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Characterization and uses of Bofe bentonite clay for adsorption of zinc (II)

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Abstract: In this work Bofe clay was characterized before and after adsorption of Zn (II). The characterization methods used were X-Ray Energy Dispersive Spectroscopy (XED), Scanning Electron Microscopy (SEM), Fisissorption of N_2 (BET) and X-Ray Diffraction (XRD). The results showed that the Bofe calcined clay has the ability to remove zinc from synthetic effluents.

Clay application for adsorption of heavy metals present in effluents has been focused in a number of studies due to countless economic advantages. The cost of clays is relatively low as compared to other alternative adsorbents. Another advantage in using clays as adsorbents is their intrinsic properties, such as: large specific surface area, excellent physical and chemical stability, and a number of other structural and surface properties [1]. The bentonite clay type Bofe calcined at 500 ºC for 24 hours was used for adsorption of Zn (II) in solution. The adsorption experiments were carried out in finite bath system with pH around 5.0, stirring constantly (200 rpm), temperature (25 °C), the contact time of 120 minutes, weight of adsorbent equal to 1.0 g and initial concentration of zinc ranging from 3 to 200 ppm to obtain the isotherms that were set to the model of Langmuir and Freundlich. The physical-chemical characterization of calcined Bofe clay before and after the adsorption process involved its chemical analysis by means of X-ray spectroscopy by energy dispersive (EDX), scanning electron microscopy (SEM), physisorption of N_2 (BET method) and X-ray diffraction (XRD). The analysis of the chemical composition of clay, by EDX, indicated the predominant presence of silicon and aluminum that are in the basic elements of the group of smectite clays, in addition to exchangeable cations Ca^{2+}, Mg^{2+} and Na^{+}, showing your polycationic property. After the adsorption of Zn (II) there was a decrease in the percentage of exchangeable cations and the presence of zinc. The mapping of contaminated clay obtained by SEM showed a uniform distribution of Zn (II) on its surface. The isotherms of physisorption of N_2 can be classified as type II, classification of Brunauer, typical in solid not porous or macroporous.The surface area of clays before and after the adsorption was reduced from 89.02 m^2 to 41.74 m^2 respectively, possibly due to the presence of ions Zn (II) in the adsorptive sites in the clay. The diffractograms were very similar, with no significant changes in the interlayer distance of the plan (D_{001}), characteristic of clays montimorillonite. The amount of metal adsorbed was 4.82 mg zinc / g of clay. The percentage removal of Zn (II) was 55%. The equilibrium data fitted well to Langmuir model (Figure 1). The parameters of Langmuir and Freundlich models are presented in Table 1. Based on experimental data we can conclude that the Bofe calcined clay has the ability to remove zinc from synthetic effluent and the occurrence of the adsorption was confirmed due to the changes occurring in the physico-chemical characteristics of clay.

Table 1: Langmuir and Freundlich model parameters.

Parâmetros	Langmuir	Freundlich
q_m	4,8195	-
b	0,3903	-
K_f		9,1904
n		0,24473
R^2	0,99975	0,93819

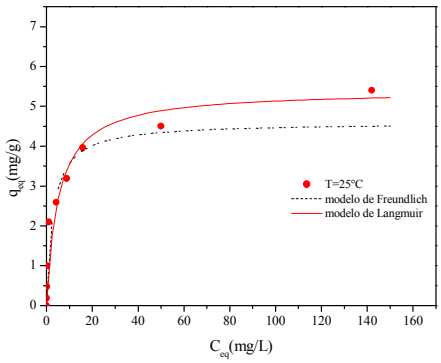

Figure 1: adsorption isotherms of Zn (II) (T=25 ºC e pH=5,0) ajusted to the models of Langmuir and Freundlich.

References

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