

[학술상]

Dissolved Organic Matter and Nitrogen Removal by Aerated Submerged Biofilm Reactor (ASBF)

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1. Introduction

The biological ammonia nitrogen removal processes is considered the less reliable of the removal process of dissolved organic matter because of the competition between heterotrophs and autotrophs for oxygen and space on the bio-film.

The objectives of this paper are twofold: 1) improve understanding of dissolved organic matter and ammonia nitrogen removal rates with dynamic relationship between heterotrophic and autotrophic bacteria in the fixed-film reactor 2) to show that removal of dissolved organic matter and ammonia nitrogen can occur at low temperatures in an ASBF system in plug-flow reactor systems.

2. Materials and Methods

2.1. Pilot Plant Set-up

The pilot test vessel was located beside an aeration ditch between the primary sedimentation tanks and the trickling filters at CVWRF. The pilot plant was constructed from a commercial dumpster with dimensions of 2.4 m by 6.7 m by 0.9 m deep. Inside, 24 ASBF modules were placed so they would be submerged by 0.6 m of primary settled effluent. Each module consisted of 12 panels with a fine bubble distribution tube along the bottom.

3. Results and Discussion

Our primary initial need was to facilitate seeding of the panels with nitrifying bacteria. Running batch systems would provide easier measurement and monitoring of the initial and final concentrations of significant substrates than Plug-Flow Reactor (PFR) systems would. The results of running the PFR at the various flow rates labeled as Systems A through J are discussed.

4. Conclusions

The conclusions we have drawn from this study are significant and practical. Nitrifiers are autotrophic, and their growth rate is very small compared with that of heterotrophic BOD oxidizers. Because of that fact, lower nitrification rates occurred for flow rates over 2.2 L/min. The main results for treatment of the aeration ditch water by ASBF during PFR System of this study are summarized as follows:

- Ammonia nitrogen removal rates were more sensitive than dissolved organic matter removal rates when flow rates exceeded 2.2 L/min.
- COD loading rates do not affect on the removal efficiency of COD.
- Lower COD loading rates provide better COD removal.
- Any COD loading rates provides excellent performance of COD removal.
- When higher COD loading rates, heterotrophs take more portions of the reactor and autotrophs have less portions of the end of the reactor.

5. REFERENCES

- APHA, AWWA and WPCF, 1998, Standard Methods for the Examination of Water and Wastewater, 20th. ed., APHA, Washington D.C..
- Goncalves, R. F., Grand, L. L., Rogalla, F., 1994, Biological phosphorus uptake in submerged biofilters with nitrogen removal. *Wat. Sci. Tech.*, **29**(10-11), 135-143.
- Hamoda, M. F., Al-Sharekh, H. A., 1999, Sugar wastewater treatment with aerated fixed-fill biological systems. *Wat. Sci. Tech.*, **40**(1), 313-321.
- Johnson, K., Revealey, L. D., Choi, Y., 2006, Submerged Ammonia Removal System and Method, US patent 7,008,539.
- Lewandowski, G. A., DeFilippi, L. J., 1998, (editors). *Biological treatment of hazardous wastes*. John Wiley & Sons, Inc.
- Okabe, S., Oozawa, Y., Hirata, K., Watanabe, Y., 1996, Relationship between population dynamics of nitrifiers in biofilms and reactor performance at various C:N ratios. *Wat. Res.*, **30**(7), 1563-1572.