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Novel hydrothermal processing of algal feedstocks into liquid fuel precursor

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Abstract

Algal biofuel production has received considerable attention from around the world, with significant research effort put in converting algae into into biodiesel, renewable diesel, gasoline and jet fuel via lipid extraction and subsequent transesterification or catalytic hydrogenation/cracking reactions. At the same time, there has been considerable interest in hydrothermal conversion of whole algae (without drying) in hot, comprssed water into solid/liquid biofuels. This presentation outlines our research efforts and findings in hydrothermal liquefaction (HTL) of whole algae into a liquid fuel precursor, "biocrude" and its upgrading via catalytic hydrodeoxygenation (HDO) into an ugraded product oil. HTL experiments were conducted at different temperatures (200-380^{o}C), holding times (30-60 min) and catalytic conditions, using a high pressure Parr reactor. HTL generated up to ~51% biocrude in the presence of a catalyst. This biocrude had higher heating value (HHV) of 32-39 MJ/kg compared to approximately 42 MJ/kg for petrocrude. HDO experiments were carried out using the 1.8-L high pressure reactor at 350^{o}C using high pressure H_2 (1500 psi). The upgraded oil was found to have improved higher heating value, 40% less N, and 60% less O than the HTL biocrude.