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P.II.3 — Catalytic upgrading of hydrothermal liquefaction-derived biocrude from chicken carcasses and food waste for sustainable biofuel production

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Poster Presentations #29

P.II.3 — Catalytic upgrading of hydrothermal liquefaction-derived biocrude from chicken carcasses and food waste for sustainable biofuel production

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Hydrothermal liquefaction (HTL) is a promising technology for the valorization of lipid- and protein-rich residues such as chicken carcasses (CC; 52 wt.% total solids, 37 wt.% lipids and 22 wt.% protein content) or food waste (FW; 5 wt.% total solids; 18 wt.% lipids and 1 wt.% protein content) to produce a high-energy-density liquid fraction known as biocrude. HTL and co-HTL experiments were carried out in 1.8 L high-pressure batch reactor (4530 Parr, USA). HTL experiments were performed at 270-330 ºC for 60 min with 15 wt.% solids loading of CC. Co-HTL was conducted at 330 ºC for 15 and 60 min with 12.5% solids loading on a 2:3 (CC:FW) ratio on a dry basis.

Biocrude yields from HTL ranged between 62-67%, regardless of the reaction temperature. Co-HTL of FW and CC resulted in lower yields, decreasing to 40% 49% after 15 min and after 60 min of reaction. Elemental analysis revealed that the samples contained 72–75% carbon, 11.3–15.4% oxygen, and 2.2–2.7% nitrogen. Simulated fractional distillation by thermogravimetric analysis identified fuel-range fractions of interest in CC biocrudes. At 330 ºC, light fractions, primarily heavy naphtha and kerosene, accounted for up to 90% of the product distribution, whereas FW addition reduced this proportion to 75%. However, the high oxygen and nitrogen contents, together with density values of 0.943–1.013 g/mL and total acid number between 91–101 mg KOH/g, highlight the need for further upgrading before these biocrudes can be considered suitable for biofuel applications.

Therefore, catalytic upgrading is being explored as a subsequent step to promote hydrodeoxygenation (HDO) and hydrodenitrogenation (HDN) [1]. NiMo/Al_2O_3, CoMo/Al_2O_3, NiMo/n-ZSM-5, CoMo/n-ZSM-5 have been selected to assess the influence of the active metal phase on oxygen and nitrogen removal, with the aim of improving biocrude quality and compatibility with conventional refinery streams.

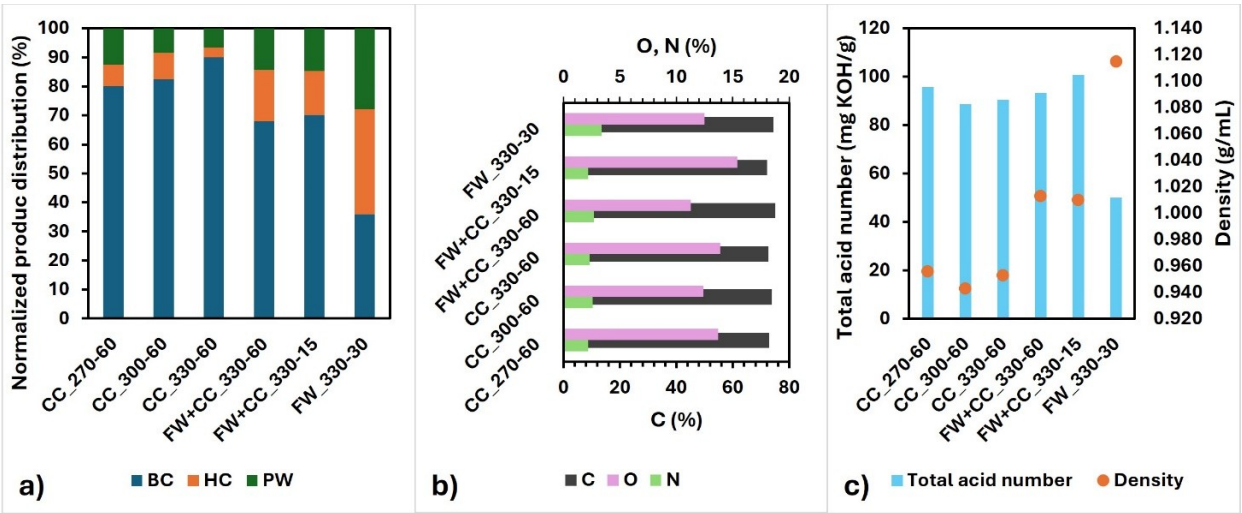

Figure 1. a) Normalized product distribution of HTL and co-HTL experiments; b) C, N and O content of biocrudes; c) physicochemical properties of the biocrudes.

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