

# Wastewater Management for Small Village by MBR Method

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## Abstract

The goal of this study is to provide sustainable waste water treatment. The proposed wastewater treatment facility is located in the Maharashtra state study area of vashind (khanivali). The environment is severely polluted as a result of population increase that is occurring too quickly, a lack of knowledge, and poverty, particularly in rural areas. In this section, the document provides information on the area's population, drainage, water supply, and ground water quality. In order to treat waste water in rural regions, a wastewater treatment process (the MBR Approach) that is an imported method used in China has been proposed in this work. Wastewater that has been cleaned can be put to a variety of uses, including the cultivation of plants and vegetables.

**Keywords:** Waste water treatment, MBR method.

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## I. INTRODUCTION

### MEMBRANE BIOREACTOR (MBR)

Effective compact technology for the treatment of industrial and municipal wastewater. Membrane bioreactors (MBRs) are now a strong rival to other techniques for cleansing water quality. Although it is not overly difficult to use, this new and innovative technology is nonetheless somewhat pricey. The operation of a membrane bioreactor is similar to that of a traditional activated sludge process, but it does not necessitate secondary clarification or tertiary treatment, such as sand filtering. Effluent or treated water is separated from untreated water using low-pressure membrane filtration, either microfiltration (MF) or ultrafiltration (UF). Membrane bioreactors (MBRs) combine biological wastewater treatment methods like activated sludge with membrane processes like microfiltration or ultrafiltration. Now, municipal use of it is widespread.

### 1.2) SELECTION OF VILLAGE:

For this project the khanivali village selected. It is located in vashind of thane district in Maharashtra, India. It is situated in 15 mins away from vashind railway station.

### 1.3) INFORMATION COLLECTED FROM GRAM PANCHAYAT OF KHANIVALI VILLAGE:

- POPULATION OF VILLAGE AS PER CENSUS 2021-1071
- NO. OF HOUSEHOLDS AS PER CENSUS 2021-1155

### 1.4) VILLAGE INFORMATION:

Sr.No.	Population as per grampanchayat records 2021	Grampanchayat Data
1.	Total Population	1071
2.	Total No. Of Houses	115
3.	Female Population %	45% (482)
4.	Total Literacy Rate %	80% (857)
5.	Female Literacy Rate%	53% (255)
6.	Working Population %	70% (750)
7.	Child (0-6) Population By 2021	180

Table no. 01

1.5) POPULATION FORECASTING:

Sr.No.	year	population	Difference
1.	1991	650	
2.	2001	856	206
3.	2011	964	108
4.	2021	1072	108

Table no. 02

POPULATION FORECASTING BY USING ARITHMETIC INCREASE METHOD

- $PN = PO + NX$
- $P_{2041} = 1072 + 2 * 140.66$
- $P_{2041} = 1353$  SOULS
- POPULATION IN 2041 IS ESTIMATED TO BE AROUND 1353 SOULS BY USING ARITHMETIC INCREASE METHOD

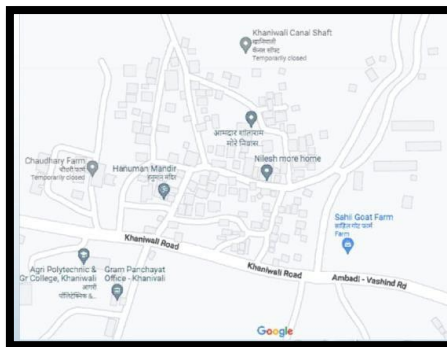
1.6) EXISTING WASTEWATER MANAGEMENT PROCEDURE OF VILLAGE:

- Wastewater are collected in septic tank.
- Septic tank made by gram panchayat.
- Few people throws the wastewater on village road.
- Some houses have their wastewater outlet in that pond.

1.6) PROBLEMS GENERATED AND DRAWBACKS:

- Unplanned septic tank.
- Lack of wastewater management facilities ie. Channels and gutters.
- Still some houses do not have septic tank
- Because of septic tank ground water pollution is increasing.
- There are increasing number of algae in pond water day by day.
- Because of wastewater many diseases are created like dengue, malaria and diarrhea etc.

MAP VIEW OF KHANIVALI VILLAGE:



PHOTOGRAPHS OF VILLAGE



Fig.no.1.0 photos of village

1.7) ADVANTAGES OF WASTEWATER TREATMENT FOR VILLAGE:

- Save water (30-35% reduction in consumption) and money.
- Reduce the demand for fresh water.
- That waste water can be used for planting trees, washing cars, etc.
- Reusing waste water.
- Reducing ground water pollution.

1.8) SURVEY OF VILLAGE:

- We had visited that village for more informations which are useful for our projects.
- Also, we had done survey of village. And we find out the problems related wastewater.
- In that village, there are no proper management of wastewater.
- Then, we decided to give speech for village's peoples.
- We told them about wastewater, why we need to treat wastewater, importance of water, which diseases spread from wastewater.
- Also, we explained them MBR method and how it will work?
- On our speech they gave us good responses and also gave us permission to work on village.



Fig.no.1.1 survey of village

**II. AIM AND OBJECTIVES:**

Aim: Waste Water Management of Small Villages by MBR method.

Objective:

- To treat the sewage water for village development.
- To reuse sewage water.

**III. LITERATURE REVIEW:**

- Title: Application of Membrane-Bio-Reactor in Waste-Water Treatment  
Author: Jain Jyot etal Department of Chemical Engineering, MNIT, Jaipur, Rajasthan.  
Conclusion: The MBR technology has proven optimal for treatment of many industrial wastewaters. The external membrane MBR configuration is preferred versus the internal membrane configuration, for a number of technical reasons. Recent membrane and system design advances have resulted in comparable economics for external versus internal membrane MBR over a much broader wastewater flow rate range.
- Title: Anaerobic Membrane Bioreactor as Highly Efficient and Reliable Technology for Wastewater Treatment  
Author: Meenu Jainetal Indian Institute of Technology, Delhi, India  
Conclusion: Operational costs related to energy requirements for gas/liquid recirculation for membrane fouling control and chemical costs required for membrane cleaning are still heavy burdens on the economic feasibility Due to low energy yields per gram of substrate, anaerobic bacteria grow very slowly and hence efficient reactor design needs to separate hydraulic retention time (HRT) from the solids retention time (SRT)
- Title: Application of Membrane Bioreactor Technology for Waste Water Treatment and Reuse: Case Study of MBR Plant in Luxury Hotel in Delhi.  
Author: Prof. S. K. Singh etal (Professor and Head of Department Research Scholar Department of Environmental Engineering Delhi)  
Conclusion: The performance of BOD and COD removal of the plant can be improved by proper sludge recirculation to maintain the optimum number of heterotrophic bacteria, which are responsible of de

gradation of carbonaceous and nitrogenous matter in wastewater. The treated water from the MBR plant of study area is being successfully used for flushing and HVAC purpose in the hotel. Membrane Bioreactor Technology is a simple and reliable alternative waste water treatment method. The space requirement is less as compared to conventional treatment methods as the need for settling tanks is eliminated. MBR plant can be quickly installed, commissioned and maintained by trained personnel. Membrane does not require regular backwashing or cleaning. Membrane cleaning can be done twice a year by use of chemicals. The pore size in MBR can significantly increase the performance and effectively reduce bacterial rate at considerably cheap and effective cost.

- Title: A review of membrane bioreactor technology and their applications in the waste water treatment system.  
Author: Abdel kader etal  
Publication: Eleventh international water technology conference, IWTC11 2007 sharn El- Sheikh, Egypt.  
Conclusion: In this study, they removed organic and inorganic contaminants from wastewater effectively. MBR technology also has a lot of promise for use in a variety of applications, such as municipal, industrial, and wastewater treatment
- Title: Application of membrane bioreactor technology for wastewater treatment and reuse: case study of MBR plant in luxury hotel in Delhi.  
Author: s.k. singh etal  
Publication: international journal for innovative research in science and technology may 2015 ISSN: 2349-6010  
Conclusion: This study's findings indicate that the plant's treated water was of higher quality than water treated using other techniques. The MBR plant in the study area is effectively employed in the hotel for HVAC and flushing purposes. They also demonstrated in this research that the effectiveness of BOD and COD removal varied.
- Title: Chemical and environmental engineering case studies.  
Author: Elsevier etal  
Conclusion: The review study demonstrated correct operation and efficient fouling Also covered in detail is the characteristic of the bioreactor treatment procedure.
- Title: A critical review on nano materials membrane bioreactor (NMs-MBR) for wastewater treatment.  
Author: Md. Nahid Pervez etal  
Publication: published in partnership with king fahd University of petroleum and minerals.  
Conclusion: This paper provided a review of recent studies on the use of membranes in cooperating nano materials in MBR. In this paper, also highlighted the sustainability and cost viability aspects of NMs-MBR technology. This paper provided the progress in the development of NMs-MBR application for wastewater treatment.
- Title: Membrane bioreactor for hospital waste water treatment.  
Author: Yan Zhao etal  
Publication: Massachusetts institute of technology Cambridge, MA 021391 USA.  
Conclusion: This research paper showed that by applying MBR method for pharmaceuticals can be effectively removed from hospital waste water. Also, MBR play a role in removing viruses from hospital waste water, etc. Through this paper, it believes that the advancement in MBR concept and system great potential in assisting hospital wastewater treatment.
- Title: Membrane bioreactor for hospital waste water treatment.  
Author: Kwang Ho Chu etal  
Publication: Boston University of Technology MA 021391 Cambridge  
Conclusion: This studies shown that medicines may be successfully removed from hospital wastewater by using the MBR approach. MBRs are useful for eliminating viruses from hospital waste water, among other things. The advancement of the MBR idea and system has a lot of promise to help with hospital wastewater treatment, according to this paper.
- Title: A Review on Membrane Bioreactor (MBR)  
Author: Ajay P. Pardeyetal  
Publication-Institute of Research Advances)  
Conclusion: The process produces high quality, reusable water as the NF permeates, and at the same time reduces the amount of concentrated waste and even allows the recovery of valuable components. The concept is very attractive for micro pollutant removal and more detailed research on the behavior of specific emerging micro pollutants in the MBR NF process with concentrate recirculation is important.
- Title-Green technology in treatment of waste water.  
Author: Manu S E etal  
Publication: Faculty of engineering and technology jain Bengaluru India.

Conclusion: The numerous benefits of mbr technology make it a dependable choice, yet practical option that outperforms many wastes management method. This research has incorporated MBR integration with other treatments programs. The number of new MBR architectures are being proposed. MBR demonstrated promising results in terms of nitrogen elimination and it could soon be a feasible alternative for waste reuse and recycling

- Title: An experimental study on sewage treatment using MBR.  
Author: DayalanJ etal  
Publication: Christ University Faculty of engineering Bengaluru India.  
Conclusion: The highly effective membrane bio reactor system generates high-quality effluent that is virtually completely solid-free and has BOD and COD contents that fully satisfy the TNPCB criteria. The sample findings show that the membrane technology had a substantially greater level of purification than the conventional system. The MBR method typically produces less sludge than conventional processes because of the longer sludge age and higher mixed liquid suspended solids.
- Title: MBR- a Promising Technology for Wastewater treatment  
Author: Md.Tamez Uddin etal  
Conclusion: The MBR system requires smaller plant area and produces a better-quality treated water reusable in the industry. With the obvious advantages of the MBR technology, it shall gradually replace the conventional activated sludge system in large industrial plants.
- Title: An overview of the technology behind membrane bioreactors (mbr) and how it is used in wastewater treatment systems.  
Author: Amr M. Abdel Kaderetal  
Conclusion: In the MBR system, this separation is accomplished through membrane filtration, whereas it is accomplished through secondary clarification in the conventional system. The MBR system's treatment offers a high level of treatment in terms of removing suspended particles and organic debris. The MBR technology offers considerable promise for a variety of uses, such as municipal, industrial wastewater treatment, and solid waste digestion.
- Title: The Application of Membrane Bioreactors for Molecular Micro-Contaminant Removal from Aquatic Environment  
Author: My-Linh Nguyen etal  
Conclusion: MBRs have emerged as a promising and efficient technology to remove various types of micro-contaminants from aquatic environments. One of the most important operational challenges towards the application of MBRs is the occurrence of fouling inside the membrane.

#### IV. METHODOLOGY:

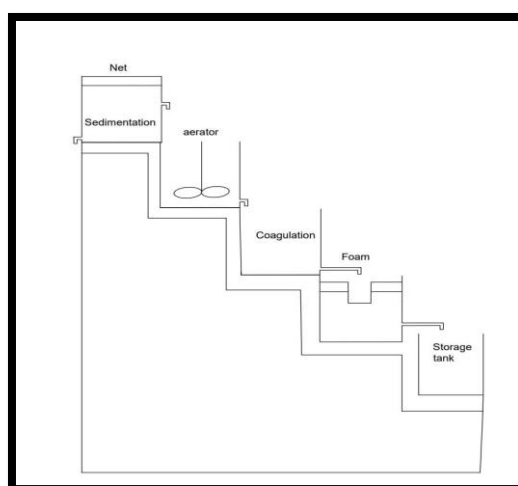


Fig.no.4.0

#### V. WORKING OF MODEL:

- **SEDIMENTATION :**  
We had plain sedimentation. Plain sedimentation is the process to settle down the particles by gravity. It takes 3-6 hours to settle down.
- **AERATOR :**  
To increase the oxygen level in water. Also to reduce the harmful gases from water. It takes 1-2 hours.



- **MBR TANK :**  
In MBR tank we used sponge. Sponge works like a reverse osmosis process. Sponges are useful because their pores are big enough to absorb large pollutants, such as bacteria or oil droplets (micrometre scale), without clogging. The core concept is that they fill with polluted water, then the pollutant sticks to the sponge surface.
- **COAGULATION :**  
Coagulation is the chemical water treatment process used to remove solids from water, by manipulating electrostatic charges of particles suspended in water. This process introduces small, highly charged molecules into water to destabilize the charges on particles, colloids, or oily materials in suspension. We used magnesium chloride. To determine the coagulant dosages. We perform jar test for coagulation.
- **DISINFECTION :**  
Disinfection is a process to kill micro-organisms in water. we used UV Ray's process to kill the micro-organisms. UV light is normally effective against all viruses, bacteria and protozoa.

**VI. MODEL:**



Fig.no.6.0 MBR Model

**VII. RESULTS :**

**TEST BEFORE FILTRATION**

TEST	BEFORE FILTRATION	PERMISSIBLE LIMIT
pH	4.7	0 - 7
TURBIDITY	53.2 NTU	More than 10 NTU
TOTAL SUSPENDED SOLIDS	225 mg/l	155 - 330 mg/l
TOTAL SOLIDS	550 mg/l	500 mg/l
TOTL DISSOLVED SOLIDS	535 mg/l	2000 mgl
DISSOLVED OXYGEN	2.9 mg/l	2 mg/l
HARDNESS	225 mg/l	More than 300 ppm
RESIDUAL CHLORINE	1.0 mg/l	1.0 mg/l
BIOCHEMICAL OXYGEN DEMAND	74 mg/l	80 mg/l
CHEMICAL OXYGEN DEMAND	570 mg/l	More than 250 mg/l

Table no. 03

**TEST AFTER FILTRATION:**

TEST	AFTER FILTRATION	PERMISSIBLE LIMIT
pH	9.6	6.5 - 8.5
TURBIDITY	8.7	5 - 10 NTU
TOTAL SUSPENDED SOLIDS	250 mg/l	500 mg/l
TOTAL SOLIDS	300 mg/l	500 mg/l
TOTL DISSOLVED SOLIDS	270 mg/l	50 -150 mg/l

DISSOLVED OXYGEN	5.5 mg/l	6.5 -8 mg/l
HARDNESS	150 ppm	200 ppm
RESIDUAL CHLORINE	2.0 mg/l	2.0-mg/l
BIOCHEMICAL OXYGEN DEMAND	96 mg /l	30 mg/l
CHEMICAL OXYGEN DEMAND	332 mg/l	250-500 mg/l

Table no. 04

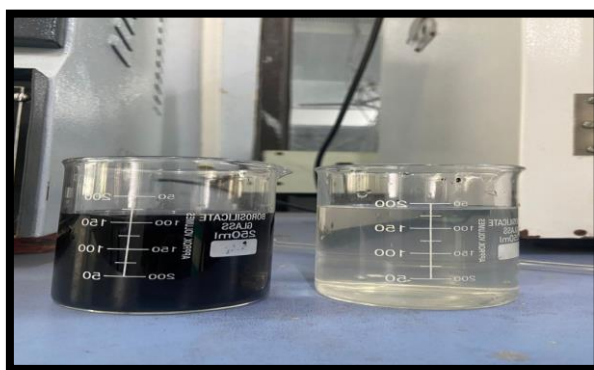


Fig.no.7.0 before and after water

### VIII. CONCLUSION

So we conclude that before filtration and after filtration the difference between results is much better. We can use that water for plantation, washing cars, construction works, etc. In this way we reused the water in different ways. This method is economic and environmental friendly. The bacteria which was present in water decreased, impurities and other harmful substances were reduced. In this method we used Waste water which from khanivali village. That waste water is basically sewage, black and grey waters. It contends with a large amount of physical impurities and chemical impurities. The outcome we got is very effective. In areas where scarcity of water is there this method can be effective. But not only in areas where scarcity is there, this method can be adopted anywhere.

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