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Co-pyrolysis of cassava peel with synthetic polymers: thermal and kinetic behaviors

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Abstract

This research effort focuses on the co-pyrolysis of cassava peels waste and some synthetic polymers towards energy conversion and reducing the volume of these waste fractions dumped on dumpsites. The co-pyrolysis behavior and pyrolysis kinetics of various synthetic polymer wastes/cassava peel blends were investigated by blending cassava peel waste with low-density polyethylene (LDPE), polyethylene terephthalate (PET), and polystyrene (PS) at different weight ratios. The physical characteristics of each sample were investigated and the co-pyrolysis experiments were conducted at a heating rate of 10 °C/min from room temperature to 800 °C in N_2 atmosphere in a thermogravimetric analyzer. Subsequent to thermal decomposition, kinetic analysis was done using the thermogravimetric data. Results from

physicochemical characterization showed that cassava peel has a relatively lower calorific value of 15.92 MJ/kg compared with polystyrene (41.1 MJ/kg), low-density polyethylene (42.6 MJ/kg), and polyethylene terephthalate (21.1 MJ/kg). The thermal decomposition behavior of cassava peel was seen to be significantly different from those of the synthetic polymers. The decomposition of the biomass material such as cassava peel generally occurs in two stages while the decomposition of LDPE, PS, and PET occurred in a single stage. The activation energy required for thermal degradation in cassava peel was also found to be lower to that of the plastic material. The co-pyrolysis of cassava peel and different synthetic polymers affected the thermal and kinetic behaviors of the blends, reduce the activation energy and residue after pyrolysis.

Availability of data and material

The data that support the finding of this research are available on request from the corresponding author.

Code availability

Not applicable.

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Ethics declarations

Conflict of interest

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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