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Huihui Wang, Xin Wang, Yanshan Cui, Zhongcai Xue, Yuxin Ba

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Slow pyrolysis polygeneration of bamboo (*Phyllostachys pubescens*): product yield prediction and biochar formation mechanism

Huihui Wang [a,b], Xin Wang [a,*], Yanshan Cui [b], Zhongcai Xue [a], Yuxin Ba [a]

[a] Institute of Energy Conservation and Low Carbon Technology, Shenwu Technology Group Corp, Shenniu Road 18, Changping District, Beijing, P.R. China

[b] College of Resources and Environment, University of Chinese Academy of Sciences, Beijing, P.R. China

*Corresponding Author: Xin Wang

Address: Shenniu Road 18, Changping District, Beijing, P.R. China, 102200

Tel: +86-01-60751999

Fax: +86-01-60751999

E-mail: wangxinbuaa@buaa.edu.cn

Abstract: Slow pyrolysis of bamboo was conducted at 400-600°C and pyrolysis products were characterized with FTIR, BET, XRD, SEM, EDS and GC to establish a pyrolysis product yield prediction model and biochar formation mechanism. Pyrolysis biochar yield was predicted based on content of cellulose, hemicellulose and lignin in biomass with their carbonization index of 0.20, 0.35 and 0.45. The formation mechanism of porous structure in pyrolysis biochar was established based on its physicochemical property evolution and emission characteristics of pyrolysis gas. The main components (cellulose, hemicellulose and lignin) had different pyrolysis or chemical reaction pathways to biochar. Lignin had higher aromatic structure, which resulted higher biochar yield. It was the main biochar precursor during biomass pyrolysis. Cellulose was likely to improve porous structure of pyrolysis biochar due to its high mass loss percentage. Higher pyrolysis temperatures (600°C) promoted inter- and intra-molecular condensation reactions and aromaticity in biochar.

Keywords: Bamboo, slow pyrolysis, biochar characteristics, yield prediction model, pyrolysis mechanism