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Macroalgae for bio-crude production

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Abstract—Obtaining biofuel from algae has acquired a great importance in recent years, mainly due to the rising prices of conventional fuels and the high potential of biofuels to replace them. The algal biomass has good qualities which make it an attractive raw material for manufacturing biofuels. In coastal areas, the death of a multitude of clams and bivalves is caused by the large accumulation of macroalgae on the seafloor or on sandbacks. These algae, which are mostly untapped, can be collected and used to produce liquid, solid or gaseous biofuels. Different hydrothermal processes such as hydrothermal carbonization (HTC), hydrothermal liquefaction (HTL) or hydrothermal gasification (HTG) can be used to obtain fuels from macroalgae. At present, none of these processes has been studied in depth.

In this research, hydrothermal liquefaction (HTL) to obtain a liquid fuel was carried out using macroalgae as raw material. Three different species of marine macroalgae collected in Spain, were used: Fucus Spiralis, Pelvetia Canaliculata and Enteromorpha Prolifera (Ulva). All tests were carried out with 1:10 ratio algae:distiller water, which is 9% by weight of solids. The liquefaction experiments were conducted at temperatures of 250 °C and 300 °C, with residence times of 15-180 min. Na_2CO_3 was used as catalyst. Once mixed (algae, distilled water and catalyst), the mixture was introduced into the discontinuous reactor, it was closed at 15 Nm and then it was introduced into a muffle. The heating temperature, from room temperature to the working temperature, was experimentally calculated resulting in 16.42 °C/min. After the HTL process completion, the resulting product was mixed with dichloromethane and then decatated and separated. The dichloromethane was then evaporated to obtain the bio-crude which was analysed. The best results were achieved for Enteromorpha Prolifera macroalga when it was subjected to 2 hours of HTL at 250 °C of temperature.

Keywords—bio-crude, fuel, algae, waste, hydrothermal liquefaction