Study the Efficiency of Moving Bed Bio-Film Reactor (MBBR) for Dairy Wastewater Treatment

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Abstract— *In this research, an experimental study to evaluate removal of COD and BOD from Dairy wastewater by treatment Moving Bed Bio-Film Reactor (MBBR). The paper discusses biological treatment. The objective of the study was evaluation of operational parameters and performance of reactors based on attached growth process by using MBBR. The result shows removal efficiency of Biochemical oxygen demand (BOD), Chemical oxygen demand (COD) and PH were 89%, 84% respectively. The conclusions also indicate that MBBR, with polypropylene media as biofilm carrier, possess great removal Dairy wastewater. The MBBR tanks were filled with suspended plastic carriers, with a 30 to 50% filling ratio. Under optimum conditions, almost complete COD/BOD removal efficiency of 79 % was achieved. This study indicates that its demonstrated that use of this reactor results in removal from wastewater.*

Keywords— Dairy wastewater, Bio-film Media, Biological carrier, COD, BOD, Biomass.

I. INTRODUCTION

A steady rise in the demand for milk and milk products in many countries has led to advancements in veterinary science, which has subsequently led to steady growth in the production of milk per head of cattle. This has caused enormous growth in dairy industries in most countries of the world. Consequently, the amount of wastewater generated and discharged from these industries has also increased.

Two technologies are commonly used for biological treatment of sewage: activated sludge and trickling filters. A moving bed biological reactor (MBBR) is a compilation of these two technologies. The biomass in the MBBR exists in two forms: suspended flocks and a biofilm attached to carriers. It can be operated at high organic loads, and it is less sensitive to hydraulic overloading. The first MBBR was installed in 1989. Although it is a relatively new technology to the United States (first introduced in 1995), there are now over 400 installations worldwide in both the municipal and industrial sectors with over 36 in North America.

1.1 Dairy wastewater:

Dairy industry wastewater is primarily generated from the cleaning and washing operations in the milk processing plants. It is estimated that about 2% of the total milk processed is wasted on drains. The wastewater generated from milk processing can be separated into two groups—the first group concerns wastewater having high flow rates and the second concerns the effluents produced in small milk transformation units (cheese production for instance). Dairy wastewater is characterized by high biological-oxygen demand (BOD) and chemical oxygen demand (COD) concentrations, and generally contains fats, nutrients, lactose, as well as detergents and sanitizing agents. Nutrients lead to eutrophication of receiving water, and detergents affect the aquatic life. Due to the high pollution load of dairy wastewater, the milk-processing industries discharging

untreated/partially treated wastewater cause serious environmental problems. Moreover, the Indian government has imposed very strict rules and Regulations for the effluent discharge to protect the environment. Thus, appropriate treatment methods are required to meet the effluent discharge standards.

1.2 Moving Bed Bio-Film Reactor (MBBR):

The basic principle of the moving bed process is the growth of the biomass on plastic supports that move in the biological reactor via agitation generated by aeration systems (aerobic reactors) or by mechanical systems (in anoxic or anaerobic reactors). The supports are made from plastic with a density close to 1 g/cm3 letting them move easily in the reactor even when the capacity reaches 70%. The moving bed processes come from the current trend in wastewater treatment, from the use of systems that offer an increased specific surface in the reactor for the growth of the biomass, achieving significant reductions in the biological reactor volume.

Some factors have been reported to affect the performance of MBBR. The high specific area of the carrier media controls the system performance which is because of very high biofilm concentrations presence in a small reactor volume. It was reported that typical biofilm concentrations range from 3000 to 4000 g TSS /m3, which is like values obtained in activated sludge processes with high sludge ages. The percentage of reactor volume comprised of media is limited to 70%, with 67% being typical (Odegaard et al.,2000). However, wastewater characteristics and specific treatment goals are the main factors determining the percentage of media required in the reactor

II. MATERIAL AND METHODS

2.1 Experimental set-up:

The Moving Bed Biofilm Reactor (MBBR) technology is an attached growth biological treatment process based on a continuously operating, non-clogging biofilm reactor with low head loss, a high specific Biofilm surface area, and no requirement for backwashing. MBBR is often designed as an aerobic system. Samples will be collected from low income and high-income society and its parameters will be evaluated prior to treatment. The proposed experimental set-up for Moving Bed Biofilm Reactor can be made as shown in Fig. 1.

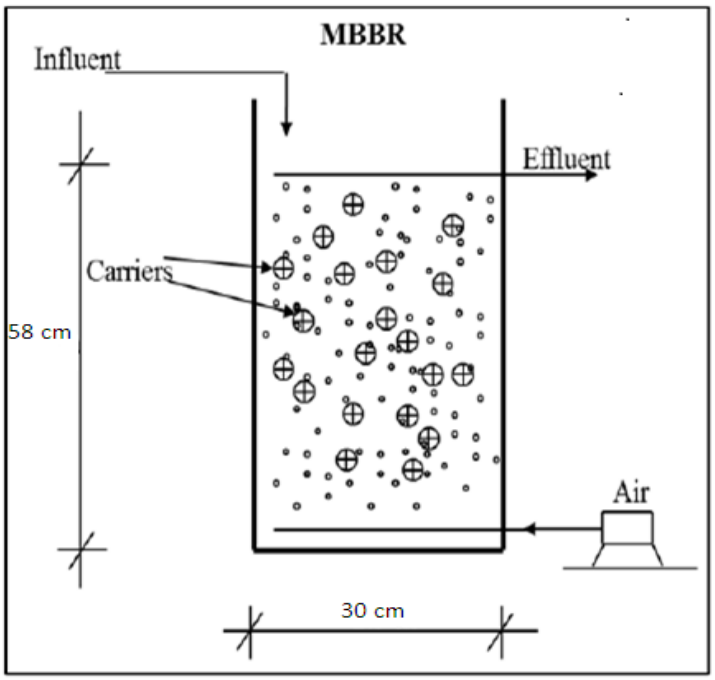
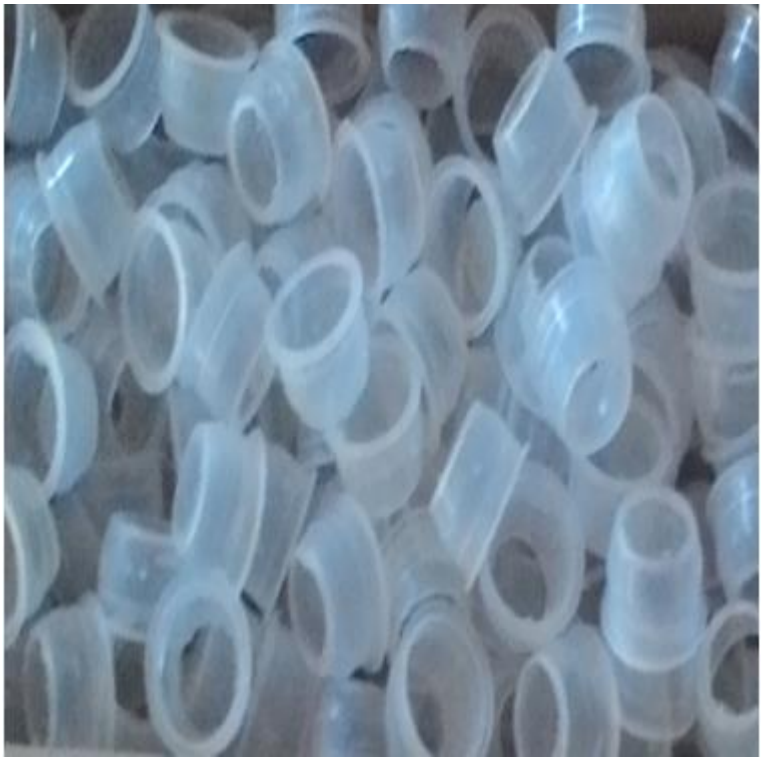


FIGURE 1: Moving Bed Bio film Reactor experimental setup

The Moving Bed Bio-film reactor (MBBR) setup proposed for this study will be made up of plastic containing one compartment. The inlet arrangement for influent after primary treatment of dairy wastewater will be given at the top of tank. The Outlet will be provided at lower level than inlet. The proposed experimental set-up for Moving Bed Biofilm Reactor can be made as shown in the above Figure.

The Moving Bed Bio-film reactor (MBBR) process uses floating plastic carriers (media) within the aeration tank to increase the number of microorganisms available to treat the wastewater compared to conventional secondary treatment. The microorganisms consume organic material. The media provides increased surface area for the biological microorganisms to attach to and grow in the aeration tanks. The increased surface area reduces the footprint of the tanks required to treat the wastewater. The media will be continuously agitated by bubbles from the aeration system that adds oxygen at the bottom of the compartment of the aeration tank. The microorganisms consume organic material. After treatment, final treated effluent will be taken outside through outlet.

Polypropylene carrier



Surface area - 7.144 cm2, cost 340 per/Kg

FIGURE 2: Characteristics of the bio media

FIGURE 3: Top view of experimental setup

III. RESULT AND DISCUSSION

The characteristics of dairy wastewater taken from after primary settling tank are described in the table. The various tests were conducted on the wastewater as per procedure laid down in standard

TABLE 1

CHARACTERIZATION OF SAMPLE

Sr	Parameter	Method Specification	Permissible Limit	Unit	Result at different sampling days					Average Value
1	pH	Standard Method by APHA Ed.2nd.2012,4500 - H+B	6.5-8.5	-	8.2	8.0	7.8	8.0	7.5	7.9
2	COD	Standard Method by APHA Ed.22nd .2012,5220-B	250	Mg/l	980	950	870	935	1050	957
3	BOD	Standard Method by APHA Ed.22th .1998,5220-B	30	Mg/l	435	450	470	506	525	478

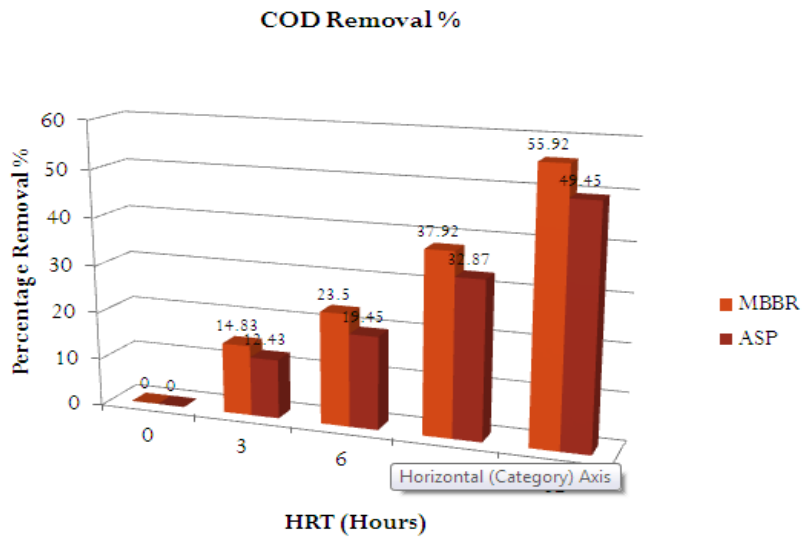


CHART 1: Compression of COD Removal % between MBBR and ASP

CHART 2: Compression of BOD Removal % between MBBR and ASP

IV. CONCLUSION

This study confirmed that the MBBR was highly effective on removing BOD up to 71 mg/L and COD at up to 171 mg /L at 12 hours detention time with a removal efficiency of BOD is 85%, and COD is 55% for dairy wastewater. Reductions in TDS and TSS were not significant. And as compared to Asp this treatment is best giving and for more biomasses grow its more effective result more 90% as less duration. Initially the pH of Dairy waste sample was more alkaline but due to the techniques implemented the pH was brought up much near to the neutral axis. Organic matter removal was generally higher in systems, suggesting that plants may play an important role in removing organic matter from MBBR. So, the treated waste can be effectively used for irrigation and local purposes. Hence, the MBBR treatment process may prove to be a handy solution for the organic effluents from food-based industries.

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