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CO-HYDROTHERMAL CARBONIZATION OF CAVITATED STABILIZED ORGANIC FRACTION AND LANDFILL LEACHATE: OPTIMIZATION OF HYDROCHAR CHARACTERISTICS

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Abstract

The problem of municipal solid waste (MSW) management is becoming an issue more and more relevant. Hydrothermal carbonization (HTC) is an emerging path to address the concerns arising from the management of MSW, promoting a from-waste-to-resource action plan. In this study, the HTC was performed by using the stabilized organic fraction (SOF) of the MSW to evaluate the hydrochar characteristics and to determine the optimum temperature and residence time of the HTC process. Preliminary tests were achieved with SOF and two different liquid substrates, the landfill leachate (LL) and the concentrate fraction (CF) of landfill leachate from the reverse osmosis plant, respectively. The HTC was performed at different process temperatures and residence times, while the solid-to-liquid ratio was maintained at 1/10. Furthermore, the influence of hydrodynamic cavitation (HC) to enhance the homogenization of SOF and liquid substrate before the HTC was studied. Response Surface Methodology (RSM) was applied to determine the best HTC process conditions (process temperature and residence time) based on the experimental campaign developed through the Central Composite Face-Centered Design (CCF-CD). By statistical analysis, it was possible to understand how the process variables influenced the fixed carbon content, deashing efficiency and mass yield (considered as responses of the model). The optimum condition for the HTC process was at 232°C and 2.65 h. The preliminary results showed that the hydrochar from HTC of the cavitated blend of SOF and LL is a valid mixture for the production of eco-sustainable plasters to be used in the building sector in a circular economy approach.

Key words: HTC, hydrochar, hydrodynamic cavitation, municipal solid waste, response surface methodology

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