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Research article

Synergetic biofuel production from co-pyrolysis of food and plastic waste: reaction kinetics and product behavior

Apip Amrullah [a,*], Obie Farobie [b], Shofwatunnida Septarini [c], Justinus A. Satrio [d]

[a] Department of Mechanical Engineering, Lambung Mangkurat University, Banjarmasin, South Kalimantan, Indonesia
[b] Department of Mechanical and Biosystem Engineering, Faculty of Agricultural Engineering and Technology, IPB University (Bogor Agricultural University), IPB Darmaga Campus, PO BOX 220, Bogor, West Java 16680, Indonesia
[c] Environmental Engineering Department, Universitas Hamzanwadi, Selong 83612, Indonesia
[d] Department of Chemical Engineering, Villanova University, Villanova, Pennsylvania 19085, United States

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ABSTRACT

This study aimed to develop a process for producing bio-oil, char, and value-added chemicals from food waste and plastic waste blend using co-pyrolysis under controlled conditions. The food waste (rice, vegetables, and fish) was blended in definite ratios (70:30, 60:40, and 50:50 w/w) with polyethylene terephthalate (PET). Experiments were conducted at various temperatures (250, 300, and 350 °C) and reaction times (30, 60, 90, and 120 min). A kinetic analysis was performed to fit experimental data, and reaction kinetics were observed to follow Arrhenius behavior. Maximum yields of bio-oil and bio-char, 66 and 40 wt% respectively, were attained at 350 °C, with yields being strongly influenced by variations in temperature and weakly affected by variations in reaction time. Co-pyrolysis promoted the formation of carboxylic acid, hydrocarbons, and furan derivatives. Formation of carboxylic acid could be increased by increasing the ratio of plastic waste. A maximum carboxylic acid content of 42.01% was achieved at 50% of plastic waste. Meanwhile, a maximum aliphatic hydrocarbon content of 44.6% was obtained with a ratio of 70:30 of food waste to plastic waste at 350 °C. Overall, pyrolysis of food and plastic waste produced value-added compounds that can be used as biofuels and for a variety of other applications.