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# Studies on Natural Fibrous Materials as Fixed Aerated Beds for Domestic Wastewater Treatment

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***Abstract—In the course of the most recent thirty years composite materials, plastics and earthenware production have been the overwhelming developing materials. The volume and number of consumptions of composite materials have developed regularly, entering and overwhelming new markets firmly. Present day composite materials constitute a noteworthy extent of the designed materials showcase going from ordinary items to advanced specialty applications. While combinations have officially confirmed their value as weight-sparing materials, the present test is to inspire them to financially savvy. This paper examine about common strands and its applications. Additionally, this paper focuses on biomaterials advance in the field of orthopaedics. A push to use the points of interest offered by inexhaustible assets for the improvement of bio composite materials in light of bio epoxy resin and Natural fibres, for example, Agave sisalana and Banana fibre and its application in bone uniting substitutes.***

***In the present investigation endeavours have been made to check the effectiveness of two distinctive stringy materials, Agave sisalana strands and Banana fibre utilized as channel media at various contact periods. To examine the similar evacuation effectiveness of COD, BOD, sulphate, nitrate utilizing Agave sisalana and Banana fibre on 15cm channel media and 30cm channel media.***

***Keywords—overwhelming,composite materials, Agave sisalana, Banana fibre***

## I. INTRODUCTION

The sewage after treatment may be disposed either into a water body such as lakes, streams, river, estuary and ocean or into land. It may be used for several purposes such as conservation, industrial use or reclaimed sewage effluent in cooling systems, boiler feed, process water, reuse in agriculture, horticulture, sericulture, reuse is becoming increasingly popular, especially in geographies where potable water is in short supply. Reduction of strength of domestic wastewater using two different bed materials Banana fibre and Agava sisalana fibre as a filter media is one such type of treatment method adopted. The consumption of fixed films for wastewater treatment process has been gradually measured due to essential improvements over suspended growth system. The present work is planned to study the relevance of the comparative study between the fibres ie., Banana fibre and Agava sisalana as a fixed bed for treating domestic wastewater and to know the comparative removal efficiency of COD, BOD, nitrate, sulphate, chloride with conventional gravel bed in a small volume reactor. There has been lot of do research on use of natural fibre reinforcements. Banana fibre, a ligno-cellullosic fibre, gained from the pseudo-stem of banana plant, is a most excellent fibre with comparatively good mechanical properties. Banana plant is a large perennial herb with leaf sheaths that from pseudo stem. Its height can be 10-40 feet (3.0-12.2 meters) encircling with 8-12 large leaves. The leaves are up to 9 feet long and 2 feet wide (2.7 meters and 0.61 meter). Banana plant is available throughout Thailand and Southeast Asian, India, Bangladesh, Indonesia, Malaysia, Philippines, Hawaii, and some Pacific islands. Sisal fibre (Agave sisalana species) is obtained from the leaves of this plant. The lustrous strands, usually creamy white, average from 80 to 120 cm in length and 0.2 to 0.4 mm in diameter. Sisal fibre is fairly coarse and unbending. It is valued for cordage use because of its strength, durability, ability to stretch, affinity for certain dyestuffs, and resistance to deterioration in saltwater.

## 2. Materials and Methodology

Two distinct fibrous filling materials used for the present study are Agave sisalana and banana fibre. Two reactors used in this study, are made of 6mm glass, having measurements 45cm x45cm x60 cm, filled with agave sisalana and banana fibres for a known depth of 30 cm. Reactors are rectangular in shape and constructed for downflow mode and for batch operation process. Diffused aerators are used to retain the dissolved oxygen level inside both the reactors.

Initially to start-up the reactor, hostel waste water obtained from REVA hostel is been used for seeding. These reactors were then aerated with diffused air pumps constantly for 7 days for acclimatization and growth of biomass in both the reactors. After the complete growth of biomass on the surface of fixed beds in both reactors, known volume (25L) of wastewater is fed through inlet pipe and MLSS is kept stable at an average in both the reactors. The initial characteristics of the wastewater used for the study is determined. The sampling was done after attaining a DO concentration 2.5mg/L in both reactors at an period of 24 hours up to a contact time of 72 hours. The water is left in filter with a contact time of 24hr and each parameter such as BOD, COD, chloride, sulphate, Turbidity, Total solids, pH and Temperature is determined for the collected sample

### 3.Results And Discussions

Table:3.1 Removal Efficiency using Agava Sisalana.

| Parameters | Initial | 1st day | Removal efficiency (%) | 2nd day | Removal efficiency (%) | 3rd day | Removal efficiency (%) |
|---|---|---|---|---|---|---|---|
| pH | 6.5 | 6.8 | - | 6.82 | - | 6.82 | - |
| Temperature (degree Celsius) | 22 | 22 | - | 23 | - | 23 | - |
| Turbidity (NTU) | 262 | 253.7 | 3.16 | 240.2 | 8.32 | 230 | 12 |
| Chloride(mg/L) | 267.6 | 255 | 4.70 | 252.9 | 5.49 | 244.9 | 8.48 |
| Sulphate(mg/L) | 14.7 | 13.51 | 8.09 | 13.18 | 10.34 | 12.44 | 15.37 |
| Total solids(mg/L) | 958 | 918 | 4.17 | 782 | 18.37 | 741 | 22.65 |
| COD (mg/L) | 446 | 422 | 5.38 | 395 | 11.43 | 373 | 16.36 |
| BOD (mg/L) | 215 | 205 | 4.65 | 193 | 10.23 | 181 | 15.81 |

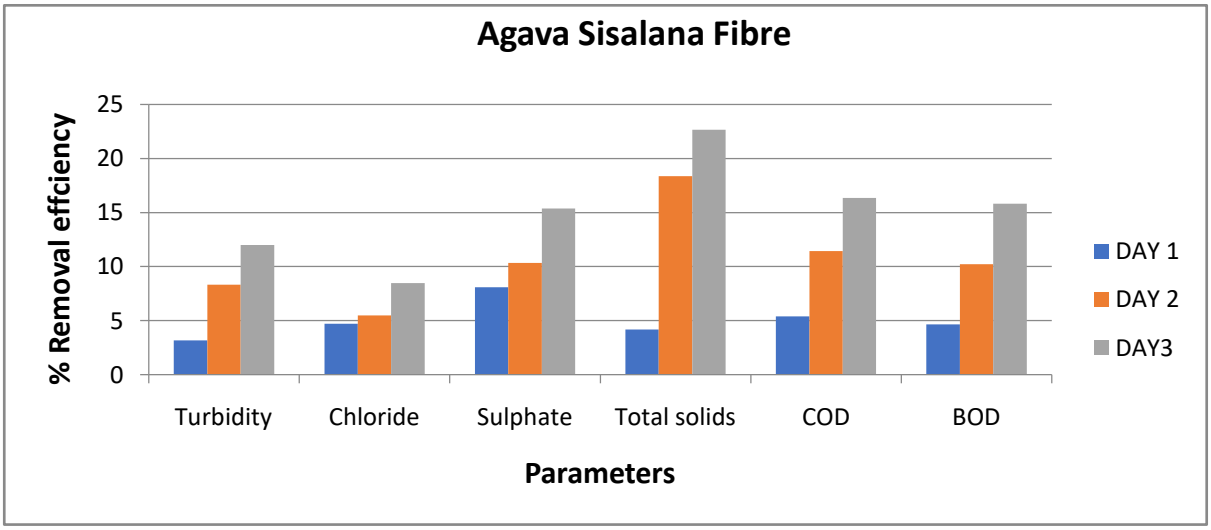


Fig: 3.1 Percentage removal of different Parameters using Agava Sisalana

Tabel 3.1 and figure 3.1 represents the values of turbidity, chloride, sulphate, total solids, COD and BOD as 262, 267.6, 14.7, 958, 446, 215 respectively. After 24 hours of contact time the removal efficiency was found to be 3.16%, 4.70%, 8.09%, 4.17%, 5.38% and 4.65% respectively, similarly after 48 hours it was found to be 8.32%, 5.49%, 10.34%, 18.37%, 11.43% and 10.23% respectively and at the end of 72 hours it was found to be 12%, 8.48%, 15.37%, 22.65%, 16.36% and 15.81% respectively and the table 3.1 shows that the pH was found to be constant throughout the contact period of 72 hours.

Table: 3.2. Removal Efficiency using Banana Fibre.

| Parameters | Initial | 1st day | Removal efficiency (%) | 2nd day | Removal efficiency (%) | 3rd day | Removal efficiency (%) |
|---|---|---|---|---|---|---|---|
| pH | 7.24 | 7.24 | - | 7.36 | - | 7.36 | - |
| Temperature(degree Celsius) | 22 | 22 | - | 22 | - | 22 | - |
| Turbidity(NTU) | 79.5 | 34.1 | 57.10 | 30.2 | 62.01 | 25.3 | 68.17 |
| Chloride(mg/L) | 123.99 | 55.99 | 54.88 | 40.28 | 67.51 | 33.32 | 73.12 |
| Sulphate(mg/L) | 5.68 | 2.06 | 63.73 | 1.08 | 80.98 | 0.50 | 91.19 |
| Total solids(mg/L) | 740 | 700 | 5.40 | 680 | 8.10 | 605 | 18.24 |
| COD(mg/L) | 420 | 391 | 6.90 | 355 | 15.47 | 319 | 24.04 |
| BOD(mg/L) | 360 | 321 | 10.83 | 283 | 21.38 | 247 | 31.38 |

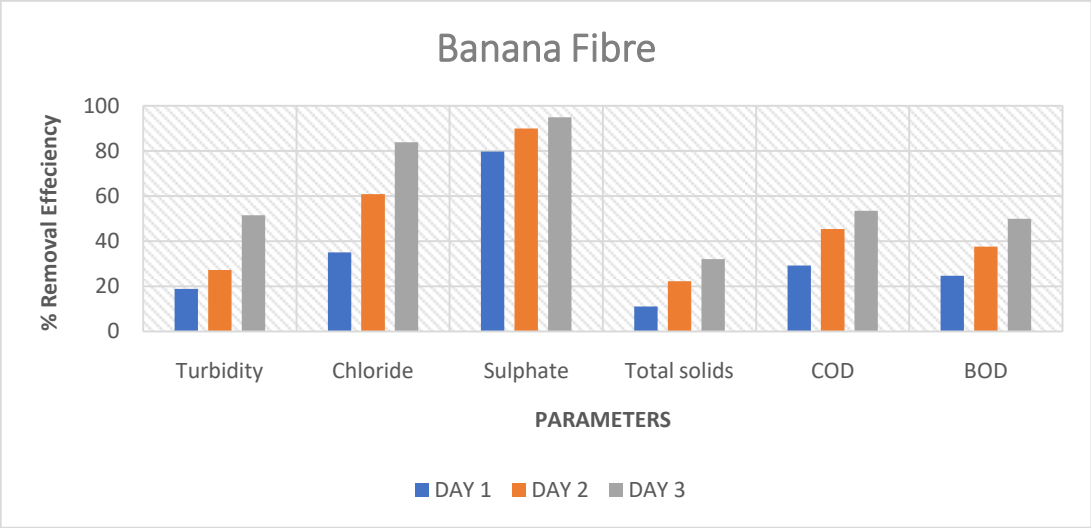


Fig: 3.2. Percentage removal of different Parameters Banana Fibre.

Tabel 3.2 and figure 43.2 represents the values of turbidity, chloride, sulphate, total solids, COD and BOD as 79.5, 123.99, 5.68, 740, 420 and 360 respectively. After 24 hours of contact time the removal efficiency was found to be 57.10%, 54.88%, 63.73%, 5.40%, 6.90% and 10.83% respectively, similarly after 48 hours it was found to be 62.01%, 67.51%, 80.98%, 8.10%, 15.47% and 21.38% respectively and at the end of 72 hours it was found to be 68.17%, 73.12%, 91.19%, 18.24%, 24.04% and 31.38% respectively.

Table: 3.3. Removal Efficiency using Banana-Agava Sisalana Fibre.

| Parameters | Initial | 1st day | Removal efficiency (%) | 2nd day | Removal efficiency (%) | 3rd day | Removal efficiency (%) |
|---|---|---|---|---|---|---|---|
| pH | 7.2 | 7.23 | - | 7.3 | - | 7.54 | - |
| Temperature (degree Celsius) | 23 | 23 | - | 23 | - | 23 | - |
| Turbidity (NTU) | 65.5 | 53.1 | 18.93 | 47.7 | 27.17 | 31.8 | 51.45 |
| Chloride(mg/L) | 136.2 | 88.5 | 35.02 | 53.4 | 60.79 | 22 | 83.84 |
| Sulphate(mg/L) | 6.4 | 1.3 | 79.68 | 0.9 | 89.93 | 0.3 | 94.84 |
| Total solids(mg/L) | 810 | 714 | 11 | 630 | 22.2 | 550 | 32.09 |
| COD (mg/L) | 480 | 340 | 29.16 | 262 | 45.41 | 223 | 53.54 |
| BOD (mg/L) | 410 | 309 | 24.63 | 256 | 37.56 | 170 | 50 |

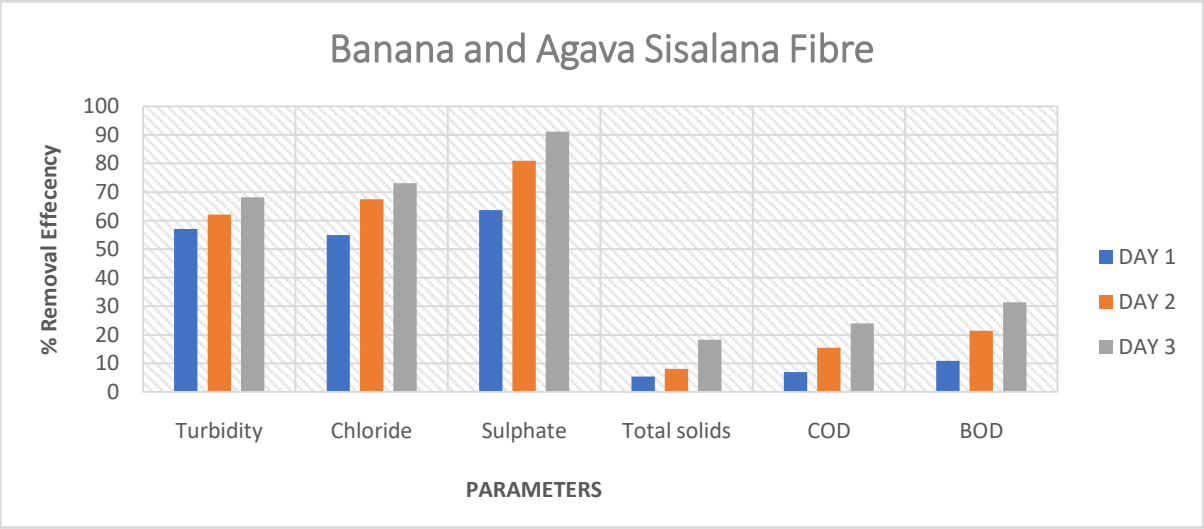


Fig: 3.3. Percentage removal of different Parameters using Banana-Agava Sisalana Fibre.

Tabel 3.3 and figure 3.3 represents the values of turbidity, chloride, sulphate, total solids, COD and BOD as 65.5, 136.2, 6.4, 810, 480 and 410 respectively. After 24 hours of contact time the removal efficiency was found to be 18.93%, 35.02%, 79.68%, 11%, 29.16% and 24.63% respectively, similarly after 48 hours it was found to be 27.17%, 60.79%, 89.93%, 22.2%, 45.41% and 37.56% respectively and at the end of 72 hours it was found to be 51.45%, 83.84%, 94.84%, 32.09%, 53.54% and 50% respectively.

## 4.Conclusions

Considerable reduction in BOD, COD, Total solids, turbidity, sulphate sand chlorides were achieved. The removal efficiency of BOD and COD by using Agava as filter media was found to be 15.81% and 56% respectively. The removal efficiency of BOD and COD by using Banana fiber as filter media was found to be 31.38% and 24.04% respectively. The removal efficiency for BOD and COD were found to be 50% and 53.54% respectively, when Banana and agava both the filter medias were combined. The operation trouble faced during the study was foul odour emission due to the early decomposition of the fibres.The treatment efficiency of Banana was found to be higher than that of Agava fibres.The treated wastewater can be used for gardening and other domestic purposes like washing and cleaning purposes.The spent fibers were rich in nutrient values and can be used as an organic manure.

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