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Systematic Model Analysis of Residential Greywater Treatment

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ABSTRACT

Greywater is all wastewater generated in households or office buildings from streams without fecal contamination. Sources of greywater include, sinks, showers, baths, clothes washing machines or dish washers. The gap between water demand and available water supply is increasing day by day.The issue of greywater management is gaining more and more importance, especially in developing countries where improper wastewater management is one of most important causes for environmental pollution and fatal diseases.The main purpose of this paper is to present the current state, regarding greywater management. The paper presents typical greywater characteristics, the main treatment systems applied around the world and existing regulations for greywater treatment and reuse.

Through critical analysis of data from existing greywater recycling applications this paper presents the simple technologies, biological and extensive schemes achieved good general treatment of greywater with a particularly good removal of the impurities.Finally, the study suggests the possible greywater recycling scheme for reuse of Greywater.

KEYWORDS: Greywater Treatment, Sources, Treatment, Reuse.

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INTRODUCTION

Infrastructure monitoring has been an attractive subject for researchers in recent years. Advances in electronics and decreases in the cost of sensors and electrical components have made smart infrastructures a reality. Pipeline systems are responsible for transporting vital materials such as water, oil and gas. Currently, pipelines are only monitored at key points, which can be spaced several kilometers apart. A system with a higher spatial resolution would provide operators with a better understanding of their network.

Plumbing system is used for water supply in building .It supplies water to kitchen, toilet outlets via distribution system of pipes. Drainage system is used to get rid of human wastes through well-arranged network of drainage pipes. For distribution system pipes generally used are GI, copper, HDPE, CPVC, mostly now a days CPVC plastic pipes are used as they don't get rusted, light weight, easy installation and maintenance and economic.

Grey Water: **Greywater** is gently used water from your bathroom sinks, showers, tubs, and washing machines. It is not water that has come into contact with feces, either from the toilet or from washing diapers.

Greywater may contain traces of dirt, food, grease, hair, and certain household cleaning products.

OBJECTIVES OF STUDY

1. To study characteristics of grey water for treatment.
2. To study building drainage system for better designing and treatment.
3. To design drainage system so that grey water is treated in pipe itself.
4. To treat grey water and reuse it for flushing which will be cost effective.

METHODOLOGY

Treatment System

Management of greywater graduates from simple to extremely complex when the necessary strategies and technology is not in place or not properly implemented. Many developed countries have however implemented from simple to advanced methods of handling, managing and treating greywater with some countries recycling the greywater for both potable and non-potable uses. Treatment systems have been used to reduce the level of contamination in greywater before reuse or final disposal. They are contaminant-specific, and each is applied along the conventional wastewater treatment sequence (pre-treatment, primary, secondary and tertiary treatment). Each of these systems adopts either a physicochemical or biological means of treatment. Physicochemical methods adopt physical and/or chemical methods of treatment including filtration, adsorption and reverse osmosis,

among others. Biological treatment methods adopt a combination of microbes, sunlight and oxygen manipulation; examples of such systems include activated sludge systems, trickling filters, waste stabilization ponds, rotating biological contactors and many others. The widely used systems have mostly been filtration, rotating biological contactors, membrane bioreactors, constructed wetlands and upflow anaerobic sludge blankets (UASBs) which is not economically friendly. This paper therefore discusses the effective way of treating greywater.

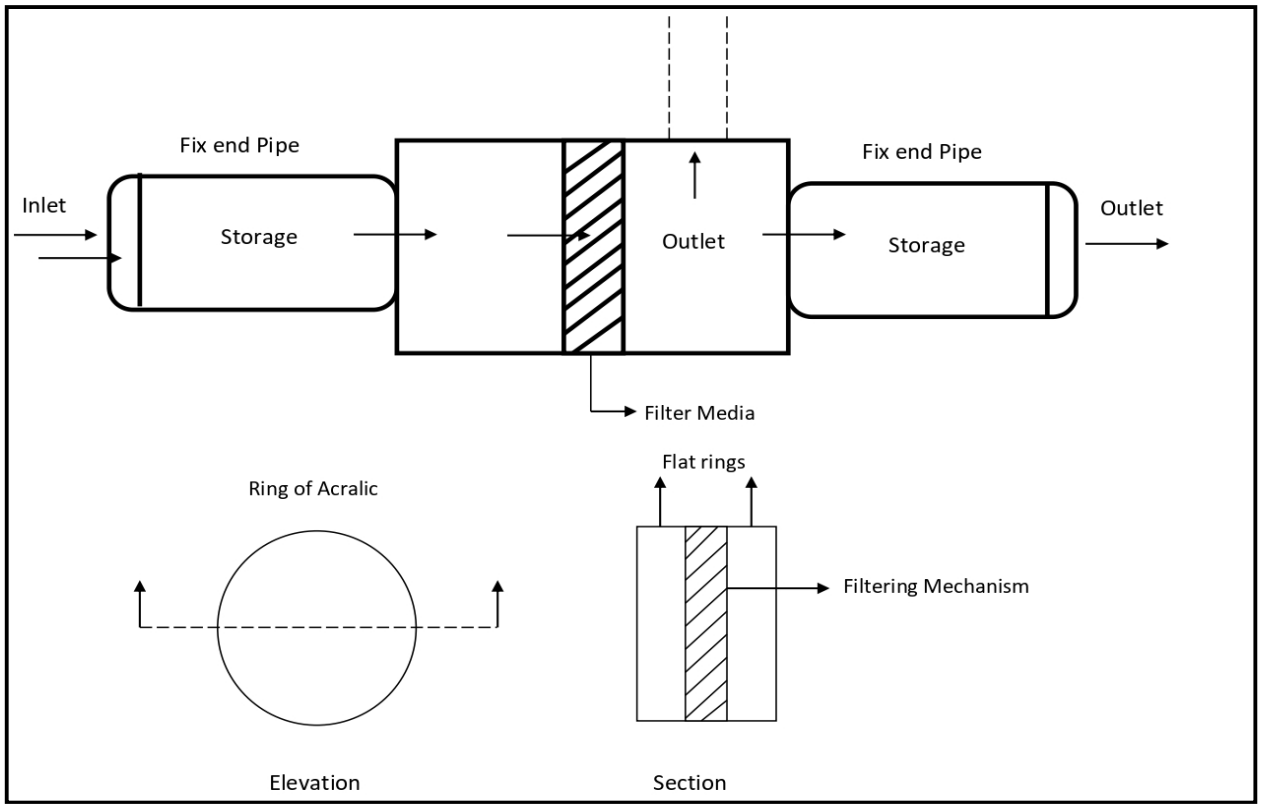

Fig No.1:"Showing Model for treating greywater"

Mechanism

Grey water collected from wash basins, bathrooms from inlet pipe to storage chamber, from where water is passed from filter media resulting into removal of contaminants. Filter media used in this process is Non woven polypropylene sheet of 1.5 mm. Inlet pipes are used of 3" PVC whereas elbow used are of 3".

Table No.1: "Showing % of greywater with respect to sources"

S.No	Sources	% of greywater
1	Bathing	55
2	Laundry	20
3	Washing of house	10
4	Washing of Utensils	10
5	Cooking	5
Total		100

Quantification of Grey Water, determination of grey water generation and flow rate is the first requirement in the design of grey water, collection, treatment and reuse system. Following methods are proposed for quantification of grey water shown in table no 3.

Table No.2: "Showing methods for quantification of grey water."

S.No	Method	Types
1	Direct Method	a) Water meter b) Bucket method
2	Indirect Method	a) Water consumption b) Type of uses

Sample collection and analysis

Laboratory scale grey water treatment system was designed. The easily available filter media in the filtration unit such as Non woven polypropylene sheet of 1.5 mm. The gravitational flow was used for the flow of water from raw grey water unit to the storing unit of treated grey water. The samples were collected from raw water and from each stage for the analysis. These samples were analyzed by standard method at laboratory (Aery, 2010; WHO, 2004; OECD, 2003; APHA, AWWA Int. J. Curr. Microbial. App. Sci (2015) 4(8): 113-124 115 and WEF, 2005; Clair et al., 2003). The parameter such as Turbidity, Total suspended solid (TSS),Total dissolved solids (TDS), Total hardness (TH), Chemical oxygen demand (COD) and Biochemical oxygen demand (BOD) and were determined of raw and treated water sample for the performance study of the grey water treatment system. Statistical analysis All analyses were performed in triplicates. The data were recorded as means ± standard deviation and analyzed using Microsoft excel.

RESULT AND DISCUSSION

Experimental setups were performed by using low cost material and their performances were evaluated. The low cost material such as Non woven polypropylene sheet of 1.5 mm were used in the filtration unit. The sample of water was taken before and after filtration. The samples were analyzed for the physical and chemical parameters to check the quality of wastewater (raw grey water) and subsequently used the data for the selection of treatment process.

Efficiency and performance

Table No. 3 "Showing Concentration of various parameters"

S.No	Parameters	Wastewater	Non woven polypropylene
1	Turbidity(NTU)	167.58±0.50	20.2±0.02
2	TSS(mg/l)	132.2±0.01	12.02±0.01
3	TDS(mg/l)	868±0.01	854.2±0.05
4	TH(mg/l)	576.86±0.02	311.01±0.01
5	TN(mg/l)	53.44±0.05	18.22±0.01
6	COD(mg/l)	165.47±0.20	58.52±0.03
7	BOD(mg/l)	48.27±0.10	18.71±0.13

CONCLUSION

This work highlights an important issue which occupies a lot of researchers around the world, namely the issue of lack of usable water. Therefore many studies have been developed for the search of solutions to that problem, such as use of treatment technologies for providing good water quality for water reuse. It was noted that the most difficult challenges of treatment is the presence of microbial pathogens in greywater, which lead to the occurrence of disease and sometimes could lead to death.

These natural materials are widely available in most developing countries, and their total integration into the conventional treatment systems should be explored. They can be used to design simple household level greywater treatment systems that target a certain reuse option and thereby increase local level participation.

Perception of greywater reuse has been closely related to the choice of reuse as most users will want to reuse greywater for activities that do not involve personal contact. In general, public perceptions are important to consider when implementing a certain method for a specified use. On the basis of this review, we conclude that to achieve effective greywater treatment and reuse, extensive contributions from technical and non-technical experts in many disciplines are called for. It also requires a comprehensive assessment of the greywater characteristics in order to choose an appropriate method or system of treatment. That notwithstanding, greywater treatment and reuse if embraced and enforced can lead to substantial decline in over-reliance on freshwater resources for non-potable uses.

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