Comparison of sulfidic and non-sulfidic catalysts for hydrotreating of rapeseed oil

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Statement of the Problem & Aim: According to the OPEC World Oil Outlook in 2040 the increase of diesel and jet fuel worldwide demand about 20% and 40%, respectively in comparison with today is expected. The increasing worldwide consumption of fossil fuels evokes efforts and usage of renewable raw materials for the production of biofuels which decreases the accumulation of greenhouse gases and allows restricted consumption of non-renewable crude oil reserves. The hydrotreating of triglycerides now-a-days seems to be a perspective way for the production of renewable component into diesel fuel. The purpose of this study is to compare the activities of sulfidic Ni Mo/γ-Al_2O_3 and Co-Mo/γ-Al_2O_3 and reduced Ni/γ-Al_2O_3 catalysts for the hydrotreating of rapeseed oil.

Methodology & Theoretical Orientation: Continuous flow reactor with an inner diameter of 21 mm and fixed bed of catalyst was used. The reaction temperatures in the range of 260 360°C, the pressure of 4 MPa and WHSV of 2 h^{-1} were tested.

Findings: The complete deoxygenation of triglycerides was achieved at temperatures of 320°C; 340°C and 360°C with Ni Mo; Ni and Co-Mo catalysts, respectively. The intensive hydrogenolysis of alkanes and methanization of CO and CO_2 at higher reaction temperatures were observed on Ni catalyst. Gaseous products from Ni catalyst thus contained only a minor amount of CO, CO_2 and propane in contrast to both types of sulfidic catalysts. Hydrodeoxygenation (HDO) reactions were almost in balance with hydrodecarbonylation (HDCn) and hydrodecarboxylation (HDCx) reactions in case of both sulfidic catalysts. Higher isomerization activity of Co-Mo catalyst was observed in comparison with other tested catalysts.

Conclusion & Significance: Reduced Ni/γ-Al_2O_3 catalyst is a perspective type of catalyst for hydrotreating of neat triglycerides. The activity of this type of catalyst is sufficient and additionally, the doping of the feedstock by sulphur compound for the preservation of catalytic activity like in case of sulfidic catalysts is not necessary.

Biography

Petr Straka is an Assistant Professor at the University of Chemistry and Technology Prague in Czech Republic. He has his expertise in the development and testing of catalysts for the hydrotreating of triglycerides with the aim of the production of diesel fuel renewable bio-component. His work is also focused on the hydrotreating of straw bio-oil from ablative fast pyrolysis and consequent processing of the product in oil refinery. Now-a-days he is researching on possibilities of hydrocracking of Fischer-Tropsch wax in the neat form or in the mixture with petroleum vacuum gas oil.

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