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DOMESTIC WATER RECYCLE

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ABSTRACT

For the purpose of domestic water recycle different methods of treatment were studied and a lab scale treatment unit was fabricated. The unit consists of sand beds for filtration, chemical treatment tank for soap removal and charcoal beds for colour and odour removal. Characterization of wastewater coming from kitchen and bathroom is done. To monitor the changes during the treatment, different tests like turbidity, total filterable solids and total dissolved were conducted

INTRODUCTION

Water recycling is reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a ground water basin (referred to as ground water recharge). Through the natural water cycle, the earth has recycled and reused water for millions of years. The uses of recycled water are expanding in order to accommodate the needs of the environment and growing water supply demands. Recycled water can satisfy most water demands, as long as it is adequately treated to ensure water quality appropriate for the use.

Recycled water is most commonly used for nonpotable (not for drinking) purposes, such as agriculture, landscape, public parks, and golf course irrigation Other nonpotable applications include cooling water for power plants, toilet flushing, dust control, construction activities, concrete mixing and artificial lakes.

What are the Environmental Benefits of Water Recycling?

In addition to providing a dependable, water recycling provides tremendous environmental benefits like -

1. By providing an additional source of water.
2. Water recycling can decrease diversion of fresh water from sensitive ecosystems.
3. Water recycling decreases discharge to sensitive water bodies.
4. Water recycling can reduce and prevent pollution.

Following parameters were considered for the treatment process,

1. Total filterable solids
2. Total dissolved solids
3. Soap content
4. Turbidity, colour and odor

Stepwise procedure was followed for reducing the above parameters.

1. For removal of filterable solids, sand beds were provided.
2. For removal of soaps, chemical treatment was given.
3. For color and odor removal, activated charcoal was used.

C haracteristics of waste water

Basis : F'ive member family on daily basis

Table 1 . Water coming out from bathroom

Description	Quantity
Water for bathing and washing cloths	180 liters
Toilet soap	15 g
Washing soap	15 g
Detergents	22 g
Soil	15 g

Table 2. Water coming from Kitchen

Description	Quantity
Water	30 L
Filterable particles	250 g
Oil	10 mL
Detergents	5 g

Experimental setup

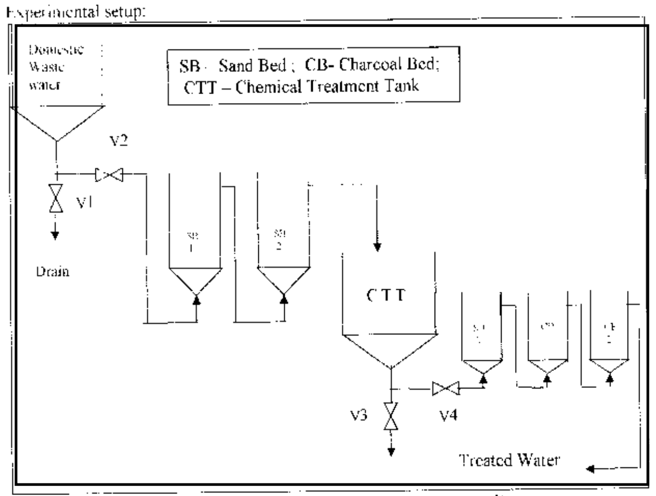

Fig. 1 Domestic wastewater treatment unit

The treatment unit consists of the following sub-units:
1. Wastewater storage tank, 2. Sand beds (2 no's),
3. Chemical treatment unit coupled with third sand bed,
4. Activated charcoal beds (2 no's)

All the sub units are supported on a stand so that the flow of wastewater is by gravity.

Wastewater storage tank : Wastewater storage is at an elevated position which has a capacity of around 25 L. At the bottom of this tank two valves are provided (Vl for draining and V2 for sending to further treatment). During the storage bleaching powder is added for the purpose of disinfection and to prevent microbial growth.

Sand Beds : Wastewater from the wastewater storage tank is first passed through the sand bed 1 and 2 were filterable particles are removed.

Chemical Treatment Tank : This tank has a capacity of around 14 liters. It is provided with 2 valves (V3 for draining and V4 for sending to further steps). Keeping the valves 3 and 4 closed the sand bed effluent is collected in the tank. Soap removal is accomplished in this stage of process.

Charcoal Bed : The effluent from the chemical treatment unit passing through the third sand bed is passed through the two charcoal beds in series for colour and odour removal.
The final treated water is collected.

3. Operating procedure

1. All the valves are kept closed.
2. Wastewater is collected in the wastewater storage tank after passing it through a wire mesh.
3) 1 -2 grams of bleaching powder is added to the wastewater and mixed well.
4) Slowly open the valve-2 and let it pass through the sand beds and collect in the chemical treatment unit to a sufficient level (14 litres)
5. Close the valve-2,Optimum amounts of calcium chloride and alum is added to the chemical treatment unit, mixed well and residence time of 30-60 minutes is given.
6. Drain the settled precipitate using the valve-3
7. When relatively clear water starts coming, close the vlave-3 and slowly open valve-4 to allow water to pass through charcoal beds.
8. Treated water which is crystal clear is collected in a container.

RESULTS

Different tests were conducted in order to monitor the changes such as turbidity, Total filterable solids, Total dissolved solids.

DISCUSSION

In the first trial, third sand bed (fine sand) was not considered thinking that the precipitate will not enter the next stages. But after the first trial it was observed that some precipitate was collected in the pipe which got accumulated in the charcoal beds.

During the second trial it was found that there was growth of micro-organisms in the stagnant water in the bed after the first run. This problem was overcome by the addition of bleaching powder, a disinfectant.

In the third trial it was tried to increase the efficiency of the second sand bed by sending the feed from the bottom, hence avoiding the channeling, but got lower flowrate because of large pressure drops in the beds.

Table 3. Turbidity

Unit	Trial (NTH)	Trial (NTU)	Trial (NTU)
Sample	450	507	408
First sand bed effluent	110.2	130.7	101.7
Second sand bed effluent	70.1	80.6	Nil
Third sand bed effluent	Nil	35.1	23.6
First charcoal bed effluent	11.3	12.8	9.8
Second charcoal bed effluent	3.1	4.3	1.5

Table 4. Total filterable solids

Unit	Trial (g/50mL)	Trial (g/50mL)	Trial (g/50mL)
Sample	0031	0 042	0.028
First sand bed effluent	0 025	oor>	0.0131
Second sand bed effluent	0016	0021	Nil
Third sand bed effluent	Nil	0.0093	0.0075
First charcoal bed effluent	0.0067	0.0076	0.005 1
Second charcoal bed effluent	0.0020	0.0048	0.0012

CONCLUSION

1. 99.63% removal of turbidity is achieved.

Table 5. Total dissolved solids

Unit	Trial (g/25mL)	Trial (g/25mL)	Trial (g/25mL)
Sample	0.0265	0.0326	0.0172
First sand bed effluent	0.0173	0.0245	0.0131
Second sand bed effluent	0.0142	0,0194	Nil
Third sand bed effluent	Nil	0.0127	0.0087
First charcoal bed effluent	0.0121	0.0198	0.0069
Second charcoal bed effluent	0.0065	0.00842	0.0051

2. Satisfactory reduction (95.71%) in the filterable solids has been achieved.
3. 70.34% removal of total dissolved solids is achieved. This is less compared to other results because we are adding chemicals like alum, calcium chloride.
4. Total removal of soap was possible in the chemical treatment unit.
5. 100% removal of colour and odour has been achieved in charcoal beds.

Water recycling has proven to be effective and successful in creating a new and reliable water supply. Nonpotable reuse is a widely accepted practice that will continue to grow. While water recycling is a sustainable approach and can be cost-effective in the long term.

As water demands and environmental needs grow, water recycling-will play a greater role in our overall water supply. By working together to overcome obstacles, water recycling, along with water conservation, can help us to conserve and sustainably manage our vital water resources.