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DESIGN AND TREATABILITY STUDIES OF GREYWATER

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Abstract - *This paper presents the design of laboratory scale grey water treatment system, which is restricted to four stages of physical operations. The continuous flow-based constructed bio-bed filter for grey water treatment is a technique for reusing the domestic grey water. The system has been found as more effective for treating the Physico-chemical parameters such as pH, electrical conductivity, TSS, TDS, BOD, COD. The results reported the removal efficiency in the biological oxygen demand (86.2%), chemical oxygen demand (81.1%). Consequently, this biofiltration method is natural, simple, and low cost-effective treatment.*

***Key Words*: Grey water, biofiltration, Recycling.**

1. INTRODUCTION

Grey water can be defined as the wastewater generated from the baths, showers, hand basins, washing machines, laundries and kitchen sinks. The main objectives of the biofiltration greywater treatment system are to provide a better way for greywater disposal, issues of greywater treatment odors around the treatment plants[26]. The present study is focuses on the theoretical and modelling aspects of developed bio-filter and to investigate the performance of the bio-filter in removing organics, nutrients from grey water.

1.1 Treatment of Greywater

Greywater treatment includes physical, chemical and biological processes, and followed by pre-treatment and disinfection, respectively. Coarse sand, soil and membrane filtrations are the commonly applied physical processes. Greywater treatment is essentially required to reduce the organic load, nutrients and pathogenic microorganisms. Untreated greywater discharged in to any ecosystem is unsafe and hence proper treatment is required for safe discharge of greywater.

2. METHODOLOGY

The easily available and natural materials were used as filter media in the laboratory scale biofiltration unit such as sand, gravel,activated carbon and plants. The samples were collected from storing tank at every 10th day for the analysis. These samples were analysed by standard method at laboratory. The parameter such as pH, EC, Total suspended solids (TSS), Total dissolved solids (TDS), Chemical oxygen demand (COD) and Biochemical oxygen demand (BOD) were determined of raw and treated water sample for the performance study of the grey water treatment system.

2.1 Collection of Greywater Sample

Grey water sample was collected from home kitchen, wash basin, washing machine. It was stored in tank of 30 litre capacity. Containers are filled with water, transported to the laboratory investigation of grey water before treatment and refrigerated. However, maximum effort was taken to get the samples analysed within 24 hrs of the storage.

2.2 Designing of Bio-bed Filter

The plastic containers were used for the construction of four same rectangular bio-beds with proper dimensions [35 cm (l) x 14 cm (b) x 19 cm (h)]. Four experimental setups were designed for grey water treatment and their structures are given as follows. Fig.2.1 shows bio filtration experimental setup. The first bio-ded contains gravel and sand. coir waste and sand were filled one above the other in the bio-bed horizontally in second bio-bed. Gravel, soft clay, red soil and humus were filled in third bio-bed .The filter bed four was filled charcoal and sand.

2.3 Determination of Filtration Performance

The treated grey water samples were collected in a well cleaned container and stored in a tank. The grey water samples from tank were collected at regular intervals and physico-chemical parameters were determined for raw and treated grey water samples. The parameters such as pH, EC, TDS, TSS, BOD, and COD were measured in the laboratory using the standard procedure.

3. RESULTS AND DISCUSSION

The effectiveness of the developed bio-bed filters determined by carried out physio-chemical analysis on the filter-treated water samples at regular intervals of ten days. In the physico-chemical analysis, three different greywater samples were used.

Fig -1: Bio-bed filter setup

Table -1: Water test results after filtration

PARAMETER	UNITS	DAY 10	DAY 20	DAY 30
pH	-	8.02	7.92	7.8
EC	µS/m	950	630	540
TDS	mg/L	870	756	515
TSS	mg/L	215	185	135
BOD	mg/L	97	68	35
COD	mg/L	285	174	87.2

3.1 Calculation of Removal Efficiency

The removal efficiency of the following physico-chemical parameters is analyzed and the values are tabulated below. Sample II showing the maximum removal efficiency of various parameters. Removal efficiency was found to be 63.7 % for TDS 51.7 % for TSS and in bio-bed filter. Also, the removal efficiency for BOD and COD were found to be 86.2 % and 81.1 %.

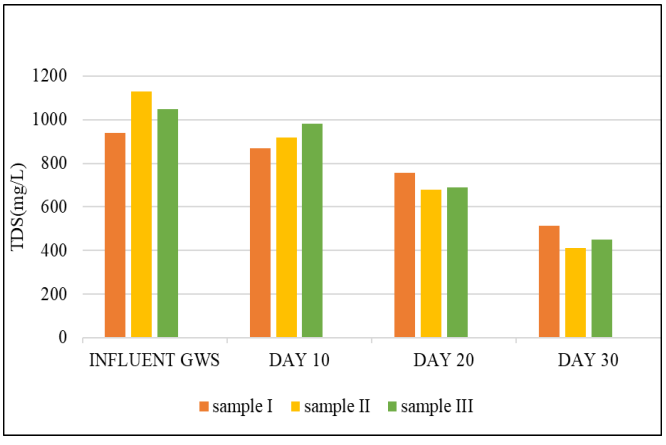

Chart -1: Variation in TDS value

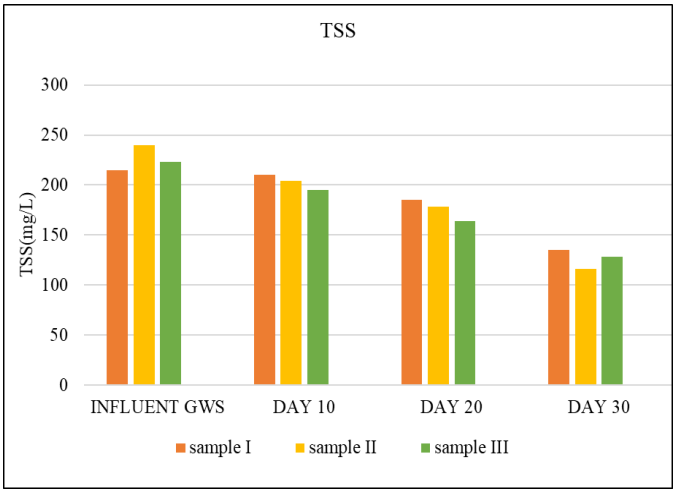

Chart -2: Variation in TSS value

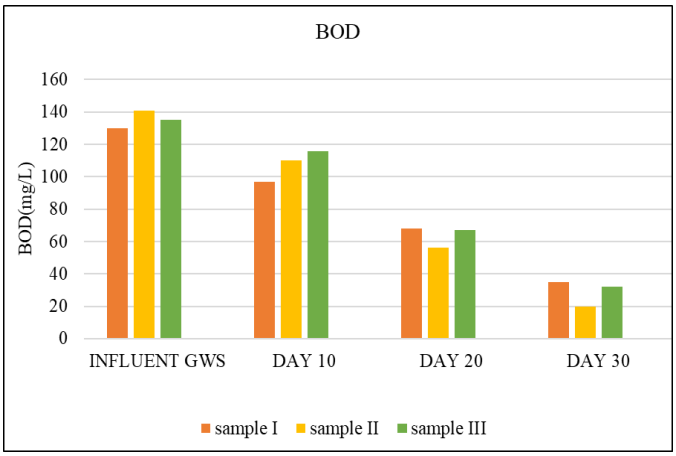

Chart -3: Variation in BOD value

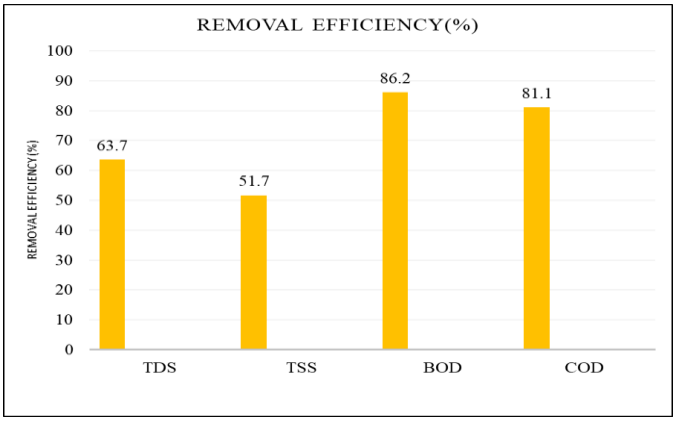

Chart -4: Variation in removal efficiency

4. CONCLUSIONS

The designed low-cost technology for grey water treatment was found to produce grey water characterized by high potential for BOD, COD, TSS and TDS. The materials used in this system such as sand, gravel, clay, red soil, humus, coir

waste, charcoal used in the grey water treatment were found to be effective purifiers. Hence, this method is environment friendly, without chemical operation, less time consuming, low energy demand, less operating and maintenance cost, highly effective purification, and less area occupied. Treated grey water becomes reusable after treatment and can be used for irrigating the garden or flushing the toilet.

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