일반강연 B-12

막결합 연속회분식 반응조와 종래의 시스템과의 생물학적 영양염류 제거 성능 비교

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Comparison of biological nutrient removal performances between membrane sequencing batch reactor and conventional SBR system.

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1. Introduction

There is a growing interest in combining membranes with biological wastewater treatment. In the membrane bioreactor (MBR) system, the membranes are the main solid-liquid separation devices. One of representative MBR system is a membrane coupled activated sludge system (MCAS), which is accomplished by combining of membranes with activated sludge system. MCAS is the advanced wastewater treatment system and has a good performance for organic removal. However this system is poor in nutrient removal. Since the nitrogen and phosphorus are considered as main sources of eutrophication and give rise to unpleasant effect on receiving water, it has been required to improve the MBR system for biological nutrient removal (BNR).

Recently biological nitrogen removal has been achieved by membrane coupled A/O (Anoxic/Oxic) process (Cote al el., 1997) or introduction of intermittent aeration method to MBR system. (Ueda et al., 1996) But phosphorus removal is still hardly improved in MBR system.

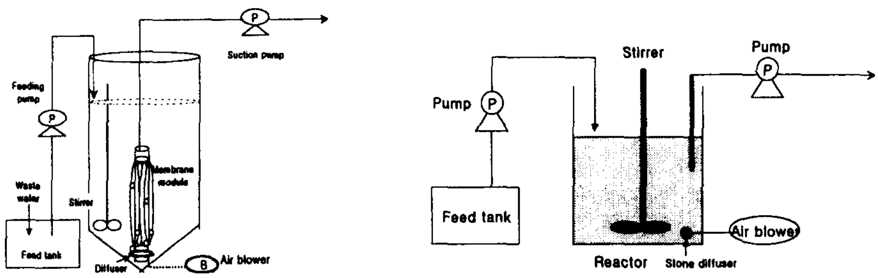
In this study, the membrane separation process was coupled to a sequencing batch reactor (SBR), which is one of the BNR process. In order to compare BNR performances, conventional SBR was operated with the MSBR for 40 days under identical condition simultaneously.

2. Experimental

A schematic diagram of MSBR and conventional SBR are shown in Fig. 1. A hollow fiber membrane module (MF10, SK chemicals co., Korea) was directly submerged in the reactor and effluent was sucked out by peristaltic pump (FLEX-FLO, USA). The membranes were made of polysulfone with pore size of 0.1 m. The effective surface area of the membrane was 1.0 m^2. Module was designed to reduce the membrane fouling, i.e. air diffuser was installed at bottom of the membrane module directly. Operation mode of both reactor was identical except the solid/liquid separation period.

Influent collected from Haitai Diary co. (Suwon, Korea), was supplied to the reactor without any pretreatment. The seeding sludge was supplied from a nearby food industry wastewater treatment plant. After seeding, the sludge was cultivated by dairy industry wastewater over one month to establish stable performances.

The analytical methods from Standard Methods (APHA, 1992) were adopted for the measurement of water quality.



(a) (b)

Fig. 1 Schematic diagram of wastewater treatment systems.
(a): MSBR system and (b): conventional SBR system.

3. Result and discussion

The performance of SBR was less stable than that of MSBR due to the high strength wastewater. Treatment behaviors of both system were shown in Fig. 2.

Fig. 2 (a) shows a BOD removal behavior. Effluent BOD concentration of MSBR and SBR were 86 and 382 mg/L respectively. And BOD removal of SBR was only 85 % on average due to the unstable system performance, but on the other hand 97 % BOD removed in the MSBR. Further, effluent of MSBR was less fluctuated than that of SBR.

In case of nitrogen, this tendency was more cleared than BOD. As shown in Fig. 2 (b), nitrogen of SBR effluent increased with the increase of influent nitrogen, and removal efficiency was only 76 %. On the other hand the MSBR effluent was stable regardless of influent fluctuation and removal efficiency was much higher than that of SBR. In case of phosphorus, both of system showed unstable removal behaviors (Fig. 2 (c)). But effluent concentration of SBR was maintained higher than that of MSBR, and removal was less than 60 %.

As shown in Fig. 2 (d), SS could not be removed well in the SBR, and removal was 73 %. But the MSBR could extract the SS-free effluent.

4. References

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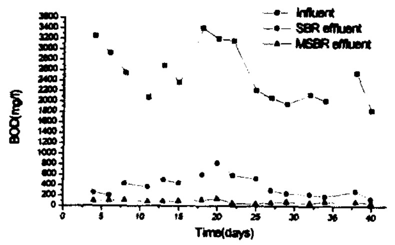
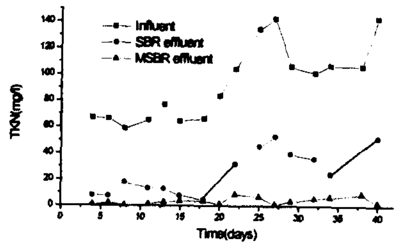
Fig. 2 Raw and treated water quality of the SBR and MSBR system.
(a) BOD, (b) Nitrogen, (c) Phosphorus, (d) Suspended solid



(a)



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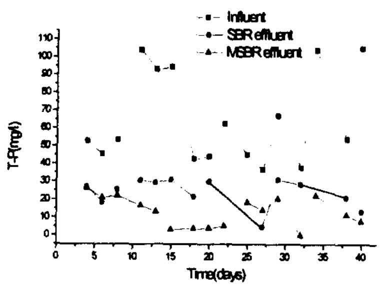
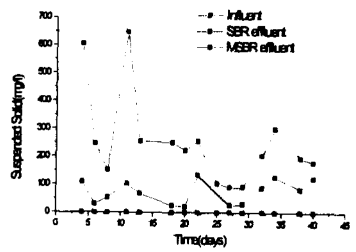


(c)



(d)