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Adsorption of Malachite Green on Fe-modified biochar: influencing factors and process optimization

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ABSTRACT

Paper sludge and wheat husk biochar was converted to a Fe-composite through a simple co-precipitation process and its adsorption behavior was tested against an emerging pollutant, Malachite Green (MG). Response surface methodology was employed to determine the optimum experimental conditions and the interactions between pH, initial MG concentration, temperature and treatment time. The maximum adsorption percentage obtained experimentally was 97.1%, whereas the Box–Behnken design predicted a maximum adsorption of 98%, at pH 6.16, initial MG concentration of 6.56 ppm, temperature of 34.75°C and treatment time of 22 min. Compared with the original biochar, the Fe-modified sample improved the adsorption of MG by ~34%. The adsorption mechanism followed the Langmuir model (q_{max} = 172.3 mg/g, correlation coefficient 0.960) and the kinetics of the process were best described by the pseudo-second-order model (correlation coefficient 0.9818), although boundary layer effects were also observed.

Keywords: Biochar; Malachite Green; Adsorption; Fe-modified composite; Response surface methodology

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