Kinetic parameters from wood thermal degradation under vacuum to implement a mathematic model

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INTRODUCTION

In the present work, the thermal degradation of wood under vacuum condition is investigated. Two different wood species, poplar (Populus nigra L.) and fir (Abies pectinata Lam.), are examined in this study. The reaction system involved four subsystems: heat treatment, balance measurement, vacuum compressor, and data collection. The kinetic model is based on two-step kinetic method approach and the kinetic parameters are calculated from the experiment results. As a whole, the obtained results and developing model are conducive to performing the heat treatment of wood in industry. Moreover, the operating cost of wood heat treatment can be reduced.

EXPERIMENTAL PROGRESS

1. Sampling and drying
   - Wood size: W 170, L 670, H 22 mm
   - Drying temperature: 103°C

2. Wood heat treatment under vacuum
   - Pressure: 200 hPa
   - Temperature program (0.2°C min⁻¹):
     170°C for 2h, then 230°C for 14h

3. Establish heat treated wood kinetic model
   - Calculation of weight loss
   - Calculation of kinetic parameters

RESULTS

CONCLUSIONS

The thermal degradation of poplar (Populus nigra L.) and fir (Abies pectinata Lam.) under vacuum is examined in this study. The results indicated that the weight loss of poplar (14.21 wt%) is higher than fir (10.45 wt%) at the heat treatment condition of 230°C for 14 hours. In addition, a two-step thermal kinetic model is developed, and the kinetic parameters (K_A, K_V1, K_B, and K_V2) are calculated based on this model. The thermal degradation distribution from kinetic model is fit the experiment results well.

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