Waste Valorisation Through Hybrid Technologies

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Abstract:

The organic waste can be considered a secondary source for their conversion into target bio-based products such as value-added chemicals, alternative fuels, catalysts, activated carbon, fertilizer, soil amendments and energy. Globally, in 2024, the production of animal meat accounted 350 million metric tons from which the most dominated one is given by poultry accounting 40% . This study explores the utilization of poultry bones waste using conventional and emergent approaches that consisted in: a) classical and novel ultrasound enzymatic pre-treatment of the feedstock and b) the production of value-added bio-based products produced from typical, catalytic and microwave pyrolysis. As result, the study proposes a new integrated processing concept that was lab-tested. The concept consists in: A. Conventional catalytic pyrolysis for biochar and bio-oil production from poultry bones using bio-based catalyst; B. Microwave assisted processing for bio-based support for catalyst synthesis using ultrasound-enzymatic pre-treatment and C. Microwave assisted pyrolysis of secondary source (biomass and plastic) in the presence of biochar derived from poultry bones - as susceptor and catalyst.

In this study, a new integrated hybrid processes concept was developed and lab-tested for the efficient conversion of secondary sources into bio-based products. The results show:

-The ultrasound-enzymatic pre-treatment process enhances the breakdown mechanism of bone's matrices prior to its thermochemical treatment.

-New biochar and HaP production via microwave assisted processing to serve as catalyst support .

-Production of target chemicals groups to be used as additives.