포스터 발표 P-5

막오염 저항성이 우수한 정밀여과막의 생물학적 처리공정 적용

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Application of a fouling resistant microfiltration membrane in activated sludge process

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1. Introduction

Membrane bioreactors (MBRs) used for water purification are based on the association of a bioreactor, within which a culture of microorganisms degrades the polluting compounds, and a membrane filtration separator. The use of a porous barrier usually ensures the disinfection of the effluent. Although such processes usually give a high quality treatment, their development is nevertheless limited by membrane fouling which is not yet fully controlled [1-2]

Most of the MBRs producing low filtration flux (10-20 l/m^2hr) work in the

presence of a "filtration cake" due to the accumulation of bioparticles on the membrane surface. This leads to a rapid increase in membrane hydraulic resistance from the very beginning of the filtration, until the flow rate levels off after a few minutes or a few hours.

In this work, we prepared the nano particle embedded-MF membrane with a pore size of 0.1-0.4m. We also investigated the fouling property of the membrane against microorganisms in MBR process.

2. Experimental

The MF membrane is a flat-sheet type prepared through the phase inversion method. A polymer solution consisting of polysulfone , NMP, TiO_2 (P25, Degussa), and the additives was cast with 200 m casting knife onto polyester non-woven fabric (AWA, Japan). The cast solution was coagulated into 40℃ water. The membrane performance (pure water flux) was tested at 0.2 bar and 25℃. The membrane morphology (cross section and top layer) was observed with a scanning electron microscope (SEM, JSM 1025, JEOL). The experiments were conducted at a constant initial water flux of 1.0 m3/m2day. The wastewater was fed into the membrane cell. The flux was normalized by dividing flux with time (J) by initial water flux of steady state (J_0). The temperature and the flow rate in the experiment were 25℃ and 3.0 *l*/min, respectively. The performance of a plate and frame module in the activated sludge process (aerobic reactor) was investigated. Two membrane modules (PSf and TiO_2-embedded PSf) were immersed in an aeration tank (working volume 80L) of the activated sludge system. Porous membrane with 260cm^2 surface area was used in this study. A centrifugal suction pump was used at 7 minutes on and 3 minutes off intermittent operations to extract the permeate through the membranewith a low pressure of 10 mmHg. A constantupflow velocity of air near the membrane surface was 10 L/min. The effluent flow rate and transmembrane pressure were measured. The hydraulic retention time (HRT) and the sludge retention time (SRT) were 24hr and 20days,

respectively. The mixed liquor suspended solid (MLSS) was 3,500 mg/L. The influent was a synthetic wastewater consisting of inorganic salts of NH4Cl (10 mg/L as T-N) and KH_2PO_4 (1 mg/L as T-P) and a carbon source of glucose (1000 mg/L as COD).

3. Results and Discussion

The addition of TiO_2 nano particles in the PSf casting solution resulted in adecrease in the pore size and porocity owing to the plugging of the nano particles in the pores and delayed demixing during the phase inversion. The MBR experiments demonstrated that with an increase in the TiO2 content in the membrane,the fouling by bacteria on the membrane surface was reduced. Compared to the TiO_2-embedded PSf membranes, the floc particles accumulated onto the hydrophobic PSf membrane led to a rapid increase in the transmembrane pressure owing to the compressed gel. The gel on the TiO2-embedded PSf membrane could be more easily cleaned than the PSf membrane.

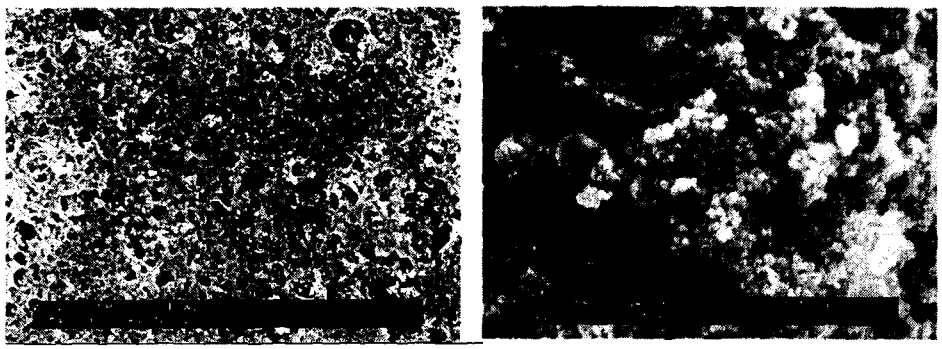

Figure SEM picture of the nano particle embedded-MF membranes.
(a) surface and (b) cross-section.

References

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[2] Y. Shimizu, Y. Okuno, K. Uryu, S. Ohtsubo and A. Watanabe, Filtration characteristics of hollow fiber microfiltration membranes used in membrane bioreactor for domestic wastewater treatment, *Water Res.*, **30**(1996) 2385-2392.