Treatment of Soap Industry Wastewater using MBBR Technology

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***Abstract* -With the development of industries in world, industrial effluents are also increasing over the time. On the hand water scarcity is one of the major problems concerned by society. Thus, wastewater treatment has become important as the treated water can be used in recreational works, agricultural land etc., This paper presents the treatment of soap industry wastewater by lab scale MBBR which is highly contaminated with organic and inorganic compounds.**
The MBBR (Moving Bed Biofilm Reactor system) is advanced wastewater treatment which treats the wastewater with the help of biomass. In this system, biomass is suspended and attached as well. Thus, MBBR system combines the advantage of both conventional Activated Sludge and Biofilter Process making it a best wastewater treatment.

Keywords: Lab Scale MBBR Apparatus, Growth of Microorganisms, BOD removal, COD Removal.

I. INTRODUCTION

Wastewater is processed water from any combination of domestic, industrial, commercial or agricultural activity and any sewer inflow or sewer infiltration. Wastewater includes a pollutant which are harmful to the surrounding environment. Hence it is important to treat the wastewater and to keep the concentration of pollutants within the limit before it is released into a natural body. Industrial wastewater treatment covers the mechanisms and process used to treat wastewater that have been contaminated in some way by anthropogenic, industrial or commercial activity prior to its release into the environment. wastewater treatment is a mixture of unit process and can be divided into three categories physico-chemical treatment, biological treatment and combination of these treatment. MBBR (Moving Bed Biofilm Reactor) Technology is the one of the biological treatment units with higher contaminant removal performance.

The MBBR is origin Norway and emerged from the University Science and Technology of Norway within corporation known as Kalends Miljoteknologi or Anox Kalends. During 1989 it was the earliest MBBR, though comparatively new technology, but has been introduced in the US as back as 1995.The idea for the development of MBBR method was to optimize reliability and the most efficient technology. MBBR method takes this advantage and apply it to the growing the microorganism's and biofilms above the media carrier that move free inside the sewage.

MBBR media carriers have a density similar to that of water, so they mix well with the wastewater to promote consistent waste digestion. Using MBBR media is particularly advantageous because the tiny pieces take up minimal space, are easy to maintain and digest waste efficiently. The microorganisms on the media can also automatically adjust to changes in the amount and type of waste in the water. Although MBBR systems require some monitoring they are largely self-sufficient.

II. OBJECTIVE OF THE STUDY

The primary goal of this project is to conduct experimental study to evaluate the performance of lab-scale MBBR system. To achieve this goal the following objectives have been identified.

1. To observe the growth of microorganism on lab-scale MBBR system.
2. To check COD removal efficiency of soap industry wastewater on the lab scale MBBR system.
3. To observe PH variation of waste water on the lab scale MBBR system.
4. To check BOD removal efficiency of soap industry wastewater on the lab scale MBBR system.

III. MATERIALS

[1] Soap industry wastewater

Characterization of the wastewater from soap industry manufacturing unit indicated that the waste was highly contaminated with organic compounds as indicated by COD and BOD values. Moreover, effluent from the soap manufacturing plant contains significant concentrations of oil and grease.

[2] MBBR Plastic media

MBBR process utilizes floating High-Capacity Microorganism Biofilm media within the aeration tanks. The media provides increased surface area for the biological microorganisms to attach and grow. The microorganisms consume organic material.

Table 1 specification of plastic media

Properties of media	media Volume	Material of the media	Specific surface area
Plastic filter media	60%	Microfiber PVC	500m^2/m^3

[3] Industrial Sludge and Cow Dung

Industrial Sludge from Maharaja soap industry has taken for initial growth of microorganisms in lab scale MBBR apparatus.

Initially Microorganisms consume organic matter present in the wastewater to grow over the media. Since Soap industry Wastewater has BOD in the range of 350-400mg/l it would take more than 12 weeks for complete growth. Thus, by adding Cow Dung and Jaggery in the sludge will enhance the BOD concentration in the wastewater which helped in fast growth of microorganisms.

[4] Experimental Setup

The experiment is performed on the lab scale MBBR system which includes parts as follows.

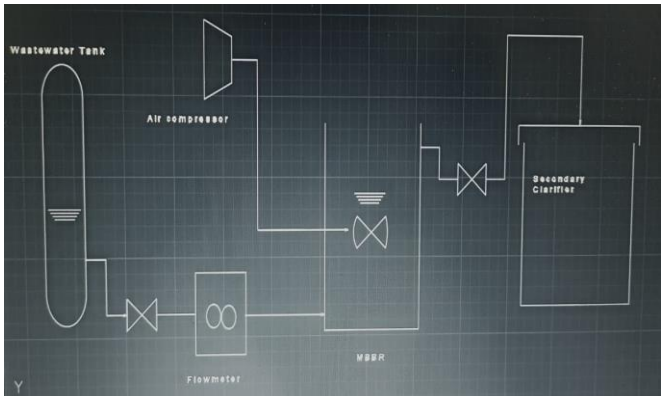

Fig. 1 schematic diagram of lab scale MBBR system

Fig.2 experimental setup of lab scale MBBR system

Fig.3 plastic media in MBBR reactor

IV. METHODOLOGY

In this project the soap industry wastewater is allowed to flow through MBBR reactor at HRT of 2,4,6 and 8 Hour. The system is checked for COD removal efficiency, BOD removal efficiency, variation of PH at different hydraulic retention time. The flowchart of conducting of project is as follows:

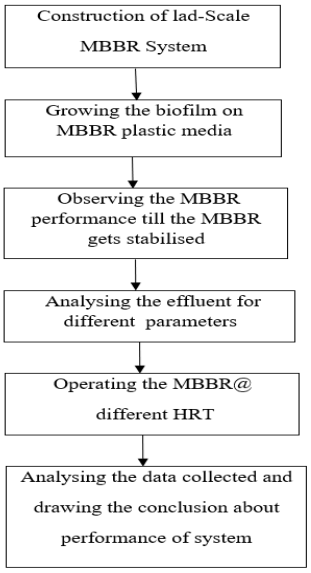

Fig. 4 Flow chart showing methodology

V. EXPERIMENTAL RESULTS AND DISCUSSION

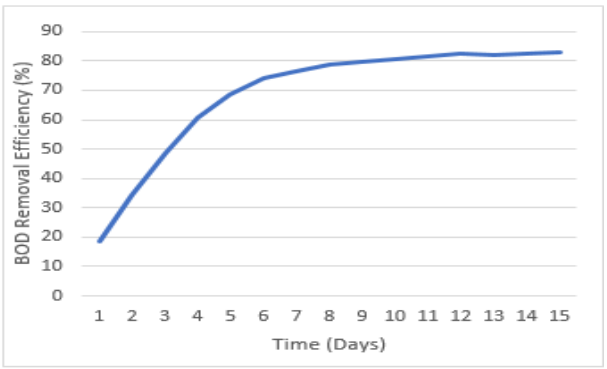

Figure 5 growth of microorganusms

Observation of Growth of Microoragisms

As observed in the above the graph, BOD removal efficiency has increased with increase in the numbers of microorganism from 1st day to 15th day. On the first day there was 18% BOD removal is mainly due to aeration. Later on there is increase in BOD removal efficiency indicating growth of organisms over the media. Increase in the BOD removal efficiency has reached 82.33% on the eleventh day and later there is no remarkable increase in the BOD removal efficiency which indicates that optimum growth of microorganisms over the media.

Table 2 growth of microorganisms

Days	BOD Value in mg/l		Efficiency
	Inffluent	Effluent	
0	1053.21	858.79	18.46
1	1000.2	657.83	34.23
2	921.32	473.93	48.56
3	956.25	374.47	60.84
4	1045.56	330.19	68.42
5	989.25	256.02	74.12
6	964.58	226.29	76.54
7	1150.84	244.44	78.76
8	1190.56	243.35	79.56
9	968.25	188.32	80.55
10	978.15	180.37	81.56
11	1089.56	192.53	82.33
12	1074.23	192.07	82.12
13	976.02	171.19	82.46
14	1189.02	202.85	82.94

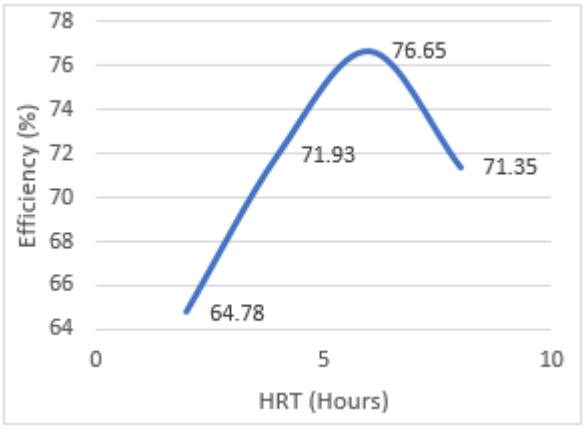

Figure 6 BOD removal efficiency at different HRT

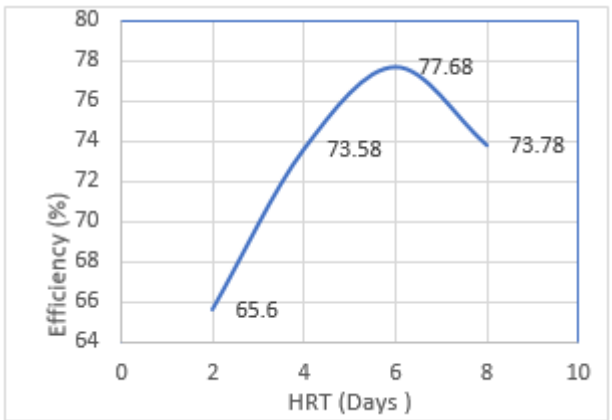

Figure 7 COD Removal Efficiency at different HRT

As observed in the above graphs, The BOD and COD removal Efficiency has increased with increased HRT. At higher HRT, wastewater remains in the reactor for longer duration thus achieving better removal efficiency in comparison to lower HRT. Maximum removal efficiency achieved at 6 HRT, further increase in the HRT will allow the wastewater remains in the reactor for longer duration which results in lower F/M ratio Thus there is a decrease in the removal efficiency above 6 HRT.

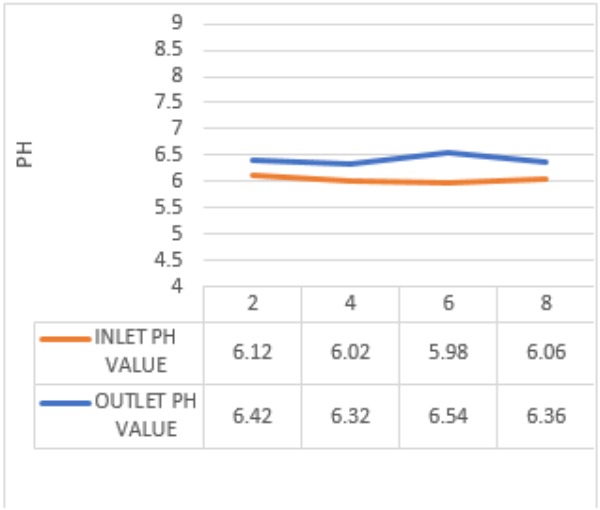

Figure 8 pH Variation of wastewater at different HRT

As shown in the above graph, the average pH of inlet wastewater is 6.05 and average pH of the effluent of reactor is 6.43. Thus, Wastewater has become alkaline after passing through the reactor.

VI. CONCLUSION

- The optimum growth of organisms is observed on the 12th day in the lab scale MBBR system
- BOD and COD removal Efficiency has increased with increase in the HRT and maximum removal efficiency has achieved at 6 HRT. With the further increase in the HRT the removal efficiency has decreased.
- Wastewater has become alkaline after passing through the reactor.

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