Fouling characteristics of microfiltration membranes by organic and inorganic matter and evaluation of flux recovery by chemical cleaning

Yun Chul Woo\textsuperscript{a}, Jae Kyu Lee\textsuperscript{b}, Han-Seung Kim\textsuperscript{a,}\textsuperscript{*}

\textsuperscript{a}Department of Environmental Engineering and Biotechnology, Myongji University, San 38-2, Nam-dong, Cheoin-gu, Kyonggi-do 449-728, Yongin-si, South Korea

\textsuperscript{b}R&D Institute, Coway, San 4-1, Nakseongdae-dong, Kwanak-gu, Seoul, South Korea

Received 8 May 2013; Accepted 9 July 2013

\textbf{ABSTRACT}

Characteristics of membrane fouling by organic and inorganic foulants and flux recovery by chemical cleaning were investigated in this study. Three kinds of raw water with organic matter (15 mg/L humic acid), with inorganic matter (1 mg/L Fe and 1 mg/L Mn) and a mixture of organic and inorganic matter (humic acid, Fe and Mn) were tested. The effects of Ca\textsuperscript{2+} and pH on fouling were also investigated as well as efficiency of chemical cleaning. The results showed that raw water with the mixture reduced the final flux by 10%. On the other hand, the final fluxes were reduced by 8% for inorganic matter and by 78% for organic matter. Although, FI decreased with the existence of Ca\textsuperscript{2+} in the mixture of humic acid, Fe and Mn, flux was recovered easily by backwashing because Ca formed a cake layer by chelating with humic substances. However, pre-treatment with sodium hypochlorite reduced the flux severely for raw water containing inorganic matter. Acid (2\% nitric acid) and base (1\% sodium hydroxide), were used to clean the fouled membranes. Cleaning efficiency was different by changing the cleaning sequence of the two chemicals (acid/base and base/acid). Flux recovery was 20\% higher in base/acid sequence. These results showed that both raw water characteristics and cleaning method should be thoroughly investigated for appropriate operation of membrane processes.

\textit{Keywords:} Chemical cleaning; Cleaning sequence; Flux recovery; Fouling; Microfiltration