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Amine-functionalized magnetic bamboo-based activated carbon adsorptive removal of ciprofloxacin and norfloxacin: A batch and fixed-bed column study

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ABSTRACT

Amine-functionalized magnetic bamboo-based activated carbon (AFM-BAC) derived from bamboo products wastes were employed for effective adsorption of fluoroquinolone antibiotics ciprofloxacin (CIP) and norfloxacin (NOR) through batch processing. The effects of factors on the adsorption of both antibiotics were studied. The studies of various factors influencing the adsorption behavior indicated that the maximum adsorption capacities for two antibiotics adsorption were observed in weakly acidic condition and the adsorption amounts of two antibiotics increased with the increase of zwitterionic form, implying the importance of zwitterionic form, and the adsorption process is spontaneous and endothermic. The result of date indicated that adsorption of both two antibiotics onto the AFM-BAC better fits Langmuir isotherm model. The saturated magnetization of AFM-BAC reached 8.55 emu g^{-1}. A fixed-bed column adsorption with a bench-scale was carried out. Desorption and regeneration experiments showed that the AFM-BAC for both antibiotics could remain above 80% after five consecutive recycling cycles.

Keyword: Bamboo-based activated carbons; fluoroquinolone antibiotics; isotherm; zwitterionic form; A fixed-bed column

1. Introduction

Quinolone antibiotics, which have been widely used for the treatment or prevention of bacterial infections in humans and animals **(Ding et al., 2016)**. The behavior of quinolone antibiotics in the environment has become a global emerging issue, it can be released into the aquatic environment by incomplete metabolism of body and the discharging of effluents from livestock and pharmaceutical wastewater, with the concentrations range from ng L^{-1} to mg L^{-1}, which exhibit harm effects toward ecosystem and human health by developing and inducing antibiotic resistant bacteria **(Gao et al., 2015b; Li et al., 2015)**. Ciprofloxacin (CIP) and Norfloxacin (NOR) are family of a second generation broad-spectrum fluoroquinolone group antibiotic, chosen to represent a group of antibiotics, which is widely utilized and difficult to be degraded in natural environment **(Wu et al., 2013).**

A number of purifications methods have been applied for removal of antibiotic from wastewater. Among others, the adsorption is an attractive and favorable technique for antibiotic removal because of its simplicity of operation, wide application range and relatively simple regeneration. Activated carbons as a adsorbent, owing to its high selectivity, easy operation, an

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