

Upcycling of Plastic Waste into Valuable Products through Microwave Assisted Co-pyrolysis with Biochar from Residual Biomass

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Introduction

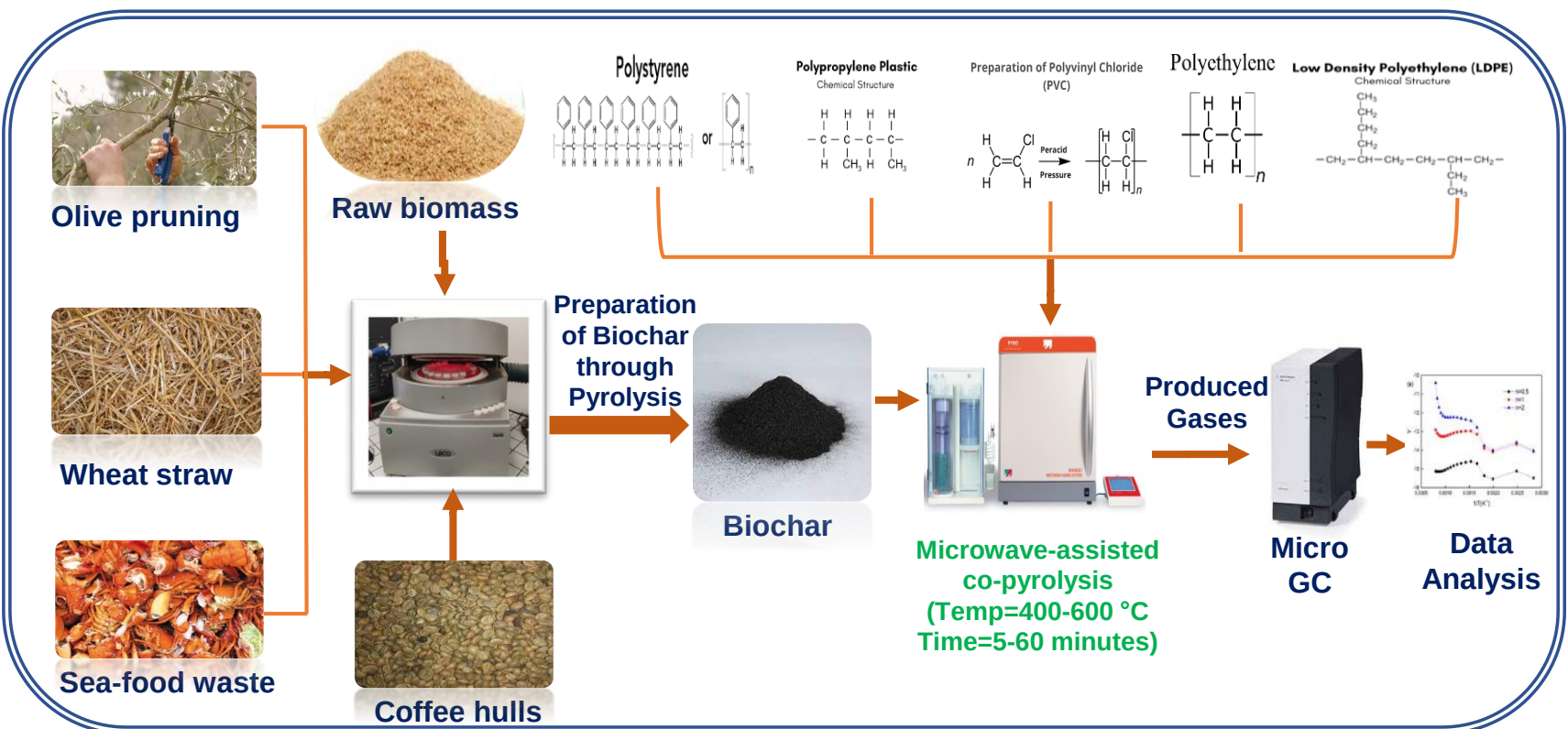
Plastic waste pollution has emerged as a global crisis. Developing nations witness a considerable 43% of the over 200 megatons generated in 2020 ending up in landfills, open dumps, or as litter. Pyrolysis efficiently converts plastic end waste into liquids, oils, and gases. However, conventional pyrolysis struggles to achieve high hydrogen purity. Recent advancements in microwave-assisted pyrolysis have shown promise in plastic recycling, yielding different product compositions compared to conventional pyrolysis.

Objective

Aims to convert plastic waste into valuable products through microwave-assisted co-pyrolysis with biomass, developing an environment friendly and efficient process to address global plastic waste challenge.

Experimental Design

1. Collection and preparation of plastic materials and raw biomass.
2. Preparation of biochar from raw biomass to serve as a catalyst and microwave absorber.
3. Microwave-assisted co-pyrolysis of plastic and biochar at temperatures between 400-900°C for 5-60 minutes.
4. Gas analysis using micro gas chromatography to determine hydrogen gas yield.
5. Characterization of solid residues and exploration of potential applications as adsorbent material.
6. Data analysis using statistical software to assess the influence of parameters on hydrogen gas yield and determine optimum conditions for maximum production.



Expected Results

This research is anticipated to demonstrate an efficient method for producing high yields of hydrogen gas.

It will result in lower carbon emissions and minimized toxic pollutants compared to conventional incineration methods.

Effective utilization of plastic waste and biomass will contribute to circular economy and reduce waste accumulation.

This approach will offer sustainable solutions for a cleaner future with reduced plastic pollution and enhanced resource utilization.

Experimental Design

- Banu et al. (2020). Impervious and influence in the liquid fuel production from municipal plastic waste through thermo-chemical biomass conversion technologies-A review. Sci. Total Environ., 718, 137-145.
- Haque et al. (2022). Occurrence and characteristics of microplastic in different types of industrial wastewater and sludge: A potential threat of emerging pollutants to the freshwater of Bangladesh. J. Hazard. Mater. Advan., 8, 100166.
- Suriapparao et al. (2022). Role of ZSM5 catalyst and char susceptor on the synthesis of chemicals and hydrocarbons from microwave-assisted in-situ catalytic co-pyrolysis of algae and plastic wastes. Renew. Energy., 181, 990-999.

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