



Tertiary treatment of biologically treated effluents from pulp and paper industry by microwave modified activated carbon adsorption

Rongrong Hou^a, Haiqing Li^a, Huilun Chen^{a,*}, Rongfang Yuan^a, Fei Wang^a,
Zhongbing Chen^b, Beihai Zhou^{a,*}

^aBeijing Key Laboratory of Resource-Oriented Treatment of Industrial Pollutants, School of Energy and Environmental Engineering, University of Science and Technology Beijing, Beijing 100083, China, Tel. +86-10-62332465; emails: chenhuilun@ustb.edu.cn (H. Chen), zhoubhai@sina.com (B. Zhou), hourongrong1994@163.com (R. Hou), haiqing10810@163.com (H. Li), yuanrongfang@ustb.edu.cn (R. Yuan), wangfei@ustb.edu.cn (F. Wang)

^bFaculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Prague 16500, Czech Republic, email: chenz@fzp.czu.cz (Z. Chen)

Received 13 June 2019; Accepted 23 November 2019

ABSTRACT

Nowadays, biologically treated effluents (BTW) from pulp and paper industry still contain a significant organic load, which makes it unsuitable to discharge directly into the waterway. Therefore, a tertiary treatment by activated carbon adsorption was investigated. To improve the treatment efficiency of BTW in the pulp and paper industry, wood-based activated carbon (WAC) was modified by microwave irradiation (MWAC). WAC and MWAC were characterized by scanning electron microscopy, N₂ adsorption, elemental analysis, Fourier transform infrared and X-ray photoelectron spectroscopy. Compared with WAC, MWAC has a higher surface area and lower oxygen-containing groups. The BTW adsorption capacity of MWAC is higher than that of WAC. WAC and MWAC were used to remove chemical oxygen demand (COD) in BTW and the effects of adsorbent dosage, contact time, pH and temperature on the removal of COD in BTW were studied. The adsorption isotherms of WAC and MWAC revealed that the Langmuir models applied to the adsorption process. Molecular weight analysis showed that 1,531 Da was the main component in untreated and treated BTW. MWAC seemed to be more effective in adsorbing small molecular organics due to more micropores. The result indicated that microwave radiation was an efficient method to modify activated carbon for BTW tertiary treatment.

Keywords: Pulp and paper effluent; Wood-based activated carbon; Microwave modification; Adsorption

* Corresponding authors.