Zero Valent Iron Nanoparticle Enhanced Polyethersulfone Membranes for Water Filtration: Isolating Casting Parameters for Global Applications

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Many newly identified organic contaminants and disinfection by-products have been found in natural water sources and treated drinking water. Current water filtration membranes do not always remove these harmful substances, but new water treatment innovations such as nanoparticle enhanced filtration membranes have shown increased interest and promise. This research focuses on the effect of embedded iron nanoparticles on the thickness and water flux of polyethersulfone membranes produced by phase inversion. The study evaluated membranes that were cast from solutions that contain stabilized nanoparticles, pore former, polyethersulfone and solvent. Parameters evaluated include the concentration of zero valent iron (ZVI) nanoparticles, the type of nanoparticle stabilizer, the type of pore former, the concentration of ethanol, and the type of solvent. Membranes were evaluated using dead end filtration, micrometer measurements, and scanning electron microscopy (SEM). Results indicate that casting parameters, in addition to nanoparticle concentration, affected the behavior of the membranes. Additionally, oxidation of the iron nanoparticles was observed to cause morphological changes to the surface and internal structure of the membrane as well as decrease the flux of the membrane. Only certain casting parameters, for example, those membranes cast from dimethylacetamide or dimethylformamide, were observed to result in this oxidative degradation in the membranes. Keywords: nanoparticle enhanced nanofiltration membranes; water flux; polyethersulfone; organic contaminants; zero-valent iron nanoparticles

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