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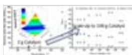
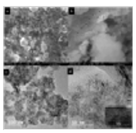
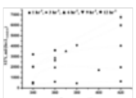
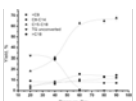
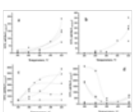


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Research article

Optimizing renewable oil hydrocracking conditions for aviation bio-kerosene production

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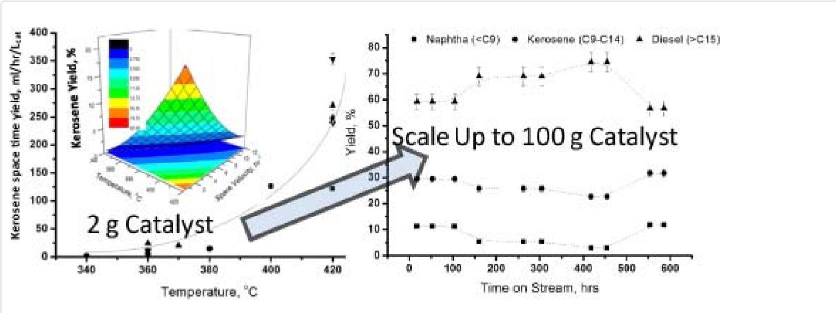
Highlights

- Aviation bio-kerosene from Jatropha oil (Ni–W/SiO_2–Al_2O_3 catalyst) meets ASTM D7566.
- Strong dependence on temperature, space velocity and hydrogen pressures.
- H_2 pressure above 60 bars favour C—O bond cleavage and deoxygenation.
- H_2 pressure below 60 bars favour C—C bond cleavage and dehydrogenation.

Abstract

In the present work we have performed a parameter study to maximize the yields of aviation bio-kerosene and renewable diesel range products obtained from the conversion of plant-oil triglycerides over Ni–W/SiO_2–Al_2O_3, hydrocracking catalyst. Specific insights and changes in reaction mechanisms, with C—O bond breaking favoured at increased pressures (> 60 bar) leading to depropanation/deoxygenation, as compared to C—C bond breaking becoming favoured at reduced pressures (< 60 bar) leading to formation of lower range esters and short chain glycerides, are established for the first time using analytical techniques (GC, NMR and IR). The C—C cleavage and low hydrogen partial pressures (< 60 bar) led to formation of unsaturated intermediates, which promoted cyclization, aromatization and coking reactions, which increased deactivation of catalyst. High space time yield with a maximum of 240 ml/(h · $L_{catalyst}$) for < C9 products and 350 ml/(h · $L_{catalyst}$) for C9–C14 products was observed at 420 °C temperatures. Stable catalytic performance was observed until 450 h of continuous operation with 25–30% yield of aviation bio-kerosene which meets all ASTM D 7566 standards.

Graphical abstract



Keywords

Hydrocracking; Triglyceride; Biofuel; Aviation fuel; Biokerosene catalyst life

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