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COMPARISON AND ANALYSIS OF ACTIVATED SLUDGE PROCESS AND MOVING BED BIO-REACTOR FOR THE TREATMENT OF DOMESTIC SEWAGE

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Abstract - *Moving bed biofilm reactor (MBBR) incorporates benefits provided by both attached growth and suspended growth process. Increment in the field of Wastewater Treatment Plant, which includes removal of bacteria, by using the MBBR (Moving Bed Bio Reactor) or other process of wastewater treatment. More attention is now paid to the MBBR. Micro-organism combined with Activated Sludge Process (ASP), has turned out to suitable methods for minimizing the effluent load. The Moving Bed Bio-Reactor is provided in recent plants for impromising capacity and bacteria removal without requiring additional plants or tanks. So that the project duration become short and space for this project required very less. The purpose of this research project was to learn more about the roles of the biofilm media in the MBBR process, with the intention to improve process performance and develop new MBBR applications.*

Key Words: Moving bed Biofilm Reactor(MBBR), Levapor Media, Activated Sludge Process (ASP), Bio Chemical Oxygen Demand (COD), Biochemical Oxygen Demand(BOD).

1. INTRODUCTION

There is need to effectively treat the wastewater generated at the various sources to create a hygienic environment. The sewage after treatment may be disposed either into water body such as lakes, streams, rivers, and oceans or into a land. Wastewater reuse is becoming increasingly popular, especially in areas affected by water scarcity.

The strength of waste water can be reduce by various aerobic treatment technologies like Moving Bed Biofilm Reactor (MBBR), Activated Sludge Process (ASP), Sequencing Batch Reactor (SBR), Up Flow Anaerobic sludge blanket (UASB). In the work experiment were conducted to treat the effluent of domestic sewage treatment plant by using Moving bed biofilm reactor (MBBR) and Activated sludge process (ASP). The present work intended to study removal efficiency of COD, BOD, TSS, TDS, Turbidity by used Levapor Carrier cubes in MBBR tank

Moving bed biofilm reactor (MBBR) is type of waste water treatment process that was first invented by Prof. Hallvarddegaard at Norwegian university of Science and Technology in the late 1980s. The MBBR consist of aeration tank (similar to activated sludge tank) with special MBBR media that provide a surface where Biofilm can grow.

1.1 Objective

To study the performance Evaluation of domestic sewage treatment plant after treating with ASP and MBBR technology located at Aditya Garden City, Warje, Pune.

- Performance and comparison of Activated sludge process with Moving bed bio-film reactor.
- To determine performance of MBBR using levopar as MBBR media.

2. MATERIALS AND METHODOLOGY

2.1 Materials

Levapor carriers based aerobic biological wastewater treatment solutions are offered as MBBR process configuration. In this process ordering, MLSS is also maintained in the suspended phase along with Levapor carriers using RAS (Returned Activated Sludge) as practiced in the conventional activated sludge process. This combination of both suspended growth and attached growth process makes Levapor MBBR a truly synthesis process bringing superiority of both attached growth and suspended growth processes.

Advantages of Carriers:

Due to their mentioned advantageous properties,

- LEVAPOR carriers enable a very fast
- Reversible adsorption of inhibitory, slowly degradable pollutants and
- Colonization of carrier surface by more active,

- special, bio-film forming micro-organisms than simple carriers resulting in faster process start-up
- higher removal efficiency
- higher process stability
- lower sludge yields and
- Better process economy

Table-1: Properties of Media

Media name	Levapor
MOC	Reticulated Pu foam
Structure	cubes
Height & Diameter	20 mm x 7 mm
Weight	65 -80kg /m^3
Colour	Black
Thickness	7mm

Fig -1 : Levapor Media

2.2 Methodology

The method of treatment adopted using Levapor carriers cubes as media follows the principle of fix and suspended growth process in which waste water is made to trickle over the media containing seeding agent due to biological action the inorganic compound present in waste water get decomposed resulting in reduction of strength of wastewater get decomposed resulting in reduction of strength of wastewater.

In this process we used two fiber tank for ASP and MBBR separately as model having dimension of tank 40 x 40 x 40 cm. The air diffuser pipes provided at bottom of each tank for continuous aeration. The blower of 3.5-5lit/min is used for areation. Initially added the 30 lit sludge in each reactor then added known volume of raw sewage in each reactor. 20 liters of raw sewage is fed through the inlet at continuous rate for two weeks. The 7.5 liter Levapor carriers added in MBBR tank on which micro-organisms grow and treat the wastewater. After, this the parameters such as pH, COD, BOD, TSS and Total Nitrogen are analyzed for the sample coming the outlet by implementing the standard methods for the Examination of Water and Wastewater, (APHA, AWWA, 20th Edition). The experimental set-up for ASP and MBBR is made as shown in figure.

Fig -2: Experimental Setup

2.3 Sampling

Sample was collected from Aditya garden city sewage treatment plant, warje, Pune. Sampling was conducted for every 24hrs for a period between 2 weeks. Grab samples were collected in plastic cans rinse with distilled water.

Testing of different parameters of collected sample was done in this stage eg. BOD, COD, TSS and Total Nitrogen.

3. EXPERIMENTAL SECTIONS

Various test were carried out on wastewater Test conducted namely as: 1) pH, 2) BOD, 3) COD, 4) TSS, 5) Total Nitrogen, Tests were conducted in standard laboratory as well as few tests were conducted in college laboratory with IS specification and collaborated equipment's. Standard laboratory name: Lotus Water Testing and Analytical laboratory, Sinhgad road, Pune. Wastewater sample was treated by activated sludge and MBBR technique by analysis of outlet sample. Treated sample was analyzed in laboratory with respect to same parameters which mentioned earlier for comparison of ASP sample with MBBR sample.

4. RESULTS AND DISCUSSION

In this present study the levapor media is used in MBBR tank and continuous aeration is given to ASP and MBBR tank. The study shows higher removal efficiency for MBBR as compared to ASP

Table-2: Removal Efficiency of ASP

Test Parameters	STP Inlet Water	ASP	% REMOVAL
pH	7.66	7.29	-
Total Suspended Solids mg/L	1317	132	89.97%
Oil & Grease mg/L	16	4	75%
Total Nitrogen mg/l as N	4.80	1.6	66.66%
Chemical Oxygen Demand mg O2/L	374	62	83.42%
Biological Oxygen Demand mg O2/L	140	22	84.28%

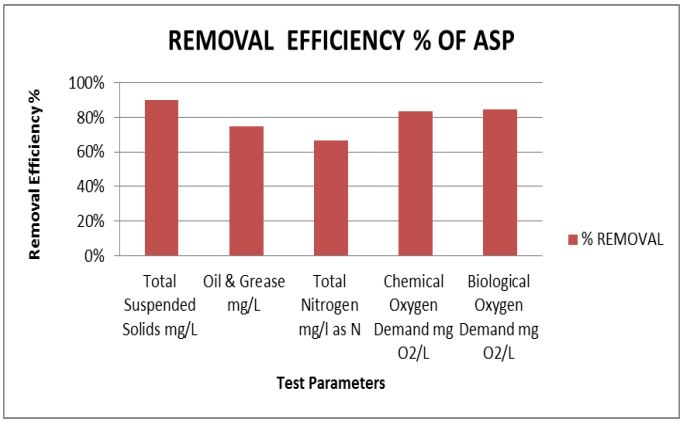

Chart -1: Removal efficiency for Activated Sludge Process

Table-3: Removal Efficiency of MBBR

Test Parameters	STP Inlet Water	MBBR	% REMOVAL
pH	7.66	7.13	-
Total Suspended Solids mg/L	1317	120	90.88%
Oil & Grease mg/L	16	<2	87.5%
Total Nitrogen mg/l as N	4.80	0.4	91.66%
Chemical Oxygen Demand mg O2/L	374	34	90.90%
Biological Oxygen Demand mg O2/L	140	8	94.28%

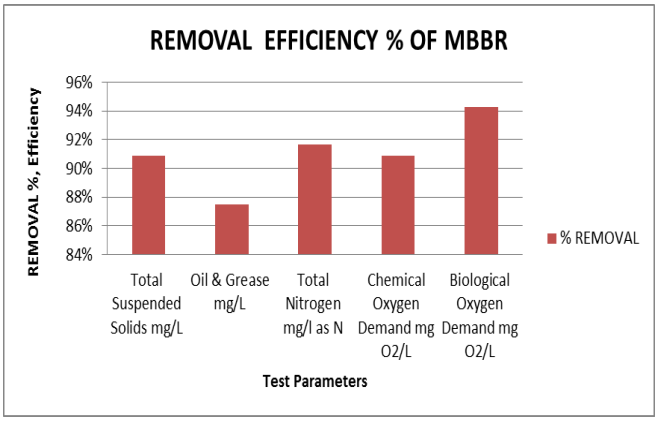

Chart -2: Removal efficiency for Moving Bed Bio Film Reactor

COMPARISION OF RESULTS:-

1. Graph showing comparative statement regarding removal efficiency of ASP and MBBR for different Parameters

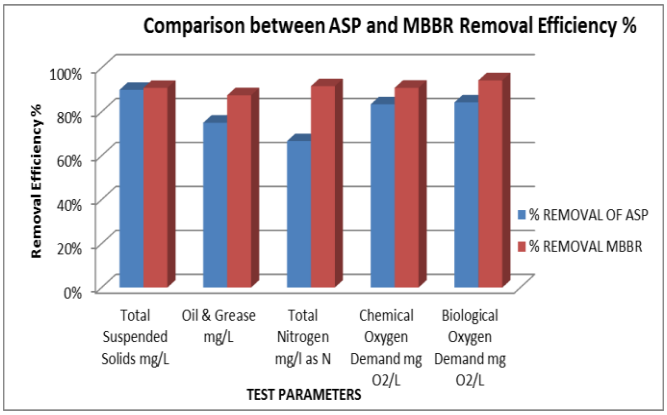

Chart -3: Removal efficiency for MBBR and ASP

2. Graph showing pH values for MBBR and ASP

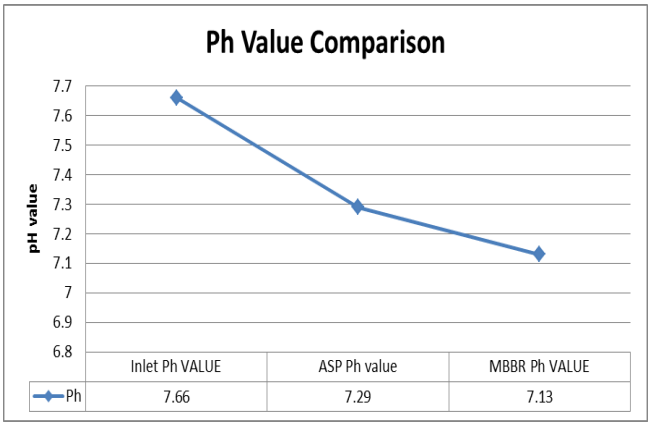

Chart -4: pH value comparison

5. CONCLUSIONS

1. In this study, some conventional and specific experiments were conducted to evaluate removal efficiency of parameters for ASP and MBBR. Based on experiment result and analysis from ASP and MBBR, following conclusions can be drawn.
2. Considerable reduction in BOD, COD, TSS, Total Nitrogen were achieved.
3. The removal Efficiency of MBBR were achieved by using Levapor as media
4. MBBR is gaining importance around the world.
5. It is a leading technology in wastewater treatment as this system can operate at smaller footprints and give higher removal efficiency.
6. The MBBR performed to be an effective process for removing most of the pollutants.
7. Nowadays, there are different types of bio-media used in river water purification technologies which are locally available and international water industry market, and the kinds of bio-media can be characterized by considering the types of treatment system.
8. In terms of removal efficiency MBBR is better than ASP.

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