

Hydrothermal Carbonization of Household Wet Waste – Characterization of Hydrochar and Process Wastewater Stream

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Abstract

In the present study, the household wet waste (HWW) was pretreated using hydrothermal carbonization (HTC) to explore resource recovery opportunities. The HTC is performed at elevated temperatures (180-250°C) and self-pressure for high carbon recovery through solid hydrochar (HC) and process wastewater (PW). The HWW collected from residential areas was subjected to HTC at 200°C for 1-8 h duration in batch mode and the products were analyzed to examine their resource recovery potential. The calorific value of the HC samples was found to be upto 27 MJ/kg compared to 18 MJ/kg for the untreated HWW. Apart from this, the application of HC samples to soil exhibited no inhibitory impact on the plant growth. The liquid stream (i.e., PW) was also analyzed for several useful value-added organic compounds such as carbohydrates, proteins, short chain organic acids and furfurals to obtain insight into the reaction mechanism. Subsequently, the biochemical methane potential test was performed on PW which showed significant methane production. Hence, PW can also be suggested as a potential source of renewable energy. Moreover, the HTC reaction kinetics was studied using carbon concentrations in the reactant and product streams as the modelling parameters. Further investigations should emphasize on the development of feasible methods for recovery value-added compounds in process water. In addition, combustion trials should be performed with solid HC to understand environmental emissions and other associated challenges.

Keywords: Biochemical methane potential; Household solid waste; Hydrothermal pretreatment; Reaction kinetics; Resource recovery; Soil amendment