SYNTHESIS AND CHARACTERIZATION OF H-Al-MCM-41 CATALYST WITH VARIATION OF Si/Al RATIO AND ITS ACTIVITY IN CITRONELAL CYCLISATION

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ABSTRACT

Al-MCM-41 catalysts with variation Si/Al ratio of 15, 25, 50, and 75 have been synthesized using hydrothermal method and followed by ion exchange process to produce H-Al-MCM-41. The characterization results of XRD, FTIR and nitrogen adsorption-desorption showed that all Al-MCM-41 catalysts have the same structure with mesopore MCM-41 that were marked by peaks of diffractogram at 2\(^\theta\) of approximately 1.8-2.4°, 3.5-4.12°, 4.31-4.82°, and 5.64-6.00°, also pore size distribution between 30.49-34.09 Å. After ion exchange process, the resulting H-Al-MCM-41 showed a decrease in the intensity of the peaks of their diffractograms, a decrease in the specific surface areas and pore size compared to their corresponding Al-MCM-41, even though the regularity of the MCM-41 structure was still observed. All Al-MCM-41 catalysts have both Lewis and Bronsted acid sites and the acidity of catalyst increased with the increase in the Al content. In addition, acidity of the catalysts after the ion exchange process increased accordingly. Catalytic activity of Al-MCM-41 and H-Al-MCM-41 catalysts on citronellal cyclisation were influenced by catalyst acidity in which catalysts with strong Lewis acid and weak Bronsted acid sites were more active and selective in the citronellal cyclisation reaction towards isopulegol. The highest activity and selectivity of 92.26% and 85.075% respectively was obtained by H-Al-MCM-41(15) catalyst using toluene as solvent.

Keywords : Si/Al ratio, citronellal cyclisation, isopulegol, H-Al-MCM-41, Lewis and Bronsted acid.
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