TextileWastewater Treatment by Soil Aquifer Treatment (SAT) System using Guava Leaf Powder as Adsorbent

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Abstract - *From past for treatment and disposal of wastewater land has been utilized. Application of wastewater on land is used not only for treatment of municipal wastewater and disposal, but also provides an abundant range of benefits on economic, environmental and social aspects. The soil aquifer treatment(SAT) is land treatment that make use of land and aquifer which take part in wastewater treatment. Industrial effluents are signalizes by their anomalous turbidity , chemical oxygen demand (COD), total suspended solids(TSS), biological oxygen demand (BOD), total hardness, conductivity..In the above work collaboration of soil aquifer treatment system and adsorption technique is exhibited which helps in identifying the removal efficiency of various parameters such as color, TDS, COD, BOD and chlorides fromTextile wastewater with the aid of adsorbent and soil.Guava leaf powder used as adsorbent and two soil Clayey Sand and Silty Sand are used.. Removal efficiency of color, TDS was maximum in clayey sand without adsorbent. Removal efficiency of chlorides, BOD and COD was maximum in clayey sand with adsorbent. Thus from the analysis of result SAT system with guava leaf as adsorbent in clayey sand performs better than silty Sand with guava leaf as adsorbents.*

***Key Words**: Soil Aquifer Treatment, Adsorbent, Clayey Sand, Silty Sand, Textile Wastewater.*

1. INTRODUCTION

Pollution of Environment is potential risk to living and non living creatures on earth. Rapid urbanization and industrialization led to environmental pollution and increase in water demand resulting in depletion of water resources. Industries such as pulp mills, dye synthesis, printing, textiles, cosmetics, food and plastic industries widely uses dye as their coloring agent. Water pollution due to textile industries are very serious issue as large quantity of effluents are discharged into the water bodies. Effluents from these industries are extremely toxic in nature as it holds high COD, suspended solids, dye and chemicals along with dense accumulation of heavy metals like Zn, Pb, Cu, Ni and Cd.

The soil aquifer treatment(SAT) is land treatment that make use of land and aquifer which take part in wastewater treatment.. Soil aquifer treatment (SAT) is an artificial ground water recharge option. under controlled condition by soil percolation process the wastewater is made to pass through groundwater. In SAT system treatment benefits are achieved during infiltration of wastewater effluent firstly through unsaturated zone and then in the saturated zone in the aquifer where effluents mixes with the neighbouring groundwater before it is recovered through a production well for further use. SAT system being cost effective and environmental friendly technology helps efficiently to reduce the pressure on fresh water resource.

1.1 Objectives of the Study

- To identify the soil on the basis of geotechnical properties required for soil aquifer treatment.

- To evaluate the performance of Soil aquifer treatment (SAT) system in treating textile wastewater with and without adsorbents.

2. MATERIALS AND METHODOLOGY

2.1 Collection of WasteWater Sample

Textile industry wastewater is used as a source of wastewater for experimentation. In large plastic can samples are collected. To maintain the characteristics of wastewater throughout the experiment they are preserved in refrigerator.

2.2 Collection of Soil

In this study two kinds of soil samples were used to appraise the applicability of soils in treating the wastewater. One of the soil samples were collected from the construction site near Royal Enfield showroom, Hadadi Road, Davangere and other from Magenahalli which is 20km away from the davangere city. Based on the examination of geotechnical properties of soil samples collected, they were classified as clayey sand (SC), and silty sand (SM).

2.3COLLECTION AND PREPARATION OF ADSORBENT

Guava leaves were collected from nearby orchard. Guava leaves were then dried under sun for 3 days. Then dried leaves were powdered in grinder and washed with distilled water. Washed powder is dried in oven for 9hr and then sieved in 300 micron sieve and stored in air tight container.

Figure 1: Collection and preparation of guava leaf adsorbent.

2.4 Experimental Set Up

To study the behaviour of SAT system in co-existence with natural adsorbent in treating textile industry wastewater with and without adsorbent column studies are made. Four column of PVC pipes are used for the experiment. The length of each column is 115cm and inner diameter is 16cm. Outlet is provided at the bottom of the column and overflow pipe is at the side in top of the column. The bottom of each column is provided with 60micron mesh inside to prevent the get-away of soil along with effluent. The field density of soil is maintained while filling the soil in the column. Wastewater is stored in feeding tank and at the top of the column it is placed. Wastewater to be treated is allowed to flow into the column from feeding tank. 30cm pounding depth is provided above the soil to maintain the flow of water. Experimental setup is shown in the fig2.2

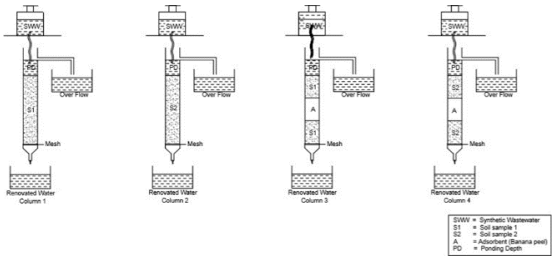

Figure2: Schematic line diagram of Experimental Setup, SAT system

3. RESULTS AND DISCUSSIONS

3.1 Classification of Soil for Experiment

Soil samples used for experiments are collected from the site are analysed for their geotechnical properties. Various tests on soil are conducted in the geotechnical lab. The soil sample collected are categorized as clayey sand (SC) and silty sand (SM) based on the result obtained. The soil samples are tested for various parameters to classify the soil.

3.2 Performance of SAT System in Treating Textile Wastewater

Table 1: SAT system performance in treating textile wastewater without adsorbent for Clayey Sand and silty sand

Sl. No	Parameter	Removal Efficiency (%)	
		Clayey Sand	Silty Sand
1	Color (Pt Co)	88.45	57.86
2	Chlorides (mg/l)	70.53	53.65
3	TDS (mg/l)	72.19	47.90
4	BOD (mg/l)	63.28	57.70
5	COD (mg/l)	63.58	62.85

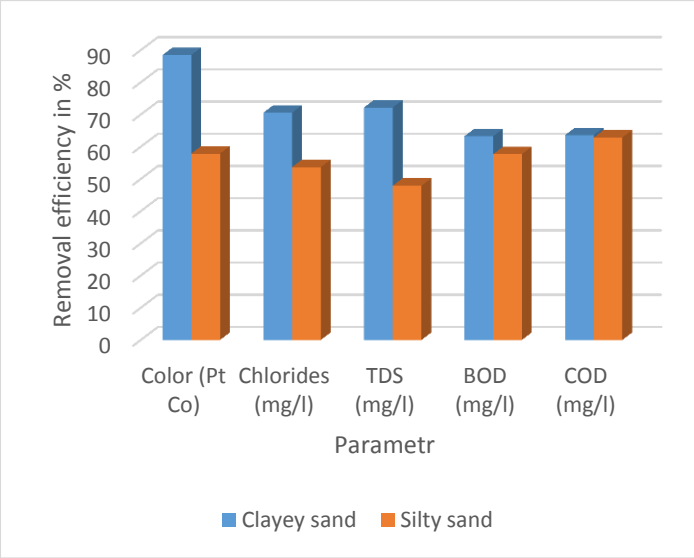

Figure 3: Effect of SAT system in treating textile wastewater without adsorbent for clayey sand and Silty sand

From table 1 and fig 3 the removal efficiency of clayey sand is better compared to silty sand without adsorbent. Highest removal efficiency was observed for color88.45% by clayey sand. Least removal efficiency was observed for TDS 47.90 by silty sand.

Table2: SAT system performance in treating textile wastewater with adsorbent(Guava leaves) for clayey sand and Silty sand

Sl. No	Parameters	Removal efficiency	
		clayey sand	Silty sand
1	Color (Pt Co)	45.58	25.06
2	Chlorides (mg/l)	76.57	75.82
3	TDS (mg/l)	59.6	55.65
4	BOD (mg/l)	79.43	74.22
5	COD (mg/l)	76.98	72.59

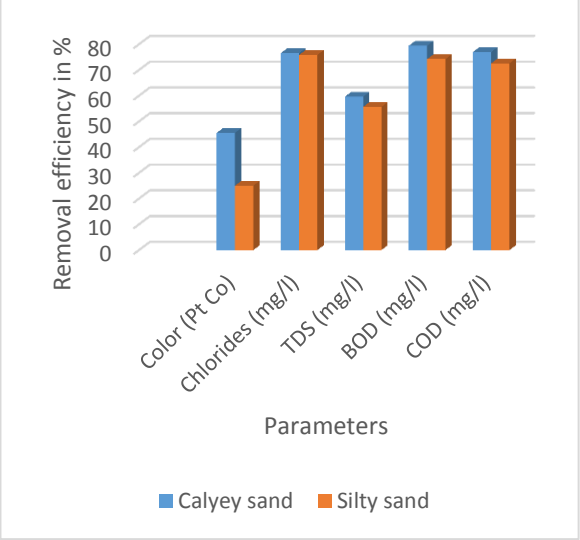

Figure4:Effect of SAT system in treating textile wastewater with adsorbent (Guava leaves) for clayey sand and Silty sand

From table 2 and fig 4 the efficiency of Clayey sand with guava leaf as adsorbent is better than the silty sand with guava leaf as adsorbent. The maximum removal efficiency is observed for BOD 79.43% by clayey sand

with adsorbent and least removal efficiency was observed for color 25.06% by silty sand with adsorbent.

4. CONCLUSIONS

To assess the capability of SAT system in treating textile wastewater bench scale column studies were carried. Different experimental conditions are considered such as soil type, different adsorbents, soil layer in conjunction with adsorbent, initial concentration of pollutants. The following conclusions were drawn based on the examination of results.

- Behaviour of SAT system without adsorbent in treating textile wastewater was more efficient in clayey sand than compared to silty sand.
- SAT system with guava leaf as adsorbent in clayey sand performs better than silty Sand with guava leaf as adsorbents.
- SAT system with adsorbent perform better than without adsorbent for both soil except for colour and TDS.
- Thus SAT system can be employed for treating textile wastewater and the renovated water can be reused.
- The adsorbents used in the experiments are locally available, biodegradable and eco-friendly, they can be employed for water and wastewater treatment.

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