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Effect of Sintering Temperature on Multipurpose Ceramic Membrane Fabricated Using Cheaper Raw Materials

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ABSTRACT

This research article investigates the influence of sintering temperature on the properties and performance of multipurpose ceramic membranes developed using a combination of fly ash and natural clay. Due to their exceptional mechanical and chemical stability, the increasing demand for sustainable and cost-effective water treatment technologies has spurred interest in membrane technology, especially ceramic membrane fabrication. In this study, we prepared ceramic membranes using fly ash and natural clay and sintered them at 600 to 1000 °C temperatures. The impact of sintering temperature on the microstructure, porosity, mechanical strength, and surface morphology of the membranes was systematically analyzed. Additionally, an aqueous lignin solution evaluated the membranes' permeability, fouling resistance, and selectivity. Results indicated that sintering temperature significantly influenced the membrane characteristics. The membranes exhibited enhanced porosity and larger pore sizes at lower sintering temperatures, improving permeability but reducing mechanical strength.

Conversely, higher sintering temperatures promoted densification and reduced porosity, increasing mechanical strength and reduced permeability. The optimal sintering temperature was determined based on a balance between separation efficiency and permeability. Furthermore, the membranes displayed promising performance in water treatment applications, effectively removing contaminants while maintaining sufficient flux.

The findings provide valuable insights for designing ceramic membranes with tailored properties to suit specific water treatment requirements, contributing to developing sustainable and efficient water treatment technologies. The outcomes of this study have implications for the development of cost-effective and environmentally friendly ceramic membranes for various industrial and municipal applications.

Keywords: Ceramic membrane, Coal Fly ash, Clay, Membrane properties, Filtration, Sintering

