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CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

Upgrading Biocrude Oil into Sustainable Aviation Fuel using Zeolite-supported Iron-Molybdenum Carbide Nanocatalysts

Background/Objective

Wet waste, including food waste and biomass, are promising candidates for sustainable aviation fuel (SAF) production due to their triglyceride content, which can be converted into biocrude via hydrothermal liquefaction (HTL). SAF precursors must meet criteria derived from conventional fuels (e.g. Jet A), including complete oxygen removal to prevent jet engine corrosion and a higher heating value (HHV) close to Jet A. Currently, no HTL-derived biocrude meets these. This study explored using zeolite-supported molybdenum carbide (Mo_2C) nanocatalysts to upgrade wet waste-derived biocrudes into SAF precursors that meet all essential criteria for the first time.

Approach

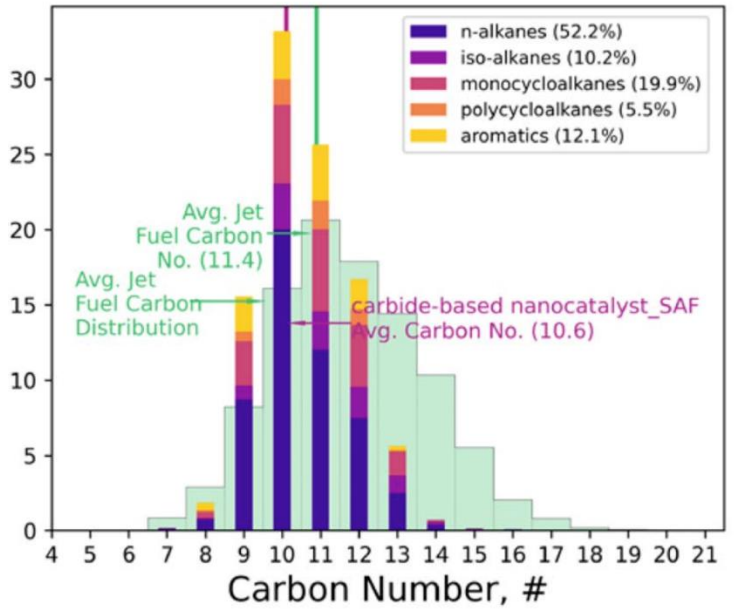
Mo_2C nanocatalysts were generated in gas phase and dispersed onto zeolite, tested for their ability to remove oxygen from biocrudes, then used to upgrade wet waste-derived biocrude to SAF via HTL. The upgraded biocrudes were characterized against Federal Aviation Administration specifications.

Results

Our data showed complete oxygen removal from the biocrude and a high heating value of 46.5 MJ/kg, comparable to Jet A. Prescreening tests showed the average carbon number of the upgraded biocrude's distilled SAF fraction was 10.6, close to 11.4 for average conventional jet fuel, and it satisfied all key SAF prescreening standard specifications, including surface tension, density, viscosity, flash point, and freezing point. The metal carbide nanocatalysts were reusable in upgrading tests multiple times and retained their deoxygenation activity.

Significance/Impacts

This work demonstrates for the first time the feasibility of catalytically upgrading wet waste-derived biocrudes into SAF precursors using zeolite-supported Mo_2C nanocatalyst.



Characterization of the distilled SAF fraction of upgraded biocrudes.

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