Effect of acid and basic pretreatment on the performance of hydrothermal liquefaction of waste biofeedstocks

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Hydrothermal liquefaction (HTL) could be a promising technology to produce biocrude (BC) from wet matrices. A conceptual analysis on the HTL of microalgae assisted by solar heat demonstrated that the bio feedstock cost strongly impacts the economic sustainability of the process (Appl. Energy 208 (2017) 1139–1149). To overcome this issue, zero-cost wet matrices such as the organic fraction of municipal solid waste (OFMSW), sewage sludge (SS) or food industry waste could be adopted. However, the time variability of these biofeedstocks remains a significant challenge for the development of industrial HTL processes. In this context, we started to study the impact of acid and basic pretreatments with HCOOH and KOH of SS, olive oil pomace (OOP) or OFMSW, on the yield and quality of BC to find an effective and economically sustainable method to enhance the plant's productivity independently on the matrix variability. The preliminary results obtained in this study will be presented. It was found that pretreatment is more effective in improving the BC yield of heterogeneous and mixed SS, while it is less effective with more homogeneous matrices like OOP. In fact, after the HTL of pretreated SS, we obtained higher yields of BC enriched in aliphatic chains with higher values of H/C ratios and energy recovery. In particular, KOH-pretreatment of SS increased the H/C of the BC from 1.79 to 1.93 at 300°C and from 1.67 to 1.85 at 350°C. Furthermore, we observed a lower area of absorbance peaks related to -OH, -NH and carbonyl functional groups in FT-IR spectra of synthesized BC, indicating that the alkaline-pretreatment removed oxygen and nitrogen-bearing chemical species from SS. Instead, a notable increase in BC yield and energy recovery was observed with HCOOH-pretreated SS after HTL at 350°C, attributed to the beneficial impact of acid pretreatment in enhancing the organic content of the matrix. Collected data indicate that HCOOH-pretreatment of SS and proper kinetic severity of HTL allow a densification of chemical energy in the produced BC.

Keywords: *Waste Valorisation; hydrothermal liquefaction; Pretreatment.*

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