

Physicochemical Characterization of Grey Water and Treatment

KavitaGour, ParasBatra

Abstract The international water management institute system predicts that by 2025, one person in three will live in conditions of absolute water scarcity. When grey water properly managed, grey water can be a valuable resource for horticulture, agriculture growers as well as flushing for toilet. The paper presents a design of Grey water treatment system for treatment of grey water for residential area. The Treatment system combines biological treatment with physicochemical treatment. The Treatment system produced effluent of excellent quality, meeting the BIS quality regulation. Grey water treatment system was very efficient in removal of Suspended solids, Turbidity, Total hardness, Sulphate, Nitrate, Total phosphorous, Sodium, BOD, Total coliform, Faecalcoliform & E-coli. Total coliform, Faecalcoliform & E-coli is absent in produced effluent & that also met drinking water standards. Further, the paper discusses the implications on the applicability of grey water reuse for toilet flushing purpose. Recycling of grey water reduces the amount of fresh water needed to supply and reduces the amount of waste water entering sewer or septic tank.

Keywords : Treatment, Waste Water, Recycling

I. INTRODUCTION

Wastewater that is discharged from a house, excluding black water (toilet water) is known as Grey water. Sources of Grey water are showers, bathtubs, sinks, kitchen, dishwashers, laundry tubs, and washing machines. Grey water contains soap, shampoo, and toothpaste, food particles, droplet of cooking oils, liquid & solid detergents and hair. It gives the largest proportion of the total wastewater flow from households or office in terms of volume. Typically, 50-80% of the household wastewater is greywater. Wastewater recycling has been and continues to be practiced all over the world. (1) The advantage of recycling grey water is that it can be used for toilet flushing and outdoor uses such as car washing and garden watering. However, at larger scale, other applications such as irrigation of parks, school yards, cemeteries and golf courses, fire protection and air conditioning have been considered. Grey water recycling is both feasible and can contribute to sustainable water management is now widely accepted. The amount of grey water generated in a office/ household can vary place to place. While the water consumption is different as per the need of the person.

It is about 20- 30 litres per person per day for some people while the requirement is much higher to other people. (2)

II. MATERIALS & METHODS

Domestic grey water sample was collected for physicochemical & bacteriological analysis various physicochemical parameter like pH, conductance, TDS, Chloride, sulphate, ammonia. Nitrate-Nitrogen, Nitrogen, So dium, Phosphorous, BOD, Total hardness were carried out. Standard methods as per mentioned in table 1 is used for determination of physicochemical and biological parameters.

A. Details of Grey Water Treatment Unit

Storage tank : Initially the water is stored in this unit before the treatment starts. Capacity of storage tank is about 32 liters of water at a time.

Aeration tank: Aeration is a unit process in which air and water are brought into intimate contact. Aeration is important water treatment process, it is used for the following operations: carbon dioxide reduction, oxidation of iron and manganese detected in many well waters, ammonia and hydrogen sulfide reduction. The aeration is a useful method for bacteria control. In this unit with the help of compressed air machine, oxygen is mixed with water using air diffusion method. **Flash mixer:** Flash mixture is basically for proper mixing of chemical or coagulant. Alum was used a coagulant in this unit. **Sedimentation tank:** The sedimentation process removes many particles including clay and silt based turbidity, natural organic matter, and other associated impurities. These impurities include microbial contaminants, toxic metals, synthetic organic chemicals, iron, manganese and humic substances. Humic substances come from soil are produced in natural water. Their sedimentation occurs by chemical and biological processes. **Filtration unit:** The last step in purifying the water is accomplished by passing water through a bed of sand and gravel. As water filters through the sand, the remaining particles of suspended matter are trapped in the sand bed. In the filtration process, water flows on top of the sand bed and travels through the bed until it is collected at the bottom in under drains. The water passes through different filter media for its filtration. **Disinfection:** Disinfection is the process of inactivation of pathogenic microorganisms in Greywater. Disinfection provides the opportunity for homeowners to use treated greywater for domestic purposes, such as toilet flushing and car washing. There are many methods of disinfection: chlorine, bromine chloride, calcium hypochlorite, ozone and ultraviolet radiation. **Disinfection unit by UV Rays:** The water enters this unit for the process of disinfection which is done by UV ray light fitted in the tank.

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Disinfection unit by chlorination: The water is again disinfected by the process of chlorination in the final unit. (3-5)

Preparation Of Filtering Media : Fine and coarse aggregate were taken and sieve analysis was done .Appropriate sizes of aggregates taken for the filtering media .The aggregates were washed and oven dried at 1000 C for 24 hours and then various layers were set in the filtration unit.



Fig1a :Filtration Media



Fig1b :Grey water Treatment Unit

Physical, Chemical & Biological Parameters In Grey Water Following results were obtained in grey water sample. EC, Turbidity suspended solids, Total hardness, sulphates, ammonia, nitrate-N, total phosphorus, sodium, nitrogen & BOD is very high. Bacteriological parameters T. colliforms, F. colliforms & E. Coli were present in high numbers. Post treatment result of grey water from designed unit was as per acceptable limit prescribed in IS 1202 .Removal efficiency for E. Coli, Total Coli. and F. Coli was 100%.

TABLE I

Physicochemical, Bacteriological Parameters In GREY Water (Before Treatment)

Parameters	Unit	Pre Treatment Results	Test Methods
pH	-	7.2	APHA 22 Ed 2012,4500-H-B4-92
Electrical Conductance	umhos/cm	1998	APHA 22 Ed 2012,2510_B,2-54
Turbidity	NTU	340	APHA 22 Ed 2012,2540-D
Suspended Solid	mg/lit	532	APHA 22 Ed 2012,2130-B,2-13
Total	mg/lit	160	APHA 22 Ed 2012,2340-

hardness(As CaCO ₃)			C,2-44.45
Sulphate(asS O ₄)	mg/lit	28	APHA 22 Ed 2012,4500-SO4-E.4-190
Ammonia	mg/lit	2.50	APHA 22 Ed 2012,4500NH3,F,4-114
Nitrate-N	mg/lit	0.25	APHA 22 Ed 2012,4500NO2,B
Total phosphorus	mg/lit	2.380	APHA 22 Ed 2012,2005,4500P-E
Sodium	mg/lit	280	APHA 22 Ed 2012,3500-Na-B,3-97
K jeldahl Nitrogen	mg/lit	5.48	APHA 22 Ed 2012,4500 NH3,B&C
BOD	mg/lit	400	IS 3025,part 44,1993,Reaffirmed1999
Total Colliforms	MPN/100 ml	3,50000	APHA 22 Ed 2012,9221-B&C,9-66,9-69
FaecalColliforms	MPN/100 ml	2,40000	APHA 22 Ed 2012,9221-B,C&E,9-66,9-69,9-74
E-Coli	MPN/100 ml	1,30000	APHA 22 Ed 2012,9221-B,C&G9-66,9-69,9-76

TABLE II

Physicochemical, Bacteriological Parameters In GREY Water (After Treatment)

Parameters	Unit	Pre Treatment Results	Test Methods
pH	-	7.1	APHA 22 Ed 2012,4500-H-B4-92
Electrical Conductance	umhos/cm	1908 umhos/cm	APHA 22 Ed 2012,2510_B,2-54
Turbidity	NTU	6.8 NTU	APHA 22 Ed 2012,2540-D
Suspended Solid	mg/lit	10 mg/lit	APHA 22 Ed 2012,2130-B,2-13
Total hardness(As CaCO ₃)	mg/lit	150 mg/lit	APHA 22 Ed 2012,2340-C,2-44.45
Sulphate(as SO ₄)	mg/lit	30 mg/lit	APHA 22 Ed 2012,4500-SO4-E.4-190
Ammonia	mg/lit	1.90 mg/lit	APHA 22 Ed 2012,4500NH3,F,4-114
Nitrate-N	mg/lit	0.21 mg/lit	APHA 22 Ed 2012,4500NO2,B
Total phosphorus	mg/lit	1.200 mg/lit	APHA 22 Ed 2012,2005,4500P-E
Sodium	mg/lit	230 mg/lit	APHA 22 Ed 2012,3500-Na-B,3-97
K jeldahl Nitrogen	mg/lit	2.3 mg/lit	APHA 22 Ed 2012,4500 NH3,B&C
BOD	mg/lit	18 mg/lit	IS 3025,part 44,1993,Reaffirmed1999
Total Colliforms	MPN/100ml	ABSENT	APHA 22 Ed 2012,9221-B&C,9-66,9-69
FaecalColliforms	MPN/100ml	ABSENT	APHA 22 Ed 2012,9221-B,C&E,9-66,9-69,9-74
E-Coli	MPN/100ml	ABSENT	APHA 22 Ed 2012,9221-B,C&G9-66,9-69,9-76

III. RESULTS & DISCUSSION

The Treatment system produced effluent of excellent quality, meeting the BIS quality regulation. Grey water treatment system was very efficient in removal of Suspended solids, Turbidity, Total hardness, Ammonia, Nitrogen, Nitrate, Total phosphorous, Sodium, BOD, Total colliform, Faecalcoli form & E-coli. Total colliform, Faecalcolliform & E-coli is absent in produced effluent. Other parameters were in the range after the treatment process as mentioned in IS: 10500, 2012. This treated grey water can be reuse for toilet flushing.



IV. CONCLUSION

Reusing grey water will help definitively to solve the problem of water demand in the world. The treatment system can be easily adopted by the developing countries. This treated grey water can be reuse for toilet flushing.

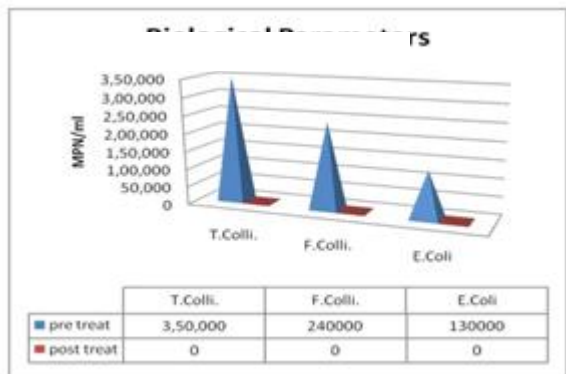


Fig. 2a : Biological Parameters

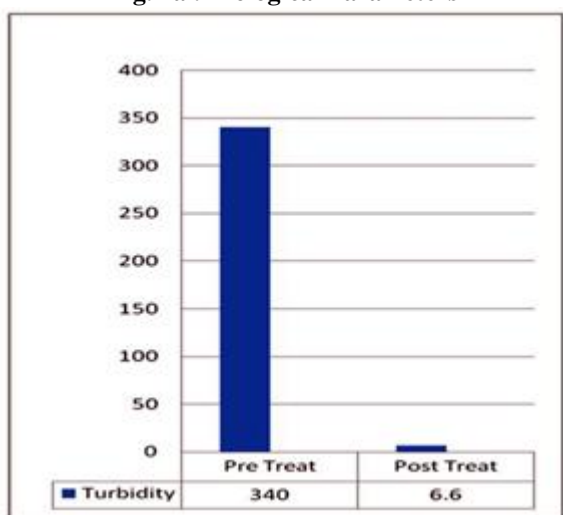


Fig. 2b : Comparison of Turbidity in Grey Water (Pre and Post Treatment)

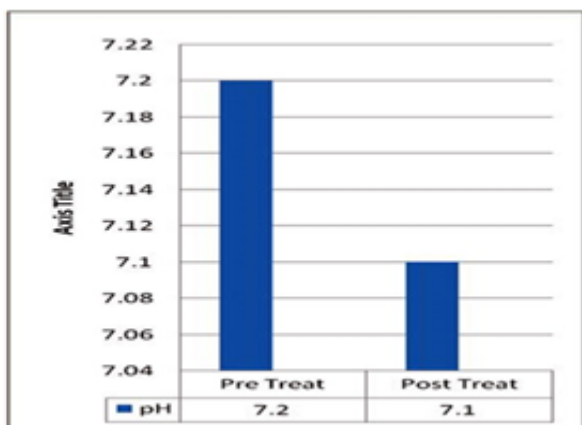


Fig. 2c : Comparison of pH in Grey Water (Pre and Post Treatment)

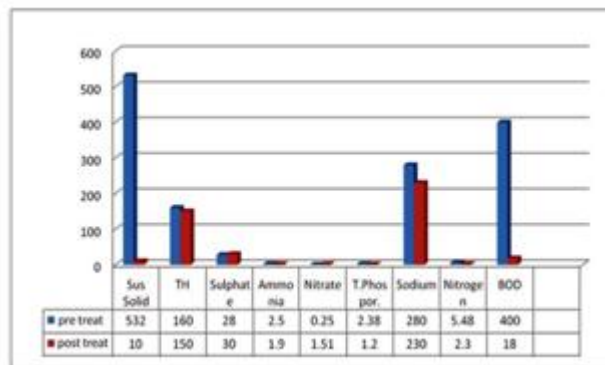


Fig. 3 : Comparison of other physicochemical Parameter in Grey Water (Pre and Post Treatment)

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AUTHORS PROFILE



Dr. Kavita Gour Presently working as Associate Professor and having 25 Years teaching experience. She has published 30 researches Paper in Journals and 26 Papers in conference. She has presented many papers in International conferences and received best Research Paper Award at Malaysia. She has guided PhD, M.Tech, B.E. Students and authored 2 Books.



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