

RTP118

# Water pollution and wastewater management in Bangladesh: Membrane Bioreactor (MBR) technology.

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**Abstract:** One of the most vital resources on Earth is water. Efficient management of this valuable resource is necessary for developing nations like Bangladesh. This study focuses on the present water pollution situation of Bangladesh and how industrial waste is affecting the country's major rivers. The study also highlights the importance of advanced wastewater treatment technology, such Membrane Bioreactors (MBR). Additionally, the paper discusses the advantages and disadvantages of the Membrane Bioreactors technology in wastewater management.

## **Introduction:**

Water is one of the most important elements of earth which is essential for life. Water makes up 71% of the Earth's surface, and only 3% of this water is freshwater, which can be found in rivers, ponds, lakes, and other water bodies. For a nation, among all the natural resources, freshwater is the most valuable one. Due to industrialization, this valuable resource is being polluted everyday causing environmental damages. Many developed countries like the USA, UK, and China have implemented measures to ensure the effective management of this valuable resource. As Bangladesh is going through industrialization, proper measures must be taken to reduce water pollution and manage wastewater. (Alam, 2009) Proper wastewater management will not only reduce the water pollution, it will allow us to reuse the treated water in the industries and household works.

**Keywords:** water pollution, Membrane bioreactor, wastewater, technology, industry, Bangladesh

**Water pollution:**

Bangladesh is known as a riverine country. There are 238 major rivers.(Uddin & Jeong, 2021) Traditionally, rivers were the most efficient mode of transportation. During the industrial revolution a lot of industries were built along the riverbanks. In modern times, a significant number of the industries remain situated along the banks of the rivers. And unfortunately due to the lack of proper waste management systems, everyday hundreds of tons of industrial waste materials are being thrown into the rivers polluting the water. There are around 7000 factories in Dhaka city, in the Tejgaon, Hazaribagh, Narayanganj, and Demra area, that dump waste materials into the Buriganga, Turag, and Dhaleshwari rivers. According to a Bangladesh Poribesh Andolon (BAPA) report, each day six thousand tons of liquid waste flows into the Buriganga River. The study also shows that the tanneries in the Hazaribagh area solely generate 3000 tons of liquid waste.(Uddin & Jeong, 2021) In a recent study, 13 elements of the Buriganga river's water were analyzed using various indexes such as the contamination factor (CF), heavy metal evaluation index (HEI), Nemerow index (NI), geoaccumulation index (Igeo), pollution load index (PLI), and heavy metal pollution index. The water of the Buriganga was found to be extensively contaminated with heavy metals. (Akbor et al., 2020) In order to save these rivers and protect the environment and public health, it is essential to implement proper waste management system



Figure 1: Buriganga river pollution .



Figure 2: Major rivers of Bangladesh

**Membrane Bioreactor (MBR) technology:** Membrane Bioreactors (MBR) are widely used in wastewater treatment in a variety of industries, including textiles, food & beverage, and pharmaceuticals. Membrane Bioreactors (MBR), combining bioreactor and membrane technologies, offer a sustainable solution for water reuse in various industries and meet environmental standards (Hoinkis et al., 2012)

Since the Textile industry in Dhaka heavily impacts groundwater levels and water quality, it is anticipated that by 2025, the groundwater level may decline significantly due to intensive textile processing. (Shamsudduha et al., 2009; Sarkara & Alia, 2009) Thus, the implementation of MBR is much needed. (Saha, 2014)

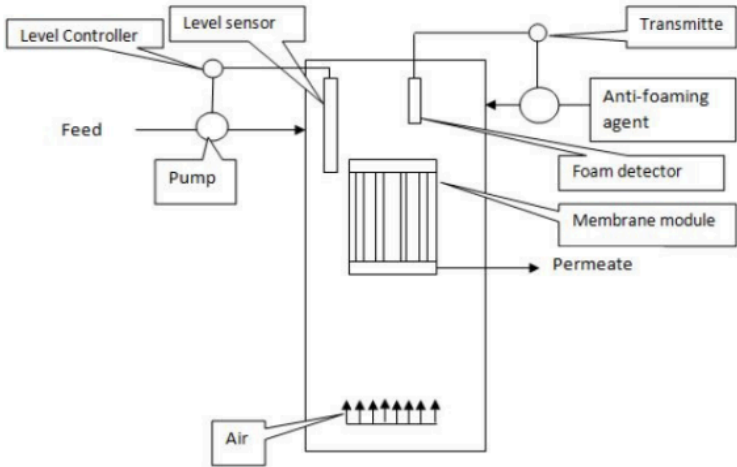


Figure 3: Schematic view of the MBR unit

MBR has several advantages over standard activated sludge systems for wastewater treatment, including:

- Compact Design: Traditional clarifiers have been replaced with more compact membrane modules.
- Clearer Treated Water: When compared to murky waters from typical clarifiers, water flowing through MBR membranes is clear and free of suspended particles and bacteria.
- High Clarification Performance: Unlike traditional systems that rely on sludge settling velocity, MBRs achieve nearly 100% separation efficiency with membranes, independent of sludge settling characteristics.
- High Biomass Concentration: MBRs maintain higher biomass concentrations (e.g., 20-30 g/L) compared to traditional systems (usually less than 5 g/L) (Islam, 2008)

Also, there are some limitations of MBR.

- The formation of a sludge layer resulting in membrane failure, due to lack of maintenance.
- Colloidal particle preferential adsorption on the membrane surface. (Islam, 2008)

### **Conclusion:**

In conclusion, the implementation of Membrane Bioreactor (MBR) technology has the potential to be an important advance in the attempt to reduce water pollution and transform the textile industries and tanneries. Although MBR technology faces challenges like membrane fouling, ongoing research aims to improve cleaning methods and enhance membrane durability. Membrane Bioreactor (MBR) technology will help developing countries like Bangladesh to reduce their water pollution levels and ensure proper management of wastewater caused by industrialization. It will also help to create sustainable industries, maintain the ecological balance, and provide clean water for future generations.

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### **Authors' Biography:**



Mubassir Rahman, a tech and car enthusiast, currently pursuing Bachelor of Science degree in Computer Science at BRAC University. He is passionate about Motorsports, Autonomous vehicles and computer graphics. Apart from that he enjoys traveling and photography, finding peace in the simplicity of nature.