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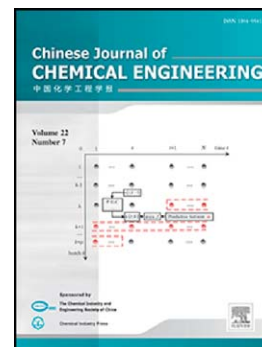
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*Energy, resources and environmental technology*

## **Molten waste plastic pyrolysis in a vertical falling film reactor and the influence of temperature on the pyrolysis products<sup>☆</sup>**

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**Abstract** Molten plastics are characterized with high viscosity and low thermal conductivity. Applying falling film pyrolysis reactor to deal with waste plastics, can not only improve heat transfer efficiency, but also solve the flow problem. In this work, the pyrolysis process of molten polypropylene (PP) in a vertical falling film reactor are experimentally studied, and the influence of heating temperature on pyrolysis products is discussed. It has been found that with the temperature increases from 550°C to 625°C, the yield of pyrolysis oil decreases from 74.4 wt% ( $\pm 2.2$  wt%) to 53.5 wt% ( $\pm 1.3$  wt%). The major compositions of the pyrolysis oil are C<sub>9</sub>, C<sub>12</sub> and C<sub>18</sub>, and  $\beta$ -scission reactions are predominant. The content of the light fraction C<sub>6</sub>-C<sub>12</sub> of pyrolysis oil is 69.7 wt%. Compared with other pyrolysis reactors, the yield of oil from vertical falling film pyrolysis reactor is slightly higher than that from tubular reactor, equal to that from rotary kiln reactor, and slightly lower than that in medium fluidised-bed reactor.

**Keywords** pyrolysis, reactor, molten plastic, pyrolysis oil, fractional condensation

## **1 INTRODUCTION**

With the development of Chinese economy and improvement of people's living standards, plastic production, consumption and the amount of waste rapidly increase. China has become the world's second largest plastic producer, and the yield of plastic products is approximately 75.6 million tons in 2015 [1]. However, 40% of these plastics will be discarded in 1-2 years [2], and ultimately become waste.

Pyrolysis is considered as one of the important methods of recycling waste plastics. It is an irreversible thermochemical process that breaks down the chemical bonds of the polymers and

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