COST EFFECTIVE FILTER MODEL FOR DOMESTIC WASTEWATER TREATMENT

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Abstract

Now a days wastewater treatment methods have well developed and grown increasingly complex with the obligation of comparatively cultured and expensive treatment plants. In addition to capital cost, significant outflow is required for operation and maintenance costs. Natural treatment systems are a feasible alternate that can produce effluents of high superiority at a part of the cost and without requiring skillful processes. Their foremost restraint for application in industry is the point that they take up lots of area. Nonetheless, they can also help to improve the environment and make the amenities suitable for recreation. Reused water can fulfill most water demands, as long as it is sufficiently treated to confirm water quality suitable for the use. In uses where there is a more chance of human exposure to the water, more treatment is mandatory. As for any water source that is not appropriately treated, fitness problems can arise from drinking or being exposed to recycled water if it contains disease-causing bacteria or other impurities. The objective of study in this paper is to develop a low cost treatment technology. Also to study the effectiveness of treatment of greywater by the simple filter model, to measure the economic return as well as assessing the beneficial value by using Indian locally available wetland spices in root zone technique.

Keywords: Domestic wastewater treatments, Cost effectiveness, Root zone, Filter model, wetland plant.

I. INTRODUCTION

In domestic wastewater, grey water is also an important part of wastewater. When greywater is mixed with urinal wastewater and discharged into the sewer then it is called as sewage. It should be treated in sewage treatment plants of the cities. This wastewater method is a septic method. When grey water is set aside, it may treated up by stimulating distributed treatments and there are reuse options. Recycled water is most frequently used for non-potable purposes, such as landscape, agriculture, public parks and irrigation. Other non-potable uses include cooling water for power plants and oil refineries, industrial process water for such facilities as paper mills and carpet dyers, toilet flushing, dust control, construction activities, concrete mixing and artificial lakes. Therefore the advantage of keeping greywater separate from toilet wastewater is that the pathogen load is much reduced and the greywater is therefore easier to treat and reuse. For these type of treatment, in present days, Constructed Wetlands, Reed bed Filters, Subsurface Wetlands etc. kinds of different technologies have been used for water treatment.

In this paper, the cost effective filter model is explained. By using this simple model the load of wastewater can be reduced from treatment plant. In areas where water resources are limited, the recycling of wastewater for reuse in agricultural, industry or even certain limited municipal non-potable uses can provide a strong economic encouragement since it combines preservation of water resources with environmental safety in what is often cost approach.

II. Theory of filter model

In the filter model, stabilization pond functions as anaerobic pond except at the top layer where aerobic condition overcomes. The top aerobic zone efficiently controls the odour problems of the stabilization pond. The ability of consuming nutrients and other substrate from wastewater has credited this plant to be biological filter. There is extraordinary reduction of BOD, COD, Total Suspended Solid, Nitrogen, Phosphorus and Heavy metals from greywater in the stabilization pond. Wastewater treatment by stabilization pond provides the treatment at a low cost. This type of treatment system can therefore help in meeting the challenges posed in developing countries for environmental protection, due to resource recovery advantages over the conventional lagoon system.

III. Working of Filter model

There are two types of filters used in the filter model. One is vertical filter and other one is horizontal filter. Horizontal filters are used in low solids situations and vertical filtered in high solids (sludge) situations. In some applications a combination may be used. In particular wastewater from households and other sources in remote areas can be treated at low cost in this way. The treatment plant is incorporated right next the house and blends fully into the garden landscape. The initial filter material, consisting of limestone blocks, pebbles and a fine sand layer was subsequently changed to a full pebble filter bed. This removed the problems of clogging observed at the inlet with the limestone layer and the slow filtration rate of the sand layer during increased water use from the washing machine. The major requirement from the household members was for an odour free operating planted filter, which, despite initial drawbacks, has been achieved during the entire five-year operating period. The presence of fish, frogs and dragonflies in the polishing pond is beneficial for the whole aquatic eco-system and keeps a firm control on the mosquitoes.

IV. Materials and Method

A. Testing of Model

Testing of this model is done by supplying grey water coming from kitchen sink of a house of 4/5 persons family. The grey water is taken out from the outlet of the filter model. The physiochemical analysis is done before and after treatment of the grey water in the laboratory. The following parameters are checked before and after treatment of the greywater : pH, Bio chemical Oxygen Demand, Chemical Oxygen Demand, Turbidity, Alkalinity, Hardness, Dissolved Oxygen, Total Suspended Solids.

This model developed natural systems as well as horizontal filter, the combinations both are given.

The processes involved in this treatment are as follows…

1. Sedimentation,
2. Filtration,
3. Gas transfer,
4. Chemical precipitation,
5. Chemical oxidation,
6. Reduction & Biological conversion.

B. Part I : Details of filter model

This Filter Model developed can treat the domestic sullage/ grey water particularly from the sink.

The model consist of two main parts,

1. Filter bed base,
2. Wetland plant .

- In this first taken one horizontal rectangular container or tank with the size for 4-5 persons in a house, approximate Width-0.30m, Length- 0.60m and Height-0.60m.
- The tank were installed on a flat surface, with the flow between tank controlled by variation in inlet and outlet heights.
- Outlet is provided 1 inch above bottom of the container surface, so that water may be present for the roots of the plant.
- Each inlet and outlet pipes used in PVC material and also PVC pipe joints used for fixing.
- The inlet was positioned higher than the outlet on tank.
- Each outlet and inlet pipe was perforated with 20 to 40 mm diameter holes.
- In the tank first bottom layer provided gravel size 40 mm.
- The middle part of the tank was 10-20mm pebbles and above it course sand.
- Top most layer of the tank provided very fine sand. The layer sand to eliminated the smell completely.
- In this process natural Aeration takes place.

C. Principle of the horizontal planted filters

1. Continuous oxygen supply to the upper layers only.
2. Anaerobic conditions in the lower parts of the filter.
3. Roots of plants provide favorable environment for bacteria

Photo 1: The middle part of the tank was 10-20mm pebbles and above it course sand.

Photo 2 : Plantation of Typha plant in Model

Photo 3: Filling of graded soil layers to supply of Sullage

Photo 4 : Model Fitted with pipes

D. Part II : Wetland plant

Photo 5 : Wetland plant Typha

- Cattail pollen is a fine substitute for flours; it is a bright yellow or green color, and turns pancakes, cookies or biscuits a pretty yellow color.
- This flour would probably contain about 80 % carbohydrates and around 6% to 8% protein.
- We use Indian locally available wetland spices like Typha.
- It is a wetland plant which takes oxygen from the atmosphere and transfers it to the roots with the help of hollow steam.
- The oxygen releasing capacity of Typha is 70 to 80% as compared to other plants.

Other Uses of Typha plant : Wildlife, wetland restoration, wastewater tertiary treatment, edible (young shoots, base of stem, flower stalks, pollen, rhizomes), baskets, matting, bedding material, ceremonial bundles, caulking material, and cordage.

Table 1: Cost Analysis Of Model

Sr. No.	**Description of Item**	**Size and cost**
1	Plastic container	Size = (0.6 x 0.3 m x 0.3 m) Approximate cost = Rs. 300/-
2	Estimated water use (4 person/home)	50 lit/day x 4nos. = 200 lit/day
3	Total plan area of model	Approx. 0.18 sq. m
4	Main treatment	Horizontal filter
5	Filter media	Gravel, Pebbles, Fine sand
6	Cost of filter Material	Approx. total cost = Rs. 200/-
7	Inlet and outlet pipes(1/2 inches) & joints	Approx. Rs. 200/-
8	Mode of disposal of treated greywater	Irrigation, Flower gardening, Flushing tank
	TOTAL COST OF FILTER MODEL	**Rs. 900/-**

V. CONCLUSION

As the grey water of kitchen sink is having less contamination and more micro-organisms, no need to discharge it into the sewer line. Unfortunately the amount of waste water to be treated in the Sewage Treatment Plant will increase. We can reduce this load effectively by using this Filter model which is studied in this paper. It is concluded that the Model is of low cost value as well as compact and effective to treat the grey water coming out of kitchen sinks. Anybody can use and handle this model easily. The maintenance cost is also very less. The analysis of grey water quality before and after treatments are done in the laboratory. The differences are compared with the BIS code of waste water. The result tables are published in another paper so it is not included here. The objective of this paper is to evaluate the cost of the model and study of design of model. If we start to use this kind of model in each and every house automatically the load on sewage treatment plant of the city is reduced. Similarly, the application of greywater reuse in urban water systems 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.

VI. REFERENCES

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