Catalytic Tandem Reaction for the Production of Jet and Diesel Fuel Range Alkanes

Jet and diesel fuels are typically composed of C_{9-14} and C_{12-20} hydrocarbons, respectively, but the carbon-chain length of sugar-derived aldehydes and furanic compounds is no longer than C_6. Here, a cascade catalytic process involving alkylation and hydrodeoxygenation (HDO) of 2-methylfuran (2-MF) with different aldehydes is conducted to directly produce long-chain alkanes with exclusive carbon number of C_{11-17} in overall yields of 50-84%. Preliminary investigations on the alkylation of 2-MF and formalin show that the relative density of Lewis and Brønsted acidic sites of zeolitic materials remarkably affect their catalytic activity and selectivity. Sn-beta(12.5) with pronounced Lewis acidity (including the acid density and strength) exhibits higher catalytic performance in the alkylation than other zeolites, producing long-chain oxygenates in 58-92% yields. Even in aqueous solution, the Sn-beta(12.5) catalyst can be reused for at least six reaction cycles with almost constant reactivity. More importantly, the co-addition of Hf(OTf)₄ with Pd/C greatly promotes C-O bond cleavage of the furan-ring during the HDO process under mild reaction conditions, producing long-chain alkanes in high yields of 84-94%.

General information
State: Published
Organisations: Centre for Catalysis and Sustainable Chemistry, Organic Chemistry, Department of Chemistry, Guizhou University, East China University of Science and Technology
Contributors: Li, H., Gui, Z., Yang, S., Qi, Z., Saravanamurugan, S., Riisager, A.
Pages: 1060-1066
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Energy Technology
Volume: 6
Issue number: 6
ISSN (Print): 2194-4288
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.83
Web of Science (2017): Impact factor 3.175
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 0.66
Web of Science (2016): Impact factor 2.789
Scopus rating (2015): CiteScore 0.21
Web of Science (2015): Impact factor 2.557
Web of Science (2014): Impact factor 2.824
Original language: English
DOIs:
10.1002/ente.201700637
Source: FindIt
Source-ID: 2392509597
Research output: Research - peer-review ; Journal article – Annual report year: 2018