FINAL REPORT

OF

MINOR RESEARCH PROJECT

MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014

"ANALYISIS OF SUGAR INDUSTRY EFFLUENT"

Principal Investigator

DR.A.S.PUJAR

Co-Investigator

Dr. M.S.YADAWE

B.L.D.E. Association's

S.B.ARTS AND K.C.P. SCIENCE COLLEGE,

VIJAYAPUR

SUBMITTED

TO

UNIVERISTY GRANTS COMMISSION

SOUTH WESTERN REGIONAL OFFICE,

BANGALORE-560009

2017

BLDE Association's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR

DEPARTMENT OF CHEMISTRY

Minor Research Project for Teachers XII Plan 2012-16

MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014

Title of the Proposed Project

PHYSICOCHEMICAL AND MICROBIOLOGICAL ANALYSIS OF UNDERGROUND WATER IN VIJAYAPUR KARNATAKA, INDIA

Principal Investigator

DR.A.S.PUJAR

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Dr.A.S.Pujar

OBJECTIVES OF THE STUDY

- To determine the physico-chemical characteristics of the effluents of the sugar mill;
- To develop a management system regarding effluents of the sugar mill.
- Study on COD, BOD of the effluent of the sugar industry
- To compare the physicochemical properties with the published data.

ABSTRACT

Treatment of effluent of sugar industry is carried out by inverse fluidized bed. Different components of effluent like chemical oxygen demand (COD), biochemical oxygen demand (BOD) and pH have been measured by varying different parameter such as concentration, time of fluidization. The growth of microorganism w.r.t. different parameter has been noted. COD, BOD and pH are observed to decrease with decreasing concentration of the solution. Again values of different output parameters (BOD, COD and pH) are observed to be reduced with increasing timing in an inverse fluidized bed. Microorganisms are allowed to grow and steady state was observed same microbes were transferred to inverse fluidized bed for studying the effect of parameters on its growth. Microorganisms are observed to be grown on the surface of polypropylene beads by producing a biofilm. The observed reduction in COD, BOD and pH indicate the suitability for the application of inverse fluidised bed for waste water treatment for any industry.

INTRODUCTION

Effluent is an out flowing of water or gas from a natural body of water, or from a manmade structure. Effluent, in engineering, is the stream exiting a chemical reactor Effluent is defined by the United States Environmental Protection Agency as "wastewater - treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters".[2] The Compact Oxford English Dictionary defines effluent as "liquid waste or sewage discharged into a river or the sea".[3]

Effluent in the artificial sense is in general considered to be water pollution, such as the outflow from a sewage treatment facility or the wastewater discharge from industrial facilities. An effluent sump pump, for instance, pumps waste from toilets installed below a main sewage line. In the context of waste water treatment plants, effluent that has been treated is sometimes called secondary effluent, or treated effluent. This cleaner effluent is then used to feed the bacteria in biofilters. In the context of a thermal power station, the output of the cooling system may be referred to as the effluent cooling water, which is noticeably warmer than the environment. Effluent only refers to liquid discharge. In sugar beet processing, effluent is often settled in water tanks that allow the mud-contaminated water to settle. The mud sinks to the bottom, leaving the top section of water clear, free to be pumped back into the river or be reused in the process again.

A sugar refinery is a refinery which processes raw sugar into white refined sugar or that processes sugar beet to refined sugar. Many cane sugar mills produce raw sugar, which is sugar that still contains molasses, giving it more colour (and any associated nutrients) than the white sugar which is normally consumed in households and used as an ingredient in soft drinks and foods. While cane sugar does not strictly need refining, sugar from beet is almost always refined to remove the strong, almost always unwanted, taste of beets from it. The refined sugar produced is more than 99 percent pure sucrose. Whereas many sugar mills only operate during a limited time of the year during the cane harvesting period, many cane sugar sugar refineries work the whole year round. Sugar beet refineries tend to have shorter periods when they process beet but may store intermediate product and process that in the off-season.

Raw sugar is either processed into white refined sugar in local refineries, and sold to the local industry and consumers, or it is exported and refined in the country of destination. Sugar refineries are often located in heavy sugar-consuming regions such as North America, Europe, and Japan. Since the 1990s many state-of-the art sugar refineries have been built in the MENA region, e.g. in Dubai, Saudi Arabia and Algeria. The world´s largest sugar refinery company is American Sugar Refining with facilities in North America and Europe.

The sugar industry in India plays a vital role towards socioeconomic development in the rural areas by mobilizing rural resources and generating higher income and employment opportunities. Abort 7.5 per cent of the rural population covering about 45 million sugarcane farmers, their dependents and a large number of agricultural labourers are involved in sugarcane cultivation, harvesting and ancillary activities. About half a million skilled and semi-skilled workers, mostly from the rural areas are also engaged in the sugar industry. In India, the sugar industry is the second largest agro-based industry, next only to textiles and contributes about Rs.1650 crore to the central exchequer as excise duty and taxes annually. Besides, the State Governments realise about Rs.600 crore annually through purchase taxes, cess etc. The total value of sugarcane produced in the country is estimated at Rs.24000 crore per year. Sugar exported from India increased from 2000 tonnes [valued at Rs.0.91 crore] in the financial year 1990-91 to 1004317 tonnes [valued at Rs.2119.68 crore], in the financial year 2006-07 [upto July 2006].

The sugar industry in India finds itself entangled in a complex web of problems leading to 'declining profitability to the cane growers as well as sugar industry'. The reasons for the same are to be traced and suitably addressed to give a boost to this sector in the country. Unlike many western or major sugarcane growing countries, sugarcane is the only source of sugar in our country and therefore, any mismatch between demand and supply of sugar in the country assumes significance at the national level and influences the economics of sugarcane cultivation to a great extent. The initiatives by the State Governments in the form of fixing a remunerative sugarcane price and pressurizing sugar mills to make payment within a reasonable time encouraged farmers to put in more area under the sugarcane crop. This underlines the need to study the economics of sugarcane cultivation in order to understand the effectiveness of the price policy in determining the area under sugarcane crop. The initiatives of research institutions, particularly of those directly involved with sugarcane crop are required to be listed in order to study the growth in productivity of sugarcane crop. Further, the globalization of the Indian economy started in early 90s is bound to direct the trade of agricultural commodities in the years to come.

In Karnataka, the cost per acre of production of planted sugarcane varied from Rs.31691 [Belgaum district] to Rs.36720 [Mandya district], the average being Rs.33882 and that of ratoon sugarcane varied from Rs.20315 [Belgaum district] to Rs.33426 [Mandya district], the average being Rs.27623. Lower expenditure in raising ration sugarcane could be attributed mainly to no incurring of expenditure towards tractor hire [which was necessary for field preparation before planting in the case of planted sugarcane] and planting and incurring of lower expenditure towards seed material [used for gap filling] and farm yard manure. The cost of production of sugarcane per acre varied from Rs.29475 in Belgaum district to Rs.35790 in Mandya district, the average being Rs.32409. Higher cost of production of sugarcane per acre observed in Mandya district, could be attributed to the fact that harvesting and transportation charges of sugarcane were met by the sugarcane growers. However, in the case of Belgaum district, these charges were met by the sugar factories.

Karnataka Sugar Industry ranks 3rd in terms of its contribution of sugar in the total sugar production in the country. The Sugar Industry in Karnataka is able to manufacture sugar in such huge quantities due to the fact that sugarcane is abundantly available in the state. In fact, Karnataka stands 4th in the country in the cultivation of sugarcane. Sugarcane and sugar beet are the main sources of sugar in Asia and Europe respectively. While sugarcane is grown primarily in the tropical and sub-tropical zones of the southern hemisphere, sugar beet is grown in the temperate zones of the northern hemisphere. During 1970s, sugarcane and sugar beet accounted for 60 per cent and 40 per cent respectively of the total sugar production in the world. However, during 1990s, the corresponding figures were 68 per cent and 32 per cent. During 2005-06, sugarcane accounted for 75 per cent of the total sugar production in the world and sugar beet accounted for the rest. These figures amply demonstrate the growing importance of sugarcane in sugar production. Sugarcane provides the raw material mainly for the production of white sugar, jaggery [gur] and khandsari. It is also used for chewing and extraction of juice for beverage purpose. 1.02 Sugarcane originated in New Guinea where it has been known since about 6000 BC. From about 1000 BC its cultivation gradually spread along human migration routes to Southern Asia and India. It is thought to have hybridized with wild sugarcanes of India and China, to produce the 'thin' canes. Sugarcane has a very long history of cultivation in the Indian sub-continent. The earliest reference to it is in the Atharva Veda [1500-800 BC] where it is called ikshu and mentioned as an offering in sacrificial rites. The Atharva Veda uses it as a symbol of sweet attractiveness. The word 'sugar' is derived from the ancient Sanskrit word sharkara. By the 6th century BC sharkara was frequently referred in Sanskrit texts which even distinguished superior and inferior varieties of sugarcane. A Persian account from the 6th century BC gives the first account of solid sugar and describes it as coming from the Indus Valley. This early sugar would have resembled what is known as 'raw' sugar: Indian dark brown sugar or gur. 1.03 Sugarcane Breeding Institute, Coimbatore, internationally recognized as the world leader in sugarcane breeding, has the credit of being the first institute in the world to initiate inter-specific hybridization between Saccharum officinarum and Saccharum spontaneous species in the beginning of the 20th century resulting in the development of Co 205- an epoch making hybrid distinctly 1 superior in yield and sucrose content to the indigenous low yielding then canes belonging to S. sinense and S. barberi species then cultivated in North India. This was the beginning of a sweet revolution in the world. The most outstanding research finding of the Indian Institute of Sugarcane Research, Lucknow in seventies was the development of MHAT of seed cane which effectively controls RSD and GSD diseases, responsible for gradual decline of productivity of sugarcane particularly the ratoon crop. Based on this technology, a three-tier seed programme was developed which helped in producing disease free seed and prolonging the life span of important varieties under cultivation. This technology has proved effective in maintaining and improving the sugarcane yield as well as sugar recovery in the country. Micro-propogation of seed cane through Tissue Culture using apical meristem tissue has been developed recently which may replace the traditional system of seed multiplication in future. 1.04 During 2005, in terms of area under sugarcane, India (3.75 million ha.) stood next to Brazil (5.77 million ha) and in terms of production of sugarcane also, India (232.32 million tonnes) stood next to Brazil (420.12 million tonnes)1 . However, in terms of productivity per hectare of sugarcane, India (61.95 tonnes) stood tenth, the first nine countries being Colombia (92.29 tonnes), Australia (91.06 tonnes), Philippines (81.58 tonnes), Indonesia (72.86 tonnes), Brazil (72.85 tonnes), Mexico (70.61 tonnes), South Africa (69.63 tonnes), United States of America (66.63 tonnes) and China (65.16 tonnes). Lower productivity of sugarcane in India could be attributed to raising of sugarcane under diverse growing conditions by millions of farmers. This points out to the need for taking suitable steps towards increasing the productivity of sugarcane in India. 1.05 In India, during 2008-09, the gross area under rice was the maximum (45.6 million ha.), followed by wheat (27.7 million ha), cotton (9.5 million ha.), bajra (8.7 million ha.), gram (8.2 million ha.), maize (8.0 million ha.), jowar (7.7 million ha.), groundnut (6.2 million ha.), and sugarcane (4.4 million ha.)2 . Thus, in terms of cropped area, sugarcane stands ninth in the country.

The sugar industry in India plays a vital role towards socioeconomic development in the rural areas by mobilising rural resources and generating higher income and employment opportunities. About 7.5 per cent of the rural population, covering about 45 million sugarcane farmers, their dependents and a large number of agricultural labourers are involved in sugarcane cultivation, harvesting and ancillary activities. About half a million skilled and semi-skilled workers, mostly from the rural areas are also engaged in the sugar industry3 . 3. Directorate of Sugar, Revitalisation of Sugar Industry, Department of Food and Public Distribution, Ministry of Food, Consumer Affairs and Public Distribution, GOI, Krishi Bhavan, New Delhi, 14 July 2006 4. National Federation of Co-operative Sugar Factories Ltd., New Delhi, Co-operative Sugar, Vol.40, No. 10, June 2009. 5. Sugar-year refers to the period from 01 October to 30 September. 1.07 In India, the sugar industry is the second largest agro-based industry, next only to textiles and contributes about Rs.1650 crore to the central exchequer as excise duty and taxes annually. Besides, the state governments realise about Rs.600 crore annually through purchase taxes, cess, etc. The total value of sugarcane produced in the country is estimated at Rs.24000 crore per year. 1.08 In 1980-81, utilisation of sugarcane output was maximum for the production of gur and khandsari (55 per cent), followed by white sugar (33 per cent) and seed, feed and chewing (12 per cent). However, utilisation of sugarcane for white sugar production increased from 61 per cent in 2001-02 to 73 per cent in 2007-08, and that for gur and khandsari decreased from 28 per cent to 15 per cent during the same period. Thus, utilisation of sugarcane for white sugar production has been rising and that for gur and khandsari production, falling. For seed, feed and chewing, utilisation of sugarcane has been stable at about 12 per cent4 . 1.09 The production of sugar in India increased substantially from 164.53 lakh tonnes in sugar year (SY)5 1995-96 to 201.45 lakh tonnes in SY 2002-03 and decreased to 135.46 lakh tonnes in SY 2003-04 and to 126.91 lakh tonnes in SY 2004-054 particularly due to the onslaught of drought and white woolly aphid in major sugar producing states like Maharashtra, Tamil Nadu and Karnataka resulting in a fall in sugarcane production, delayed payment of cane price and closure of some sugar mills. However, considering the increasing price of sugar in the international market, the Indian sugar industry encouraged the sugarcane farmers to plant more sugarcane. Accordingly, there was substantial diversion of area from other crops to sugarcane in anticipation of higher return. The area under sugarcane cultivation increased from 3.662 million hectares in 2004- 05 to 4.201 million hectares and 5.134 million hectares in 2005-06 and 2006-07 respectively. Sugar production increased substantially from 19.267 million tones in SY 2005-06 to 28.364 million tones in SY 2006-07 against domestic consumption of 18.945 million tonnes and 20.160 million tonnes in SY 2005-06 and SY 2006-07 respectively. Due to maximum sugar production in SY 2006-07, sugar exports increased substantially from 1.661 million tonnes in SY 2006-07 to 4.957 million tonnes in SY 2007-086 . 1.10 The production of gur (including khandsari) in India substantially decreased from 98.62 lakh tonnes in 1992-93 to 56.94 lakh tonnes in 2002-036 . This could be attributed to diversion of utilisation of sugarcane for manufacture of white sugar on account of changed demand pattern. 1.11 The number of sugar factories in operation in India increased from 416 in 1995-96 to 455 in 2005-06. However, due to maximum production of sugarcane, in 2006-07 followed by 2007-08, this number increased to 504 and 516 in 2006-07 and 2007-08 respectively. As against the installed sugar production capacity of 189.85 lakh tonnes in 2004-05, utilisation of capacity was only 67 per cent. The lower utilisation of sugar production capacity during 2004-05 could be attributed to lower sugarcane production and higher installed sugar production capacity. However, in 2006-07, as against the installed sugar production capacity of 213.91 lakh tonnes, utilisation of capacity was of the order of about 133 per cent. The higher utilisation of sugar production capacity during 2006-07 could be attributed to maximum sugarcane production. 1.12 The sugar export from India increased substantially from 8.87 lakh tonnes in SY 1995-96 to 49.57 lakh tonnes in SY 2007-08. The sugar import into India increased substantially from 0.42 lakh tonnes in SY 1995-96 to 1.24 lakh tonnes, 5.53 lakh tonnes and 16.00 lakh tonnes in SY 2002-03, 2003-04 and 2004-05 respectively6 . Thus, during the SY 1995-96 to SY 2007-08, the quantity of sugar exported was substantially higher than what was imported.

Sugar exported from India increased from 2000 tonnes (valued at Rs.0.91 crore) in the financial year 1990-91 to 16,62,370 tonnes (valued at Rs.1769.49 crore) in the financial year 2002-03 and decreased to 12,00,600 tonnes and 1004317 tonnes in the financial years 2003-04 and 2006-07 respectively, whereas sugar imported into India decreased from 17,65440 tonnes (valued at Rs.2245.85 crore) in the financial year 1994-95 to 320 tonnes (valued at Rs.1.11 crore) in the financial year 2006-075 . 1.14 During the decade ended 2008, sugar export from India was maximum to UAE (5.40 lakh tonnes), followed by Bangladesh (3.74 lakh tonnes), Pakistan (3.50 lakh tonnes), Sri Lanka (1.62 lakh tonnes), Malaysia (1.32 lakh tonnes) and Yemen (1.17 lakh tonnes)7 . 1.15 The Government of India, vide its notification dated July 04, 2006 had banned export of sugar purportedly to check inflation caused by rising sugar prices. International Sugar Organization (ISO) assessed the increase in sugar prices of different countries during October 2005 to April 2006 and stated that the increase in domestic price of sugar in India is "a mere tepid 10 per cent in aggregate terms over the past six months" compared to 58 per cent in Brazil, 50 per cent in Russia and 27 per cent in China". The Indian sugarcane farmers and the sugar industry which had suffered major losses during 2003-04 and 2004-05 could recoup the losses incurred, by exporting sugar. Higher world market prices make sugar export a viable proposition, particularly when excess stocks are available beyond local needs. In India, sugar is a prime requirement in every household. Almost 75 per cent of the sugar available is consumed by sugar based bulk consumers like bakeries, candy makers, sweet makers and soft drink and ice cream manufacturers. Industrial consumption of sugar is growing rapidly particularly from the food processing sector and sugar-based bulk consumers. A rising trend in usage of sugar could be attributed to greater urbanization, rising standard of living and change in food habit. While domestic consumption of sugar accounts for 98 per cent of sugar production in India, export accounts for the rest (long run average). 1.17 India is the world's largest sugar consumer. On the basis of existing trend of sugar consumption and population growth rate of 1.6 per cent per annum, the estimated requirement of sugar by 2010 would be 24.3 million tonnes and the corresponding area required. under cultivation would be around 5.5 million ha. The increase in area under sugarcane cultivation from the level of 4.41 million ha. in 2008-09 to 5.5 million ha. by 2010 may not be possible due to other competing crops, constant land area and water shrinkage and hence will necessitate improvement in productivity of sugarcane and sugar recovery, for which, research institutions have to play a very important role. Khandsari sugar is less refined and is typically consumed by sweet makers. Gur is an unrefined form of lumpy brown sugar. It is mostly consumed in rural areas. Some quantity of gur is illegally diverted for alcohol production. The per capita consumption of white sugar in India increased substantially from 4.80 kg in 1960-61 to 19.10 kg in 2007-08 and that of gur and khandsari decreased substantially from 15.20 kg to 4.50 kg during the same period.Molasses is the chief by-product of sugar industry and is the main raw material for alcohol production and alcohol-based industries in India. The production of molasses in the country increased from 6.5 million tonnes in 1994-95 to 13.11 million tonnes in 2006-07 and decreased to 11.31 million tonnes in 2007-08. The second by-product of sugar industry is bagasse, which is the fibrous material left over after crushing. Sugarcane bagasse is the chief source of power in the sugar mills. This is also being used as a raw material in the paper industry. In most sugar mills, cogeneration of power, using bagasse as fuel is considered feasible. It has been estimated that about 3500 MW power can be generated annually without extra fuel and with investment much less than that required for generating the same through thermal power plants. The third by-product of sugar industry is pressmud, which contains many plant nutrients and could be an important source of organic matter, major and micro-nutrients. By making use of byproducts, many sugar factories have been establishing facilities to produce power, alcohol, ethanol, bio-compost, etc. 1.23 Green tops of sugarcane are used as cattle feed. Sugarcane juice has great demand particularly in urban areas, as a thirst quencher.

Need for the Study

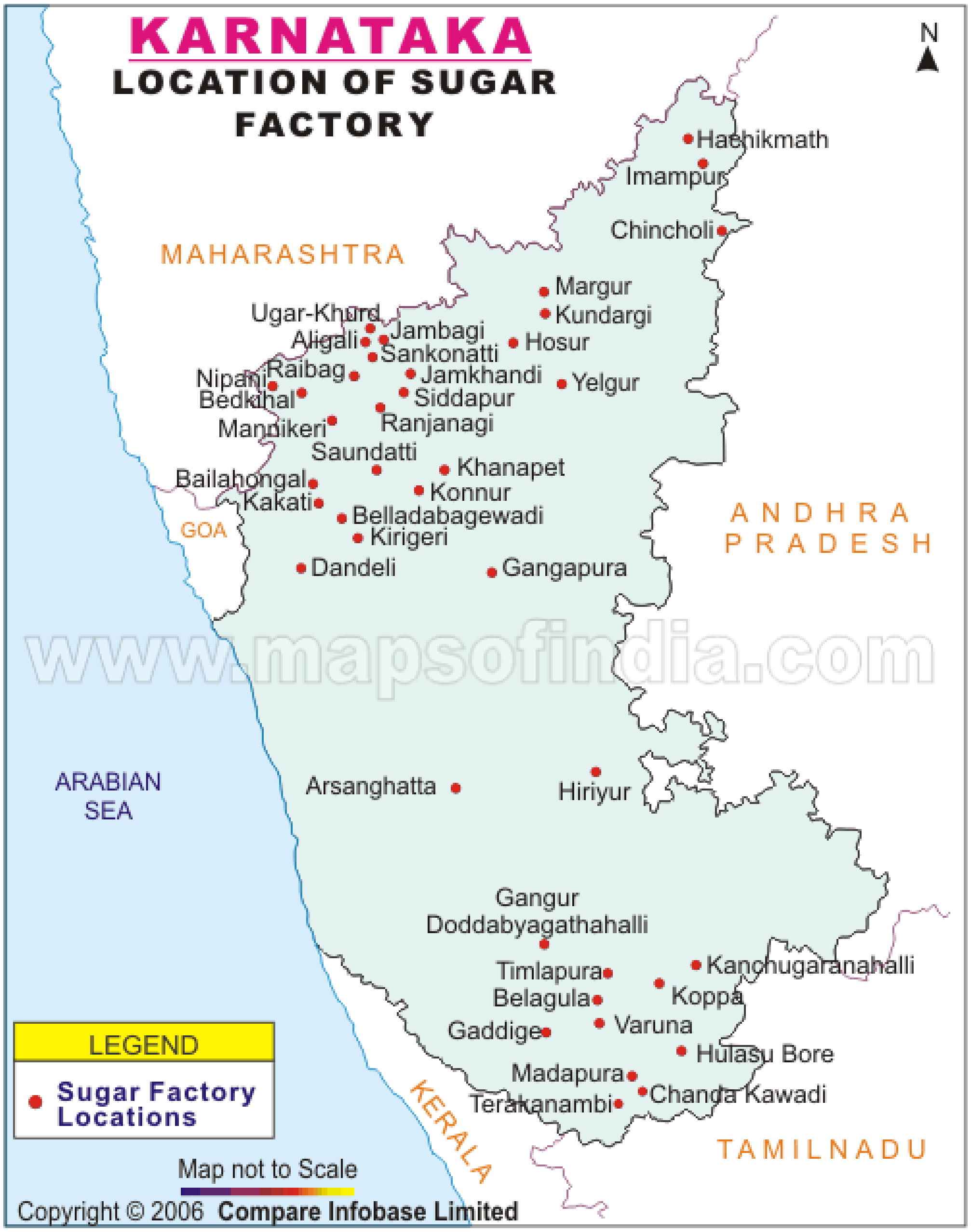
The sugar industry in India finds itself entangled in a complex web of problems leading to "declining profitability to the cane growers as well as sugar industries". The reasons for the same are to be traced and suitably addressed to give a boost to this sector in the country. Unlike many western or major sugarcane growing countries, sugarcane is the only source of sugar in our country and therefore, any mismatch between demand and supply of sugar in the country assumes significance at the national level and influences the economics of sugarcane cultivation to a great extent. The initiatives by the state governments in the form of fixing a remunerative sugarcane price on one end and pressurizing sugar mills to make payments within a reasonable time on the other end encouraged farmers to put in more area under the sugarcane crop. This underlines the need to study the economics of sugarcane in order to understand the effectiveness of the price policy in determining the area under sugarcane crop. The initiatives of research institutions, particularly of those directly involved with sugarcane crop are required to be listed in order to study the growth in productivity of sugarcane crop. Further, the globalization of the Indian economy started in early 90s is bound to direct the trade of agricultural commodities in the years to come. It is, therefore, necessary to study the status of Indian sugar in the export market with respect to domestic market. Keeping the above aspects in view, it was felt necessary to conduct a commodity specific study on sugarcane in a few selected states of India. 1.25 The present study was undertaken in the three selected states viz., Karnataka, Uttar Pradesh and Haryana to trace the movement of sugarcane crop from the farm to the factory as also to the jaggery/ khandsari production unit and of sugar and jaggery/khandsari from the sugar factory and the jaggery/khandsari production unit respectively to the consumer, with the broad objectives of understanding the nature of production conditions, highlighting demand-supply mismatches, if any, and studying marketing and other related aspects of sugarcane, sugar, jaggery and khandsari, including their price behavior.

The Sugar Industry in Karnataka has around 41 sugar factories which are distributed all over the state. The various locations of the sugar factories of Karnataka Sugar Industry are Konnur, Varuna, Koppa, Madapura, Dandeli, Jambagi, Hosur, Margur, Yelgur, Siddapur, and Arsanghatta. The major benefits of Karnataka Sugar Industry are that it has generated many facilities in the state such as communication, employment, and transport. It has also benefited the state by helping in the development of the rural areas of the state by mobilizing the various resources of the villages. The major sugar factories of Karnataka Sugar Industry are:

- Bannari Amman Sugar Ltd. with the sugarcane crushing capacity of 5000 TCD
- Davangere Sugar Company Ltd. with the sugarcane crushing capacity of 2500 TCD
- Sri Chamundeswari Sugars Ltd. with the sugarcane crushing capacity of 4000 TCD
- Godavari Sugar Mills Ltd. with the sugarcane crushing capacity of 7500 TCD
- Mysore Sugar Company Ltd. with the sugarcane crushing capacity of 5000 TCD
- Athani Farmers Sugar Factory Ltd. with the sugarcane crushing capacity of 2500 TCD

The Sugar Industry in Karnataka can be divided into 2 groups that are the unorganized sector which comprises of the producers of the traditional sweeteners such as gur and khandsari and the organized sector which consists of the sugar mills. The manufacture of khandsari and gur is considered to be rural industry and are produced in huge quantities. The gur and khandsari are consumed mostly by the rural people as sources of nutrition and also as sweeteners. The total sugar production of Karnataka Sugar Industry came to 17.98 lakh tons in 2002-2003, in 2003-2004 the figure came to 11.57 lakh tons, and in 2004-2005 the figure stood at 13 lakh tons.The Sugar Industry in Karnataka contributes around ` 36 crore per year to the state exchequer in central excise duty. It also contributes more than ` 900 crore in the form of turnover tax and sales tax to the state exchequer. The state government in an attempt to boost Karnataka Sugar Industry has set up the Karnataka Sugar Institute (KSI) which has emerged as a center for education and training for sugar technology.

The Karnataka Sugar Institute also provides important support to the Sugar Industry in Karnataka by doing R&D in the various aspects of sugarcane processing and production. Karnataka Sugar Industry has contributed a great deal to India's total level of sugar production and thus has helped the country to meet its demand for sugar. The Karnataka state government must make more efforts in order to boost the sugar industry in karnataka.



Industrial Effluents entering the water bodies is one of major sources of environmental toxicity. It not only affects the quality of drinking water but also has deleterious impact on the soil microflora and aquatic ecosystems. Soil is the most favourable habitat for a wide range of microorganisms that includes bacteria, fungi, algae, viruses and protozoa. More than a million microorganisms represent the population per gram of then sample studied with bacteria and fungi being the prominent species prevalent. Industries keep on releasing effluents which is quite toxic whether its sugar mill or fertilizer industries, or chemical treatment given to the fields also cause problems for the survival of the soil micro flora Sugar processing requires hot water for a number of steps – such as water for imbibitions, raw sugar, remelting and various washings. Wastewater with varying levels of pollution load is generated at nearly all stages of sugar production. Relatively mild effluents from the mill house, containing oil, grease, and some sugar content, are generated from the lubricating and cooling systems, floor washings, the large quantity of water used for juice extraction, and some leakage and spill over. Washing the filter cloths used for sludge from the clarifier increases the suspended solids concentration and BOD of the wastewater. Combined with floor washings, which also add washing chemicals and more sugar, the process house effluents are considered more contaminated than effluents from the mill house. For mills that have an attached distillery, the numerous distillation stages produce a highly contaminated effluent, with BOD and COD concentrations of about 40,000 –100,000 mg/l, called stillage. In general, sugar mill effluents contain acidic and alkaline compounds, a significant concentration of suspended solids and a high BOD, COD, and sugar concentration [1, 2, 3].Undoubtedly, water is the most essential requirement not only for life sustenance but for the economic and industrial development. At the same, it is a known reality that water is an important issue in the maintenance of our environmental balance with the rapid growth of population and acceleration in industrialization. In last few decades, the tremendous increase in the demand for freshwater has also been a matter of great concern. The release of treated and untreated industrial effluents in unplanned manner is one of the major causes of water pollution. The effluents released from sugar cane factory into land and into various surface water bodies not only affect the water quality and soil but also pollute the groundwater due to percolation of some water soluble pollutants .

Industrial and domestic waste water come into contact with natural water bodies. Such waste waters contain large amount of dissolved chemical constituents and many a times, microorganisms in them. In rural area small scale industries like dairy, poultry etc and large scale industries like sugar, distillery, paper etc. release the waste (solid and liquid) after partial treatments like lagooning or often without any treatment on the land surface or directly into the natural streams thereby admitting some hazardous chemicals. These waste material is also serving as a medium for growing bacteria, fungi or chemical minerals like Na+ , K+ , NO3 - , PO4 etc get in groundwater by percolation through the soil and thus contaminate groundwater. Disposal of industrial waste in the open space and abandoned dug wells have thus caused the pollution of groundwater in some parts of rural India. Industrial effluents often infiltrate upto the of pheratic zone of aquifer depending upon the porosity and the permeability of the medium of infiltration resulting in acceptable concentration of TDS, fluorides and iron resulting in severe contamination of the groundwater[2]. Sugar industry consumes substantial volume of water and chemicals in different processing units. All chemicals used wash away with the waste water discharged through industrial outlet. Thus effluents consist of all types of chemicals which contain toxic heavy metals. Effluents store pond is highly contaminated. Effluents moves along with heavy metals and reach in shallow water table by leaching processes and contamination may disperse in a wide range of the region. Contamination of soils of close areas occurs when the effluents or polluted water comes under contact of soil. The regular contact of polluted water with soil makes the sodic soils and alters the physico chemical characteristics, texture and profile of soil stratum [3]. India is widely known for its sugar industry; it has emerged as one of the largest sugar producing country in the world. In term of the economic development, sugar industry played a vital role in the Indian subcontinent. The industry particularly in Maharashtra holds a very important position in the economy and politics of the state. These sugar industries have initiated many economic activities by setting up dairies, distilleries, paper mills and poultries etc. in their respective regions. Besides, many of sugar industries run their own educational institutions to impart education at different levels e.g. from KG to PG and have started the technical institutions. Thus, contributing to the social change rural areas within their jurisdiction [4].

Increase in sugar industrialization along with high rate of urbanization and subsequent increase in population has led to unprecented increase in the environmental degradation of the resources. The damage to both aquatic and terrestrial ecosystems caused by the enormous quantity of waste released in the form of effluent produces is certainly alarming. These pollutants not only alter the physico chemical characteristics of the recipient aquatic bodies but also affect the aquatic flora and fauna. Similarly, the rural and semi-urban population, drinking water from streams or rivers and using it for agricultural and domestic purposes has undergo serious health hazards on account of the sugar mill effluents, being discharged into the environment. Farmers have been using these effluents unscientifically for irrigation and found that the growth, yield and soil health is reduced. Contaminants such as Cl^- , SO_4^{2-}, PO_4^{3-}, Mg^{+2} and NO_3^- are discharged with the effluent which creates a nuisance due to physical appearance, odor and taste[5]. In recent past various studies have been made on the impact of sugar mill effluent on groundwater quality[6-13] . Sangamner area is of particular importance because effluents from municipal sewage, agricultural runoff, sugar cane factory effluents and industrial waste are discharged into the Pravara River bringing out considerable change in the groundwater quality. However there exists negligible data and information available about the effect of sugar mill effluent on the quality of groundwater of this area. Considering these serious issues, the present study was carried out to find out the possible effects of such effluents on the quality of groundwater in the proximity of a sugar factory.

internal processes, in the boiling house, mill house and filter cloth washing and comes out as an effluent. This effluent with very little partial treatment like lagooning goes through a zig - zag natural stream flowing through the agricultural area in the downstream part for a distance of about 5 km and finally meets the river Pravara at Sangamner. Geographical locations of lagoons are at higher elevation in the foothill zones where thickness of colluvial deposits is more, colluvium overlies on amygdaloidal/vesicular basalt that shows moderate degree of weathering. This has possibly favoured induced infiltration of effluent into the subsurface. In addition to this, while flowing through the natural stream the effluent infiltrates through the soils, leading to contamination and changes in chemical composition of water from nearby dug wells. It should be noted that water from this area was uncontaminated and was also of potable quality prior to installation of the sugar factory.

Methodology

The streams carrying effluent from sugar mills flows through the study area. The loss of some effluents envisaged due to percolation through the soil zone. This waste water is therefore, expected to reach the groundwater table. Hence it was essential to have the sampling sites near the stream and few meters away from the effluents stream. The groundwater composition is likely to vary from place to place due to the effect of mixing of effluent with natural groundwater. Hence representative water samples were collected from the wells close to the stream and progressively away from it. Thus fifteen sampling stations in the study area were selected by adopting the above mentioned criteria. The wells which are used for drinking, irrigation and contaminated by sugar mill effluents were selected for sampling.

Suggestions

Industrialist should check their instruments equipment to avoid leakage. Each industry should follow environmental¬ policies, regulations and environmental protection acts to conserve the environment. Industrialist should use such raw materials which will give maximum good products and less toxic waste in fewer quantities. Industries should be installed in low laying¬ areas away from the public locality. Each industry should have ETP plant to treat the effluents, which can be further used for the agricultural purpose.

REFERENCES

[1] .Verma, S.R. and Shukla, G.R. Pollution in a perennial stream, 'Khala' the sugar factory effluent near lakes. Env. Health. 1969; 11: 145-162.

[2] Behra, B.K. and Mishra, B.N. The effect of a sugar mill effluent on enzyme activities of rice seedlings. Industrial Research 1969 37: 390-8.

[3] Roy,R.P., Prasad, J. and Joshi, A.P. (2007) Effect of sugar factory effluent on some physic-chemical properties of soils – a case study. J. Environ. Sci. 2000; 49(4):277-282.

[5]. Siddiqui W.A. and Waseem M., A comparative study of sugar mill treated and untreated effluent – A case study, Oriental Journal of Chemistry, 28(4), 1899-1904 (2012)

[6] Pondhe G.M., Patil S.F. and Pawar N.J., Groundwater pollution due to sugar mill effluent at Sonai, Maharashtra, India, Environmental Geology, 34(2), 151-158 (1958) 3. Bharati P.K., Groundwater Pollution, Biotech Books, New Delhi (2012)

[7]. Sabade B.R., Industrial developments of Maharashtra, 22nd Annual Convention IWWA, 17- 27 (1990).

Material and Methods

For the present study the samples of treated and untreated effluent from a sugar industry located at Shamli western Utter Pradesh India were collected during the crushing session of 2011-12. A comprehensive study was carried out primarily data collection for the related work and secondary literature survey took place. Then to obtain basic ideas of the quality, characteristics and chemical composition of the effluent of sugar factory samples of treated and untreated effluents were collected in1 liter polythene-carbuoys bottle and mixed well in equal proportion to get homogeneous samples (Rain water and Thatcher, 1960) Random selection procedure was adopted for the selection of both sampling unit and the sampling point in given site (APHA1985). Tape water and 8 M HNO3 were used to wash the bottles, which were used for the sample preservation followed by washing them with distilled water and finally with double distilled water (Jeffery 1996). Then the bottles were rinsed thrice with effluent samples stored in refrigerator. Temperatures, pH, electrical Conductivity (EC) were measured at the sample collection site. Physicochemical properties such as total dissolved solids (TDS) chemical Oxygen Demand (COD), chloride, TSS, TS, Sulphate and oil grease, heavy metals were measured using APHA standard method9 . For physical and chemical analysis of the samples a number of sophisticated instruments. were used and standard methods were followed. To measure the effluent parameters of the collected samples the Physico-chemical studies and heavy metals determinations were performed in sophisticated laboratory of Environmental Science lab, Faculty of Engineering & Technology, Jamia Millia Islamia New Delhi 110025.Heavy metal determination were performed using Atomic Absorption Spectrophotometer model 3100 (Perkin Elmer, USA). For Studying germination pattern in treated and untreated effluents for different types of cereal crops seed viz Peniselium typhorides (Bajra), cicer arientinum (Chana), zea myes (Maize) and Triticum aestivum (wheat) were selected. Twenty five seeds of each were soaked in untreated effluent and another set in treated effluent as control for 24 hour in separate Petri dishes using filter paper method (Aggarwal 1995), the seeds were folded in germinating paper. Each paper contains 10 seeds. The folded paper along with seeds were tied with thread and kept in 500 ml beaker. 200 ml untreated effluent was poured in it, while another beaker was kept as control by using treated effluent. After every two days interval, water was added as per requirements depending upon rate of absorption. After seven days the germinated seeds were removed and then shoot & root lengths and weight of the seeding were measured and analyzed.

pH: In the present investigation the pH value of treated and untreated were recorded as 5 and 6.8 respectively. According BIS standards the pH of the effluents should be in range 6.5 to 8.0.Relatively low pH values of both treated and untreated samples are due to use of phosphoric acid and Sulfur dioxide during cleaning of sugar cane juice. pH is one of the important biotic factor that serves as index for pollution. If such water is used for irrigation for a longer period the soil becomes acidic resulting in poor crops growth and yield. The factors like photosynthetic exposure to air, disposal of industrial effluent and domestic sewage also affect the pH of the soil.

Dissolved Oxygen: The analysis of DO is very important in water pollution control as well as waste water control. Aquatic ecosystem totally depends on DO, various biochemical changes and its effects on metabolic activities of microorganism were very well documented. Its presence was essential to maintain variety of forming of biological life in water and effect of water discharge in water body are largely determined by oxygen balance of the system. According to the BIS standard the DO of the effluent should be within the range 4 to 6 mg/lit. In the present investigation the DO of the untreated and treated effluent sample was recorded 1.30 and 2.30 mg/lit respectively which is sufficiently low than the BIS Indian standard (3) values.

BOD: Biochemical Oxygen Demand (BOD) is defined as amount of oxygen required by microorganism while stabilizing biological decomposable organic matter in water under aerobic conditions. The biological oxidation is very slow process during oxidation; organic pollutants are oxidized by certain microorganism into carbon dioxide and water using dissolved Oxygen. Hence lowering in dissolved oxygen value is the measure of BOD relation. In the present investigation the BOD of the untreated effluent was 98 mg/l while the treated effluent recorded 88 mg/l. According to BIS Indian3 standard the BOD should not exceed the 50 mg/l.

COD: The chemical Oxygen demand test determines the oxygen required for chemical oxidation of organic matter with the help of strong chemical oxidant. The COD is a test which is used to measure pollution of domestic and industrial waste. The effluent is measured in term of quality of oxygen required for oxidation of organic matter to produce carbon dioxide and water. It is a fact of all organic compounds with few exceptions that they can be oxidized by the action of strong oxidizing agents under acidic conditions. COD is useful in pinpointing toxic condition and presence of biological matters. In the present investigation the COD of the untreated effluents was 350 mg/l while treated effluent was recorded 255 mg/l. In untreated effluent it is appreciably high compared to BIS standard (250 mg/L). This indicated high organic pollutants in the sample.

TDS: The total dissolved solids concentration in the effluent represent the colloidal form and dissolved specters. The probable reason for the fluctuation or value of total solids and subsequent the value of dissolved solid due to convent collision of the colliding particles. The rate of collision aggregated process is also influenced by pH of this effluent. In the rainy season less concentration of total dissolved solids are obtain due to dilution of waste effluent with rain water (Hosetti et.al 1994.) In the present investigation the total solids in untreated effluent was 2980 mg/l and 1920 mg/l in treated effluent. In both the samples in TDS values are much higher compared to BIS Indian Standards (500 mg/L).

Chlorides: The presence of chloride in natural water is attributed to dissolution of salt deposit, discharge of effluents from chemical industries oil well operations. In the present study chlorides of untreated was 210 mg/l and in treated effluent was recorded 175 mg/l. This is well within the limits of BIS Indian Standard.

Determination of calcium in presence of magnesium: Pipette 50.0 mL of the sample into a 250 mL conical flask and dilute to 100 mL, preferably with deionized water. Add 2 mL of 2 mol/l of NaOH solution and approximately 0.2 g of the HSN indicator or 6 drops of the Solochrome dark blue solution. The colour of the solution should now turn to claret or violet and its pH value should be at least 12.0. Titrate with the EDTA solution to a distinct blue endpoint (v1 mL).

Determination of magnesium The magnesium present in the sample may be calculated by substracting the volume of EDTA solution required for the calcium determination from the volume required for the total hardness determination, for equal volumes of the sample. 1 mL 0.01M EDTA = 0.2432 mg magnesium.

Alkalinity: Collect 50 mL water sample, add 3 drops of phenolphthalein indicator, titrate the 50 mL sample with 0.02N sulfuric acid to pH 8.3 and estimate phenolphthalein alkalinity (phenolphthalein indicator will change color, from pink to clear, at pH 8.3). Phenolphthalein Alkalinity (in mg/L as $CaCO_3$) = $(A1 \times N \times 50{,}000) / V$

Where: A1 = volume of sulfuric acid used in mL; N = normality of acid used to titrate; V= volume of sample used in mL

REFERENCES

1. BIS. Indian Standard specifications for drinking water IS: 10500 Bureau of Indian Standard New Delhi (2010).
2. A.S. Kohle, Ingale S.R. & Sarode A.G. Physico-chemical Analysis of Sugar Mill Effluents. S. S. M. International Research Journal 1: 307-311.
3. Amathussalam, M.N. Abubakar and N. Jayabai. Impact of Sugar mill effluents on ground water, A case study Jr. of Industrial pollution 18(2): 119-124 (2002).
4. Gunter Gunkel , Jan Kosmol, Maria Sobral, Hendryk Rohn., Sugar cane Industry as a Source of Water Pollution
5. Standard methods for the examination of water and waste water, 1985, 16th Edition APHA, AWWA and WPCF Inc. New York.

CHAPTER III

Determination of BOD, COD, DO and Other Physico-chemical Properties of Sugar and Cement Industries

ABSTRACT:

Wastewater was collected from the sugar and cement industrial area situated in North Karnataka. Samples were collected determined the following parameters, pH, EC, Conductivity, total dissolved solid (TDS), chemical oxygen demand (COD), Biological oxygen demand (BOD), dissolved oxygen (DO), calcium, magnesium, alkalinity and chloride. The concentrations of the metals in the wastewater were higher limits set by W.H.O. and the maximum contaminant levels (MCL Thus, the wastewater around the North Karnataka industrial area highly polluted. Domestic and industrial waste should be properly disposed and or recycled. Relevant agencies should make continuous effort to control, regulate and educate populace on indiscriminate waste disposal from domestic and industries within the study area

INTRODUCTION

Water is our most precious resource. The cleanliness of our lakes, rivers and oceans is one of the pressing goals for environmental protection. The balance of nature depends therefore on the comprehensiveness of our approach to solve the problem of wastewater disposal. Chemical oxygen demand (COD) and biological oxygen demand (BOD_5) are two of the most common generic indices used to assess aquatic organic pollution. Concentrations of BOD_5 readings will generally report as lower than COD. This is due to differences in the methods of oxidation of the samples. While BOD_5 provides a good approximation of the biologically consumable organic fraction in waterways, the test takes 5 days. Alternatively, COD is able to provide a rapid and reliable estimate of the biogeochemical interactions in waterways. Chemical Oxygen Demand (COD) is the amount of oxygen consumed by the organic compounds and inorganic matter which were oxidized in water. Biological Oxygen Demand (BOD_5) is the amount of oxygen consumed by the organic and inorganic compounds which were oxidized by biological-oxidation effect in a certain condition. Both of them reflect the pollution degree of the water, and are the comprehensive index of the relative content of organics. As the main comprehensive index of the organic pollution, COD and BOD_5 are important in the control of the total con-tent of pollution and the management of water environment. So it is significant to further research and develop the simple and rapid method for the determination of COD and BOD_5. At present, potassium dichromate method is generally used to determine the value of COD [1] at home and abroad and other methods like spectrophotometer [2] and coulometric method [3] were reported. Wastewater discharge from sewage and industries are major component of water pollution, contributing to oxygen demand and nutrient loading of the water bodies, promoting toxic algal blooms and leading to a destabilized aquatic ecosystem [4].

Global industrialization is a very important and critical issue in context of the present society. It is often extremely difficult, especially in developing countries, to handle the situation properly ensuring sustainable green environment in and around the state. Certain chemicals or organic matters have caused serious damage to the environment and to human health resulting in suffering and premature death. Many activities are known to cause contamination of soil, surface and groundwater [5, 6], that is why, it is very important to possess the knowledge of the eco-toxicological properties of chemicals or organic matters to maintain environmental stability [7, 8]. 'Biodegradability' is an important parameter due to the simple fact that it allows to know the ecological behavior of substances and products. Information on the degradability of chemicals may be used for hazard and risk assessment [9]. The rapid growth and proliferation of industrial sector have contributed to severe deleterious effect on the environment. Good engineering practice dictates that waste materials can be discharged into receiving water in such a way that nature's ability to assimilate these wastes is utilized without any deleterious effects on the water quality. It is however necessary to analyze the industrial wastewater to determine its suitability for reuse, the degree of treatment required prior to its disposal or to device suitable measures for the recovery of useful products. It is of great importance in water quality control that the amount of organic matter present in the system be known and that the quantity of oxygen required for its stabilization be determined. Over the past few years, a number of different tests have been developed to determine the organic content of wastewater [10, 11].

MATERIALS AND METHOD

Sample area and Sampling Points

Wastewater samples were collected from the North Karnataka industrial area for the analysis of physicochemical parameters.

Sample Collection

Wastewater samples were collected in plastic containers previously cleaned by washing in non-ionic detergent, rinsed with tap water and later soaked in 10% HNO_3 for 24 hours and finally rinsed with deionised water prior to usage. During sampling, sample bottles were rinsed with sampled water three times and then filled to the brim at a depth of one meter below the wastewater from each of the four designated sampling. The samples were labeled and transported to the laboratory, stored in the Refrigerator at about 4°C prior to analysis. Wastewaters were also collected for Analysis. The dependent variables analyzed were pH, EC, TDS, CO,.DO,BOD, Calcium, Magnesium, Alkalinity and Chloride etc. Standard methods were followed in determining the above variables (APHA, 1998).

Table.1.

BOD.COD, DO and other Physico-chemical properties of North Karnataka Industrial effluents.

Sl. No.	Sample	pH	EC	TDS ppm	COD	DO	BOD	Ca^{++} ppm	Mg^{++} ppm	Alkalinity	Cl^-
1	The Ugar sugars PVT ltd	6.2	188	928	9.6	6.2	2.018	256		0.0732	0.156
2	Athani former sugar factory	5.7	74	377	6.4	7.6	2.018	96	31.72	0.0854	0.0923
3	Nirani sugars Mudhol	6.2	388	211	105.6	5.4	0.864	84	47.58	0.5612	0.734
4	Prabhulingeshwar sugars Siddapur	6.9	89	490	156.8	6.6	2.450	64	52.46	0.1342	0.156
5	Jamkhandi sugars	5.8	161	846	48	6.0	0.432	40	37.82	0.244	0.248
6	Athani former sugar factory (Kempawad ETP)	6.0	545	295	425	6.2	0.144	378	22.5	0.323	1.263
7	Cement factory Muddapur	6.5	177	940	56	6.6	1.873	124	78.08	0.0732	0.3408
8	Sangur sugars	3.3	60	313	60.8	6.2	3.603	74	30.5		0.486
9	Godawari Bio-refineries,Sameer wadi	1.2	60	345	38.4	6.0	1.153	244	45.2	0.125	2.481
10	Renuka sugars, Kokatanoor	4.9	686	118	28.8	7.2	1.873	24	10.98	0.0122	0.0747
11	Shiraguppi Coworkers pvt ltd Kagawad sugars	2.1	22	176	10.5	6.0	3.02	590	11.6	0.115	
12	Nandi sugars	2.6	250	142	13.5	0.3	0.201	490	13.5	0.250	1.1644

RESULT AND DISCUSSION

Table 1 shows values of industrial water and pH value ranged from 1.2 to 6.9. The pH of water is a measure of the acid–base equilibrium and in most natural waters is controlled by the carbon dioxide–bicarbonate–carbonate equilibrium system. An increased carbon dioxide concentration will therefore lower pH, whereas a decrease will cause it to rise. All the pH values were above the permissible limits for industrial effluents set by NEQS (Appendix-A). Acid deposition has many harmful ecological effects when the pH of most aquatic systems falls below 6 and especially below 5. Electrical conductivity of industrial water varied from 22 to 686 micro mhos/cm which is acceptable limits of BIS standards. Total dissolved solids (TDS) are the terms used to describe the inorganic salts and small amounts of organic matter present in water. Water containing TDS concentration below 100mg /lit is usually acceptable to consumers. However the presence of high levels of TDS in water may be objectionable to consumers owing to the resulting test and to excessive scaling is water pipes, heaters, boilers, & household appliances [13] . In the study area, water samples recorded TDS values in the range of 118-940mg/liter & three samples exceeded the acceptable limits of 500mg/liter prescribed by BIS. COD is indirect measure of organic compounds in the water. In the present study, COD values of industrial waste water sample ranged between 6.4 & 425mg/liter. Athani formers sugar factory (420mg/liter) water sample exceeded the acceptable limits of 250 prescribed by BIS. Dissolved oxygen varied from 0.3 to 7.6ppm. Dissolved oxygen plays an important role in water quality determination. The introduction of oxygen demanding materials either organic or inorganic into well land causes depletion of the dissolved oxygen in the water this poses a threat to fish & other higher form of aquatic life if the concentration of oxygen falls below critical point. There exist no better general indicators of water quality than DO [14]. DO levels were found to be low this is due to the addition of agriculture industrial & domestic effluents containing oxidizable organic matter & subsequent biodegradation &decay of vegetation which leads consumption of oxygen present in water [15]. BOD values varied between 1.876 to 18.144ppm these higher values indicate that untreated organic wastes are permissible limits for BOD as per WHO [13] is 5mg/liter calcium contents of samples ranged from 24 to 590mg/liter any values above 25 mg/liter indicates calcium rich water [17]. All the water samples are above the permissible limit of WHO. In the study area water samples recorded a magnesium values is the range of 10.98 to 78.08 mg/liter water samples from Muddapur Cement factory exceeded the acceptable limits 75mg/liter prescribed by BIS . Alkalinity is measures of the ability of the water to neutralize water neutralize acidity. Alkaline water may decrease the solubility of metals. The alkalinity varies in accordance with the fluctuation in pollution load [18] .Alkalinity values of water samples ranged between 0.0732 &0.5612 mg/liter & are lower than the BIS values. The chloride content ranged from 0.0734 to 2.48 mg/liter is within the permissible limit of BIS.

CONCLUSION

Results of present study revealed the pollution associated with the physco-chemical parameters are induced by the discharge of untreated or partially treated industrial waste water illegally into the water body. This clearly indicates that water resources management is incomplete & ineffective in these regions of North Karnataka & that no effectively implemented methods of integrated management exist. It is thus recommended that waste treatment plants must be established with each industry with proper follow up. Further efficient environmental laws & social awareness programme must be undertaken with respective potential threat of industrial & other waste to the management.

REFERENCES

1. Chinese government standard GB11914-1989, “Determination of COD in water by dichromate titration method [S].”
2. J. G. Zhan, G. Wei, and R. C Xiong, “Quick evaluation of chemical oxygen demand based on spectrophotometric and multi-linear analysis [J],” Journal of Beijing University of Chemical Technology (Natural Science Edition), Vol. 34, No. 7, pp. 389–392, 2007. (In Chi-nese).
3. H. B. Yu, H. Wang, *et al*., “Amperometric determination of chemical oxygen demand using boron-doped diamond (BDD) sensor [J],” Electrochemistry Communications, Vol. 9, No. 9, pp. 2280–2285, 2007.
4. Morrison, G. O., Fatoki, O.S and Ekberg, A. Assessment of the impact of point source pollution from the Keiskammahoek sewage treatment plant on the keiskamma river. Water. SA., **27**: 475-480 (2001).
5. Ladwani Kiran D., Ladwani Krishna D., Manik Vivek S. and Ramteke Dilip S., Impact of Industrial Effluent Discharge on Physico-Chemical Characteristics of Agricultural Soil, I. Res. J. Environment Sci, 1(3), 32-36 (2012) Mir Tariq A., Manderia S., Manderia K., Influence of dye industrial effluent on physico-chemical characteristics properties of soil at Bhairavgarh, Ujjain, MP, India, I. Res. J. Environment Sci, 1(1), 50-53 (2012).
6. Mashhood A. K. and Arsalan M. G., Environmental Pollution: Its effects on Life and its Remedies, Journal of Arts, Science & Commerce, II (2), 276 (2011)
7. Roppola K., Environmental applications of manometric respirometric methods, PhD Thesis, Department of Chemistry, University of Oulu, Finland (2009)
8. Xia W., Li J. and Zheng X., Biodegradability assessment of industrial wastewater by Warburg Respirometer. The 2nd International Conference on Bioinformatics and Biomedical Engineering, 16-18 May 2008, 3738 – 3740 (2008) .

9. Sawyer, C. N., McCarty P. L. and Parkin G. F., (1994). Chemistry for Environmental Engineering; 4th. Ed., McGraw-Hill International Editions
10. Metcalf. Eddy., (1995). Wastewater Engineering, Treatment, Disposal and Reuse, Vth Edition, McGraw Hill, NY.
11. APHA. Standard methods for the examination of water and wastewater. 18th Edition. American Public Health Association, Washington, DC pp 45-60 (1998).
12. WHO [1996]Guidelines for Drinking water quality ,2nd cd. vol -2. Health criteria &other supporting information World Health Organization Geneva
13. Huge Ellis, J.[1987] Stochastic water quality optimization using imbedded chance constriants water resource a research ,123(1) : 2227-2238
14. Jamel A,(1998). physico-chemical studies in vyakondam channel water of Cauvery poll .Res,17(2) . 111-114.
15. Adeleye.I.A and A.A.Adebiyi., Physico-chemical and Microbiological assessment of oka-ba –A Nigerian Abattoir J.Environ. Biol,24,309(2003).
16. Ohle,B.W,bie vrsachen der rasanten seeneutrophierung.vernd infernat.verf and hoer Uangew limno -12,375-382(1955).s

CHAPTER-IV

ASSESSMENT OF PHYSICO-CHEMICAL CHARACTERISTICS OF SUGAR INDUSTRY EFFLUENTS

ABSTRACT

Sugar mills play a major role in polluting the water bodies and land by discharging a large amount of wastewater as effluent. The sugar mill effluents are having high amount of suspended solids, dissolved solids, BOD, COD, chloride, sulphate, nitrates, calcium and magnesium. The continuous use of these effluents harmfully affects the crops when used for irrigation. The sugar industry wastewater is characterized by its brown color, low pH, high temperature, high BOD, high COD, odor problem, total solids, and high percentage of dissolved organic and inorganic matter. So this untreated wastewater will create problem to the environment. The analyzed parameters like pH, EC, TDS, Chloride, Chemical Oxygen Demand and Biochemical Oxygen Demand fluctuated from 4.0-8.78, 130-953 µs/cm.147-2400, 19.36-347.9, 14.4-977.6 and1, 5-43.2ppm respectively.

INTRODUCTION

Wastewater from sugar industries is one that has complex characteristics and is considered a challenge for environmental engineers in terms of treatment as well as utilization. Before treatment and recycling, determination of physicochemical parameter is an important mechanism. Many different types of techniques are introduced and modified for the purpose, but depend upon the water quality parameters. The main aim of this study is to determine the physicochemical characteristics of sugar industry waste water by the standard method and minimize the fresh water consumption in sugar industry by water pinch methodology. Industrial revolution has generated unprecedented disturbances in the environment due to the introduction of anthropogenic pollutants such as organic, inorganic and xenobiotic chemicals in the form of untreated industrial waste water. With increasing population and industrial expansion, the need for the treatment and disposal of the waste has grown [1]. Sugar industry is the largest agro processing industry in India with 2.5% weight in the annual industrial production. products, such as bagasse (the fibre residue of sugar cane), press mud (filter cake), molasses and distillery spent wash. Press mud contains about 70% organic matter and

29% minerals. The discharge of effluents will create pollution to the environment. Sugar industry offers employment potential and contributes substantially to economic development. Apart from sugar and alcohol, these factories generate many by-products and waste materials. For example, large amount of organic and inorganic chemicals are being generated [2]. Sugar industry plays a major role in producing a higher amount of water pollution because they contain large quantities of chemical elements. They contain higher amounts of total hardness, total dissolved solids, biological oxygen demand and chemical oxygen [3]. Various compounds of organic matter containing materials can be measured in two simple parameters, such as biochemical oxygen demand (BOD) and chemical oxygen demand (COD). It is well known that BOD is a standard test for assaying the oxygen-demanding concentration of microbes to degrade organic matter over a given time period, usually 5 days but can be extended to 30 days. COD is a standard test for water to consume oxygen in the form of potassium dichromate during the degradation of organic matter and inorganic chemicals such as ammonia and nitrite for few hours. The potassium dichromate is not specific to oxygen-consuming chemicals either organic or inorganic and therefore, both chemicals are included in COD[4]. Effluents from sugar industries induce environmental pollution. India, being one of the major producers of sugar in the world, is prone to large volume of wastes from sugar industries. The byproducts namely bagasse, molasses, distillery wastes and press mud are some of the major objectionable wastes generated by the sugar industries contributing to high BOD and COD [5]. Many researchers have been done to identify a low cost substitute for activated carbon for the treatment of industrial effluents to reduce BOD and COD. The low-cost adsorbents can be viable alternatives to activated carbon for the treatment of wastewater. It is important to note that the adsorption capacities may vary, depending on the characteristics of the individual adsorbent, surface modification and the initial concentration of the adsorbate. India is the second largest country manufacturing sugar from cane in the world. There are 488 in operation sugar mills in the country with a production of 145.39 lakh tones of sugar [6]. Sugar industry plays an important role in India's economy. It is the largest processing industry next to textiles. Located in rural areas, sugar mills have an intrinsic symbiotic relationship with the rural masses and serve as a nerve center for rural development. It is one of the major commercial crops grown here in Karnataka and is one of the major sources of revenue for majority of the farmers. The production of sugar involves enormous amounts of water and energy. The main energy source is the combustion, usually bagasse and other low quality fossil fuels with high sulphur content are used. In sugar production, the water used for processes such as cane washing, clarification of juice, cleaning of evaporators, heaters and purging boilers, cooling systems and sanitary services are discarded. Sugar cane industry generates 0.2-1.8 m^3 /tone waste water with COD 1800 to 3200 mg/L, BOD 720 – 1500 mg/L . Sugar wastewaters if disposed off into the water bodies untreated, can contaminate surface and subsurface waters. The BOD/COD causes rapid depletion of oxygen content of the water, creates foul smell, renders the stream unfit for propagating aquatic life, drinking and for other purposes.

MATERIAL AND METHODS

STUDY AREA

North Karnataka, locally known as Uttara Karnataka, is a geographical region consisting of mostly semi-arid plateau from 300 to 730 meters (980 to 2,400 ft) elevation that constitutes the northern part of the South Indian state of Karnataka. It is drained by the Krishna River and its tributaries the Bhima, Ghataprabha, Malaprabha, and Tungabhadra. North Karnataka lies within the Deccan thorn scrub forests ecoregion, which extends north into eastern Maharashtra. It includes the districts of Belgaum, Bijapur, Bagalkot, Bidar, Bellary, Gulbarga, Yadagiri, Raichur, Gadag, Dharwad, Haveri, Koppal and Uttara Kannada District. Major cities in the region are Belgaum, Hubli, Dharwad, Bellary, Bijapur, Gulbarga, Bidar, Karwar , Sirsi, Chikodi, Hospet and Gokak. Though the region is semi-arid, parts of Uttara Kannada and Belgaum district receive enough rainfall to make them lush and green throughout the year. Uttara Kannada district is coastal and hence boasts of some of the best beach towns of Karnataka like Karwar, Gokarna and Bhatkal. Belgaum district is quite big and though the north parts of the district are arid and receive less rainfall, the southern parts which are adjacent to Uttara Kannada district, like Londa, have an almost highland tropical climate. The stretch from Londa to Alnavar has some of the most dense and beautiful jungles on the Western coastal belt of India. They are part of the Western Ghats and their foothills which are now protected under National Wildlife laws. Certain parts of the region are well irrigated by many largest multipurpose projects like Upper Krishna Irrigation Project that includes Basava Sagara and Almatti Dams, Tungabhadra Dam, Supa, Kadra, Kodasalli dams, and many major and minor lift irrigation projects. Notably different from the regions of Old Mysore, Coastal Karnataka and Central Karnataka in terms of language, cuisine and culture, the region is well known for it's contributions to the literature, arts, architecture, economy and politics of Karnataka.

For the present study the samples of untreated effluent from a sugar industry located at North Karnataka India were collected. A comprehensive study was carried out primarily, data collection for the related work and secondary literature survey took place. Then to obtain basic ideas of the quality, characteristics and chemical composition of the effluent of sugar factory samples of effluents was collected in1 liter polythene-carboys bottle and mixed well in equal proportion to get homogeneous samples [7]. Random selection procedure was adopted for the selection of both sampling unit and the sampling point in given site (APHA1985). Tape water and 8 M HNO_3 were used to wash the bottles, which were used for the sample preservation followed by washing them with distilled water and finally with double distilled water. Then the bottles were rinsed thrice with effluent samples stored in refrigerator. pH, electrical Conductivity (EC) were measured at the sample collection site. Physicochemical properties such as total dissolved solids (TDS) chemical Oxygen Demand (COD), chloride and APHA standard method [8]. For physical and chemical analysis of the samples a number of sophisticated instruments were used and standard methods were followed.

Water quality data is essential for the implementation of responsible water quality regulations for characterizing and remediating contamination and for the protection of the health of humans and the ecosystem. Regular monitoring of river water resources thus play a key role in sustainable management of water resources. This study conducted seeks to serve as a preliminary study to assess the river water quality in terms of drinking and agricultural uses for a rapidly developing community located in Jamakhandi taluka.

RESULTS AND DISCUSSION

Table.1Analysis of Sugar industry effluents of North Karnataka

S.NO	Name of sugar factory	pH	EC (µs/cm)	TDS in mg/l	Chloride Mg/l	COD ppm	BOD ppm
1	Nagaralli sugar factory Yadagiri	6.15	206	916	29.1	152	20.7
2	Saidapur sugar factory Mudhol	4.0	502	254	26.6	136	9.0
3	Monali Sugars Malaghan,Sindagi	6.7	296	147	36.2	161.6	1.8
4	KPR sugars Kadani Sindagi	6.45	296	148	33.7	163.2	15.0
5	Nirani Sugars Mudhol	6.3	953	470	67.5	211.2	1.5
6	Renuka Sugars Dattaragi Afazalpur	6.2	500	297	21.3	192	9.3
7	Chikkodi Sugars	6.1	134	897	24.5	217.6	11.1
8	Jamakhandi sugars Padasalagi	4.3	830	500	34.8	28.8	25.5
9	Nandi Sugars Galagali	6.55	209	1200	19.36	193.6	25.5
10	Benur Sugars Indi	6.38	330	1900	85.2	25.6	18.6
11	Havinal Sugars Chadachan	5.97	241	1400	55.4	72.0	18.9
12	Prbhulingeshwar sugar factory Jamakhandi	7.0	206	1200	89.5	64.0	24.6
13	KPR Sugars Almel	3.86	233	1000	113.6	200.0	43.2
14	Jamakhandi Sugars	5.1	255	1300	34.8	19.2	21.3
15	Renuka Sugars Athani	4.39	290	1400	145.0	126.0	3.3
16	K.D. Nad Indi	10.3	212	2400	45.08	14.4	4.2
17	KPR Almel	8.78	130	500	347.9	78.4	39.3
18	Nandi Sugar Galagali	6.0	145	700	85.9	977.6	3.6
19	Hunashyal Sugars Gokak	8.5	14.7	800	78.1	524.8	9.9

20	Prabha Sugars Ghataprabha Gokak	8.0	18.9	1100	23.08	761.6	23.7
21	Kolavi Sugars Gokak	7.8	5.60	300	40.83	520	9.3

pH

In the present investigation the pH value of effluent water were recorded as 5 and 6.8 respectively. According BIS standards the pH of the effluents should be in range 6.5 to 8.0.Relativelylow pH values of both treated and untreated samples are due to use of phosphoric acid and Sulfur dioxide during cleaning of sugar cane juice. pH is one of the important biotic factor that serves as index for pollution. If such water is used for irrigation for a longer period the soil becomes acidic resulting in poor crops growth and yield. The factors like photosynthetic exposure to air, disposal of industrial effluent and domestic sewage also affect the pH of the soil. pH is affected not only by the reaction of carbon dioxide but also by organic solutes present in water. Any alteration in water pH is accompanied by the change in other physicochemical parameters [9]. PH maintenance (buffering capacity) is one of the most important attributes of any aquatic system since all the biochemical activities depend on pH of the surrounding water. It was concluded that the pH of water were slightly acidic. The pH was relatively low due to the use of phosphoric acid and sulfur dioxide during clarification of sugar cane juice [10].

EC

The conductivity measurement is an indicator of ionic concentration of water. It depends upon temperature and concentration and types of ions present [11].The electric conductivity value (130-953 (µs/cm) was found much high in effluents released from the sugar industries. According to the DoE standard the EC of the effluent should be 1200 µs/cm. Higher EC values suggest existence of highly mineralized groundwater. Mineralization is possibly due to higher residence time, sluggish movement of groundwater and intensive water – rock interactions in the alluvial aquifers.

TOTAL DISSOLVED SOLIDS

TDS of present samples varied from 147-2400mg/litre .On the basis of TDS, salinisation of groundwater is defined by Mehta et al [12]. The waters with TDS content ranging from 400 to >3000 mg /l have been designated as saline water. Hem [13] classified water into four categories based on the TDS values. They are slightly saline (1000-3000 mg/l), moderately saline (3000-10,000 mg/l), very saline (10000 to 35000 mg/l) and brine (>35000 mg/l). By using the same criteria, the wells along the cross section of Pravara basin were classified.

CHLORIDE

The chloride concentration in the effluent water ranges from 19.36-347.9mg/l. Hence higher concentration of chloride in the area close to sugar-mill and other industries indicate contribution of chloride could be due to mixing of waste waters and severe contamination of groundwater from the chloride rich effluent as the source. The presence of chloride in natural water is attributed to dissolution of salt deposit, discharge of effluents from industries. Chloride is not toxic, but some people can detect a salty taste at 250 mg/l. Water with high chloride may also have high sodium content. High chloride may also speed up corrosion in plumbing (just as road salt does to your car).

CHEMICAL OXYGEN DEMAND

COD values of effluent water ranged from 14.4-977.6mg/l. The COD value of the effluent was 3140mg/L, while the recommended level set by BIS is 250 mg/L; the measured COD indicates the high organic load similarly other factors exceeded the permissible limits. Thus it is clear from the data that COD of untreated and treated effluents exceed the BIS limit. COD of sugar mill effluent is high because the presence of high amount of organic waste. Importance of organic matter in the ecology of bloom firming cyano bacteria has been reported by many workers. In a study, Saranraj [14] analysed various parameters of sugar mill effluent and they have recorded the COD was 3260 mg/l. The COD test determines the oxygen required for chemical oxidation of organic matter with the help of strong chemical oxidant. It is a fact that all organic compounds with few exceptions can be oxidized by the action of strong oxidizing agents under acidic conditions COD is a useful in pinpointing toxic condition and presence of biologically resistance substances.

BOD

1.5-43.2ppm. BOD of both treated and untreated effluent exceeds the permissible limit. Jadhav et al. [15] analysed the BOD of sugar mill effluent 95-697 at different unit of sugar mill. The BO is a very slow process in oxidation; organic pollutants are oxidized by microorganisms into carbon dioxide, water using dissolved Oxygen. In the present study, the BOD of the untreated effluent was 86mg/lit. According to BIS Indian standard the BOD should not exceed the 50 mg/l.

CONCLUSION

Sugar industries are playing a significant role in the economic development of Indian and other developing countries, but the effluents produced by these industries contains a high degree of organic pollutant. Effluent released from these industries may alter the physico-chemical characteristics of the receiving aquatic bodies and also affect the life of aquatic flora and fauna. Results of present study concluded that physico-chemical parameters such as pH, EC,, TDS, chloride BOD and COD were relatively high in the treated effluent of studied sugar mill. The persistent discharge of the effluents may result into severe accumulation of the pollutants in environment. This may adversely affect the lives of plants as well as animals around the sugar mill. Hence, there is an urgent need to treat the effluents properly before the final discharge. Effluents which are released from sugar mill may be utilized for industrial processing again, after treatment and it is profitable for sugar industry. The sugar mill effluents are having higher amount of acidity, suspended solids (TSS), chloride, BOD and COD etc.

REFERENCES

1. Aneez MM, Sekar P, George J (2011). Efficacy of microbes in bioremediation of tannery effluent, Inter JCurrent Res,33(4): 324-326.
2. Rajukkannu K, Manickam TS (1997). Use of distellary and sugar industry waste in agriculture. In: Proc.Sixth National Symposium on Environment, Tamil Nadu Agricultural University, Coimbatore, India,pp 286-290.
3. Maliwa, GL, Patel KP, Patel KC, Patel MN (2004). Pollution Resident,pp: 231-169
4. Ganjar S, Sarwoko M (2010). Review on BOD, COD and BOD/COD ratio: a triangle zone for toxic, biodegradable and stable levels, Inter. J.Acad. Res., 2(4): 235-239.
5. Anand K. Parande, A. Sivashanmugam, H. Beulah, N. Palaniswamy, "Performance Evaluation of Low Cost Adsorbents in Reduction of COD in Sugar Industrial Effluent": Journal of Hazardous Materials, vol. 168, (2009), pp. 800-805.
6. National Federation of Co-operative Sugar Factories Ltd., Monthly publication, March 2010.
7. Rain water F.H and Thatcher L.L, 1960.Methods for collection and analysis of water samples, U.S. Govt print office. Washington .D.C., USA.
8. APHA. 1998. Standard method for the examination of water and wastewater (20th Edition). American Public Health Association, Washington, USA.
9. Wetzel R.G., Limoloy,W.B, SaundersCo., Philadelphia.U.S.A,743(1975).
10. Manivasakam N. 1987. Industrial Effluents Origin, Characteristics, Effects, Analysis and Treatment. Sakthi Publications, Kovai pudur, Coimbatore, India.
11. Hem J.D., Study and Interpretation of chemical characteristics of natural waters, U.S. Geological Survey water Supply Paper No. 2254, (1991).
12. Mehta S, Fryar A and Banner J, Control on the regional – Scale salinization of the Ogallala aquifer, Southern High plains Texas, USA, Applied Geology, 15, 849 (2000).
13. Hem J.D., Study and Interpretation of chemical characteristics of natural waters, U.S. Geological Survey water Supply Paper No. 2254, (1991).

14. P. Saranraj, “Bioremidiation of sugar mill effluent by immobilized bacterial constrain,” International Journal of Reserch in Pure and Applied Microbiology, vol. 2, no. 4, pp. 43–48, 2012.
15. P. Jadhav, G. Vaidyan, and S. Dethe, “Characterization and comparative study of cane sugar industrial waste water,” International Journal of Chemical and Physical Science, vol. 2, no. 2, pp. 19–25, 2013.

Annexure-I

UNIVERSITY GRANTS COMMISSION

FORMAT FOR SUBMISSION OF PROPOSAL FOR

MINOR RESEARCH PROJECT

PART – A

1. Broad Subject -	**Chemistry**
2. Area of Specialization-	Environmental chemistry
3. Duration -	08-04-2014 to 08-12-2016
4. Principal Investigator-	
i. Name:	**Dr.A.S.Pujar**
ii. Sex: M/F-	Male
iii. Date of Birth:	13/05/1962
iv. Category: (GEN/SC/ST/OBC) -	OBC
iv. Qualification:	M.Sc Ph.D
v. Designation:	Associate professor
vi. Address: Office:	S.B.Arts and K.C.P.Science College Vijayapur
Residence:	Shreenagar Colony Behind NCC Vijayapur
Email/Phone:	ashokpujar62@gmail.com 9242910975

5. Name of the Institution where the project will be undertaken:

(a) Department :	Chemistry
(b) College :	S.B.Arts & K.C.P.Sc. College Vijayapur

(c)Affiliating University: Rani Channamma University Belagavi

(d) Whether the institute is located in rural/backward area: Rural

6. Whether the College is approved under Section 2 (f) and 12 B of the UGC Act? Yes/No - Yes

7. Teaching and Research Experience of Principal Investigator :

(a) Teaching experience: UG - 29 Years PG Years -----

(b) Research experience: 20Yrs.

(c) Publication:

Papers Published: 2-papers

Accepted: N

Communicated: N

Books Published: Accepted: Communicated: (Please enclose the list of papers and books published and/or accepted during last five years) -2 Papers

1. Determination of BOD, COD, DO and Other Physico-Chemical Properties of Sugar and Cement Industries: Research Journal of Pharmaceutical, Biological and Chemical Sciences,November - December 2014 RJPBCS 5(6) Page No. 1075
2. Assessment of Physico-chemical characteristics of Sugar Industry Effluents, WJPR, Volume 4, Issue 9, 1030-1037.2015.

PART – B

Proposed Research Work

8 (i) Project Title- **Analysis of Sugar Industry effluents**

(ii) Introduction: This final project report provides a brief project description, a summary of the activities completed, references to deliverables sent during the project timeline and a link to the web site developed as part of the project. Also included are several peer-reviewed scientific papers prepared by researchers associated with the project. These are attached as appendices, which are listed at the end of this report.

(iii) Objectives- The purpose of this research project was to conduct microbial censuses, source identification and develop test procedures for water quality analysis. As described in detail in the grant agreement, the project goals can be succinctly summarized as follows:

1. Adapt the original PhyloChip to give it the capability to conduct a microbial census of recreational waters. Pathogen specific primers and probes on the microarray were to be validated. Particular attention was to be paid to the open wells, lakes and bore wells.
2. Develop a suitable testing protocol and establish baselines by sampling waters in parallel with the standard water quality tests. Conduct baseline monitoring at these sites.
3. Establish a website to publicize the project and disseminate information on progress.
4. Perform microbial census analyses on specific sources of water pollution such as septic system or sewage effluent, agricultural runoff etc. Specific event testing was a goal e.g. waters affected by a known sewage spill would give information about the microbial makeup of such waters.
5. The test method was to be evaluated by conducting testing of retrospective samples to compare them with tests conducted using the standard methods.

(iv) Methodology- **Standard Methods (SM) for water and waste water analysis (SMWW-APHA)**

In 1895, members of the American Public Health Association (APHA)recognized the need for Standard Methods in the waste water examination of water. In 1905, the first edition of Standard Methods of Water Analysis was published. The reference book in its 20th edition is, to date, entitled Standard Methods for the examination of water and waste water.

(v) Year-wise Plan of work and targets to be achieved.

9. Financial Assistance required

Item	**Estimated Expenditure**
i. Books and Journals	10000=00
ii. Equipment, if needed	125000=00
iii. Field Work and Travel	10,000=00
iv. Chemicals and glassware	50,000=00
v. Contingency (including special needs)	5,000=00
vi. Hiring Services	
Total:	200000=00

10. Whether the teacher has received support for the research project from the UGC under Major, Minor or from any other agency? If so, please indicate: UGC

i. Name of the agency from which the assistance was approved--UGC

ii. Sanction letter No. and date under which the assistance was approved-

iii. Amount approved and utilized 217002=00

iv. Title of the project for which assistance was approved-“**Analysis of Sugar Industry effluent”**

v. In case the project was completed, whether the work on the project has been published

2 papers published

vi. If the candidate was working for the doctoral degree, whether the thesis was submitted and accepted by the University for the award of degree. (A summary of the report/thesis in about 1,000 words may please be attached with the application)**---** **Nil**

vii. If the project has not been completed, please state the reasons

11. (a) Details of the UGC project/scheme completed or ongoing.- **completed**

12. Any other information which the teacher may like to give in support of this

Proposal NIL

To certify that:

a. The College is approved under Section 2(f) and 12(B) of the UGC Act and is fit to
    a. receive grants from the UGC.
b. General physical facilities, such as furniture/space etc., are available in the
    a. Department/College.
c. I shall abide by the rules governing the scheme in case assistance is provided to me from the UGC for the above project.
d. I shall complete the project within the stipulated period. If I fail to do so and if the UGC is not satisfied with the progress of the research project, the Commission may terminate the project immediately and ask for the refund of the entire amount (with interest) released by the UGC.
e. The above research Project is not funded by any other agency.

Signature of Principal Investigator **Principal**

(Seal)

Annexure – II

UNIVERSITY GRANTS COMMISSION

BANGALORE

ACCEPTANCE CERTIFICATE FOR RESEARCH PROJECT

Name: **Dr.A.S.Pujar**

MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014

Title of the Project: '**Analysis of Sugar Industry effluent'**

1. The research project is not being supported by any other funding agency.
2. The terms and conditions related to the grant are acceptable to the Principal Investigator and University/College/Institution.
3. At present, I have no research project approved by UGC and the accounts for the previous project, if any have been settled.
4. The College/University is fit to receive financial assistance from UGC and is included in the list of Section 2(f) & 12 (B) prepared by the UGC.
5. The Principal Investigator is a retired teacher and eligible to receive honorarium as he/she is neither getting any honorarium from any agency nor is he/she gainfully employed anywhere.
6. (i) His/her date of birth is: 13/05/1962

   (ii) Age : 55 years
7. The date of implementation of the project is 02/01/2014

Principal Investigator

Principal

College:__________

(Seal)

Date:________

Annexure – III

UNIVERSITY GRANTS COMMISSION

BANGALORE

STATEMENT OF EXPENDITURE IN RESPECT OF MINOR RESEARCH PROJECT

Name of Principal Investigator: **Dr.A.S.Pujar**

1. Dept. of PI - Chemistry
2. Name of College S.B.Arts & K.C.P.Sc. College Vijayapur
3. UGC approval Letter No. and Date: MRP(S)-0457/13-14/KAKA-041/UGC-WRO dated 28-03-2014.
4. Title of the Research Project : **Analysis of Sugar Industry effluent**
5. Effective date of starting the project 28/03/2014
6. a. Period of Expenditure: From 28/02/2014 to 28/12/2016

   b. Details of Expenditure

S.No.	**Items**	**Amount Approved (Rs.)**	Expenditure Incurred(Rs.)
i.	**Non-Recurring:** Books & Journals	10000=00	10300=00
ii.	Equipment	125000=00	133446=00
iii.	**Recurring:** Contingency Chemicals	5000=00 50000=00	5094=00 50562=00
iv	Field Work/Travel (Give details in the Proforma)Any other	10000=00	17600=00
	Total	**200000=00**	**217002=00**

7. if as a result of check or audit objection some irregularly is noticed at later date, action will be taken to refund, adjust or regularize the objected amounts.

8. It is certified that the grant of Rs. 90000=00 (Rupees Ninety Thousand only) received from the University Grants Commission under the scheme of support for Minor Research Project entitled "**Analysis of Sugar Industry effluent"** vide UGC letter No. F. MRP(S)-0457/13-14/KAKA-041/UGC-WRO dated 28-03-2014. has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission.

SIGNATURE OF PRINCIPAL INVESTIGATOR **PRINCIPAL**

Annexure - IV

UNIVERSITY GRANTS COMMISSION

BANGALORE

STATEMENT OF EXPENDITURE INCURRED ON FIELD WORK

Name of the Principal Investigator: Dr.A.S.Pujar

S.No	**Name of the Place visited**	**Duration of the Visit**		**Mode of Journey**	**Expenditure Incurred (Rs.)**
1	Basavan Bagewaadi, Muddebihal taluka,	**From** 08-09-2015	**To** 10-05-2015	By Car(AC)	4800=00
2	Sindagi,	20-05-2015	21-05-2015	By Car(AC)	3200=00
3	Bijapur Taluka:	27-05-2015	28-05-2015	By Car(AC)	3200=00
4	Indi Talukas	10-06-2015	11-06-2015	By Car (AC)	3200=00
5	Bijapur taluka	22-06-2015	23-06-2015	By Car (AC)	3200=00
				Total	17600=00

Certified that the above expenditure is in accordance with the UGC norms for Major Research Projects.

SIGNATURE OF PRINCIPAL INVESTIGATOR **PRINCIPAL**

(Seal)

Annexure - V

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI – 110 002

Utilization certificate

Certified that the grant of Rs. 200000=00 (Rupees_One lakh sixty thousand only) received from the University Grants Commission under the scheme of support for Minor Research Project entitled, "**Analysis of Sugar Industry effluent"** vide UGC letter No. F. MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014 has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission.

SIGNATURE OF THE PRINCIPAL INVESTIGATOR **PRINCIPAL** **STATUTORY AUDITOR**

(Seal) **(Seal)**

Abstract

Grant sanctioned	Grant released	Balance to be received from UGC
Rs: 200000=00	**Rs: 167500=00**	**Rs: 32500=00**

Annexure -VI

UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI – 110 002.

Annual/Final Report of the work done on the Minor Research Project.

(Report to be submitted within 6 weeks after completion of each year)

1. Project report No.: **Final**
2. UGC Reference No.F: MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014
3. Period of report: from: 28/04/2014 to 28/04/2016
4. Title of research project : **Analysis of Sugar Industry effluent**
5. (a) Name of the Principal Investigator **Dr.A.S.Pujar**

   (b) Dept: Chemistry

   (c) College where work has progressed: S.B.Arts & K.C.P.Sc. College Vijayapur.
6. Effective date of starting of the project 28-04-2014
7. Grant approved and expenditure incurred during the period of the report:

a. Total amount approved Rs.: 200000=00

b. Total expenditure Rs.217002=00

c. Report of the work done: separate sheet enclosed

i. Brief objective of the project :

1. The sugar industry effluent which is untreated highly contains COD, BOD, TSS, TDS, TS and low contents of DO which is toxic, to plants. So it is not permissible for irrigation. * The treated effluent of sugar industry which is well balanced of chemicals if it is diluted with other fresh water, which will be suitable for irrigation purpose. * Effluent which are released from sugar industry treated and then may be utilized for industrial processing again. Recycle rise of waste water is possible in sugar industry and it is economically profitable for sugar industry1. Adapt the original procedures to give it the capability to conduct a COD and BOD analysis of recreational waters. Pathogen specific primers and probes on the microarray were to be validated. Particular attention was to be paid to the open wells, lakes and bore wells.

2. Develop a suitable testing protocol and establish baselines by sampling waters in

parallel with the standard water quality tests. Conduct baseline monitoring at these sites.

3. Establish a website to publicize the project and disseminate information on progress.
4. Perform BOD and COD other physicochemical analyses on specific sources of water pollution such as septic system or sewage effluent, agricultural runoff etc. Specific event testing was a goal e.g. waters affected by a known sewage spill would give information about the microbial makeup of such waters.
5. The test method was to be evaluated by conducting testing of retrospective samples to compare them with tests conducted using the standard methods.

ii. Work done so far and results achieved and publications, if any, resulting from the work (Give details of the papers and names of the journals in which it has been published or accepted for publication –**Two papers published**

iii. Has the progress been according to original plan of work and towards achieving the objective. if not, state reasons -**Yes**

iv. please enclose a summary of the findings of the study. One bound copy of the final report of work done may also be sent to the concerned Regional Office of the UGC.

v. Any other information-**Nil**

SIGNATURE OF THE
PRINCIPAL INVESTIGATOR **PRINCIPAL**

(Seal)

Annexure – VII

UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI – 110 002

PROFORMA FOR SUBMISSION OF INFORMATION AT THE TIME OF SENDING THE

FINAL REPORT OF THE WORK DONE ON THE PROJECT

1. Title of the Project: **Analysis of Sugar Industry effluent**
2. NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR: **Dr.A.S.Pujar**
3. NAME AND ADDRESS OF THE INSTITUTION: S.B.Arts & K.C.P.Sc. College Vijayapur.
4. UGC APPROVAL LETTER NO. AND DATE - MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014
5. DATE OF IMPLEMENTATION 28-04-2014
6. TENURE OF THE PROJECT 28-04-2014to 28-12-2016
7. TOTAL GRANT ALLOCATED Rs 200000=00
8. TOTAL GRANT RECEIVED Rs 167500=00
9. FINAL EXPENDITURE Rs 217002=00
10. TITLE OF THE PROJECT: "**Analysis of Sugar Industry effluent"**
11. OBJECTIVES OF THE PROJECT - yes
12. WHETHER OBJECTIVES WERE ACHIEVEDGIVE DETAILS)
13. ACHIEVEMENTS FROM THE PROJECT

- The project shockingly reveals the multiple adverse effects on the health hazards on the consumers.

- At present Sugar and Distillery Industries are the polluting industries in the environment. The distillery industry wastewater is characterized by its brown colour, low pH, high temperature, high BOD, high COD, odor problem, total solids, and high percentage of dissolved organic and inorganic matter.

- Efforts be made to promote and educate the villagers and public .
- Efforts should be made to promote use waste products.
- .Regular surveys should be conducted to assess total elements in water and water based products. This will enable establish priorities in minimizing risk.
- The purpose of establishing standards/guidelines should be clearly set out to ensure effective compliance. Similarly, the methods of detection and treatment should be specifically described.
- The regulatory limits should be deduced from scientific data bringing out the relationship between the limit and the toxic elements rather than depending on adhoc decisions.

 Significant concentrations of microbes were found in water samples of study area, and in significant number of cases these exceeded the WHO Guideline value for toxic elements.

14. SUMMARY OF THE FINDINGS At present Sugar and Distillery Industries are the polluting industries in the environment. The distillery industry wastewater is characterized by its brown colour, low pH, high temperature, high BOD, high COD, odor problem, total solids, and high percentage of dissolved organic and inorganic matter. The sugar industry wastewater is characterized by its high BOD, high COD, brown colour, high percentage of dissolved organic and inorganic matter, low pH, high temperature, odor problem, total solids. So this untreated wastewater will create problem to the environment. The analyzed parameters are pH, COD, BOD, TS, TSS, TDS for Sugar & Distillery Effluent Treatment Plant.

15. CONTRIBUTION TO THE SOCIETY:

Suggestions Industrialist should check their instruments¬ / equipment to avoid leakage. Each industry should follow environmental¬ policies, regulations and environmental protection acts to conserve the environment. Industrialist should use such raw materials¬ which will give maximum good products and less toxic waste in fewer quantities. Industries should be installed in low laying¬ areas away from the public locality. Each industry should have ETP plant to¬ treat the effluents, which can be further used for the agricultural purpose.

16. WHETHER ANY PH.D. ENROLLED/PRODUCED OUT OF THE PROJECT -NO

17. NO. OF PUBLICATIONS OUT OF THE PROJECT –**Two papers published**

(PRINCIPAL INVESTIGATOR) **(PRINCIPAL)**

(Seal)

Annexure – VIII

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI – 110 002

ASSESSMENT CERTIFICATE
(to be submitted with the proposal)

It is certified that the proposal entitled" **Analysis of Sugar Industry effluent"** by Dr./Prof./Mr./Mrs.): **Dr.A.S.Pujar** . Dept. Of Chemistry has been assessed by the Expert committee consisting the following members for submission to the UGC Regional Office for financial support under the scheme of Minor Research Projects:

Details of Expert Committee:

Dr. K. G. Pujari	Principal/Chairman
Dr. P.D.Needagi	Coordinator
Dr. S. T. Merwade	Member
Mr. Rakesh Patil	Administrative Staff Honor Member
Prof. R.H. Bidari	Coordinator NAAC

The proposal is as per the guidelines.

(PRINCIPAL)
(Seal)

From:

Dr.A.S.Pujar

Department of Chemistry.

S.B.Arts and K.C.P.Science College,

Vijayapur-586103

Karnataka.

To,

The Deputy Secretaryand Regional Head

University Grants Commission,

South West Eastern Regional Office,

P.K.Block,Palace Road,

Gandhi Nagar,

Bangalore-560009.

Ref.NoF.No. MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014

Sub: Regarding Submission of Annexure-V of Dr. A.S.Pujar

Sir/Madam

I am herewith submitting Annexure**-V Minor Research Project Entitled "Analysis of Sugar Industry effluent".** This is for your information and kind notice.

Thanking You, Principal

Date:23/11/2015

B.L.D.E.ASSOCIATION'S

S. B. ARTS AND K. C. P. SCIENCE COLLEGE

BIJAPUR

RE – ACCREDITED AT THE 'B' LEVEL

Phone: (08352) – 261766, (08352) 262770 Extn. 2223, 2224

Fax: 08352 – 261766 E-mail: bldesbkcp@gmail.com

REF./ PÀæªÀiÁAPÀ : Date:

From; Dr.A.S.Pujar

Associate Professor in Chemistry

S. B. Arts and K. C. P. Science College, Vijayapur – 586103 Karnataka (India)

M: 9986291865

To : The Account Officer,

South Western Regional Office, University Grants Commission

P. K. Block Palace Road, Gandhinagar, Bangalore – 560009

(1) MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014

(2) College letter No 771/15-16 dated 23/11/2015

Sir,

I have already submitted the final report of minor research project Ref. No. 1 entitled **"ANALYSIS OF SUGAR INDUSTRY EFFLUENTS"** for your consideration, Ref. (3) along with documents (1) Two hard bound copies of final report (2) Annexure – III, IV, V, VI, VII (3) Audit report (4) Approval and sanction letters (5) Published paper (Attached to final report) (6) CD of report.

In resposnse to your letter cited above Ref. (2) I would like to clarify the point mentioned in it,

(a) I have already submitted two copies of the final report of the work done as per the guidelines duly signed by Principal and sealed along with Annexure – III, IV, V, VI, VII.

(b) I have already submitted audited utilization certificate as per the guidelines duly sealed and signed by charted accountant and the Principal.

(c) Further I would like to bring to your kind notice that final report of the project is kept in the Chemistry department library and the project summary is uploaded in College Website: http://www.bldeasbkcp.org/

However your kind consideration and quick reference I will submit one more copy of Audited Utilization Certificate, Certificate by Principal stating that the Final Report is kept in department library and summary of project uploaded in College Website. Please release the balancing amount at your earliest.

Thanking you

Bijapur

Your's faithfully

(.A.S.Pujar)

Submitted through:

The Principal S. B. Arts and K. C. P. Science College, Vijayapur

B.L.D.E.ASSOCIATION'S
S. B. ARTS AND K. C. P. SCIENCE COLLEGE
BIJAPUR
RE – ACCREDITED AT THE 'B' LEVEL
Phone: (08352) – 261766, (08352) 262770 Extn. 2223, 2224
Fax: 08352 – 261766 E-mail: bldesbkcp@gmail.com

REF./ PÀæªÀiÁAPÀ : Date:

CERTIFICATE

This is to certify that UGC funded Minor Research Project F. No. MRP(S)-0457/13-14/KAKA-041/UGC-SWRO dated 28-03-2014 entitled "**ANALYSIS SUGAR INDUSTRY EFFLUENT"** is completed by Principal Investigator Dr.A.S.Pujar , associate professor in Chemistry and bound copy of the final report of the project work done is kept in the library of Chemistry department of this college and executive summary of the report has been uploaded in the College Website: http://www.bldeasbkcp.org/

Principal
S. B. Arts and K. C. P. Science College, Vijayapur