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Biosorption of chlorothalonil on fique fiber bagasse (*Furcraea* spp): Equilibrium and Kinetic Studies

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Abstract– The fique fiber bagasse (*Furcraea* spp), a subproduct of the fiber extraction was evaluated as an adsorbent for the chlorothalonil removal from the aqueous suspension. The Batch adsorption test were performed at 25 °C and the effects of contact time, adsorbent dosage and pH were investigated. Preliminary adsorption tests indicated as the thermal treatment on the fiber is a condition with the aim to improve the adsorption capacity. The experimental data obtained in the present study indicated the ability of this type of raw material as adsorbent for removal of organochlorine pesticides.

The fique plant (*Furcraea* spp) has been harvested in Colombia since many years ago. This is a traditional fiber and annually is produced 21445 tons. Nowadays the fique fiber, called commonly *cabulla*, is the only commercial product for the coffee and rice packaging for the large scale. On the extraction of the fiber, bagasse and juice are produces as residual materials; these subproducts don't have any commercial application and they cause many environmental impacts. The subproducts represent the 96% of the total production and could be employed for suitable applications [1].

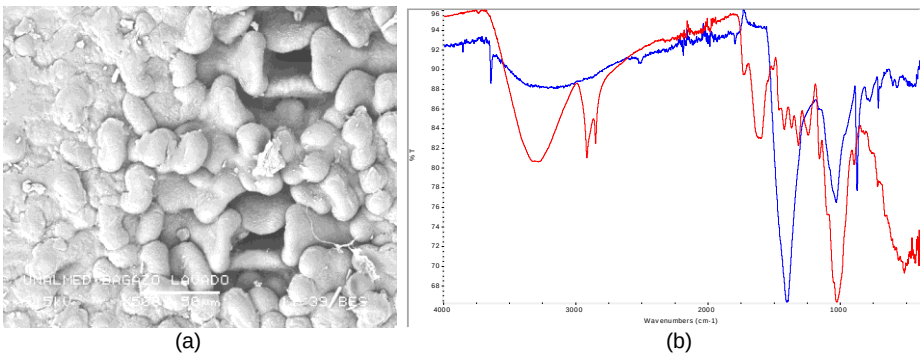
The present study includes the characterization of fique fiber bagasse, the production of activated carbons by thermic conversion, and equilibrium and kinetic studies for the development of new applications as bioadsorbent material for removal of organochlorine pesticides.

The surface structures of raw material and activated carbon from fique fiber bagasse were evaluated using Fourier Transform Infra-Red (FTIR) spectroscopy and Scanning Electron Microscopy (SEM). Effect of contact time was evaluated at time periods from 5 min to 4 h and initial Chlorothalonil (CLT) concentration of 50 ± 1 mg L^{-1} at a fixed adsorbent concentration (6 g L^{-1}). Influence of adsorbent dosage was carried with adsorbent concentration from 3 to 8 g L^{-1}, at 2 h. The concentration of CLT was evaluated by a Gas Chromathograph with a µ-Electron Capture Detector (*Agilent* 6890 N Serie) [2,3].

For the effect of contact time, the maximum percentage of adsorbed CLT was 54.8% for fique fiber bagasse. Carbonization (800°C for 2 h under N_2 flow, 0.5 L min^{-1} flow rate), provided an improvement in the adsorbent performance, with a significant increase in the amount adsorbed, attained 99.8% CLT removal.

CLT removal efficiency presented a significant improvement with the increase in adsorbent dosage. After 4 h, the percent removal of chlorothalonil varied from 17.2% to 36.7% for raw material and 96.6 to 99.1% for activated carbon; this can be attributed to the increase in surface area. However, as expected, the amount of pesticide adsorbed per unit mass of adsorbent decreased from 2.0 to 1.4 mg g-1 raw material and from 8.6 to 3.3 mg g^{-1} for activated carbon.

The results presented in this study indicate that fique fiber bagasse and its activated carbon presents great potential as an inexpensive and easily available alternative adsorbent for the adsorption of organic pesticides as CLT.



(a) (b)

(a) Fique fiber bagasse SEM. (b) FTIR fique fiber bagasse (--); FTIR Activated carbon of fique fiber bagasse (--) .

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