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Distillery Wastewater Treatability Studies By Using Soil Aquifer Treatment Using Coconut Stem Powder as Adsorbent

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ABSTRACT: Because of poor water management, the huge amount of wastewater created at all stages of sugar production is highly polluted. This form of effluent is released into the environment, either in surface water or on land. As a result, wastewater treatment for disposal and reuse is required for a healthy and sustainable environment. For improved wastewater management, many treatment procedures are used. For better distillery wastewater management, a soil aquifer treatment system is used in this study. The adsorbent is coconut stem powder, which are utilized in the experiment. Due to the high ligno-cellulose content of coconut stem powder, it was shown to be extremely effective for wastewater treatment. When compared to other materials used as adsorbents, coconut stems are renewable, accessible in large quantities, and less costly. The results of this study demonstrate that distillery wastewater may be treated utilizing a SAT system using coconut stem powder as an adsorbent. Color (Pt. Co) 91.65 percent, Turbidity (NTU) 93.46 percent, TDS (mg/l) 89.88 percent, BOD (mg/l) 71.75 percent, and COD (mg/l) 76.96 percent. As a result, the SAT system is an effective wastewater treatment technology that may be utilized on land.

KEYWORDS: Soil Aquifer Treatment, Distillery Wastewater, Adsorbent, Coconut Stem powder, sandy clay soil

I. INTRODUCTION

To have healthy populations downstream, we need clean water upstream. Society benefits from wetlands and streams because they trap floodwaters, recharge groundwater supplies, filter pollutants, and offer habitat for fish and animals. Industrial wastewater are generally far more hazardous than municipal wastewater treatment facility. In the analysis of distillery effluent samples, physico – chemical parameters such as p^H , colour, turbidity, TDS, BOD and COD were found to be high in organic pollutants. Although all physical and chemical characteristics were reduced when PTDE was diluted by 50% or 75% with water. In this study helps to inexpensive and effective biosorbent that is easily available in large quantities for treatment of wastewater. Natural materials that are available in large quantities or certain waste from agricultural operations may have potential to be used as low cost adsorbents, as they represent unused resources, widely available and are environmental friendly. Adsorption technique was many materials for water purification in these ways, and it is popular with everyone due to its processing effect, economical and low secondary contamination to the surrounding. SAT is generally a low tech, self contained wastewater treatment system. In addition, the water regained from a SAT system is clean and smell free, as it is from a well, a lake or a stream or a low zone as opposed to a sewer or sewage treatment facility. Adsorption is a mass transfer process in which a material is transported from the liquid to solid phase and gets bonded by physico – chemical adsorption. Physical and chemical properties of adsorbate and adsorbent, p^H , temperature and changing depth of adsorbent are some of the aspects to consider in the adsorption process. It is possible to utilize low cost adsorbents made from natural materials that are readily available and ecologically acceptable. Utilized adsorbents may be used as filter material and therefore disposed of simply and safely. Because of its all encompassing nature, modesty and ease of operation, adsorption is regarded the finest wastewater treatment technology.

II. RELATED WORK

(1) Kavyashree H et al., (2020) Studied the, “Treatment of Wastewater by Soil Aquifer Treatment (SAT) in with Natural Adsorbent” used banana peels and fish scales as adsorbent and obtained removal efficiency results of 99.2 percent and 98.89 percent, respectively, SS 96.52 percent and 92.78 percent, TDS 63.26 percent and 68.58 percent, BOD 82.38 mg/l and 80.89 mg/l. (2) Rashmi et al., (2020) Investigated Experiments on guava leaf powder as an adsorbent for textile waste water treatment using SAT yielded the following results: clay sand colour removal efficiency 45.58 percent, silty sand colour removal efficiency 25.06 percent, chlorides removal efficiency 76.57 percent, silty sand 75.82 percent, and TDS(mg/l) 59.6 percent and 55.65 percent. (3) Etim.U.J et al., (2016) Revealed that Coconut stem dust (CSD) was shown to be an efficient, economical adsorbent for colour removal from solutions. When the initial concentration of the dye was raised, the adsorbent demonstrated significant adsorption. (4) Hossain et al., (2012). Reported that Cu(II) ion found in effluents of textile industry was used to evaluate the adsorbent. For this experiment, used a batch adsorption method to determine the most effective agent of activation, size of particles, pH, and contact duration. The results indicated that banana stems conjoined with formalin of particle sizes of 30, pH of Cu(II) ions solution 4.0, and contact duration of 12 hours provided the best conditions for maximal Cu(II) ion adsorption. Its adsorption capacity is 13.24 mg/g, and its removal efficiency is 59.81 percent. To evaluate the effects of particle size, amount of adsorbent, solution pH, duration, agitation, and temperature on the adsorption of copper metal ions onto peels of dried banana.

III. METHODOLOGY

3.1 Collection of Soil

In this study one type of soil was used. A soil was taken from DCM Township in Davangere to preserve the field environment. In the field DCM Township, Davangere a red sandy clay soil sample was obtained using the core cutter method. This soil was collected from the depth of 20 to 60cm due to the fact of more contamination takes place at the topmost surface of soil.

3.2 Collection of Wastewater

The primary treated distillery effluent was diluted 75% and it is used as a source of wastewater for experiment. Big plastic can were used for collection of sample. Sample of industrial wastewater was taken from the sugarcane industries Duggavati at temperature 33°C. The characteristics of wastewater throughout the experiment were managed by preservation in refrigerator.

3.3 Preparation of Adsorbent

Gather the coconut stem. After gathering the stem, clean them with water many times until there are no dirt particles left. After washing the stem, we must dry this in the sun for three days until they are completely dry.

After the stem have dried, gather them and it was powdered by wood cutting saw, then wash the powder with purified water. After the washed powder has been dried in the oven for 9 hours, sieves of various sizes should be used. Keep it in an airtight container.



Fig 1: preparation of Coconut stem powder adsorbent

2.4 Experimental Set Up

SAT Studies were conducted by four PVC columns of 120 cm height and 10cm inner diameter, with outlet at the bottom and overflow pipe at the top side. Sandy clay soil was used in these columns and filled. A 60 micron mesh is installed within the bottom of each column to prevent dirt and effluents. Experiment was conducted by using adsorbents for treating the distillery wastewater. For this experiment coconut stem powder is used as adsorbent. Wastewater is placed in the feeding tank placed at the top to flow into the columns to be treated. To keep the water flowing, 30cm ponding depth is given above the earth.

Column 1 (C1) is filled with sandy clay soil at a depth of 90 cm, Column 2 (C2) is filled with coconut stem adsorbent placed in between the layers of soil at a 20% height from the bottom and an adsorbent depth of 10 cm, Column 3 (C3) is filled with coconut stem adsorbent placed in between the layer of soil at a 40% height from the bottom and adsorbent depth of 10cm, Column 4 (C4) is filled with coconut stem adsorbent placed in between the layer of soil at a 60% height from the bottom and adsorbent depth of 10cm.

IV. EXPERIMENTAL RESULTS

Experiments were undertaken to determine the behavior of the Soil Aquifer Treatment (SAT) system in treating distillery wastewater without and with adsorbent, sandy clay soil and coconut stem powder were used to treating wastewater.

4.2 SAT System Performances in Treating Industrial Wastewater

Table 1. Comparison of Removal Efficiency between Without adsorbent and With Adsorbent 20% Height from Bottom.

Sl. No	Parameter	Removal Efficiency (%)	
		Without Adsorbent	With Adsorbent, 20% height
1	Colour(Pt Co)	70.85	90.28
2	TDS(mg/l)	51.99	89.38
3	TURBIDITY, (NTU)	41.17	80.39
4	BOD(mg/l)	52.59	69.135
5	COD(MG/l)	39.72	69.91

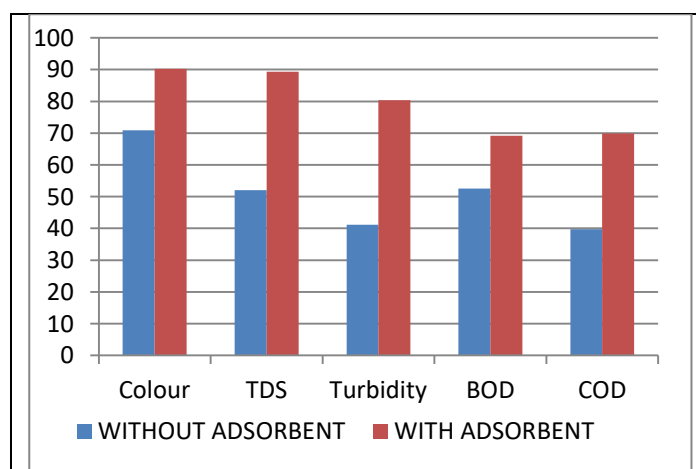
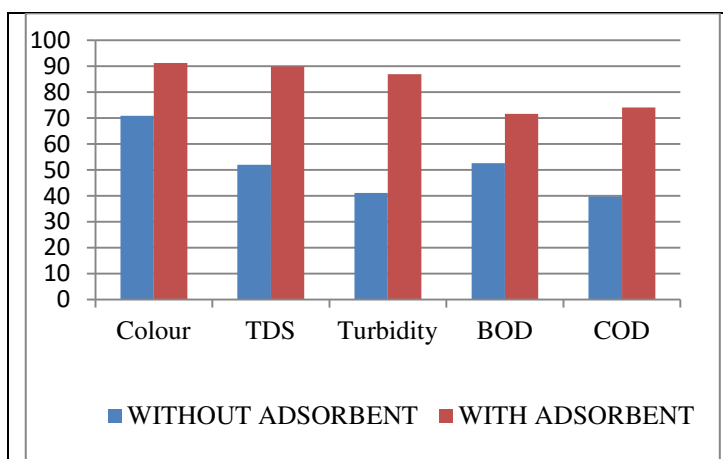


Fig 2: Comparison of SAT Performance between without Adsorbent and With Adsorbent 20% Height from Bottom

Table 2: Comparison of Removal Efficiency between Without adsorbent and With Adsorbent 40% Height from Bottom.

Sl. No	Parameter	Removal Efficiency (%)	
		Without Adsorbent	With Adsorbent, 40% height
1	Colour(Pt Co)	70.85	91.25
2	TDS(mg/l)	51.99	89.88
3	TURBIDITY, (NTU)	41.17	86.92
4	BOD(mg/l)	52.59	71.60
5	COD(MG/l)	39.72	74.14

**Fig 3: Comparison of SAT Performance between without Adsorbent and With Adsorbent 40% Height from Bottom****Table 3: Comparison of Removal Efficiency between without adsorbent and with Adsorbent 60% Height from Bottom.**

Sl. No	Parameter	Removal Efficiency (%)	
		Without Adsorbent	With Adsorbent, 60% height
1	Colour(Pt Co)	70.85	91.65
2	TDS(mg/l)	51.99	89.88
3	TURBIDITY, (NTU)	41.17	93.46
4	BOD(mg/l)	52.59	71.75
5	COD(MG/l)	39.72	76.96

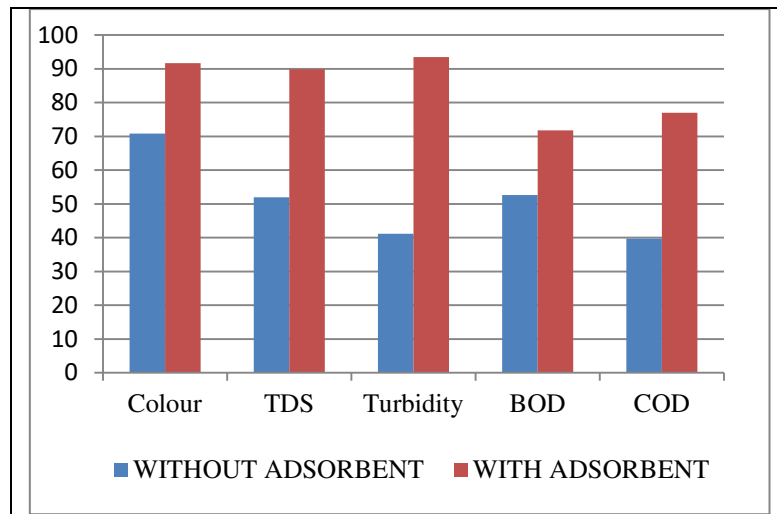


Fig 4: Comparison of SAT Performance between without Adsorbent and With Adsorbent 60% Height from Bottom

V. CONCLUSION

- This technology for the treatment and reuse of industrial wastewater has been effective role in environment.
- In SAT system the removal efficiency of turbidity was observed to be maximum (93.46%) in sandy clay in conjunction with coconut stem adsorbent as compared to without adsorbent.
- Coconut stem waste are renewable , available in large amounts and less expensive as compared to other materials used as adsorbents.
- SAT system with coconut stem adsorbent performs better than without adsorbent.
- Behavior of SAT system without adsorbent in treating distillery wastewater was more efficient in sandy clay with coconut stem powder.

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