5th International Conference and Expo on

SEPARATION TECHNIQUES

October 23-25, 2017 | Paris, France

Desalination of brackish groundwater using high flux layer by layer assembly membranes: Process performance and membrane fouling mechanisms

Motsa M Machawe¹, Bhekie B Mamba¹ and Veliefde RD Arne² ¹University of South Africa, South Africa ²Ghent University, Belgium

This work describes the performance of a high flux nano filtration membrane prepared through layer-by-layer assembly in purifying saline groundwater from the rural villages of the Vhembe district of South Africa. Therefore, under groundwater supply underpins the livelihoods in these areas, thus there is a huge need to improve the water quality. However, the water has been found to have undesirable properties such as high salinity levels (TDS 3542 mg/L), and the presence of nitrates and metals. The water samples from various boreholes around the basin were analyzed and found to constitute of different levels of Cadmium, Chromium, Copper, Iron, Manganese and Vanadium, as well as anions such as Fluorides, Nitrates and Sulphates. The membrane used was prepared by sequential deposition oppositely charged polyelectrolytes, polyethylineamine (PEI) and Poly (Sodium 4 styrene-sulfonate) (PSS) on a Polyacrylonitrile (PAN) substrate to form the desired bilayers. Its physico-chemical properties were determined using several techniques such as streaming potential analyzer, drop shape analyzer and FTIR. The effect of membrane fouling on ionic rejection and membrane performance was also studied. The membrane recorded a pure water permeability of 21 L/m2 bar. Tests with various mono and divalent salts showed that the order of rejection was as follows: MgSO4 > CaCl2 > KCl \ge NaCl. The membrane surface was found to be highly positively charged (+ 41 mV) and was dominated by the presence of nitro (-C-N) and amine (N-H) functional groups which emanates from the PAN polymer and the amine groups of PEI. The membrane exhibited a better performance compared to the commercial NF270 membrane in producing high quality product water that meets the guidelines values. The dominant presence of polar functionality on the membrane surface limited foulant-membrane interaction, thus improving its fouling resilience. The obtained results demonstrated the membrane has a promising ability to treat saline feed streams, producing high quality permeate at low applied hydraulic pressures which falls in place with the rural environment of the Vhembe villages.

machawemmvulane@gmail.com