Modification of Thin Film Composite (TFC) Membrane by Incorporation with Copper Nanoparticles (CU-NPs) for Antibacterial Properties

Chen Zhong
Dr. Baolin Deng, thesis supervisor

Abstract
Membrane biofouling has been a challenging problem restricting the application of reverse osmosis (RO) desalination process. In this paper, copper, known for its low cost, easily availability and antimicrobial properties were synthesized into copper nanoparticles (Cu-NPs) by reduction reaction. Cu-NPs with the mean diameter of 15nm were then successfully immobilized onto the surface of thin film composite (TFC) membrane. Two bonding methods (electrostatic and covalent) were performed and compared, the membrane samples of which were labeled as a TFC-CuNPs and TFC-S-CuNPs respectively. Large amounts of Cu-NPs were observed on both modified membranes via scanning electron microscope (SEM) and were confirmed to be copper element via energy-dispersive X-ray spectroscopy (EDS). Surface hydrophilicity was enhanced during the modification. Accordingly, the water flux obtained from the RO system was increased, with rejection rate slightly decreased. The modified membranes both exhibited excellent antibacterial properties against P. aeruginosa during the disk incubation test and the SEM observation. Moreover, TFC-S-CuNPs were more stable and with better anti-bacterial properties than TFC-CuNPs.