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Efficiency of Natural Adsorbents in Treating Domestic Wastewater

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Abstract

On our motherland the most vital elements involved in the construction and development of healthy life is water. The treatment of water is crucial for every living organism; hence this treatment is obligatory which is of low cost. This paper includes the characteristics study on treatment of domestic wastewater by filtration technology. It is an effective method for removal of organic pollutants from wastewater. This paper focuses on effect of natural adsorbents and use of each adsorbent in wastewater treatment. Multimedia technology shows good result compare to single media filters. Sugarcane bagasse, coconut coir and vetiver grass root are the adsorbents used. The results obtained from this multimedia technology for pH, turbidity, total dissolved solids (TDS), total suspended solids (TSS), Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) are 21%, 72%, 30%, 61%, 78% and 68% respectively. This paper intense to provide an overall vision in treating the wastewater using natural adsorbents and the treated wastewater can be used for gardening, flushing toilet or any other purpose so that we can avoid usage of fresh water to some extent. Thus saving water for future need.

Keywords*: - Coconut Coir, Domestic Wastewater, Multimedia Filtration, Sugarcane Bagasse, Vetiver Grass Root*

INTRODUCTION

On earth the most important nature is water, it is one of most important and essential for every living organism. On earth 96.5% water will present in sea, in ground water 1.7% will present and 1.7% water occurs as snow and glaciers. Because of the scarcity of clean water, treated wastewater potentially provides an alternative source for irrigation, flushing, and gardening. Treatment of wastewater may include mechanical, biological, and physical-chemical method depends on pollutant origin. Different adsorbents are used for treatment of wastewater. Few of them are coconut coir, sugarcane bagasse, vetiver grass root, rice husk, banana peels, rice husk, fish scales etc. Filtration technology is the process of removing bad contaminants like solid particles, suspended matter, micro-organism from a liquid and it is simplest and low-cost treatment technology. The main objective of project is to design the multimedia filter for treatment of wastewater using low cost adsorbents like sugarcane bagasse, vetiver grass root, coconut coir and to give the explanation about the use of different adsorbents.

Adsorption Technique

Adsorption is one of the wastewater purification practice for eliminating a wide range of compounds from waste water. Adsorption is a surface-based process. It includes the entire volume of the material. Adsorption will occur after particles in a liquid bind themselves to the surface of a solid element. Adsorbents have very high surface area that authorizes adsorption.

MATERIALS ANDMETHODOLOGY

Collection of Domestic Wastewater

The sample is collected from local area Suraram, which is located in Malkajgiri district, Telangana state, India. The collected sample is in the form of fresh sewage in the colour of light greenish.

Preparation of Adsorbents

All the three adsorbents were collected from local area and the adsorbents were sugarcane bagasse, coconut coir and vetiver grass root. These three adsorbents are firstly washed with tap water and dried under sunlight for 3 days to remove moisture content present in it. These adsorbents are made into fiber layer as shown in below figure 1, 2, 3.

Fig. 1: Sugarcane bagasse

Fig. 2: Vetiver grass root

Fig. 3: Coconut coir

Experimental setup

Filtration tank is made with glass of thickness 0.5cm and is of 45cm height, 25cm long and 25cm wide. The experiment is conducted by placing the adsorbents in the tank separately at a bed height of 7cm as shown in figure 4 and then the wastewater is allowed to pass in to the apparatus, keeping suitable retention period with outlet closed, after the period open outlet and collect the water from the tank. The collected water is then analyzed. Now the experiment is conducted by placing the combination of adsorbents in tank which is placed in series with down flow regime packed with different media. The inlet and outlet arrangement were provided at appropriate locations for feeding and with drawl of influent and effluent. The collected domestic wastewater from the inlet tank enters the inlet chamber and flows in sequence i.e. from the first compartment to the last compartment and then enters the collecting chamber and it was collected from outlet. The top most compartment was packed with sugarcane bagasse, second compartment was packed with coconut coir and third compartment packed with vetiver grass root at bed height of 7.5cm accordingly as shown figure 5. The wastewater is allowed to flow from the top

compartment to the last compartment in the down flow regime. The wastewater was collected in the collecting chamber and after reaching the outlet level the treated effluent was collected in the outlet tank.

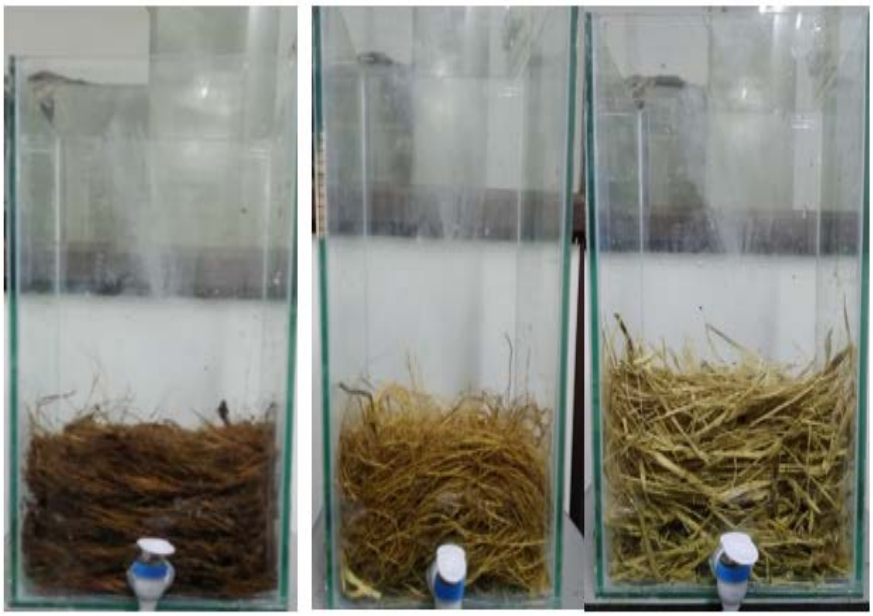

Fig. 4: Single Stage filtration technique using different adsorbents

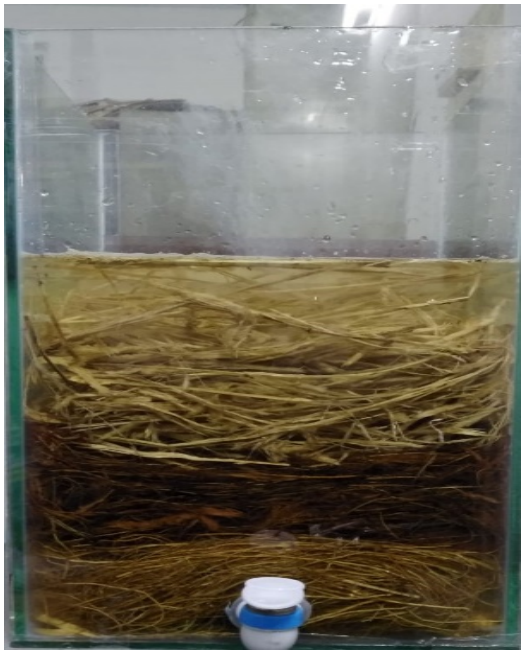

Fig. 5: Multimedia filter

RESULTS AND DISCUSSIONS

Analysis of Wastewater sample

The sample was analyzed for pH, Turbidity, total dissolved solids (TDS), total suspended solids (TSS), Biochemical oxygen demand (BOD) and chemical oxygen demand (COD). From the results shown in Table 1 it is clear that the wastewater has to be treated prior to reuse. It needs to be treated before discharging.

Table 1: Initial Characteristics of Wastewater

Parameters	Initial value
BOD(mg/l)	121
COD (mg/l)	229
TDS(mg/l)	850
TSS(mg/l)	430
Turbidity(NTU)	202
pH	8.5

Filtration using Sugarcane Bagasse

The wastewater was filtered through 7cm thick bed of sugarcane bagasse. The results obtained are given in Table 2. Results show that removal efficiency (as shown in fig. 6) was found to be more than 40% except pH and TDS.

Table 2: Characteristics of Wastewater filtered through 7cm thick bed of Sugarcane Bagasse

Parameters	Obtained value after filtration	Removal efficiency (%)
BOD (mg/l)	61	50
COD (mg/l)	125.9	45
TDS(mg/l)	722.5	15
TSS(mg/l)	223.6	48
Turbidity(NTU)	121	40
pH	7.48	12

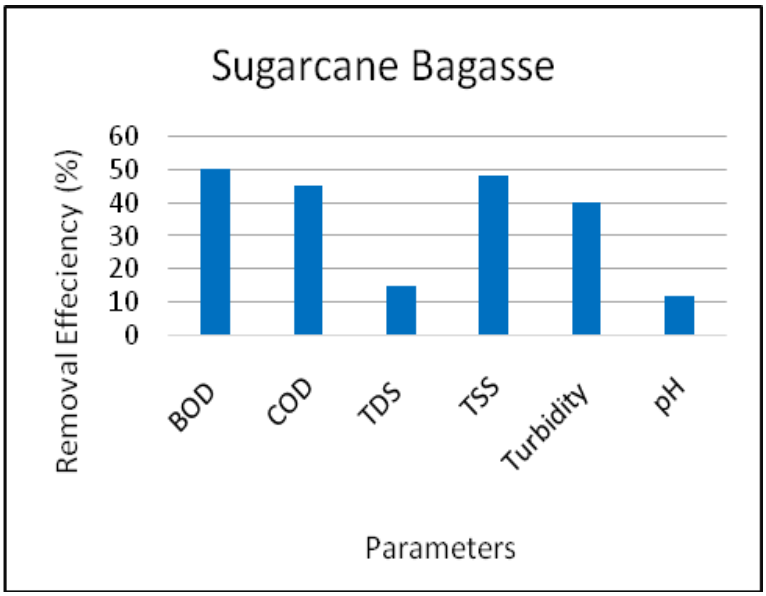

Fig. 6: Removal efficiency of parameters using Sugarcane Bagasse

Filtration using vetiver grass root

The wastewater was filtered through 7cm thick bed of vetiver grass root. The results obtained are shown in Table 3. Results show that removal efficiency (as shown in fig. 7) was found to be more than 40%.

Table 3: Characteristics of Wastewater Filtered through 7cm thick bed of Vetiver Grass Root

Parameters	Obtained value after filtration	Removal efficiency (%)
BOD (mg/l)	47.2	61
COD (mg/l)	132.82	42
TDS(mg/l)	680	20
TSS(mg/l)	190.6	56
Turbidity(NTU)	109.1	46
pH	6.8	20

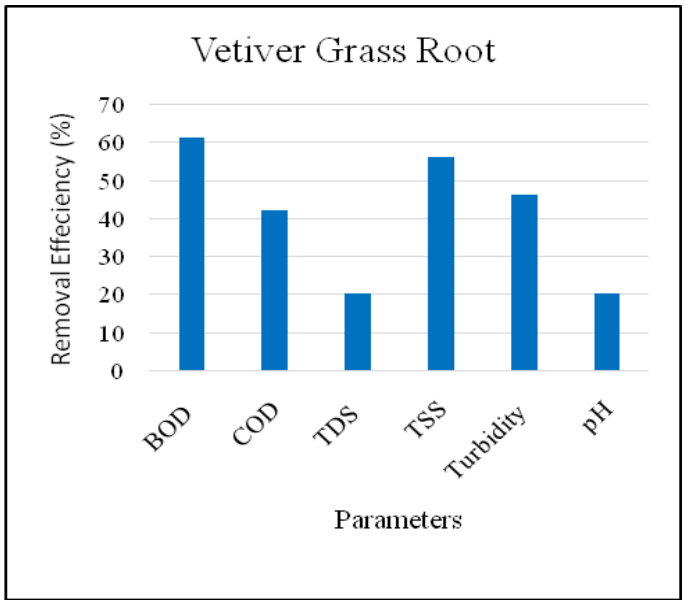

Fig. 7: Removal efficiency of parameters using Vetiver grass root

Filtration using coconut coir

The wastewater was filtered through 7cm thick bed of coconut coir. The results obtained are given in Table 4. Results show that removal efficiency (as shown in fig. 8) was found to be more than 35%.

Table 4: Characteristics of wastewater filtered through 7cm thick bed of coconut coir

Parameters	**Obtained value after filtration**	**Removal efficiency (%)**
BOD (mg/l)	72.9	40
COD (mg/l)	146.6	36
TDS(mg/l)	765	10
TSS(mg/l)	258	40
Turbidity(NTU)	121	40
pH	7.65	10

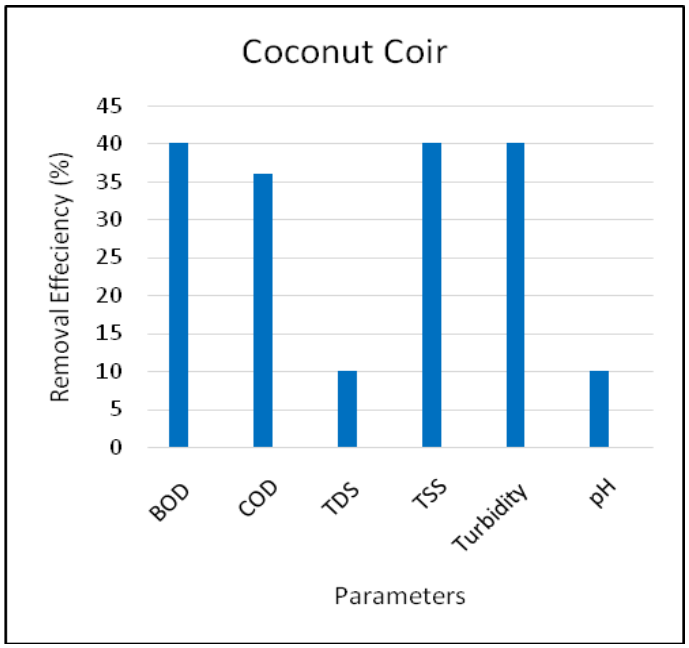

Fig. 8: Removal efficiency of parameters using Coconut Coir

Filtration using Multimedia filter

The wastewater was filtered through a bed consists of 7.5cm thick of Sugarcane bagasse, Coconut coir and Vetiver grass root each with sugarcane bagasse at top and coconut coir is below of it and vetiver grass root at bottom. The results obtained are shown in Table 5. The multimedia filter showed improved removal efficiency (as shown in fig. 9) than the adsorbents used alone.

Table 5: Characteristics of wastewater filtered through a multimedia filter

Parameters	**Obtained value after filtration**	**Removal efficiency (%)**
BOD (mg/l)	26.7	78
COD (mg/l)	73.3	68
TDS(mg/l)	594	30
TSS(mg/l)	167	61
Turbidity(NTU)	56.6	72
pH	6.7	21

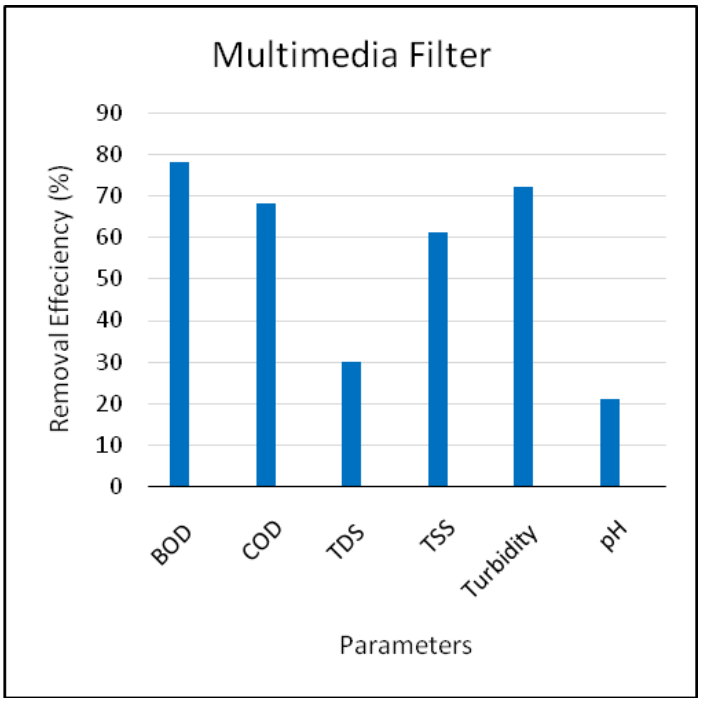

Fig. 9: Removal efficiency of parameters using Multimedia filter

CONCLUSION

This project primarily focuses on removal efficiency of vetiver grass root as a natural adsorbent and it was found more efficient than sugarcane bagasse and coconut coir.

In this study it is concluded that multimedia filter gives more removal efficiency compared to single media filter and by using multimedia filter BOD, COD, TDS and TSS had given enhanced results. The results obtained from this multimedia technology for pH, turbidity, total dissolved solids (TDS), total suspended solids (TSS), Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) are 21%, 72%, 30%, 61%, 78% and 68% respectively.

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