NUTRIENTS' FATE IN COW MANURE DURING HYDROTHERMAL TREATMENTS

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Cow manure is an abundant bio-waste stream in considerably growing amounts along with the significantly increasing cattle meat production in Africa. While manure is a burdensome issue for farmers, it is also an important nutrient source for many farmers who cannot afford or avoid chemical fertilizers. The common practice for manure management is the direct land application, however, such practices pose an environmental risk considering run-off, leaching of manure-derived components such as Nitrogen and Phosphorus which threatens water quality and leads to eutrophication of surrounding surface water bodies as well as contamination of groundwater; also, this practice wastes an opportunity to recover energy and nutrients. Anaerobic Digestion (AD) is the typical valorization route for cow manure to produce biogas whilst allowing manure stabilization and odor control. However, AD is challenged by the low biogas yields due to the manure's high nitrogen content as well as the presence of antibiotic residues. Considering the manures' high moisture content, hydrothermal treatments are a promising technology to sustainably valorize cow manure, either as a stand-alone technology or in synergy with AD, to produce biochar, referred to as hydrochar, that can be utilized as bio-fuels and soil amendments.

There are existing studies on cow manure hydrothermal treatments, nevertheless, there is still a knowledge gap in understanding the fate of the primary, secondary (Ca, Mg and S) and micro-nutrients (Zn, Bo, Fe, Mn, Cu, Mo, Cl, Si, Ni, Co and Na) in the cow manure's hydrothermal treatments products, hydrochar and process water, across the wide temperature range of hydrothermal treatments; considering thermal hydrolysis and Hydrothermal Carbonization. Accordingly, the research objectives of the proposed study are to understand the hydrothermal treatment temperature impact on the nutrients fate, as well as to identify an optimal temperature range in terms of energy consumption, and the suitability of the treatment products for land application and bio-energy recovery.

Hence, raw cow manure is treated in a 2L batch reactor for 1 hour under temperatures ranging from 100 °C to 260 °C, with a temperature step increase of 20°C, in duplicates. Raw and treated cow manure, considering solid and liquid phases, are characterized for elemental analyses, including primary, secondary, and micro-nutrients. The results of this study should support debottlenecking cow manure hydrothermal application and contribute to water pollution prevention. On these bases, the proposed study has specific relevance to the Bio-Char III conference main themes regarding biochar production processes, characterization and applications.

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