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Sustainable Development using Grey-Water Treatment

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Abstract - *In the developing countries like India, the main issue of concern is the declination of water resources. The reasons for the resources declination are over pumping of ground water, increasing fluoride concentration, surface water such as rivers, lakes, ponds, streams are depleting due to famine conditions and uneven precipitation. However, how there is a need to focus on this major issues, in the form of recycling and saving of water. To overcome the scarcity of water, Recycling and Reuse of waste water by treating it with physical, chemical and biological process. It improves Quality of water by removing various contaminations such as suspended solids, dissolved solids and biological impurities. Scope for treatment may include grey water design, quality improvement and reduction impurities, etc. Waste water treatment may be done either by diversion methods, filtration method. In our project we are focusing to make ecofriendly filter bed by using locally available materials such as brickbats, gravel and charcoal combines with root zone technique to increase in the quality of water with minimum operational and maintenance cost.*

***Key Words*: (Grey Water Treatment, Root Zone Technique, Gravel Filter, Brick Bat Filter, Charcoal, filter Sewage Treatment)**

1. INTRODUCTION

Grey water is slightly used water from your bathroom, showers, sinks, tubs, washing machines, etc. which is not contact with black toilets, urinals. It may contain waste food, traces of dirt, grease, hair, and other household cleaning products. California's latest grey water standards define Grey water that the untreated wastewater that has not been contaminated by any toilet discharge, has not infected, contaminated or unhealthy bodily wastes. It does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes. It may be contaminated with a range of soluble and insoluble (particulate) substances such as soaps, detergents, skin, saliva, dirt and lint. Each type of contaminant, whether it is detergent/surfactant, organic, microbial or particulate, must be treated appropriately. Grey water makes up around 30 to 50 per cent of wastewater discharged into the sewers. If this grey water is recycled at its source or make some arrangement separately, it will reduce the load on sewage treatment plants and also reduces the water demand. Recycle and Reuse of grey water for irrigation reconnects urban residents and our backyard gardens to the natural water cycle. The easiest way to use grey water is to pipe it directly outside and use it to water ornamental plants or fruit trees. Grey water can also be used to irrigate vegetable plants as long as it doesn't touch edible parts of the plants. In any grey water system, it is essential to use plant friendly products, those without salts, boron, or chlorine bleach.

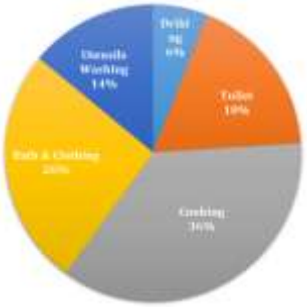

Fig -1: Domestic Water Distribution

1.1 Factors Affecting Characteristic of Grey Water

- Quality and type of the water supply
- Type of distribution net for drinking water
- Type of distribution net for grey water
- Activities in the household
- Installation from which grey water is drawn
- Type of source
- Geographical location
- Demographics and level of occupancy
- Quantity of water

1.2 Source of Grey Water

1.2.1 Bathroom

- **Microbiological –** Lower Level of thermo-tolerant coli form.
- **Chemical –** Soap, shampoo, hair dyes, tooth paste and other cleaning chemical.
- **Physical –** High suspended solid and turbidity
- **Biological –** low level concentration of BOD

1.2.2 Sink & Basin

- **Microbiological –** Variable thermo-tolerant coli form.
- **Chemical –** Detergent, Cleaning agent, etc.
- **Physical –** Food particle, oil, fat, and grease causes turbidity.
- **Biological –** High concentration of BOD.

1.3 Problem Statement

India is a semiarid region with water scarcity and a strong pressure on water sources caused by the rapid increase of population and industrialization. In this region, rain water harvesting alone is not enough to meet water supply demands due to the irregular distribution of rainfall in time and space.

Integrating rainwater harvesting with grey water reuse resulted in a more feasible and reliable strategy than those strategies based only on rainwater harvesting. Furthermore, the investments can be amortized in a shorter period of time.

1.4 Objective

- To reduce daily water supply demand
- To minimize the amount of waste water entering into sewer
- To determine the COD & BOD of grey water
- To enhance the quality of food crops.
- To reduce the loads comes on STP.
- To save fresh water, money, energy resources.

2. LITERATURE REVIEW

In 2015, Prof. Abeer Albalawneh research on Review of the Grey Water and proposed Grey Water recycling scheme for agricultural, irrigation reuses. As per research, Grey Water treatment methods vary based on site condition and Grey Water characteristics. Water consumption always depends on the quality of life standards and availability of resources. The ranges of electrical conductivity, turbidity and suspended solids for dark Grey Water are 190-1,830µS cm^{-1}, 19-444 NTU and12-315 mgL-1 respectively. while for light Grey Water these ranges are 14-921 µScm^{-1},12.6-375 NTU,and 29-505 mgL-1 respectively. Physical Grey Water treatment systems include filtration and sedimentation. A mean removal of 30% COD and a maximum E coli removal of two log CFU/100 ml was observed. Electro coagulation was effective at treating shower water from building.

In 2017, Prof. R. T. Pachkor research on the Integrated approach for grey water treatment. As per research, grey water comprises 50-80% of residential waste water. Grey water gets its name from its cloudy appearance and from its status neither fresh nor heavily polluted. Grey water is a domestic's waste water that is collected from dwelling units, commercial building and institutions of the community. Many new or modified treatment processes are being usage is becoming a necessary facet of good management. In this method quantification of grey water was determine by direct method like water meter, bucket method and indirect method like water consumption and type of uses.

Prof. J. S. Lambe research on the GREY WATER-TREATMENT AND REUSE. As per research, Geographical area which forms 2.4% of the world's land area. Water used in bathing and hand washing purpose, produces around 50-60% of total Grey Water and is assumed to be the least contaminated type of Grey Water. It readily promotes and supports the growth of micro-organisms. Grey Water from kitchen generates about 10% of the total Grey Water. Grey Water reuse methods can range from low cost methods such as the manual bucketing of Grey Water from the outlet of bathroom to primary treatments method that coarsely screen oils.

In 2013, Rawa Al-Jarallah research on The potential for reusing grey water and its generation rates for sustainable potable security in kuwait. As per research, the amount of fresh water produced will not be sufficient to meet the demand. Indeed, the shortage of fresh water is becoming a global problem. This issue has caused the scientific community to explore alternative water sources, such as wastewater reuse. The Grey Water generated as a percentage of the total water consumption differs from one country to the next based on age, gender, living standards, habits and the degree of water abundance. In australiya, 50% of the water consumed is transformed into Grey Water and reused in toilet flushing and irrigation, reducing the total water consumption by 29%. Untreated Grey Water treatment systems and biological treatment systems (environmental agency, 2011). Selection of a treatment system is based on the ultimate use.

In 2018, Jie Zhu research on Feasibility of on-site grey water reuse for toilet flushing in china. As per research, drought and water shortage are the key factors for water scarcity in arid and semi-arid areas. As a result, there is a growing need to manage water resources in a sustainable manner. As for water reuse, current technology manages to treat waste water into any desired quality compared to household composite domestic wastewater, grey-water is more lightly polluted, thus the treatment process should be optimized; the key problem is how to balance the investment and treatment costs with reuse criteria. In this paper, summary of the current grey water treatment systems and provides advice on its application. Recently, the most commonly described and promising application for grey-water reuse has been toilet/urinal flushing, which can reduce water demand within a dwelling by up to 10–30.

3. METHODOLOGY

In these project we treated Grey Water using various filter media such as gravel bed, brick bat, charcoal and root zone technique. First of all untreated Grey Water is collected in overhead tank then it allows to passed in root zone tank.

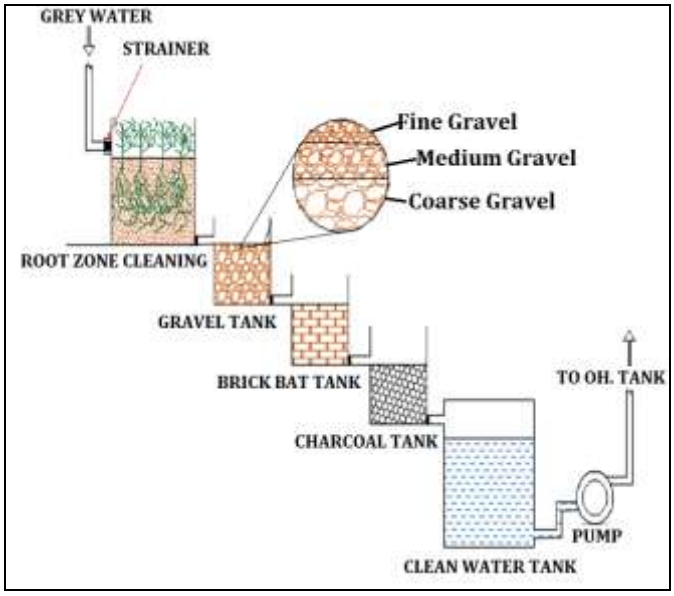

Fig -2: Process of Grey Water Treatment

3.1 Root Zone Treatment

Root zone technology is a novel technology for wastewater treatment with low cost and energy saving. In root zone system the order of untreated Grey Water is removed by removing organic load, nitrogen, surfactants & pathogens from grey water. It removed order of COD, nitrogen, surfactants of untreated Grey Water upto 93%, 90%, 85% respectively. The Grey water flow through the root zone in a vertical or horizontal way in which the organic pollutants are biochemically decomposed by the bacteria present in the rhizosphere of root plants. Soap and detergent in Grey Water consists of phosphorus which assist in plant growth and act as nutrients. In root zone system concentration of facial Bactria is decreases.

3.2 Gravel Filter

Gravel Filter is a more effective filter media because it's capable to hold back precipitates which contain impurities. In gravel filtration it removes suspended solids, particulate matters, colours & odour of grey water by sedimentation process. Filter Gravel size, hardness and angularity are the important filter Gravel characteristics to ensure proper filtering. Three layers of gravels are usually employed. fine size gravel are used at bottom, middle size gravel used at middle portion and course gravel is used at top.

3.3 Brick Bat Filtration

In Brick bat filtration it removes turbidity efficiency into 75%. Brick bat is easily available material hence it is economical to use. Filtration efficiency of brick bat is increases when their mean dimensions is decreases.

3.4 Charcoal Bed Filter

Charcoal (activated carbon) commonly used technology based on adsorption of contaminate which remains after filtration process. It removes effectively certain organics (such as unwanted taste & Odour, micro pollutants) chlorine, fluorine or radon from wastewater but disadvantages of these filter media has to be replaced regularly. Charcoal has pores where contaminants adhere to the surfaces of the activated carbon. These process is called Adsorption. Granular activated carbon is used to remove dissolved organic pollutants present in water. The efficiency of filter is also high

4. RESULTS

4.1 Total Suspended Solids

Table -1: Total Suspended Solid

Sr.No.	Sample Of Grey Water	Total Suspended Solid	
		Gray water	Purified Water
1	1 Day	1280	900
2	2 Day	1372	850
3	3 Day	1150	825

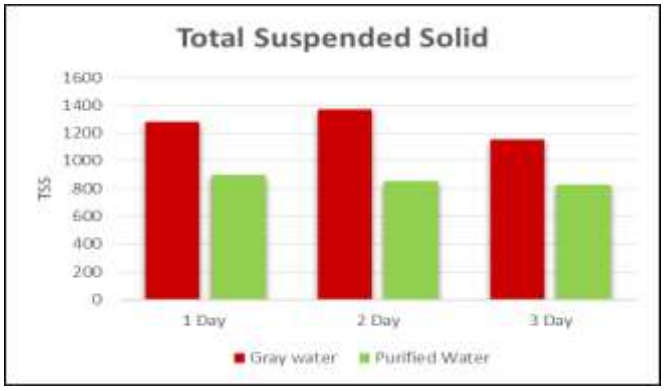

Chart -1: Total Suspended Solid

4.2 Turbidity

Table -2: Turbidity

Sr.No.	sample of grey water	Turbidity	
		Gray water	Purified Water
1	1 Day	13.8	11.7
2	2 Day	14.5	14.18
3	3 Day	12.8	11.25

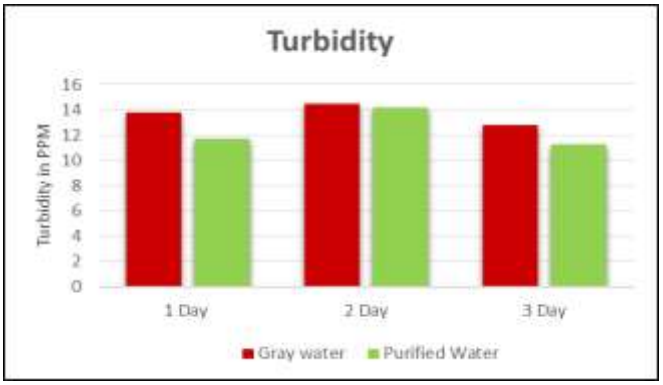

Chart -2: Turbidity

4.3 pH Determination

Table -3: pH Determination

Sr.No.	sample of grey water	pH	
		Gray water	Purified Water
1	1 Day	8.7	8.5
2	2 Day	8.1	7.7
3	3 Day	7.8	7.2

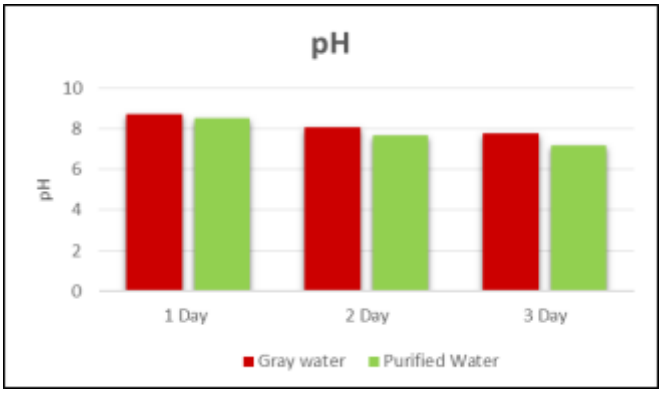

Chart -3: pH Determination

4.3 Biological Oxygen Demand

Table -4: Biological Oxygen Demand

Sr.No.	sample of grey water	BOD	
		Gray water	Purified Water
1	1 Day	59.4	41.2
2	2 Day	45.7	30.5
3	3 Day	30.6	27.9

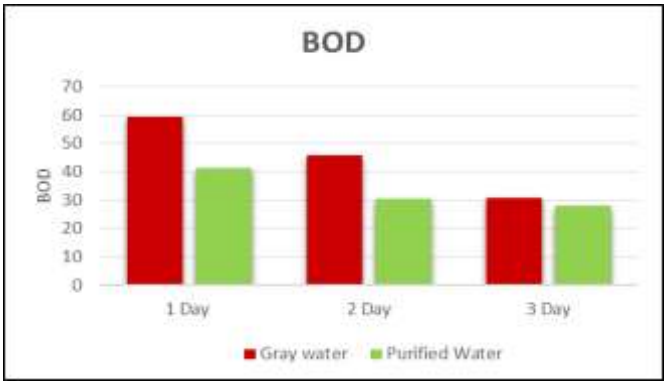

Chart -4: Biological Oxygen Demand

4.5 Chemical Oxygen Demand

Table -5: Chemical Oxygen Demand

Sr.No.	sample of grey water	COD	
		Gray water	Purified Water
1	1 Day	102.9	96.4
2	2 Day	92.3	84.2
3	3 Day	60.23	42.8

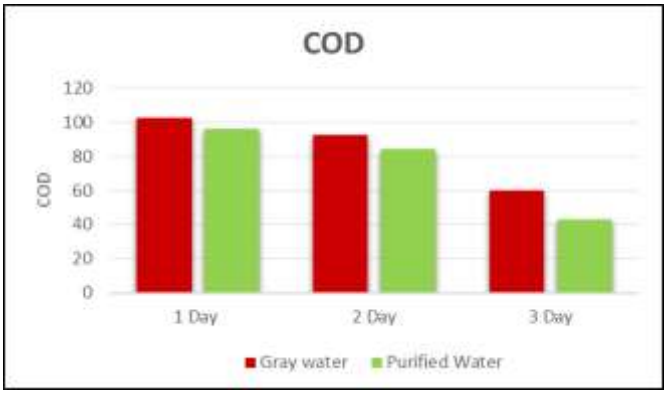

Chart -5: Chemical Oxygen demand

5. CONCLUSION

The benefits of Grey Water recycling is to Reduced use of freshwater, Less strain on septic tanks or treatment plants, More effective purification, feasibility for sites unsuitable for a septic tank, reduction in use of energy and chemicals, Groundwater recharge, Plant growth, Reclamation of nutrients, Increased awareness of, and sensitivity, to natural cycles, Saving water per day, Saving of 900 to 1500 liter water per day in Sinhgad Academy of Engineering, kondhwa. Grey water reuse for toilet flushing and gardening. Grey water is typically alkaline due to soaps & detergents but after treatment pH of grey water is decreases up to 7.5. It removes turbidity efficiency up to 92%. It removes BOD load with efficiency of 95%. With the use of natural media in these filtration system grey water treatment system proved to be economical.

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