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Effects of Mixing Time and Hydrogen Peroxide Concentration on the Synthesis of Foamed Self-Supporting Zeolite

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Abstract: This study investigates the synthesis of foamed self-supporting zeolite (SSZ) using metakaolin and Luinab red clay (Iligan City, Philippines) as aluminosilicate sources. The research examines how mixing time and hydrogen peroxide concentration affect the direct foaming of geopolymer gel. Rheological tests were conducted on the geopolymer mixture to correlate viscosity with mixing time. The impact of mixing durations (30-60 minutes) and hydrogen peroxide concentrations (0.5-1.0 wt%) on key response variables, including relative foam height, pore volume, porosity, and specific gravity, was analyzed. The results revealed transition times for manual and spindle mixing of 39.62 and 35.73 minutes, respectively. Optimal gel workability was observed within the 30–60-minute range, with a maximum viscosity of 5580 cP. Although variations in mixing time did not significantly affect the response variables, they caused a slight reduction in relative foam height (from 1.51 to 1.48) and porosity (from 51% to 48%), along with an increase in specific gravity (from 0.86 to 1.13). Changes in hydrogen peroxide concentration significantly influenced relative foam height (ranging from 1.34 to 1.66), pore volume (from 0.63 to 1.20 cm3), and porosity (from 34% to 66%), with minimal impact on specific gravity. Scanning electron microscopy and diffractogram analyses confirmed the presence of octahedral NaX zeolite. The findings suggest that both hydrogen peroxide concentration and mixing time are crucial in the direct foaming process; longer mixing times may increase geopolymer gel viscosity, which can impede foaming, while higher hydrogen peroxide concentrations generally improve foaming. These factors are important considerations in the fabrication of SSZ.

Key Words: self-supporting zeolite; mixing time; hydrogen peroxide concentration

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