Catalytical Thermal Conversion of Marine Biomass and Plastic Wastes for a Higher Added Value Energy Products Generation

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Abstract

The ongoing eutrophication processes and water pollutions caused by marine biomass and plastic waste are one of the most relevant ecological problems. Collected wastes are possible alternative feedstock for additional higher added value energy product generation. The thermal treatment could be offered to solve the ecological problems and contribute to creating a circular economy. Usually, catalysts are used in thermal treatment to refine pyrolysis products and to increase their yield. In order to study pyrolysis process and the effect of the catalyst on the formulated products, this work aims at the analysis of seaweed and used fishing nets, using TGA-DTG-FTIR systems, and mini pyrolysis plant. Experiments were conducted with ultra-stable Y-type zeolite catalyst with a ratio 1 by 3. Micro-thermal analysis using the TGA-DTG-FTIR system was processed for feedstock characterization purposes, which showed that marine biomass could decompose in two different periods, while the fishing gear only in one, with a total weight loss of 61 wt.% and 83 wt.%, respectively. The FTIR analysis exhibits that aromatic and aliphatic C-H, CO_2, and C=O (aldehyde or ketone) represents the major functional groups and compounds in the released volatile components. Catalyst slightly increased the intensity of the C-H peak in both samples and added one additional O-H peak in the seaweed sample. Pyro-oils analysis showed that the main fractions could be assigned to aromatic and aliphatic hydrocarbons, such as naphthalene, styrene, and toluene. Meanwhile, the seaweed and fishing nets samples subjected to thermal treatment produced 17% and 72% of liquid products, respectively.

Keywords: Biomass; Macroalgae; Plastic wastes; Pyrolysis; Used fishing nets;