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Synthesis of glycerol-based carbon materials as environmental application

S. Álvarez-Torrellas[†1,2], R.S. Ribeiro[2], H.T. Gomes[2], A. Rodriguez, J. García[1†]

(1) - Grupo de Catálisis y Procesos de Separación (CyPS), Departamento de Ingeniería Química, Facultad de Ciencias Químicas, Universidad Complutense de Madrid, Avda. Complutense s/n, 28040 Madrid, Spain.
(2) - Laboratory of Separation and Reaction Engineering - Laboratory of Catalysis and Materials (LSRE-LCM), Department of Chemical and Biological Technology, School of Technology and Management, Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-857 Bragança, Portugal.
E-mail address: satorrellas@ucm.es

Abstract

Crude glycerol, obtained from the biodiesel production, is actually an abundant and low-cost feedstock, making the preparation of carbonaceous materials by partial carbonization and sulfonation of this by-product an interesting research focus. Bearing this in mind, the aim of this study is to explore several types of glycerol-based carbon materials synthesized by partial carbonization of glycerol in concentrated sulphuric acid solution for the removal of flumequine and tetracycline from aqueous solutions.

This study is focused on the synthesis and application of glycerol-based carbon materials as adsorbents for the removal of the antibiotic compounds flumequine and tetracycline from aqueous solution. The different synthesized materials were labelled as GBCM followed by a subscript number corresponding to the activation temperature in ^{o}C (i.e., $GBCM_{200}$, $GBCM_{300}$, and $GBCM_{350}$). The textural, morphological and chemical properties of the GBCMs were investigated. The kinetic of flumequine and tetracycline adsorption onto $GBCM_{300}$ was analyzed using different empirical kinetic models, revealing that pseudo-second order model was the most suitable for the fitting of the experimental data. The application of the intra-particle diffusion model (expressed by Weber and Morris plot) revealed that the adsorption rate was controlled by intra-particle diffusion in the inner pores. In addition, the film mass transfer and the surface diffusion coefficients were estimated. The experimental adsorption isotherms of flumequine and tetracycline onto $GBCM_{200}$, $GBCM_{300}$ and $GBCM_{350}$ were also investigated, reasonable correlation to Langmuir and Freundlich models being found.

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