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# COMPARITAITIVE SCALE STUDIES ON COMMERTIAL GREY WATER THROUGH VERMIFILTRATION

**AMIT M. KHARWADE, SAMEER N. SHINDE, NITESH B. THIKARE**

Civil Engineering Dept., Priyadarshini Bhagwati College of Engg., Nagpur, Maharashtra, INDIA

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**Abstract:** Water is fast becoming one of the most limited resources available to us.. Greywater reuse is an attractive option through vermiculture biotechnology. Vermiculture biotechnology is an aspect of biotechnology involving the use of earthworm as versatile The reuse of grey water for non-potable water application is a potential solution for water deprived region world- wide .Therefore an attempt is made to reuse greywater, so as to reduce demand of fresh water. In present study, laboratory scale single stage filters were designed. Commercial grey water was passed through vermifilter and non-vermifilter. Domestic grey water was collected from the hotel and mess. Study is aimed to test the suitability of vermifilter and non-vermifilter for parameters viz. pH, efficiency removal of BOD and COD as well as Suspended solids in effluent grey water. From the experiment data it was found that percentage reduction in concentration of BOD and COD in vermifilter was more efficient than non-vermifilter. In vermifilter suspended solid are trapped on the top of the vermifilter and proceed by earthworm and fed to the soil microbes immobilized in the vermifilter. pH was changed from acidic to neutral by earthworm in vermifilter while pH remain same in effluent as in influent in non-vermifilter.

**Keywords**: Earthworm, *Eudrilus eugeniae*, Vermiculture, Vermifilter, Non-Vermifilter, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD).

**Corresponding Author: MR. AMIT M. KHARWADE**

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## INTRODUCTION

Water is becoming limited resource in the world. In India alone the International Water Management Institute (IWMI) predicts that by 2025, one person in three will live in conditions of absolute water scarcity (IWMI, 2003). Domestic water recycling is an attractive option. The reuse of grey water for non-potable water application is a potential solution for water deprived region world-wide.

### What is Gray Water?

Greywater is commonly defined as wastewater generated from bathroom, laundry and kitchen. Due to rapid industrialization and development, there is an increased opportunity for greywater reuse in developing countries such as India.

### Need for Greywater Reuse

Reuse of greywater serves two purposes, reduces fresh water requirement and sewage generation. In water scarce environments, Wastewater reuse and reclamation are often considered as a viable option for increased water resources availability. In water scarce developing countries, greywater reuse in schools, hospitals and government institutions is proving to be an essential alternate water resource to fresh ground, surface or rainwater supplies.

### Vermifilter and non-vermifilter

It is an aerobic treatment for greywater reuse. In this we used filtration technique called vermifiltration .Vermifiltration is emerging out low cast sustainable technology for liquid waste treatment. Vermifilter means filter with earthworm, involving the use of earthworm as versatile nature bioreactor for effective recycling of nontoxic organic solid and liquid waste. Earthworm can effectively employed to maximize the growth of aerobic Bactria for waste processing. This can be achieved by providing proper living condition and feeding them organic waste. This technique does not require expensive laboratories of sophisticated equipment. Non-vermifilter means filter without earthworm used for comparison of quality of grey water effluent.

### Objectives

The objective of present study is to compare the vermifilter and non-vermifilter for parameters viz. pH and efficiency removal of BOD and COD as well as Suspended solids in effluent of domestic grey water.

**MATERIALS AND METHODS:**

**Experimental setup for vermifilter**

The study was carried out in vermifilter kit containing gravel with the layer of black cotton soil on top. This forms the vermifilter bed, as shown in figure 1.It has provision to collect filtered water at the bottom in a collection chamber which opens out through a pipe fitted with tap. For vermifilter black cotton soil having pH 7 were collected from Laxmi Nagar area, Nagpur and earthworm surface feeder species (*Eudrilus eugenia*) were procured from Dr. Devendra Kumar Campus, Center of Science for Village, Duttpur, Wardha.The bottommost layer is made of gravel aggregate of size 20mm and it fills up to the depth of 40mm. Above this lies the aggregate of 10mm size filling up to depth of 30mm.On the top of 10mm aggregate, sand passing through 2.36mm I.S Sieves were filled up to depth of another 30mm.The topmost layer of soil mixed with cow dung in 1:3 proportion were placed at the top of sand up to depth of 120mm in which the earthworms are released.

**Experimental setup for non- vermifilter**

A non-vermifilter kit (exact replica of vermifilter kit but devoid of earthworm) was also organized for reference and comparison as shown in figure 2. Soil and aggregate in vermifilter kit also help in cleaning of greywater by absorbing the impurities. They provide ideal for colonization by decomposer microbes which work to reduce BOD, COD and Suspended solid from greywater.

**Role of earthworm in vermifilter**

In vermifilter process earthworm removed BOD, COD, and Suspended solid from grey water obtain from different collection point. Earthworms remove BOD, COD, and Suspended solid by general mechanism of 'feeding' and 'biodegradation' of organic wastes. Earthworm converts biodegradable organic matter into vermicast which is rich in nutrient.

**Experimental method used in vermifilter and non-vermifilter.**

4 liter of greywater was kept in calibrated 8 liter capacity plastic drum. These drum were kept on an elevated platform just near the vermifilter. The drum had tap at the bottom to which an irrigation system was attached .The greywater distribution system consist of simple 0.5 inch flexible rubber pipe with holes for tricking water that allowed uniform distribution of greywater on soil surface. Greywater from drum flowed through the perforated flexible rubber pipe by gravity. The greywater percolated through various layers in the vermifiler bed passing through

the soil layer inhabited by earthworms, the sand layer and the gravels and at the end was collected in a chamber at the bottom of the kit. Same day this treated water from both kits were collected and analyzed for BOD, COD , Suspended solid and pH.

**Sources of samples**

Commercial grey water was collected from the hotel shruti , Aath Rasta Square, Laxmi Nagar, Nagpur and from boys mess mate square, Nagpur ..

**Analytical methods used in laboratory study**

Analysis of greywater was carried out in Environmental lab of Civil Engineering Department, Priyadarshini Bhagwati Collage of Engineering, Nagpur. It was done to assess the BOD, COD, Suspended Solid, pH value of the influent and effluent grey water obtained from vermifilter and non-vermifilter. Lab test are performing as per IS 3025 (PART44):1993.

**RESULTS AND DISCUSSION:**

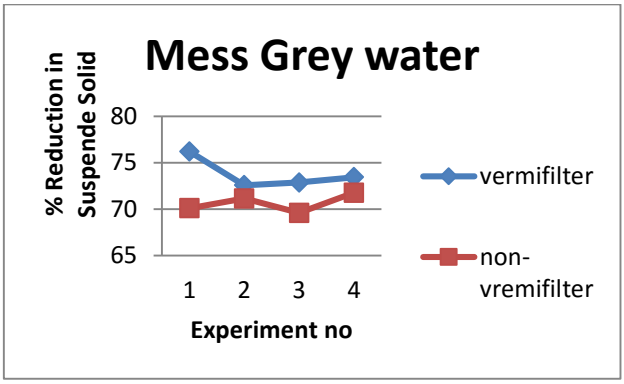
1. 


**Figure 3% Reduction in Suspended solid of mess greywater with vermifilter and non-vermifilter.**

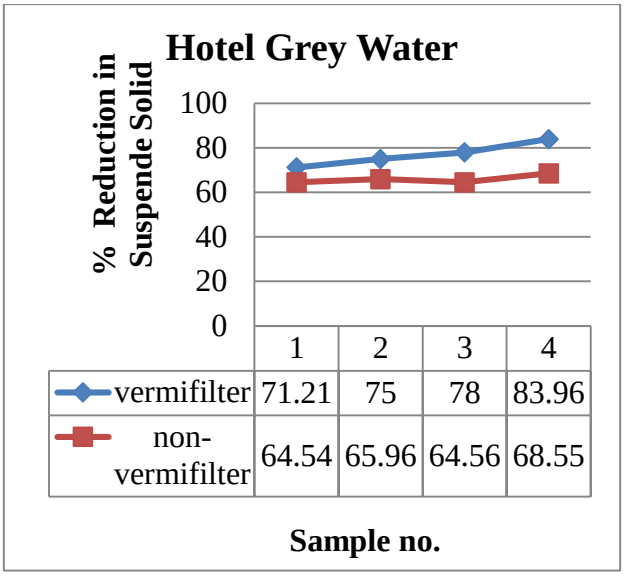



**Figure 4% Reduction in suspended solid of hotel greywater with vermifilter and non-vermifilter.**

It can be seen from figure 5 and 6 that the percentage of reduction in concentration of BOD in vermifilter ranges from 82 to 93 % while in non-vermifilter it was found to be 74 to 85 % at 2-3hr of detention time. The earthworm degrades the wastewater organic by 'enzymatic action' (which work as biological bringing the pace and rapidity in biochemical reaction) and that is the reason for BOD removal in vermifilter.

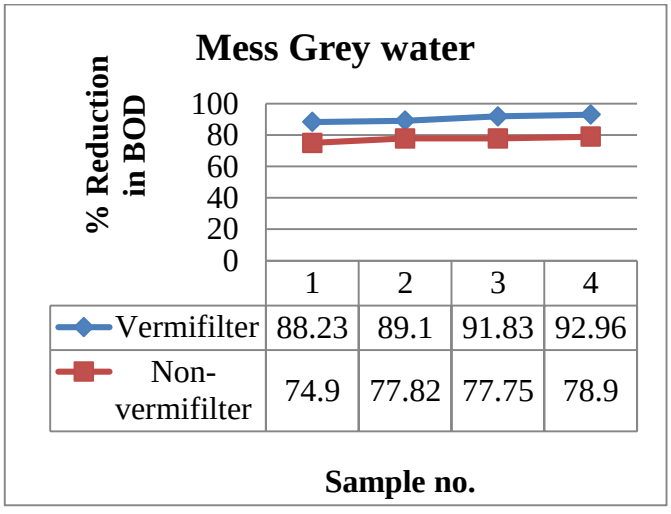



**Figure 5% Reduction in BOD of mess greywater with vermifilter and non-vermifilter.**

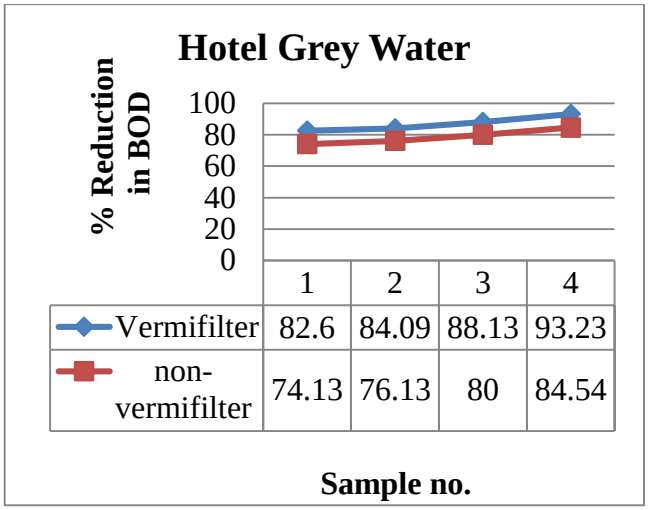



**Figure 6% Reduction in BOD of hotel greywater with vermifilter and non-vermifilter.**

It can be seen from figure 8 and 7 that percentage of reduction in concentration of COD in vermifilter ranges from 80 to 90%. COD reduction was greatly affected by detention time, higher the detention time lower will be COD. Earthworms secrete the enzyme that helps in the degradation of several other chemical which cannot be decomposed by microbes while in non-vermifilter, it was found to be 62 to 75 % .This may due to increase the formation of bio-films of decomposer microbes in geological system(gravels).

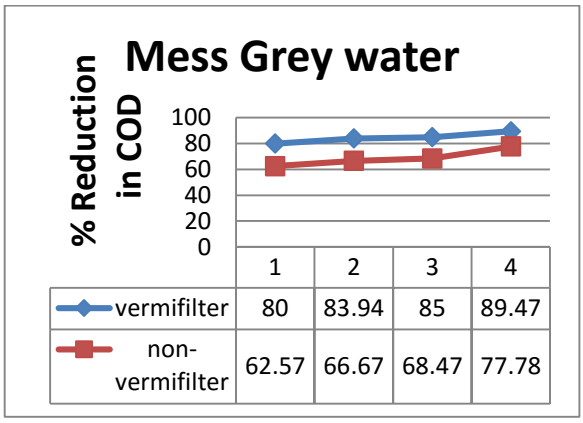



**Figure 7% Reduction in COD of MESS greywater with vermifilter and non-vermifilter.**

The percentage reduction in concentration of Suspended Solid It can be seen from figure 3and 4 in vermifilter ranges from 70 to 80% while in non-vermifilter it was found to be 60 to 70% at 2-3hr of detention time. Suspended solids from greywater are obtained and it is not much affected by detention time.

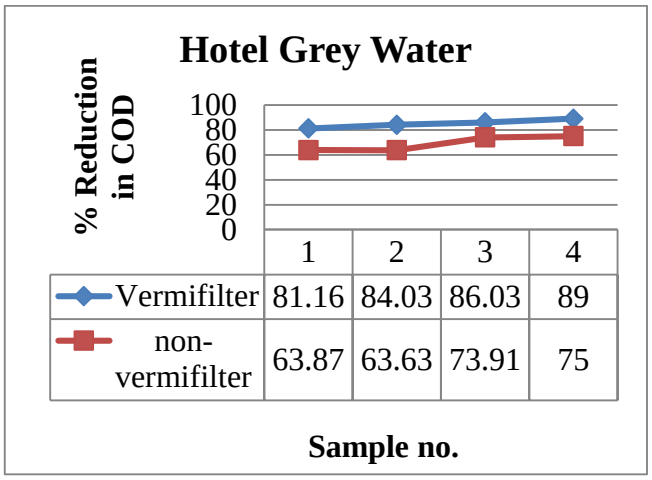



**Figure 7% Reduction in COD of HOTEL greywater with vermifilter and non-vermifilter**

In non-vermifilter removal of suspended solid from liquid waste by geological and microbial system.

**Table.1 Variation in pH For Mess graywater**

| Sr.no | Influent gray water pH | Effluent gray water pH | |
|---|---|---|---|
| | | With worms | Without worms |
| 1 | 6.6 | 7.4 | 6.7 |
| 2 | 7.1 | 7.5 | 7.3 |
| 3 | 7.3 | 7.7 | 6.9 |
| 4 | 6.5 | 7.2 | 6.4 |
| % Avg= | | 7.45 | 6.82 |

This solid accumulated over time as sludge and chock the system. In vermifilter these solids are constantly eaten up by the earthworms and do not allow any sludge to be formed and avoid chocking. Table 1 and 2 indicates that pH was neutralized by earthworm in vermifilter while pH remain same in effluent as in influent in non-vermifilter

**Table.2 Variation in pH For hotel**

| Sr.no | Influent gray water pH | Effluent gray water pH | |
|---|---|---|---|
| | | With worms | Without worms |
| 1 | 5.5 | 6.8 | 5.9 |
| 2 | 6.4 | 6.7 | 6.5 |
| 3 | 5.7 | 6.6 | 5.9 |
| 4 | 6.5 | 7.4 | 6.8 |
| % Avg= | | 6.87 | 6.27 |

**CONCLUSION:**

From the experimental data it was found that for the commercial greay water treatment vermifilter is more efficient than non-vermifilter in efficiency of removal of BOD,COD as well as Suspended solids.

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