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Synthesis and characterization of composite adsorbent to removal of phenol in aqueous solutions

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Abstract – In this work a composite adsorbent was developed and compared with the natural materials used in its synthesis (bentonite and chitosan). The composite adsorbent was prepared in different proportions of the bentonite and chitosan respectively (2:1 and 4:1 by weight) in the form of pellets and carbonized at 700℃ under nitrogen flow (100cm^3/min) and heating rate was of 10℃/ min for 1 hour. The specific surface area was obtained by adsorption of nitrogen to 77 K, using the BET model, showing a high surface area to composite adsorbent which contributed to the increase in the capacity of adsorption of phenol.

Phenolic compounds which are generated by petroleum and petrochemical, coal conversion, and phenol-producing industries, are common contaminants in wastewater and suspected as toxic and carcinogenic. [1]. These compounds, even at low concentrations, require a treatment before disposal the effluents on the environment. The most used technique is the adsorption process onto surface activated carbon. These adsorbents exhibit high adsorption capacity for phenolic compounds, but show relatively high cost. The chitosan is a natural polymer biodegradable, very abundant and been proposed as a potentially attractive material for various uses. The removal of contaminants from water is an application that has been increasing in recent years. As well as the interest in use natural clay minerals like montmorillonite, kaolinite, and illite.

In this work the chitosan, bentonite and composite adsorbent (bentonite and chitosan) were used to removal of phenol from aqueous solution. The adsorbents were characterized by X-ray diffraction (XRD), thermal analysis (TGA), energy dispersive X-ray spectrometry (EDX), Fourier transform infrared (FTIR) and superficial area by N_2 adsorption method (BET). Adsorption isotherms were obtained by introducing different concentrations of solution of phenol (10, 20, 30, 40, 50, 60, 70 ppm) in erlermeyer containing 0,5 of adsorbent.

The composite adsorbent showed an increase in the capacity of adsorption for natural adsorbents, probably this can be attributed to the increased surface area. The pellets became insolubles because of the phase loss of montmorillonite observed in Figure 1. The figure 2 shows the thermal analysis for the composite before carbonization that was used to find the ideal temperature of carbonization.

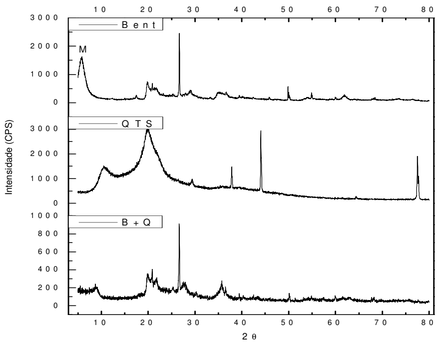

Figure 1 - XRD patterns of the adsorbents.

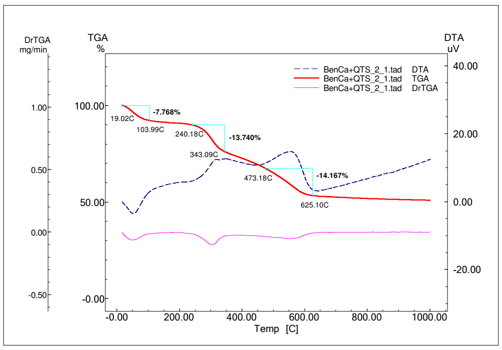

Figure 2 - Thermal analysis of composite adsorbent.

Reference

[1] B. Pan et al. / Journal of Hazardous Materials xxx (2008) xxx–xxx