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Zwitterionic polymer modification of polyamide reverse-osmosis membranes via surface amination and atom transfer radical polymerization for anti-biofouling

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Abstract

Surface-initiated atom transfer radical polymerization (SI-ATRP) is a powerful method to uniformly modify the surface of reverse-osmosis (RO) membranes with functional polymers and prevent biofouling. However, immobilization of the initiator, an essential step of SI-ATRP, is difficult to perform directly on commercial polyamide RO membranes. This study describes an effective pretreatment method to immobilize ATRP initiators on the surface of polyamide RO membranes and the effect of the polymer chain length on the biofouling behavior. Firstly, RO membrane surfaces were aminated with 3-aminopropyltrimethoxysilane (APTES). Then, α-bromoisobutyryl bromide (BIBB), an acyl halide-type ATRP initiator, was reacted with the APTES layer. A zwitterionic polymer, poly[(2-methacryloyloxy)ethyl]dimethyl[3-sulfopropyl]ammonium hydroxide (pMEDSAH), was then grafted on the membrane surface via SI-ATRP. The APTES treatment effectively improved the amount of BIBB immobilized on the membrane surface, maintaining the water permeability