

Zinc and copper organic frameworks as heterogenous catalysts for the esterification of stearic acid

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Esterification is a vital transformation in many commercially important processes. A catalyst is essential for efficient esterification. Widely available homogenous catalysts do not satisfy the need since the separation of the catalyst at the end of the reaction causes difficulties. Therefore, the need of a heterogeneous catalyst has been a topic of current interest. In this study, metal (M=Zn and Cu) organic frameworks (MOFs) were synthesized under traditional solvothermal conditions and their catalytic activity in the process of esterification was studied. MOFs were synthesized by refluxing $M_n(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ and terephthalic acid in *N,N*-dimethyl formamide at 60 °C in 1:2 molar ratio for 4 h. The resulting white powder of Zn-OF and blue powder of Cu-OF were collected by filtration and characterized by comparing their PXRD and FTIR spectra with the previously reported data. The grain diameters were calculated according to the Debye-Scherrer formula and the calculated values were 280.44 nm and 223.32 nm for Cu-OF and Zn-OF respectively. To test the catalytic activity, stearic acid (0.100 g) was refluxed with the MOFs (0.010 g). Resulting solutions were centrifuged and the supernatant layer was separated and a GC analysis was carried out. Control experiments were carried out without the application of a catalyst. Both MOFs revealed catalytic activity for the esterification of stearic acid. The catalysts were heterogeneous so that the easy separation after the completion of the reaction was possible. GC data revealed that Zn-OF has higher capacity (~13.31%) than that of the Cu-OF for the conversion of stearic acid into fatty acid methyl ester. The esterification reaction in the presence of Cu-OF is more efficient (~2.20%) than that in the absence of a catalyst. The overall results reported herein implies the higher catalytic activity in the presence of better Lewis acids such as Zn-OF than Cu-OF