

## USE OF BIOPOLYMERS FOR DYE REMOVAL

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The biopolymers application has been finding numerous uses as in industrial process including especially in wastewater treatment and in potable water purification. Many biopolymers as cellulose, chitin and yours derived it has been used as flocculate and coagulating agent for organic matter, trickling filters, as well as in the removal of metal and dyes of polluted waters. Residual dyes are the major contributors to color in wastewaters generated from textile and dye manufacturing industries. These dyes, though present in only small amounts, are visually detectable and thereby are capable of causing serious problems of na aesthetic nature in receiving water bodies. Most of the commercially used dyes are resitant to photodegradation, biodegradation and even oxidizing agent<sup>(1-3)</sup>. Unless properly treated, dyes can significantly affect photosynthetic activity due to reduced light penetration and may also be toxic to certain forms of aquatic life due to the presence of substituent metals and chlorine. Dyes have also been known to interfere with certain municipal wastewater treatment operations such as ultraviolet disinfection<sup>(1)</sup>. Sorption is one of the several techniques that has been successfully employed for effective dye removal. In the last years, a lot of researches have been accomplished tends in view the search of new materials and alternative methods for that purpose. Recently, many methods for the purification became important. With that purpose, in the present investigation, the xanthan (produced by *Xanthomonas campestris pv pruni strain 06*)<sup>4</sup> and chitin biopolymers, were tested as materials for removal of the color of solutions containing: Basic Blue 9 (C.I. 52015), Direct Violet 51 (C.I.27905) and Direct Yellow 4 (C.I.24890). In a first study, in order to evaluate the optimum pH of adsorption, flasks containing 100mg of polymeric material, dye solution and buffers prepared at different pH values, were shaking for two hours in the temperature 25 °C, soon after the samples were centrifuged and then accomplished the readings of the absorbencies in the maximum wavelength for each dye. The optimum pH was identified corresponding to maximum colour removal. The amount adsorbed for gram of polymer were certain according to the equation (1):

$\{X/M = (C_i - C_f)V/W\}$  where: X/M, represents the amount of solute adsorbed per unit of adsorbent (mg g<sup>-1</sup>); C<sub>i</sub> and C<sub>f</sub>, are the initial and final concentrations of dye (mg L<sup>-1</sup>), respectively; V the final volume of the solution (L) and W the weight of polymer used (g). In the kinetic studies, aliquots of the solutions containing 1,0 g of chitin, dye and buffer, were removed for increasing intervals of time of 5, 10, 20, 40, 60, 120, 180 and 200 minutes, until no more dye was removed and equilibrium was achieved, then the samples

were centrifuged for subsequent absorbance reading. In the determination of adsorption parameters, samples of 100 mg of polymer were placed in flasks containing 100 and 200ml L<sup>-1</sup> of the dye solution. The flasks were maintained under agitation for a time period equal to the equilibrium time for that particular dye at 25 °C, later, the samples were centrifuged followed for the measures in a spectrophotometer. All experiments were replicated and the average results were used in data analysis. The studies showed that the adsorption was to be dependent of the pH, and for the xanthan biopolymers, the best pH value for the adsorption was around 4,0 and a equilibrium time of two hours, while for the chitin a time of four hours at 3,4 pH was necessary when the experiments were carried out with Direct Yellow 4; and two hours at 3,60 pH for the Direct Violet 51. Most dyes are ionic and upon dissolution release coloured dye ions into solution. The adsorption of these ions onto the adsorbent surface is primarily influenced by the surface charge on the adsorbent with in turn is influenced by the solution pH. These studies showed that the adsorption is higher in acidic medium, pH prevailing a mechanism then for ionic- exchange for dye anions. For the Direct Violet adsorbed on chitin, the experimental data agreed with BET isotherm, the form is represented by equation (2).

$$C / (C_s - C) (X/M) = 1 / BQ + (B-1 / BQ) (C / C_s) \quad (2)$$

where X/M = amount of solute adsorbed per unit weight of adsorbent (mg g<sup>-1</sup>); C = concentration of solute remaining in solution at equilibrium (mg L<sup>-1</sup>); C<sub>s</sub> = saturation concentration of the solute (mg L<sup>-1</sup>); Q = amount of solute adsorbed per unit weight of adsorbent in forming a complex monolayer on the surface (mg L<sup>-1</sup>); B = constant expressive of the energy of interaction with the surface. The linear form of the Langmuir isotherm used to fit the experimental data in this work is represented in equation (3).

$$C / (X/M) = (1 / bQ) + (C / Q) \quad (3)$$

The results showed that the adsorption capacity found by Langmuir fitting was 9,48 mg of Direct Violet 51 dye adsorbed per gram of polymer, while to the BET adjustment this value was 10, 40 mg of dye adsorbed per gram of polymer. It can also be observed that both isotherm models exhibited a good coefficient of correlation. The BET isotherm, presented the good adjustment of the data only in lower concentrations because to high concentrations of C/C<sub>s</sub> the BET isotherm is not linear. For the Direct Yellow 4 dye, the experimental data exhibit a behavior in agreement with the Langmuir equation and it was found a value of 18,67 mg of dye adsorbed per gram of polymer. Future studies are on investigation where is intended, in a next stage, to determine the maximum capacity of adsorption of the complex xanthan- basic Blue 9. We shall still investigate further on the adsorption of this biopolymers with a series of dyes used by textile industries.

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