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Environmental sustainability assessment of a new food waste anaerobic digestion and pyrolysis hybridization system

This research conducted an environmental life cycle assessment (LCA) to evaluate an anaerobic digestion-co-pyrolysis (ADCo-Py) system in which pyrolysis was added to traditional food waste (FW) anaerobic digestion (AD) systems to treat the solid fraction and impurities separated from FW. The solid fraction, including residues and impurities such as wooden chopsticks, plastics, eggshells, and bones, is usually incinerated, while pyrolysis can be a viable alternative to optimize FW treatment pathways. The environmental impact of ADCo-Py was compared with stand-alone AD, pyrolysis, and ADCo-INC (AD with incineration of separated solids). The results indicate that both ADCo-Py (-1.726 kg CO2-Eq/kgFW) and ADCo-INC (-1.535 kg CO2-Eq/kgFW) outperform stand-alone AD (-0.855 kg CO2-Eq/kgFW) and pyrolysis (-0.181 kg CO2-Eq/kgFW) in mitigating global warming potential (GWP). Additionally, pretreatments were found to have the most significant influence on GWP, ecotoxicity potential (ETP), and acidification potential (AP). The two-step pretreatment in ADCo-Py, including the separation of solids and drying, significantly improved the environmental sustainability of the system when compared with standalone pyrolysis.

Keywords: Life cycle assessment; Plastic waste; Impurities; Integrated systems; Resource recovery; Bioenergy

Biography

I hold a Ph.D. in environmental science from the Ohio State University in the United States, and a B.S. in environmental science from Wuhan University in China. I pursue my research interests at the intersection of anaerobic digestion, pyrolysis, bioenergy production, nutrient recovery, and waste valorization. I devote myself in developing techologies that can take a full use of organic wastes, and I also assess the econoic and environmental feasiblity of the technologies and systems I developed.

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