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EQUILIBRIUM MODELLING OF COPPER IONS BIOSORPTION BY DATE STONES AND PALM-TREES WASTE

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Abstract

The biosorption equilibrium isotherms of copper ions from wastewater onto date stones (DS) and palm-trees Waste (PTW) in aqueous solution over a range of temperatures between 25 and 70°C were studied and modelled. To predict the biosorption isotherms and to determine the characteristic parameters for process design, five models frequently used in the literature - Langmuir, Freundlich, Temkin, Sips and Redlich-Peterson were applied to experimental data.

The Langmuir's model gives the most accurate fit with high R^2 (0.99) for all the tested temperatures. The maximal biosorption capacity, q_m , increases with temperature from 3.07 mg/g at 25°C to 4.36 mg/g at 70°C for DS and decreases with temperature from 1.53 mg/g at 25°C to 1.27 mg/g at 70°C for PTW. In addition, the affinity of date stones and palm-trees waste for copper, represented by parameter K_L in Langmuir's model varies from 0.055 to 0.097 L/mg for DS and from 0.19 to 0.08 L/mg for PTW when the temperature raises from 25 to 70°C. Equilibrium data are well fitted by the Langmuir, Sips and Redlich-Peterson models as the sum of squared deviations (s^2) has a small value (<0.32). Finally, the shape of Langmuir's model, represented by the dimensionless parameter R_L , shows that copper biosorption on DS and PTW is favourable for all the tested temperatures and initial copper concentrations. The biosorption isotherm models fitted the experimental data in the order: Langmuir (two-parameter), Sips and Redlich-Peterson (three-parameter) > Temkin (two-parameter) > Freundlich (two-parameter) for DS, and in the order: Langmuir > Sips > Redlich-Peterson > Temkin > Freundlich for PTW.

Key words: biosorption, copper, date stones, equilibrium modelling, palm-trees waste

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