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## USE OF PIPE FILTRATION SYSTEM FOR TREATMENT OF GREY WATER FROM HOUSEHOLDS

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**Abstract:** - Cities have become the place where development challenges and opportunities increasingly come face to face. In 2014, 3.9 billion people, or 54% of the global population, lived in cities, and by 2050, two-thirds of the global population will be living in cities (UNDESA, 2014). These statistics will be a bit higher in terms of India is concerned. Urban water needs and challenges require multi-sectored, inclusive and comprehensive strategies. Several strategies are notable in the region, including efforts towards urban nexus planning; integrated storm water management and green buildings water sensitive urban design. One of the technique discussed in this dissertation is filtration process of the grey water by using In-pipe Filtration System and can be again used for flushing purpose in the construction system. Experimental Study was performed on the sample collected from the urbanized area of Talegaon, Pune. From the dissertation it is concluded that the In Pipe Filtration system is able to increase the positive quality of grey water and successfully can be used in the flushing system.

**Keywords:** Urban water usage, grey water, In-Pipe filtration, Reuse, Flushing

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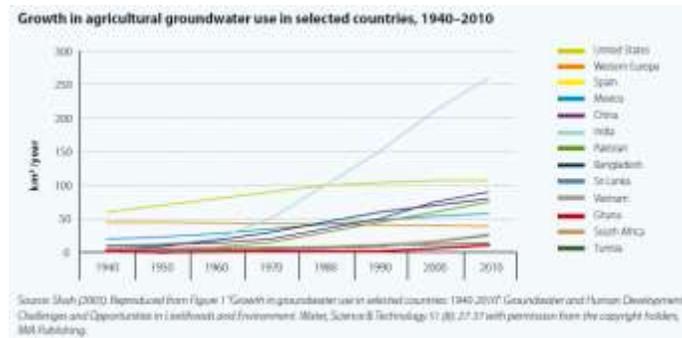
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**INTRODUCTION**

a) Usage of water in Urban India and generation of Grey water in relation to the domestic usage



**Fig 1. Groundwater usage in India**

Water usage in India as per given in fig1. Its related to agricultural groundwater. It can be related to the usage of water in urban areas and then generation. In low-cost decentralized sanitation projects implemented in developing countries, the main focus is often put on latrine building, thus ignoring/neglecting the issue of greywater. If one wants to have comprehensive and sustainable decentralized sanitation projects with dry toilet systems one has to provide well functioning management systems for the greywater as well, otherwise the project will not have the expected impact on public health and environment. Proper greywater management, comprising collection, treatment and reuse or disposal, prevents humans of being in contact with it and limits pathogen transfer. A sound treatment also has positive effects on the nearby water bodies, since it limits the input of impurities. Greywater management is not only a precondition for clean and healthy living conditions, it also has a great potential for reuse. Treated greywater in a decentralized way is reused for a whole range of applications around the world; in developing countries, the reuse of treated greywater for irrigation purposes is most common.

**b) Study Area :** Yashwant Nagar , Talegaon Dabhade Pune.

In rural areas of India the Grey water is mostly disposed in open area or use septic tank is rarely use. Due to less population disposing of grey water is not that important as compare to city like Talegaon. Generation of grey water is at greater level in the urban areas as the reason behind that is living culture of people in city which makes them to use more water. Talegaon is located on the leeward side of Sahyadri mountains approximately 25 km from Lonavala. It falls under

moderate type of rain zone. Most of its part is located on the bank of river Indrayani. As there is poor provision of Sewer and non availability of Sewage Treatment Plant, the sewerage water is directly disposed into Indrayani river. So there is need to improve the quality of the grey water in this particular area and so as apply a system so that it treats grey water which can be reused in the same building and eventually reducing the load on fresh water.

### **c) Methodology:**

This project has followed a perfect series of specialized step to complete the following objectives:

- 1) To Study the experimental analysis for quality of grey water coming from the household.
- 2) To Proposed design of in pipe filtration process to improve the quality of grey water.
- 3) To provide the improved grey water to be used in flushing system.

The methodology

A) Primarily, a reference case study related to the finalized topic is to taken which will act as base for the dissertation. a actually case study is taken from a G+5 building is to be taken from Yashwant Nagar area of the above mentioned Talegaon Area, Pune.

B) Secondly, a precise set of experiment related to improvement of grey water as per IS standard is to be performed on the grey water sample collected from the household.

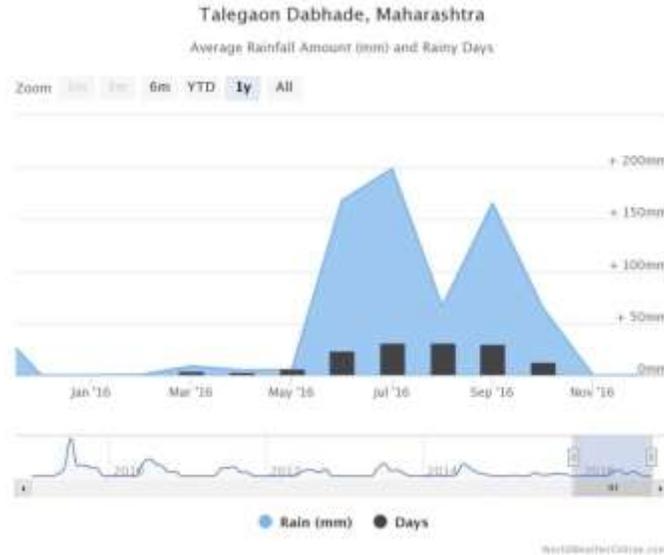
C) Study of different methods of improving water quality of grey water out of which the In Pipe Filtration Method is to be used. A Proposed Design of In Pipe Filtration to be done as per the load calculation of the generation of grey water in the Building.

D) To Design a internal Plumbing System so to optimize the use of treated grey water for flushing purpose in toilets.

### **II) Study Area Chosen:**

Talegaon Dabhade is a Municipal Council city in district of Pune, Maharashtra. The Talegaon Dabhade city is divided into 23 wards for which elections are held every 5 years. The Talegaon Dabhade Municipal Council has population of 56,435, as per report released by Census India 2011. Talegaon Dabhade Municipal Council has total administration over 13,856 houses to which it supplies basic amenities like water and sewerage. Out of total population, 20,537 were engaged in work or business activity. In census survey, worker is defined as person who does

business, job, service, and cultivator and labour activity. Of total 20537 working population, 92.49 % were engaged in Main Work while 7.51 % of total workers were engaged in Marginal Work.



**Fig.2.Rainfall Data of Talegaon Dabhade.**

We have chosen a Building 'Kalpchaya' near Bombay society of Yashwant nagar area. The building was constructed in 2004 and have 5 floors. On each floor there are 4 units of 2 BHK. Following is the Collective data.

Floor no.	Room No.	Total Number of Resident	Water Consume	Gerywater Generated
1	101,102,103,104	3+4+3+5= 15	2250 ltr	1050 ltr
2	201,202,203,204	4+2+5+3= 14	2158 ltr	1552 ltr
3	301,302,303,304	0+4+6+3=13	2050 ltr	1125 ltr
4	401,402,403,404	5+4+3+3=14	1968 ltr	1142 ltr
5	501,502,503,504	4+4+2+5=15	2021 ltr	1020 ltr

After the Permission taken from the Municipal Authority Talegaon and the Co-Operating Housing Society we started collecting sample with the help of the dwellers. For the dissertation we have limited our Grey water sample as source of kitchen and bathroom only.

Characteristics of ground water:

The composition of greywater depends on several factors, including sources and installations from where the water is drawn:

- Quality and type of the water supply (groundwater well or piped water)
- Type of distribution net for drinking water
- Type of distribution net for greywater (because of leaching from piping, chemical and biological processes in the biofilm on the piping walls)
- Activities in the household (lifestyle, custom and use of chemical products) - installation from which greywater is drawn (kitchen sink, bathroom, hand basin or laundry wash) - type of source: household or industrial uses like commercial laundries- geographical location- demographics and level of occupancy- quantity of water used in relation to the discharged amount of substances III) Experimental Analysis : Based on the Literature survey and the study of reference Case area we have taken we have chosen the following set of experiment to study the quality analysis of the grey water collected from the above mention building in the Talegaon. We started collecting sample on a weekly basis on Monday, Wednesday, Friday and Sunday and the timing of sample collection were decided to be taken as after the most of sample is at peak form i.e in morning time and afternoon when kitchen household works are over and same is to be repeated in the evening .The people living in the house were ask to collect the sample and next day analysis was to be done. The sample size to be collected was restricted to 500 ml which was sufficient to carry out the required set of experiment and some of sample acted as buffer stock. Sample of grey water may be collected by following two methods:

- a) Water meter method
- b) Specific size bucket method
- c) 55 to 65 % of total water consumption

Following is the set of Experiment as per Indian Standards

- 1) Measure sample Ph.
- 2) Solids Analysis.
- 3) To determine the Dissolved Oxygen of the given Gray water sample.
- 4) To determine the Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) of the given Gray water sample.

Following is the sample observation table which was taken for submitting the values

Sr.no	Sample Details	Ph Value
1	House no 101 (Area)	8.4
2	House no 102 (Area)	9.2
3	House no 103 (Area)	8.5
4	House no 104 (Area)	8.6

**Table no. Ph Value of Floor number**

Following is the observation table for the first floor of the building for various set.

Floor No	Experiment	Observed Values
1)	<b>Ph Value</b>	<b>(Ph Sacle)</b>
	House 101	8.4
	House 102	8.9
	House 103	8.1
	House 104	8.3
2)	<b>Turbidity</b>	<b>(NTU)</b>
	House 101	81

<b>3)</b>	House 102	90
	House 103	96
	House 104	94
	<b>BOD</b>	<b>( Mg/L)</b>
<b>First Floor</b>	House 101	274
	House 102	290
	House 103	295
	House 104	286
<b>4)</b>	<b>COD</b>	<b>( Mg/L)</b>
<b>First Floor</b>	House 101	560
	House 102	590
	House 103	615
	House 104	580
<b>4)</b>	<b>Total Solids</b>	<b>( Mg/L)</b>
<b>First Floor</b>	House 101	980
	House 102	1000
	House 103	1175
	House 104	996

Similarly the data was prepared for all the remaining 4 floors.

#### IV) Grey Water Filtration Process:

A) Grey water

Grey water can be divided into several groups, according to the source of the greywater. In this semester work the structure shown in table 3 is used. Table gives a first overview of the general characteristics of the three main greywater source types.

Water source	Characteristics
<b>Laundry</b>	<p><i>Microbiological:</i> variable thermotolerant coliform loads</p> <p><i>Chemical:</i> sodium, phosphate, boron, surfactants, ammonia and nitrogen from soap powders and soiled clothes</p> <p><i>Physical:</i> high in suspended solids, lint and turbidity</p> <p><i>Biological:</i> high in biochemical oxygen demand (BOD)</p>
<b>Bathroom</b>	<p><i>Microbiological:</i> lower levels of thermotolerant coliforms</p> <p><i>Chemical:</i> soap, shampoo, hair dyes, toothpaste and cleaning chemicals</p> <p><i>Physical:</i> high in suspended solids, hair, and turbidity</p> <p><i>Biological:</i> lower levels of concentrations of biochemical oxygen</p>
<b>Kitchen</b>	<p><i>Microbiological:</i> variable thermotolerant coliform loads</p> <p><i>Chemical:</i> detergents, cleaning agents</p> <p><i>Physical:</i> food particles, oils, fats, grease, turbidity</p> <p><i>Biological:</i> high in biochemical oxygen demand</p>

General features of greywater are that it contains lower concentrations of organic matter, of some nutrients (e.g. nitrogen, potassium) and microorganisms than blackwater. But the concentrations of phosphorus, heavy metals and xenobiotic organic pollutants are around the same levels. The main sources for these pollutants are chemical products such as laundry detergents, soap, shampoo, toothpaste and solvents. Washing detergents are the primary source of phosphates found in greywater in countries that have not yet banned phosphorus-containing detergents (Eriksson et al., 2002). According to (Gunther, 2000), greywater has a typical N/P ratio of 2, thus far below the N/P ratio of around 10 which would be optimal for nutrient uptake by plants. This is very important if greywater is reused for irrigation. Nitrogen

then represents the limiting substance, leading to a sub-optimal phosphorus uptake unless the plants can get nitrogen from other sources.

### **B) Treatment system:**

Greywater treatment process varies from simple devices that divert greywater for direct application such as irrigation to complex systems involving sedimentation tanks, filters, bioreactors, pumps and disinfection systems. Advances in the effectiveness and reliability of wastewater technologies have improved the capacity to produce reused water that can serve as alternative water source in addition to meeting water quality protection and pollution abatement requirements (Lazarova, 2000).

The following greywater systems considering non-contact application are considered:

#### a) Primary treatment - pre-treatment to secondary treatment

- Screening
- Equalization

#### b) Secondary treatment

- Gravel filtration
- Sand filtration
- Chlorination.

In addition this the drawer type of in pipe filtration system is used which help u to regulate the water system which can has more quality of improvement of greywater.

### **V) Result and Conclusion**

After completing the experimental analysis on the treated water we get the following result which are actually giving the positive result that the in Pipe filtration system can be used for the treatment of the greywater at such a local level .The design helps out to make it economical as compare to the other treatment methods and its more effective.

Following is the results and comparison table for the first floor of the building for various set.

Floor No	Experiment	Observed Values	Result Value
1)	Ph Value	(Ph Scale)	(Ph Scale)
First Floor	House 101	8.4	7.4
	House 102	8.9	8.0
	House 103	8.1	7.2
	House 104	8.3	7.3
2)	Turbidity	(NTU)	(NTU)
First Floor	House 101	81	15
	House 102	90	20
	House 103	96	21
	House 104	94	18
3)	BOD	( Mg/L)	( Mg/L)
First Floor	House 101	274	104
	House 102	290	115
	House 103	295	118
	House 104	286	107
4)	COD	( Mg/L)	( Mg/L)
First Floor	House 101	560	240
	House 102	590	250
	House 103	615	271
	House 104	580	265
4)	Total Solids	( Mg/L)	( Mg/L)

First Floor	House 101	980	104
	House 102	1000	120
	House 103	1175	127
	House 104	996	118

#### VI) Future Scope:

The following project can be carried at a larger level of inputs i.e numbers of residents or building units can be increased or this project can be carried at a bigger township level. Work can also done in changing the material of the pipe system and result can be studied. Lastly the cost benefit analysis can be carried out for comparing the other grey water treatment system with the In pipe system used in this project.

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