

Combined heat, power and hydrogen (CHPH) production from brown algae via hydrothermal liquefaction using aspen plus ®

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This work focuses on modeling of Hydrothermal Liquefaction (HTL) of brown algae in the stoichiometric reactor model using Aspen Plus® for the production of hydrogen gas along with the generation of power and heat facility to meet the process requirement. The number and the type of compounds used in Aspen Model to represent HTL oil and associated aqueous phase must reasonably match key properties such as chemical group, density, heating value, GC-MS data. Algae feed of 140,000 lb/hr was fed to the HTL reactor, 100 % conversion of the Algae and a balanced reactor was achieved yielding 54.7 % aqueous phase, 23.70 % of gas phase and 21.53 % of non-aqueous phase. Production of H₂, by the gasification of the aqueous products followed by the water gas shift reaction and pressure swing adsorption shows the production of 4464 kg/hr of hydrogen gas and the remaining comprising CO₂ and minute amounts of N₂, CH₄, C₂H₆, CO, and H₂. The heat and power unit runs in a controlled loop and changes with the demand required for the HTL and H₂ production process to operate.