A Novel Optimization Technique Using Hydrophilic POSS-PEO Nanoparticles and PSU-PEO Block Co-polymers on Hydrophobic Polysulfone Membranes

Kayat, Ahmed

Critical worldwide applications, such as seawater desalination, utilize Polysulfone (PSU) membranes. They are part of the ultrafiltration and microfiltration processes because of their chemical and mechanical stability. However, due to their hydrophobocity they are susceptible to fouling, which causes a great decline to the flux and a need to be cleaned, which consumes money and time. After a number of cleaning times, the membrane will no longer be usable. The aim of this project is to implement a novel technique of adding hydrophilic additives to the PSU membrane formulation for the purpose of making them more efficient. Hydrophlilic POSS-PEO nanoparticles and PSU-PEO co-polymers were added to 11 membranes at concentrations ranging between 1wt% and 40wt%. The POSS-PEO nanoparticles were used to increase the membrane hydrophilicity, but the PSU-PEO co-polymers were used make the POSS-PEO nanoparticles and the PSU homopolymer more compatible. The membranes were characterized using contact angle measurement, scanning electron microscope (SEM), Energy-dispersive X-ray spectroscopy (EDS), water flux measurement, bovine serum albumin (BSA) rejection, and hydraulic resistance measurement. The results showed that contact angle decreased 25%, water flux increased to 975.6 L/m2bh, and the BSA rejection was 99% at 30wt% concentration. This confirmed that POSS-PEO nanoparticles were effective at increasing the hydrophilicity of the PSU membranes. Also, the PSU-PEO co-polymer was proven by SEM to be effective at increasing the compatibility between the nanoparticles and the homopolymer. This study is a potential stepping stone for these membranes to be used efficiently in water desalination, wastewater treatment and pharmaceutical capacities