Response surface design, modelling and analysis on pyrolysis of waste high-density polyethylene (HDPE)

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Aims and scope

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Abstract

The pyrolysis of waste plastics is important because it offers a viable solution to mitigate environmental pollution by converting plastic waste into valuable resources, such as fuel, chemicals, and carbon materials. In this research, response surface optimization was performed to maximize wax yield through slow thermal pyrolysis of 5 kg waste high density polyethylene (HDPE). The slow pyrolysis was executed by varying heating rate (4 to 8 °C/min) and temperature (388 to 438 °C). A theoretical quadratic model was generated to optimize the wax yield and then validated through experiments. A maximum wax yield of 79.1% was achieved at heating rate and temperature of 7.9 °C/min and 434.3 °C, respectively. The wax thus collected was distilled to obtain 2.2 L pyrolysis oil and the properties were investigated. The characteristics of fuel were observed to be in-between those of petrol and diesel. Thus, HDPE could be a potential substrate to produce liquid transportation fuel by slow thermal pyrolysis.

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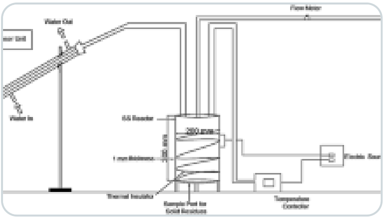

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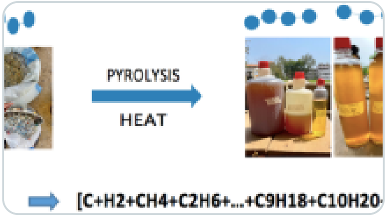

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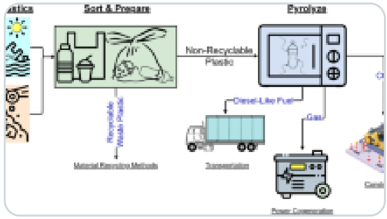

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Ethics declarations

Conflict of interest

Authors declare no conflict of interest.

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