Experimental Study on Performance Evaluation of ETP of Sugar Industry

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

Abstract*—Sugar Industry is also called sugar cane mill. The production of sugar from which is carried out. As we known the cane is cash crop. So the sugar industry is the major industry which takes part in the growth of the country. Sugar industry is one of the major industries which have been included in the polluting industries. Sugar industry wastewater has a high degree of pollution parameters. Present report thus gives the different parameter studies such as pH, BOD, COD, etc. also the study of the sugar industry BS SUGARS Ltd. The parameters permissible limits which are prescribed by the board are also studied.

Indexed Terms*—Sugar Industry, cash crop, pollution parameters, BOD, COD.

I. INTRODUCTION

Water is an essential part of all living organism. Among the whole water availability, only 3% fresh water is available on the earth. In this scenario the conservation stratergies plays an important role in the conservation of fresh water bodies as well as water quality. Huge quality of fresh water will be held in the industry.

In the developing countries like India are facing severe problems in collections, treatment and disposal effluents. Unmanaged organic waste fractions from industries, municipalities and agricultural sector decompose in the environment resulting in large scale contamination of land, water and air.

Most of the sugar industries in developing countries discharge their waste water without adequate treatment, in this aspect the present study pointed out the pollutants concentration in the sugar industry effluent.
Sugar industry effluent is characterized by a high load suspended solids and nutrients and by a high COD mainly, due the presence of carbohydrates. Discharge of such effluent into the environment as a negative impact on aquatic ecosystems.

In the countries like India Jamaica, Cuba sugar is produced from sugarcane, a large volume of waste of organic nature is produced during the period of production and normally they are discharge into land or into the nearby water coarse usually small streams, practically without pre-treatment condition becomes worse as the stream flow reaches a very low level and eventually when in enough dilution when water is not available during the period of operation

II. METHODOLOGY

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

- 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.

- 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

- 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.

- BACKGROUND OF STUDY AREA:

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 irrigation purposes.

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.

- THE TEST AND PROCEDURE

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 solid

III. RESULT AND DISCUSSION

- READINGS IN THE MONTH OF DEC- JAN

SI No.	Parameters	Untreated	Treated	As per BIS (mg/lit)
1.	colour	Dark greenish yellow	Whitish yellow	-
2.	Temperature	40	36	35
3.	pH	5.8	7.2	6.5-9.0
4.	DO	1.3	2.3	4-6
5.	TS	2700	2010	2300
6.	TDS	2980	2350	2100
7.	TSS	110	100	600
8.	BOD	98	86	100
9.	COD	160	255	250
10.	Chlorides	210	175	600
11.	Sulphates	760	420	1000
12.	Oil and grease	16	10	10

- READINGS IN THE MONTH OF MARCH-APRIL

SI NO.	Parameters	Untreated	Treated	As per BIS (mg/lit)
1	Colour	Dark greenish yellow	Whitish yellow	-
2	Temperature	46	34	35
3	pH	5.9	7.6	6.5-9
4	DO	1.3	2.3	4-6
5	TS	2800	2250	2300
6	TDS	2630	2092	2100
7	TSS	142	130	600
8	BOD	93	88	100
9	COD	168	342	250
10	Chlorides	210	170	100
11	Sulphates	682	422	1000
12	Oil and grease	14	9	10

- READINGS IN THE MONTH OF APRIL-MAY

SI.NO	Parameters	Untreated	Treated	As per BIS (mg/lit)
1	Colour	Light pale yellow	Whitish yellow	-
2	Temperature	46	34	35
3	pH	5.9	7.6	6.5-9.0
4	DO	1.3	2.3	4-6
5	TS	2800	2250	2300
6	TDS	2630	2092	100
7	TSS	142	130	600
8	BOD	93	88	100
9	COD	160	342	250
10	Chlorides	210	170	600
11	Sulphates	682	422	1000
12	Oil and grease	48	9	10

A. Colour

In the present study, the colour of the unprocessed effluent was dark brownish and processed effluent appeared in light brownish. Colour is a qualitative characteristic that can be used to measure the general form of wastewater. 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. It depends upon season, sampling time, etc. The water released from the industry, which is normally high in temperature and affects the land harmfully. In this study, the temperature of untreated effluent was recorded as 42°C and treated effluent was recorded as 33°C. The temperature of the discharge should not exceed 35°C. If the untreated effluent has high temperature (46°C), will adversely affects the germination process.

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.

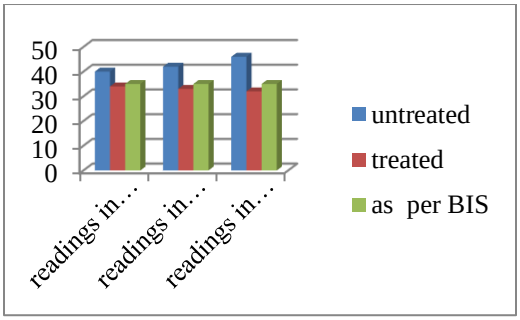

Chart.1: Comparison between Treated and Untreated Temperature

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. pH is the one of the most essential biotic factors that serves as a pollution index. 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. The factors such as photosynthetic exposure to air, releasing of industrial wastewater and domestic sewage will affect the pH value of the soil. In the present study, the pH value of treated effluent was recorded as 7.6 and untreated effluent was recorded as 5.9 respectively. According to BIS standards, the pH value of effluents should be in range 6.5 to 9.0. 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.

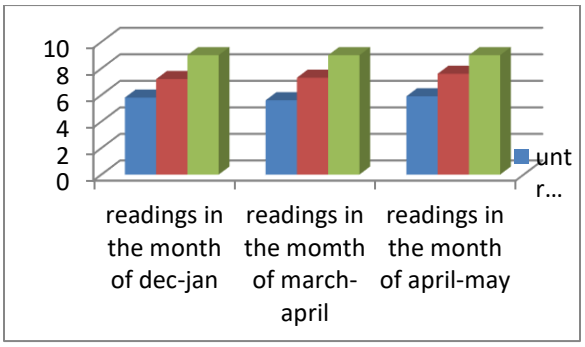

Chart.2: Comparison between Treated and Untreated Ph

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. 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. 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 1.4 mg/lit and treated effluent was recorded as 3.2 mg/lit respectively, which is sufficiently lower than the BIS Indian standard values.

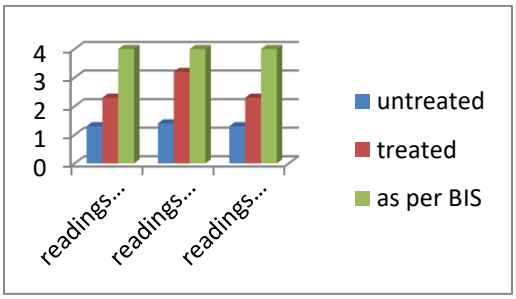

Chart.3: Comparison between Treated and Untreated Dissolved Oxygen

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 2821 mg/lit and treated effluent was recorded as 2250 mg/lit respectively. As per the bureau of Indian Standard (BIS) 2300 mg/lit.

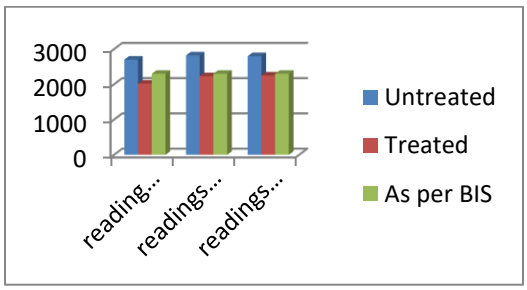

Chart.4: Comparison between Treated and Untreated Total Solids

F. 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. 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

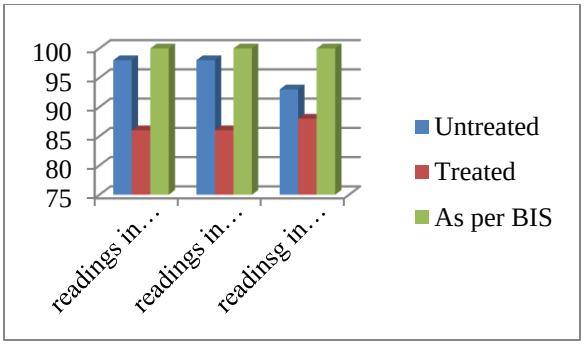

Chart.5: Comparison between Treated and Untreated Bio-chemical Oxygen Demand

G. 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.

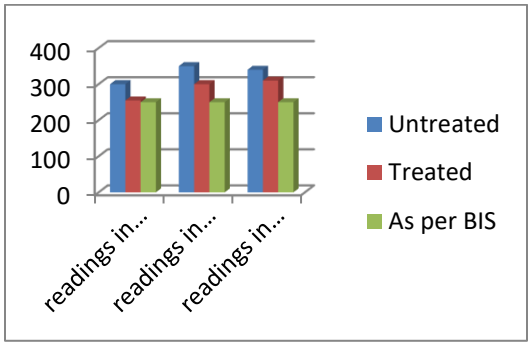

Chart.6: Comparison between Treated and Untreated COD

CONCLUSION

Present study concerned with the performance evaluation of ETP for dairy industry and it is used for the gardening purpose. The COD, BOD and TSS removal efficiency of ETP was observed to be 88%, 87 % and 77 % respectively but value of BOD and Suspended Solids exceed the permissible limits. Hence it is recommended to redesign the wastewater Treatment Plant to achieve the desired standards.

The Treated effluent is used for eco-plantation. The plants which are grown are Eucalyptus, Poplar, Teak and Jatropha. The high transpiration capacity of plants grown in soil matrix enables the system to serve as biopump. The wastewater of that plant is used for the gardening purpose or it will go to the sewerage system. It is not reused. The performance studies on the dairy wastewater treatment plant were evaluated. As per available 3 months data, existing effluent treatment plant appears to be capable of withstanding the shock loads without affecting the efficiency of the plant. The individual units are also performing well and their

Removal efficiencies are satisfactory. Thus, this activated sludge process can be considered as a potential plant for industrial wastewater treatment.

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.

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