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Utilization of spent K-cups for crude bio-oil production

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Statement of the Problem: K-cup is a popular single-serve coffee brewing system in North-America. With the growing popularity, the waste produced from this "convenient" process, referred to as spent K-Cups, has raised concern over their potential environmental impact, and thus disposal and/or utilization have attracted increasing attention.

Methodology & Theoretical Orientation: Hydrothermal liquefaction is a thermochemical process for the transformation of biomass or organic waste into liquid biofuels under reaction conditions of temperature and pressure in sub-/supercritical water or organic solvents. In this study, spent K-Cups were liquefied to crude bio-oil in water-ethanol mixture of 50/50 (v/v).

Findings: The optimum reaction conditions for maximizing crude bio-oil yield were determined: temperature of 276°C, reaction time of 3 min and solvent/feedstock mass ratio of 11:1, giving the crude bio-oil yield of 60.0%. GC-MS and FT-IR helped identify that the volatile compounds in the resulting crude bio-oil were long-chain aliphatic acids, esters and aromatic compounds. The addition of a catalyst, NaOH, promoted the decomposition of feedstock and thus significantly enhanced the bio-oil production and liquefaction efficiency. However, the addition of acidic catalyst, H2SO4 showed a negative impact on the liquefaction process, decreasing the crude bio-oil yield.

Conclusion & Significance: This study offered not only a viable route for the production of crude bio-oil and also an effective approach for waste management.

Biography

Qaun (Sophia) He has her expertise in the development of biofuels from low value biomass and organic waste. Her research interests include: 1) Biodiesel synthesis and application in non-energy sectors; 2) Hydrothermal liquefaction of biomass; 3) Catalyst development and application; and 4) Development of oil-based preservatives for wood treatment.

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