Rejection of nutrients contained in an anaerobic digestion effluent using a forward osmosis membrane

Sosuke Onoda\textsuperscript{a,b}, Yuta Masumori\textsuperscript{a}, Taro Miyoshi\textsuperscript{a,*}, Masahiro Yasukawa\textsuperscript{a}, Tomoki Takahashi\textsuperscript{b}, Hideto Matsuyama\textsuperscript{a,*}

\textsuperscript{a}Center for Membrane and Film Technology, Department of Chemical Science and Engineering, Kobe University, 1-1 Rokkodai, Nada, Kobe 657-8501, Japan, emails: s.onoda@kobelco-eco.co.jp (S. Onoda), yuta.mas1024@gmail.com (Y. Masumori), t-miyoshi@pegasus.kobe-u.ac.jp (T. Miyoshi), m.yasukawa@people.kobe-u.ac.jp (M. Yasukawa), t.takahashi@crystal.kobe-u.ac.jp (T. Takahashi), matuyama@kobe-u.ac.jp (H. Matsuyama)

\textsuperscript{b}Research and Development Planning Department, Technical Development Division, Technical Research Center, Kobelco Eco-Solutions Co. Ltd, 1-1-4 Murotani, Nishi, Kobe 651-2241, Japan

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\textbf{ABSTRACT}

The possibility of applying a forward osmosis (FO) membrane filtration process for the post-treatment of an anaerobic membrane bioreactor (AnMBR) was investigated in this study. The FO membrane filtration test, using a surrogate AnMBR effluent prepared by supernatant obtained from a real anaerobic digester, demonstrated excellent rejection of phosphate ions. On the other hand, the rejection of ammonium ions was moderately effective and depended heavily on the operating conditions of the FO membrane (e.g. orientation of the FO membrane) solute concentration in the draw solution (DS) and ammonium ion concentration in the feed solution (FS). The flux of ammonium ions across the FO membrane decreased as the solute concentration in the FS increased. The reverse solute flux from the DS to FS also increased as the solute concentration in the DS increased. The above-mentioned trend was particularly remarkable in the FO filtration with an active layer facing DS (AL-DS) orientation, in which the reverse solute flux was higher than that in the active layer facing FS (AL-FS) orientation. The relationship between the degree of reverse solute flux and flux of ammonium ion was further explained by the FO filtration test using different solute species in the DS. When we used the solutes with higher reverse solute flux than sodium chloride as DS, the flux of ammonium ion became smaller. On the basis of the results obtained in this study, it can be concluded that the reverse solute flux would have a positive influence on the rejection of ammonium ions.

\textbf{Keywords:} Forward osmosis; Rejection of nutrients; Solute diffusion; Anaerobic membrane bioreactor

\textsuperscript{*Corresponding authors.}

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