Single-step catalytic deoxygenation-cracking of tung oil to bio-jet fuel over CoW/silica-alumina catalysts

ABSTRACT

Bifunctional Co-W catalysts with variable Co-W dosages on silica-alumina (SA) were prepared and tested for the catalytic deoxygenation-cracking of tung oil (TO) for the production of jet fuel (n-(C_{10}-C_{16})) fractions. The CoW/SA catalyst appeared to be most active (hydrocarbon yield = 69%, jet fuel selectivity = 60%) and outperformed the monometallic Co and W analogues. Based on the effect of metal dosage, Co– and W-rich catalysts do not provide a workable approach in enhancing deoxygenation-cracking of the TO for jet fuel production, and overly cracking can be successfully controlled at lower metal dosages (5 wt% Co, 10 wt% W). The CoW/SA reusability study showed a consistent deoxygenation-cracking ability for four runs with hydrocarbon yields within the range of 77–84% and 64–77% jet fuel selectivity. GCMS analysis and physicochemical properties of TO oil fuel (TO-gasoline, TO-jet, TO diesel) confirmed that rich aromatic species in TO-diesel negatively affected the quality of the fuels. TO-fuels with a short chain had better combustion properties than those with a longer chain hydrocarbon. The TO-jet qualities are complied with standard Jet A-1 in accordance to ASTM D1655 and DEF STAN 91–91 specification standards. The TO-jet also exhibited excellent cold properties and superior combustion characteristic than Jet A-1.