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The influence of alumina particle size on the properties and performance of alumina hollow fiber as support membrane for protein separation

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Abstract

The advantages offered by ceramic membranes compared to the polymeric membrane have attracted more interest, especially in fluid separation application owing to its ability to withstand harsh operating conditions. In this study, five alumina hollow fiber membranes were prepared from different loading ratios of alumina particle sizes which are 1 μm, 0.5 μm, and 0.01 μm. The membranes were prepared via phase-inversion technique using water as an external and internal coagulant and sintered at 1400 °C. The effect of the alumina powder particle sizes on membrane morphology, pore size distribution, mechanical strength, surface roughness, pure water flux, and Bovine Serum Albumin (BSA) rejection was investigated in this study. By varying the overall loading and particle size of alumina, different morphologies of membranes were obtained. Higher loading of coarse particles produced more porous and low mechanical strength membranes, whereas reducing the amount of coarse particles produced a more compact membrane with the highest mechanical strength of 27 MPa. Meanwhile, BSA rejection is declining when more coarse particles were used to fabricate the membrane. Among all the membranes, the 5:3:2 ratio able to reject up to 66% of protein (BSA) with the flux of 138.7 L m^{-1} h^{-1}.