

Structural Analysis of Porous Ceramic Membrane Support for High Pressure Water Desalination

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Abstract

This study investigates the design of ceramic membrane supports for water treatment and desalination, particularly within sustainable filtration systems powered by renewable energy sources such as wind and solar. The research focuses on optimizing material properties and support designs to enhance both the mechanical strength of ceramic membrane supports for high-pressure desalination applications. A database of tensile strength and permeability was developed for ceramic support materials with varying pore sizes and porosities. By numerically modelling single- and multi-bore tubular designs under various operational feed pressure up to 100 bar, the study also examines the impact of design parameters—such as bore diameter, wall thickness, and spacing—on stress distribution and maximum stress values under varying feed water pressures. The findings indicate that carefully selected material properties and support dimensions can significantly improve filtrate flow, boosting the efficiency of seawater desalination systems.