Graphene Oxide Embedded Reverse Osmosis Membrane in Both Active and Support Layers

Hee-Ro Chae[1], Chung-Hak Lee[1,*], Pyung-Kyu Park[2], In-Chul Kim[3]

1 Seoul National University, Seoul , Republic of Korea

2 Yonsei University, Wonju, Gangwon-do, Republic of Korea

3 Korea Research Institute of Chemical Technology, Daejeon, Republic of Korea

(E-mail: chr0619@snu.ac.kr, leech@snu.ac.kr)

Keywords: Reverse osmosis; Thin-film composite membrane; Graphene oxide; Permeability; Anti-biofouling; Chlorine resistance

Abstract

Although reverse osmosis (RO) process has attracted considerable attention as a commercial desalination process, various researches still have been conducted to improve RO membrane which is the key factor of the RO process. We demonstrated that a thin-film composite (TFC) membrane with graphene oxide (GO) embedded in its active and support layers exhibited high water permeability, anti-biofouling property, salt rejection, and chlorine resistance. The GO fabricated by chemical exfoliation was separately dispersed in a polysulfone organic solution to fabricate the GO embedded support layer and in an m-phenylenediamine (MPD) aqueous solution to make the GO embedded active layer. The water permeability, anti-biofouling property, and salt rejection of the TFC membrane with GO embedded in both layers were enhanced by 70%, 99%, and 8%p compared with those of the TFC membrane without GO, respectively. These enhancement could be attributed to the change in its hydrophilicity, surface zeta potential, and surface roughness. Moreover, the degree of change in the salt rejection after 80,000 ppm h chlorination was just -2%p for the TFC membrane with GO embedded in both layers whereas those of the TFC membrane without GO was -13%p. The increase of chlorine resistance might come from barrier effect of GO and hydrogen bonding between GO and polyamide active layer.