Experimental Study of Physio-Chemical Analysis on Sugarcane Effluent Around Bidar City

PUNEETH KUMAR

Assistant Professor, Department of Civil Engineering, Guru Nanak Dev Engineering College Bidar

Abstract- 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 Alkalinity, Acidity, Chloride, Biological oxygen demand, Total hardness, Calcium hardness, etc methods.

I. INTRODUCTION

Sugar industry is one of the most important agro based industry in India and is highly responsible for creating significant impact on ruler economy in particular and country's economy in general sugar industry ranks second among the agro based industry in India sugar industry seasonal in a natural and operates only for 120 to 200 days in a year a significant large amount of waste is generated during the manufacture of sugar and contains a high amount of production load particularly in items of suspended solids organic matters effluent sludge press mud and bagasse this wastewater sir disposed into nearby water bodies and they are being used for irrigation the discharge of disciplines into the water bodies on soil is causing a serious problem of water pollution resulting in sewer damage to the flora and fauna and the environmental degradation.

Besides the heavy metals and non bio-degradable and faucets for the longer periods in aquatic as well as terrestrial and ornaments Thursday can exert detrimental effect on the human health and environment due to the toxicity of heavy metals. the effluent released produce a high degree of organic pollution in both aquatic and terrestrial ecosystem thereafter the physical physicochemical characteristics of receiving aquatic bodies and affect the aquatic flora and fauna sugar factory of plant produces a bonus order and unpleasant color when released into the environment without proper treatment farmer have been using this applied for irrigation found that the growth hills and the soil health where reduce the life in effluent is highly diverse and consists of interacting pollution of microorganism and effluent and their activities affect physical chemical and biological characteristics of effluent.

1.2 Objectives of the Study

- The main aim of this study is to determine the physio–chemical characteristics of sugar industry effluent by the standard method.
- To ascertain the level of pollution of the river due to the discharged effluents.
- To compare the physical, and chemical parameters in the river with the Bureau of Indian Standards (BIS) acceptable standard for drinking water.

II. METHODOLOGY AND MATERIALS

The present study was undertaken to examine the quality of sugarcane effluent.

* The sugar cane effluent where collected and the following parameters like pH alkalinity dissolved oxygen chloride nitrates and hardness of the collected sugarcane sample are tested

2.1 SAMPLE COLLECTION

It is important to collect sugarcane effluent under normal conditions in order to representative sample. Proper procedures for collecting effluent must also be observed. Technicians should be properly trained since the way in which samples are collected has an important bearing on the tests results. Samples should

be collected in a non-reactive borosilicate glass, plastic bottle or plastic bag that has been cleaned, rinsed and sterilized. A sample container is usually provided as part of portable field kits. Every sample container should have a label. The sample label has information about Project name.

2.2 PRECAUTIONS DURING SAMPLING

- To label the bottle before taking a water sample
- Do not touch the inside of the bottle
- Do not rinse the bottle
- Do not put the bottle cap on the ground while sampling

2.3 PRECAUTIONS DURING TESTING

To wash hand before starting the work Regularly clean your working area with disinfectant Put testing equipment in a clean place Never eat, smoke or drink when carrying out water quality tests.

2.4 Background of the study area

The NARANJA SUGAR INDUSTRY is located in the JANWADA which is 20km away from BIDAR city. The effluents of all industries in the area are falling through small open drains into main drain known as Manjahara river. This study was initiated to evaluate the various industrial effluents for physic chemical characteristics at the discharge point and assess the quality of ground water in the surrounding area to know if the industrial effluents had any effect on the contamination of such water, used for drinking or irrigation purposes.

2.5 Effluent treatment

Generally, the treatment of effluent is carried out by Anaerobic method where 4 types of reactors are generally used in industries are,

- Anaerobic batch reactor
- Anaerobic fixed bed reactor (AFR)
- Up-flow anaerobic fixed bed (UAFB) reactor
- Up-flow anaerobic Sludge Blanket (UASB) reactor

The present study was undertaken to examine the quality of sugarcane effluent. The collected effluent is treated by Up-flow anaerobic sludge blanket reactor. Sugarcane effluent was collected and the following parameters like pH alkalinity dissolved oxygen chloride nitrates and hardness of the collected sugarcane sample are tested. For this study, the wastewater was collected from sugar industry in 3-4 liter can at the source and appropriately sealed. It was preserved for long period by the addition of chemicals to analyse in the laboratory. For the assessment of various Physio- Chemical characteristics, a standard procedure given by APHA was use.

2.6 Test and procedures

The following test parameters which are to be conducted are as follows: -

- Determination of pH
- Determination of Dissolved Oxygen
- Determination of BOD
- Determination of COD
- Determination of Chloride
- Determination of Sulphate
- Determination of Total solids
- Determination of Total Dissolved Solids
- Determination of Total Suspended solids

III. RESULTS AND DISCUSSION

Sl no	Parameters	Untreated	Treated	As per BIS (mg/lit)
1	colour	Brownish	Brownish	
2	Temperature	40	34	35
3	pH	7.5	7	8
4	DO	2.83	3.91	6
5	TS	2981	2641	2700
6	TDS	2679	2379	2100
7	TSS	301	262	600
8	BOD	2740	2350	2200
9	COD	321	259	250
10	Chlorides	211.6	181	600
11	Sulphates	649	341	100
12	Oil & Grease	14	9	10

A. Colour

In the present study, the colour of the unprocessed effluent was dark brownish and processed effluent appeared in light brownish [1]. Colour is a qualitative characteristic that can be used to measure the general form of wastewater [2]. Colour is a very significant factor for aquatic life for the production of food from the sun rays. Due to the dark colouration, the photosynthesis activity is found to be reduced and also affects the other parameters like temperature, D.O, B.O.D. etc.

B. Temperature

The temperature of the effluent plays an imperative role for its effect on certain chemical and biological process taking place in water which affects the organism and inhabitation of aquatic medium [1]. It depends upon season, sampling time, etc. The water released from the industry, which is normally high in temperature and affects the land harmfully [3]. In this study, the temperature of untreated effluent was recorded as 40°C and treated effluent was recorded as 34°C [1]. The temperature of the discharge should not exceed 35°C. If the untreated effluent has high temperature (40°C), will adversely affects the germination process [1].

The untreated effluent from sugar industry contains high amount of COD, BOD, TSS, TDS, TS and low content of DO which is harmful to plants. So, it is not permissible for irrigation purpose. Untreated waste water from sugar industry shows higher values of cod and low value of do. The treated effluent from the sugar industry, which is well balanced of chemicals if it is diluted with fresh water, then it is suitable for irrigation purpose. Effluent which is discharged from sugar industry is treated and then it may be utilized for industrial processing again. Recycling of waste water is achievable in sugar industry and it is economically cost-effective for sugar industry. The treated effluents from sugar industry are not extremely polluted and they satisfy the ISI standard values and hence it can be used for irrigation purpose.

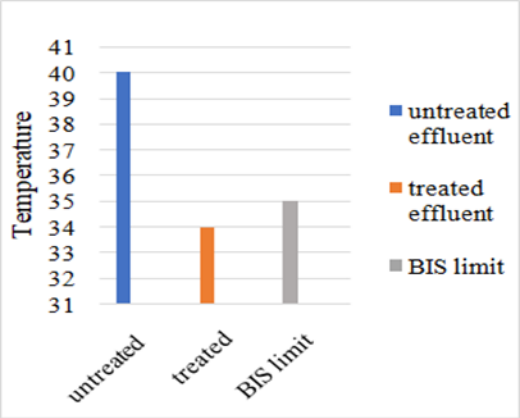

Fig. 1 Comparison between Treated and Untreated Temperature

C. pH

pH is the value expressed in the negative logarithm of the hydrogen ion concentration. Its value ranges from 0 to 14. 7 indicates neutral, less than 7 indicates acidic and above 7 indicates basic or alkaline. The broad narration in the pH of effluent can affect the biological reaction rate and endurance of several microorganisms [3]. pH is the one of the most essential biotic factors that serves as a pollution index [3]. If such water is used for irrigation purpose for a long period of time, the soil becomes acidic nature resulting in poor crops growth and yield [1]. The factors such as photosynthetic exposure to air, releasing of industrial wastewater and domestic sewage will affect the pH value of the soil [1]. In the present study, the pH value of treated effluent was recorded as 7.0 and untreated effluent was recorded as 7.5 respectively. According to BIS standards, the pH value of effluents should be in range 6.5 to 8.0 [1]. During the cleaning process of sugar cane juice, the use of phosphoric acid and Sulfur dioxide will lower the pH values of both treated and untreated effluents [1].

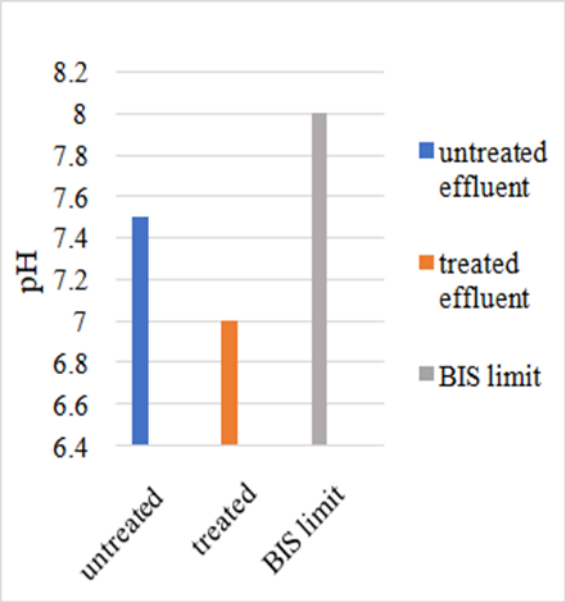

Fig. 2 Comparison between Treated and Untreated pH

D. Dissolved oxygen

It is one of the most essential parameters in water quality analysis. Dissolved Oxygen is an indicator of physical and biological process going in water. The Dissolved Oxygen level in natural water as well as waste water depends on physical, chemical and biological activities of the water body. In water pollution control as well as waste water control, the investigation of Dissolved Oxygen plays an important role. Aquatic environment is entirely depending on dissolved oxygen, various biochemical changes and its effects on metabolic activities of microorganism were very well recognized [3]. Its presence was necessary to retain a variety of forming of biological life in water and effects of water discharged into water body are mostly determined by oxygen balance of the system [3]. According to BIS standard, the Dissolved Oxygen of the wastewater should be within the range 4 to 6 mg/lit. In the present study, the Dissolved Oxygen of the untreated effluent was recorded as 2.83 mg/lit and treated effluent was recorded as 3.91 mg/lit respectively, which is sufficiently lower than the BIS Indian standard values [1].

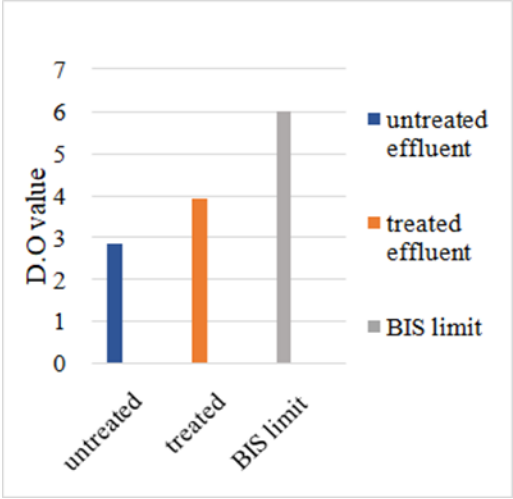

Fig. 3 Comparison between Treated and Untreated Dissolved Oxygen

E. Total Solids (T.S)

The term solid refers to the substance either filterable or in filterable that remain as residue upon venerating and subsequent drying at a particular temperature employed for drying and ignition. Based on method of application, there are different forms of solids are defined for their determination. In wastewater total solids, total dissolved solids and total suspended solids are generally composed of carbonates, bicarbonates, chlorides, sulphates, nitrates, Ca, Mg, Na, K, Mn and organic matter silts and other water polluting particles which increase the concentration of total solids. In the present study, the range of total solids for untreated effluent was recorded as 2981 mg/lit and treated effluent was recorded as 2641 mg/lit respectively [3].

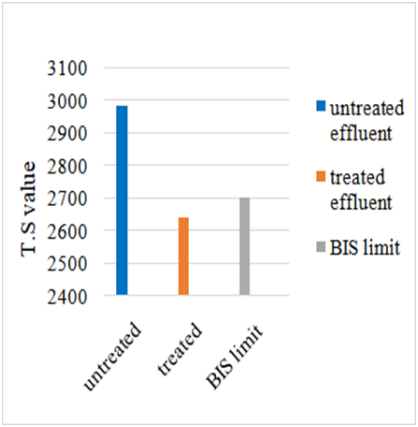

Fig. 4 Comparison between Treated and Untreated Total Solids

F. Total Dissolved Solids (T.D.S)

In summer, the concentration of total solids was maximum, which increased in rainy season whereas in winter it was found as minimum value probably because of stagnation. The concentrations of total solids in waste water represent the colloidal form and dissolved specters. The feasible reason for the variations in values of total solids and subsequent value of dissolved solids are due to the convent collision of the colliding particles. The collision rate for aggregated process is also influenced by pH of these effluents. In the rainy season, low concentrations of total dissolved solids are obtained due to dilution of wastewater with rain water [Hosetti et.al, (1994)]. In the present study the total solids for untreated effluent was 2679.3 mg/l and 2379 mg/l for treated effluent. The Total Dissolved Solids values for both samples are much higher than BIS Indian Standards (2100 mg/L) [3].

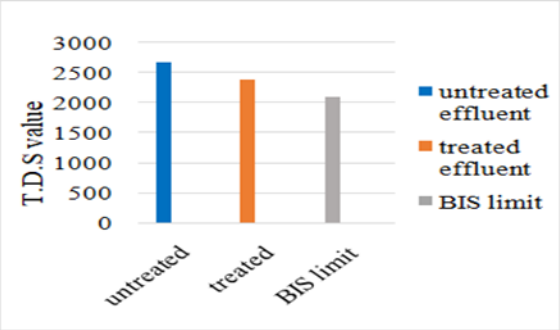

Fig. 5 Comparison between Treated and Untreated Total Dissolved Solids

G. Total suspended solids (T.S.S.)

The light intensity of water is affected by the Total Suspended Solids. Suspended solids are reason for the suspended particles inside the water body influencing turbidity and transparency. Wastewaters from the different industries may have different amount of solid particulate matter either as suspended solids or total dissolved solids. In the present investigation, the suspended solid for untreated effluent was 301.7 mg/l and 262 mg/l for treated effluent respectively.

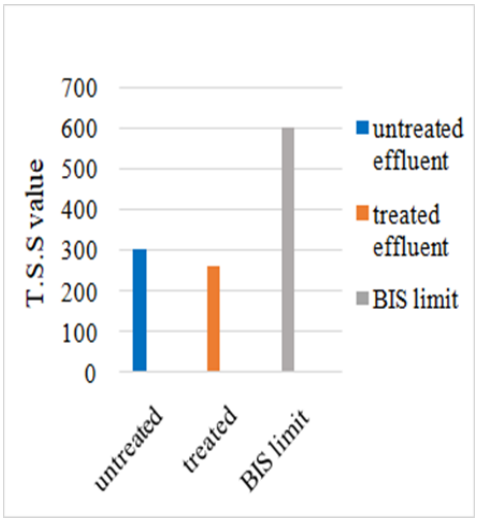

Fig. 6 Comparison between Treated and Untreated Total Suspended Solids

H. Biochemical Oxygen Demand (B.O.D)

Biochemical Oxygen Demand (BOD) is defined as the amount of oxygen required by the microorganism to biologically degrade the organic matter in water under aerobic conditions. The biological oxidation process is a very slow process during oxidating organic pollutants are oxidized by certain microorganism into carbon dioxide and water using Dissolved Oxygen. Therefore, low dissolved oxygen value is the measure of BOD relation. Biological oxygen demand is an essential parameter that indicates the extent of water pollution, by the oxidizable organic matter and the oxygen is used to oxidize inorganic material likes sulphides and ferrous ions [3]. In the present study, the BOD of the untreated effluent was recorded as 83 mg/l and the treated effluent was recorded as 72 mg/l. According to BIS Indian standard, the BOD should not exceed the 30 mg/l.

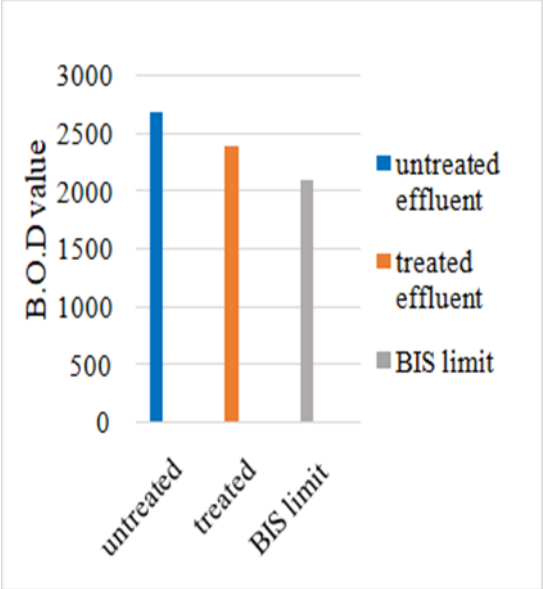

Fig. 7 Comparison between Treated and Untreated Biochemical Oxygen Demand

I. Chemical Oxygen Demand (C.O.D)

The Chemical Oxygen Demand (COD) test determines the oxygen required for the chemical oxidation of organic substance with the aid of strong chemical oxidant. The Chemical Oxygen Demand (COD) is an experiment, which is used to evaluate the pollution level of domestic and industrial waste. The waste is calculated in terms of quality of oxygen required for oxidation of organic matter to produce carbon dioxide and water. It is a fact all organic compounds with few exceptions that they can be oxidized by the activity of strong oxidizing agents under acidic conditions. COD is useful in investigative toxic condition and existence of biological resistance substances. The conjugation of BOD test, with the COD test is helpful to indicate the toxic conditions and the existence of biological resistance. In the present study, the COD of the untreated effluents was recorded as 321 mg/l and the treated effluent was recorded as 259 mg/l. In untreated effluent the COD level is noticeably higher than to BIS standard (250 mg/L). This indicates the high organic pollutants exist in the sample.

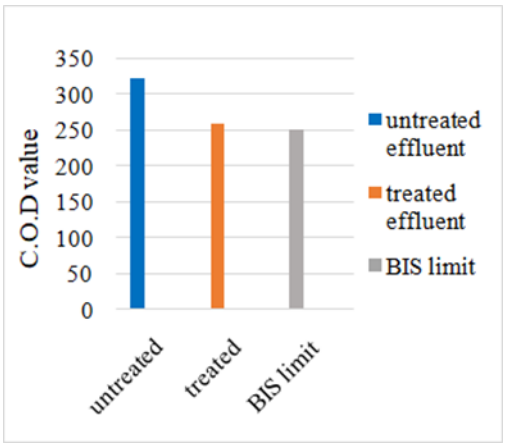

Fig. 8 Comparison between Treated and Untreated Chemical Oxygen Demand

J. Chlorides

In natural water, the presence of Chlorides is usual. The existence of chloride in natural water attributed to dissolution of salt deposits releasing of wastewater from chemical industries, oil well operations, sewage discharges, initiation drainage, contamination from refuse leachates, and sea water invasion in coastal area. In the present investigation, the Chlorides in untreated effluent were recorded as 211.66 mg/l and in treated effluent were recorded as 181 mg/l. This is well within the limits of BIS Indian Standard.

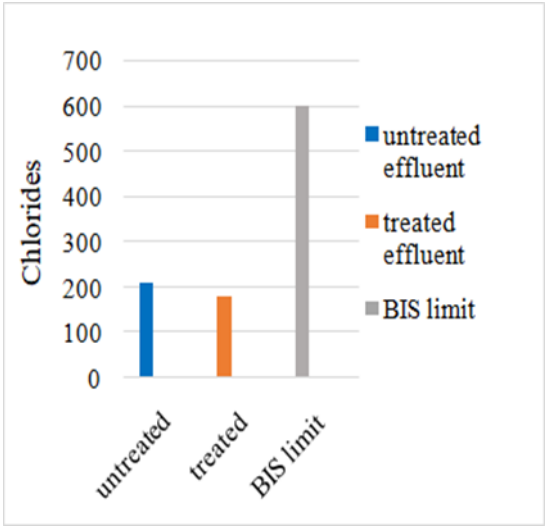

Fig. 9 Comparison between Treated and Untreated Chloride

K. Sulphate

Sulphate is one of the most active occurring in natural water. It may come into natural water through

weathering of deposits. It may be leached from sedimentary rocks and also from sulphate deposits like gypsum and anhydrate. Wastewaters from the certain industries are also major sources for sulphate into the receiving water. Sulphate can also be produced by factorial or by an oxidizing action as in the oxidation action or in the oxidation of oregano sulphur compounds. Sulphur itself has never been a preventing factor in aquatic system, the standard levels of sulphates are more than sufficient to meet plants needs. Odours are easily greater when water is over loaded with organic waste to the point that oxygen is reduced, the SO4 is an electron acceptor is frequently used for the disintegration of organic matter and H2S is produced causing bad smell of rotten egg [Welch 1980]. In this present study, sulphate in untreated effluent was recorded as 649 mg/l and treated effluent was recorded as 341.5 mg/l. According to BIS Indian standard the sulphate level should not exceed the 100 mg/l. High amount of SO42- in both treated and untreated effluents is attributed to the use of sulphur during crystallization process.

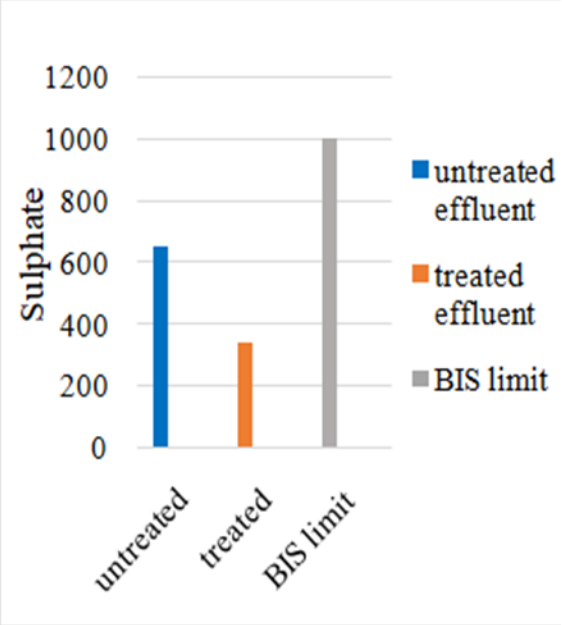

Fig. 10 Comparison between Treated and Untreated Sulphate

L. Oil and Grease

It is present in the water can be extracted in petroleum also which is immiscible in water and can be removed by a separatory funnel. Oil, grease, fats and waxes are dissolved in appropriate solvent and separated from the aqueous phase. The solvent film is then evaporated and the residue is weighed as oil and grease. In the present investigation, oil and grease present in untreated effluents was recorded as 14 mg/lit and treated effluents was recorded as 9 mg/lit respectively.

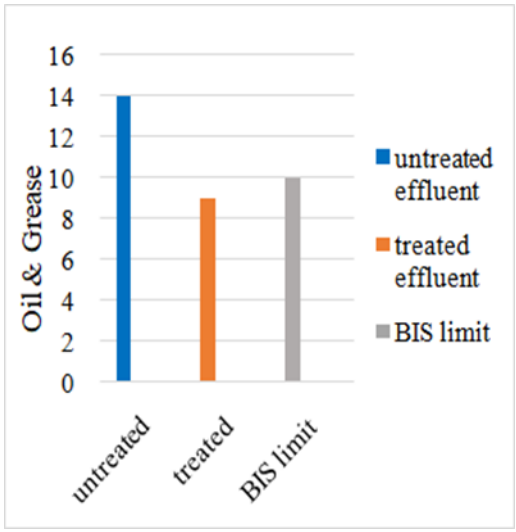

Fig. 11 Comparison between Treated and Untreated Oil and Grease

CONCLUSION

The untreated effluent from sugar industry contains high amount of COD, BOD, TSS, TDS, TS and low content of DO which is harmful to plants. So it is not permissible for irrigation purpose. Untreated waste water from sugar industry shows higher values of cod and low value of do. The treated effluent from the sugar industry, which is well balanced of chemicals if it is diluted with fresh water, then it is suitable for irrigation purpose. Effluent which is discharged from sugar industry is treated and then it may be utilized for industrial processing again. Recycling of waste water is achievable in sugar industry and it is economically cost-effective for sugar industry. The treated effluents from sugar industry are not extremely polluted and they satisfy the ISI standard values and hence it can be used for irrigation purpose.

REFERENCES

[1] Barman, S.C., S.K. Sahu , S.K. Bhargava and C. Chatterjee, 2000. Distribution of heavy

metals in wheat, mustard and grown in field irrigated with industrial effluent. Bulletin of Environmental and Contamination Toxicology, 64: 489-496

[2] Kisku, G.C., S.C. Barman and S.K. Bhargava, 2000. Contamination of soil and plants potentially toxic elements irrigated with mixed industrial effluent and impact in the environment. Journal of Water, Air and Soil Pollution, 120: 121-137.

[3] Babich, H., M. Schiffenbauer and G. Stotzky, 1982. Comparative toxicity of trivalent and hexavalent chromium to fungi. Bulletin of Environmental and Contamination Toxicology, 28: 193-202.

[4] Singh D.K., D. Kumar and V.P. Singh. 2005

[5] International journals of Advanced Engineering and research development (IJAERD) march 2018.

[6] BIS., Indian Standard specifications for drinking water IS: 10500 Bureau of Indian Standard New Delhi (2010).

[7] Chatterjee, S. K.; Bhattacharjee, I.; Chandra, G (2010). Water quality assessment near an industrial site of Damodar River, India. Environ. Monitor. Assess., 161 (1-4), 177- 189.

[8] D. Shivappa, E.T. Puttaiah and B R. Kiran (2007), Physico-chemical Characteristics ofSugar Mill Effluents-Current Scenario in Bhadrvathi Taluka, Karnatka, India Jr.of Industrial Pollution controls 23(2): pp 217-221.