Synthesis and catalytic performance of bimetallic NiW- and NiMo-ZSM-5/MCM-41 composites for production of biofuels

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This work presents a synthesis of bimetallic NiW and NiMo modified ZSM-5/MCM-41 composites and their heterogeneous catalytic application for the conversion of crude palm oil (CPO) to production of biofuels. Firstly, ZSM-5/MCM-41 composites were synthesized through a self-assembly of cetyltrimethyl ammonium bromide (CTAB) surfactant with silica-alumina from ZSM-5 zeolite prepared from natural kaolin by the hydrothermal technique**.** Secondly, the synthesized composites were deposited with bimetalic NiW and NiMo by impregnation method. The obtained composite and its modified ones presented a micro-mesoporous structure, confirmed by XRD, SEM, NH_3-TPD and N_2 adsorption-desorption techniques. Subsequently, the catalytic activity of these materials was studied toward hydrocracking process of CPO in a batch microreactor at 400 ^oC for 2 h. The results showed that the catalytic activity decreased in the order of NiW-ZSM-5/MCM-41 > NiMo-ZSM-5/MCM-41 > Ni-ZSM-5/MCM-41 > W-ZSM-5/MCM-41 > Mo-ZSM-5/MCM-41 > NiW-ZSM-5 zeolite > ZSM-5/MCM-41 > ZSM-5 zeolite > MCM-41. Finally, types of hydrocarbon products, identified by simulated distillation gas chromatography-flame ionization detector (SimDis GC-FID), were gasoline, kerosene, and diesel. Thus, NiW- and NiMo-ZSM-5/MCM-41 composites could be considered as candidates for the production of useful biofuels.

Keywords: Self-assembly; ZSM-5/MCM-41 composite; Micro-mesoporous structure; Hydrocracking process· Crude palm oil