - 1) + \frac{2}{3} \alpha_1^{-2} \alpha_2^{-2} e^{-2\alpha_1 t} (a_1 e^{\alpha_2 t} - 1)^{\frac{2(m+1)}{(m+2)}}$$

Physical Behavior of the Model

From equation (30), the spatial volume is finite i.e. the universe starts evolving with some finite volume at $t=0$ and expands with cosmic time t . At $t=0$, the expansion scalar is infinite and obtain some finite value at late time. From equations (24) and (25), the spatial scale factors are not zero for any value of t and hence the model does not have singularity.

From equation (34) and (34a), the mean anisotropy parameter A_m is constant and $\lim_{t \rightarrow \infty} \frac{\sigma^2}{\rho^2} (\neq 0)$ is also constant, hence the model is anisotropic throughout the evolution of

the universe except at $m=1$ i.e. the model does not approach isotropy. In figure 11, the plot of energy density verses time is given which indicates that the model starts with infinite density and as time increases the energy density tends to a finite value. Hence, after some finite time, the model approaches steady state. In figure 12, the plot of deceleration parameter verses time is given from which we conclude that the model is decelerating at an initial phase and changes from decelerating to accelerating. Hence the model is consistent with the recent cosmological observations (Perlmutter et al. [1-3], Riess et al. [4, 5], Schmidt et al. [100], Garnavich et al. [101]). Thus, our DE model is consistent with the results of recent observations.





Conclusion :

In this paper, we have investigated a spatially homogeneous and anisotropic Bianchi type-III universe filled with two-fluid in the Saez-Ballester theory of gravitation. The spatial volume V of the model increases with time which shows that the model is expanding as $t \rightarrow \infty$. The Hubble parameter, expansion scalar diverges at $t=0$ while they all approach to zero as $t \rightarrow \infty$. The physical parameters ρ_m, ρ_r, p_m, p_r and diverges at $t=0$ while they all approach to zero at $t \rightarrow \infty$.

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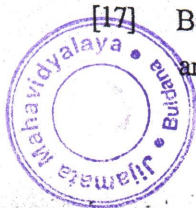
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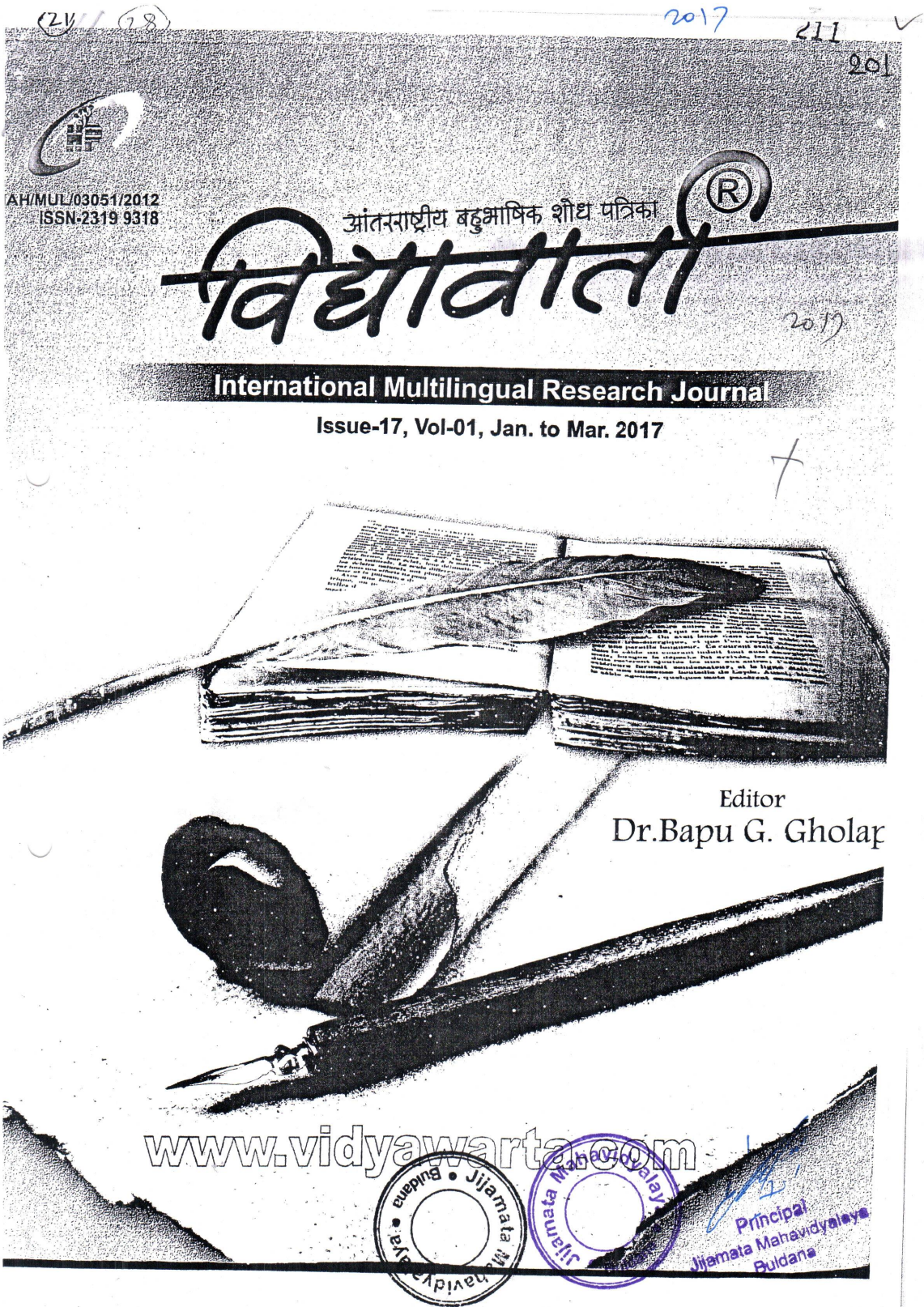


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प्रेस यांची कविता म्हणजे स्वच्या आंतरिकतेचा आविष्कार आहे. त्यापलीकडे येथे कोणतेही विश्व नाही. या अर्थाने ही कविता कमालीची स्वकेंद्री, आत्मलक्ष्मी, आत्ममग्न कविता आहे. समकालीन वर्तमानाचा त्यांच्या कवितेत कोणताही जाणा नाही. विशिष्ट स्वर्णाचे आंतरिक वास्तव हे त्यांच्या एकूण कवितेचे मुत्र आहे. हे मुत्र त्यांच्या कवितेतून अविष्कृत होणाऱ्या जाणिवांशी आगमाशी मग्नित आहे. हे मुत्र त्यांच्या मनाशी, नादाशी पंगिमा प्रती काशी, पर्यायाने त्यांच्या काव्य शैलीशी मग्नित आहे. त्यानं येथे त्यांच्या कवितेतील दुर्बोधेला संबंधित आहे. साठनंतरच्या मगठी कवितेत प्रेस यांची कविता तिच्यातील संमोहक नादमयात, लयबद्धता तिची अतोन्वी शब्दकळा, तिची वैशिष्टपूर्ण प्रतिमासुग्री अशा वेगवेगळ्या कारणांनी चर्चेत राहिली आहे. त्यांच्या या संमोहक शैलीविषयांशी अनेकानी लिहिले आहे. म. सु. पाटील यांनी या कवितेला 'मग्नकविता' म्हणले आहे. (म.सु.पाटील, २०१२:१७) सुरेश भृगुवार यांनी या कवितेला शैलीचे गारुड म्हणले आहे. त्यांनी प्रेस यांची शब्दकळा मुक्तोमल, तरल कशी आहे, ते मांडले आहे. (सुरेश भृगुवार, २०१२:४) देवानंद मोनटक्के यांच्या

एका लेखाचे शीर्षक 'प्रेसची भूल' असे आहे. (देवानंद मोनटक्के, २०१२). स्वतःप्रेम यांनी आपली कविता 'मजक पोण्टी' मारखी आहे असे म्हणले आहे. (अक्षयकुमार काळे, २००९:५०) अलीकडेच प्रकाशित झालेल्या प्रवीण नर्दापुरकर संपादित पुस्तकाचे नावही 'प्रेस नावाच गारुड' (२०१३) असे आहे. या पुस्तकातील वीणा आलामे यांच्या लेखाचे शीर्षक 'मायानगरीचा पाहुणा' असे, तर अरुणा हेरे यांच्या लेखाचे शीर्षक 'इंद्रजाल' असे आहे. (वीणा आलामे, २०१३:३९ अरुणा हेरे २०१३:७१). मात्र त्यांच्या कवितेवरील मुख्य आक्षेप दुर्बोधेचा आहे. हा आक्षेप अनेक समीक्षकांनी वेगवेगळ्या निमित्ताने घेतलेला दिसतो. अर्थात, या दुर्बोधेच्या अंगाने जयंत पराजपे यांच्या 'प्रेस आणि दुर्बोधता' (१९८६) या पुस्तकाचा अपवाद करता विस्ताराने फारसे लिहिले गेले आहे, असे दिसत नाही. प्रेस यांच्या कवितेला मुळातच भव्यादिव्यतेच अलौकिकतेचे आकर्षण आहे. प्रेस यांच्या कवितेचे स्थूलमानाने दुःख, मृत्यू, विनाश, निर्मिती, एकाकीपणा, भीती, प्रेम अशा मूलभूत मानल्या जाणाऱ्या अनुभवांचा, जाणिवांचा, भावभावनांचा आविष्कार होतो. हो या कवितेतील महत्त्वाची आशयसूत्रे आहेत. मात्र या सर्व आशयसूत्रांमधून जीवनातील दुःख, शोक, आत्म भावन व्यक्त होत राहतो. त्यामुळेच प्रेस यांच्या गृहभूषण आंतरिक विश्वाचे एक महत्त्वाचे अनुभवकेंद्र वा जाणोत फेद दुःख, शोकभाव आहे, असे म्हणता येईल. हा शोकभाव दुःख मनातून आहे त्याचे उगम, त्यांचे कारणे अनेकदा अतक्य, गहन असलेल्या दिमतात आपण दुःखाचे महाकवी आहोत, हे कवीने म्हणले आहेत:

मी महाकवी दुःखाचा

प्राचीन नदीपरि खोल

गडाने माझ्या हाती

वेगाने हाते फुल

प्रेस यांच्या जवळपास सर्वच कवितांमध्ये दुःख, शोकभाव, वेदना आणि त्यांच्याशी संबंधित उदयोपना, आर्तता, व्याकुलता, खिन्नता, करुणा भग्न राहिली आहे. 'दुःख' या शीर्षकाच्याच काही कविता आहेत. परंतु त्यांच्या कवितेतील दुःख विशिष्ट, मूर्त परिस्थितीत

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सापडलेल्या व्यक्तीचे दुःख म्हणून सहसा प्रतीत होताना दिसत नाही. याचे कारण या दुःखाशी समकालीन सामाजीक जीवनातील अनेकविध आणि अनेक पातळ्यांवरील प्रश्नांचा, समस्यांचा कोणताही संबंध नाही. ते सनातन, सार्वत्रिक आणि अमूर्त स्वरूपाचे आहे. कवीच्या शब्दांत सांगायचे तर हे दुःख कुण्या जन्माचे/क्षितिजाला बिलगून आले (१९७७:८८) आपल्या अतर्क्य, गहन दुःखाविषयी, 'विजनव्याकुळ दुःखा' विषयी या कवितेत फारसा आकांतही दिसत नाही, आपल्या दुःखाविषयी कवी म्हणतो:

छोटेसे दुःख घेउन मी नीट उभा
श्राहू शकेल असे शोधताय् शहर
क्वचित काही वेळा दुःखाचे तत्वज्ञानही केले
जाते, उदाहरणार्थ, 'दुःख' या शीर्षकाच्याच कवितेत
कवी म्हणतो:

दुःख सांगितले की हलके होते.
आकर्षक होते जगून दाखविले की
मरून दाखविल्यावर
दुःख मिटते ?

अर्थात, असे तत्वज्ञान करणे ही काही ग्रेस यांच्या कवितेची प्रकृती नव्हे. त्यामुळेच या संदर्भात जी.के.ऐनापुरे यांनी ग्रेस यांच्या कवितेतील दुःखाच्या जाणिवेच्या संदर्भात उपस्थित केलेले प्रश्न किंवा बुद्ध्याच्या दुःखाच्या कल्पनेशी केलेली तुलना ही मोठ्या प्रमाणात अनाटायी ठरते. या संदर्भातील त्यांच्या ग्रेसची कविता दुःख अधिक गोंडस आणि नक्षीदार करण्याचा प्रयत्न करते, हा आक्षेप मात्र योग्य आहे. (जी.के. ऐनापुरे, २००५:२८.३२). हे दुःख कोणते आहे, त्याचे मूळ कोठे आहे, हे शोधण्याचा प्रयत्नही काही ममीक्षकांनी केलेला दिसतो. उदाहरणार्थ, नाराण कुलकर्णी कवठेकर यांनी ग्रेस यांच्या लौकिक चरित्राचा आधार घेउन त्यांचे आईशी असलेले संबंध या दुःखाचे मूळ मानले आहे. (नाराण कुलकर्णी कवठेकर, २०१२:१०२. ३). ऐनापुरे यांनीही या लौकिक माहितीच्या आधारे दुःख जाणिवेविषयी काही चर्चा करण्याचा प्रयत्न केला आहे. (जी.के.ऐनापुरे, २००५:२१.२४). या सगळ्या खटाटोपातून वाचकाच्या पदरात या कवितेच्या आकलनाच्या कवितेच्या मूल्याच्या दृष्टीने काहीच पडत

नाही.

या कवितेत शोकभावाखेरीज अन्य भाव जवळपास नाहीत. आनंद, आशा, उत्फुल्लता अशा भावांना येथे जवळजवळ मज्जाव आहे. येथील प्रेमानुभवातही व्याकुळता, आर्तता भरलेली दिसून येते. त्यामुळे कवितेचा रंग गडद होतो. मात्र आधी म्हटले त्याप्रमाणे येथे साहसा उग्रता, हिंस्त्रता, अमानुषता, भयावहता यांचा अविष्कार नाही. येथे दुःखाचा सूर आहे, परंतु तो मंद आहे. ही 'दुःखद नक्षीची कविता' आहे. सामान्यतः येथे ताणाचा अनुभव येत राहतो, परंतु हा ताण अत्यंत आकर्षक शब्दकळेतून, नादमयतेतून, लयीतून आविष्कृत होत असल्यामुळे तो हादरवून टाकणारा, अस्वस्थ करणारा, भयानक स्वरूपाचा वाटत नाही.

ग्रेस यांच्या कवितेतून व्यक्त होणाऱ्या या शोकभावाला, दुःखाला कोणतीही विशिष्टता नसली तरीही ते सर्व अस्तित्वाला व्यापून राहते. हे 'दुःख अभिजात' आहे, 'व्रतस्थ', 'अतर्क्य' स्वरूपाचे आहे. ते 'भरजरी' आहे. काहीसे रसास्वादात्मक पद्धतीने ग्रेस यांच्या शब्दांत सांगायचे तर 'दुःखाच्याकृ समर्थ वैभवांत' रमणारी ही कविता आहे. 'दुःखाचे वैभव' ही प्रतिभा त्यांच्या कवितेत काही वेळा आवृत झालेली आहे. आणखी एका कवितेत कवी म्हणतो, माझेच दुःख आले/माझ्या घरात बहय' त्यामुळे येथे दुःखाचे रोमंटिक आकर्षण कसे आहे, ते स्पष्ट व्हावे. ग्रेस यांच्या कवितेतील शोकभावाचा, दुःखाचा किंवा तत्संग भावांचा, वृत्तीचा, अनुभवांचा अविष्कार करणाऱ्या आणखी काही ओळी पाहता येतील. उदाहरणार्थ पाही:

गाय जशी हंबरते,
तसेंच व्याकुळ व्हावे
बुडतां बुडतां मांजप्रवाही,
अलगद् भरुनी यावे.

निजून आलें
उरलें सरलें दुःख मनाचे किंवा
शब्द फुटण्याच्या आधी
ऊर दुभंगते हांक किंवा

याबरोबरीनेच येथे पहिल्या संग्रहापासून ते शेवटच्या संग्रहापर्यंत अनेक कवितांमधून शोकाच्या

दुःखाच्या संदर्भातील अक्षरशः शेंकडो प्रतिमा येतात. त्यांच्या कवितेतील सर्वच अनुभव दुःखाच्या छायेखालील असल्यामुळे असे घडणे स्वाभाविक आहे. 'संध्याकाळच्या कविता' या पहिल्याच संग्रहातील शोकभाव व्यक्त करणाऱ्या आणखी काही मोजक्या प्रतिमा पाहा : संपूर्ण गर्द शोकाच्या/ अश्रूत उतरली किरणे, दुःखाचा जन्म घरा ये, तुझ्या कृपेच्या दुःखाच्या देखामागे/ येईन मी अनवाणी, बहरात दुःख अनवाणी/ की पैलथडीची रात., हलकेच जाग मज आली/ दुःखाच्या मंद सुराने, या वळणाशी/ दुःख उतराशी, फक्त दुःखाच्या देखाव्यांना दिशाबद्ध/ करणारे पिरॅमिडांचे अंथांतर, तुझे दुःख झरते, जणुं दुःख घराला आले/ दुःखावर डोळे पसरून, तुझे अमल दुःख दे मजसि तेवढा जोगवाकृपेस यांच्या कवितेतील या शोकभावशी संलग्न अशा व्याकुळता, करुणा, दाटून येणे, गंहिवरणे, उदासीनता, खिन्नता, व्यथा, अश्रू इत्यादी भावांचा, शारीरिक अवस्थांचाही अनेक प्रतिमामधून आविष्कार झालेला पाहावयास मिळतो. उदाहरणार्थ,

वान्याने हलते रात

तुझेमुनसान

हृदय गहिवरलें

गायीचे डाळे करुण उभे की

सांज निव्हाईतले.(३०)

याबरोबरीनेच पही : नभ व्याकुळते, अनावर धुळ या व्याकुळ संध्यासमयी अंगव्याकुळ, शिल्पउदाम गाकुळता, व्यामव्याकुळ, उरी दाटून ये भगवंत, उर दुभंगते, चोळीत दुधाचा थेंब जसा तळमळतो, हृदय करुणा नेत्र भरले, सांज हंबरे, सांद करुणा, आमवांचे मळे, व्यथालय इत्यादी. ग्रेस यांच्या कवितेतील गृहभूसरतेच्या मुत्राला पूरक अशीच ही शोकाची, दुःखाची जाणीव आहे.

आधी म्हटले त्याप्रमाणे या दुःखाला, व्याकुळतेला कोणताही एक विशिष्ट संदर्भ नाही ते एका विशिष्ट काळातील, विशिष्ट अवकाशातील दुःख नाही ते मानवी जीवनाला वेढून असणारे सनातन, आदिम स्वरूपाचे दुःख स्वरूप शोधण्याचा तो अटीतटीचा प्रयत्न करत आहे, त्याच्या उगमापन्नत जाण्याची धडपड आहे, या दुःखाविषयी काही प्रश्न कवीला

पडले आहेत, असा काही प्रत्यय ही कविता देत नाही. व्यं.वि.सरदेशमुख यांनी या दुःखाच्या संदर्भात चर्चा करतांना असे म्हटले आहे की या दुःखाचा कोणताही प्रत्यय येत नाही. ते म्हणतात, 'दुःख' या शब्दाच्या राशीच्या राशी येऊन पडतात पण दुःखाचा तुमचा — माझा प्रत्यय मात्र ग्रेस यांच्या कवितेत आकारास येत नाहीकू दुःख नुसते सुलभच नव्हे तर पुरे गुळचट करून टाकले आहे असे जाणवले' व्यं.वि. सरदेशमुख, १९८५ : ११२) या कवितेत दुःखाचे सर्वदूर अस्तित्व मुख्यत्वे भाववृत्तीच्या स्वरूपात आपल्यासमोर येते. या अर्थाने हा अनाम रोमॅंटिक दुःखाचा आविष्कार आहे. ग्रेस यांच्या कवितेत दुःखाशी, शोकभावाशी संबंधित मृत्यू, विनाश, भय, एकाकीपणा तुटलेपण, निर्मिती, प्रेम इत्यादी वा भावना वा जाणिव आविष्कृत झालेल्या आहेत.

संदर्भ ग्रंथ :-

आलसे विणा १९७७ (दिवाळी): चंद्रमायवीचे प्रदेशाच्या निमित्ताने सत्यकथा, मुंबई
ऐनापुरे, जी.के. २००५, प्रेमचौ कविता: अर्थवोधाचे तपशिल प्रतिष्ठान, औरंगाबाद
(मार्च एप्रिल)

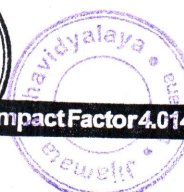
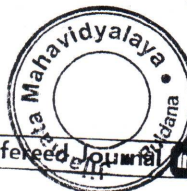
काळे अक्षय कुमार २००९ प्रेमविषयी नागपूर विषय प्रकाशन

कुळकर्णी द.मि. २०१२: प्रेम काळे सावळे वासर समित मुंबई (ब.अ. ४९ अं. ५ मे)

परंजये जयंत १९८६ : प्रेम आणि दर्बोधता नागपूर पा.ना.वनहद्दी प्रकाशन.

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EVALUATION OF ELECTRICITY GENERATION BY MICROBIAL FUEL CELL FROM HYPERSALINE INDIAN SODA LAKE

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ABSTRACT

India has faced challenge for more electricity generation and alternative for the traditional sources and due to the lack and depletion of primary sources. Microbial Fuel Cells (MFCs) is an alternative source of the sustainable and renewable energy. The objective of this study was to investigate the electricity generation from the haloalkaliphilic bacterium isolated from Lonar soda crater (India). Aerobic, haloalkaliphilic bacteria were isolated and characterized from sediment and water samples. A total twenty eight bacterial culture were isolated, of which ARS4 was selected for the further MFC was investigated. The two-chamber MFCs were used to conduct experiments. The MFC was constructed and measure the electricity generation after various intervals, 387mV was electricity was generated after 1h, but after 48h the electricity generation dramatically decreased to 229mV. The effect of salt on MFC was also studied, NaCl enhanced electricity generation compared to KCl, indicating requirement of NaCl for bacterium ARS4 MFC. Supplement of glucose, increased electricity generation was found to be increases (170mV). Our results also suggest that seeking for and isolating novel bacteria that are more halophilic and alkaliphilic from Lonar crater could be a new strategy to generate bioelectricity from MFCs.

KEYWORDS: Microbial Fuel Cells, Lonar soda crater, Electricity



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INTRODUCTION

In related with global warming effects and decreasing limited fossil fuel sources have promote to the search for alternative sources for energy production¹. Generally biomass products tested for energy generation include a wide range of growth plants, crops and wastes². In this context, microbial fuel cells (MFCs) can serve as an alternative to land based methods for energy generation. The cultivation of microorganisms has several advantages over other alternatives- they require less low cost nutrient, have higher growth rates and less expensive energy production. The microbes are able to degrade the organic content to produce the electricity which is known as microbial fuel cell (MFCs). The microbes act as catalyst that degrades the organic manure resulting in the generation of electricity. It is specific designs that cause microbial metabolic or enzyme catalytic activity into electricity by using electrochemical technology³. The MFC are potential for immediately capturing the electrons bring into existence when electrochemically unique bacteria degrade the organic substrates. Microbial fuel cell have become the dynamic due to the generate energy in the electric state or hydrogen from renewable sources of organic and inorganic substance by these activity MFC also can used in the bioremediation in the polluted soil and water.. The MFC are cells, producing electric power by utilizing microorganisms, instead of isolated enzymes, to assist redox reactions. The conventional MFC is a two chamber system, consisting of anode and cathode chambers that are separated by a proton exchange membrane⁴. MFCs have operational and functional advantages over the technologies currently used for generating energy from organic matter⁵. These approaches encourage, studying the microbial physiology, energy metabolism under the extremophilic environment, making MFC unique technique for studying the extracellular electron transfer system in mixed microbial communities and pure cultures. Some scientific investigation was studied for *Shewanella* sp. for the Electricity generation as MFC. Some scientific investigation was studied for *Shewanella* sp.⁶ Over the past decade, The most extensively studied has been execute MFCs that used electrochemically active bacteria (EAB) and these were enable to convert carbon substrates into electric power. Over the past decade, The most extensively studied has been execute MFCs that used electrochemically active bacteria (EAB) to convert carbon substrates into electrical current and power⁷⁻⁸. Many EAB have the inherent ability to reduce metal content in their natural condition by performing extracellular electron transfer⁹⁻¹⁰. These EAB naturally occurring environments in the world, such as ocean, lake and river¹¹⁻¹². The electricity production has not previously been linked to the metabolic activity of haloalkaliphiles or other salt-tolerant microorganisms. However, electricity generation by anaerobic bacteria and anoxic sediments from hypersaline soda lakes was investigated by Miller and Oremland¹³. Soda lakes are a specific type of salt lake with high to extremely high carbonate alkalinity (pH from 9 to 11) and a moderate to extremely high salinity. They are spread all over the world, but located mostly in inland salt lakes, arid and semi-arid areas where the evaporative climate favors

accumulation of salts in local depressions. These equally extreme conditions make soda lakes a unique ecosystem. In the last decade, special attention has been given to the investigation of the microbial communities in soda lakes using traditional isolation methods and molecular biology techniques. But very few studies were investigated related to the electricity generation from MFCs from soda lake. The alkaline Lonar Lake in Buldhana district of Maharashtra is unique ecosystem and wonder in the India (latitude 19°58', Longitude 76°36'). The lake water is alkaline having an average pH of 9.5- 10. Lonar Lake is a closed lake without any outlet and unique due to its salinity, alkalinity and biodiversity. Due to the uniqueness, the lake has evoked much scientific value among researchers. The ecology and diversity of an soda lake was studied and extensively reviewed for their biotechnological potential from all over the world. The microbial diversity of saline lakes has been studied primarily by focusing on the isolation and characterization of individual organisms with potential industrial applications¹⁴⁻¹⁸. Many previously unidentified MFCs have been discovered in environmental samples. However, due to the difficult and time consuming procedures required to isolate such species, potentially useful EABs native to the environment most likely remain undiscovered¹⁹. As far as Indian soda lakes are concerned, a culture-dependent and independent approach has been applied to analyze bacterial diversity²⁰. But MFCs studies for the electricity production have not previously been studied from haloalkaliphiles or other salt-tolerant microorganisms from the Lonar soda lake. The aim of the present study was to get insight into the species composition of microbial communities for electricity generation from Lonar crater.

MATERIALS AND METHODS

Enrichment and isolation of microorganisms

Enrichment of water samples and sediment samples were carried out in various enrichment media. All flasks were incubated at 37°C on a rotary shaker (100 rpm) for 48h. After enrichment, the organisms were isolated on respective media agar plates and incubated at 37°C for 24h. Well isolated and morphologically distinct colonies from these plates were transferred on the respective medium slants and maintained as stocks.

Identification of the bacterial culture

Bacterial cultures were examined for their cultural, morphological character, and standard biochemical test were performed according to Bergey's Manual of systematic bacteriology.

Cultural condition

The culture was retrieved by streaking on bioluminescent agar plates and incubated at 37°C. For MFC operation 2-3 isolated colonies were inoculated in 100 ml of bioluminescent Broth and incubated at 37°C at 160 rpm in 48 hrs in shaking conditions.

Enrichment of culture

The 100 mL bioluminescent media prepared and inoculated with culture and incubated for 48h at 37°C.



All the flasks were incubated at RT on arotary shaker (120 rpm) for 48h. After enrichment, these cultures serve as a MFC for the electricity generation.

MFC assembly design and component

Electrode

Carbon electrode (Copper) of dimension 15cm×0.2cm were used at both the ends of cathode and anode and tightly fixed with the containers containing medium, culture and distilled water.

Cathodic chamber

The cathode chamber of the MFC was made up of 0.5 liter plastic bottles filled with distilled water as catholyte.

Anodic Chamber

0.5 liter plastic bottles were used for this purpose. The bottles were surface sterilized by washing with 70% ethyl alcohol and followed by UV exposure for 15 minutes. Then 100 ml of previously enriched culture of bacteria was added in sterile soil.

Salt bridge

The salt bridge was prepared by dissolving 3% agarose in 2M NaCl. The mixture was boiled for 2 minutes and poured in PVC pipes (dimension 10 × 3 cm) under aseptic condition. The salt bridge was properly sealed and kept in refrigerator for proper settling. Two holes were made in the lower side of bottles for the insertion of salt bridge.

Circuit Assembly

Two chambers were internally connected by salt bridge and externally the circuit was connected with copper wires which were joined to the two electrodes at its two ends and to the multimeter by another two ends.

Measurement of potential difference and current

The potential difference generated by the Fuel Cell was measured by using multimeter from HAOYUE -DT830D.

MFC operations

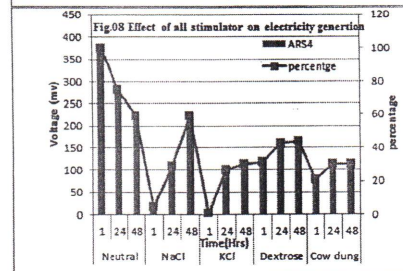
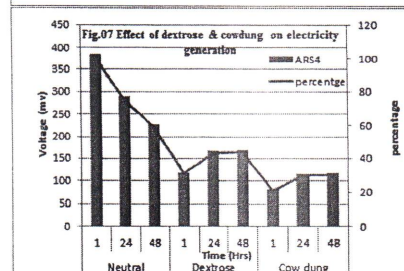
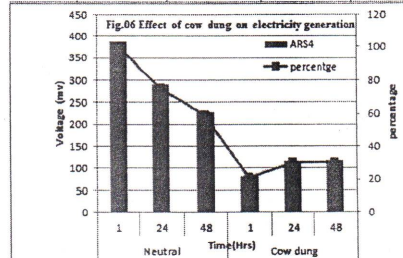
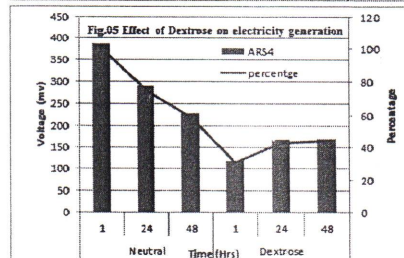
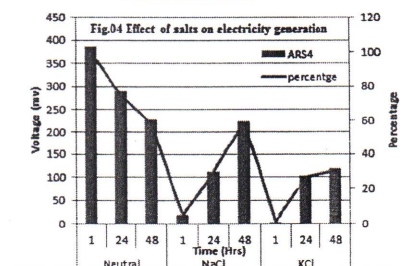
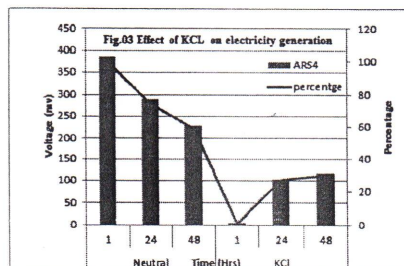
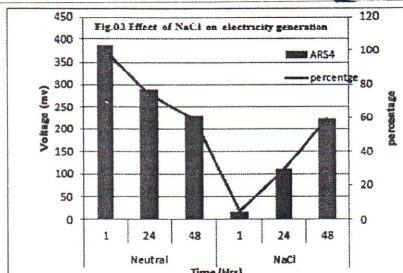
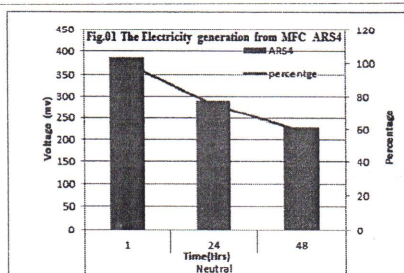
All the components of MFC were connected i.e. via salt bridge internally and with externally with wires to the multimeter. The pure colony were aseptically transferred in 100 ml specific broth and incubated at 37° C at 160 rpm for 48 hours. The bottles were surface sterilized prior to operation of MFCs by 70% alcohol and exposed to UV radiation for 15 minutes. The salt bridge was sealed inside the holes under aseptic conditions. Sterile soil was poured in the anodic chamber and ARS4 culture broth was mixed in sterile soil and prepared liquid suspension. Then in cathodic chamber sterile distilled water was poured. The MFCs was operated at room temperature. The MFC set up was kept at static conditions. The varied carbon source and salt concentration was one by one tested isolates for their ability to generate potential difference. The MFCs was run up to 48 hrs and the voltage was recorded at every 1h, 24h, 48h interval in all the cases.

RESULTS AND DISCUSSION

The alkaline Lonar Lake is a unique basaltic rock meteorite impact crater. Lonar Lake is a one such soda Lake in which the indigenous microflora is present, and such microbial flora has ability thrives in alkaline condition²¹. Total twenty eight bacterial isolates obtained in the isolation exercise, cultural, morphological characteristics and standered biochemical test were performed for all the isolates. This was done to avoid several identical isolates from the total isolates. Out of twenty eight, seven bacterial cultures were selected for the electricity generation, out of seven one bacterial isolate ARS4 was selected for the further MFC studies. In the present study, the 48h alkaline pH (10) culture was prepared and aseptically pours into anodic chamber which contain sterile soil.. Similar study was performed with MFC *B. selenitireducens* by Miller and Oremland¹³. Electricity can be generated directly from sewage sludge with a microbial fuel cells (MFCs), combining degradation of organic matter and MFC for the generation of bioelectricity and the degradation of sewage sludgeorganic matter under the alkaline condition studied by yuanet al.²². In the present study, the 48h alkaline pH (10) culture was prepared and aseptically poured into anodic chamber which contain sterile soil. After the preparation of sediment slurry, MFC assembly was constructed MFC was constructed and measure the electricity generation after various intervals such as 1h, 24h and 48h. the electricity generate 387 and 290 mV after 1h and 24h interval respectively, but after 48h the electricity generation was dramatically decrease about 41% (229mV). Velasquez-Orta et al.²³ evaluated the performance of MFCs using two different types of algae as substrates- *Chlorella vulgaris* (a microalgae) and *Ulvalactuca* (a macroalgae). One of the first pure cultures to be studied as an oxidation catalyst in MFC systems was *Shewanellaoneidensis*^{6,24}. Salinity effect on the microbial fuel cell performance was investigated. The 4% of NaCl was added into the MFC, after the addition of NaCl, the electricity generation was found to be decrease. But as the incubation period was increase the electricity was also increases (1h, 19mV), after 24h and 48h the electricity was 111mV and 224mV generated respectively. The contrary result was observed by Luo et al.²⁵, after the addition of NaCl on electricity generation was decreases. Muralidharan et al.²⁶ was studied on the impact of salt concentration on electricity production in microbial hydrogen based salt bridge fuel cells. The best of our knowledge, these MFC was most efficient for electricity generation. Parkash et al.²⁷ studied the impact of various salt and concentration on the electricity generation based on dual chambered MFC. They revealed that the KCl salt bridge was efficient electricity generating that the NaCl. The 4% of KCl was added into the MFC, after the addition of KCl, the electricity generation was found to be decrease. But as the incubation period was increase the electricity was also increases (1h, 4mV), after 24h and 48h the electricity was 104mV and 117mV generated respectively. But in the present study, the effect of salt on MFC NaCl was the prominent electricity generation than the KCl, indicating a bacterium ARS4 was required NaCl for the MFC. Tarte et al.²⁸ were studies on effect of NaCl and Glucose on generation of electricity from

waste water with the different combinations of glucose and NaCl. In the present studies, bacterium ARS4 also supplemented with the glucose, after the addition of glucose, the electricity generation was found to be

increases. When the incubation period was increase the electricity also increases (1h, 119mV), after 24h and 48h the electricity was 168mV and 170mV generated respectively.



The various studies have been performed such as the effect of different carbon sources sugars, starch, and cellulose, salt, MFCs From waste water, and substrate for MFC's include human, animal, and industrial waste water²⁹. Evaluation of electricity generation from animal based wastes in MFCs has also been studied³⁰. In the present study, use of animal manure as the organic fuel and its bacteria as biocatalyst in the anode chamber along with water as catholyte for the production of bioelectricity generation by MFCs. The bacterium ARS4 also supplemented with the cow dung as organic fuel, after the addition of sterile cow dung suspension, the electricity generation was found to be increased. When the incubation period was increased the electricity also increases (1h, 81mV), after 24h and 48h the electricity was 116mV and 118mV generated respectively. Similar finding was studied by Kumar *et al*³¹ explored the usage of cow dung as anolyte against sewage water as catholyte.

CONCLUSION

A total twenty eight bacterial isolates obtained in the isolation exercise, cultural, morphological characteristics and standard biochemical test were performed for of all

the isolates. Out of twenty eight, seven bacterial cultures were selected for the electricity generation; out of seven ARS4 was selected for the further MFC studies. In this study, double chamber MFC using bacterium ARS4 was used as biocatalyst. Anode chamber was kept up in batch condition for the addition of sugar, cow dung and in cathode chamber salt was added and maintained at continuous condition. The MFC was constructed and measure the electricity generation after various intervals, 387mV was electricity was generated after 1h, but after 48h the electricity generation was dramatically decrease upto 229mV. The effect of salt on MFC, NaCl was enhance electricity generation than the KCl, indicating a bacterium ARS4 was required NaCl for the MFC and salt, sugar, and cow dung had an even greater effect on execute the electricity generation by MFCs. Our results also suggest that seeking for and isolating novel bacteria that are more halophilic and alkaliphilic from Lonar crater could be a new strategy to generate bioelectricity from MFCs.

CONFLICT OF INTEREST

Conflict of interest declared none.

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Isolation and characterization lipase producing *Bacillus flexus* AW3(2), cultural conditions, nutritional requirements and some properties of crude enzyme

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Abstract

Microbial culture dependent phenotypic characteristic were to study the lipase producing bacteria from the Lonar crater. Aerobic, haloalkaliphilic bacteria were isolated and characterized from sediment and water samples of Lonar Lake. Out of twenty nine, thirteen bacterial strains were selected on the basis of their lipolytic activities and subjected to physiological and standard biochemical characterization for their identification. Out of them strain AW3(2) was selected for 16S rDNA sequencing, production and, partial characterizations of lipase on the basis of their maximum lipolytic activity. A Gram positive bacterium was identified as *Bacillus flexus* by morphological, physiological, biochemical characterizations and 16S rDNA sequencing. Optimum enzyme activity was found to be at 70°C. The lipase was highly stable over a broad temperature from 40 to 90°C, and NaCl concentration 0.5-4M ranges, showing excellent thermostability, and haloalkaline tolerant nature. The enzyme activity has enhanced by ZnSO₄ and NiCl₂ indicating it was a metalloenzyme. Among the organic nitrogen sources, optimum lipase production was found to be in presence of ammonium nitrate. This is valuable information for enzyme production and optimization of lipase has a bright future towards the improvement and production of novel enzymes for entirely new areas of industrial and biotechnological applications involving molecular enzymology.

Keywords: bacillus flexus, lipase, lonar crater

Introduction

Hyper alkaline saline lakes, with salinity and alkalinity ranges at or near saturation are extreme environments; yet, they often harbours remarkably high microbial cell densities and are biologically very productive ecosystems [1-3]. To evolve to such conditions, bacteria have developed various mechanisms to maintain cell structure and function in such extreme environment. The investigation of such bacteria are of great importance due to produce industrially important compounds such as extracellular and lipolytic enzymes that have diverse potential [4-7]. Most of the industrial protocols are proceed through under specific physicochemical stipulation which may not be unconditional adjusted to the optimal points required for the activity of the available enzymes. thus, it would be of great consequences to have enzymes that exhibit highest activities at various parameter such as salt concentration, pH and temperature. Halophiles and alkaliophiles are an excellent source of such enzymes which are not only salt tolerant, but also may be active at high temperature and pH values [8-9].

Lonar Lake an Indian soda lake situated in Lonar, District Buldhana, Maharashtra, India (latitude 19° 8, longitude 76° 36). The alkaline saline Lonar crater is a unique basaltic rock meteorite impact crater, ranking third in the world and is filled with saline water having an average pH of 9.5-10. Lonar Lake is a closed one without any outlet and unique due to its salinity, alkalinity and biodiversity. Due to the uniqueness, the lake has evoked much scientific value among researchers. The presence of brackish water inside the crater having pH 10 is a distinctive feature towards ecosystem along with the concentration of chlorides, calcium carbonate and water since

a long period of time [10]. Alkaline saline habitats are constant inhabited by a wealth of microbial communities suitable to these ecosystems [11-12]. The ecology and diversity of an East African Soda Lake was studied and extensively reviewed for their biotechnological potential [13]. Lipase producing bacterial strains from lake Bogoria were isolated and characterized [14]. The isolation of moderate and extreme haloalkaliphiles able to produce lipase will provide the possibility to have optimal activities at different pH and salt concentrations that could be useful in some industrial processes.

Lipases represent an important group of biotechnologically important enzymes. Lipases are ubiquitous enzymes produced by all biological systems, viz., animals, plants, and microorganisms. Microbial lipases are most appropriated for industrial applications due to their cost-effective towards production, wide variety, and stability to organic solvents. The numerous demands for microbial lipases can be attention to their specificity of action, harsh conditions required for reaction, stereo specificity, and less energy consumption than chemical methods [15]. Microbial lipases have huge industrial applications in the fields of food, dairy, pharmaceutical, detergents, textile, biodiesel, and cosmetic industries and in synthesis of fine chemicals, agrochemicals, and new polymeric materials [16-17]. The unusual properties of these enzymes offer a potential opportunity for their utilization in processes under such extreme conditions. In view of the above facts, the present study focused on the optimization of Lipase production from a haloalkaliphilic bacterial strain isolated from Indian saline alkaline Lake.



Materials and Methods

Collection of Lonar lake water and sediment sample

Total four sediment and eight water samples were collected in year 2012 from alkaline Lonar Lake. Water samples collected in sterilized plastic bottles and sediments in sterilized plastic bags were transferred to laboratory for isolation and identification of bacteria followed by their screening for lipolytic activity. Well-isolated and differentiated colonies were transferred to respective medium agar slants ^[12].

Isolation of Alkaliphiles

The 1.0 g of soil sample was transferred to 100 mL sterilized distilled water in 250 mL conical flask and agitated (200 rpm) at 37°C for 15 min in shaker. The suspension was then diluted to 10⁻⁷ dilutions. One mL of each diluted sample was lawn into Petri Plates containing nutrient agar medium (pH 10) and inoculated at 37°C for 24 h.

Screening of bacterial alkaliphiles

Individual bacterial colonies were screened for lipolytic activities on nutrient agar containing lipid (Egg yolk 10mL, Peptone 5.0, Yeast Extract 1.5, Agar 20.0, pH 10). The pH of the medium was adjusted to pH 10 with 1N NaOH before and after sterilization. The inoculated plates were incubated at 37°C for 48 h. The halo zone was observed for lipolytic activity of isolates ^[12].

Preparation of crude enzyme extracts

The 100 mL broth (Clove oil 10mL, Peptone 5.0g, NaCl 5.0g, and Yeast Extract 3.0g, pH 10) was prepared. The sterile broth was inoculated with culture and incubated for 48h at 37°C. After 48 h incubation, centrifugation of the broth at 10,000 rpm for 15 min was carried out. The supernatant served as crude enzyme source ^[18].

Characterizations of crude lipase enzyme

Estimation of lipase activity

Estimation of lipase was carried out with 5 mL of olive oil emulsion in a flask, 5 mL of Triss Hcl buffer, 1 mL of enzyme source was added and incubated for 10 min at 37°C. After incubation 10mL of Acetone: Methanol solutions were added to stop the reaction. Then add 2 to 4 drops of phenolphthalein indicator and then titrate with 0.025N NaOH solution. Following the color change. One enzyme unit (unit/mL) is defined as the amount of enzyme which releases 1 μ mole of fatty acid. Characterization of lipase was carried out as described earlier by Tambekar *et al.*, ^[18].

Effect of temperature on alkaline lipase activity

The effect of temperature on alkaline lipase activity was determined by incubating the reaction mixture (pH 10) for 10 min at different temperature ranging from 40°C to 90°C.

Effect of substrate on alkaline lipase activity

The effect of substrate concentration on alkaline lipase activity was determined by incubating the reaction mixture for 10 minutes with different substrate concentration, ranging from 1mL to 3mL.

Effect of enzyme concentration on alkaline lipase activity

The effect of enzyme concentration on alkaline lipase activity was determined by incubating the reaction mixture (pH 10) for

10 minutes at different enzyme concentration ranging from 1mL to 3mL. The activity of the lipase was then measured as per assay procedure.

Effect of time on alkaline lipase activity

The effect of time on lipase activity was determined by incubating the reaction mixture (pH 10) at different time interval ranging from 10-90 minutes. The enzyme was added to 5 ml olive oil emulsion as substrate, buffer and incubated at 37°C. Assay was performed in triplicates. Reaction mixture flask were sampled at different time interval by removing the flask and adding to it 10 mL of acetone: methanol (1:1) solution to stop the reaction. After it will be titrated with 0.025N NaOH solution using as titrant, then add 2 to 4 drops of phenolphthalein indicator and observe for color change from colorless to faint pink.

Effect of NaCl concentrations on alkaline lipase activity

The effect of NaCl concentrations on enzyme activity was tested by measuring the activity in the reaction mixture containing different NaCl concentrations ranging from 0 to 4 M and incubated at 37°C for 10 minutes.

Effect of different metal ions and chemical reagents

In order to determine the effect of different metal ions on the enzyme activity, the enzyme assay was performed in the reaction mixture as described above in the presence of various metal ions at a final concentration of 1 mM. The activity of the enzyme without any additives was taken as 100%. The influence of various metal ions such as Calcium chloride, Cupric chloride, Potassium chloride, Barium chloride, Zinc sulfate, Manganese sulfate (1 mM each) on amylase activity was studied by preincubating the enzyme with the compounds for 10 min at 37°C. Then, the remaining activity was measured under the enzyme assay conditions ^[19].

Organic solvent stability of the lipase

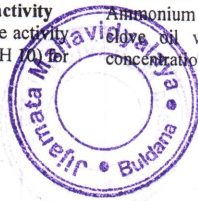
Stability of the lipase enzyme was determined in the presence of various organic solvents such as Methanol, Acetone, 1-Butanol, Chloroform, Benzene, Toluene. 0.25 ml of organic solvent was added to 1 ml of the lipase solution in a 1.5-ml microcentrifuge tube with a screw cap. The mixture was shaken at 150 rpm for 120 min at 37°C. Then, the remaining activity was measured under the enzyme assay conditions ^[20].

Effect of carbon sources on production of lipase

The production medium containing (g/l) (clove oil 10mL, Peptone 5.0, Yeast Extract 1.5, NaCl 5.0, pH 10), was supplemented with different carbon sources like Maltose, Xylose, Sucrose, Fructose, Lactose and Galactose individually at 20 g/l concentration and was sterilized. Then add 20mL clove oil in to it then, The medium flasks were inoculated and incubated at 37°C for 48 h. Then, the remaining activity was measured under the enzyme assay conditions.

Effect of nitrogen sources on production of lipase

The production medium described above was prepared using different organic and inorganic nitrogen sources. The nitrogen sources such as Yeast extract, Beef extract, peptone, Ammonium nitrate, Potassium nitrate, Sodium nitrate and clove oil were added to the medium individually at a concentration of 20mL/L. The medium was sterilized,



inoculated and incubated as mentioned above. Then, the remaining activity was measured under the enzyme assay conditions.

Results and discussion

Screening of bacterial isolates

Total 29 different bacterial species were isolated from water sample of Lonar Lake, out of which 13 isolates were lipase producer [12]. Out of 13, 1 bacterial strain was selected for the further production and characterizations on the basis of maximum lipolytic activity AW3(2).

Identification of the Strain on traditional and molecular-genetic analysis

On the basis of the traditional morphological and phenotypic characteristics the AW3(2) was belong to genus *Bacillus*. Biochemical and physiological tests, growth properties and 16S rDNA sequencing indicated that the bacterial isolate was found to *Bacillus flexus*.

Effect of different Carbon Sources on lipase production

The effect of different carbon sources on lipase production by the alkaliphilic *Bacillus flexus* AW3(2) were studied. In the present study, maltose was the best carbon source for production of lipase it shows 1.0unit/mL, 190% activity. Whether, the production of lipase was intensely decreased with galactose. Whereas presence of certain carbon sources such as glucose, galactose and especially glycerol in culture of *G. Stearotherophilus* can enhance the level of lipase production [21]. Where as soyabean oil were found to be best carbon source by *corynebacterium paurometabolum* [15].

Effects of Different Nitrogen Sources on lipase Production

Several inorganic and organic nitrogen sources were examined to optimize the source of nitrogen for lipase production generally, organic nitrogen sources have been preferred for production of lipase. The result showed that beef extract were the best nitrogen source for the production of lipase it shows 0.8u/mL, 166% activity. In the present study minimum production was found with peptone (133%) as nitrogen source. The inorganic nitrogen sources such as ammonium nitrate, potassium nitrate and sodium nitrate were also examined for the production of lipase. The production of lipase was found maximum on ammonium nitrate as nitrogen source (175%). Whereas potassium nitrate and sodium nitrate were found to be best nitrogen source by *corynebacterium paurometabolum* [15].

Effect of different NaCl concentration on activity of lipase

The effects of different NaCl concentrations ranging from 0.5-4 M was carried out under standard assay conditions. The enzyme shows maximum enzymatic activity (1.1 Units/mL, 100%) at 1.5M and at 2 M NaCl concentration. The activity of lipase decreases as the NaCl concentration increase above 2 M. The enzyme retained about 82% of its activity (0.2 Units/mL, 18%) at NaCl concentration of 3M.

Effect of substrate on production of lipase

Several oils were used as substrate sources for production of lipase. These oil sources were examined for production effect of lipase enzyme. The sources of substrate for lipase production such as ground nut oil, soya oil, mustard oil, kardai

oil, coconut oil and sunflower oil were used for production of lipase. The result showed that, mustard oil 0.6Units/mL followed by soyabean oil and sunflower oil was found to be 0.6Unit/mL, 0.6Units/mL respectively. In the present study minimum production was found with coconut oil (133%).

Effect of temperature on activity of lipase

Effect of temperature on *Bacillus flexus* AW3(2) lipase activity was observed by incubating the enzyme at different temperature ranging from 40-90° C with Standard assay condition. The temperature profile of lipase activity of *Bacillus flexus* AW3(2) showed maximal enzymatic activity of 0.8 Units/mL at 70° C which was considered as 100% activity, which indicated that the enzyme was thermostable at high temperature. The lipase retained more than 50% of the highest activity between 50-90° C. Subsequently, the enzyme activity progressively decreased at 90° C which was found 50% and 75% lipase activity were found decreases at temperature was 40° C but the contrast result were found to *corynebacterium paurometabolum* and maximum activity of lipase was at 25° C [15].

Effect of substrate concentration on activity of lipase

The different concentrations of substrate were assayed ranging from 1-3 mL under constant assay conditions. Substrate utilization revealed that during the period of 10 minutes incubation at 37°C, 62% of substrate was utilized (0.5 Units/mL) but optimum substrate concentration were found 2.5 mL and activity was 1.0 Units/mL.

Effect of Enzyme concentration on activity of lipase

The effects of different enzyme concentrations ranging from 1-3 mL was carried out under standard assay conditions. The enzyme shows maximum enzymatic activity (1.2 Units/mL) at 1 mL of enzyme concentration. The activity of lipase decreases as the enzyme concentration increase above 2 mL. The enzyme retained about 50% of its activity (0.6 Units/mL) at enzyme concentration of 2.5.

Effect of Time interval on activity of lipase

The activity of enzyme lipase was studied at different time intervals ranging from 10-90 minutes. As the time period goes on increasing the activity of lipase also goes on increasing. But, after increasing period then activity decreases in very large period of incubation. The highest activity with 0.8 Units/mL, 100% activity was shown at 37° C when the reaction mixture containing enzyme was incubated for 60 minutes. But as the incubation time increasing than 65 min activity goes on decreasing. The lowest activity was shown when incubation period was of 90 minutes (0.6Units/mL, 75%) activity were observed.

Influence of various organic solvents on activity of lipase

The effect of organic solvents on the activity of the lipase was determined. The data elucidate that the enzyme was highly active to all organic solvents tested. As compared to control which was considered as 100%. Lipase enzyme produced from *Bacillus flexus* were observed in presence of tested solvents. Thus, it can be concluded that all the solvents has an enhancing effect of the activity of lipase produced by *Bacillus flexus* AW3 (2).



Influence of different metal ions on activity of enzyme lipase

The effect of different metal ions on activity of *Bacillus flexus* AW3(2) lipase was carried out under the standard assay conditions. Metal ions have different effects on activity of lipase. The enzyme was activated by NiCl_2 , ZnSO_4 . However, the lipase activity was inhibited by BaCl_2 , MgCl_2 , CoCl_2 , CaCl_2 . The lipase showed highest activity (1.2 Units/mL, 135%) in presence of NiCl_2 . The activity decreased about 35% in presence of MgCl_2 . In previous reports, lipase activity was assessed in presence of Mg^{2+} and Ba^{2+} had little positive effect on lipase activity.

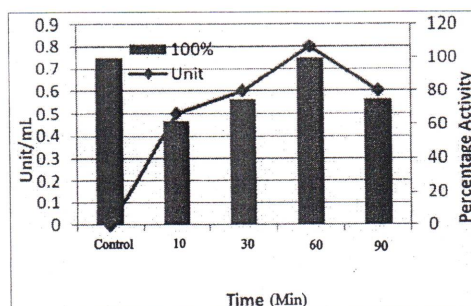


Fig 1: Effect of Time on activity of Lipase

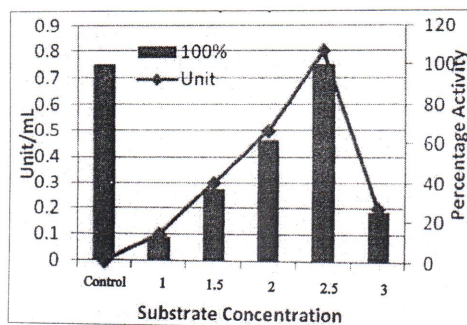


Fig 2: Effect of Substrate Concentration of activity of Lipase

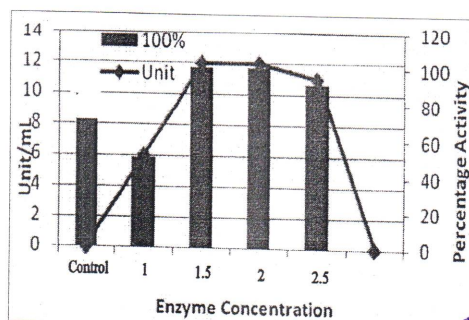


Fig 3: Effect of Enzyme Concentration on activity of Lipase

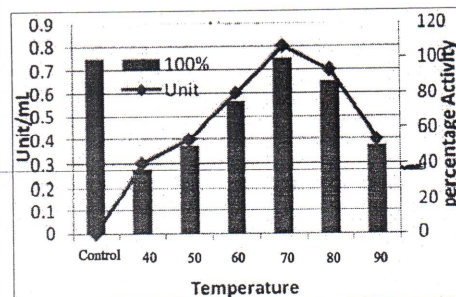


Fig 4: Effect of Temperature on activity of Lipase

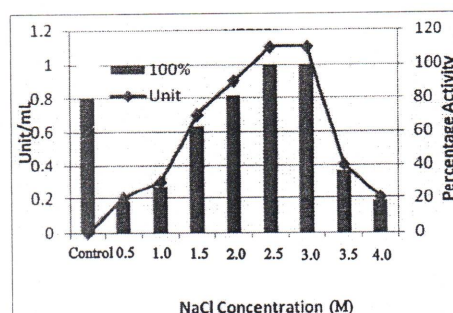


Fig 5: Effect of NaCl Concentration on activity of Lipase

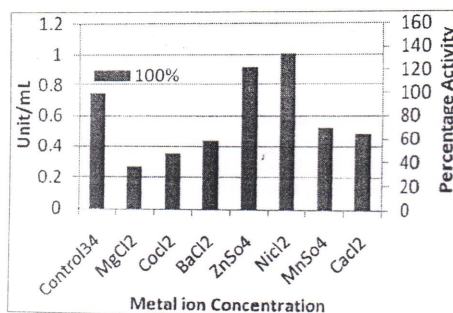


Fig 6: Effect of Metal ion Concentration on activity of Lipase

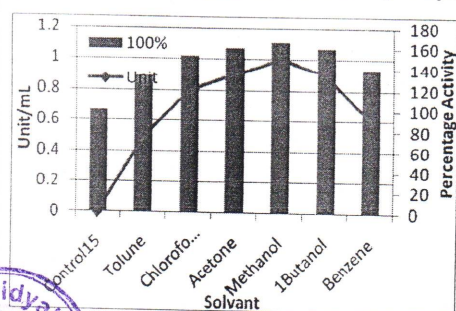


Fig 7: Effect of Solvent on activity of Lipase

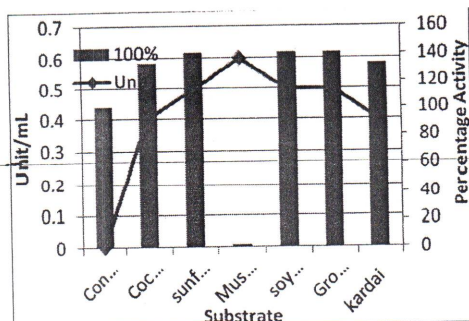


Fig 8: Effect of Substrate on Production of Lipase

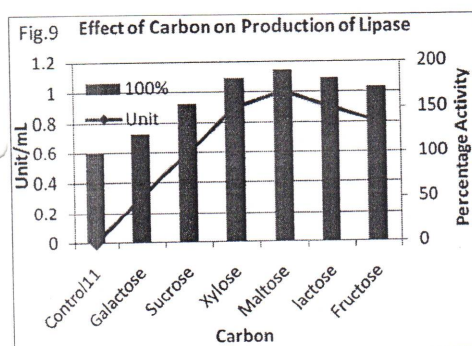


Fig 9: Effect of Carbon on Production of Lipase

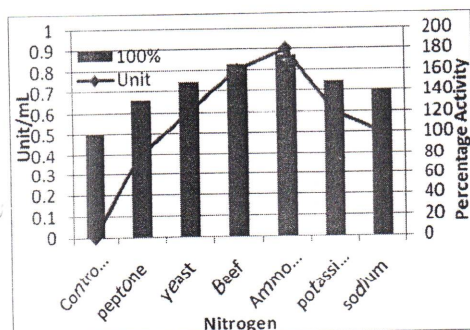


Fig 10: Effect of Nitrogen on Production of Lipase

Conclusion

In this work, alkaline-adapted lipase-producing bacterium was isolated and identified as *Bacillus flexus* AW3(2). The enzyme described in the present report emphasizing several features like to those found in other halophilic enzymes, including salt-dependent activity and thermal stability closely resembled to features reflected in thermophilic organisms. Moreover, the stability of lipase at multitude of extremities of salt, temperature, metal ions and organic solvents displayed unique novel features for biotechnological applications along with the

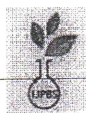
suitability of this enzyme for industrial status. It suggests that the mechanism of action of the lipase of *Bacillus flexus* AW3(2) is different from reported lipases. In additions, the findings have also highlighted the presence of a novel haloalkaliphilic bacterium from the unexplored saline habitats in Indian Soda lake and these findings also indicated that the Lonar Lake is one of the best resources for screening novel haloalkaliphilic adaptive enzymes.

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CHARACTERIZATION OF PROTEASE FROM ALKALI-TOLERANT *BACILLUS* SP. DS2 ISOLATED FROM LONAR SODA LAKE, INDIA

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ABSTRACT

The among several strains of moderately alkalophilic bacteria that were isolated from Lonar lake, *Bacillus* sp. DS2 was selected as the best producer of extracellular protease and was used for further studies. Phenotypic and biochemical classification analysis placed DS2 in the genus *Bacillus*. The bacterium was Gram positive, aerobic, motile, sporulating and rod-shaped bacterium and optimal growth temperature was found to be 37°C. The cells were able to grow well at a pH range of 8-10 which indicate that *Bacillus* sp DS2 was alkalophilic. The protease exhibited its optimal activity at 90°C and optimum pH 10.5. The enzyme activity was enhanced by Ethanol, Methanol, Chloroform, Benzene, Hexane, Propanol, Acetone, Xylene and Acetic acid. However, the protease activity was inhibited by Ethyl acetate. The optimum protease activity was enhanced in presence Chloroform (208.07%). The enzyme activity has enhanced by FeCl₃, BaCl₂ and CaCl₂ and optimum enzyme activity enhanced by MgCl₂ indicating it was a metalloenzyme with a potential to be a candidate for the biotechnological potential.

KEY WORDS: Lonar Lake, Alkaliphiles, Halophiles, *Bacillus*, Protease, Metalloenzyme,



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TCA was added to stop the reaction and centrifuged the reaction mixture at 5000-8000 rpm for 15 min. Supernatant was separated and 2 ml of Na_2CO_3 and 1 ml of Folin-Ciocalteu reagent were added in 1 ml of supernatant. The reaction mixture was boiled for 1 min in a boiling water bath and 6 ml of distilled water was added to make a final solution to 10 ml. In control tube, the reaction was terminated the reaction at zero time and the absorbance was read at 650 nm.

Partial characterization of protease

Partial characterization of protease from *Bacillus* species was carried out by effect of pH, temperature, substrate, enzyme, metal ions and organic solvents on alkaline protease activity was then measured as per assay procedure.

Effect of pH on alkaline protease activity

The effect of pH on alkaline protease was determined by assaying the enzyme activity at different pH values ranging from 7.0 to 12.0 using the phosphate (PO_4) buffer systems with concentration of buffer as 0.2 M. The activity of the protease was then measured as per assay procedure.

Effect of temperature on alkaline protease activity

The effect of temperature on alkaline protease activity was determined by incubating the reaction mixture (pH 10) for 10 min at different temperature ranging from 35°C to 100°C. The activity of the protease was then measured.

Effect of substrate concentration on alkaline protease activity

The effect of substrate concentration on alkaline protease activity was determined by incubating the reaction mixture for 10 minutes with different substrate

concentration, ranging from 0.5 mg/ml to 5 mg/ml. The activity of the protease was then measured.

Effect of enzyme concentration on alkaline protease activity

The effect of enzyme concentration on alkaline protease activity was determined by incubating the reaction mixture (pH 10) for 10 minutes at different enzyme concentration ranging from 0.5 ml to 5 ml. The activity of the protease was then measured.

Effect of different metal ions on protease activity

The effect of different metal ions on alkaline protease activity was determined. The enzyme assay was performed in the reaction mixture as described above in the presence of various metal ions at a final concentration of 1 mM. The activity of the enzyme without any additives was taken as 100 %. The influence of various metal ions such as Potassium chloride, Sodium chloride, Ferric chloride, Barium chloride, Cupric chloride and Magnesium chloride (1 mM each) on protease activity was studied by pre-incubating the enzyme with the compounds for 15 min at 37°C. Then, the remaining activity was measured under the enzyme assay conditions.

Enzyme stability in the presence of solvents

Stability of the protease enzyme was determined in the presence of various organic solvents such as Ethanol, Methanol, Chloroform, Benzene, Hexane, Propanol, Acetone, Ethyl acetate, Xylene and Acetic acid (10 mM each). 0.25 ml of organic solvent was added to 1 ml of the protease solution in a 1.5 ml micro centrifuge tube with a screw cap. The mixture was shaken at 150 rpm for 100 min at 37°C. Then, the remaining activity was measured under the enzyme assay conditions.

RESULTS AND DISCUSSION

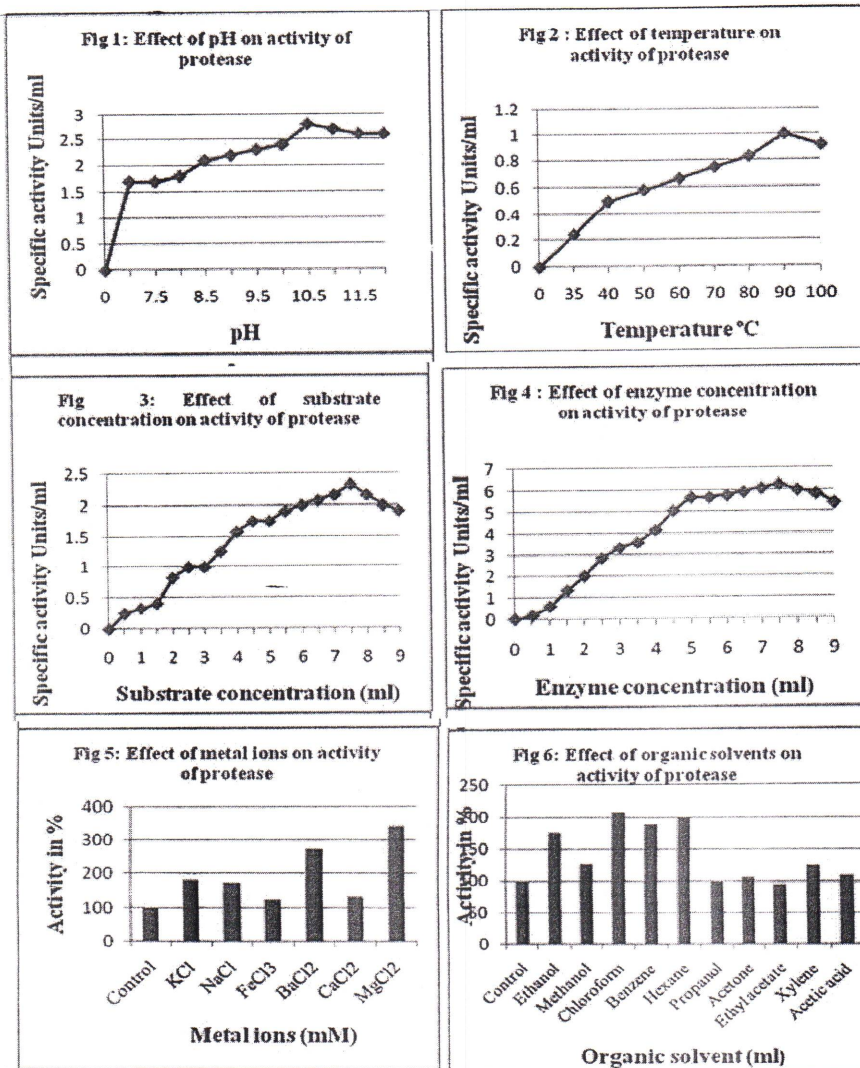
Table 1
Morphological and biochemical characters
of *Bacillus* sp. DS-2

Sr. No.	Test	Observation
1	Isolation Media	D
2	Color	White
3	Shape of Colony	Circular
4	Size of Colony	1 mm
5	Elevation	Convex
6	Edge	Entire
7	Gram Reaction	Positive
8	Shape	Long rod
9	Spore Reaction	+
10	Motility	+
11	Catalase	+
12	Oxidase	+
13	Glucose	+
14	Arabinose	+
15	Mannitol	-
16	Xylose	+
17	Sucrose	-
18	Maltose	-
19	Fructose	+
+ Positive and - Negative		



The effect of organic solvents on the activity of *Bacillus* sp. DS-2 protease was determined. Organic solvents have different effects on activity of protease. The enzyme activity without any additives was taken as 100%. The enzyme activity was enhanced by Ethanol,

Methanol, Chloroform, Benzene, Hexane, Propanol, Acetone, Xylene and Acetic acid. However, the protease activity was inhibited by Ethyl acetate. The optimum protease activity (208.07%) was enhanced in presence Chloroform.



CONCLUSION

In the present studies, protease isolated from the *Bacillus* sp DS2 was tolerant and stable in the presence of extreme conditions such as pH (optimum pH 10.5), temperature (90°C) and high salt concentrations and organic solvent tolerant compared to other bacterial protease. The enzyme activity has enhanced by FeCl₃,

BaCl₂ and CaCl₂ and optimum enhanced by MgCl₂ indicating it was a metalloenzyme with a potential to be a candidate for the biotechnological potential.

CONFLICT OF INTEREST

Conflict of interest declared none.





ANTIBACTERIAL ACTIVITY OF A BACTERIOCIN-LIKE INHIBITORY SUBSTANCE PRODUCED BY BACILLUS SP. FROM HALOPHILIC ENVIRONMENT

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ABSTRACT

The objective of this study was to investigate a bacteriocin like inhibitory substance (BLIS) produced by a *Bacillus* sp. isolated from the halophilic Lonar crater. In present study total fourteen *Bacillus* sp isolated, out of them twelve *Bacillus* species showed that the antimicrobial activity against the *E. coli* and *S. typhi* except the CW1 and CW3. The *Bacillus* sp. CW2 was found 24 mm zone of inhibition that considered as prominent BLIS producer against *E. coli* while the *Bacillus* DS3 was found 25 mm zone of inhibition that considered as prominent BLIS producer against *S. typhi*. The *Bacillus* Sp. GW3 and *Bacillus* Sp. HS4 were found moderate activity with 22 mm zone of inhibition against *P. aeruginosa* and 28 mm zone of inhibition against *P. vulgaris* respectively. Out of fourteen, nine *Bacillus* sp were found antibacterial activity against *B. subtilis*. The *Bacillus* Sp EW2 and *Bacillus* Sp. DS7 was found moderate activity with 21 mm zone of inhibition against *B. subtilis* and 22 mm against *B. megaterium* respectively. The isolated *Bacillus* sp. DS3 and DS2 were found antibacterial against all tested all gram positive bacteria. In conclusion, the studies suggested that halophilic environments could be sources of bacterial strains capable of synthesizing novel metabolites with antibacterial activity. These bacteria in general represent a new and rich source of BLIS that need to be explored

KEY WORDS: *Bacillus*, bacteriocin-like inhibitory substance, halophilic



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INTRODUCTION

Hyper alkaline saline lakes, with salinity and alkalinity ranges at or near saturation are extreme environments; yet, they often harbour remarkably high microbial cell densities and are biologically very productive ecosystems¹⁻³. To evolve to such conditions, bacteria - have developed various mechanisms to survive in such extreme environment. Halophilic bacteria from marine environment are also better sources of secondary metabolites that may have potential of pharmaceutical and biotechnological applications⁴. The development of resistance to multiple drugs is major issue in the medication of infectious disease caused by pathogenic microorganism. The multidrug resistance is presently targeted on exploration and therefore need to search new bioactive compound. To achieve this conditions and circumstances, there is concern to ameliorate novel class of antibiotics that have distinct mechanisms of activity worldwide. The investigations of such bacteria are of great importance due to produce medically important metabolites such as bacteriocin or bacteriocin like inhibitory substance (BLIS)⁵⁻⁶. The important features of bacteriocin, such as their natural sources, wide range of activities, and their proteinaceous nature, which implies a putative degradation in the gastrointestinal tract of man and animals, have interested researchers seeking to develop new antimicrobial⁷⁻⁸. Now a days it is seen the rapid emergence of antibiotic-resistant in pathogenic bacteria and there is an essential for discovering novel antimicrobial compounds⁹⁻¹⁰. The hypersaline environment including halophilic microorganisms may, as indicated, serve as source of antibacterial compounds¹¹. Only a minor fraction of the halophilic and alkaliphilic microbiota is culturable and assessing the complete potential of bioactivity of the extremophilic microbial diversity would require inclusion of both cultured and uncultured organisms from marine environment^{4,12-13}. The alkaline Lonar crater is a unique basaltic rock meteorite impact crater, ranking third in the world and is filled with saline water having an average pH of 9.5- 10. In Lonar, no significant studies have been conducted so far to isolate and produce useful antibiotics. Therefore, present study is intended to isolate, screen and characterize bacteriocin producing bacteria from Lonar Lake which could be further explored for a biotechnological potential.

MATERIALS AND METHODS

Enrichment and isolation of microorganisms

The alkaline Lonar Lake in Buldhana district of Maharashtra is unique ecosystem and wonder in the India (latitude 19°58', Longitude 76°36'). Water and sediment sample were collected in sterile bottles and polythene bags respectively, from defined sampling site. Enrichment of water samples and sediment samples were carried out in Horikoshi I, Horikoshi II, and nutrient

broth at pH 10, nutrient broth at pH 10.0 with 30 g l⁻¹ sodium chloride. All the flasks were incubated at room temperature (RT) on a rotary shaker (100 rpm) for 48h. After enrichment, the organisms were isolated on respective media agar plates and incubated at 37°C for 24h. Well isolated and differentiated colonies from these enrichment media were transferred on the respective medium slants and cultures were maintained as stocks¹⁴⁻¹⁵.

Identification of the bacterial culture

The *Bacillus* culture isolated from Lonar lake water and sediment samples were identified by conventional biochemical tests in according with Bergey's Manual of systematic bacteriology.

Detection of antagonistic activities

The antagonistic properties of *Bacillus* preparations were determined by modifying the disc diffusion method. Sterile blotting paper discs (6mm) were dipped into 48h incubated cell free culture broth and then placed on solidified Nutrient agar seeded with 3h old culture of test organism, which included *Escherichia coli* (MTCC 443) *Proteus vulgaris* (MTCC 426), *Salmonella typhi* (MTCC 734), *Bacillus subtilis*, *Bacillus megaterium*, *Bacillus cereus*. The plates were kept for incubation at 37°C for 24h. Zones of inhibition were measured¹⁶.

Antibacterial assay of bacteriocin

As potential bacteriocin producers grown in respective broth at 37°C for 48h. Cell suspensions were centrifuged at 5000 rpm for 15 min. The antagonistic activity of antibacterial substance was determined by disc diffusion method¹⁷⁻¹⁸.

RESULT AND DISCUSSIONS

The alkaline Lonar Lake is a unique basaltic rock meteorite impact crater. Lonar Lake is a one such soda Lake in which the indigenous microflora is present, and such microbial flora has ability thrives in alkaline condition. Total fourteen isolates obtained in the isolation exercise, cultural, morphological characteristics of all the strains were studied. The isolates were screened on the basis of biochemical characteristics as described earlier All the fourteen bacterial cultures were revealed to be *Bacillus* by their positive Gram reaction, spore bearing, motile, and rods in cell morphology. Then a various conventional phenotypic tests were used to identify them tentatively. In present investigation was to determine antibiotic substance producing diversity of Lonar Lake using different enrichment media with various substrates as peptone, yeast extract, glucose, and starch, Casein and egg yolk. The media composition seemed to have an effect on the recovery of different species of the *Bacilli*. There are evidence to show that the moderately halophilic bacteria have strong potable solutes, fermented foods, enzyme, polymers and degradation of toxic compounds¹⁹⁻²².



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Table 1
Biochemical characteristic of Bacilli
isolated from Lonar Lake

Morphological characteristic																				Biochemical characteristic										Bacteriocin-like inhibitory substance against									
Sr.NO	Isolation Code	Gram	Shape of Bacteria																																				
				Colony Size	Catalase	Oxidase	Glucose	Arabinose	Mannitol	Xylose	Sucrose	Maltose	Fructose	<i>B. subtilis</i>	<i>B. cereus</i>	<i>P. vulgaris</i>	<i>P. aeruginosa</i>	<i>E. coli</i>	<i>S. typhi</i>	<i>B. megaterium</i>																			
1	IS4	+	SR	1.5	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+																		
2	IW3	+	SR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+																		
3	EW1	+	SR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+																		
4	EW2	+	SR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+																		
5	DS3	+	SR	1.5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		
6	DS7	+	SR	2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		
7	CW1	+	SR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-																		
8	CW2	+	SR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+																		
9	CW3	+	SR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-																		
10	HS3	+	LR	2.5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		
11	HS4	+	LR	3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		
12	ES1	+	LR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+																		
13	DS2	+	LR	1	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+																		
14	GW3	+	LR	1.5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																		

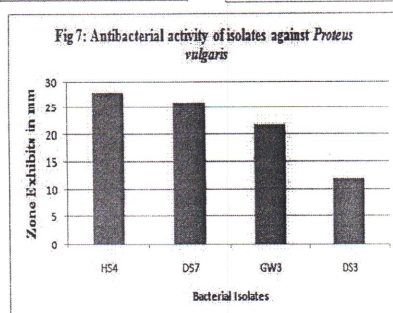
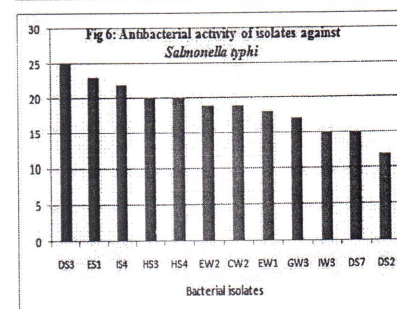
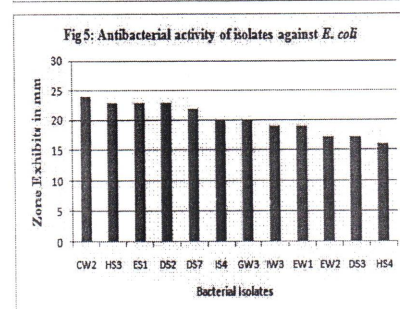
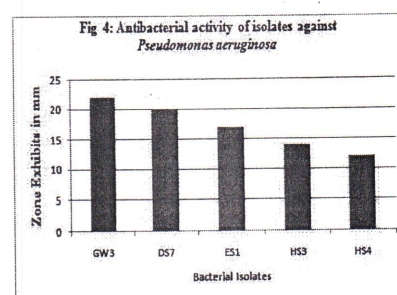
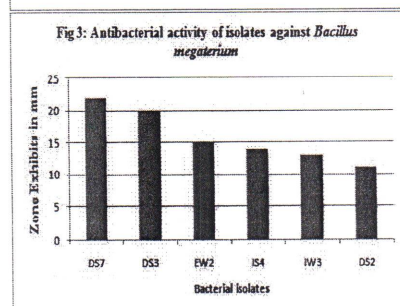
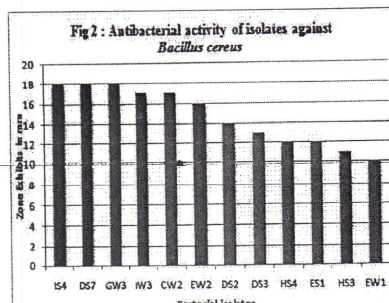
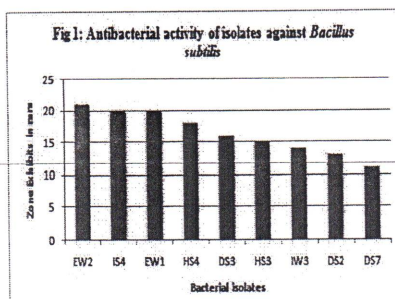
SR- Short Rod, LR- Long Rod, + Positive, - Negative

SR- Short Rod, LR- Long Rod, + Positive, - Negative

Lei chen *et al.*,²³ were studied on the antimicrobial and cytotoxic activities of moderately halophilic bacteria isolated from the Weihai Solar saltern. In present study twelve *Bacillus* species showed that the antimicrobial activity against the *E. coli* and *S. typhi* except the CW1 and CW3 were not showed activity. The *Bacillus* CW2 was found 24 mm zone of inhibition that considered as prominent antibiotic substance producer against *E. coli* followed by the HS3, ES1 and DS2 were shows 23mm zone of inhibition. While the dissimilar result was observed by Motta *et al.*,²⁴, when the antibacterial substance produced by *Bacillus* sp BLS P34 was co-added with EDTA showed antibacterial activity but BLS or EDTA alone showed no inhibitory effect on the *E. coli* and *S. typhi*. The *Bacillus* DS3 was found 25 mm zone of inhibition that considered as prominent antibiotic substance producer against *S. typhi* followed by the ES1 was shows 23mm zone of inhibition. Few attention have been addressed to their application as antimicrobials in clinical studies. Because attention towards the bacteriocin is important, effective and not harmful to human perspectives, it has been already investigated as an another choice for disease control²⁵⁻²⁶. The antibacterial substance produced by *Bacillus* sp. may represent an antimicrobial substance with potential application in the prevention and treatment of *E. coli* and *S. typhi*. The prominent antibacterial activity of *Oceanobacillus ihyensensis* was found against *E. coli* and moderate activity against *K.*

pneumoniae, *S. typhi*, *S. aureus* and poor antibacterial activity against *P. vulgaris* and *E. aerogenes* while no antibacterial activity found against *P. aeruginosa*¹¹. In the present studies, five *Bacillus* sp. were found antibacterial activity against *P. aeruginosa*. The *Bacillus* Sp GW3 was found moderate activity with 22 mm zone of inhibition towards the *P. aeruginosa*. Followed that the *Bacillus* Sp. DS7 was found 20mm zone of inhibition while HS4 was found lowest activity. These results against *P. aeruginosa* indicate that the these antibacterial substance may be effective against *P. aeruginosa* which is responsible for the biofilm formation. Similar results were observed by Nakamura *et al.*,²⁷ the antibacterial activity of violet pigment produced from psychrotropic bacterium RT102 Strain. These antibacterial substance produced by *Bacillus* sp. may represent an antimicrobial substance with potential application in the prevention of biofilm formation and treatment of *P. aeruginosa*. Shanks *et al.*,²⁸ was performed the isolation and identification of a bacteriocin with antibacterial and antibiofilm activity from *Citrobacter freundii*. The *Bacillus* Sp. HS4 was found moderate activity 28 mm zone of inhibition towards the *P. vulgaris*. Followed that the *Bacillus* Sp. DS7 was found 26mm zone of inhibition while DS3 was found lowest activity. Similar results were observed by Tambekar and Dhundale⁶ against *E. coli*, *K. pneumoniae*, *P. vulgaris* and *E. aerogenes*.





The present knowledge about the inhibitory range of bacteriocins from Gram-positive bacteria is that they are narrow to inhibit the other Gram-positive bacteria. The range of sensitive strains can vary significantly, from relatively narrow as in the case of lactococci which have been found to kill only *Lactococcus*, to extraordinarily broad²⁹. In the present study, the isolated

Bacillus sp were produced antibacterial substance against *B. subtilis*, *B. cereus* and *B. megaterium*. Out of fourteen, nine *Bacillus* sp were found antibacterial activity against *B. subtilis*. The *Bacillus* Sp EW2 was found moderate activity with 21 mm zone of inhibition towards the *B. subtilis*. The *Bacillus* Sp IS4 and EW1 were found 20mm zone of inhibition while DS7 was found lowest activity. Similar results were observed by Nakamura et al.,²⁷ the antibacterial activity of violet pigment showed antibacterial activity against gram-positive bacteria such as *S. aureus*, *B. licheniformis*, *B. subtilis*, *B. megaterium*. The *Bacillus* sp. DS7 was exhibit 22 mm and *Bacillus* sp. DS3 (20mm) the prominent zone of inhibition against *B. megaterium*. The isolated *Bacillus* sp. DS3 and DS2 were found antibacterial against all tested gram positive bacteria such as *Bacillus subtilis*, *B. megaterium* and *B. cereus*, but the degree of activity were found variable towards the different *Bacillus* sp. The twelve isolated *Bacillus* sp were found antibacterial activity including IS4, DS7 and GW3 were exhibit the optimum antibacterial activity against the *B. cereus* while the *Bacillus* sp EW1 display lowest activity. Similar result was found to Motta et al.,²⁴ bacteriocin like substance (BLS) produced by a novel *Bacillus* sp. strain P34 isolated from the Amazon basin.

The effect of the BLS was tested against *Listeria monocytogenes*, showing a bactericidal effect, while dissimilar results were found against *Bacillus cereus*. The isolation, identification and biochemical characterization of bacteriocins produced by *Bacillus* sp., and exploration of their important use in the control of pathogenic and spoilage microorganisms. The genus *Bacillus* comprises a variety of industrially important species and has a history of safe use in both food and pharmaceutical industry³⁰⁻³⁵. The genus *Bacillus* encompasses a number of bacteriocinogenic species, such as *B. subtilis* which produces subtilin³⁶ and subtilisin³⁷, *B. coagulans* which produces coagulin³⁸, and *B. megaterium* which produces megacin³⁹.

CONCLUSION

In conclusion, antibacterial activity of Bacteriocin like inhibitory substance isolated from Lonar Lake bacterial culture. The comparative results, between various bacterial cultures, suggested that EW2, IS4, DS7, GW3, CW2, DS3 and HS4 were revealed important to the antibacterial performance with different tested bacterial cultures. In future the genomic data will be determined for the presence of genes encoding possible antibiotic activity.

CONFLICT OF INTEREST

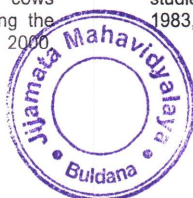
Conflict of interest declared none.

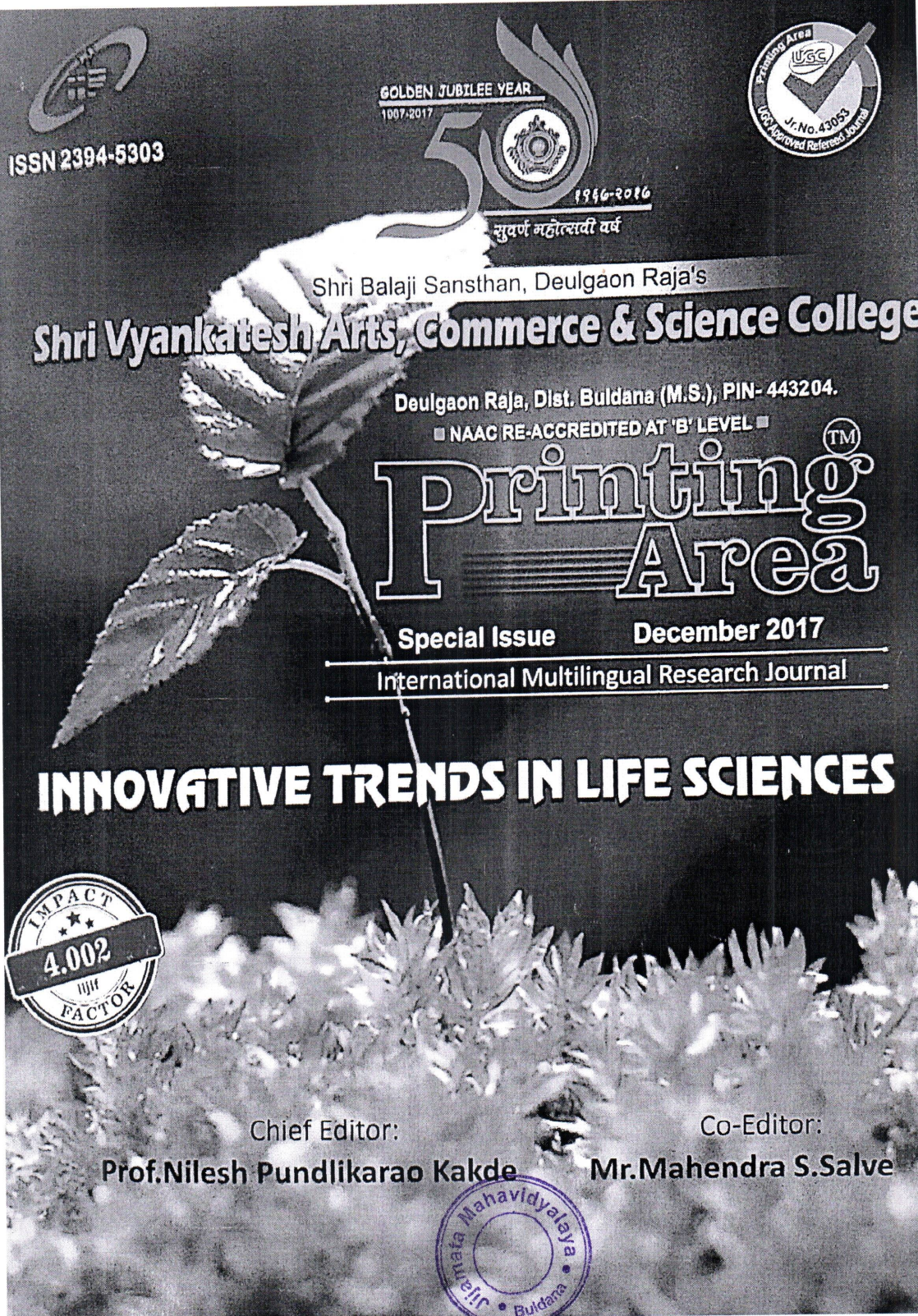
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Impact of pesticides on Fresh Water Fish *Catla catla* of Mun Dam, District Buldhana (M.S.), India

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ABSTRACT

Industrialization of the world affects the faunal diversity of the water, as the waste water from these industries is directly dumped into the water bodies without any treatment. Water pollution is a global issue, as the rising population leads to a number of industries such as pesticides, paper, and fertilizers. *Catla catla* fish were caught from Mun Dam of Buldhana district. The fishes are nearly 100-150 gms. The LC50 value of Profenofos for *Catla catla* was 0.6 ppm. The subacute concentrations were 0.015 ppm, 0.030 ppm and 0.06 ppm were taken for concentrations. The total carbohydrate, protein and cholesterol concentration in the present study from Mun dam of Buldhana region (M.S.) India reveals a significant decrease in the level of carbohydrate, proteins and cholesterol in the fishes treated with profenofos.

Key words– Profenofos, Mun dam, pesticides,

INTRODUCTION

Traditionally the problem of agricultural

pest control has been dealt with by formulating new and more potential pesticides. Very few pesticides kill the intended target but often lead to the death of many non target organisms. Due to increased public awareness of the potential of persistent pesticides that cause harm to environment and public health, great stress is being laid for developing least persistent and selective pesticides. Synthetic pyrethroids are one of wide variety of pesticides contributing to this situation. But these insecticides also tend to affect the biology of non target species along with pests. These chemicals pollute the ponds, lakes, and river water. The chemicals from these industries directly affect the faunal diversity of our country and fish are mostly affected among them. Industrialization of the world affects the faunal diversity of the water, as the waste water from these industries is directly dumped into the water bodies without any treatment. Water pollution is a global issue, as the rising population leads to a number of industries such as pesticides, paper, and fertilizers. Pesticides are used worldwide in agriculture and aquaculture to control the pest and insects (Yonar *et al.*, 2012).

Organophosphate pesticides like ethion, dimethoate, monocrotophos and chlorpyrifos are widely used for paddy crop pests. The widespread use of synthetic organic pesticides over decades has led to their frequent exposure in the environment. Also acute and chronic exposures of humans to pesticides occur during their commercial production and their application. Fishes are a major source of proteinous food of our masses. Once the effluents are discharged into the water bodies, the toxins are incorporated in the bodies of fish resulting in bioaccumulation of the toxins and if these fish are consumed as food by the people, some of the toxins cause several health hazards in them due to biomagnifications. The pesticides, fertilizer chemicals can adversely affect the physiology, histopathology and biochemistry of fish fauna. These chemicals are sub-lethal for fish and their toxicity leads towards the mortality of fish. The aim of present study is to check out the sublethal effects of pesticides and fertilizers chemicals on

histopathology of fresh water fish *Catla catla*.
Material and Methods

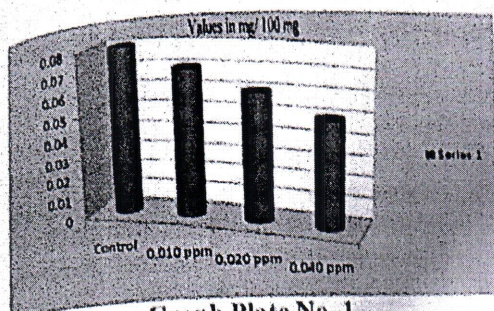
Catla catla fish were caught from Mun Dam of Buldhana district. The fishes are nearly 100-150 gms. Healthy fishes were carefully packed in a medium sized polythene bag with sufficient oxygen which would help them to carry on their normal processes of metabolic activities during their period of transportation. When arriving in Laboratory fishes were carefully transformed into large glass aquarium.

They were left for acclimatization in the normal laboratory conditions for a period of ten days. Feeding was stopped one day before commencing of experiments in order to minimize the quantity of excretory products in the test tank. After acclimatization the fish were weighted totally and individually, and then transformed into the treatment tubs carefully. The physico chemical conditions of well water used in the present study has the following characteristics; Dissolved oxygen 7.6-8 ppm; Salinity 0.5-0.7 ppm; Alkalinity 245 mg/l as CaCO₃; Hardness 357mg/l; as CaCO₃ PH: 7.2 to 7.5; Temperature : 27 °C

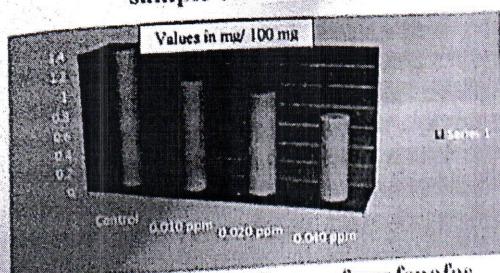
The fishes were exposed to different acute concentrations of Profenofos 50% Ec (0-4- bromo-2-chlorophenyl 0-ethyl S-propyl phosphorothioate) to arrive at LC50. The LC50 was determined following the procedure of Finney (1971). Based on the results of the acute toxicity study, with a LC50 value of 0.6 ppm doses of sub acute value of Profenofos 50%E.C. were selected for subacute exposure following the procedure of Desi *et al.* (1985). Fishes were divided in three treated and one control. In each aquarium 2 fishes are released. In the experimental set up profenofos sub acute values of 0.015, 0.030 and 0.06 ppm were added to the glass aquarium. Muscle sample from the experimental fishes were dissected out by sacrificing the fishes after 48Hrs time intervals. Muscle is the edible portion of the fish energy yielding substances like protein (Lowry *et al.* (1951) with Folin-Phenol reagent), carbohydrate (Anthrone method Roe, 1955) and cholesterol (Allain, 1974) in the muscle were analysed using standard procedures.

Results
The LC50 value of Profenofos for *Catla*

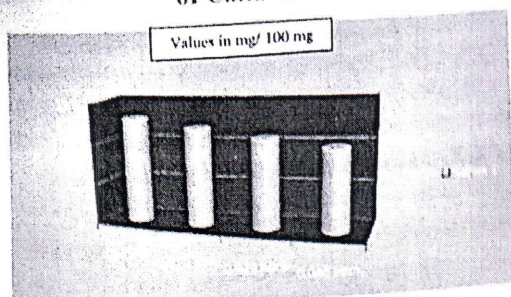
Catla was 0.6 ppm. The subacute concentrations were 0.015 ppm, 0.030 ppm and 0.06 ppm were taken for concentrations. The concentration of Profenofos showed the spontaneous biochemical changes, and reduces the levels of biochemicals such as protein, carbohydrate and Cholesterol.



Graph Plate No. 1
Conc. of profenofos
Estimation of Carbohydrate in the muscle
sample of *Catla catla*



Graph Plate No. 2 Conc. of profenofos
Estimation of Protein in the muscle sample
of *Catla catla*



Graph Plate No. 3 Conc. of profenofos
Estimation of Cholesterol in the muscle
samples of *Catla catla*

Discussion

The biochemical analysis of the present study reveals a significant decrease in all the biochemical parameters. There was a significant reduction in the levels of carbohydrate content. Carbohydrates are the immediate source of energy in the cells. They play a major role in the cellular metabolism by serving as fuel and providing energy to the cells. Fluctuations in oxygen consumption reflect fluctuations in energy demands of the animal, changes in carbohydrate metabolism that would meet the changing energy demands may be expected to stress. The oxidation requirements of the living organisms require carbohydrate and they are used as chemical energy through the breakdown of glucose by the citric acid cycle (Quastel, 1969). The metabolism of carbohydrate decreases when the fish are exposed to toxicants is due to the fact that carbohydrate forms the immediate source of energy that increases the stress caused by the toxicant.

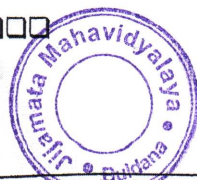
The total protein and cholesterol concentration in the present study from Mun dam of Buldhana region (M.S.) India reveals a significant decrease in the level of proteins in the fishes treated with profenofos. Protein and cholesterol is the most abundant carbon compound in all the living organisms (Parameswaran et al., 1987). It is the dominant biochemical constituent in the tissues of fishes (Pillay and Nair, 1973). Holbrook (1980) stated that the toxicant may directly cease protein synthesis.

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□□□



Production of an extracellular keratinase from *Bacillus amyloliquefaciens* KP015745 leather deteriorates

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Abstract

Extracellular keratinaseproducing bacteria wereisolated from deteriorated leather samples using feather meal as a substrate. From isolates, proficient keratinase producer was identified belong to genus *Bacillus*. 16s rDNA sequencing was done and sequence was deposited to GenBank with accession number *Bacillus amyloliquefaciens* KP015745. With 2% inoculum isolateproduced 38.59±3.72U/ml keratinase at optimum temperature 37°C and at pH 7 after72h using 1% feather meal as a substrate. Mg²⁺ and Mn²⁺stimulatedkeratinase production while mercaptoethanol completely inhibited the activity. The isolated bacterial keratinolytic protease was found to be metalloprotease, as the activity was inhibited by EDTA at the percentage 14.2% but not by PMSF. *Bacillus amyloliquefaciens* KP015745 also revealed the production of caseinase, gelatinase



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महानुभाव पंथ अभ्यासक-डॉ. ब्रह्मानंद देशपांडे

अनिल आसाराम तुपकर

संशोधक विद्यार्थी

डॉ. नामदेव वामनराव ढाले

संशोधक मार्गदर्शक, इतिहास विभाग प्रमुख, जिजामाता महाविद्यालय, बुलढाणा.

महानुभाव पंथ हा महाराष्ट्रातील एक प्रमुख आणि प्राचीन संप्रदाय आहे. महानुभाव पंथीय साहित्य हे आधुनिक महाराष्ट्राचे अपूर्व सांस्कृतिक धन आहे. न आधुनिक काळात महानुभाव पंथाचे अभ्यासक, संशोधक म्हणून डॉ. ब्रह्मानंद देशपांडे यांचा उल्लेख करावा लागतो. त्यांनी महानुभावीय साहित्य संशोधन क्षेत्रात केलेले कार्य अजोड आणि अपूर्व आहे. महानुभावीय संशोधनातील ते आघाडीचे शिलेदार होते.

देवगिरीच्या यादव वंशाचा अभ्यास करण्यासाठी डॉ. ब्रह्मानंद देशपांडे महानुभाव पंथाकडे वळले. देवगिरीचा यादववंश आणि महानुभाव पंथ हे समकालीन होते.^१ लीळाचरित्र, गोविंदप्रभूचरित्र, स्थानपोथी, स्मृतीस्थळ हे महानुभावीय ग्रंथ यादवकालीन महाराष्ट्रातील समाजजीवनाच्या अभ्यासाच्या दृष्टीने अतिशय महत्वाचे आहेत. या ग्रंथांचे त्यांनी सखोल अध्ययन आणि चिंतन केले अक्षरशः अनेक स्मृती, लीळा, दृष्टांत, ओव्या त्यांना मुखोदगत होत्या.

गुप्त लिपी हे महानुभाव पंथाचे आगळेवेगळे वैशिष्ट्य आहे. महानुभाव पंथाचे साहित्य हे गुप्त लिपीत बंद झाले होते. सकळी, सुंदरी, परिमांडल्य, अंक, वज्र, मनोहर शिरोलिपी अशा एकुण २८ लिप्यांची नोंद आढळते.^२ या लिपीचा निर्मिती काळ वि.भि. कोलते आणि यु.म. पठाण यांनी अंदाजे शके १२७५, (इ. स. १३५३) असा मानला आहे. विसाव्या शतकाच्या प्रारंभापर्यंत गुप्त लिप्यांच्या बज्रकपटात वज्रकपटात बंद असलेले हे साहित्य आता मुक्त झाले आहे. पण यासाठी अनेक महानुभाव संत, महंत, संशोधक, अभ्यासक, पंडित यांची आयुष्ये खर्ची पडली आहेत. त्यामध्ये डॉ. ब्रह्मानंद देशपांडे यांचे योगदान महत्वाचे आहे. महानुभाव साहित्य गुप्त लिपीच्या आवरणात बद्ध असल्यामुळे मराठी शब्दांची शुद्ध रूपे आणि अचूक अर्थ, तसेच तत्कालीन सामाजिक, सांस्कृतिक, राजकीय स्थिती आपणास प्राप्त होते.^३

महानुभाव साहित्याचे अंतरंग जाणून घेण्यासाठी डॉ. ब्रह्मानंद देशपांडे यांनी सकळी, सुंदरी लिपी शिकल्या होत्या.^४ महानुभाव साहित्याच्या प्रकाशनात त्यांचा सहभाग अतिशय महत्वाचा होता. महाराष्ट्र शासनाने प्रकाशित केलेल्या लीळाचरित्राची द्वितीय आवृत्ती तसेच श्रीचक्रधर दर्शन याग्रंथाची मुद्रिते त्यांनी कटाक्षाने तपासली होती. 'महानुभाव' मासिकाचे संपादन व मुद्रित शोधन ही त्यांनी केले होते.^५

केशिराज व्यास विरचित 'रत्नमाला स्रोत्र पूर्वार्ध', लीळाचरित्र एकांक आणि श्रीगोविंदप्रभू चरित्र ह्या ग्रंथांचे डॉ. ब्रह्मानंद देशपांडे यांनी अतिशय साक्षेपी संपादन केले महानुभाव पंथावर अहंमन्य संशोधक ब्रुवांनी केलेले भ्रांत आरोप त्यांना 'चक्रपाणि चिंतन, तिन शोधनिबंध, सप्तपर्णी या ग्रंथातून सडेतोड विवेचनाने खोडले. महानुभावीय शोधनिबंध हा ग्रंथ त्यांच्या दिर्घ व्यासंगाचे फलित आहे. महानुभाव पंथावर प्रकाश टाकणारे अनेक संशोधन लेख त्यांनी लिहले. महानुभाव आश्रम हे



त्याचे श्रद्धास्थान होते. महानुभाव पंथ, संत, मंहत, तपस्विनी, उपदेशी यांच्या सोबत चर्चा करून महानुभाव पंथाचे अंतरंग जाणून घेतले. महानुभाव साहित्याच्या आणि पंथाच्या अभ्यासासाठी डॉ. ब्रह्मानंद देशपांडे यांनी विदर्भ, मराठवाडा, खानदेश या भागात अखंड पायपीट केली.

डॉ. ब्रह्मानंद देशपांडे यांनी महानुभाव पंथाचा अभ्यास करित असतांना 'महानुभाव संशोधनाचा इतिहास' नावाचा एक संशोधन लेख लिहला होता. त्यामध्ये विसाव्या शतकाच्या प्रारंभापर्यंत गुप्त लिप्यांतील साहित्य मुक्त करण्यासाठी ज्या महानुभाव संत, मंहत, संशोधक, अभ्यासक, पंडित यांनी परिश्रम करून महानुभाव साहित्याच्या भांडारात भर पाडली. त्यामध्ये प्रामुख्याने वि. का. राजवाडे, लोकमान्य टिळक, वि. ल. भावे, श्री गोपिराज राजधर मंहत श्रीदत्त लक्ष्मराज, श्रीगोपीराज मुसाफिर यशवंत खुशालराव देशपांडे, वामन देशपांडे, ह. ना. नेने, नी. ब. भवाळकर, वि. भि. कोलते, श. गो. तुळपुळे, यू.म. पठाण, मंहत श्रीनागराजबाबा, कृष्णदास महानुभाव, पुरुषोत्तम नागपुरे, चंद्रकांत निभोरकर, इयन रीसाईड, अर्नफेल्डहाऊस, बुत्सेनेत्सोव आणि डॉ. ब्रह्मानंद देशपांडे यांचा समावेश होतो.^६

डॉ. ब्रह्मानंद देशपांडे यांनी 'महानुभाव साहित्य आणि सूर्यउपासना' या लेखामधून यादवकालीन महाराष्ट्रातील सूर्य उपासनेवर प्रकाश टाकला आहे. संशोधन क्षेत्रात सूर्य उपासना ही भारतात केवळ सागर किनाऱ्यावरच काय ती प्रचलित होती असा गैरसमज रुढ आहे. तेव्हा महानुभाव साहित्यातील सूर्यउपासनेचे उल्लेख डॉ. ब्रह्मानंद देशपांडे यांनी दाखवून दिले. त्यामुळे वरील धारणेला छेद गेला आहे.^७

श्रीचक्रधर स्वामी महाराष्ट्रातील परिघणाविषयी च्या काही नितात भ्रांत कल्पना होत्या त्यांच्या मते श्रीचक्रधर स्वामी मुदाम यक्षमंदिरातच उतरत असत हा त्यांचा सिद्धांत होता. डॉ. ब्रह्मानंद देशपांडे यांनी या चूकीच्या सिद्धांते सआधार खंडण केले आहे.

डॉ. ब्रह्मानंद देशपांडे यांनी 'नरीद्रकवी आणि महानुभाव पंथ या लेखात नरीद्र कवीचा 'रुक्मिणी स्वयंवर' हा ग्रंथ मार्गासी कसा आला. नरीद्रकवीने महानुभाव पंथाची भिक्षा घेतली का? 'रुक्मिणी स्वयंवर' ग्रंथ गुहस्थाश्रमी पूर्ण केला का? हा पंथप्रवेशानंतर पूर्ण केला यादव राजवंशाशी काय संबंध या सर्व प्रश्नांचे उत्तर नरीद्रकवी आणि यादव राजवंश, नरीद्रकवी आणि टीपग्रंथ, नरीद्रकवीची भिक्षा, रुक्मिणी स्वयंवर आणि महानुभाव पंथ इत्यादी मुद्याच्या आधारे स्पष्ट केले आहे.

दृष्टान्तपाठात येणाऱ्या चौदोत्तरसते दृष्टान्तांचे (एकशे चौदा दृष्टान्तांचे) कर्तृत्व कुणाचे याविषयी काही वेगवेगळी मते प्रतिपादित केली होती यांचा परामर्श डॉ. ब्रह्मानंद देशपांडे यांनी 'चौदोत्तरसते दृष्टान्त श्रीमुखीचेच' या लेखामध्ये घेतला आहे. त्यांना श. गो. तुळपुळे, डॉ. सुरेश डोळके, वि. भि. कोलते यांच्या मताची चिकित्सा करून दृष्टान्तपाठातील दृष्टांत हे केशिराजबासाचे नसून ते श्रीचक्रधरस्वामीचे आहेत असा स्पष्ट अभिप्राय केशिराजबासाचा आहे असे डॉ. ब्रह्मानंद देशपांडे यांनी दाखवून दिले.

डॉ. ब्रह्मानंद देशपांडे यांनी 'श्रीचक्रधरांचे पैठण' या लेखामध्ये पैठणचा इतिहास, भूगोल, सांस्कृतिक वैशिष्ट्य, सातवाहन, वाकाटक, बदामी, चालुक्य, राष्ट्रकुट, यादव या संपूर्ण राजकीय परिवर्तनाच्या आलेखात पैठण साकारले आहे या पार्श्वभूमीवर श्रीचक्रधरस्वामींचे पैठणशी असलेले नाते स्पष्ट केले आहे.^८

श्रीचक्रधरांच्या गुर्जरत्वाविषयी काही निरर्थक आणि आधारहीन आक्षेप काही संशोधक घेत आहेत. त्यांचाच विचार डॉ. ब्रह्मानंद देशपांडे यांनी 'श्रीचक्रधरांचे गुर्जरत्व' या लेखात केला आहे. द्वाशवतीकार चांगदेवराऊळ हे महाराष्ट्रात आले

आणि तेच महाराष्ट्रात श्रीचक्रधर या नावाने वावरले असे मत पा. कृ. सावळापूरकर यांचे होते.^९ तसेच प्रा. सुरेश डोळके यांनी 'श्रीचक्रधर मराठी आणि महाराष्ट्र' या लेखामध्ये श्री चक्रधरांच्या गुर्जरत्वावर आक्षेप घेतला आहे. त्यांच्या विधानाचा कस डॉ. ब्रह्मानंद देशपांडे यांनी तपासून सआधार श्री चक्रधरांचे गुर्जरत्व स्पष्ट केले आहे.

महानुभावांचा अहिंसाविचार या लेखामध्ये डॉ. ब्रह्मानंद देशपांडे यांनी महानुभाव पंथीयाचा अहिंसा विषयक विचार मांडला आहे. महाराष्ट्रात महानुभाव पंथाचे आकलन दोन स्तरांवर आहे. महानुभाव साहित्य प्रकाशात आणून विचारवंतांनी आणि साहित्यिकांनी या साहित्याचा चिकित्सक अभ्यास केला. महाराष्ट्रातील ग्रामीण लोक गेली सात-साडेसात शतके या पंथाच्या सहवासात आहे. ग्रामीण म्हणी, वाक्यप्रचार आणि उखणे आदि लोकसाहित्यातून या पंथाची काही वैशिष्ट्ये जनमानसात नोंदली गेली. जनमानसात महानुभावांची एक प्रतिमा ते आत्यंतिक अहिंसक असल्याचे मत डॉ. ब्रह्मानंद देशपांडे यांनी मांडले आहे.

डॉ. ब्रह्मानंद देशपांडे यांनी देवगिरीच्या यादव राजवंशाचा इतिहास अभ्यासताना लीळाचरित्र, स्मृतीस्थळ, गोविंदचरित्र, स्थानपोथी आदि महानुभाव पंथीय ग्रंथाकडे लक्ष वेधले गेले. यादव कालीन राजकीय, सामाजिक आणि धार्मिक जीवनाचे कितीतरी सुक्ष्म बारकावे ह्या ग्रंथांमधून सापडतात. महानुभावपंथीय साहित्य हा यादवकालीन समाजतिहासाचा अतिशय महत्वाचा आधारस्रोत आहे. महानुभाव साहित्य आणि शिलाताम्रशासने यांचा तौलनिक अभ्यास करून डॉ. ब्रह्मानंद देशपांडे यांनी महानुभावाय ग्रंथाचे प्रामाण्य आणि विश्वसनीयता सिद्ध केली

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