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# PERFORMANCE EVALUATION OF MACRO FILTER USING WOVEN FABRIC IN MBR FOR SEWAGE TREATMENT

**[1] Desai Prachi D., [2] Pandya Minarva J.**

[1] *PG Student, Environment Department, L.D.College of Engineering, Ahmedabad, India.*

[2] *Associate Professor, Environment Department, L.D.College of Engineering, Ahmedabad, India.*

**ABSTRACT**

*Membrane bioreactor technology has many advantages include small footprint, low excess sludge and better effluent quality. However its applicability is limited due to low permeate flux, higher tendency of membrane fouling which increase operational and maintenance cost. So in this study Woven fabric filter with larger pore size (>2µm) is used in MBR by replacing conventional membrane which is cost effective and highly effective for biological treatment. This study showed that biofilm layer attached on Woven fabric filter shows good filterability. The average COD and TSS removal efficiencies reached 82% and 92% respectively. Sludge concentration was maintained 4000 mg/L was maintained in reactor without excess sludge discharged. The low concentration of sludge was beneficial for mitigating filter fouling. Thus, Macro filter using woven fabric filter in MBR provides low cost and efficient treatment. Also system shows a high potential forapplication in rural and sparsely populated area for reuse purpose.*

***Keywords:****Biofilm layer,Filter material,Macro filter, MBR*

## I. INTRODUCTION

Membrane bioreactor (MBR) is an advanced technology which is widely applied for wastewater treatment. MBR Technology has many advantage including small footprint, low excess sludge production and good effluent quality. Membrane fouling control and low permeate flux are the major constrains which result in relatively high energy consumption and higher operating cost. Moreover membrane replacement further increases the maintenance cost. Also many currently available system have limitation in providing adequate effluent quality at low cost with simple operation and maintenance. Therefore there is an urgent demand to modification in conventional MBR which is cost effective and provide better effluent quality.

In order to develop economical and simple operation system MBR is provided with fabric filter with a larger pore size (>2µm) using woven fabric filter in MBR by replacing membrane. In such system the biofilm layer attach on the fabric filter provide effective biological treatment. Woven fabric filter itself a highly permeable

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rough filter, the biofilm forming on its surface acts as effective filter medium that is capable of retaining small particles. This concept is feasible when economic budget is low and minimum land with minimized sludge disposal is required.

This study aims to investigate the performance and feasibility of Macro filter in MBR for sewage treatment. A Submerged membrane bioreactor using polypropylene woven fabric as filter material is used. The pollutant removal efficiency and Macro filter performance was evaluated.

## II. MATERIALS AD METHODS

### Experimental Set up

A lab scale MBR using Polypropylene (PP) woven fabric filter was operated. Fig shows the reactor consist of tank with a volume of 120 L (77*22*70 $cm^3$) (L*B*H). Working Volume of the tank is 100 L. Plate type filter module is used in submerged MBR using Polypropylene (PP) woven fabric. The pore size of the fabric filter 5, 15, 50 µm was tested.Effective filtration area of 0.1858 $m^{2.}$ The blower was equipped at the bottom of the tank supply air bubbles. The tank is seeded with activated sludge. The MLSS concentration was maintained 3500-4000 mg/L in the reactor. No excess sludge is discharged during entire experimental work. Sewage was continuously fed into the reactor through a feed pump. The inflow rate kept at 10 L/hr and HRT was 12 hr.

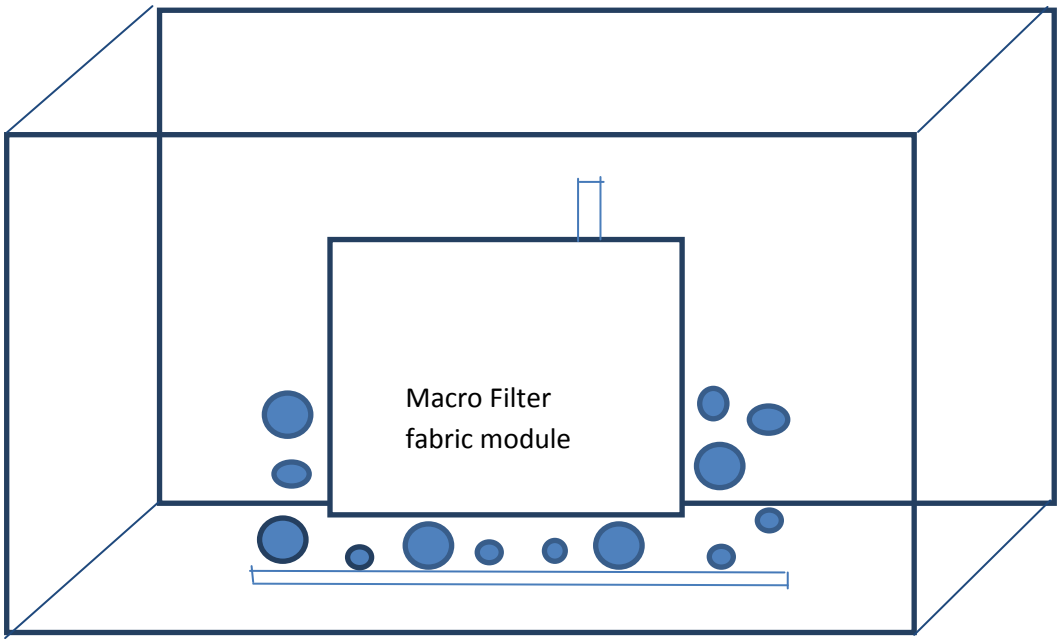


Fig 1 . Schematic diagram of Macro filter in MBR

### III.Effect of MLSS Concentration

In Macro filtration Membrane bioreactor it is necessary to maintain MLSS Concentration in reactor. As biofilm layer attach on the fabric filter provide good biological treatment. So MLSS Concentration play key role for Macro filtration MBR Using Fabric Filter material. And so to maintain MLSS Concentration in reactor is

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necessary. MLSS ranges 3500-4000 mg/L is maintained for good effluent quality. If MLSS concentration become low the biological treatment couldn't efficiently work and efficiency decreased so as effluent seems poor quality.

## IV.Analysis

Sample were collected from Influent, Effluent and the Reactor on daily basis. The parameters included chemical oxygen demand (COD), mixed liquor suspended solid (MLSS), Dissolved Oxygen (DO), Potential of Hydrogen (pH), Total Suspended Solid (TSS) were experimentally evaluated. The analysis was done as par the American Standard methods for examination of water and wastewater (APHA) (Edition 23rd).

## VI. Results

Table 1 Experimental Results of Macro filter MBR with different Pore Size

| Fabric Material | Parameter | Influent | Macro filter MBR | Effluent |
|---|---|---|---|---|
| **Pore size-5 µm** | | | | |
| **Polypropylene (PP) Woven Fabric** | pH | 7.6 | - | 8.2 |
| | DO | 3.2 | 4.2 | 4 |
| | TSS | 526 | - | 68 |
| | COD | 650 | - | 52 |
| **Pore Size-15 µm** | | | | |
| **Polypropylene (PP) Woven Fabric** | pH | 7.5 | - | 8.1 |
| | DO | 3.4 | 3.9 | 4.1 |
| | TSS | 496 | - | 74 |
| | COD | 595 | - | 59 |
| **Pore Size-50µm** | | | | |
| **Polypropylene (PP) Woven Fabric** | pH | 7.6 | - | 8.1 |
| | DO | 3.3 | 3.8 | 4 |
| | TSS | 530 | - | 132 |
| | COD | 620 | - | 150 |

Experimental result shows that 5µm, 15µm, provide better efficiency than 50µm. Total dissolved solids having 87%, 85% and 75% removal respectively. COD removal was 92%, 90% and 84% removal respectively.

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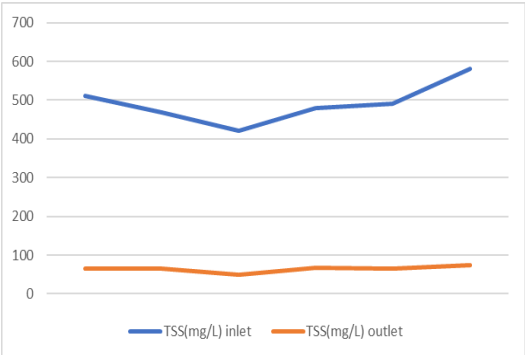


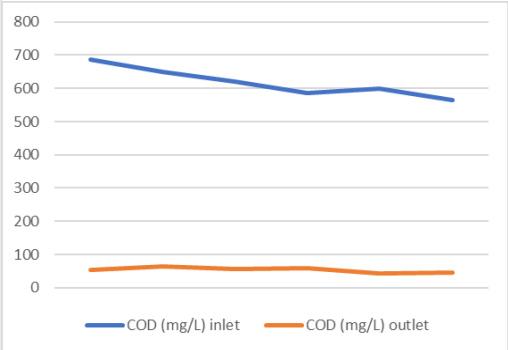


Fig.2 Graph of TSS (mg/L) ReductionFig.3 Graph of COD (mg/L) Reduction

## VII. CONCLUSION

From the study of Woven fabric with larger pore size in MBR we conclude following:

- Woven fabric can be used as filter material in MBR for sewage treatment.
- The system produced steady and better effluent quality which adequately meet sewage discharge standard.
- Woven Fabric filter is able to develop efficient biofilm layer on its surface and provide better biological treatment and enabled effective rejection of TSS and High Removal efficiency of COD was achieved.
- This work opens the possibility for the development of a cost effective, efficient and promising technology for the sewage treatment.

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