Grey Water Filter Module for Household

A Small Scale Domestic Waste Water Filtration Technology

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Abstract—The work is related with grey water filtration. The objective behind this project is to develop a practice of grey water filtration and reuse of it for different purposes in house work only. This project will help to reduce the wastage & generation of grey water respectively. Instead of wasting this grey water into sewers and increasing load on municipal sewer (if they are in existence) and in STP and also were there are less source of drinking water (like river or streams) in the area (urban, rural) this filter module which is merely made of easy available natural filter material (like sand, red brick pieces, jute mesh, etc) and from economical point of view, it is a re-step towards sustainable development.

Keywords—STP (Sewage treatment Plant), grey water, module; red-brick pieces

I. INTRODUCTION

This article main objective is to develop a practice and setup a trend for reusing the grey water by filtering it in and use it for day to day life work. As in developing country like India, today also India faces water crises & drought. Urbanization is at the peak due to increasing human population and as the population increases demand water is also increases. About 42% of India’s land area is facing drought, with 6% exceptionally dry–four times the spatial extent of drought last year, according to data for the week ending March 26, 2019, from the Drought Early Warning System (DEWS), a real-time drought monitoring platform. Andhra Pradesh, Bihar, Gujarat, Jharkhand, Karnataka, Maharashtra, parts of the North-East, Rajasthan, Tamil Nadu and Telangana are the worst hit. These states are home to 500 million people, almost 40% of the country’s population [1]. As freshwater is fast becoming a scarce resource, it’s high time India takes grey water recycle and reuse seriously. In order to meet the growing water demand, two sustainable options are available – desalination and wastewater recycle and reuse. As wastewater from houses categorize in black water (generated from toilets) not easily treatable due to bacteria, pathogen contain & greywater (generated from sinks, showers, washing machines and bathtubs) is treatable as it contains salts & some percentage of heavy metals due to chemicals.

A. Understanding Greywater

Greywater is generated from sinks, showers, washing machines and bathtubs. About 133 liter (35 gallon) water is generated per person per day. The content of the greywater varies by the source (means kitchen, laundry or bathroom) and the country. The amount of organic material is much lower compare to blackwater from toilets but the amount of heavy metals are about the same. Almost all the inorganic materials are manmade & synthetic substances which include soaps, bleaches, detergents, shampoo, etc.

B. Characteristics of Greywater

The quality of greywater depends on the source from which it is drawn as well as the use to which this water is put, but there are general characteristics that apply to greywater (Carden et al. 2006). Greywater can be divided into two categories based on pollutant loads: high pollutant load and low pollutant load (Friedler 2004). According to Li (2009), greywater generated from household kitchens and those from the laundry are higher in organics and physical pollutants compared to bathroom and mixed greywater. Various factors, such as the number of residents in a household, age distribution, living standard, residents’ cultural habits and the quality of the water supplied to the household, may have an influence on the greywater characteristics and result in a wide variation in the quality of greywater generated from different households and from various sources within a household (Morel & Diener 2006).

II. METHODOLOGY

We have made a filter module consisting of layers of different filter media in a plastic module (container) as shown in figure (1). Module (container) is made of a simple plastic jar and is divided in to five compartments i.e. aggregate layer, sand layer, coal layer, resin layer and brick layer. Aggregate layer with depth of 8.70cm, Coal layer with depth of 6.70cm, Sand layer with depth of 27.30cm, Resin layer with depth of 1.30cm and Brick layer with depth of 1.90cm with a freeboard of 0.8 cm Then we are going to pour the water sample from top side of the jar and water will pass through filter different media in trickling action. There is outlet/ tap at bottom of jar from were filtered sample will be collected for laboratory analysis. The sample results will be then tally to the discharging of wastewater norms of Govt. approval authority.

A. Greywater Sampling

This study sampled and assessed the physical and chemical properties of greywater generated from the kitchen and wash basin sources (in mix form). Samples of greywater
source were collected from 01 house over a week. Grab samples were collected once a day. Samples were collected directly from the manual washing areas or wash basins while the kitchen water was collected from the kitchen sink.

**Fig. 1. Greywater Filter Module**

**B. Laboratory Analysis**

Physico-chemical analyses of the greywater collected were determined for the selected parameters:

**TABLE I. CHARACTERISTICS OF GREYWATER**

| Sr. No. | Characteristics of Grey Water (initial readings) | Parameters | Inlet Readings Subhead |
|---------|--------------------------------------------------|------------|------------------------|
| 1       | Physical Observation                             | Turbid     |                        |
| 2       | Odour                                            | Soapy     |                        |
| 3       | Turbidity (NTU)                                  | 204        |                        |
| 4       | PH-Value                                         | 8.90       |                        |
| 5       | Chlorides                                        | 160        |                        |
| 6       | Nitrates                                         | 20.11      |                        |
| 7       | Total Hardness                                   | 190        |                        |
| 8       | Alkalinity                                       | 50         |                        |
| 9       | Permanent Hardness                               | 140        |                        |
| 10      | Iron                                             | 0.11       |                        |
| 11      | Fluoride                                         | 0.85       |                        |
| 12      | Total Dissolved Solids                           | 470        |                        |

**TABLE II. CHARACTERISTICS OF SAMPLE GREYWATER**

| Sr. No. | Characteristics of Grey Water (final readings) | Parameters | Inlet Readings Subhead |
|---------|-------------------------------------------------|------------|------------------------|
| 1       | Physical Observation                             | Turbid     |                        |
| 2       | Odour                                            | Soapy     |                        |
| 3       | Turbidity (NTU)                                  | 79.90      |                        |
| 4       | PH-Value                                         | 8.60       |                        |

**III. RESULT AND DISCUSSION**

The results obtained from the physico-chemical characterization of greywater.

A. Turbidity Test

The results obtained from the tests for various parameters, are within permissible limit suggested by the MPCB. Thus by reusing the wastewater upto 64% of potable water can be saved daily resulting in the reduction of requirement of fresh water along with the reduction in sewage generation, minimizing its impact on the environment

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