

Activity of Ni-based catalysts for hydrotreating of rapeseed oil

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Abstract

Statement of the Problem: The hydrotreating of vegetable oils is nowadays a very promising way to produce renewable components of engine fuels. Using reduced nickel-based catalysts for this purpose seems to be very perspective. However, these catalysts are characterized by relatively low stability during the deoxygenation of triglycerides, mainly due to the deposition of coke on their surface. For this reason, bimetallic nickel-based catalysts with Ag and Cu promoters were tested and their activities and stabilities were compared.

Methodology & Theoretical Orientation: The hydrotreating was performed in a tubular fixed-bed reactor with the co-current flow of a feedstock and hydrogen. Commercially available rapeseed oil was used as a feedstock and Ni, Ni-Ag and Ni-Cu catalysts with γ -Al₂O₃ support were prepared and tested. Temperatures in the range of 220 – 320 °C, the pressure of 4 MPa, weight hourly space velocity of 1 h⁻¹ and hydrogen to feedstock ratio of 1000 m³·m⁻³ were used.

Findings: For all tested catalysts, the conversion of triglycerides increased with the increasing reaction temperature and the full conversion was achieved for Ni and Ni-Ag catalysts at the reaction temperature of 260 °C and at 280 °C for the Ni-Cu catalyst. The key component of all gaseous products was methane, probably due to the strong hydrogenolysis activity of all compared catalysts.

Conclusion & Significance: If Ni-Cu/ γ -Al₂O₃ catalyst was used, hydrogenolysis reactions were slightly suppressed and the higher stability at the higher reaction temperatures was observed. For this reason, Ni-Cu/ γ -Al₂O₃ seems to be a perspective catalyst for the hydrotreating of vegetable oils with the aim of the production of renewable components of engine fuels.



Biography:

Veronika Váchová is a PhD student at UCT Prague. She is engaged in the hydrotreating of vegetable oils to motor fuels, especially in terms of testing new catalysts and the influence of process conditions on the quality of the products. She has participated in several international conferences, such as International Conference on Chemical Technology in Mikulov, Czech Republic.

Speaker Publications:

1. Váchová V., Straka P., Kochetkova D., (2019) Nickel-based catalysts for hydrotreating of fatty acids triglycerides; Paliva; 2; 2019; 49-56
2. Váchová V., Straka P., Malysheva A., Blažek J., (2019) Influence of conditions of rapeseed oil hydrotreating on the products quality, Paliva, 3, 11, 94-100
3. Vrtiška D., Vozka P., Váchová V., Šimáček P., Kilaz G.; (2019) Prediction of HEFA content in jet fuel using FTIR and chemometric methods; Fuel 236, 1459-1464.
4. Vozka P., Váchová V., Blažek J., (2015) Catalysts for hydrotreating of liquid products from processing of biomass. Paliva, 7, 59-65, ISSN 1804-2058
5. Váchová, V.; Vozka, P., (2015) Processing of vegetable oils to diesel fuel. Paliva, 7, 66-73, ISSN 1804-2058



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