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PERFORMANCE OF CERAMIC FILTERS: INFLUENCE OF PARTICLE SIZES AND SINTERING TEMPERATURES

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ABSTRACT
The usage of ceramic filters in the separation industries has become increasingly important especially in the wastewater treatment, food and beverages industries. This is because ceramics are inert materials, have high mechanical strength and can withstand high temperatures and corrosive environment [1-4]. Fused-alpha-alumina has been used very widely as ceramic filter elements or as supports for ceramic membrane filters. This is due to the high flexural strength, high porosity and low pore size characteristics exhibited by this material for ceramic filters. Furthermore, its particle structure which is elongated helps created interlocking structure which enhances the ceramic filters capability. The effects of the particle size and sintering temperatures on the performance of the alumina filters were investigated in this paper. Three particle sizes of alpha-alumina with different average sizes were studied: F500 (20 μm), F600 (10 μm) and F 2000 (1 μm). The apha-alumina powders were mixed with bentonite clay, CMC and water and extruded into tubular form with certain dimensions. The tubes were sintered at 1100° to 1500°C following a fixed temperature programme. The alumina tubes were then characterised for thermal, mechanical and physical properties. The optimum sintering temperature for each size was determined. The findings of this study showed that generally higher sintering temperatures and lower particle sizes reduce porosity and increase flexural strength. These properties however, have to be balanced in order to achieve good ceramic filters. Overall, F500 was found to have excellent properties for ceramic membrane filters at 1350°C sintering temperature with high porosity (40-50%), high flexural strength (60-70 Mpa), reasonable pore size (5 μm) and good permeability capability.

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