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Synthesis of highly hydrothermally stable catalysts for the conversion of castor oil into bio-aviation fuel

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Fossil fuels are becoming exhausted and new alternative fuels need to be found to meet the increasing energy demand. Biofuels have emerged as one of the most strategically important sustainable fuel sources and an increasing number of developed and developing countries found biofuels as a key to reducing reliance on foreign oil, lowering GHG emissions and meeting rural development goals. Therefore, raw materials such as animal fats, waste greases, edible oil and inedible oil have been studied for preparing aviation fuel through hydrodeoxygenation (HDO) technology [1-5]. In this study, Highly hydrothermally stable HDO catalysts Ni–Mo/MCM-41–TiO_2 have been investigated for overcoming the detrimental effect of water on the catalyst in the process of hydrotreating castor oil with high oxygen content (15 wt%). Characterization by XRD, XPS, FT-IR and activity test results showed that modified MCM-41 (Ti–O–Si) improved the water resistance of the catalyst and prevented loss of the active component as given in Fig. 1. With increasing reaction time, the water that is produced by the HDO reaction can gradually impact on MCM-41, as shown in Fig. 1(c). It can be seen that the conversion begins to decrease at 40 h and the XRD characterization also proved that the crystallization peaks of NiO and Ni have disappeared after 40 h on NiMo/MCM-41, while the NiO and Ni peaks still exist for NiMo/MCM-41–TiO_2 (10 wt%) after 200 h (see Fig. 1(d)). This phenomenon suggests the loss of the active component in the dehydration process over a long time. Therefore, NiMo/MCM-41–TiO_2 was synthesized for enhanced water resistance and weak interaction between metal and carrier.

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