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Municipal Wastewater Treatment by using Membrane Bio-Reactor

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Abstract - *Water plays an essential role in human life. WHO says that approximately 36% of urban and 65% of rural Indian are without access of safe drinking water. Fresh water is most important resources crucial for the survival of the living beings. Many people in Wagholi town of Pune depends on fresh water supplies from ground water. It provides water for domestic use for all parts of the Wagholi town. The availability of ground water depends on the rate at which ground water depends on the rate at which it is recycled by hydrological cycle than on the amount.*

The present work that is analysis of water is carried out in the vicinity of the Wagholi town. In order to study the water quality,in wagholi area, different sample collection points were located in the study area. The water supplies were collected from these locations. The water samples were tested immediately after its collection so that there would not be any change in its, characteristics. The results of the study were obtained and presented in the chapters to come.

Key Words: (WHO, Ground water, Hydrological cycle, vicinity)...

1. INTRODUCTION

Membrane Bioreactors (MBRs) have attracted a significant attention of scientists and engineers in the past two decades. Improvement of membrane technologies coupled with experiences gained from application of membranes in different industrial processes have opened a gamut of opportunities in wastewater treatment. The solid liquid separation that is conventionally carried out in gravity based clarifier is replaced by membrane filtration in a MBR system thus combining the strength of biological treatment processes and efficiency of membrane filtration. This and several other advantages have made the MBR system ideally suited for treatment of strong industrial wastewater and reclamation of water. However, commercial use of membrane in wastewater treatment remained limited primarily due to low membrane flux, low permeability, limited membrane life and high cost of membrane. From early 90's due to active researches in the field of membrane technology, a new generation of membranes evolved that overcame many of the above limitations and the cost of membranes started to decline. This attracted a lot of attention to commercial use of membranes in wastewater treatment.

1.1 General

The membrane bioreactor (MBR) process (membrane activated sludge process) is an advanced wastewater treatment Technology and constitutes a suspended growth activated sludge system, which instead of secondary clarifiers utilize slow-pressure Membranes for solid/liquid separation (as shown in Fig. 1and 2). As opposed to secondary clarification, the quality of solids separation is not dependent upon the mixed liquor suspended solids concentration, or the settling characteristics. Hence, MBR can Operate with much higher mixed liquor suspended solid concentrations, constituting an intensified biological process. Accordingly, the two major benefits of the MBR process are substantially reduced land and space requirements one the One hand and the reclamation of waste water (permeate) of excellent quality on the other hand, which is a valuable source forHigh demand reuse applications. Membrane bioreactor technology (MBR) a combination of the activated sludge process with micro- and ultrafiltration is widely regarded as an effective tool for waste water treatment and water reuse due to its high product water quality and low footprint. Due to their robustness and flexibility MBR systems are more and more preferred.

Membrane bioreactor provides benefits of biological treatment with a physical barrier separation. Compared to convent ional treatment processes, membranes are able to provide better quality effluent with a smaller, simplified treatment processes. Looking into all these advantages, the project aims at finding out efficiency of small bio reactor.

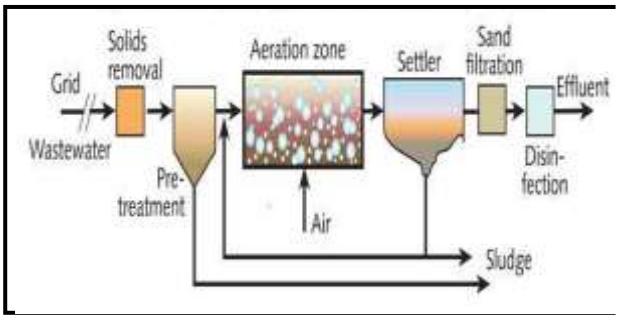

Fig -1: Flow Diagram of waste water Treatment using ASP

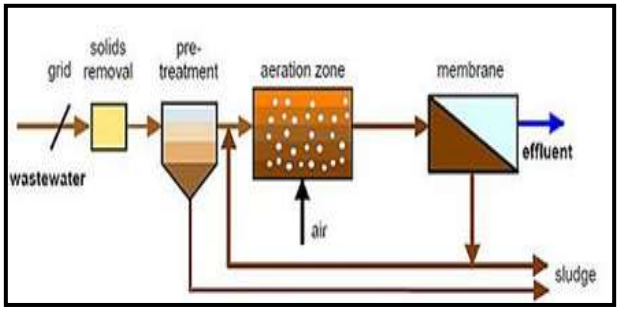

Fig -2: Flow Diagram of waste water Treatment using MBR

1.2 Objectives

1. **To develop a laboratory scale model of MBR**
   A small lab scale working model of MBR (MEMBRANE BIO REACTOR) is to be prepared to treat the wastewater.
2. **To characterize wastewater usingprepared model of MBR**
   The characterization of various important parameters of wastewater is to be done. For that, waste is to be treated using prepared model and important tests such as BOD, COD, DO, etc. are to be performed on this wastewater before and after treatment.
3. **To investigate the performance of the MBR model**
   After conducting tests on wastewater, the parameters of waste obtained are to be compared with permissible limits. From this, performance of model is to be checked weather it is effectively working or not.

2. METHODOLOGY

A laboratory scale MBR model is prepared to explain methodology of the complete process. Waste water is treated with use of the portable MBR model and conducted various tests on the waste water and concluded outcomes in form of test results.

Details of laboratory scale MBR model are as follows:

2.1 Components used to develop lab scale model of membrane bio reactor.

1) BIOREACTOR TANK
2) SCREEN
3) STIRRER
4) MEMBRANE
5) AERATOR
6) INLET AND OUTLET

- **BIOREACTOR TANK**

Thermocol tank is used which will acts as a membrane bio reactor unit. The tank has two separate compartments separated by barrier:

1st compartment is for biological process.

2nd compartment is for aeration and membrane filtration.

- **SCREEN**

Generally, Screen is provided for primary treatment of wastewater to remove floating matter, rags plastic, etc. As we collected wastewater sample from aeration tank it was already screened, so in the model no such screening arrangement is provided.

- **STIRRER**

A rotating stirrer is used in 1st compartment of tank to keep all particles in suspension and for formation of floc.

- **MEMBRANE**

Fabric filter is used as membrane.

Filter is fitted in 2nd compartment of tank.

- **AERATOR**

Aerator is used in 2ndcompartment of tank to supply oxygen in wastewater. Fish tank aerator is used for aerating wastewater.

- **INLET AND OUTLET**

Funnel is used as a inlet and pipe as an outlet.

2.2 Processes in membrane bio reactor model

- **SCREENING**
- **BIOLOGICAL PROCESS**
- **(ACTIVATED SLUDGE PROCESS)**
- **AERATION**
- **MEMBRANE FILTRATION**
- **TREATED EFFLUENT**

3. RESULTS AND OBSERVATIONS

3.1 DISSOLVED OXYGEN TEST RESULTS:

Sr.no	Description of sample	ml of titrant used
1	Sample 1 - Untreated	**3.6**
2	Sample 2 – Treated	**7.6**

3.2 CHEMICAL OXYGEN DEMAND TEST:

Sr.no	Description of sample	Dilution	ml of titrant used	COD (mg/l)
1	Sample1 (untreated)	1 to 2	a = 36.2 b = 17.20	**380**
2	Sample2 (treated)	1 to	a = 12.2 b = 10.53	**16.71**

3.3 BIO CHEMICAL OXYGEN DEMAND TEST:

Sr. No	Description of sample	Dilution factor	Bottle no	DO (initial) (A)	DO (final) (B and C)	$BOD_5@20^0$ c mg/l
1	Sample1 (untreated)	50	1	7.2	3.39	**190.5**
2	Sample2 (treated)	2	2	7.6	4.75	**5.71**

3.4 FINAL RESULTS:

Sr.No	Wastewater parameters	Untreated Wastewater (mg/l)	Treated Wastewater (mg/l)	Efficiency of Removal (%)
1	Dissolved oxygen (mg/l)	**3.6**	**7.6**	**111.11**
2	Chemical oxygen demand (mg/l)	**380**	**16.71**	**95.6**
3	Bio-chemical oxygen demand (mg/l)	**190.5**	**5.71**	**97**

4. CONCLUSION

The experiments were carried out in environment engineering lab of GHRCEM, Pune. A physical model have been prepared to study the characteristics of treatment process. Following conclusions are drawn.

I. The results obtained after treatment of MBR are excellent.
II. It is easier to operate as compared to conventional systems of treatment of waste water.
III. The membrane may get foul after its continuous use and its performance reduces which may increase the maintenance cost of MBR.

For Future study:

I. Finding sustainable membrane material to avoid its fouling
II. Full scale application of MBR technology.

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