American Journal of Engineering Research (AJER)
e-ISSN : 2320-0847 p-ISSN : 2320-0936
Volume-03, Issue-03, pp-48-50
www.ajer.org

Research Paper Open Access

Removal of Organic Based Oil and Grease from Food Service Facility Effluent Using a Laterite Column

H. Ajith Hebbar[1], K.S.Jayantha[2]
[1]Research Scholar, Department of Civil Engineering, Malnad College of Engineering, Hassan, India
[2]Professor, Department of Civil Engineering, Malnad College of Engineering, Hassan, India

Abstract: - The effluents from food service facilities like restaurants, hostels and cafeteria typically contain floating cooked oil, ghee, and other fatty materials which are of organic in origin. Conventionally, before allowing this effluent to treatment plant or sewer, grease traps and skimming devices are used to separate these floating organic matters. If these are not effectively separated, these may clog sewers or interfere with biological treatment system. But these conventional methods need frequent maintenance and may not be cost effective. Alternatively, in this experimental work, an attempt was made to remove floating oil and grease using adsorption by passing the wastewater through a Laterite grain column. A real scale study unit was set up at the effluent point of a restaurant. The Various parameters like height of the column, grain size, and flow rate were monitored during the experiment. The results showed that the oil and grease could be removed up to an extent of 97.6% proving that Laterite has good adsorption potential.

Keywords: - *Flow rate, Laterite column, Laterite grain, Oil and grease removal efficiency.*

I. INTRODUCTION

Oil, grease and fatty materials are the main culprits of nuisance in the wastewater if not removed early from the point of source. The main sources of hydrocarbon based oil and grease are effluents from vehicle garages and service stations. Further, effluents from restaurants, hostels and cafeteria are the main sources of organic based oil and grease. The kitchen wastewater from a food service facility contains mainly cooked fatty oils, butter and ghee. If oil and grease laden wastewater is disposed to water bodies, it floats and spreads rapidly and forms thin film on the water surface, preventing the oxygen transfer from the atmosphere. This leads to low dissolved oxygen levels in the water due to microbial oxidative attack on hydrocarbon molecules. Further oil and grease is toxic to some aquatic organisms. Moreover, these can clog sewer pipes and pumping system in the treatment plants. If present in excess it may interfere with aerobic and anaerobic biological process, leading to decreased wastewater treatment efficiency. Present day techniques to remove oil and grease are to use skimming tanks, oil and grease traps and interceptors in treatment plants which need frequent cleaning of pipes and sometimes replacement of pipe system, thus resulting in increased maintenance and inspection cost. With these points in view, an alternate method was developed to remove oil and grease from wastewater using adsorption technique [1], [2], [3] and [4]. Easily and cheaply available Laterite grains were used as adsorbent material [5]. A column study using Laterite grains was made by setting up a real scale experimental unit at the effluent point of a restaurant.

II. MATERIALS AND METHOD

The Laterite stones from a quarry were crushed in to two size ranges 16mm-10 mm and 10mm-4mm.
In Phase I of the experiment, the study was done on grains 16mm-10 mm size range. These grains were filled in a vertically positioned polyvinylchloride pipe of diameter 2 inch (0.05meter) fitted with taps at an equal interval of 0.7 meter from top, as shown in Fig.1. The experimental setup was sized to suit the effluent point of the restaurant. Wastewater from the restaurant was collected in a tank and passed through the pipe containing laterite grains. An additional tank containing same wastewater was used to maintain a constant head and constant flow rate of wastewater. When the flow came into contact with the adsorbent in the pipe and stabilized, the samples were collected from different taps provided and tested for oil and grease contents. Trials were

conducted for flow rates of 0.25 liters per sec (LPS), 0.5 LPS and 0.75 LPS. In Phase II, the same procedure was repeated for grain size range of 10mm-4mm and samples were tested. Results were compared to the initial concentration of oil and grease in the effluent and percentage removal of oil and grease was evaluated.

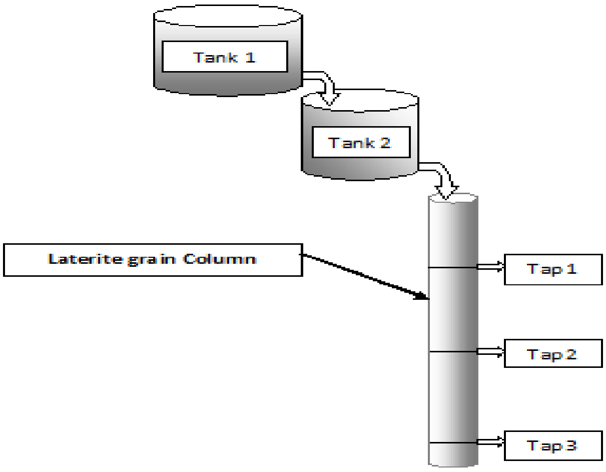

Figure 1: Schematic View of the Experimental Setup.

III. RESULTS AND DISCUSSION

The results obtained from the Phase I and Phase II are tabulated in Table 1 and Table 2.

Table 1: Oil and grease removal efficiency of Phase I

Phase I Grain size : *16mm-10 mm*		**Initial oil and grease Concentration (mg/L)**	**Final oil and grease Concentration (mg/L)**			**Oil and grease removal efficiency (%)**		
			Tap 1	Tap 2	Tap 3	Tap 1	Tap 2	Tap 3
Flow Rate (LPS)	0.25	45.6	8.9	6.2	3.6	80.3	86.4	92.1
	0.5	45.6	10.4	8.2	5.2	77.2	82.1	88.6
	0.75	45.6	13.3	10.7	8.3	70.8	76.5	81.7

Table 2: Oil and grease removal efficiency of Phase II

Phase II Grain size : *10mm-4 mm*		**Initial oil and grease Concentration (mg/L)**	**Final oil and grease Concentration (mg/L)**			**Oil and grease removal efficiency (%)**		
			Tap 1	Tap 2	Tap 3	Tap 1	Tap 2	Tap 3
Flow Rate (LPS)	0.25	51.6	8.9	4.3	1.2	82.8	91.7	97.6
	0.5	51.6	10.8	7.5	4.5	79	85.5	91.3
	0.75	51.6	13.9	11.4	7.8	73.1	77.9	84.8

From the results of Table 1 and Table 2 it is evident that the efficiency of oil and grease removal for a given tap position was highest for slowest flow rate and it started decreasing with increase in the flow rate, as shown in Fig.2. This was due to the fact that for slower flow rate more contact time with adsorbent was available. Further, for a given flow rate, efficiency was highest for Tap 3 position as shown in Fig.3. This was because the Tap 3 position needed a longer travel distance. The maximum efficiency in the Phase I was 97.6% for the flow rate of 0.25 LPS and in Phase II it was 92.1% for the same flow rate. This higher efficiency in Phase II was due to the usage of smaller sized grains in more numbers and hence more adsorption.

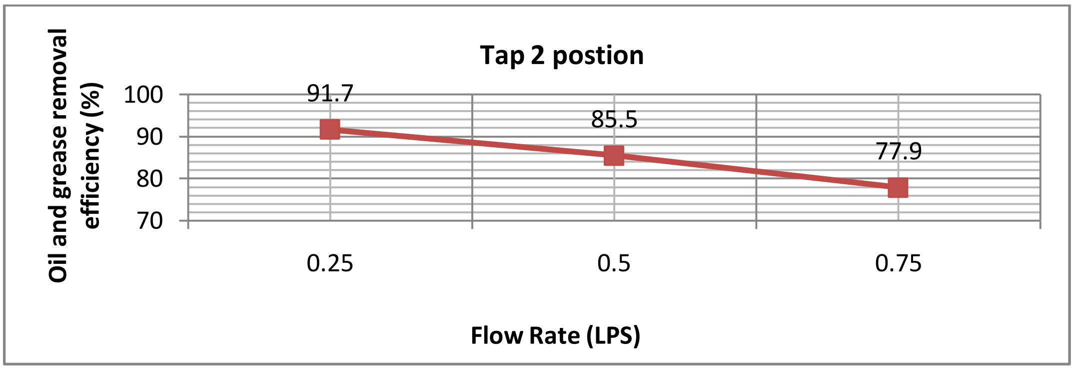

Figure 2: Variation of Oil and grease removal efficiency with Flow Rate

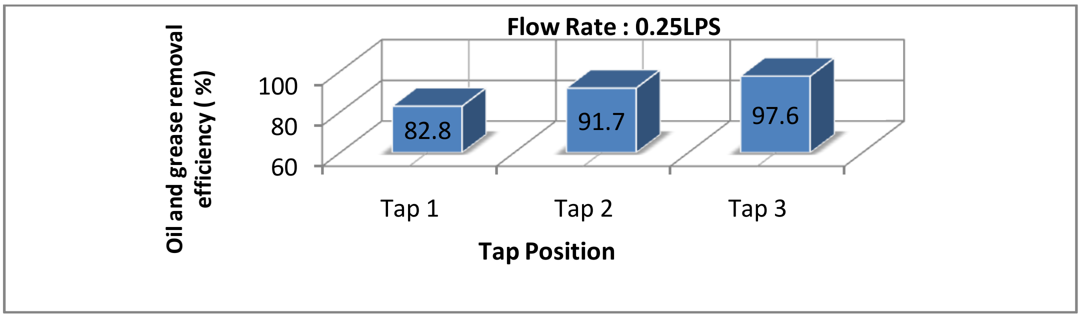

Figure 3: Variation of Oil and grease removal efficiency with Tap Position

IV. CONCLUSION

Based on the results obtained in the different stages of this experiment, it is quite evident that Laterite is a powerful adsorbing medium. For smaller grain sizes, the efficiency of the adsorbent found to be high. Further the adsorbent performed better for slower flow rates and higher distance of travel in the column. In the places where Laterite is cheaply and easily available, initial expenses of installation of the unit are low as compared to other systems. This can be adopted as pretreatment method in biological treatment plants. However further investigations may be necessary on performance of adsorbent for continuous wastewater flow and its reuse potential.

REFERENCES

[1] Abdul Latif Ahmad, Suzylawati Ismail, Norliza Ibrahim, Subhash Bhatia , Removal of suspended solids and residual oil from palm oil mill effluent, *Journal of Chemical Technology & Biotechnology*, *78 (2)*, 2003, 971–978.

[2] A. Sherry Mueller, R. Byung, E.Kim, E. James ,Anderson, Abizer Gaslightwala, J. Michael Szafranski and A. William Gaines, Removal of Oil and Grease and Chemical Oxygen Demand from Oily Automotive Wastewater by Adsorption after Chemical De-emulsification, *Pract. Periodical of Haz., Toxic, and Radioactive Waste Mgmt*., *7(4)* , 2003, 156-162.

[3] K.S.Jayantha, G.R. Ranjana, H.R. Sheela, Modang Ritu and Y.S.Shivananni, Defluoridation studies using Laterite material, *J. Environmental Science and Engineering, 46 (3)*, 2004, 282-288..

[4] A.L.Ahmad , S.Sumathi , B.H. Hameed , Residual oil and suspended solid removal using natural adsorbents chitosan, bentonite and activated carbon: A comparative study, *Chemical Engineering Journal* , *108 (2)*, 2004, 179-185.

[5] K.S. Jayantha, Santhosh Ingalagi, Shwetha, Sushma, B.S. Prashant., Oil and Grease Removal Using Laterite Column: A Case Study, *Proceedings of the International Conference on Business, Environment, International Competitiveness and Sustainable Development of the Asia Pacific Economics*, Malaysia, 2007, 103.