Nanofiltration enhancing the mine water treatment

Michał Bodzek\textsuperscript{a,*}, Mariola Rajca\textsuperscript{b,*}, Malwina Tytła\textsuperscript{a}, Krystyna Konieczny\textsuperscript{b}, Barbara Tomaszewska\textsuperscript{c}

\textsuperscript{a}Institute of Environmental Engineering of the Polish Academy of Sciences, Zabrze, Poland, emails: michal.bodzek@ipis.zabrze.pl (M. Bodzek), malwina.tytla@ipis.zabrze.pl (M. Tytła)

\textsuperscript{b}Institute of Water and Wastewater Engineering, Silesian University of Technology, Gliwice, Poland, emails: mariola.rajca@polsl.pl (M. Rajca), krystyna.konieczny@polsl.pl (K. Konieczny)

\textsuperscript{c}AGH University of Science and Technology, Kraków, Poland, email: bts@agh.edu.pl (B. Tomaszewska)

Received 20 May 2018; Accepted 11 August 2018

\textbf{ABSTRACT}

The use of reverse osmosis (RO) in water desalination often requires careful selection of the pretreatment methods to reduce scaling. One of them is nanofiltration (NF), which almost completely removes multivalent ions, whereas only 10\%–50\% of monovalent ones. The objective of the studies was to develop a two-stage membrane desalination process (NF + RO) to treat mine water. In the experiments, commercial membranes by Dow-Filmtec (NF-270, NF-90 and BW30FR-400) and Lanxess (PA00416 HR) were used in the NF and RO tests. The treatment efficiency (flux and permeate composition) and predicted scaling were determined. It was concluded that for both RO membranes and for the more compact NF membrane (NF90), the effectiveness of desalination was satisfactory. They achieved a high permeate flux and almost complete removal of most salts. It was necessary to apply a more compact nanofiltration membrane (NF-90) before RO. Application of the NF-90 membrane allowed to protect the RO membrane before scaling, that is, the precipitation of mineral compounds on the membrane surface.

\textit{Keywords:} Nanofiltration; Mine water desalination; Reverse osmosis; Scaling