

Analysis of Grey Water and Reuse in three Star Hotel Lucknow

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Abstract:- What is grey water and how we can use it? There are lots of proven and operating grey water systems in the world. India is in this regard quiet lagging country, where system doesn't have this position, neither instance of application. Due to approach the topic of reuse systems, this article describes grey water system reuse and its brief characteristic. The main aim of this article is to characterize the grey water system, its design and water treatment on the case study by pointing out its saving potential. Therefore this study confirms, that system of alternative recycled water use, can save particular source of potable water, where the water is unnecessarily wasted and used where drinking water quality is no needed. In parallel to water savings, grey water system can bring financial savings, which are relevant especially for users at decision-making processes. It is obviously that system have advantages and disadvantages, but if we are sustainable thinking, we have to refer about every drop of water we can save, and we can consider that grey water system is the way we can reach it.

Key-Words: - water demand, water production, saving potential, system design, grey water, white water

Introduction-

The reuse of waste water represents common part of building water cycle in most countries. We can say that for India is using of recycled water entirely new concept. For end users are in particular the best known terms like using rainwater, or in case of sufficient groundwater sources using water from the well. But it is important point to the fact, that there exist another alternative source of water supply, which is daily available during our routine using of water in buildings.

The main topic of this article is to describe, how we can treat with this source of water, and demonstrate its potential utilization, which means saving particular source of potable water and in parallel to water savings, bring financial savings.

Hotel facilities consume significant amount of water, essential resource for their services. Due to the increase of water demand in last decades, and to the current situation of water scarcity in many regions of the planet, water management should be improved. This work presents the study of three star hotel facilities located in the city of Lucknow and surroundings, whose water consumption have been registered for three months, and evaluated.

For each of them, fixtures and equipment used and current water management have been analyzed, identifying water saving opportunities, considering replacing existing fixtures and equipment, implementing correct standards of behavior and considering alternative water sources for non-potable applications. The work analyses the impact of these actions on consumption, and their economic profitability.

Water is a finite and vulnerable resource, nowadays considered an economic good. It is well known that a crisis of water resources is taking place all over the world as more than 2 billion people lack access to clean drinking water and a large share of world population will face severe water scarcity by next decades. Moreover, in last years, due to population and economic growth, changes in lifestyle and higher standards of living, global water use has tripled.

The purpose of the study is part of a broader concept: developing green management standards that hotel businesses should implement. In particular, the whole work arises from the need to optimize and improve water consumption within hospitality facilities, presenting key water measures that businesses should implement.

The moral reasons are equally compelling: water is a scarce resource in many resorts around the world so hotels have a responsibility not to use more than necessary; in rural or remote areas it ensures that local residents are not deprived of their essential supply; and by reducing the amount of waste-water that needs to be treated, this lessens the risk of water pollution.

OBJECTIVE OF THE STUDY:-

- To be responsible for the wastewater sector in Mauritius and to carry out, monitor, supervise, maintain, manage and control grey water works.
- To promote the treatment and reuse of grey water.
- To ensure the proper functioning, inspection and maintenance of hotel sewers and grey water systems.
- To ensure the generation of sufficient resources from tariffs to finance the operation, maintenance and depreciation costs of grey water systems, sewerage and sewage treatment installations.

SCOPE:-

Recycled water can satisfy most water demands, as long as it is adequately treated to ensure water quality appropriate for the use. The Treatment and Uses chart shows types of treatment processes and suggested uses at each level of treatment. In uses where there is a greater chance of human exposure to the water, more treatment is required. There are many ways the proper treatment and reuse of greywater can help alleviate the demands on our existing water supply.

METHODOLOGY OF WASTE WATER IN HOTELS:-

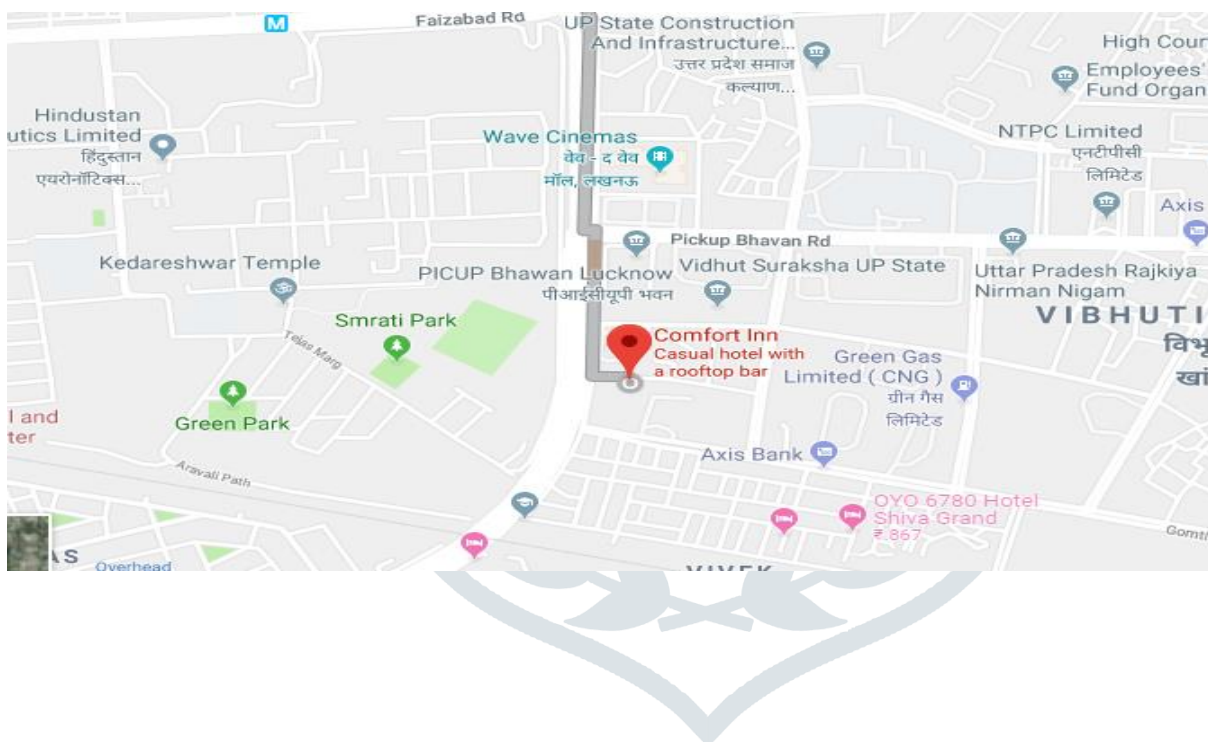
- BOD and COD test
- pH test
- turbidity test
- TSS
- TS
- TDS
- Water saving
- Developing strategies for each area

- Controlling and reducing water consumption
- Maintaining proper functioning facilities
- Optimizing the use system
- Raising awareness among customers

Site description:-

Hotel comfort Inn:- hotel comfort inn is situated in vibhuti khand lucknow near polytechnic chauraha. Courty manners, beautiful gardens, poetry, music, and fine cuisine-Lucknow is popularly known as the City of Nawabs. It is also known as the Golden City of the East, Shiraz-i-Hind and The Constantinople of India. Situated in the city of “mehman nawazi” and “Tehzeeb”, Comfort Inn Lucknow is all set to serve you with delight and honour.

The hotel is centrally located in Gomti Nagar- the business hub of Lucknow and is well connected from all parts of the city with excellent road connectivity. Close Proximity to the International airport 18 kms makes it an apt choice for the modern Business Traveller.



GREY WATER

Grey water is gently used water from your bathroom sinks, showers, tubs, and washing machines. It is not water that has come into contact with feces, either from the toilet or from washing diapers.

Grey water may contain traces of dirt, food, grease, hair, and certain household cleaning products. As grey water contains fewer pathogens than domestic wastewater, it is generally safer to handle and easier to treat and reuse onsite for toilet flushing, landscape or crop irrigation, and other non-potable uses.

The application of grey water reuse in urban water system provides substantial benefits for both the water supply subsystem by reducing the demand for fresh clean water as well as the wastewater subsystems by reducing the amount of wastewater required to be conveyed and treated. Treated grey water has many uses, for example toilet flushing or irrigation. The major problem related to infiltration of grey water is the risk of contamination of the soil and receiving waters due to the relatively high content of different types of pollutants (chemical compounds and microorganisms). To assess the risk it is necessary to know about the

quality of the water to be infiltrated and also about the soil characteristics and processes determining the fate of the pollutants in soil and water.



Fig. grey water

SOURCES OF GREY WATER

- 1 sinks
- 2 showers
- 3 Baths
- 4 dish washer
- 5 kitchen

COMPOSITION OF GREYWATER..

Grey water from Bathroom:-

Water used in hand washing and bathing generates around 50-60% of total grey water and is considered to be the least contaminated type of grey water. Common chemical contaminants include soap, shampoo, hair dye, toothpaste and cleaning products. It also has some faecal contamination (and the associated bacteria and viruses) through body washing.

Grey water from Cloth Washing:-

Water used in cloth washing generates around 25-35% of total grey water. Wastewater from the cloth washing varies in quality from wash water to rinse water to second rinse water. Grey water generated due to cloth washing can have faecal contamination with the associated pathogens and parasites such as bacteria.

Grey water from Kitchen:-

Kitchen grey water contributes about 10% of the total grey water volume. It is contaminated with food particles, oils, fats and other wastes. It readily promotes and supports the growth of micro-organisms. Kitchen grey water also contains chemical pollutants such as detergents and cleaning agents which are alkaline in nature and contain various chemicals. Therefore kitchen wastewater may not be well suited for reuse in all types of grey water systems.

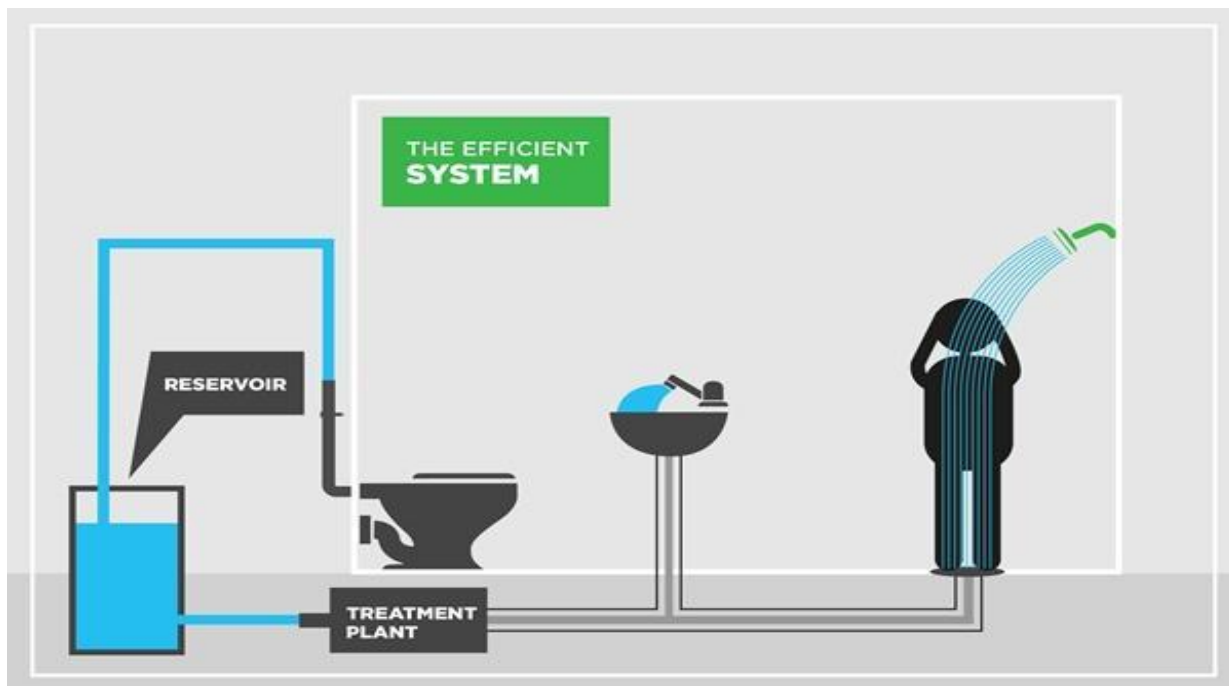
Percentage of grey water generated

Sr.no.	Sources	% of grey water
1	Bathing	55
2	Shower	20
3	Cloths washing	10
4	Kitchen	10
5	Drinking	5
	TOTAL	100

Grey water system

Grey water system can be described as system which is oriented on capturing waste water before its discharging from building. If we want to apply this system, the waste water has to be separated on grey water and black water. There are a lot of descriptions, what grey water means, We can consider grey water as domestic wastewater.

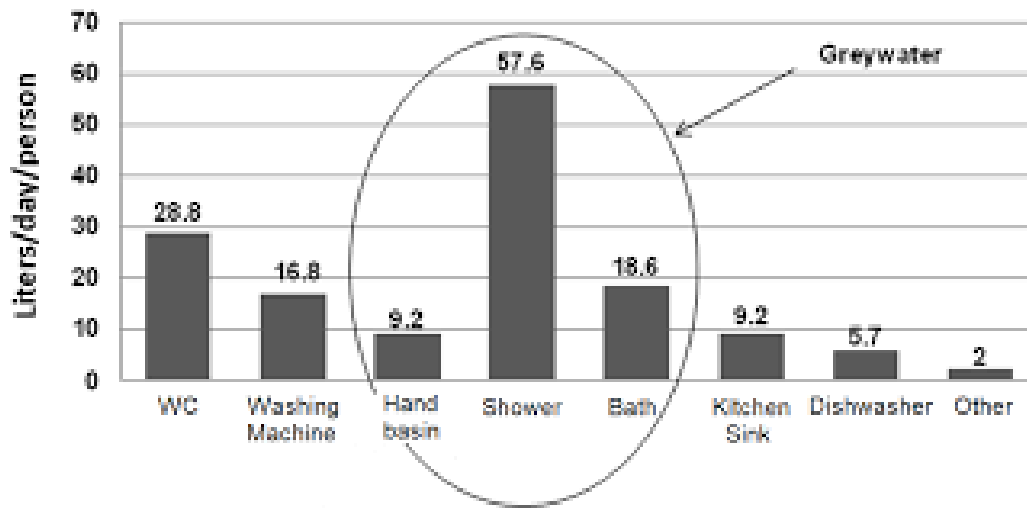
This characteristic specifies using waste water from sanitary appliances, which are not expected high rate of water pollution. Usually that are sinks, baths and showers, also can include washing machines, but with sufficient cleaning process, which ensure the required quality of water for its further use.



2. Building characteristics. As an example we used the hotel building. The building has four floors; on the first floor we can find reception, fitness, restaurant, kitchen and technical room. The rest floors are approximately identical, with only one difference on the second floor, where hotel rooms are placed instead of conference rooms. Hotel provides accommodation for 138 to 191 people

3. Comparison with use grey water system

Average water consumption in 2-3 star hotels It is clear that the daily water consumption is specific for each hotel, because the water consumption is affected by several factors (provided services, number of beds, occupancy, users' behavior). But according to some studies and grey water system application, we can say that for 2-3 star hotels is recorded water use 160 l/day per guest, of which is 52 l/day the amount of grey water discharge.



TREATMENT METHOD OF GREY WATER

The separate treatment of grey water falls under the concept of source separation which is one principle commonly applied in ecological sanitation approaches. The main advantage of keeping grey water separate from toilet wastewater is that the pathogen load is much reduced and the grey water is therefore easier to treat and reuse.

When grey water is mixed with toilet wastewater, it is called sewage or black water and should be treated in sewage treatment plants or onsite sewage facility, which often is a septic system. When it is kept separate, it may open up interesting decentralized treatment and reuse options.

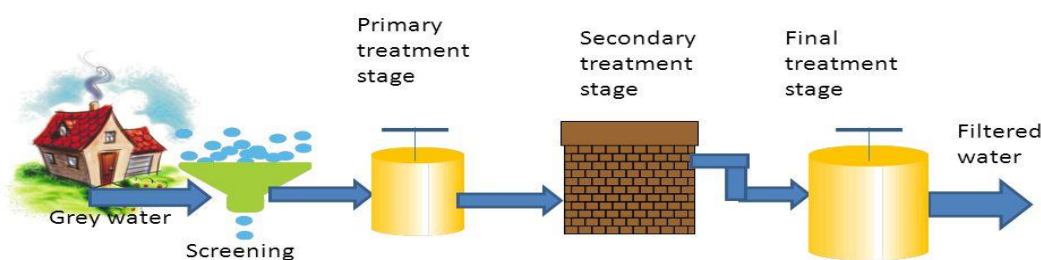
Grey water from kitchen sinks contains fats, oils, and grease and high loads of organic matter. It should undergo preliminary treatment to remove these substances before discharge into a grey water tank. If this is difficult to apply, it could be directed to the black water system or to an existing sewer.

Most grey water is easier to treat and recycle than black water (sewage), because of lower levels of contaminants. If collected using a separate plumbing system from black water, domestic grey water can be recycled directly within the home, garden, or company and used either immediately or processed and stored. If stored, it must be used within a very short time or it will begin to putrefy due to the organic solids in the water. Recycled grey water of this kind is never safe to drink but a number of treatment steps can be used to provide water for washing or flushing toilets.

The treatment processes that can be used are in principle the same as those used for sewage treatment, except that they are usually installed on a smaller scale (decentralized level), often at household or building level.



Basic Grey Water Treatment



We are going to give a some description for the three different treatment routes.

The technologies applied for grey water treatment include physical, chemical and biological processes. Grey water reuse must increasingly become part of a set of integrated actions towards the rational use of water, since this type of effluent represents an alternative source for non-potable uses, with extensive applicability not only in residential, commercial and industrial buildings but also in Hotel buildings.

1. Physical treatment-

The physical treatments include sand soil and membrane filtration followed mostly by a disinfection step.

2. Chemical treatments-

The chemical processes applied for grey water treatments include coagulation, photo catalytic oxidation, ion exchange and granular activated carbon.

3. Biological treatments-

The biological processes were often preceded by a physical pre-treatment step such as sedimentation,

How to reuse grey water

Reusing grey water can be as cheap and easy as bucketing water outside, or as complex and costly (but convenient to use) as installing automatic grey water diversion, treatment, distribution and/or irrigation systems.

Laundry washing accounts for 10-30% of the average household water use. Grey water from laundry is easy to capture and, with the right choice of laundry products, the treated grey water can be reused for garden watering or irrigation.

The gray water has relation with the wastewater from the toilets. Thus it is pretty safe to avail the **gray water reuse** services to ensure appropriate reuse of the wastewater in the hotels. After the treatment of gray water, this water can be efficiently used for toilet flushing and other potable uses.

In hotels, the amount of gray water is more as compared to other wastewater. Thus, the hotel owners greatly prefer the **gray water reuse** services from the reputed firms. The reputed companies, which are dealing with gray water, first understand the wastewater drainage system from the hotels.

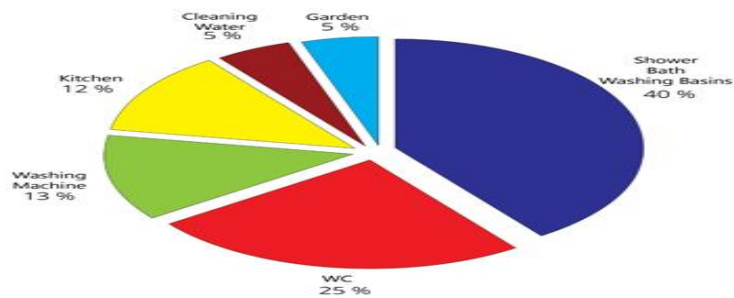
There are different type of reuse system of grey water:-

In the simple type of grey water are as reuse some other type of filter given below

1.Mesh Filter bag . A basic grey water filtration system can be made at home by any one Grey water is first passed through a coarse mesh filter bag. This removes any large particles such as lint and hair immediately. The grey water is then passed through a much finer filter to remove the small particles.

2.Sand Filter. An example of a sand filter system, Basically it is made up of a thin layer of gravel topped off with a much thicker layer of sand within a container (old plastic barrel or drum). Coarsly filtered water passes through the sand being finely filtered.

3.Slow sand filter. A slow sand filter remove the smallest particles. A slow and constant flow of water through the filter described above leads to biological activity as the top layer of sand traps micro-organisms (e.g. bacteria).



BENIFITS

Demand on conventional water supplies and pressure on sewage treatment systems is reduced by the use of grey water. Re-using grey water also reduces the volume of sewage effluent entering watercourses which can be ecologically beneficial. In times of drought, especially in urban areas, grey water use in gardens or toilet systems helps to achieve some of the goals of ecologically sustainable development

The potential ecological benefits of grey water recycling include

- Reduced freshwater extraction from rivers and aquifers
- Less impact from septic tank and treatment plant infrastructure
- Reduced energy use and chemical pollution from treatment
- Groundwater recharge
- Reclamation of nutrients
- Greater quality of surface and ground water when preserved by the natural purification in the top layers of soil than generated water treatment processes

Basic guidelines

1. Don't store grey water (more than 24 hours).. If you store grey water the nutrients in it will start to break down, creating bad odors

2. Minimize contact with grey water. Grey water could potentially contain a pathogen if an infected person's feces got into the water, so your system should be designed for the water to soak into the ground and not be available for people or animals to drink

3. Keep your system as simple as possible, avoid pumps, avoid filters that need upkeep. Simple systems last longer, require less maintenance, require less energy and cost less money.

ADVANTAGES AND DISADVANTAGES OF GREY WATER

Advantages

- Reduction of overall water demand
- Reduction of Organic and hydraulic loadings on the municipal wastewater system
- Reduction in water bills
- Replenishment of ground water which contributes to a healthy water cycle
- Protection of aquatic ecosystems due to decreased diversions of freshwater

Disadvantages

- Cannot be stored for more than 24 hrs (since nutrients break down and cause bad odor)
- Biodegradable soaps and detergents can also present a problem over a period of time when grey water is used for irrigation
- Health standards of the water and quality concerns
- Contains fats, oils, grease, hair, lint, soaps, cleansers, fabric softeners, and other chemicals that are harmful to plant

RESULT AND DISCUSION

In many parts of the world, water scarcity is one of the most significant challenges to human health and environmental integrity. As the world's population grows and prosperity spreads. Water demands increase and multiply without the possibility for an increase in supply. Grey water uses can be toilet flushing, garden irrigation, outdoor uses, but also laundry and even showering. The treatment technique and the quality of the treated grey water will have to be adapted to the reuse purpose. The reuse and recycling of grey water has been practiced in several countries because of the obvious benefits in terms of fresh water saving and management.

Characteristics Grey water Before treatment

SR.NO	TEST	READING	RANGES OF GREY WATER
1	PH	9.6	6.6 -8.7
2	BOD5	120	90 -290
3	COD	125	280 – 800
4	TSS	115	65 -280
5	TS	125	70 -275
6	TURBIDITY	78	22 -200
7	TDS	177	126 -175

The present study demonstrate the reuse and treatment of residential bathrooms, basins waste water called as grey water for the purpose of landscaping, gardening, irrigations, plant growths and toilet flushing. Based on finding of this study, this treatment technology can be considered as a viable alternative to conventional

treatment plants in rural region since they are characterized by high potential for COD, TDS, TSS, total hardness, oil and grease, anions and cations removal. The benefits found are low energy demand, less operating and maintenance cost, lower load on fresh water, less strain on septic tank, highly effective purification, and ground water recharge

Characteristics Grey water After treatment (For irrigation and flushing purpose)

SR.NO.	TEST	READING	RANGES OF GREY WATER
1	PH	8.1	6.3 -8.7
2	BOD5	94	90 -290
3	COD	112	280 -800
4	TSS	88	65 -280
5	TS	213	70 -275
6	TURBIDITY	55	22 -200
7	TDS	125	126 -175

Characteristics Grey water treatment by Alum

SR.NO	TEST	READING	RANGE OF GW
1	PH	7.3	6.3 -8.7
2	BOD	66	90 -290
3	COD	103	280 -800
4	TSS	35	65 -280
5	TS	133	70 -275
6	TURBIDITY	32	22 -200
7	TDS	98	126 -175

DISCUSSION

The results presented in this study establish the potential applicability of the developed methodology. This laboratory scale grey water treatment plant is a combination of natural and physical operations such as settling with cascaded water flow, aeration, agitation and filtration, hence called as hybrid treatment process. All the natural and easily available low cost materials were used for the treatment process. The coconut shell covers are the waste materials, which can be easily procured and used as an efficient adsorbent in water treatment process for the removal of water pollutants and heavy metal ions from waste water. In economy of the plant, the power supply, which is an important part of the operating cost of the conventional system and it is a today's major issues of India, was required a minimum, because system works on the natural force for flowing of water from first to last stage.

The laboratory scale model shows the better and effective performance by the experiment and balances the advantages and disadvantages of the system. As per the Indian standard, the treated water is used for landscaping, gardening, toilet flushing, floor washing, car washing and irrigation. Hence on the large scale grey water treatment plant is more beneficial and economical for the college campus development

CONCLUSION

The benefits of grey water recycling include: Reduced use of freshwater, Less strain on septic tanks or treatment plants, More effective purification, Feasibility for sites unsuitable for a septic tank, Reduced use of energy and chemicals, Ground water recharge, Plant growth, Reclamation of nutrients, Increased awareness of, and sensitivity, to natural cycles. Saving water per day. Saving of 750 to 1000 liter water per day in residential hotels. Saving of drinking water by reuse of grey water. Grey water reuse for toilet flushing and gardening.

This means reducing the pressure and demand on the potable water sources. There are also other options such as Waste Water Recycling. A number of different grey water reuse systems exist on the market and depending on the customer needs,

There is a broad choice of decentralised treatment systems for grey water. The systems mainly differ in terms of treatment efficiency (influencing the reuse option), dimension, price, durability and user-friendliness. The choice of a treatment system should thus be based on a careful evaluation of the local conditions, together with the beneficiaries of the system, taking into account aspects such as the legislation and the socio-economic environment as well. Natural treatment systems such as constructed wetlands or pond systems are the most frequent systems presented in literature. Other systems such as trickling filters are also applied for decentralised grey water treatment, though less frequently.

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