

AN EXPERIMENTAL INVESTIGATION OF GRAY WATER TREATABILITY AND ITS CHARACTERISTICS ENHANCEMENT BY DIFFERENT MEDIUM

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ABSTARCT: *Gray water is generated during domestic activities through wash basins, bathrooms, kitchen sinks and automobile cleaning etc. They often contain objectionable parameters, such as solids, organic, nutrients, coli forms etc restricting the disposal into water bodies/its beneficial uses. Gray water plays an important role to be a resource which can be treated for application in a lot of areas which are water starved. Treated Gray water can be one of the reliable alternatives with the increased challenges of freshwater availability. It contains low organic matters which makes it to be used prior to the treated sewer water as its availability is throughout the year. It is cost feasible for recycling and also a good source of water for augmenting water supply. Various medium of a filter treatment method of Gray water are used in this research such as gravels, Course Sand, Charcoal for both Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) removal efficacy. A study was performed on Gray water generated from residences of Sector 26, Pratapnagar, Jaipur collected and physico-chemical-biological parameters analyzed from the same. The samples analyzed showed clearly high values of pollution parameters necessitating a simple treatment scheme to suit the reuse as a medium at gardens for irrigation purpose.*

Key Words: *Screen SSF Charcoal filter/Sand Filter/Wood Flour Filter*

I Introduction

World is facing a global challenge in the form of freshwater availability due to various reasons including global warming, using potable water insanely, increased urbanization and population, pollution etc. It is a fact that by the year 2050 about one fourth of the population around the world will face water shortage. ^[6]

Water shortage problems have become one of the most urgent problems of this era. Some researchers have suggested that water shortage will prior to oil shortage in the future and will become more serious. ^[4] Hence, The countries that are experiencing drought wholly or partly, have enhanced their awareness of water shortage hazards and policies affiliated with water utilization have been suggested and many strategies targeted at reducing water usage ^[5]

Gray water most easily offsets water demands for irrigation. In conjunction with rainwater harvesting, it can supply most, if not all, of the landscape irrigation needs of a domestic dwelling in a semiarid region. ^[10] Gray water can contain nutrients (e.g. phosphorus and nitrogen from detergents) that can benefit plant growth, reduce the need for fertilizer application, and result in more vigorous vegetation. Utilization of treated Gray water for irrigation of indoor plants, agricultural crops and turfs is reported. ^[1, 3] In addition to irrigation application; Gray water can also be used to offset potable water demands for use in toilet and urinal flushing. As previously mentioned, if adequately treated and disinfected, Gray water can also be used for a wide range of other non-potable water uses including bathing, showering, laundry, washing, etc.

It can be said evidentially that major source of Gray water is domestic activities. Major contribution involves washing vehicles, soaking/cleaning fruits, vegetables, cooking food, bathrooms etc; they have severe odors, excess solids, milky appearance, and intense color and often contain organic matter and pathogens etc. ^[8]

Environmentally they are unsafe as they affect light passage; create unsightly appearance in receiving water body, deplete oxygen levels and cause disease. Hence, characterization of Gray water and treatment technologies are necessary prior to its disposal into sewers or reuse for a designated purpose. ^[7, 9]

II Study Area and Sample Collection:

The present study is made to assess the Gray water produced at various domestic sources of Sector 26, Pratap Nagar, Jaipur and need for conceptualizing a treatment scheme. While carrying out the study, the work elements consider is:

- Characterization for various parameters and sources generating Gray water.
- The removal of objectionable parameters from Gray water.

Grey water water samples (2000 mL each) were collected manually at each site using acid-washed (10%, v/v HCl) into High-Density Polyethylene (HDPE) bottles to avoid any contamination from metal and non-metal ions.^[2] The pre-washed bottles were rinsed thrice with water samples on the site before sample collection. Gray water samples were collected from outlets of kitchen sinks from each source. Samples were transported to laboratory and were preserved at 4°C refrigeration prior to the analysis. Analysis was completed within 48 hrs of collection of samples.

III MATERIALS AND METHODOLOGY:

3.1 MATERIALS:

Different mediums were used to check the gray water treatability and its characteristics.

3.1.1 SAND

Sand is used as one of the filtering layer produces very high quality water free from pathogens, taste and odor without the need for chemical aids. Sand filters, apart from being used in water treatment plants, be used for water purification in singular households as they use materials which are available for most people. The grain size is around or less than 0.1mm in diameter, a sand filter removes all inorganic materials. The Size of Sand varies from 150 μ to 600 μ .

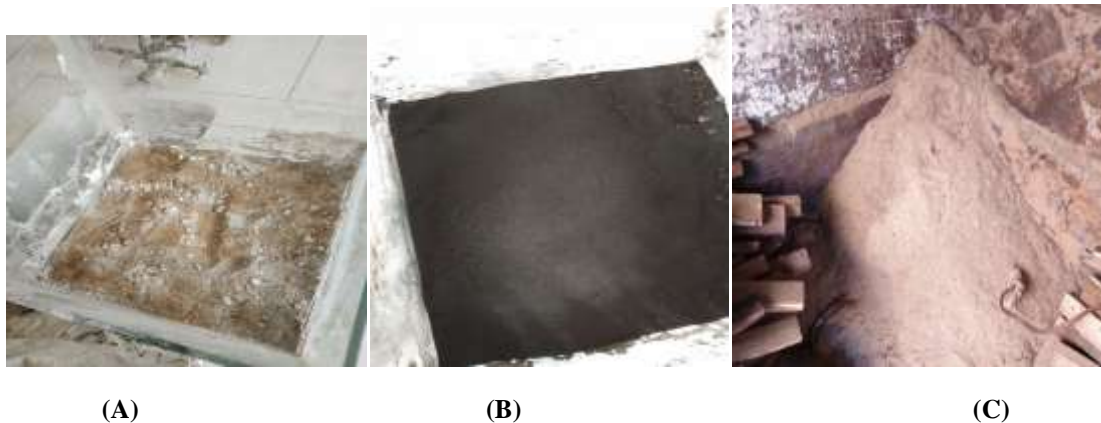


Figure 1 (A) Sand (B) Charcol (C) Wood Powder

3.1.2 CHARCOAL

Active charcoal carbon filters are most effective at removing chlorine, particles such as sediment, volatile organic compounds (VOCs), taste and odor from water. They are not effective at removing minerals, salts, and dissolved inorganic compounds (DOCs). When the water is allowed to flow through the filter at a slower rate, the contaminants are exposed to the filter media for a longer amount of time.

3.1.3 WOOD FLOUR

Wood flour is finely pulverized wood that has a consistency fairly equal to sand or sawdust, but can vary considerably, with particles ranging in dimensions from a fine powder to roughly that of a grain of rice.

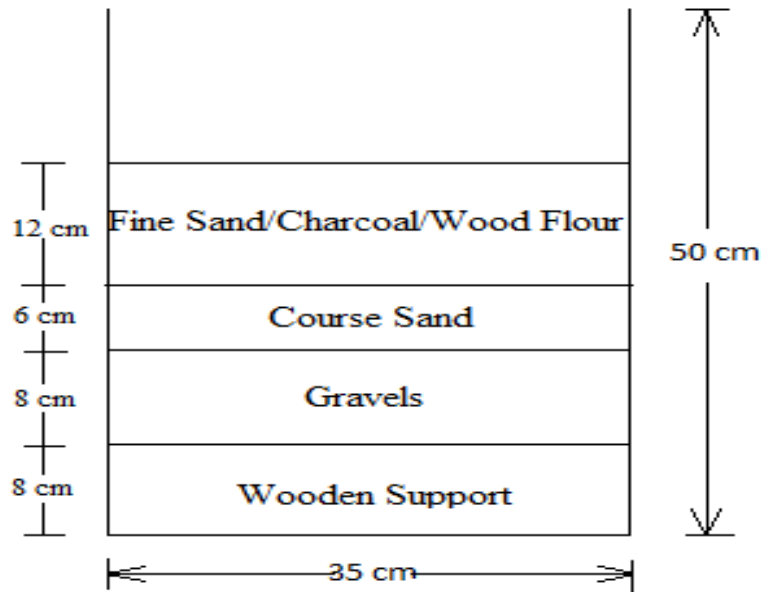


Figure 2 Experimental Set up

IV RESULTS & DISCUSSION

4.1 CHARACTERIZATION OF KITCHEN GRAY WATER

Kitchen Gray water analyzed of various physical parameters (pH, Total Solids, Dissolved, Satiabile and Suspended Solids, Turbidity), chemical parameters (Alkalinity, BOD and COD) values are represented from table 1. The variations of all the parameters in Gray water are shown in Table 1.

Parameters	Sample	Wood	Charcoal	Sand
pH	6.9	6.1	7.3	7.2
Turbidity	8.7	7.2	6.5	6.8
COD	130	140	120	135
BOD	49	35.2	28.4	38.25
TSS	608	450	320	412
TDS	2990	2535	2080	2250
Settle-able	560	430	210	210
TS	4158	3415	2610	2972
Alkanity	1000	800	640	730
Hardness	920	850	300	450

Table 1 Variations of the parameters in Gray water with different medium

4.3 SCHEME-CONCEPTUALIZATION OF KITCHEN GRAY WATER

The Gray water on an average has acidic pH, high suspended and dissolved solids, etc. To reduce the objectionable parameters, the following units may be adopted.

Unit	Purpose
Screen	To remove floating matter, coarse food particles(suspended solids)
Wood Flour filter	To remove physical drawbacks (Odor, Color et.)
Sand filter	To remove microorganisms, colloidal organic matter (BOD,COD,etc)
Charcoal	To remove dissolved materials (chlorides, organics etc.)
Disinfection	To destroy disease causing organisms

Table 2: Operations Proposed for Gray water



Figure 3: Sand Filter



Figure 4: Wood Flour Filter



Figure 5: Charcoal Filter

The treated Gray Water shows adequate levels of the Physico-Chemical-Biological properties. This shows clearly it as a reliable medium for gardening at the residences. Although the efficiencies of treatment schemes proposed above were not studied, it could be observed that the treatment system would work out in producing consistent effluent for reuse purpose. Gross et al (2007) reported on the removal of chemical contaminants indicator organisms, and pathogens from Gray water for further reuse.

V CONCLUSION

Based on the study characterization and treatability studies on Gray water at household, the following conclusions are drawn:

- Sometimes Gray water has more objectionable parameters. Hence, the sample needs adequate dilutions prior to the filtration.
- Gray water from kitchen is found full of pollutants in terms of BOD, solids, Hardness, alkalinity etc. Therefore, its treatment prior to disposal/use for designated purpose is considered.
- The treatment options for Gray water such as wood flour filter, sand filter and Charcoal filter may be feasible in order to make it fit for irrigation. However exact researches are yet to be worked out.
- Gray water is not the exact nomenclature for that waste water. It could be raw kitchen washes.

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