TREATMENT AND REUSE OF GREY WATER, AN INTEGRATED APPROACH TO HOUSEHOLD WATER IN PCMC AND NATURAL STREAM PROTECTION

Mr. Sachin J. Mane

ME(Environmental)

Mr. Rakesh Kumar

Mr. Kushagra

Mr. MD. Numan Khan

Mr. Naveen Kumar

DEPARTMENT OF CIVIL ENGINEERING

D.Y. PATIL COLLEGE OF ENGINEERING, AKURDI, PUNE

'Abstract'

Fresh water unavailability is big problem which is going to be faced by whole world now a day. Fresh water unavailability can be classified in two categories first it can be because of unavailability of fresh water and second it can be because of mismanagement of fresh water. India is a country which fall in later category. Previous year population density was very less which was supporting the management of waste water but increasing population leads to unavailability of site where grey water can be poured. It was either at household level or community level. Adverse situation leads to policy method to manage waste water in some other way. They decide to collect waste water from household and treat it centrally. Waste water from household carry mainly 2% of solid in it rest is water, reflect on the fact that it is too much dilute. There is a principal in treatment industry that "dilution never results into economic treatment" so there should be effective measure on treatment of waste water at their origin. Per capita demand of water can be reduced by reusing by a proposed design of waste water in secondary activities like flushing, gardening etc. This project explain how PCD water can be reduced by reusing of waste water in secondary activities like flushing and gardening by proposed plumbing design. waste water can be managed more efficiently, we need to treat grey water at household level. It can be done by root zone technology which is most convenient, economic and best way to treat for its reutilization.

Key words: *Economic Treatment, Mismanagement, Root Zone, Reutilization*

1. INTRODUCTION

Water is a priceless gift to all living being in the world. It is second most important element after air for existence of life. Most part of Indian territories have sufficient water for their present use so people don not bother to think of future. People are not understanding that even one drop of water require huge capital and energy for its creation. Water conservation is not an issue, as it is conserved naturally. Consumable water is something which need quick attention. Increasing population require huge water supply for domestic, agricultural, industrial, recreational and various other activities. Inadequate management of polluted water leads to pollution in natural steam which effect all other living in that aquatic system.

2. Objective

1. To reduce per capita demand of water by reusing treated water. Since we propose to use less fresh water which would result in to less waste.
2. 2. To quantify the discharge and to study physical & chemical properties of domestic grey water before and after treatment.
3. 3. Design of small scale root zone plant.

3. MATERIAL AND METHODS

3.1 GENERAL

Every thesis needs some experimental set up for it is justification. It gives precise visualization of how process will take place and also helps in identifying the real time problem in execution of idea. We drew a plan of G+2 building considering it in PCMC region. It includes innovative plumbing system and will justify the methodology proposed. Root Zone Technology has been used for treatment of grey water for its reuse. More importantly we are concern about reducing PCD therefore flow reducer can play vital role on discharge point.

3.2.1 *SITE OF TESTING*

Proposed work focuses on PCMC area therefore it was very necessary to select location in same location. We Consider "C 509 Oriental Marvel, Near Moraya Gosavi Stadium, Next to Goyal Garima Building, Keshavnagar, Chinchwad, Pune, Maharashtra 411033."

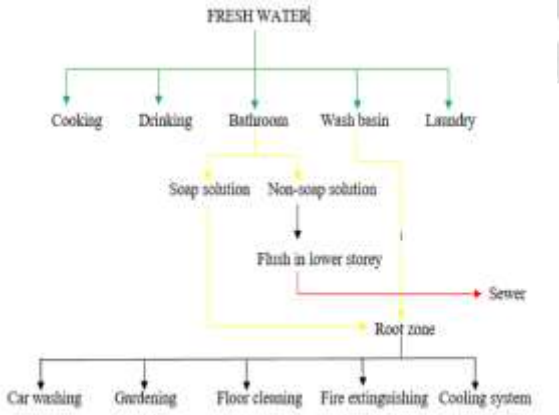
3.2.2 *SAMPLING PROCEDURE*

Representative sampling is key to the quality analysis of grey water therefore we have taken three different trial of sample. Different research paper suggests that pollution level in morning discharge is more than that of any other time & we also came to know that with increase in temperature different parameters vary therefore we opted to take sample in morning. We have taken three different samples for analysis for better representation of observation. We take first grab sample on 23rd of November 2017 by using 10 BOD bottle, by inserting bottle into the tank such that no air is allowed to enter into the bottle, 5 bottles are used for BOD, COD test and 5 bottles are used for all other tests. Second grab sample taken on 28th January 2018& third is on 9th February but rest of the procedure are same.

3.3 *I*MPLEMENTATIONAL MODEL

Let us consider a G+2 building located in PCMC in which there are 8 peoples living in which 4 are children, minimum water requirement is 135Lpcd [1].

3.3.1 *F*LOW CHART OF PROPOSED WATER USE FOR DIFFERENT ACTIVITIES.



3.3.2 *G*REY WATER ESTIMATION

Total water demand = 135lpcd*8= 1080Litre.

Different activities demand. [2]

(i) For Drinking purpose =3lpcd *8 = 24Litre.
(ii) For Bathroom purpose: 45lpcd *8 = 360Litre
   a. For soaps and detergent = 20% of 360 = 72Litre.
   b. Grey water from Bathroom = 360-72Litre = 288Litre.
(iii) For W/C and Washbasin = 40lpcd*8 = 320Litre.
   200liter of non-soap solution from bathroom will be used for flushing purpose, rest of the demand is fulfilled by fresh water supply.
(iv) For Laundry purpose = 30lpcd *8 = 240Litre.
   a. For chemicals in the laundry = 30% of 240 = 80Litre.
   b. Grey water from laundry = 240-80Litre = 160Litre.
(v) Kitchen = 10lpcd*8 = 80Litre.
   a. For Oils, Greece and Chemicals = 10% of 80 = 8Litre
   b. Grey water from kitchen = 80-8 = 72Litre.
(vi) Miscellaneous purpose = 7lpcd*8 = 56Litre.

Total grey water should be treated = 72+204+72+ (288-200) +120+160 = 716Litre.

3.3.3 *D*ISCUSSION OS DISTRIBUTION SYSTEM

Total 1080Lpcd of fresh water collecting from PCMC water supply line and is collected in under water tank and then pumped up with a 1HP [3] motor on roof, after collecting on roof used for different purposes as required but in bathroom there are two Nani trap one is used for collecting for foams and detergent & other is used for collection of grey water, when one is used other is closed with lid cover. After use of fresh water non-soap solution water of G+2 is used in the G+1 for flushing purpose by the use of tank situated on chajja of G+2, remaining non-soap solution with kitchen grey water, laundry grey water passed from root zone media. After treatment of water the treated grey water pumped up with 1HP [3] motor and collected in overhead water tank and then the treated water used for different secondary purposes such that the fresh water demand is reduced. Flushed water and black water is then collected in bore hole and then via duct it is passed in municipal waste supply line.

3.4 *I*NSTALLMENT OF FLOW REDUCER

Generally, on household level people install some discharge capacity tap, contrary every utility need different discharge capacity for their efficient function for example discharge rate from bath room tap obviously should have more than wash basin. Therefore, these less discharge utilities contribute in unnecessary wastage of water, thus we need to install different discharge flow rate for different activities such that it should be sufficient to fulfill the purpose. We propose to install flow reducer to wash basin, kitchen sink. Importantly it is applicable to the existing tap and flow reducer can be installed by an individual with ease.

3.5 *E*STABLISHMENT OF ROOT ZONE TECHNOLOGY

3.5.1 PRETREATMENT

The wastewater flowing through the pipe contains silt/sediments, floating suspended materials (polythene pouches, leaves wood pieces etc.) To remove the floating material and other debris we did not provide any separate instrument, all the floating material should be moved by maintaining gradient of 1:100 such that self-cleaning velocity can be achieved such that the grey water tank will carry minimum suspended particle. Prior to entry in the root zone system the wastewater is pretreated in grey water tank of 2.57m^3 capacity with retention time of 12 hours. This chamber provides detention time for settling of solids presents in the wastewater. This pretreatment helps in removing the floating materials and sediments to large extent from the wastewater before.

3.5.2 *ROOT ZONE OR MAIN REED BED*

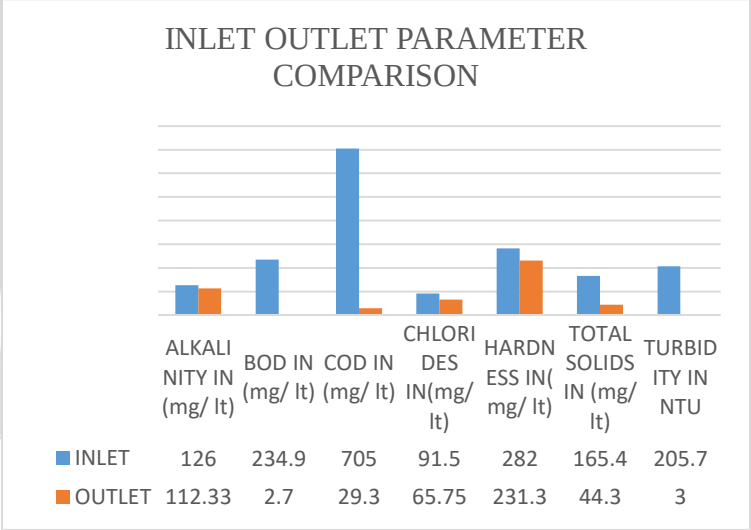
1.Gravel bed: The root zone bed was constructed in an area of 26 m^2 having depth 0.70 m, approximate length breadth ratio 2:1, 1% slope and water retention time of 12 hr. The bottom of bed is sealed by compact 8-10 cm layer of locally available clay having impervious property. The bed was filled with gravels (0.7 cm to 2.5 cm diameter) [4] to enable profuse root zone development and increased hydraulic capacity.

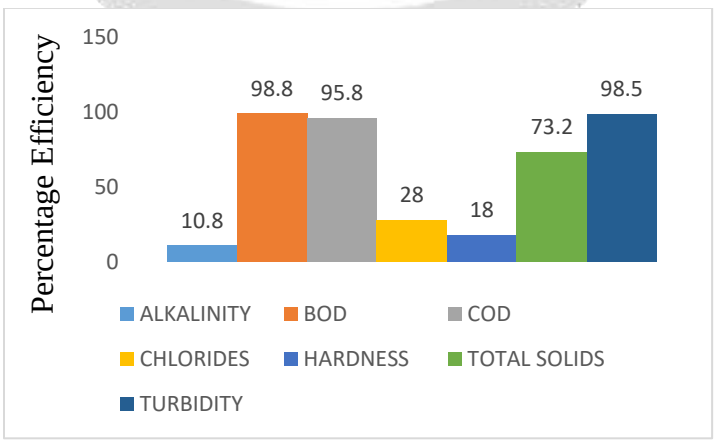
2. Inlet and outlet arrangements: To enhance the distribution of waste water along the full cross-sectional area in the root zone bed, horizontal PVC pipe (10 cm diameter) [4] with orifices across the whole breadth was laid at the surface of the inlet. For collection of treated wastewater from the root zone system perforated PVC pipe (15 cm diameter) [4] was embedded in the bottom of the bed at the distal end. The treated water from the root zone bed flows to a sump at the outlet point and is controlled by a PVC bend pipe fixed at appropriate height. This helps in maintaining the water level in the gravel bed.

3. Plants*:* - The macro phytic vegetation play important role in functioning of root zone treatment systems. The common Reed grass Phragmites species is especially suitable because of strikingly deep roots (up to 0.75 m) [4] and rhizomes with large number of rhizospheres per unit surface area. In the present study the gravel bed was planted with reed grass-Phragmites karka- The density of plantation was 02 plants per square meter.

4. PERFORMED EXPERIMENTS AND RESULT DISCUSSUION

Efficiency of Root Zone Technology can be known by testing different parameter before and after treatment. Since we are supposed to reuse treated water for secondary activities therefore quality analysis of different parameter should be with in permissible limit. Results of some important experiments are mentioned below justifying the feasibility of proposed work.





4.1 NEW ESTIMATION OF DEMAND PER CAPITA

Since waste water generated considering 8 occupant is 716 litre per day. Generally 20% water loss occur in treatment therefore reuse of treated water for each occupant would be 716*0.8/8=71.6 litre per capita per day. So reduced fresh water demand is approximately 130-70=65 litre per capita.

4.2 EFFECT OF NEW PROPOSED DESIGN ON PCMC

Every activity on domestic level does not need quality of potable water for its use. We propose to use secondary water for less important activities such as flushing, cleaning etc. Proposed design emphasizes on reuse of treated water. It is hugely advantageous in terms of quantity and quality as well. PCMC is a huge growing city and leads the growth of national population growth of 2% by 5% **[3].** Proposed Fresh water used PCD is 65 LPCD and current population is 2.2 million. Implementation of proposed design will enhance the service life of STPs, WTP. Existing Capacity of WTPs is 480 MLD. Considering 15% losses, Capacity of WTPs may be taken as 417MLD and can serve population of 6.42 million. Considering reduced demand is even 65 MLD. Waste water generated would be 107.25MLD, considering 75% of fresh water is waste water. Capacity of existing STPs are 333MLD **[5]** which is surely more than sufficient. Some STPs which are not functioning properly and cause degradation in quality of environment especially in domain of atmosphere should be audited properly and if found so should be shut with immediate effect

5. CONCLUSION

Reuse of treated water should be encouraged as it enhances the water potential of area and reduces the load on water bodies in that area. Proposed design reduces the per capita demand to almost 50% therefore existing capacity of WTP would be sufficient for population of 5.56 Million. Decrease in fresh water demand will reduce waste water generation. Audit of STPs working now a day should take place and some of the STPs which are not functioning properly and contributing in environmental pollution specially degradation of air quality which affect adversely on people living nearby should be closed like AKURDI STP. Since rest of STPs would be sufficient to treat waste water if proposed design is implemented. Huge water loss takes place in conveyance because of leakage and cause loss to economy so it should be taken care and modern technique should be used for its remedy.

6. REFERENCES

[1]. Indian Standard 1172; 1993

[2]. J.B.Kagathara; ME (Environmental) LFIWWA, MIAEM NEERI (LONDON) ; Ex. Special City Engineer RMC and Consultant

[3]. Home Tips, LLC 3715 Market Street, Suite 205 Glendale, CA 91208 USA

[4]. STUDY OF ROOT ZONE TECHNOLOGY FOR CAMPUS WASTE WATER TREATMENT; G.Baskar, V.T.Deeptha and A.Abdul Rahaman School of civil engineering Faculty of Engineering and Technology, SRM University, Kattankulathur, Chennai (INDIA)

[5]. Pimpri Chinchwad Municipal Corporation.