© 2018 IJSRST | Volume 4 | Issue 8| Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Modern Effluent Treatment Plant

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ABSTRACT

In this study, the sugar industry waste water generation sources, characteristics, recent advancements in the aerobic, anaerobic, and physico-chemical treatment technologies, and the areas needing further research have been explored. Possibility of treated wastewater reuse was also investigated. A treatment plant was setup with the introduction of activated charcoal Unit and the effluent sample was allowed to pass through the treatment unit and various tests were carried out the results proved satisfactory.

Keywords: Sugar Industry, Activated Charcoal, Effluent

I. INTRODUCTION

Sugar industry is a seasonal industry working for maximum of 5-6 months in one season. The industry uses sugarcane as their raw material along with various chemicals added to increase the face value of the final product. During the process a huge amount of water is also used per day and as a result industry generates waste water (effluent) on daily basis

Waste water from sugar industries, if not treated properly, contains significant amount of TDS and TSS. This water may not be useful for crop land irrigation. There are reports which indicate that infiltration rate decreases with increased loading of BOD and TDS & TSS. The high value of TSS can cause decrease in soil porosity due to salt deposition. High TDS value in waste water may also have adverse effect on crops. A TDS of 500-1000 ppm may have detrimental effect on sensitive crops. In view of the above facts, it is quite evident that the sugar industry is a significant contributor to the environmental pollution and has typical problems. Another important factor in studying the pollution effect is that the sugar industry is seasonal industry and the waste flow is mainly during the crushing season. This causes difficulty in employing biological pollution abatement systems which should otherwise remain very suitable for treating such wastes. Waste water from sugar industries, if not treated properly, contains significant amount of TDS and TSS. This water may not be useful for crop land irrigation

Objectives of the project

- To generate the working model of the activated charcoal unit
- To carry out the various test of the effluent sample
- To determine the BOD,COD,PH of the effluent sample

II. SOURCES OF EFFLUENT

The waste water generated from different sub streams can be classified as follows

A **Mill House**

The effluent consists of water used for cleaning the mill house floor which is liable to be converted by spills and pleased sugar juice (This clearing up operation will prevent growth of bacteria on the

juice-covered floor).Water used for cooling of mills also forms part of the waste water from this source. Basically this water contains organic matter like sucrose, bagacillo, oil and grease from the bearings fitted in to the mills.

B.**Waste Water from Boiling House**

The waste water from boiling house results from leakages through pumps, pipelines and the washings of various sections such as evaporators, juice heaters, clarification, pans crystal is action, and centrifugation etc. The cooling water from various pumps also forms part of water

C. **Waste Water from Boiler Blow-down**

The water used in boiler contains suspended solids dissolved solids like calcium salts, magnesium salts, sodium salts, fatty salts etc. These salts get concentrated after generation stream from the original water volume. These solids have to be expelled time to time to save the boiler being covered up by scales.

D.**Excess Condensate**

The excess condensate does not normally contain any pollutant and is used as boiler feed water and the washing operations. Sometimes it gets contaminated with juice due to entertainment of carry-over of solids with the vapours being condensed in that case if goes in to the waste water drain. The treatment requirement in this case is almost negligible and can replace fresh water or let out directly as irrigation water after cooling it to ambient temperature.

E.**Condenser cooling water**

Condenser cooling water is re-circulated again unless it gets contaminated with juice, which is possible due to defective entrainment separators, faulty operation beyond the design rate of evaporation etc. if gets contaminated, and the water should go into the drain invisibly. This volume of water also increased by additional condensing of vapour of trained from the boiling juice the pan.

III. METHODS AND MATERIAL

Effluent Treatment plant is the one type of waste water treatment method which is particularly designed to purify industrial waste water for its reuse and its aim is to release safe water to environment from the harmful effect caused by the effluent.

Sugar industrial effluent contains various materials Depending on the industry. Some effluent contains oil and grease and some toxic materials. Therefore specific treatment technology called ETP is required.

1. Screens.
2. Oil and Grease trap.
3. Aeration tank.
4. Equalisation tank.
5. Biological filter.
6. Buffer tank.
7. Clarifier.
8. Sludge digestion tank.
9. Activated charcoal carbon filter

Storage tank

1. **Screen Chamber:**

Screening is a unit operation that separates large floating materials in and/or on water (found in different sizes) from water and from entering water treatment/ Waste water treatment facilities and mains. The unit involved is called a screen.

2. **Oil and Grease Trap**

Grease and oil traps are devices utilizes within plumbing systems to capture grease and oil from the discharge of industrial and consumer equipment and applications.

3.**Aeration Tank**

Aeration is one of the important unit operation of gas transfer the aim of the aeration is to create extensive, new and self-renewing interface between air and water to keep interfacial films from building thickness

4.**Equalization Tank**:

Effluent from collection tank comes to the equalization tank in waste water treatment.The main function is to act as buffer.to collect the incoming raw effluent that comes at widely fluctuating rates

5.**Biological filter**

Biological filter enable bacterial colonies to propagate and breakdown wastes.

6.**Buffer tank**:

A buffer tank is a unit where the holdup (volume) is exploited to provide smoother operation.

7.**Clarifier**

Clarifiers are settling tanks built with mechanical means for continuous removal of solids being deposited by sedimentation

8.**Sludge digestion tank**

Sludge digestion is a biological process in which organic solids are decomposed into stable substances

9.**Activated Charcoal Carbon filter**

Activated carbon is used for the control of tastes and odours in water, resulting from the presence of dissolved gases. It has also valuable colour removal properties. Activated carbon is produced by passing a carbonaceous material such as coke, charcoal, paper, char or sawdust through a heating mechanism at high .temperature against a counter current of air, steam, carbon dioxide, chlorine or flue gases. Sometimes, chemical agents, such as phosphoric acid or zinc chloride may be added. This 'activation' and the greatly increased power of carbon to absorb gases and organic matters distinguishes activated carbon from charcoal. The activation of the carbonaceous materials removes the hydrocarbons which might interfere with the adsorption of organic matter. Activated carbon is very. porous and has many carbon atoms with free valencies. It is available in granular as well as powder form, and is sold under trade names such as Darco, Minchar and Nuchar. Activated carbon must possess the properties of easy wetability, prolonged suspension and effective odour absorption capacity. Activated carbon removes organic contaminants from water by the process of adsorption. High surface area is the prime consideration in adsorption. Granular activated carbons typically have surface areas of 500-1400 m^2/g.

A. **Activated Carbon Treatment has the following Functions**:

- It has been found effective in aiding coagulation, if adopted before filtration of water
- It has valuable colour removing properties
- It is effective in preventing or retarding the decomposition of sludge in settling basins
- It is useful in removing tastes and odours due to excess chlorine, hydrogen sulphide, phenols and other elements
- It reduces the chlorine demand of treated water.
- It adsorbs organic matter in water

B**Activated carbon can be applied to water treatment in two ways:**

*(a)*As filter media *(b)* as fine powder feed.

As a filter media, granular activated carbon is used in place of the usual filter sand. Filtered water is passed through the bed of activated carbon. This will remove taste and odour, and will also adsorb organic

compounds. The activatecL carbon filter bed, 75 to 100 cm thick is supported on about 35 to 50 cm thick graded gravel bed. When used in pressure filters, the tank interior should be coaled against electrolytic corrosion. In the course of time, the carbon reaches the limit, of its adsorptive powers and must be 'rejuvenated'. This is done by passing live steam into the carbon through steam pipes placed in the gravel.

The activated carbon in powder form may be applied to water at various stages of its treatment as follows:

i. It may be applied to raw water, ahead of treatment plant.
ii. It may be applied in the mixing basin, either alone or fixed with other chemicals such as alum, by means of any of the types of dry chemical feed machines.
iii. It may be fed before, during or after coagulation, at more than one point. This is known as *split treatment.* Usually, a portion is fed in the mixing basin and the balance just ahead of filter.
iv. It may be applied just ahead of fillers. Its rate of application is high when filter is washed, and becomes lower and lower as filter gets clogged.

The required dosage of powdered activated carbon is controlled by means of thresh hold odour test. For effective use, the dose must be adequate, the mixing thorough and the time of contact long enough for the material to carry out its intended work. Compared to dosing with powdered carbon, the use of carbon filter beds is more advantageous, since it is effective in removing not only the 'earthy' or 'mouldy* tastes or odours, but also in removing a wide range of complex organic substances such as pesticides and aromatic hydrocarbons.

Fig.1 Activated Carbon

IV. EXPERIMENTAL PROGRAMME

A. Developed working treatment plant with activatedcharcoal

The working treatment plant is developed and the effluent sample is allowed to pass through the various units of the treatment plant. The various tests such as COD, BOD, PH TDS, TSS are carried out for the treated effluent plant

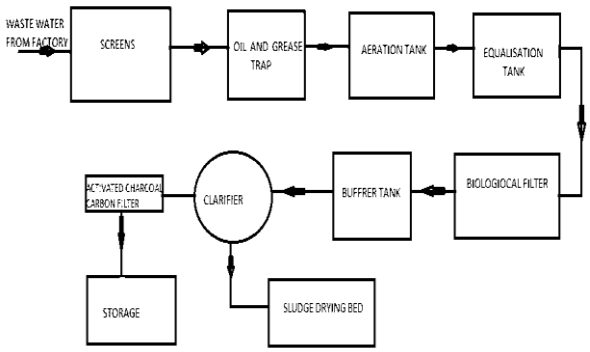


Figure 2. Flow Chart of Effluent Treatment Plant

The working model has been developed and the effluent water has been passed and the results are obtained by the tests carried out

Fig. 3 Developed Effluent Treatment Plant

The Tests conducted are

a) PH Value Test
b) Bod Test
c) Cod Test
d) Chloride Test
e) Total Dissolved Solids Test
f) Sulphate
g) Oil And Grease Test

V. RESULTS AND DISCUSSION

The operation of the ETP is such that it will give an effluent of such standard, prescribed by the Karnataka Pollution Control Board (KPCB). The following prescribed standard by the board

Table.1

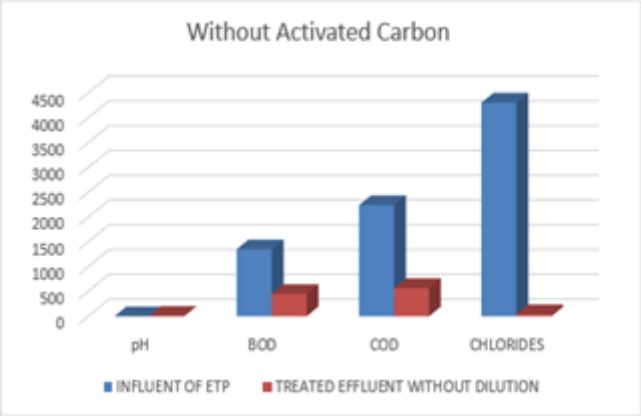
Permissible parameters

SL NO	parameter	Range(not exceeding)
1	pH	5.5-9
2	BOD	100mg/l
3	COD	250mg/l
4	Chloride	600mg/l
5	Total Dissolved solids	2100mg/l
6	Total suspended Solids	100mg/l
7	Sulphates	1000mg/l
8	Oil and Grease	10mg/l

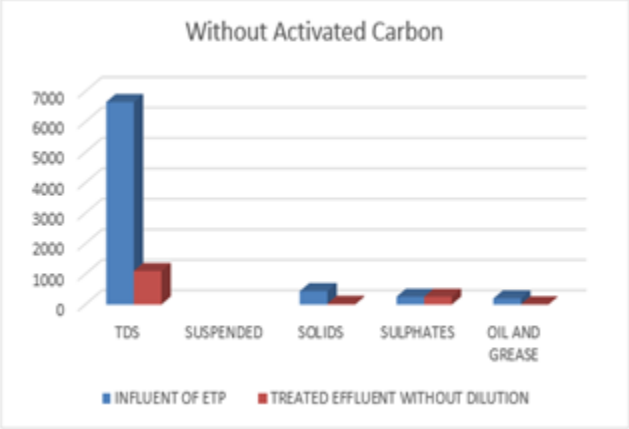
Table. 2

Parameter treated without Activated Carbon

SL NO	Parameters	Influent of Effluent Treatment Plant(ETP)	Treated Effluent without Dilution
1	pH	4.5-5.5	8
2	BOD	1350mg/l	100mg/l
3	COD	2240mg/l	250mg/l
4	Chloride	4305mg/l	600mg/l
5	Total Dissolved solids	6645mg/l	2100mg/l
6	Total suspended Solids	440mg/l	100mg/l
7	Sulphates	257mg/l	1000mg/l
8	Oil and Grease	200mg/l	10mg/l



Graph.1 graph of parameters without activated carbon



Graph.2 graph of parameters without activated carbon

Table. 3

Parameter treated without Activated Carbon

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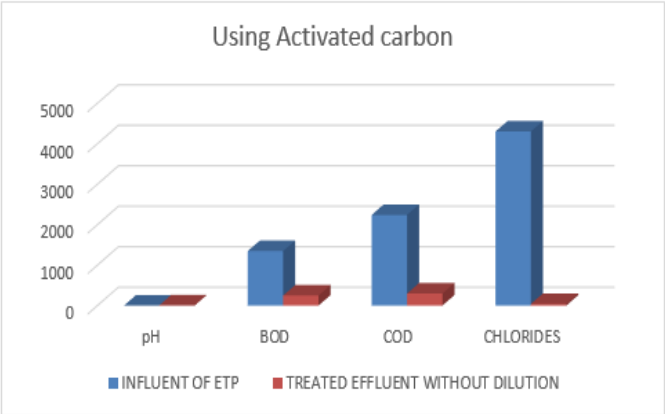
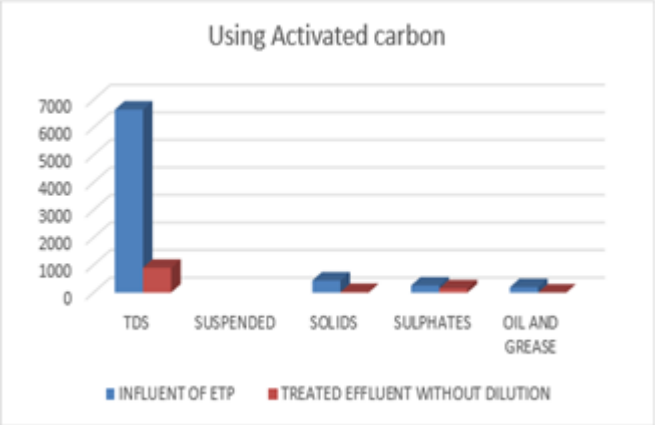


Graph. 3 graph of parameters using activated carbon



Graph. 4 graph of parameters using activated carbon

VI.CONCLUSION

The project carried for ETP for sugar industry can be concluded that, the overall performance of the effluent treatment plant was satisfactory. The individual units are also performing well and their removal efficiencies are satisfactory

- The parameters after treating with activated carbon gives good quality of water.
- The treated effluent water can be used for gardening, and other normal usages

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