

Development of a Nano-Alumina-Zirconia Composite Catalyst as an Active Thin Film in Biodiesel Production

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Abstract : A nano-alumina-zirconia composite catalyst was synthesized by a simple aqueous sol-gel method using $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ and ZrCl_4 as precursors. Thermal decomposition of the precursor and subsequent formation of $\gamma\text{-Al}_2\text{O}_3$ and t-Zr were investigated by thermal analysis. XRD analysis showed that $\gamma\text{-Al}_2\text{O}_3$ and t-ZrO₂ phases were formed at 700 °C. FT-IR analysis also indicated that the phase transition to $\gamma\text{-Al}_2\text{O}_3$ occurred in corroboration with X-ray studies. TEM analysis of the calcined powder revealed that spherical particles were in the range of 8-12 nm. The nano-alumina-zirconia composite particles were mesoporous and uniformly distributed in their crystalline phase. In order to measure the catalytic activity, esterification reaction was carried out. Biodiesel, as a renewable fuel, was formed in a continuous packed column reactor. Free fatty acid (FFA) was esterified with ethanol in a heterogeneous catalytic reactor. It was found that the synthesized $\gamma\text{-Al}_2\text{O}_3/\text{ZrO}_2$ composite had the potential to be used as a heterogeneous base catalyst for biodiesel production processes.

Keywords : nano alumina-zirconia, composite catalyst, thin film, biodiesel

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