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Moving Bed Sequential Batch Reactor Using Municipal Wastewater

Bheema M Bhajantri[1] and G.B.Megeri[2]
Department of Civil Engineering BEC Baglkot.

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ABSTRACT: The development of wastewater is failed to provide the importance of society for the treatment and collection of municipal wastewaters from the sewage treatment plant (STP) of Bagalkot so it is necessary to treat the STP wastewater. The moving bed sequential batch reactor is an effective efficient wastewater treatment and it can be achieved in small scale plants.
This experimental set up can be done in laboratory scale for treating wastewater treatment in MBSBR Reactor under varied operating conditions such as fill, mixing, Aeration and decant for evaluating the performance of MBSBR like TOC, BOD, COD.
Removal efficiency of TOC, COD and BOD by using 70% of carrier fill in the MBSBR shows relatively lesser efficiency compared to 20% of carrier fill.
Key words: Municipal Wastewater, moving bed sequential batch reactor, biofilm carrier element, aerators, Acrylic glass sheet, cow dung, etc.

I. INTRODUCTION

Considering the world environment required limitations of a centralized conventional wastewater treatment system. It is very important to consider flexible decentralized and low-cost wastewater treatments along with a good quality community benefit. A new generation of highly effective efficient, compacted friendly used and the systems which are used with low cost treatment is to be used for developing countries. Some Authors will suggest that a uniform package plant is completely necessary such as like without knowing persons can understand the procedures of designing, operating, and fabrication work.

If we consider the world population lives in the driest half of the planet is about 75%. The people who don't have access to clean water is nearly about 693 million and the water scarcity in the world population is about 50%. Above mentioned water is waste therefore the water should be under go some of the treatment which be the standard one such as sequential batch reactor, moving bed biofilm reactor, moving bed sequential batch reactor and the trickling filter. The wastewater in the sense of domestic wastewater, municipal wastewater and industrial wastewater should be undergoing treatment so that we can reuse the treated waste water for plant growth and for agricultural purposes and also for sustainable practices.

Moving bed sequential batch reactor is activated sludge process so it finding its application all over the world. MBSBR operates with a given time interval. This reactor is a best effective method for treatment of industrial wastewater and municipal wastewater. Then MBSBR is highly efficient for the removal of suspended solids, nutrient removal and other toxic substances from the waste water. MBSBR is basically an activated sludge system which is operated in the form of SBR like fill, react, settle, decant, idle and draw methods. MBSBR shows two cycles among one is a process of aeration and sedimentation process in the reactor and below the figure shows that five step of MBSBR.

Objectives

- To design and fabricate the lab-scale model for MBSBR.
- Present study is to understand and evaluate the performance of moving bed sequential batch reactor under varied operating condition treatments using municipal wastewater.
- TOC, COD and BOD removal efficiency where investigated on the basis of different percentages of carrier fill (pall rings) where added to the moving bed sequential batch reactor along with consideration of hydraulic retention time (HRT).

Materials

Collection of wastewater, Biofilm carrier element (pal ring), Acrylic sheet, Air Pump withdiffuser stones, Water taps, Araldite and Cyanoacrylate, cow dung.

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Design consideration.

Rectangular in shape, 0.5cm thickness of the acrylic sheet, 60cm long, 25cm wide, 16cm height, Capacity of this reactor is 10L.

MBSBR Reactor

Reactor

Working procedure of MBSBR.

- Moving bed sequential batch reactor is fabricated as per the design considerations such as 0.5cm thick, 60cm long, 25cm wide, and 16cm height of acrylic sheet, 4 water taps were provided and the distance between each water tap was 15cm.
- 10 liters of municipal wastewater was collected from a Bagalkot municipality.
- 10liters of wastewater poured into the moving bed sequential batch reactor. And three air Pumps were supplied with diffuser stones to the reactor of capacity 8Lpm. 20% of biofilm carrier (pall rings) were added to the reactor.
- Create MLSS (mixed liquor suspended solids) with cow dung approximately taken 20 g of cow dung then added to the 2 liters of wastewater and the system was kept for two days. After the completion of 2 days and the created MLSS was supplied to the reactor.
- By fallowing above 5 steps of moving bed sequential batch reactor which was known as the experimental set up.
- After the completion of experimental set up start the working procedure.
- Switch on 3 air Pumps by using electricity.
- The combination of above steps was known as the moving bed sequential batch reactor system.
- Moving bed sequential batch reactor is operated with different carrier fill percent 20, 30, 40, 50, 60, 70% etc.
- For every carrier fill percent four readings were taken by giving hydraulic retention time (HRT) as 1hr, 2hr, 3hr, and 4hr respectively.

II. RESULTS AND DISCUSSION

Removal efficiency of Total Organic Carbon (TOC), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for 70% Carrier Fill.

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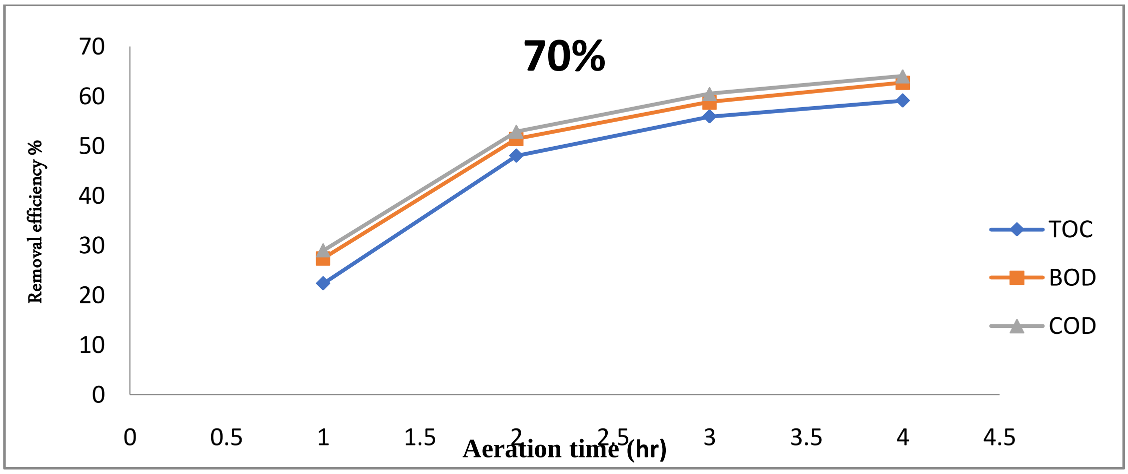
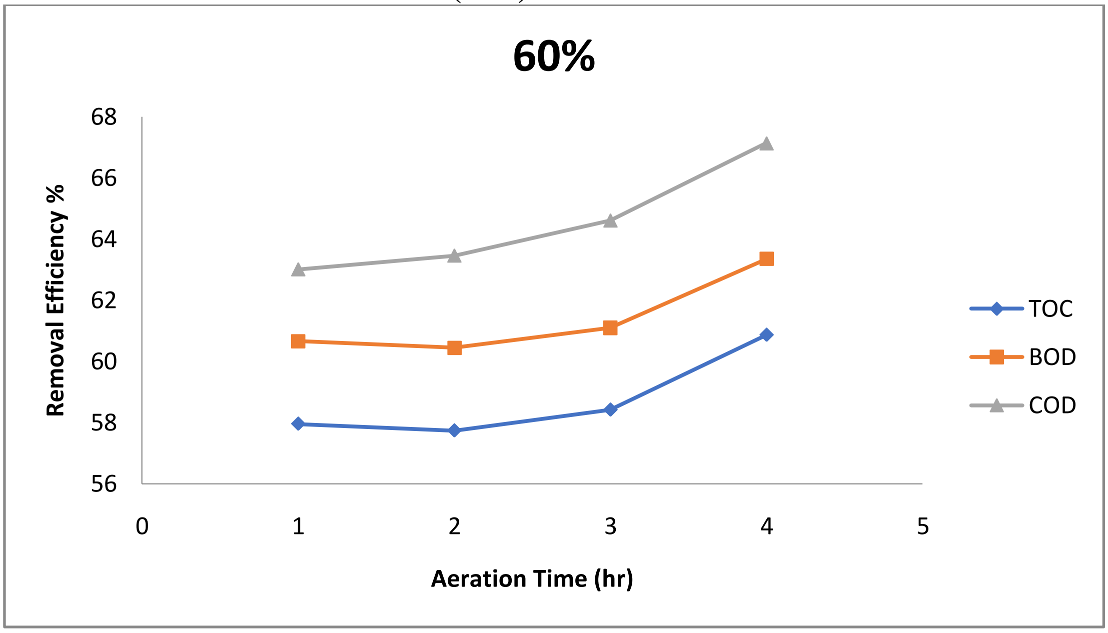


Removal efficiency of Total Organic Carbon (TOC), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for 60% Carrier Fill.



Removal efficiency of Total Organic Carbon (TOC), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for 50% Carrier Fill.

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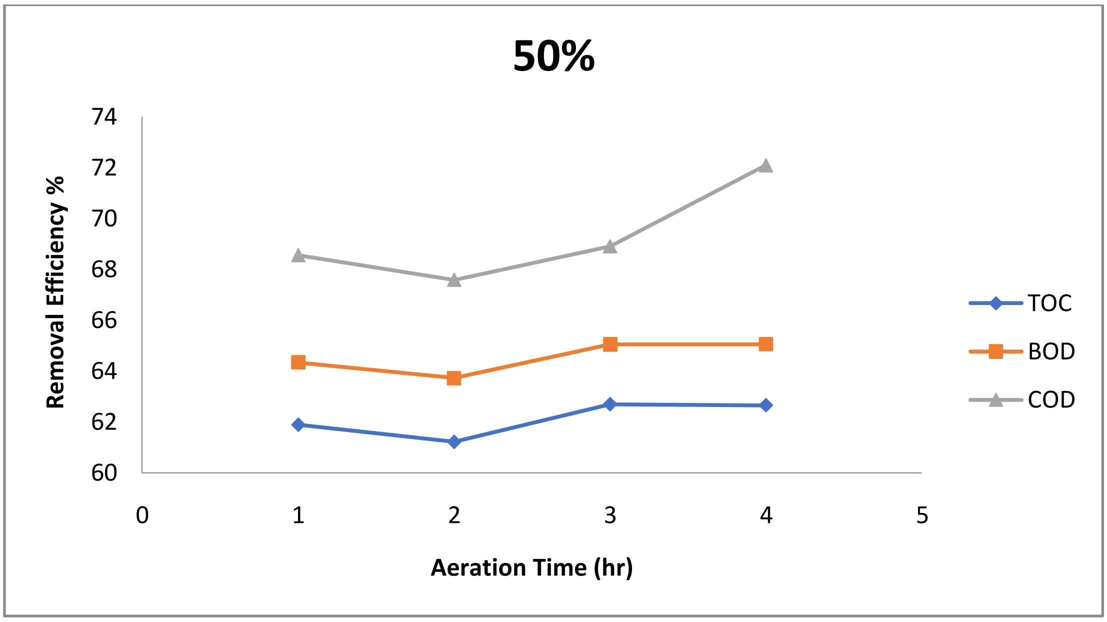
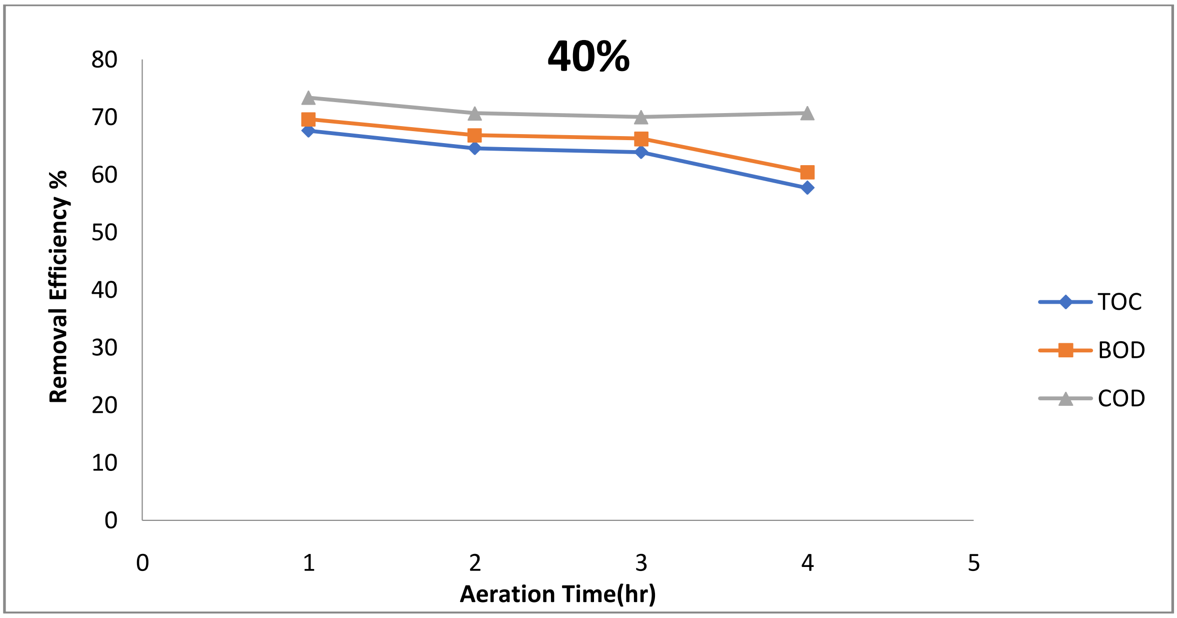
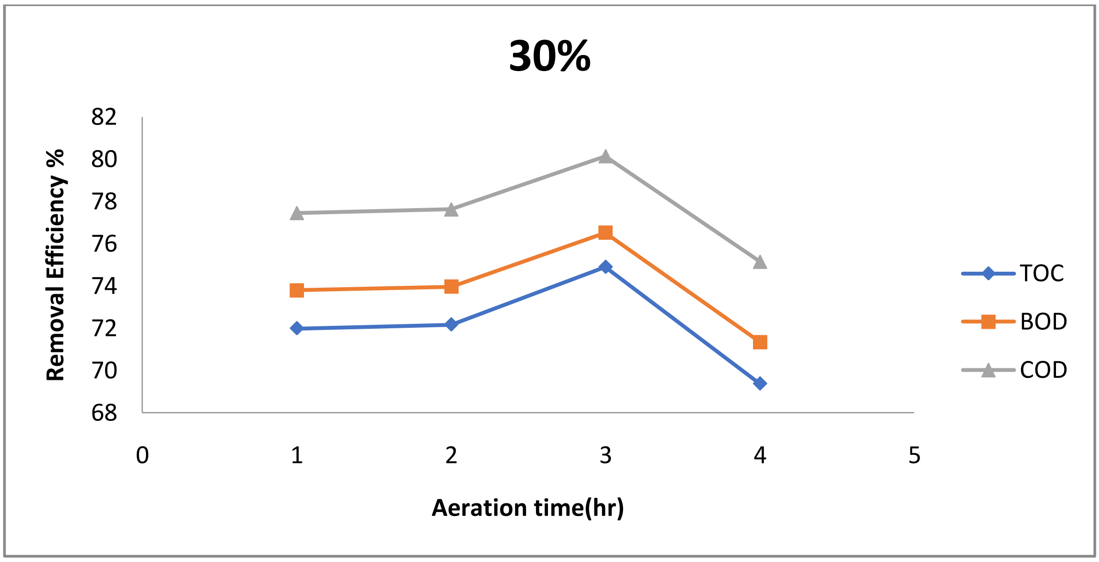


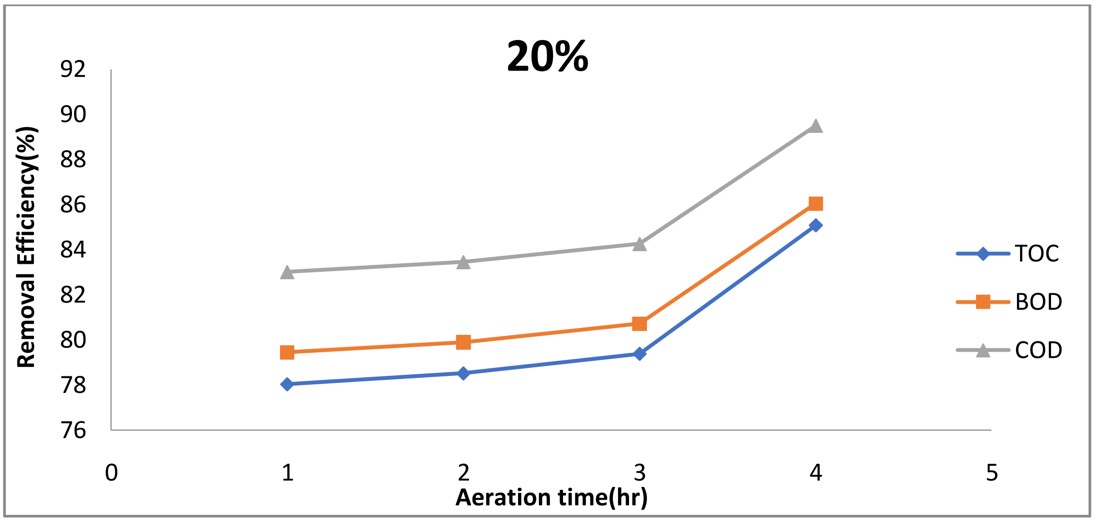
Removal efficiency of Total Organic Carbon (TOC), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for 40% Carrier Fill.



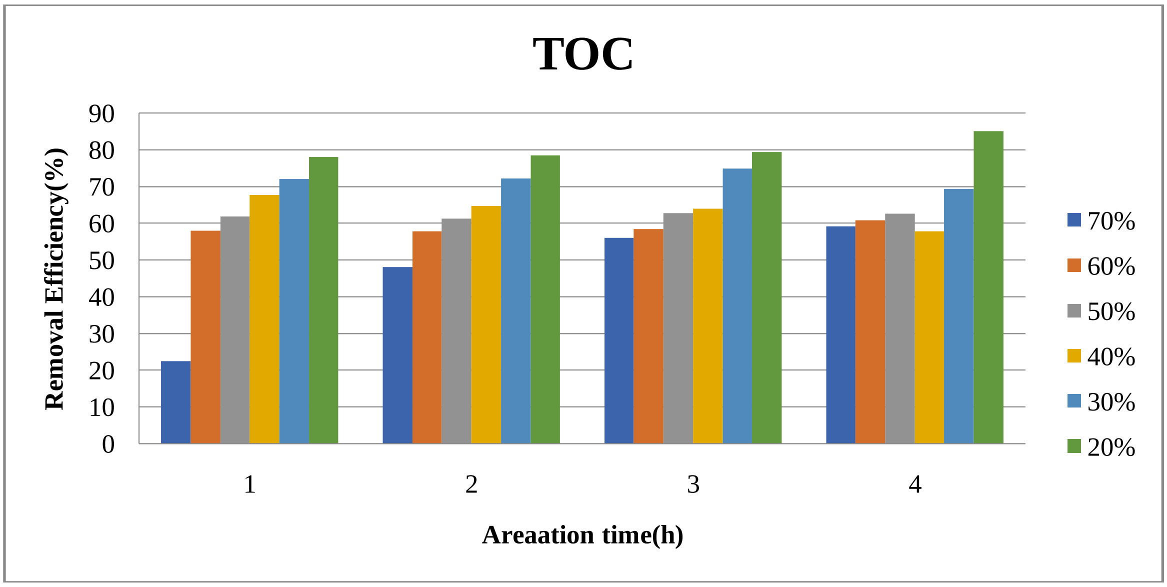
Removal efficiency of Total Organic Carbon (TOC), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for 30% Carrier Fill.



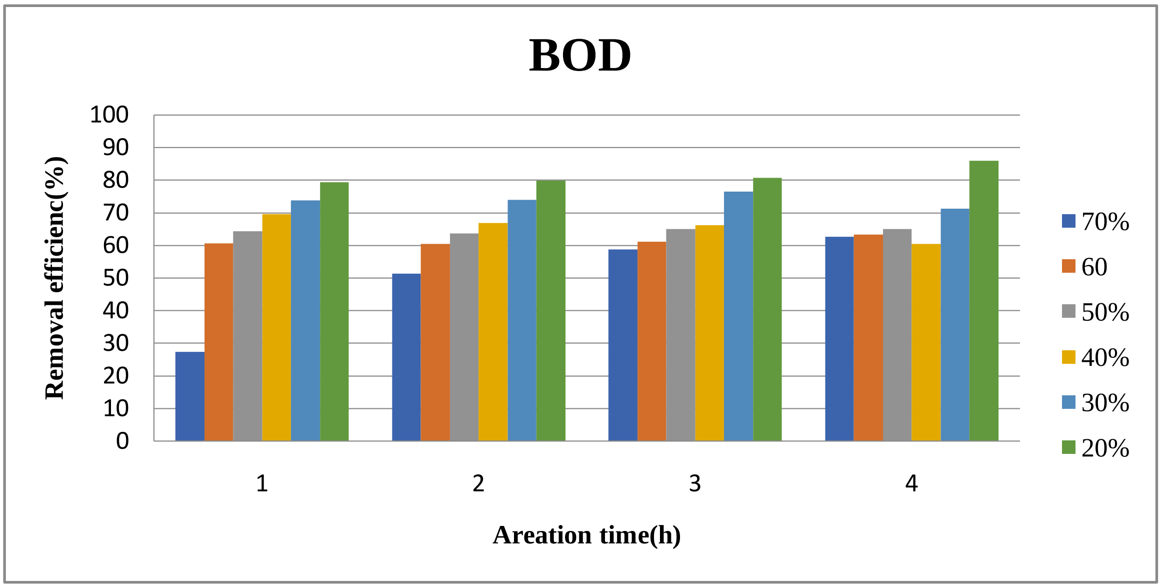
Removal efficiency of Total Organic Carbon (TOC), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for 20% Carrier Fill.



Effect of Aeration time and different carrier fill percent on performance of MBSBR in terms of Total Organic Carbon Removal.



Effect of Aeration time and different carrier fill percent on performance of MBSBR in terms of Biological Oxygen Demand Removal.



9 Effect of Aeration time and different carrier fill percent on performance of MBSBR in terms of Chemical Oxygen Demand Removal.

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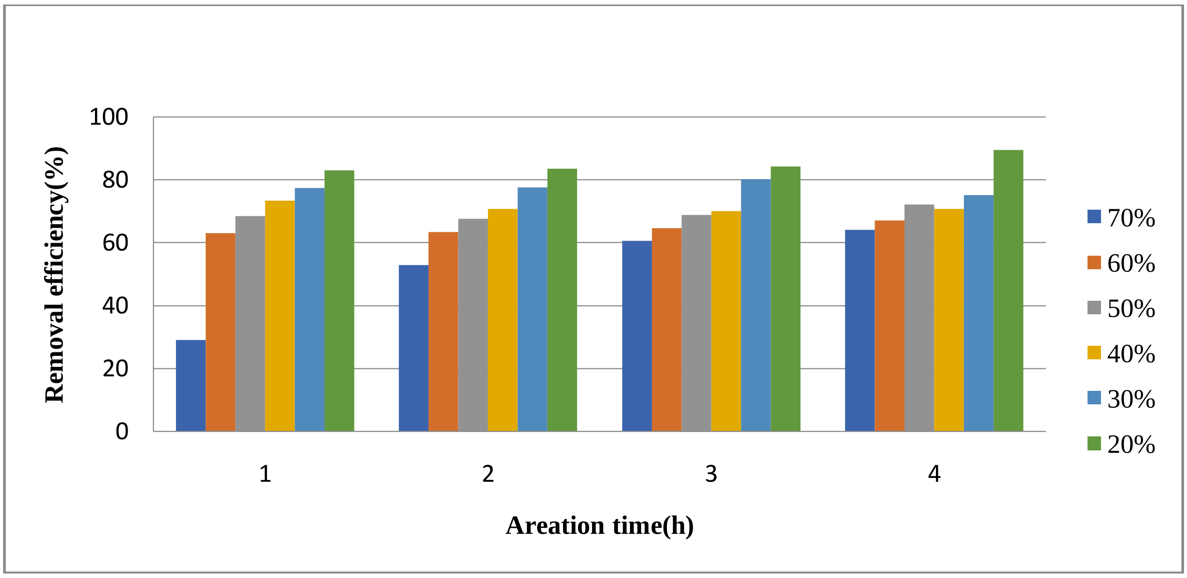

III. CONCLUSION

This experimental set up was carried out for the treatment of Municipal wastewater from the sewage treatment plant at Bagalkot using Moving Bed Sequential Batch Reactor with three Aerators and different carrier fill percent such as 70%, 60%, 50%, 40%, 30%, 20%.

a) The Municipal wastewater was treated for 70% of "carrier fill", the results were obtained for the maximum removal efficiency of TOC, BOD and COD at 4th hour was 59.18%, 62.74% and 64.09% respectively.

b) The Municipal wastewater was treated for 60% of "carrier fill", the results were obtained for the maximum removal efficiency of TOC, BOD and COD at 4th hour were 60.87%, 63.35% and 67.14% respectively.

c) The Municipal wastewater was treated for 50% of "carrier fill", the results were obtained for the maximum removal efficiency of TOC, BOD and COD at 4th hour was 62.65%, 65.05% and 72.10% respectively.

d) The Municipal wastewater was treated for 40% of "carrier fill", the results were obtained for the maximum removal efficiency of TOC, BOD and COD at 4th hour was 67.56%, 69.65% and 73.39% respectively.

e) The Municipal wastewater was treated for 30% of "carrier fill", the results were obtained for the maximum removal efficiency of TOC, BOD and COD at 4th hour was 74.91%, 76.52% and 80.14% respectively.

f) The Municipal wastewater was treated for 20% of "carrier fill", the results were obtained for the maximum removal efficiency of TOC, BOD and COD at 4th hour was 85.08%, 86.04% and 89.49% respectively.

g) Finally it was concluded that the higher removal efficiency of TOC, BOD and COD were occurred with 20% of carrier fill compare to 30, 40, 50, 60 and 70%.