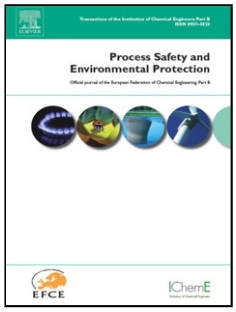
Accepted Manuscript



Title: Hydrogenation of bio-oil via gas-liquid two-phase discharge reaction system

Authors: Weidong Zhao, Xiaoyin Zhang, Jianquan Huang, Kang Ni, Wang Junfeng

PII: S0957-5820(18)30090-9
DOI: https://doi.org/10.1016/j.psep.2018.03.035
Reference: PSEP 1342

To appear in: *Process Safety and Environment Protection*

Received date: 13-10-2017
Revised date: 20-3-2018
Accepted date: 28-3-2018

Please cite this article as: Zhao, Weidong, Zhang, Xiaoyin, Huang, Jianquan, Ni, Kang, Junfeng, Wang, Hydrogenation of bio-oil via gas-liquid two-phase discharge reaction system.Process Safety and Environment Protection https://doi.org/10.1016/j.psep.2018.03.035

Hydrogenation of bio-oil via gas-liquid two-phase discharge reaction system

Weidong Zhao, Xiaoyin Zhang, Jianquan Huang, Kang Ni, Wang Junfeng*

School of Energy and Power Engineering, Jiangsu University, Zhenjiang 212013, China

Abstract: In view of current technical problems of catalyst coking inactivation, poor equipment safety and large amount of hydrogen consumption, which are caused by high hydrogen pressure and operating temperature in bio-oil hydrogenation, an innovative gas-liquid two-phase discharge reaction system was constructed and applied to actualize the hydrogenation of bio-oil under catalyst-free, normal temperature and pressure conditions. Single-factor experiments were performed to explore the effects of working voltage, gas-flow rate and reaction time on the deoxygenation rate and high heating value of refined bio-oil. Furthermore, with the results of multi-factor orthogonal experiments, the operating parameters optimization model for the deoxidation rate of bio-oil was developed. The reasonable reaction pathways for the hydrogenation of various oxygenated compounds under gas-liquid two-phase discharge reaction conditions were well inferred. Under optimized operating parameters, the deoxidation rate of 65.26% with the high heating value of 35.15MJ/kg of bio-oil were achieved. GC-MS analysis results demonstrated that aldehydes, ketones were completely diminished, and alcohols, esters, phenols and acids were decreased. A remarkable increase of hydrocarbons was revealed, which indicated the quality of bio-oil was

*Corresponding author.
E-mail address: wangjunfeng@ujs.edu.cn (J.Wang)