# Organic fouling characterization of PRO membrane used in wastewater according to pretreatments

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**1. Introduction**

Osmotic power is the energy released during the mixing of water streams with different salinities. Membrane-based technologies such as pressure retarded osmosis (PRO) can convert the osmotic power to mechanical energy or electricity. However, the performance of the PRO process is affected by membrane fouling. Therefore, this study tries to understand the organic fouling of PRO process. Thin-film composite PRO membranes were examined via a lab-scale system by using real wastewater (tertiary-treatment effluents) as feed water. In order to conduct a systematic investigation of organic fouling, membrane fouling characteristics were compared according to the size of organic foulants and particle using membrane-based pretreatment. However, as can be seen from previous studies, it was not possible to completely control organic fouling even with UF-level membrane-based pretreatment of wastewater. Accordingly, this study presents a novel pretreatment method that can effectively remove organic foulants and particles. In addition, we have constructed a model formula that can predict the organic fouling of the PRO process. Finally, we analyze the economic efficiency with other processes and propose a new process that maximizes the efficiency of PRO.

**2. Methods**

Wastewater were collected in a ILSAN water quality restoration center in Korea. Commercial-grade PRO membranes provided by Toray Chemical was used, which consist of a polyamaide (PA) active layer and a polymer support layer. Experiments were carried out in laboratory-scale PRO systems. The feed and draw solutions were the wastewater(tertiary) and 35000mg/L NaCl, respectively. Water flux and power density were measured during the PRO experiment.

**3. Results and Discussion**

A series of experiments were carried out to examine the fouling of PRO membrane using wastewater. For instance, Figure 1 shows the flux and power density for the PRO process with the applied pressure of 10 bar and tertiary effluent for feed. The water flux gradually decreased with fouling. Various pretreatments are necessary to prevent the flux from decreasing. Figure 2 shows support layer of the PRO membrane fouled by wastewater.

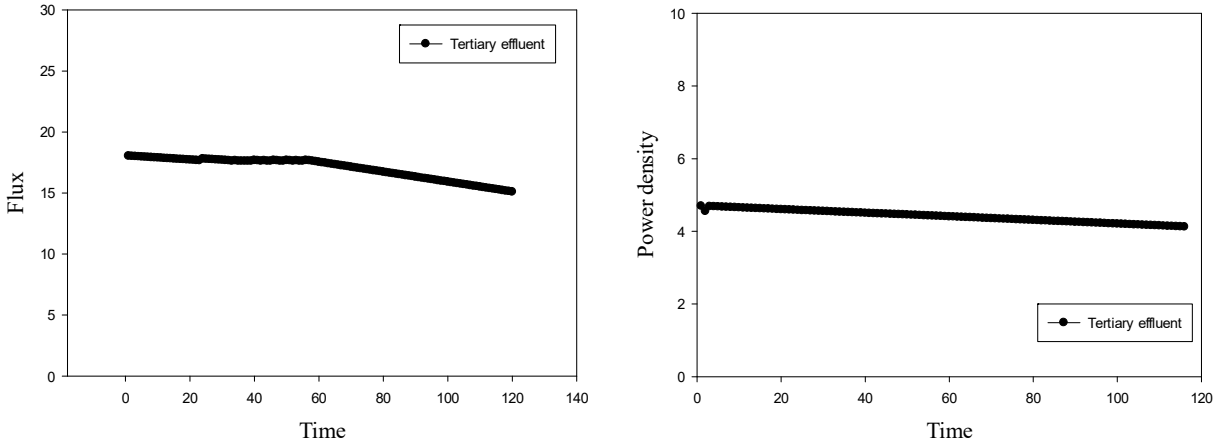



Fig 1. Flux and power density for PRO system using waste water and NaCl 35g/L(Operating conditions : Applied pressure 10bar, Feed flow rate 1L/min, Draw flow rate : 1L/min, Membrane : CSM-PRO-3).

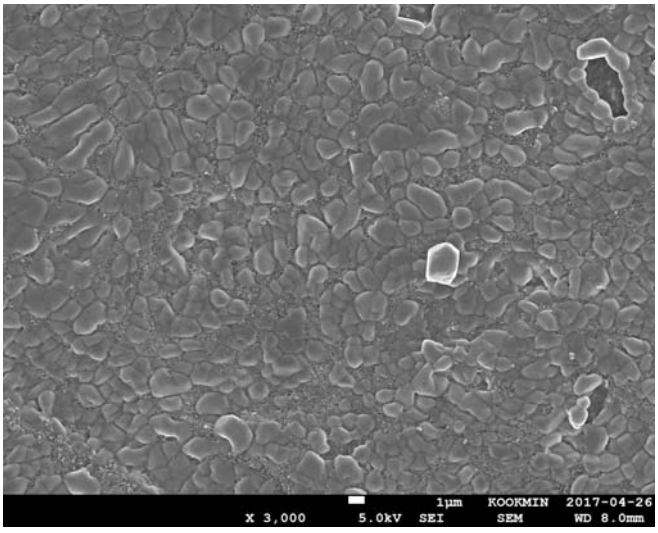



Fig 2. Image of support layer for fouled membrane by waste water.

**4. Conclusion**

Experimental results indicated that the flux and power density of the PRO membranes were greatly influenced by the quality of the feedwater. Based on a membrane-based pretreatment, we confirmed the elimination of turbidity. Because TOC was not removed, the decrease in flux was not prevented. Therefore, novel pre-treatment combined with membranes has increased power production. In addition, the model could help to systematically optimize the performance of the PRO process for organic fouling

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