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Preparation and characterization of thin-film-composite reverse-osmosis polyamide membrane with enhanced chlorine resistance by introducing thioether units into polyamide layer

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Abstract

In this study, chemically reductive thioether units were introduced into the polyamide (PA) layer of a thin film composite (TFC) reverse osmosis (RO) membrane to enhance its chlorine resistance. The sulphur moieties could be oxidized to partially capture chlorine, therefore protecting the membrane from being chlorinated. The thioether units were introduced into the PA layer by partially replacing trimesoyl chloride (TMC) with 4, 4' -thiodibenzoyl chloride (TDC) in the organic phase during interfacial polymerization. Both ATR-FTIR and XPS investigations revealed that the thioether units had been incorporated into the PA layer successfully. In addition, the introduced thioether units were also uniformly dispersed, as confirmed by the STEM-EDS results. The introduction of the thioether units influenced the morphology of the membrane significantly, which in turn markedly impacted its performance. The introduction of thioether groups was found to have a positive effect on improving the chlorine resistance of the TFC membrane. Taking the 60%-TDC-TFC membrane as an example, the chlorine exposure (95 ppm·h) at which the normalized flux fell below 1 was much higher than that of the pure membrane (34 ppm·h) when chlorinated in an