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1 **Kinetics evaluation and thermal decomposition characteristics of**
2 **co-pyrolysis of municipal sewage sludge and hazelnut shell**

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7
8 **Abstract**

9 Hazelnut shell, as novel biomass, has lower ash content and abundant
10 hydrocarbon, which can be utilized resourcefully with municipal sewage sludge (MSS)
11 by co-pyrolysis to decrease total content of pollution. The co-pyrolysis of MSS and
12 hazelnut shell blend was analyzed by a method of multi-heating rates and different
13 blend ratios with TG-DTG-MS under N₂ atmosphere. The apparent activation energy
14 of co-pyrolysis was calculated by three iso-conversional methods. Satava–Sestak
15 method was used to determine mechanism function $G(\alpha)$ of co-pyrolysis, and
16 Lorentzian function was used to simulate multi-peaks curves. The results showed
17 there were four thermal decomposition stages, and the biomass were cracked and
18 evolved at different temperature ranges. The apparent activation energy increased
19 from 123.99 to 608.15 kJ/mol. The reaction mechanism of co-pyrolysis is random
20 nucleation and nuclei growth. The apparent activation energy and mechanism function
21 afford a theoretical groundwork for co-pyrolysis technology.

22 **Keywords:** co-pyrolysis; municipal sewage sludge; hazelnut shell; kinetics;
23 pseudo-multi component stage model

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