

## Carbon nanotube-based nanocomposite desalination membranes from layer-by-layer assembly

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### ABSTRACT

In this work, we fabricated the nanocomposite reverse osmosis (RO) membranes based on the layer-by-layer (LbL) assembly of functionalized multi-walled carbon nanotubes (MWCNTs) and polyelectrolytes (PEs). The CNTs were incorporated to enhance the mechanical strength and the chlorine resistance of multilayered RO membranes. To fabricate the MWCNT-based nanocomposite multilayers, poly(allylamine hydrochloride) (PAH) and poly(acrylic acid) (PAA) were used as positively and negatively charged PEs, respectively, and the surface of MWCNTs was modified with carboxylic group. During the LbL assembly process, 1 wt % of carboxylated MWCNTs relative to PAA were used and (MWCNT-PAA/PAH)<sub>n</sub> multilayers membranes with 10, 15, and 20 bilayers were prepared. The existence of MWCNTs in multilayers was confirmed by thermogravimetric analysis (TGA), and we observed the improvement in thermal stability of multilayers after incorporation of MWCNTs. The salt rejection and permeate flux of these membranes were measured by a homemade RO test cell. To examine the chemical resistance to chlorine, (MWCNT-PAA/PAH)<sub>n</sub> multilayers were immersed in 3,000 ppm sodium hypochlorite (NaOCl) solutions for 4 h. Consequently, it was found that the salt rejection of (MWCNT-PAA/PAH)<sub>n</sub> membranes decreases by 16.2%, 15.2% and 9.9% for 10, 15 and 20 bilayers, respectively, while the conventional polyamide membrane exhibited 21.8% decreases in the salt rejection.

**Keywords:** Desalination; Multi-walled carbon nanotube; Polyelectrolytes; Nanocomposite multilayers

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