Grey Water Reuse: A Sustainable Solution of Water Crisis in Pusad City in Maharashtra, India

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***Abstract*:** Pusad is tehsil place in Yavatmal district in Maharashtra. Due to rapid population growth and unplanned urbanization, the scarcity of water is the major problem. The reuse of grey water is an attractive solution to minimize the deficit demand and supply of water in pusad city. The purpose of this paper is to purpose some efficient, cheap and sustainable grey water treatment system for household. The treated grey water can be used for non-potable use purposes such as irrigation, car washing etc. To achieve this objective, samples were collected from 100 households and laboratory tests were conducted on these samples and they revealed the presence of the BOD, TSS, COD, and Coliforms etc. From the results an attempt has been made to prepare the laboratory scale integrated model for the treatment water. It is hoped that this project would be of great help for the cities of developing countries especially, countries effected by drought.

Keywords: *Grey Water, Black Water, sand filter, household and drought.*

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I. INTRODUCTION

1.1 Back Ground of Study

Waste water is generally made of black water and grey water. Grey water, also known as sullage, is non industrial wastewater generated from domestic processes such as washing dishes, laundry and bathing. Grey water 55% -75% of waste water .grey water is distinct from black water in the amount and composition of its chemical and biological contaminants.

Grey water gets its name from its cloudy appearance and from its status as being neither fresh nor heavily polluted. Due to scarcity of fresh water all over the world, balancing the supply and demand of fresh water has always been a great challenge. The recycle and reuse of waste water is considered as a strategy of water demand management (WDM) system. Many investigations have been conducted on domestic grey water quality analysis, treatment and reuse in the US, Japan and Australia. Grey water treatment system have been successfully implemented in the US, Japan and Australia to reclaim Grey water for non-potable uses. With the technological advancement and public acceptance, Grey water seems to be a potential source of water saving.

India is a developing country. Maharashtra is considered as one of the most densely populated state in India. Population growth usually increases demand for water in all sectors of economy: agricultural, industrial and domestic. Due to rapid population growth, unplanned urbanization, surface water pollution and continuous ground water extraction. To deal with this complicated situation, some innovative measures should be taken to minimize the use of potable water. Recycle and reuse Grey water, rainwater harvesting during monsoon are good options for saving fresh drinking water. However waste water treatment and reuse is not common in India.

The main objective of this paper is to propose some efficient, cheap and sustainable Grey water treatment system for Grey water generated from households.

1.2 Benefits of Grey water Reuse

Water recycling and reuse has become an attractive option for conserving and extending available water supply in many countries because of their readily available water supplies. Recycled water has been widely used for non-potable reuse purposes such as agricultural and landscape irrigation, public parks irrigation, toilet flushing in the USA, EU, and Australia and some middle –east countries. Other non-potable urban uses of treated Grey water can be in fire suppression, air conditioning and soil compaction. High quality water does not required for such kind of non-potable uses.

Recycle of Grey water will protect aquatic ecosystems by decreasing the diversions of freshwater, reducing the quantity of nutrients and other toxic contaminants entering waterways. it will reduce the need for water control structures .there are some other benefits of using Grey water . It reduces the total wastewater treatment cost as it lessens the organic and hydraulic loads of waste water treatment plant. Reclaiming nutrients in Grey water improves the soil quality. Grey water application in excess of plant needs is also a good way to recharge groundwater. Highly treated Grey water can be reused for aquifer recovery and storage.

1.3 challenges of Grey water reuse

There are several barriers in the Grey water treatment and reuse. These include limited human and financial resources, reliability of waste water treatment, system energy demand, economic feasibility of the system, public perception and willingness, social and institutional acceptance, water right issues and political process, insufficient and inconsistent codes and guidelines etc. In India, guidelines and standards for Grey water reuse does not exist.

Grey water recycling system includes collection, storage, treatment and reuse. Recycling of Grey water is based on exclusion of black water. For this purpose the plumbing system should be modified so that the disposal of Grey water is facilitated through different pipes. In fact dual plumbing system is essential for successful implementation of Grey water reuse scheme. Pusad is an unplanned city .possibly the

most important to the adoption of Grey water reuse , is homeowners acceptance .the willingness of homeowners to incur the expense associated with maintenance and installations of Grey water system is central to widespread voluntary adoption. To overcome these challenges, practical strategies should to be employed depending on the socio-economic condition for implementation of Grey water recycle system in India.

II. . EXPERIMENTAL MATERIALS AND METHODS

Laboratory scale integrated grey water system plant is designed for 100 lit/hr capacity restricted five components such as storage tank with 100 litres capacity, sedimentation tank has 40 litres capacity, Filter-I (Gravel + Sand) has 40 litres Filter-II (Coconut shell coal + Charcoal) unit of 40 litres capacity and Disinfection Tank has also 40 litres capacity. Dimensions and capacity of component of laboratory scale model are summarized in table 1.

The sources of the grey water was collected from bathrooms and basins in residential rural area in a tank and sent to the primary storage unit. The components of integrated grey water system plant is as per fig. 1 contained the operation of sedimentation, filtration and disinfection tank. The gravitational force was used for the flow of water from one stage to another stage. The easily available and natural materials were used as filter beds in the filtration unit explained in table 2.The samples were collected from raw water and from each stage for the analysis. These samples were analyzed by standard method for water and waste water analysis at environmental laboratory. The

Parameters such as pH, total dissolved solids (TDS), Total suspended solids (TSS), chemical oxygen demand (COD), turbidity, chloride content in Grey water were determined for each sample. Fig 2 shows integrated grey water treatment model.

Table 1 :- dimensions and capacity of components of laboratory model

Sr. No.	Component	Dimensions	Capacity
1	Storage Tank	30 x 30 x 60cm	100 litre
2	Sedimentation Tank	25 x 20 x 45cm	40 litre
3	Filter-I (Gravel + Sand)	25 x 20 x 45cm	40 litre
4	Filter-II (Coconut shell coal + Charcoal)	25 x 20 x 45cm	40 litre
5	Disinfection Tank	25 x 20 x 45cm	40 litre

Table 2 :Filter media in Filter-I and Filter-II

Sr. No.	Component	Filter media	Thickness
1	Filter-I (Gravel + Sand)	Sand	8cm
		Gravel(20mm)	10cm
		Gravel(40mm)	10cm
2	Filter-II (Coconut shell coal + Charcoal)	Charcoal layer (alternate two layer)	7.5cm
		Coconut shell coal (alternate two layer)	7.5cm

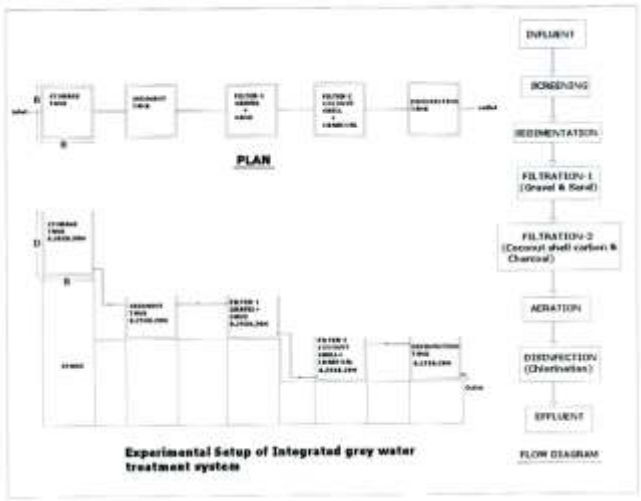

Fig 1:- experimental setup of integrated grey water system

Fig 2 :- integrated grey water treatment plant

III. RESULT AND DISCUSSION

3.1 Performance of the integrated grey water treatment plant

The grey water was collected from the bathrooms, basins of the residential area of Pusad city, Maharashtra, India. Total 08 samples of grey water were taken at first day of morning and evening of every week and the performances of system were investigated for these 08 samples of grey water at steady state conditions and the average value data are summarized in Table 3.

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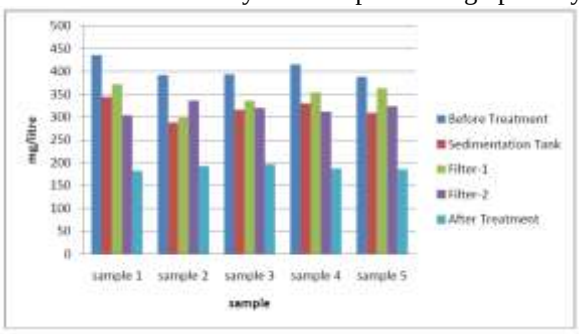
Table 3:- chemical analysis of grey water

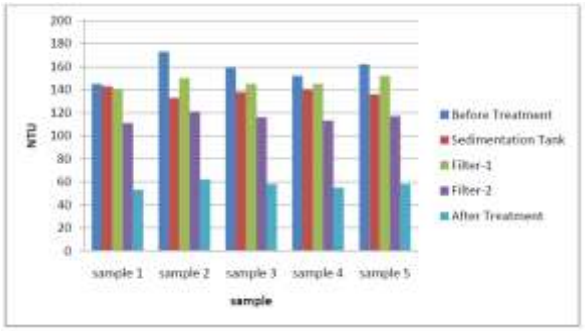
Sr. No	Tests	Units	Characteristics of Grey water				
			Before treat-ment	After treatment			
				Sedime-ntation	Filter 1	Filter 2	Disinf-ection
01	PH	mg/lit	7.5	7	7	8	6.5
02	Hardness	mg/lit	436	344	372	304	182
03	Chloride	mg/lit	82.57	88.57	82.57	256.52	256.52
04	Turbidity	NTU	145	143	140	111	53
05	Temperature	°C	32.5	29	32	34	33.5
06	BOD	mg/lit	350	280	227	210	104
07	TSS	mg/lit	320	360	280	280	120
08	TDS	mg/lit	400	300	700	810	240
09	Colour	-	Dark grey	Light grey	Light grey	Light black	Light black

IV. GRAPHICAL REPRESENTATION OF CHEMICAL ANALYSIS

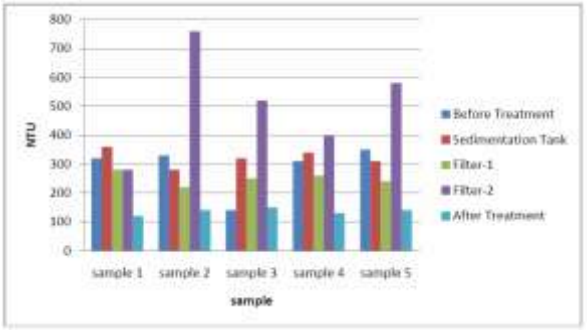
The results of chemical analysis of various samples collected from the study area has presented graphically



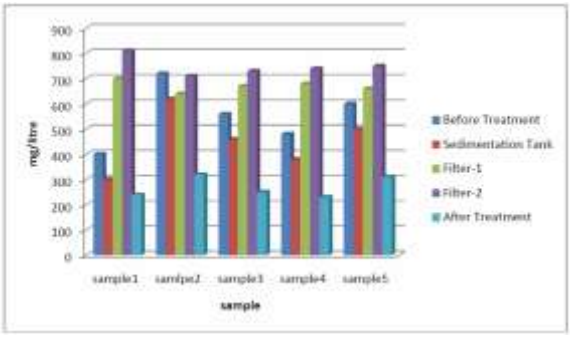
Graph : Hardness



Graph : Turbidity



Graph : TSS



Graph : TDS

V. COMPARISON OF PRESENT GREY WATER TREATMENT PLANT WITH OTHER TREATMENT PLANT

Table 4 Comparison of the Grey water system with other treatment system

Sr. No	Parameter	Present system	Other system
1	pH	Nil	Nil
2	Hardness	53.49%	50%
3	Turbidity	68%	55%
4	TSS	58.78%	82.60%
5	TDS	51.08%	69.9%

The other system is suggested by Saroj B. Parjane and the difference is mentioned in the above table.

VI. CONCLUSION AND RECOMMENDATIONS

Water shortage in India will be a key issue for its sustainable development in the future. India is facing a water crisis and by 2025 it is estimated that India's population will be suffering from severe water scarcity. International Water Management Institute (IWMI) predicts that by 2025, one in three Indians will live in conditions of absolute water scarcity. Conventional groundwater and surface water sources are becoming increasingly vulnerable to industrial and natural pollution. The best alternative and cost effective process in rural areas is the reuse of grey water. The potential of potable water savings can be substantial by using these proposed greywater treatment systems

The present study demonstrate the reuse and treatment of residential bathrooms, basins waste water called as grey water for the purpose of landscaping, gardening, irrigations, plant growths and toilet flushing. Based on finding of this study, this treatment
technology can be considered as a viable alternative to conventional treatment plants in rural region since they are characterized by high potential for BOD, TDS, TSS, total hardness, oil and grease, anions and cations removal. The benefits found are low energy demand, Less operating and maintenance cost, lower load on fresh water, less strain on septic tank, highly effective purification, and ground water recharge. Hence, this is an environmental friendly, without chemical operation, cost effective and resourceful plant for rural development.

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