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HYDROTHERMAL LIQUEFACTION OF MICROALGAE IN THE PRESENCE OF HOMOGENEOUS AND HETEROGENEOUS CATALYSTS

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The continuous raise in the prices of fossil fuels and the awareness of the society challenges related to their use has recently driven a strong growth of interest on the investigation of different biochemical or thermochemical processes for the production of liquid biofuels .

In this context hydrothermal liquefaction (HTL) of terrestrial biomass seems to be promising from some process costs analyses, even if different technological hurdles are still to be overcome to reach high process efficiency [1]. For example, problems must be solved concerning the effect of biomass impurities and inhomogeneity, the necessity of using corrosion resistant materials, the technological complexity of continuous plant layout, the feeding of water-biomass mixture.

Several studies have shown that the biocrude obtained from thermochemical liquefaction of microalgae has a quite high heating value, although its oxygen and nitrogen contents are significant [2].

In this study, experiments of hydrothermal liquefaction of microalgae were carried out in near critical water in the presence of homogeneous and heterogeneous catalysts to estimate their influence on the performances of the process.

All the experiments were carried out in a 29.7 mL AISI 316 batch reactor, filled with an algal slurry at 10 wt % of biomass. The used algal biomass was constituted by Nannochloropsis gaditana dry powder. Tests were carried out at near critical conditions for water (375 °C and P > 22.1 MPa) with a reaction time of 15 minutes. Catalyst were tested both at 30 % and 60 % of reactor filling, to study the influence of the system density and pressure.

Products collected at the end of each liquefaction experiment were distributed in four different phases: a solid residue, an aqueous phase, a bio-crude oil and a gaseous mixture. The amount, the yield and the organic content of each phase were

estimated. Moreover, the composition of the obtained gas was investigated by chromatographic analysis, the total organic carbon (TOC) of the aqueous phase was measured, and the biocrude oil was characterized by elemental and GM-MS analysis.

All investigated catalysts exhibited influence on the yields of the different obtained phases in terms of distribution and composition as well. Results will be shown and discussed with respect to critical product parameters, such as biocrude and gas yields, gas composition and presence of heteroatoms (N, O, S) in the obtained biocrude.

References

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