Chemical Engineering Research and Design Volume 182, June 2022, Pages 645-658

Pore volume and surface diffusion model (PVSDM) applied for single and binary dye adsorption systems

Dison S.P. Franco, Kátia da Boit Martinello, Jordana Georgin, Matias S. Netto, Edson L. Foletto, Luis F.O. Silva, Glaydson S. dos Reis, Guilherme L. Dotto

Abstract

The PVSDM model was used for single and binary dye adsorption systems. This model is commonly used for adsorption in single systems, but this is the first time used in a binary mixture of dyes in the literature. To that end, a new adsorbent derived from *Bauhinia forficata* waste was created and described for eventual use in the treatment of a dye combination (methylene blue and crystal violet). The single and binary isotherms revealed that increasing the temperature decreases the methylene blue adsorption capacity while increasing the crystal violet adsorption capacity. The Langmuir and extended Langmuir models described the single and binary systems, respectively. Maximum adsorption capacities of 229.13 mg g^{-1} at 298 K for methylene blue and 324.12 mg g^{-1} at 328 K for crystal violet were obtained.
The thermodynamic parameters showed that the adsorption process for both dyes is spontaneous, being exothermic for the methylene blue and endothermic for the crystal violet. Similar decay curves for the single and binary systems were observed. The PVSDM was able to describe both single and binary adsorption systems. The external mass transfer and the surface diffusion change according to the initial dye concentration and the system type (single or binary).

Keywords

Bauhinia forficata, Binary system, Methylene blue, Crystal violet, PVSDM