

Synthesis of MCM-41-NH₂ Catalyst by Sonochemical Method for Transesterification of Waste Palm Oil

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Abstract : Synthesis of MCM-41 based on silica from Lapindo mud by sonochemical method grafting with amine group from (3-aminopropyl) trimetoxysilane (3-APTMS) to produce the MCM-41-NH₂ base catalysts had been investigated. The purposes of this research are to study the effect of sonication time towards the crystallinity of the MCM-41 and to verify catalytic activity of the MCM-41-NH₂ catalyst in the transesterification of waste cooking oil. The silica was extracted from Lapindo mud using 6 M of HCl and NaOH solution. The silica content was characterized by XRF. The synthesis of MCM-41 was carried out by sonochemical method under time variation of 30, 60, 90, 120 and 150 min. The Grafting of the 3-APTMS into the MCM-41 was performed in N/Si mol ratio of 5%. The MCM-41 and MCM-41-NH₂ were characterized by XRD, Surface Area Analyzer, and TEM. The GC-MS was used to characterize the transesterification product.

The XRF analysis showed that the silica extracted from Lapindo mud was 97.5 %. The XRD analysis of the MCM-41 for 150 min sonication showed the highest characteristic peaks on 2θ between 2-5° with specific surface area of 1603 m²g⁻¹, pore diameter of 2.57 nm and has a mesoporous character with adsorption and desorption isotherm pattern of type IV and hysteresis loops of type H1. The TEM images of the MCM-41 showed the order pore distribution. The MCM-41-NH₂ catalyst has specific surface area of 1037 m²g⁻¹ with pore diameter of 2.39 nm. Product conversion of transesterification of the waste oil was 76.55 %.

Keywords : Sonochemical, MCM-41, MCM-41-NH₂, Lapindo mud, transesterification.