RECYCLING OF DOMESTIC GREYWATER FOR REUSE AT HOUSEHOLD LEVEL IN OSMANABAD CITY

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ABSTRACT:

Grey water is the waste water generated from bathrooms, sinks, washing machines, and other kitchen appliances. Grey water is generated by human beings during their household activities can be recycled by treatment for activities like gardening, flushing etc. This grey water if not managed properly creates problems like health hazards, river water pollution and land pollution. Thus it becomes extremely necessary to have a proper waste/grey water management system. Grey water generated from residential area, commercial area, institutional area, and recreational area falls under waste water. There is an increase in grey water constantly due to increase in population and change in life style.

Osmanabad is a city and municipal council in Osmanabad district in the Marathwada region of Maharashtra state in India. This district as no larger river flowing through it less rainfall than any other region of Maharashtra state and so facing the problem of drought. The weather is 27^0C, wind SE at 8 km per hour, 40 % humidity, elevation is 2142 ft. the climate Osmanabad is generally dry. The rainy season starts from mid june and continues until end of September. During summer the temperature of Osmanabad dist. are low as compare to other district of Marathwada region. For Osmanabad city water supply scheme is designed from Ujani Dam reservoir in 2013. It is sufficient for peoples daily requirements of water as per IS 135 Ltr.per day per person. The population of Osmanabad city was 112085 according to 2011 census. This population will reach upto 3,35,000 in 2054. Present requirement of water is 16 MLD in future this requirement will reach upto 50MLD. To fullfill the future requirement of water municipal corporation need to invest around 300 cr rupees**.** But there are for other purposes peoples need extra water like car washing, gardening, floor washing, toilet flushing. This extra amount of water can be obtained from greywater recycling. Greywater means water from bathroom, kitchen sink, wash basin. This greywater can be recycled from filtration method through sand filter and this water can be used for above said purposes at household level. Grey water recycling will reduce the load of water supply as well as cost of supply. It will also important option in dry season.

Keyword- Grey water, Recycling, Reuse, Waste water

1. INTRODUCTION

Domestic wastewater, or “sewage”, can be divided into two categories: blackwater which originates from toilets and kitchens has gross faecal coliform contamination and generally has high concentrations of organic matter; and greywater which originates from bathrooms and laundries and constitutes the largest flow of wastewater.

The term "greywater" refers to untreated household wastewater, which has not been contaminated by toilet waste. It includes the water from bathtubs, showers, hand basins, laundry tubs, floor wastes and washing machines. It does not include waste from kitchen sinks, garbage disposal units or dishwashers .

It is called greywater because if stored for even short periods of time, the water will often cloud and turn grey in colour. The exact sources of greywater vary according to countries and organizations. Some definitions include the water sourced from the kitchen and dishwasher.

Sr.No.	Sources	% of Greywater
1	Bathing	55
2	laundry	20
3	Washing of House	10
4	Washing of Utensils	10
5	Cooking	05
	Total =	**100**

2.Problem Statement :

The water supply scheme from ujani dam reservoir for Osmanabad city in 2013 is design only for drinking purpose of osmanabad citizens not for agricultural and industrial purpose or MIDC of Osmanabad city .

By considering the coming 2054 population of Osmanabad city municipal council of Osmanabad sanctioned new ujani water supply scheme 299 Cr. This scheme is parallel to ujani water supply scheme of 2013.

The Osmanabad city municipal council has given sanction to it's DPR of scheme. The capacity of this scheme is 50 MLD. Existing water supply scheme is of 16MLD capacity but only 8 MLD water is available for citizens.

Today's population of Osmanabad city is 1,34,000 and in 2054it will be 3,35,000 by considering this population this new scheme is designed. Every citizen will get 135 ltr. of water. This is a 30 year plan layout and work is going on this scheme from 2024. Primary level OMC has sanctioned this and further it is expected that Maharashta Jivan Pradhikaran will also give technical sanction to same and forwarded them to do it.

Water supply scheme for Osmanabad City

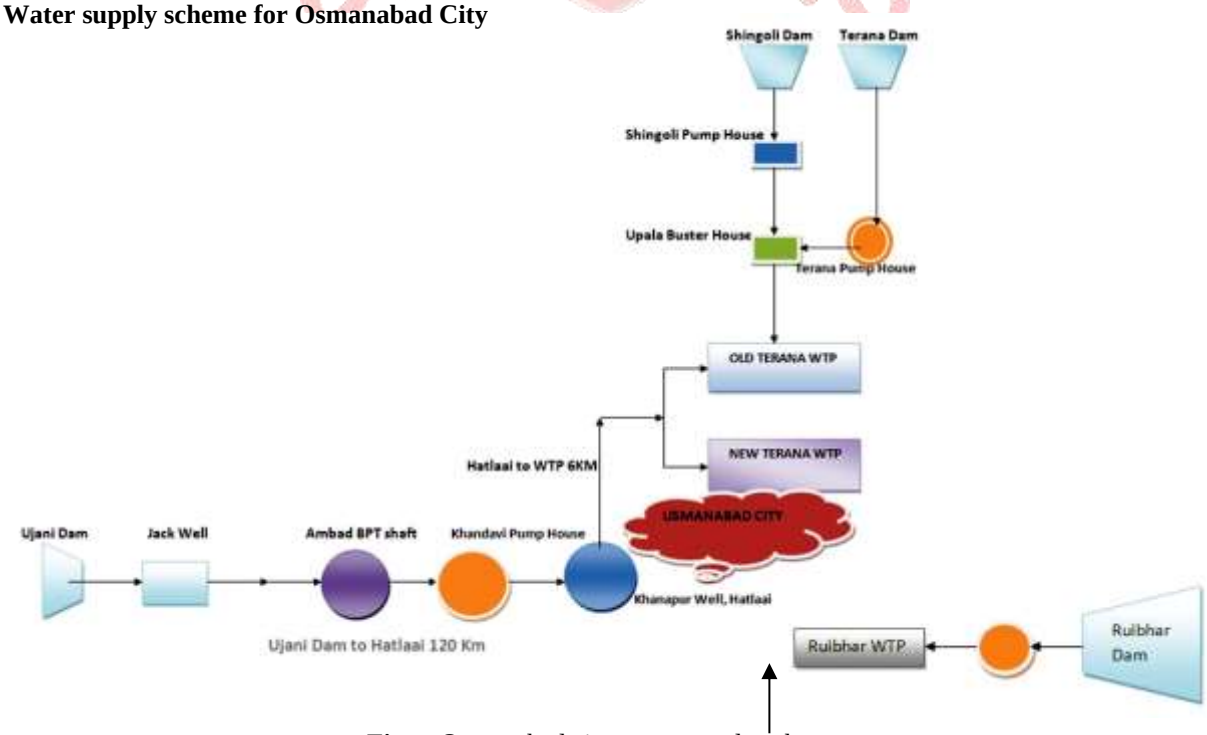


Fig. : Osmanabad city water supply scheme

3. LITERATURE REVIEW

3.1 B.Jefferson ALaine S. Parsons T. Stephenson S.Judd (2000) :

Domestic wastewater recycling is still in its infancy as such there is a paucity of reliable information relating to both the nature of greywater and the range of recycling technologies available. The lack of water quality standards and poor understanding of the nature of greywater have led to the development of plethora of technologies for recycling application.

Greywater quality varies considerably but can be considered to be of a similar strength to domestic sewage. Storage is required to balance the imbalance in the dynamics of water demanded by toilet flushing and greywater production for washing. Membrane bioreactors must all the applicable water quality standards but are currently costly. Advanced filtration system reduce all components of gray water but do not reliably meat all the water recycling standard.

3.2Stewart Dallas, Barinscheffe, Goenho (2004) :

In rural area of latin America untreated greywater is piped to nearest street or stream while only black water from toilet is plumed to septic system. This practice constitutes discernible health risk with significant environmental impact they present low cost reedbed system for the treatment of domestic greywater designed upon ecological sanitation principals.

This case study has demonstrated the ability of low cost reedbeds to take advantage of pre existing culture of domestic waste water separation and treat greywater to level that meets the Costa Rican guide lines for waste water use. This guide line place emphasis upon pathogen removal and as a result of hydraulic retention time (HRT) becomes the dominant design criteria. An environmental services contract (ESC) was established as a part of this project in an Endeavour to ensure. The long term sustainability of the system.

3.3 M Halalsheh, S.Dalahmeh, M.Sayed, W.Sulemain , M Shareef, M.Mansour , M.Safi. (2008) :

Low water consumption in rural areas in Jordan had resulted in the production of concentrated greywater. Average COD BOD and TSS values where 2568 mg/L, 1056 mg/L, 845 mg/L to be 14L/C/D. Three different treatment option were selected based on certain criteria and discussed in this article. The examined treatment system are septic tank followed by intermittent sand filter, septic tank followed by wet lands and UASB hybrid reactor.

Greywater in rural areas of mafraq governorate is characterized by very high values of 2568 mg/L, 1056 mg/L, 845 mg/L respectively. A) considerable fraction (46%) of the COD is found in suspended form for treating greywater with such characteristics it was shown that UASB hybrid reactor would be best option for house on site treatment in the studied area. Produced effluent in expected to meet Jordanian set for reclaimed water reuse in irrigating through tree.

4. METHODOLOGY

1) Experimentation – certain physical and chemical and biological parameters tests should be conducted on domestic greywater before and after filtration treatment and compare their characteristics.

2) Collection of greywater sample from 3 different houses of osmanabad city before and after filtration for testing

3) Calculation of amount of greywater generated from individual house from no. of occupants in house of osmanabad city

4) Design of sand filter of various grades and different thickness layers for greywater filtration system.

5) Comparison of obtain results with standards values of greywater characteristics.

6) Calculation of an estimate of installation of greywater recycling system at household level.

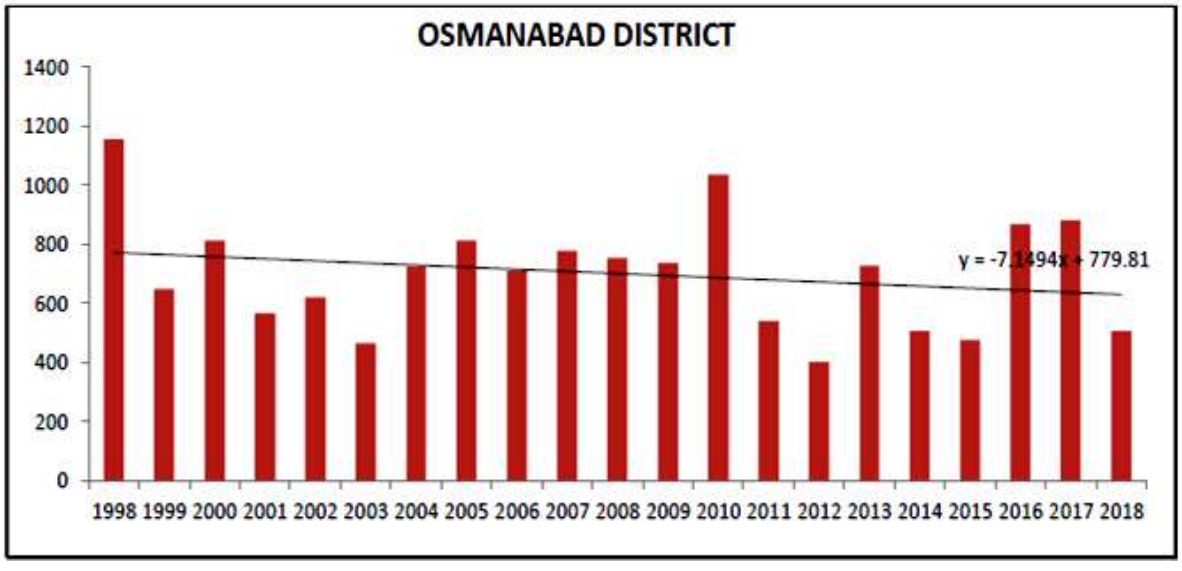
5. STUDY AREA

This project was selected with these primary objectives: (1) to obtain reliable quantitative data from actual use of gray water systems under realistic conditions, and (2) to make recommendations to the municipal corporation based on the findings of the project, for safe use of graywater in the City of Osmanabad.

Fig. : Location of Osmanabad city in Maharashtra state

Fig. : GPS View of Osmanabad city

Annual Rainfall Pattern (1998 – 2018)



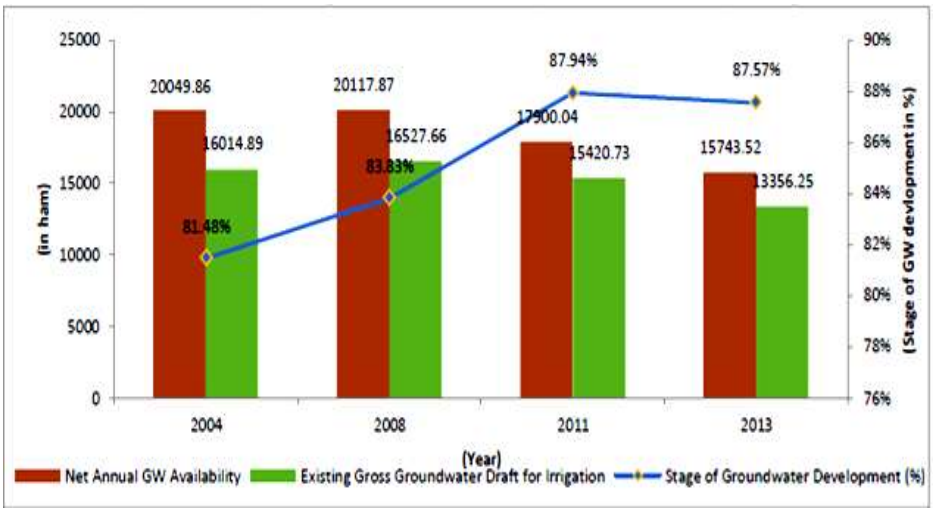
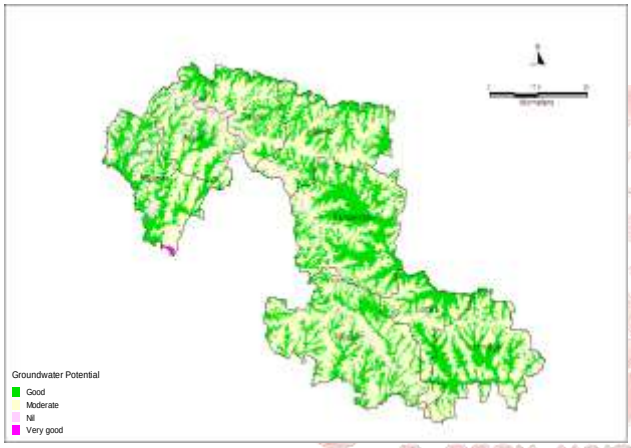


Fig. State of GW Development in %

Osmanabad District – Groundwater Potential Map :



From above rainfall data and ground water potential data for Osmanabad region it shows that Osmanabad district is under drought prone area. So the people should adopt the water recharge method to avoid the water crisis. There are two method of water recharge 1) Roof top rain water harvesting 2) Grey water filtration. In which roof top rain water harvesting method is most useful in rainy season but second method Grey water filtration is useful for water reuse for all season of the year.

Fig. Ground water potential map

6. DESIGN OF SAND FILTER :

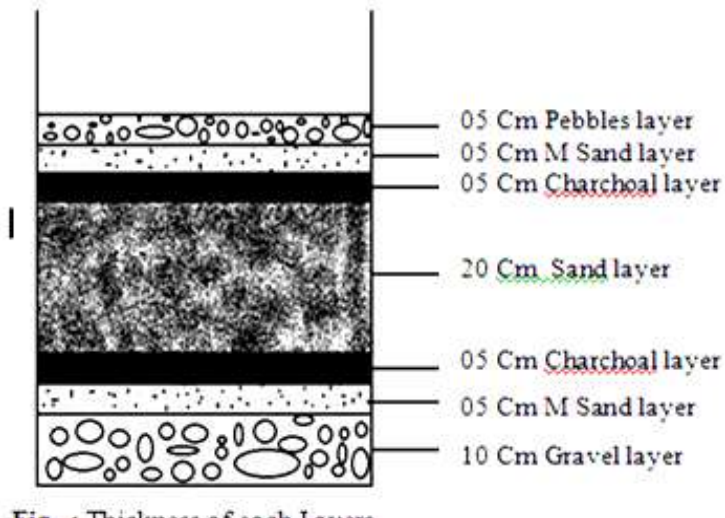


Fig. : Thickness of each Layers

Fig. Filtered greywater sample collection

115 litres per day per person greywater is generated from house daily.

Daily amount of greywater generated for 4 persons in a family = 4*115=460 liters per day .

Rate of filteration (loading rate)is the flow rate of water applied per unit area of the filter.

Loading rate on sand filter in hours=460/24 = 19.16~ 20 liters per hour

Loading rate on sand filter=amount of greywater /surface area of filter=0.460m3/0.088m2=5.22m3/m2/hour

LABORATORY TESTING IMAGES :

pH and *Measurement of Sodium*

Turbidity and Dissolved Oxygen

RESULT & DISCUSSION :

After the analysis following conclusions were drawn

Sr. No	Test	Avg. value before treatment	Avg. value after treatment	Percentage of removal
1	**pH Test**	8.9	7.4	16.85
2	**Total Hardness as CaCo3**	340	186	45.29
3	**Total Suspended Solids**	653	379	41.97
4	**Turbidity**	13.8	2.8	79.72
5	**Chloride Content**	485	246	49.27
6	**Total phosphorus**	7.64	0.84	89
7	**MPN (per 100 ml)**	8	0	100
8	**Sulphate**	246	43	82.53
9	**Ammonia**	16.3	0.9	94.47
10	**Sodium**	368	197	46.46
11	**Electrical Conductivity**	152	16.35	89.24
12	**Dissolved Oxygen**	2.6	5.7	119.23

13	**Biochemical Oxygen Demand**	89	27	69.67
14	**Chemical Oxygen Demand**	378	113	70.11

8 CONCLUSION :

1. It was found during project that no treatment for waste water is present in Osmanabad city.
2. Untreated Waste water is directly disposed in open drain, nalla, septic tanks or open land in the vicinity of city.
3. During preliminary experimentation it was found that grey water of domestic unit BOD value around 89 mg/litre and total solids 653 mg/litre, which should be 30 mg/liter and 100 mg/liter respectively as per Indian standards for inland surface water standards.
4. Form the preliminary project survey it has been concluded that grey water generated from any place can be treated properly for reuse.
5. For decreasing the amount of BOD and COD a model was prepared and analysis of samples is done for different thickness of filtration material (sand) and found optimum thickness of sand layer for filtration. After filtration amount of BOD has decreased to 27 mg/litre and COD has decreased to 113 mg/litre.
6. Grey water treatment cost is lesser than waste water treatment. Any waste water contains 50-80% grey water. So we concluded that cost of waste water treatment can be reduced by proposing grey water treatment system. From grey water sample results of Osmanabad city It is concluded that many benefits can be obtained by proposing grey water treatment system.

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