LOW COST AND EFFECTIVE TREATMENT TECHNOLOGY FOR GREYWATER USING NATURAL MATERIALS

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ABSTRACT

Greywater is defined as the domestic wastewater except the waste water generated from toilet sources. As the population increases day by day, the demand of water for various activities also increases directly. Greywater generally generated in a large volume and with high biodegrability, low levels of contaminating pathogens. Hence there is a need of time to look into the different alternative aspects of greywater treatment and its reuse.

In this research paper an attempt made to develop a low cost as well as effective treatment technology for greywater. In this various natural materials like coconut husk, drumstick and charcoal is used in sand filters. These treatment technologies can be used at household level and treated greywater can be used for different non drinking purpose.

Key words: - Greywater, Treatment, Effective, Naturals and Materials

1. INTRODUCTION

Greywater is defined as the wastewater that mostly generates from bathrooms, showers, hand wash basins, washing machines, dish washer, kitchen sinks excluding the wastewater from toilets. Greywater also known as sullage. It generally generates as high volume. The level of pollution is lower in greywater compared to the house hold sewage i.e. the wastewater generating from latrines. The greywater is easier to treat and recycle. The treated greywater can be used for gardening, washing, flushing of toilets.

The various treatment processes which can be used for greywater treatment are classified into biological systems like construction of wetlands, membrane bioreactors. Mechanical systems like sand filtration.

The main purpose of to develop effective and low cost treatment process for greywater is to:

- Reduce the stress on extraction of freshwater for non productive work.
- Less impact on the existing facility of the treatment plant.
- Help for recharge of groundwater level.
- Reclamation of nutrients in soil.
- Reduction of energy consumption and chemical utilization in treatment plant.

In this research we designed slow sand filter along with the various natural materials like coconut husk, drum stick and charcoal to increase the efficiency of removal of impurities present in greywater.

2. CHARACTERISTICS OF COLLECTED GREYWATER

Greywater was collected from outlet of satellite plaza society, one of the residential society situated at Vastrapur area of Ahmedabad districts in Gujarat. Samples were collected during the morning peak hour. Total 20 samples were collected at the interval of each 2 days. Various physiochemical parameters were analyzed at laboratory. The samples which are collected are of mixed in nature. Below table is the average characteristic of 20 greywater collected samples.

Table 1: Characteristics of Greywater sample

Sr. No.	Parameters	Values
1	pH	6.9
2	Temperature	28.3 ° C
3	Turbidity	320 NTU
4	Electrical conductivity	4.3 ms
5	Total Hardness	720 mg/L
6	Total suspended solid	830 mg/L
7	Total solids	2800 mg/L
8	Acidity	180 mg/L
9	Alkalinity	268 mg/L
10	COD	480 mg/L
11	Total coliform (MPN index / 100ml)	= 3200

3. EXPERIMENTAL SETUP

Treatment of greywater is done by using low cost technique. A plastic container of length 46cm was chosen. The whole container is divided into three layers each of 12cm (12 × 3 = 36) with 10cm for water reservoir i.e. 6cm for sample greywater and 4cm for freeboard (36 + 6 + 4 = 46).

The materials which are used for setup design are gravels of 1/8 to 4/8 inches with larger size at bottom and smaller size at top, sand of size of 0.5mm - 1.25mm particle size, wood coal of 500 - 800 microns size and coconut mesh. All the materials were cleaned properly with tap water and sun dried. Three different experimental setups were arranged in different layers. Following is the table.

Table 2 : Arrangement of experimental setups

Layers	Setup-1	Setup-2	Setup-3
1	Gravel	Gravel	Gravel
2	Sand	Coal	Sand
3	Coal	Coconut mesh	Sand
4	Coconut mesh	Sand	--------

4. RESULTS AND DISCUSSION

The pH of greywater sample varies from 6.10 to 8.3. The variation on pH shows that the living habits of the people, types of products used. After the filtration, on set up 1 pH comes to neutral range i.e., 6.10 to 7.3 (chart 1). The same type of results shown for set up 2 and 3. This change in the pH range is due to adsorption and ion-exchange reaction between the greywater and sand layer.

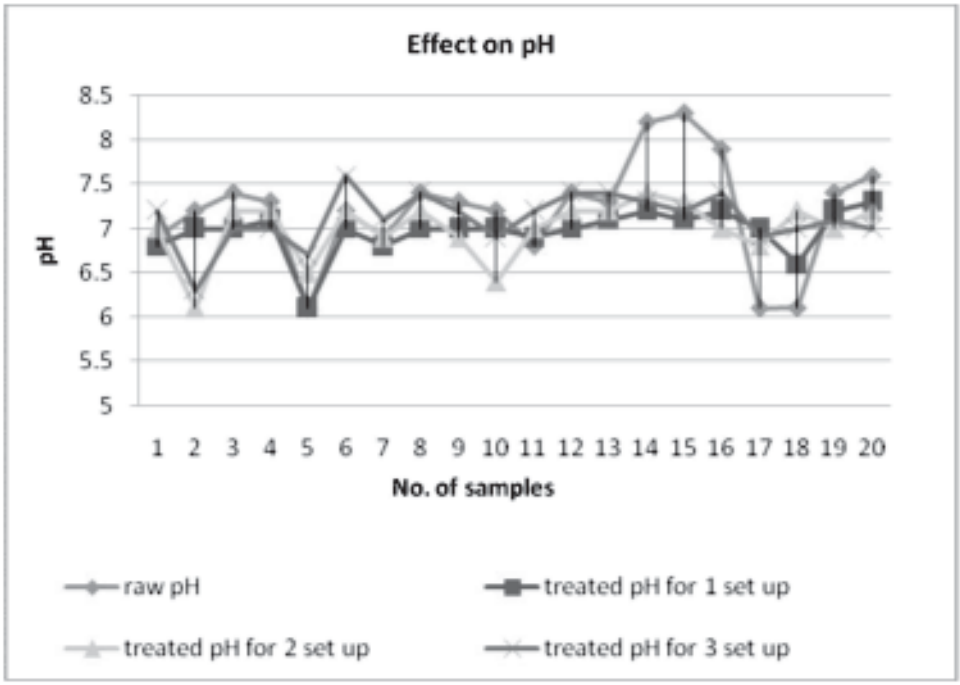

Chart 1: Effect on pH of different set up

Total solids amount in different greywater varies from 2600 mg/L. There is a drastic reduction in the amount of total solids in the entire three set ups. The physiochemical characteristics of sand and coal are responsible for the reduction of total solids. Set up 1 removes around 80 % of total solids (chart 2). The highest percentage of removal due to presence of coal at upper layer. The coals are in small size and large surface area act as a packing material. The contact time of greywater, coal and sand increases in set up 1, this helps to more removal of total solids. The coconut layer also acts as adsorbent materials which also help to reduce the total solid concentration.

The total solids removal for set up 2 is around 70% (chart 3). In set up 2 large sized sand at top layer, so the contact time between grey water and sand layer decreases.

For set up 3 sand layer is present while both coal as well as coconut mesh is absent. Hence the removal percentage less compared to other two set up i.e. around 60% (chart 4).

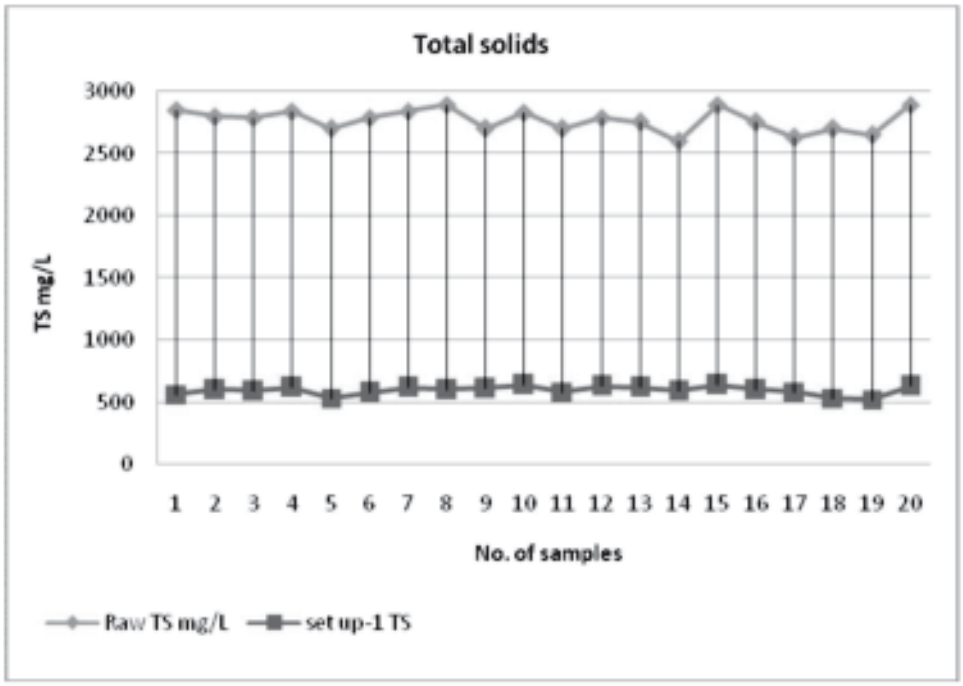

Chart 2: Effect on total solid of set up-1

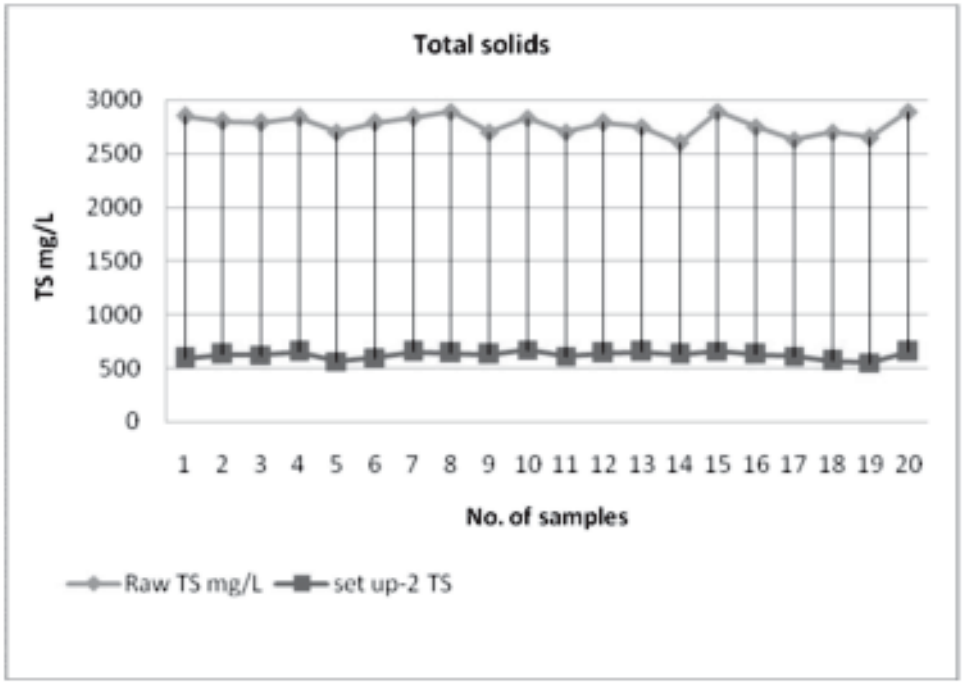

Chart 3: Effect on total solid of set up-2

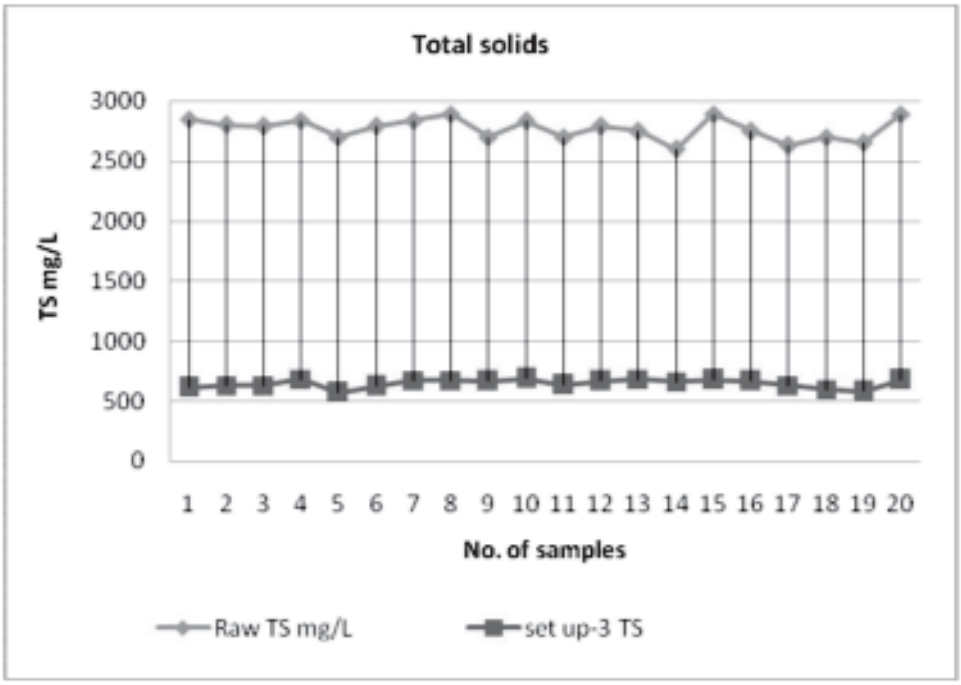

Chart 4: Effect on total solid of set up-3

Turbidity mainly due to the presence of suspended solids in the sampled greywater. Among all the three set up, set up 1 shows the maximum removal of turbidity (chart 5). The main reason behind the turbidity removal is adsorption and sedimentation by the adsorbent layer. On the sedimentation process the suspended particles attach to the process of sand layer.

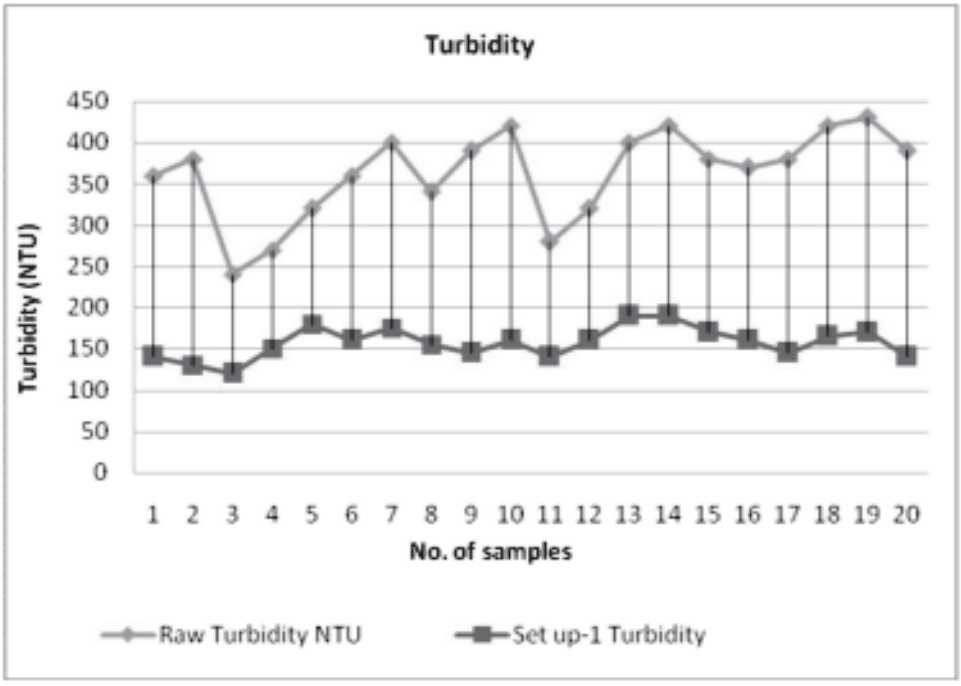

Chart 5: Effect on turbidity of set up-1

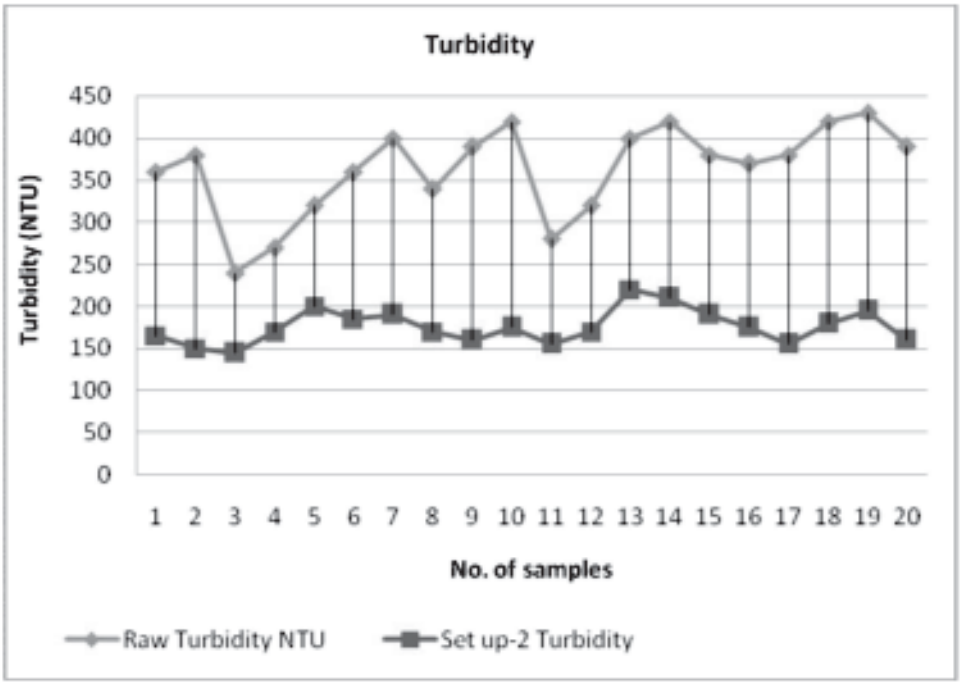

Chart 6: Effect on turbidity of set up-2

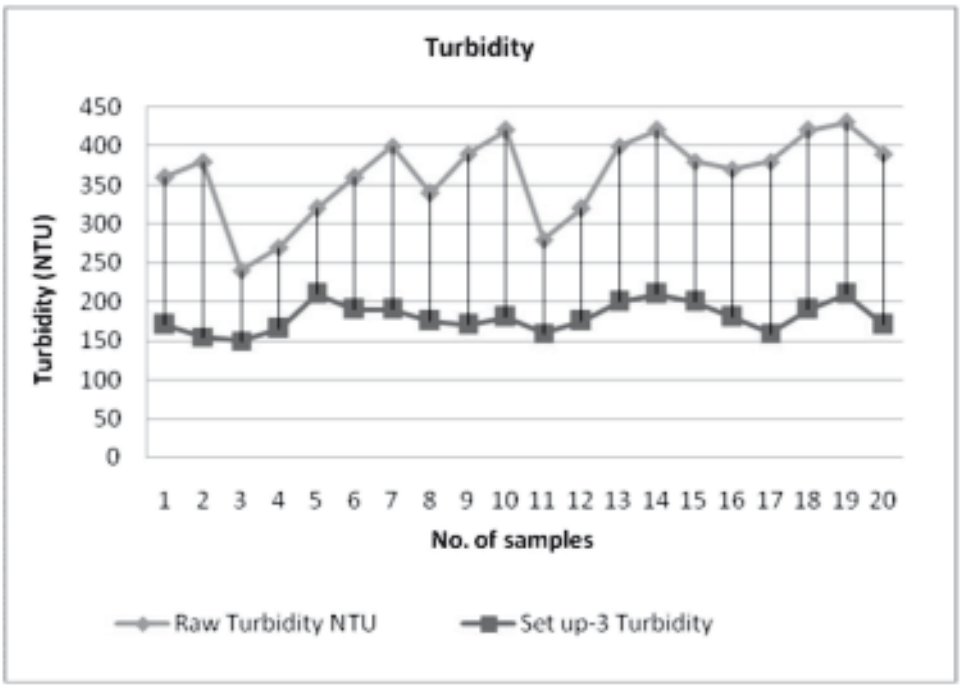

Chart 7: Effect on turbidity of set up-3

The maximum COD removal is in set up 1 with compare to set up 2 and 3. In set up 1 the removal is around 81% (chart 8). Where as in set up 2 and 3 the efficiency is 72% and 65% respectively (chart 9 & 10). The removal of COD is due to the sedimentation and filtration process of particulate forms. For set up 1 the highest COD removal is due to sufficient contact time and proper supply of O2.

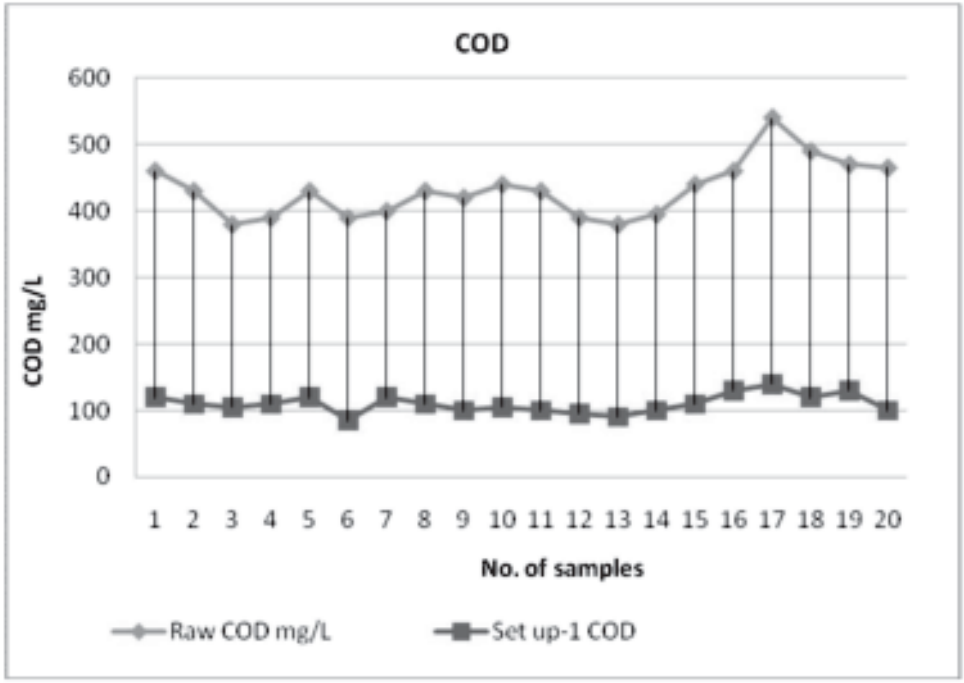

Chart 8: Effect on COD of set up-1

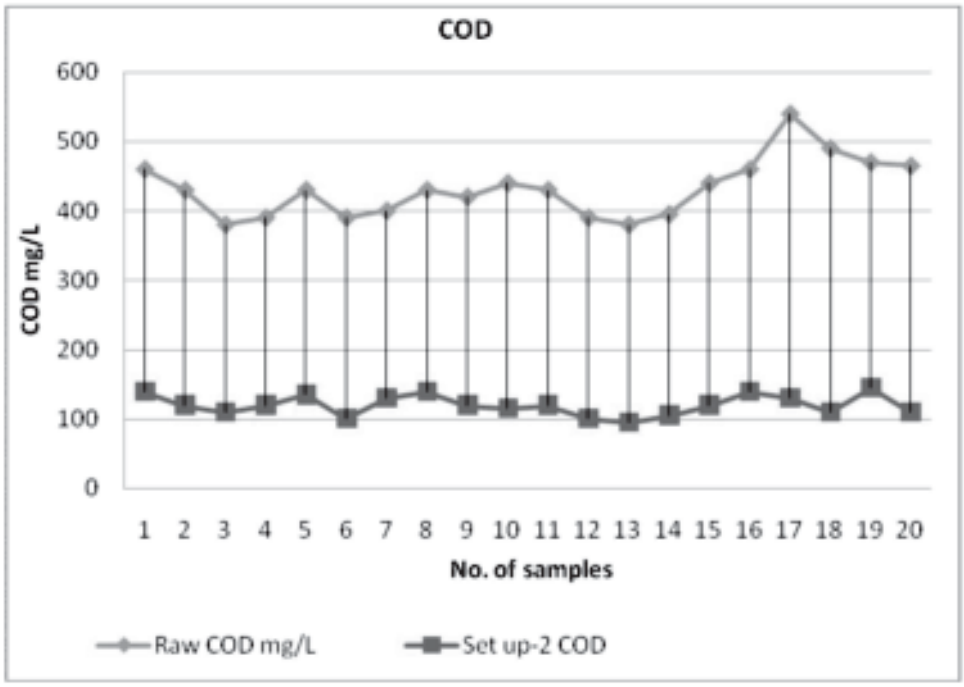

Chart 9: Effect on COD of set up-2

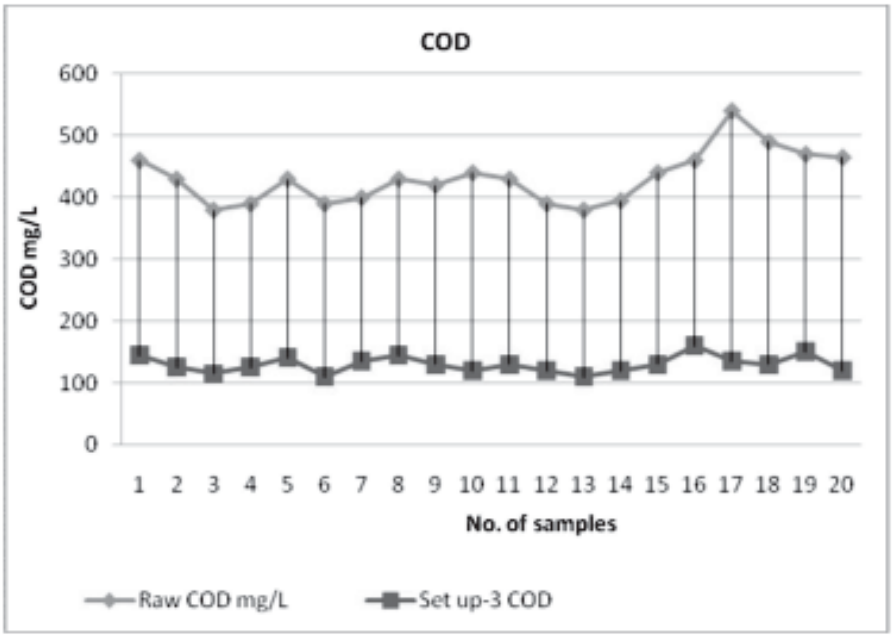

Chart 10: Effect on COD of set up-3

5. CONCLUSION

Greywater contains a large amount of total solids, organic matter, turbidity etc. From all the three experimental set up wood and coal is the most efficient natural adsorbent material for removal of COD, total solids and turbidity. Set up 1 shows the highest removal i.e. 80% of total solids, 80% COD removal. The turbidity removed from 420 NTU to 120 NTU i.e. 70% removal. The small and medium size sand and natural adsorbent plays an important role for the removal efficiency of a treatment process. The treated water can be reused for non potable uses like gardening, cleaning, flushing and irrigation purpose. The simple design, high removal efficiency and low cost can be help to implement this type of system for common use to treat the greywater.

5. REFERENCES

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