

GREYWATER REUSE: A REVIEW

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ABSTRACT

Abstract: Today, the biggest problem is scarcity of water which is vital for survival of living things, so the different methods are being adopted to reuse the waste water. We propose the treatment of greywater for analyzing the recycling of household greywater through a simple process. Many authors investigated many aspects of the utilisation of grey water/waste water for recycling the increases the availability of water supply, reduces vulnerability to drought and enable greater human benefits with less use of fresh water. Greywater use is important because restricts fresh water demand and reduce stress on treatment system. The treated greywater can be used for non-potable purposes such as irrigation, toilet flushing, car washing and dust control etc. The use of greywater is therefore the last option for water conservation. Greywater reuse is one of the main alternatives for reducing potable water consumption in households, industries and commercial buildings. In times of drought, especially in urban areas, greywater use in gardens or toilet systems helps to achieve some of the goals of ecologically sustainable development. This paper summarizes by various authors who investigated many aspects of utilization of greywater.

Keywords: Greywater, Blackwater, Recycling & Reuse etc.

1. INTRODUCTION

Water is becoming a rare resource in the world. In India alone the international water management institute (IWMI) predicts that by 2055, one person in three will live in condition of absolute water scarcity (IWMI, 2003). It is therefore essential to reduce surface and ground water use in all sectors of consumption, to substitute fresh water with alternative water resource and to optimize water use efficiency through reuse option. These alternative resources include rainwater and greywater.

Waste water is generally made of black water and greywater. Greywater is waste water generated from bathroom, laundries, kitchens, those components of household sewage that do not come from toilet, urinal.

Grey water, also known as sullage, is non-industrial wastewater generated from domestic processes such as washing dishes, laundry and bathing. Greywater 55% -75% of waste water. Grey water is distinct from black water in the amount and composition of its chemical and biological contaminants.

Due to rapid population growth, unplanned urbanization, surface water pollution and continuous ground water extraction. To deal with this complicated situation, some innovative measures should be taken to minimize the use of potable water. Recycle and reuse Grey water, rainwater harvesting during monsoon are good options for saving fresh drinking water. The present paper reviews the research work done on various aspects involved in Reuse of Greywater.

2. SOME EXPERIMENTAL STUDIES

1. **Shaikh, sk sameer (2015)** studied the greywater to achieve this objective, samples were collected from 100 households and laboratory tests were conducted on these samples and they revealed the presence of the BOD, TSS, COD, and Coliforms etc. From the results an attempt has been made to prepare the laboratory scale integrated model for the treatment water. It is hoped that this project would be of great help for the cities of developing countries especially, countries affected by drought.

2. Kamal Rana, Mitali Shah, Amita Upadhyay (2014): A review of those processes has been done to identify the best suited processes at household and community level. Septic tank, constructed wetland and intermittent sand filter are identified as the most suitable processes for decentralized treatment due to the simple operation and maintenance facilities as well as cost effectiveness of these systems.

3. J.S.Lambe, R.S.Chougule (2010): It is possible to intercept this grey water, at the household level, treat it so that it can be recycled for garden washing and flushing purposes

4. Zeng sheng et al (1) carried out treatment of kitchen wastewater by coagulation magnetic separation method. The dosage and dosing sequence of magnetic power and coagulant were studied. The comparison between coagulation magnetic separation and convention coagulation was also carried out. The concentration of oil and suspended solids were reduced from 149 mg/L and 285 mg/L in influent to 5.2mg/L and 68 mg/L in effluent respectively after treatment by equipment developed. space occupied by the equipment was only half of that by dissolved air floatation process.

5. Saroj B. Parjane, Mukund G. Sane suggested the best alternative and cost effective process in rural area for the reuse of greywater in which they presented the finest design of laboratory scale greywater treatment plant, which is a combination of natural and physical operations such as primary settling with cascaded water flow, aeration, agitation and filtration, hence called as hybrid treatment process.

3. SOURCES OF GREY WATER

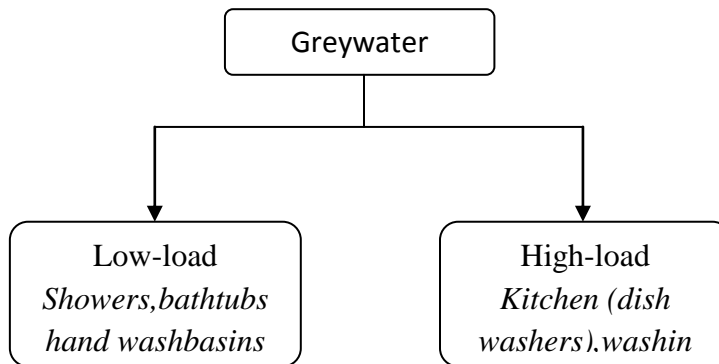
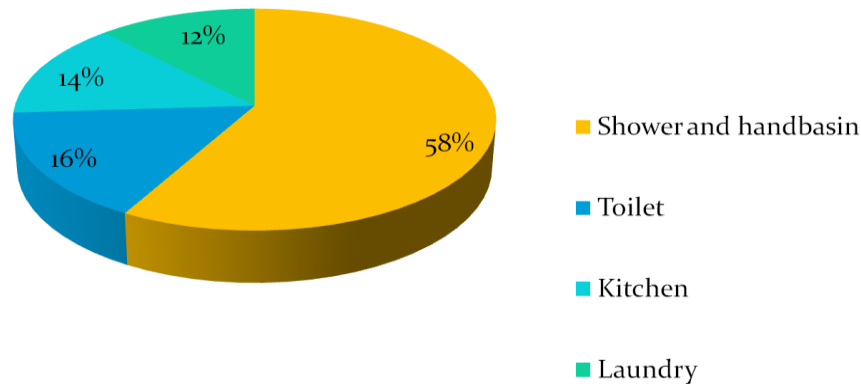


Table 1: Greywater sources

Water	Sources	Possible uses
Fresh water	Ground & surface water	Drinking, cooking, bathing
Grey water	Bathing, cloth washing	Toilet cleaning, irrigation, floor washing, construction after treatment
Black water	Toilet, urinal	No use in majority of the cases and requires extensive treatment

I. Daily water usage

According to state and local authorities we each use about 140 litres of water per day for cleaning and washing - greywater. The table below lists the expected volume in litres from each greywater source.



4. CHARACTERISTICS OF GREYWATER

Common Contaminants found in greywater are salts, food particles, oil, surfactants and microorganisms. Indeed, the greywater characteristics are highly variable as influenced by factors such as lifestyle, social and cultural behaviour of residents, and water availability. The characteristics of grey wastewater depend firstly on the quality of the water supply, secondly on the type of distribution net for both drinking water and the grey wastewater and thirdly from the activities in the household. The compounds present in the water vary from source to source, where the lifestyles, customs, installations and use of chemical household products will be of importance.

I. PHYSICAL CHARACTERISTICS

1) Temperature

- Grey water temperature is often higher than of the water supply.
- Varies within a range of 18-30°C.
- This is due to use of warm water for personal hygiene and discharge of cooking water

2) Colour

- Colour of grey water is greyish.

3) Turbidity

- Grey water is less turbid as compared to waste water.
- Its turbidity lies between 15-270 NTU

II. CHEMICAL CHARACTERISTICS

Parameters	Unit	Range
pH	-	6.4-8.1
Suspended solids	mg/l	40-340
Turbidity	NTU	15-270
BOD ₅	mg/l	45
Nitrate	mg/l	0.1-1.0
Ammonia	mg/l	1.0-26
Total kjeldhal nitrogen	mg/l	2-23
Total phosphorus	mg/l	0.1-0.8
Sulphate	mg/l	0.3-12.9
Conductivity	mS/cm	325-1140
Hardness	mg/l	15-50
Sodium	mg/l	60-250

5. GREY WATER TREATMENT TECHNOLOGY

The choice of technology for grey water treatment is dependent on several factors:

- Planned site
- Available space
- User needs
- Investment and maintenance costs

TREATMENT PROCESSES

Treatment processes divide into three types

- 1) Primary Treatment
- 2) Secondary Treatment
- 3) Tertiary Treatment

1) PRIMARY TREATMENT

- Oil, grease and suspended solids may lead to collection, Treatment and disposal problems.
- The aim of primary treatment is removal of coarse solids, settleable suspended solids, oil and part of organic matter.
- Some organic nitrogen and phosphorous as well as heavy metals associated with those solids are also removed.

2) SECONDARY TREATMENT

- The main objective of secondary treatment is the removal of organic matter.
- Reduction of pathogen and nutrient loads

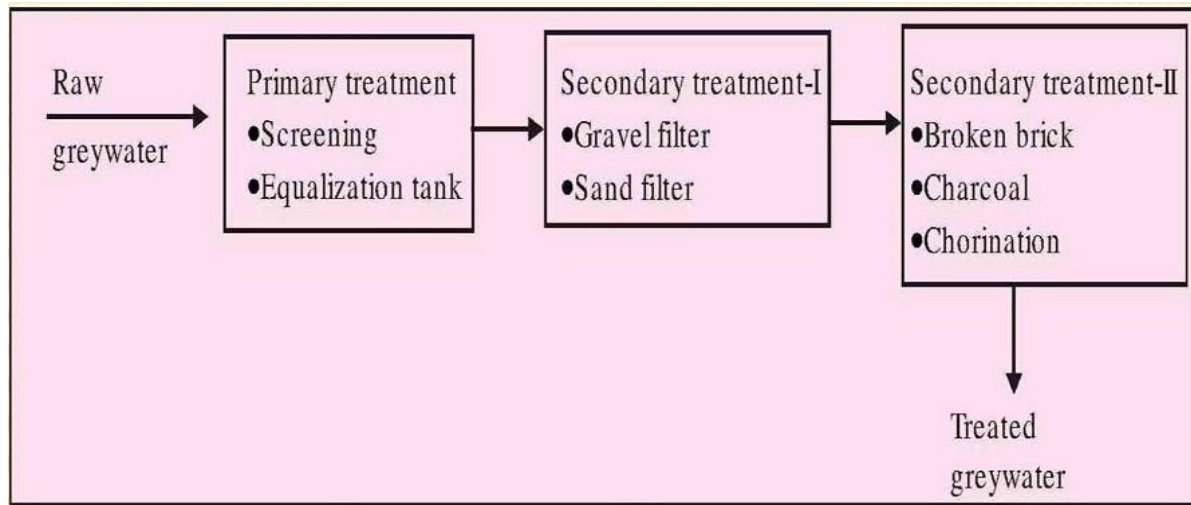


Fig 1: Greywater Treatment Scheme

3) TERTIARY TREATMENT

- Tertiary treatment processes further improves the quality of grey water or polish it for reuse applications.
- Fixed film biological rotating drums, membrane bioreactors, biological acrated filters, activated sludge and membrane treatment system are all included in this category

6.REUSE OF GREY WATER

In water scarce areas, with specific treatment the greywater can be cleaned and reused not only for gardening but for other use also. The greywater is reuse as follow.

- 1.Irrigation
- 2.Toilet flushing
- 3.Construction
- 4.Car washing
5. Floor cleaning
- 6.Gardening

Table 2: Reuse of greywater

Use of Greywater	Purpose
Individual household, school, government/ non government office, hospital, theatre, hotel, airport, railway station, apartment/ colony	Toilet flushing, floor cleaning, irrigation, gardening, car washing, construction

Grey water has a great potential for reuse:

- 1) An increased supply for irrigation water can be ensured which will in turn lead to an increase in agricultural productivity.
- 2) Grey water from the laundry or bathroom is diverted to the garden for immediate use in restricted irrigation, without making changes to its quality. This system is called as a diversion system.

7. ADVANTAGES OF GREY WATER

Even though grey water reuse is very advantageous in arid and semi-arid places. It is accompanied. Some of the advantages of grey water reuse are listed in the following section.

ADVANTAGES

1. Save water (15-25% reduction in consumption) and money
2. Lowers fresh water requirement
3. Reduce the demand on your Increase the lifespan of your septic system
4. Less strain on public sewage treatment system
5. Reduction in energy use by the municipality
6. Grey water is rich in phosphorous, potassium, and nitrogen, a good source for irrigation

8. CONCLUSION

The various paper regarding the reuse of grey water summarised the various aspects of utilization of greywater. It is concluded that the greywater is more efficient of efficiency of oil, greases etc. Greywater recycling has the water saving potential. Greywater system bring significant savings in fresh drinking water, and thus reducing the pressure on the environment. Also reduces urban water demand by up to 15-20%. So the greywater is sustainable, effective and cheapest method.

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