

Book of Abstracts

III Convegno Nazionale della Divisione di Chimica per le Tecnologie (DCT-SCI)

XIV Convegno Nazionale dell'Associazione Italiana di Chimica per l'Ingegneria (AICIng)

Eolian Milazzo Hotel
Milazzo (ME)
1 – 4 settembre 2025

Valorization of biochar and aqueous phase derived from the hydrothermal liquefaction of sewage sludge

C. Imparato,^{1,*} A. Bifulco,¹ V. Nebbioso,¹ I. Mazzuocolo,¹ G. Marotta,² F. Di Lauro,¹ J. Passaro,³
P. Russo,³ G. Malucelli,⁴ F. Montagnaro,² M. Balsamo,² A. Aronne¹

¹ Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università di Napoli Federico II, Naples, Italy; ² Dipartimento di Scienze Chimiche, Università di Napoli Federico II, Naples, Italy; ³ Istituto per i Polimeri, Compositi e Biomateriali (IPCB), Consiglio Nazionale delle Ricerche, Pozzuoli (Naples), Italy; ⁴ Dipartimento di Scienza Applicata e Tecnologia, Politecnico di Torino, Turin, Italy.

*claudio.imparato@unina.it

Hydrothermal liquefaction (HTL) is a thermochemical process able to transform sludges from wastewater treatment into bio-fuels, thus recovering energy from waste matter. Our research group is investigating HTL as an effective route to produce bio-oil, as target product, from municipal sewage sludge.¹ The valorization of solid, aqueous, and gaseous by-products obtained through this process (Figure 1) is a key to enhancing the sustainability and circularity of HTL technology.

We propose the use of the solid residue (biochar) as a green flame-retardant additive in polymer composites. Owing to the large inorganic fraction and abundant surface functional groups, HTL biochar can improve the thermal and fire resistance of epoxy resins, providing self-extinction (i.e., V-0 rating in vertical flame spread tests) in combination with other additives.²

The aqueous phase resulting from HTL has a high organic content and needs to be treated before being recirculated in the system or reutilized in alternative ways. We are testing the purification of the aqueous phase through adsorption and photodegradation by means of different TiO₂-based hybrid materials,³ aiming to reduce the concentration of organic contaminants, with particular attention to the most harmful ones (e.g., polycyclic aromatic hydrocarbons).

These activities are performed in the framework of the Programma per il Finanziamento della Ricerca di Ateneo (FRA) 2022 of the University of Naples Federico II (Project EPIC).

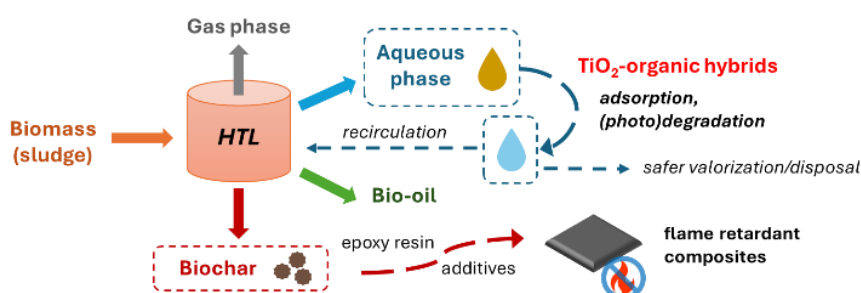


Figure 1. Scheme of HTL process and possible strategies for the reuse of its by-products.

References

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