Biofiltration: A Sustainable Solution for Grey Water Treatment

Prof. N.R Gowri
Dept.of Civil Engineering
HKBKCE
Bengaluru,India
nrgowri@gmail.com

Khateeb SM Raqeeb
Dept. of Civil Engineering.
HKBKCE
Bengaluru,India
khatebraqeeb28@gmail.com

Mohammed Abdul Muizz
Dept. of Civil Engineering
HKBKCE
Bengaluru,India

Mohammed Quisar
Dept. of Civil Engineering
HKBKCE
Bengaluru, India

***Abstract*—: Freshwater is becoming more and more scarce due to population growth's increased demand. One strategy for alleviating the freshwater deficit is the reuse of greywater. Greywater may be hazardous to health if it is not properly treated, so it must be thoroughly cleaned and compliant before being utilized again for any specific purpose. Therefore, to treat and reuse greywater, a more inventive and trustworthy proven treatment procedure is needed. Wastewater management that is sustainable is offered by the biofiltration method of treating greywater. In this study, we treated greywater using waste materials as filter media, including eggshells, pebbles, and coconut shell woodchip. In this study, we treated greywater using waste materials as filter media, including eggshells, pebbles, and coconut shell woodchip. In this study, we treated greywater using waste materials as filter media, including eggshells, pebbles, and coconut shell woodchip. Using the waste material, the findings revealed that reduction in Turbidity, TDS, BOD and COD was achieved successfully. Therefore, the biofilter that has been created can effectively treat greywater.**

Keywords—Freshwater, Greywater, Biofiltration, Waste materials

I. INTRODUCTION

The increasing demands on freshwater resources around the world necessitate a paradigm shift in water management practices in order to ensure the sustainability and availability of clean water for current and future generations. A growing number of individuals' urbanisation, industrialization, intensification of agriculture, and climate change are contributing to the worsening of freshwater issues, such as pollution, water scarcity, and the degradation of aquatic ecosystems. Given this, reusing greywater stands out as a viable tactic to deal with these issues.

Greywater, the wastewater from domestic activities other than flushing the toilet, is a substantial but frequently disregarded part of domestic sewage. Improper handling and disposal of it can lead to environmental issues such as soil and water contamination, freshwater resource depletion, and even health risks. Conventional techniques for treating greywater, like filtration, chemical disinfection, and sedimentation, can be expensive to operate and may not be sufficient to handle the intricate makeup of greywater.

In recent years, there has been growing interest in exploring sustainable and environmentally friendly alternatives for greywater treatment [1].Among these alternatives; biofiltration has emerged as a promising solution. Biofiltration harnesses the natural processes of microbial degradation to remove organic contaminants and nutrients from greywater, resulting in treated water suitable for reuse in irrigation, toilet flushing, and other non-potable applications. Many studies have been carried out in the past to evaluate the recycling greywater using biofiltration and built wetlands [2].Biofiltration technique uses different kinds of filter media beds to get rid of different kinds of pollutants from greywater.[3,4,5] .This proves as one of the cost effective and economically viable solution to treat greywater.

Therefore, the current study focuses on developing biofilter units that uses waste materials as the filter media, such as egg shells, wood chips, and coconut shells for treating greywater

II METHODOLOGY

A. Experimental set up and Greywater collection

The filtration setup consisted of plastic bottles filled with filter material, such as sand, charcoal, pebbles, coconut shells, eggshells and wood chips. Material was stacked six centimeters high within each filter unit. The local market was the source of pebbles, charcoal, and sand. Woodchips were acquired from a local furniture manufacturing business. Coconut shells and eggshells was collected from our house(Fig. 1) depicts a schematic design of the suggested biofilter setup.Working model of the biofilter is shown in figure 2.

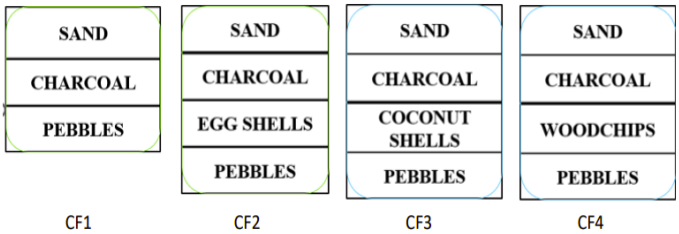

Fig.1 Configuration of the biofilter unit

Fig.2.Working model of the biofilter unit

B. Filtration test:

A sample of greywater was obtained from the kitchen sink and the washing machine, two distinct sources. Each filter unit received a total of 1 litre, which was then left to sit for 4 hours. Following that, physiochemical studies were performed on the sample collected. The same process was repeated for a week on alternate days. The following significant parameters were measured: pH, turbidity,TDS, BOD and COD.

III. RESULTS AND DISCUSSIONS

The various parameters such as pH, turbidity, TDS, BOD and COD of the untreated and treated wastewater were estimated.

A. Effect of pH

Greywater pH depends largely on the water supply's pH.The pH of the treated water samples was around the 6.5to 8.5, suggesting that it can be used for reuse after treatment

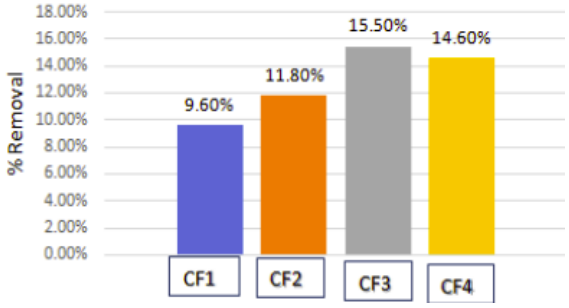

Fig. 3. pH of the water sample

B. Effect of Turbidity:

Turbidity is a measure of suspended solids, and itis vital for maintaining the effectiveness of the filtration technology. The percentage reduction in turbidity of various water samples (Fig 3) was found to be in the range of 15–60%. Maximum percentage removal of 87% turbidity was obtained for the CF1 followed by CF3 which showed 57% reduction in turbidity.

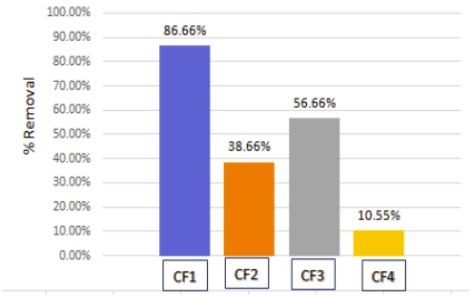

Fig 4. Turbidity of water sample

C. Effect of TDS:

Total Dissolved Solids (TDS) represent the combined content of all inorganic and organic substances contained in a liquid, which can significantly affect the treatment of greywater. As in the figure 4 the maximum removal efficiency is 97.05% for configuration 1.

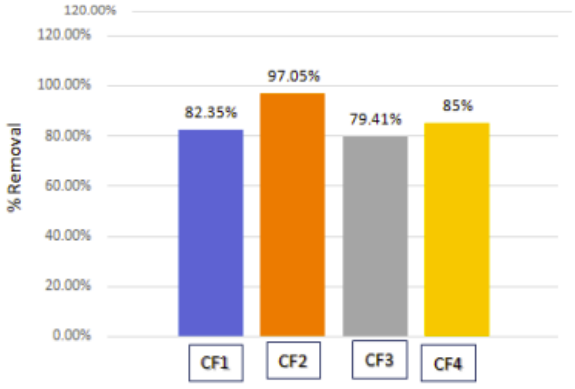

Fig 5. TDS of the water sample

D. Effects of BOD:

Biochemical Oxygen Demand (BOD) is a critical parameter in wastewater as it indicates the amount of organic matter present, which directly impacts the treatment process, particularly biofiltration systems technology. The percentage reduction in BOD of various water samples (Fig 5) was found to be in the range of 35-88%. Maximum 88% removal efficiency was obtained for CF4.

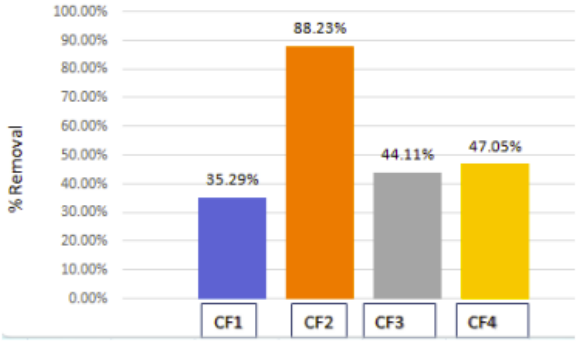

Fig 6. BOD graph of the water sample

E. Effects of COD:

Chemical Oxygen Demand (COD) is an important parameter in greywater treatment, representing the total amount of oxygen

required to oxidize both organic and inorganic matter in the water. The presence of high COD levels in greywater can significantly affect the treatment process; particularly in biofiltration systems.There was a reduction of almost 60% for CF4.

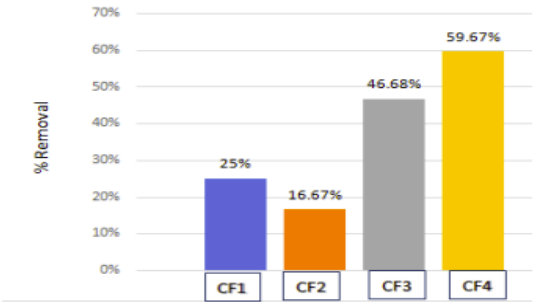

Fig 7. COD of the water sample

IV CONCLUSION

- The percentage of BOD reduction and TDS removal was as high as 88% and 97.05% showing suitable removal of biodegradable organic compounds and dissolved solids through this treatment process.
- 57% reduction in Turbidity was also achieved by using the waste material
- pH after treatment was obtained in neutral range.
- Based on the above investigation biofiltration using waste materials can be considered as promising alternative to the conventional methods available.
- This developed design is simple, eco-friendly and economically viable treatment method.

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