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Algal Biofuels Production over NiMoC Catalysts Supported Chemically Prepared Activated Carbon from Algal Derived Hydrochar †

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Abstract: Hydrothermal liquefaction of microalgae as a third generation of biofuel feedstock under milder reaction conditions was studied to produce and characterize biocrude oil and hydrochar. The optimum yield of biocrude oil (57.8 wt.%) and highest energy recovery (85.3 %) was obtained at 272°C, 11.5 MPa, and reaction time of 35 min. This study also focused on utilizing hydrochar-based catalysts as a renewable carbonaceous material to improve the overall economy. The chemically prepared activated carbon with a specific surface area of 631 m^2/g was obtained, which also revealed total pore volume and average pore size of 0.36 cm^3/g and 8.2 nm, respectively. The use of novel NiMo carbide catalysts supported activated carbon obtained from chemical activation of algal hydrochar for the catalytic hydrodeoxygenation of algal biocrude oil was investigated. The synthesized catalysts were screened through hydrodeoxygenation (HDO) reactions of HTL algal biocrude oil to produce liquid hydrocarbon fuels. The NiMo carbide synthesized through co-impregnation and carbothermal reduction showed high activity for oxygen removal due to its high acidity and higher active phase exposure to active hydrogen. The upgraded biocrude oil at reaction conditions of T=400°C, t=2.7 h, and 10 wt.% of catalyst loading revealed an oxygen reduction percentage of 94% with HHV of 43.9 MJ/kg.

Keywords: algal biofuels; hydrodeoxugenation; hydrothermal liquefaction; NiMo catalysts; microalgae.

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Conflicts of Interest

The authors declare no conflict of interest.