

일반강연 III-8

## 교차흐름 막결합형 생물반응기에서의 막오염 연구

최중구, 김인철, 최남석, 홍성표, 탁태문  
서울대학교 생물자원공학부

### Study of membrane fouling in the crossflow MBR system

J. G. Choi, I. C. Kim, N. S. Choi, S. P. Hong, T. M. Tak  
Division of biological resources and material Eng.,  
Seoul National University, Suwon, Korea

#### 1. Introduction

Now the lack of water is serious problem all over the world because of the growth of population and expansion of industrial activities. So wastewater recycle and reuse is essential in many countries.

One of the most popular wastewater treatment processes is conventional activated sludge system. In spite of significant degree of treatment rate the biological process has some operational difficulties and capital disadvantages. In conventional activated sludge process, sludge settling condition is getting worse in case of sludge bulking, it is common that overall process fails due to wash-out of biomass causing low concentration of MLSS in the aeration tank. Because of the absence of clarifier the membrane bioreactor(MBR) process is less affected by such problems.[1]

However, MBR process has serious problems called membrane fouling and concentration polarization.[2] If that occurs, thick gel layer is formed on and into membrane then the permeate flux declined very fast.

#### 2. Experimental

Synthetic wastewater was used in this study. The activated sludge cultivated by attached growth method made by Samkang Tech. Institute. Three types of activated sludge were filtrated by membranes, which prepared in our laboratory with three different materials.(cellulose acetate, polyethersulfone, sulfonated polyethersulfone) The aims of this study were to investigate the degree of fouling of each membrane on each condition

and the effects of compressed air expected that it break up the gel layer. Finally the qualities of treated water were investigated.

### 3. Results and Discussion

The casting solution compositions of each membrane were as below;

PES membrane; PES/NMP/PVP=24/76/50wt% of PES

CA membrane; CA/NMP/Acetone=20/40/40

SPES membrane; SPES/NMP=24/76

All prepared membranes have almost same solute rejection rate about 85% at PEG 35,000Da. As proved in the previous literature[3] the key element to induce the membrane fouling is Extracellular- polymers(ECPs) of biomass. Though very large distribution of molecular weight of ECPs, it is commonly accepted that molecular weight of ECPs is above 35,000Da. Therefor the different configurations of casting solution are chosen to meet the solute rejection rate.

The characteristics of filtration behavior of each membrane at initial condition are shown in Fig.1. All experimental were conducted at same MLSS concentration, 4g/l. The permeate flux declined significantly within 2hrs. This implies that the initial concentration polarization and fouling were almost formed and the biomass floc was broken up by the shear stress of recycling pump within that time. The particle size of biomass was examined. Though the size of biomass had very large distribution originally, as soon as system started the floc was broken up by shear stress. Therefor the flock size had narrow distribution near 2 $\mu$ m.

To eliminate the effects of size of biomass on membrane fouling the filtration performed under pre-floc broken up condition. The initial flux was lower than that of Fig.1. It is thought that the size differences of biomass caused the initial flux gap. After 6hr the permeate flux was superimposed that of initial condition.

The effects of compressed air were investigated. In all cases the flux declined very fast on the condition of bulking state. Especially the hydrophobic membrane(PES membrane) showed this phenomena seriously.

### 4. References

1. T. Yokomzo, *Desalination*, **98**, 319(1994).
2. Y. Shimizu, Y. Okuno, K. Uryu, S. Ohtsubo and A. Watanabe, *Wat.Res.*,

30, 2385(1996)

3. 장인성, 서울대학교 공학박사 학위논문, 서울대학교(1997)

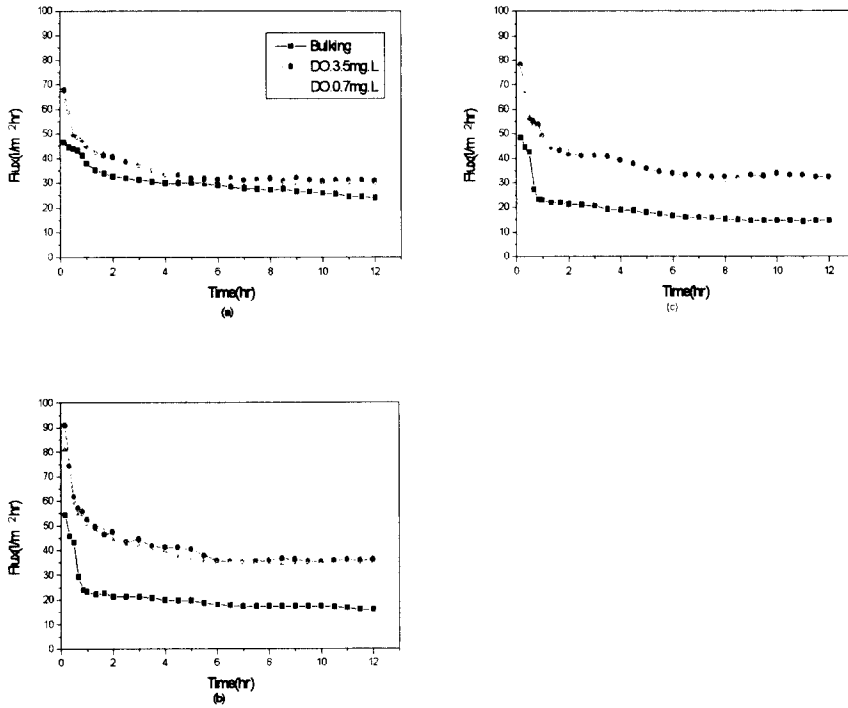


Fig.1 Initial flux declines with various condition  
(a)CA membrane, (b)PES membrane, (c)SPES membrane