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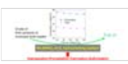
Figures and tables



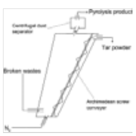
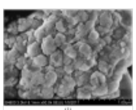
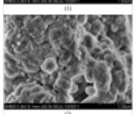
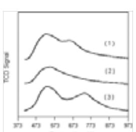


Table 1







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Hydrocracking of the crude oil from thermal pyrolysis of municipal wastes over bi-functional Mo–Ni catalyst

Junhui Li, Hui Xia, Qian Wu, Zhonghua Hu, Zhixian Hao, Zhirong Zhu

Department of Chemistry, College of Environmental Science and Engineering, Tongji University, 1239, Siping Road, Shanghai 200092, China

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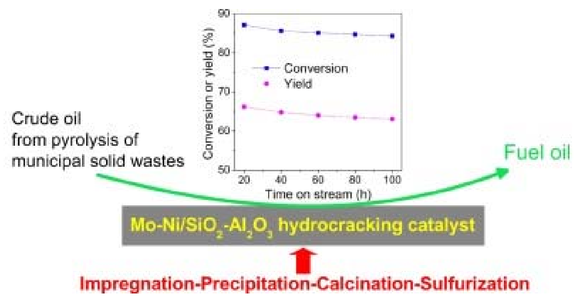
Highlights

- Overall refining of crude oil from pyrolysis of municipal solid wastes was performed.
- A bi-functional Mo–Ni/SiO_2–Al_2O_3 catalyst was prepared for refining of the crude oil.
- A specific preparation procedure was impregnation–precipitation and sulfurization.
- NiO particle size and dispersion were controlled with urea as precipitator.
- High yield of fuel oil was obtained with a good catalytic stability and regeneration.

Abstract

Bi-functional Mo–Ni/SiO_2–Al_2O_3 catalyst was prepared by loading bimetal Ni–Mo over large porous and acidic SiO_2–Al_2O_3 substrate via impregnation–precipitation–calcination–sulfurization procedure. Highly dispersed NiO clusters were loaded with urea as a precipitator. The catalytic performance for the hydrocracking of the crude oil from thermally pyrolysis of municipal solid wastes was investigated in a fixed bed reactor. It is found that SiO_2–Al_2O_3 composites with the mid-acidity and large pores were more suitable as the substrate than Al_2O_3 and Al_2O_3–Y(Y zeolite). Mo–Ni/SiO_2–Al_2O_3 catalyst with 8 wt% Mo and 14 wt% Ni showed the higher reactivity and higher yield of fuel oil. Moreover, its hydrocracking reactivity could be further improved by partial sulfurization of Ni and Mo. Besides, the bi-functional Mo–Ni/SiO_2–Al_2O_3 showed a good stability, and the deactivated catalyst could be easily regenerated by on-line combustion. Under the optimized conditions of 10 MPa, WHSV 0.3 h^{-1} and 698 K, the conversion of pyrolysis oil was up to 86% with 66% yield of fuel oil, greatly better than a commercial hydrocracking catalyst. The overall hydrocracking refinement converts most of the olefin, acid, ketones and poly-aromatic presented in the pyrolysis oil into alkanes, alcohols, and alkyl-aromatics, with a significant decrease of N and S contents as well as viscosity.

Graphical abstract



Keywords

Mo–Ni/SiO_2–Al_2O_3; Bi-functional catalyst; Pyrolysis oil; Hydrocracking; Municipal solid wastes

Corresponding author.