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“Using Hydrothermal Liquefaction (HTL) for Cost Efficient Production of a Bio-crude Suitable for Refineries”

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Introduction

Green diesel, which can also be called a renewable diesel, is a hydrocarbon fuel that is produced from biomass. Green diesel has a high Cetane rating as compared to other diesels, and is also considered to be of high grade. It has the capability for effortlessly substituting traditional diesel in the market [1].

The common biomass sources that can be used for renewable diesel production include: woody biomass, grasses, other herbaceous plants, algae, as well as agricultural crops such as corn, soybean, and sugarcane.

The best possible biomass that can be used is microalgae. Recently, the use of algae for environmental applications, including wastewater treatment, carbon dioxide sequestration and biomass generation for energy production purposes, has emerged as an area of interest among researchers due to algae's unique properties and distinct features.

The HTL process provides a higher conversion rate of biomass to bio-crude [2] and thus would lead to a higher percentage of energy efficient biofuel.

Objective

- 1.) Use HTL technology to convert wet-algae biomass into energy dense “bio-crude” suitable for use in refineries and recycling nutrients for growing algae.
- 2.) Determine the ideal HTL conditions for various algal biomass compositions.

Diagrammatic Representation



Methodology

- 1.) Algae pre-screened for fast growth rates by UDRI and grown via autotrophic (under sunlight / artificial light with CO₂ or inorganic carbon), heterotrophic (sugars / organic carbon) and mixotrophic (combination of organic and inorganic carbon in the presence of light) are harvested and dewatered to 20-30% solids or higher concentration.
- 2.) Biomass was characterized for its composition
- 3.) The algae slurry was heated in a pressure vessel (at 2000–3500 Psi, 300°C–350°C) at various reaction times and reactor configurations to determine optimum process conditions for the selected biomass.
- 4.) The different fractions (aqueous phase, organic bio-crude, solid char and gaseous phase) formed from the HTL reaction were separated and characterized for composition and quantified for yield (speciation for organic and inorganic content) .
- 5.) Aqueous phase was tested for nutrient recycling; gaseous phase was studied for energy recovery and emissions / environmental impact.



A) Wet algae paste



B) Experimental set-up.



C) Gas sample bags



D) Separation of bio-crude



E) Final product samples

- 6.) The crude quality was assessed with help from refinery process specialist and UDRI fuels upgrading laboratory; energy consumed and process economics are to be determined to give the highest yield with the lowest impurities.

Result Found

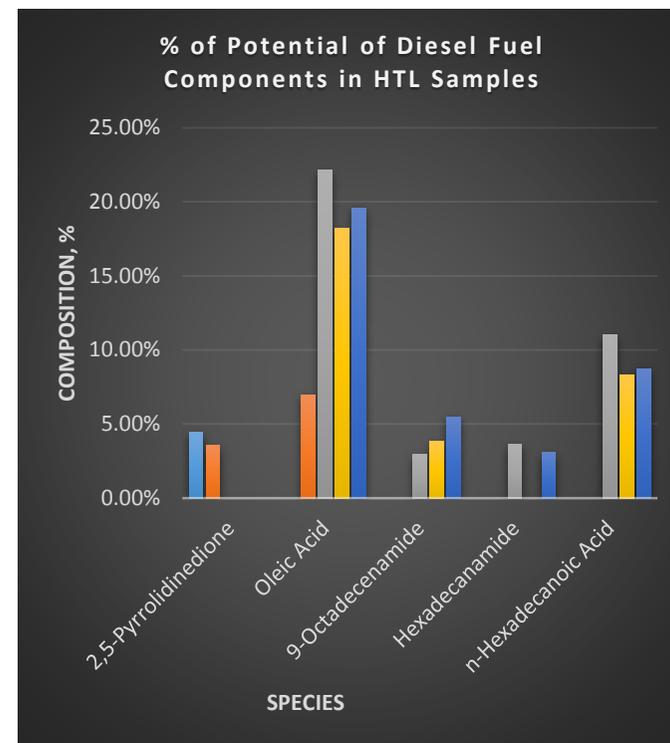


Figure: % of Diesel fuel components in HTL Samples.

Bibliography

- 1.) Holmgren, J., Gosling, C., Marinangeli, R., and Marker, T., “New developments in renewable fuels offer more choices,” Hydrocarbon Processing, 2007, pp.67-71
- 2.) Processing Algal Biomass to Renewable Fuel: Oil Extraction and Hydrothermal Liquefaction
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