EVALUATE THE TREATMENT EFFICIENCY OF COIR FIBER AS AN ATTACHED GROWTH MEDIA FOR SYNTHETIC WASTE WATER

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Introduction

Wastewater treatment is one important field in environmental engineering since it has extensive impacts over the environment. Deprive of Dissolved Oxygen (DO) levels in natural water bodies, spreading water born diseases, addition of heavy metals into food chain are some of the major impacts caused by wastewater contaminations. In this regard main sources of waste include industrial sources, domestic sources and agricultural sources.

Essentially effluents from septic tanks treating domestic toilet waste need further treatment if it is to meet the required Sri Lanka allowable tolerance levels (SLS745) for the discharge of treated wastewater into the open environment. As a common practice, however in most instances a septic tank effluent is soaked into the ground as the final disposal thus eliminating the requirement to comply with above tolerance levels as it is soaked into ground. Here the bacteria in the soil are expected to remove these wastes before it reaches groundwater. However, the option of soaking is not always possible as it highly dependent on the groundwater table and the soaking ability of the existing soil. Therefore in such a situation where soaking is not favorable, there are numerous other techniques available with modern engineering practices to meet the required standards. But, most these techniques are not very attractive mainly due to high capital and maintenance costs involved.

A possible solution for the above described problems is to find a low tech, low cost, low maintenance but effective method of wastewater treatment. The intended system is best especially if it is a self energized treatment gravity driven system that minimize the operational cost involved. It should be cheap enough to construct so that it can be promoted in the society. This means it should be small as possible and require less material and labor to construct. Further it should be a versatile treatment system where it could be fit into various types of systems. Incidentally one of the best methods to cater all these requirements is to develop a high efficient cheap filter based on attached growth specially an anaerobic treatment.

In attached growth anaerobic filters, the treatment occurs when the wastewater passes over a film of microorganisms developed on a suitable media. The biologically degradable nutrients in the waste water are consumed by the bio film to produce new cells. Here today one of the major challenges faced by the developers of attached growth filters is to find a cheap, durable, high efficient filter media. If a media which satisfy above conditions can be found out it will be an immense finding for

the field of wastewater engineering in developing countries.

Materials and Methods

In this research coir fiber to be tested in vertical filter column under anaerobic conditions where waster of synthetic origin (Urea ($(NH_2)_2CO$), Sugar ($C_{12}H_{22}O_6$) and trace minerals) is sent upwards through the column. Exercise is performed until the system gets matured. The sampling was performed in every 7 days where influent, effluent and intermediate samples where tested for BOD, COD, and NO_3-N.

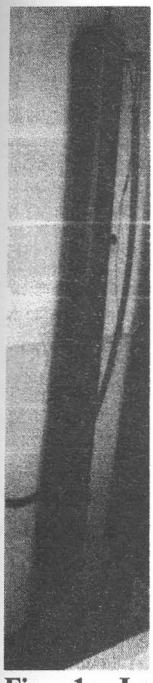

Fig. 1: Lab scale model of coir anaerobic filter

Variation of BOD percentage removal is studied with time and once the BOD removal percentage achieved a steady state, removal efficiencies of other water quality parameters such as COD and NO3-N to be determined.

Sectional front elevation of the experimental filter unit is shown in Fig 1. The vertical column is developed basically form 150mm PVC pipe of 2400mm high. The synthetic wastewater is fed from the bottom into the chamber where it is partitioned by a pretreated 10mm plastic sheet. The coir fiber is placed in upper chamber where it was packed in a manor to achieve uniform distribution. The vertical column was made air tight by placing a polythene cover on top of the column and strangling it with a rubber ring.

Results

The obtained influent and effuent data over the investigation period is tabulated in table 1 below. Also the same is graphically presented in fig 2. Furter, based on the influent and effluent quality, the volumetric loading rates of biodegradable matter is calculated based on a filter volume of 32.32ml and an influent flow rate of the of 21.255 L/day. Obtained volumetric loadings are tabulated in table.02.

It is observed that after 6 weeks of testing, the proto type coir anaerobic filter model possess a BOD removal percentage of 59.3%. This removal percentage was achieved with corresponds to 96.09% porosity and of 36 hr hydraulic retention time. Obtained results for the volumetric load, though not at high rates too shows that the removal is improved overtime.

Table 01: BOD5 Removal Efficiency

Date	Number of Days	Influent Sample BOD_5 mg/L	Effluent Sample BOD_5 mg/L	% of BOD Removal %
08/03/2010	7	148.2	129.3	12.75
15/03/2010	14	76.2	57.3	24.80
22/03/2010	21	133.2	106.25	20.23
29/03/2010	28	112.2	67.5	39.84
05/04/2010	35	136.2	66.9	50.88
12/04/2010	42	180.6	73.5	59.30

Table 02: Volumetric Loading rates of the filter

Date	Number of Days	Volumetric Loading Rates $kg/m^3/day$		Removal $kg/m^3/day$
		Influent	Effluent	
08/03/2010	7	0.098	0.085	0.012
15/03/2010	14	0.050	0.038	0.012
22/03/2010	21	0.088	0.070	0.018
29/03/2010	28	0.074	0.045	0.030
05/04/2010	35	0.090	0.044	0.046
12/04/2010	42	0.119	0.049	0.071

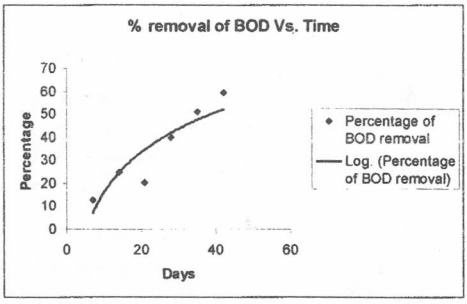

Fig. 2: Percentage removal of BOD vs. Time

Also it was obtained that under these conditions the model has not accomplished required BOD_5 level of 25mg/L at the end of 6 weeks.

Conclusions

Further testing is required with different combinations of increased hydraulic retention times and reduced porosities to come to any conclusion. However the study shows some promising signs of coir anaerobic filters to be used to achieve acceptable levels of effluent treatments.

At this point of experiment it can only be concluded that an anaerobic coir filter of porosity 96.09% and hydraulic retention time of 36 hrspossess a BOD_5 removal efficiency of 59.3%.

References

Tchobanoglous, G, Burton, F.L, 1991, Third Edition, Wastewater Engineering- Metcalf & Eddy, INC.121-141.