Synthesis of Electrospun Nanosilver-Functionalized Nylon 6 Nanofibres for Membrane Water Purification

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Biofouling is a major problem in membrane-based desalination and wastewater reclamation processes. It greatly compromises the performance of membranes and increases operating costs. In this study, nylon 6 nanofibrous membranes functionalized with silver nanoparticles (AgNPs) were developed and synthesized via electrospinning. The AgNPs were synthesized via wet chemical methods, by reducing silver nitrate with trisodium citrate, a non-toxic alternative to the conventionally used sodium borohydride. The membrane pore size, porosity and nanoparticle dispersion were evaluated via Scanning Electron Microscopy and Energy Dispersive X-Ray Spectroscopy, while other characterization tests to evaluate ultimate tensile strength, turbidity reduction and silver leaching were also conducted. The membranes synthesized had a small average pore size of 0.3 microns and were able to achieve a 4.92 log reduction in E. coli (a greater log reduction of 5.50 in the presence of AgNPs) after filtration. After 60 hours of cross-flow filtration, the amount of Extracellular Polymeric Substances secretion reduced by 93% and 77% for polysaccharides and proteins respectively, and the viable cell count decreased by 97.4%, suggesting that these membranes drastically reduced biofilm formation. These nanosilver-functionalized membranes could potentially be used as an anti-biofouling pre-treatment filtration stage for both seawater and wastewater reverse osmosis processes, making these processes more affordable and efficient.

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