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APPLICATION OF AMBERLITE XAD 2 RESIN FOR TEXTILE DYE REMOVAL

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Introduction

Nowadays, the needs of the dyeing process in the textile industry is covered by synthetic dyes. Over 50% of dye industry is represented by azo dyes. The main characteristic of azo dyes is that it covers the whole spectrum of the visible colours. Moreover, the presence of dyes in textile effluents changes their spectrophotometry. In spite of this, azo dyes can cause pollution of surface water and aquatic species and also are hazardous for human health. The dyeing process generates a large volume of residual textile effluents. It was also found that the dyeing process is wasting about half of the dyes concentration used depending on the textile fiber to be dyed. Thus, significant quantities of dyes are found in textile effluents. Unfortunately, most azo dyes have good chemical stability, are not biodegradable making them difficult to remove from the environment. All these characteristics of azo dyes turn the biodegradation process difficult while using the conventional methods applied in wastewater treatment. In spite of this, a wide range of conventional technologies was desired to select environmentally friendly technologies which are more efficiently in removing azo dyes from textile effluents. The toxic effect evaluated by bacterial biological model highlights that even at the lowest concentrations, the azo dyes produce harmful effects on aquatic medium. The toxic azo dye effect confirms the fact that it is even more necessary to retain the dye from the textile effluents. The aim of the present study was to establish the optimal working parameters for the Acid Blue 193 toxic azo dye removal on Amberlite XAD 2 resin from aqueous solutions.

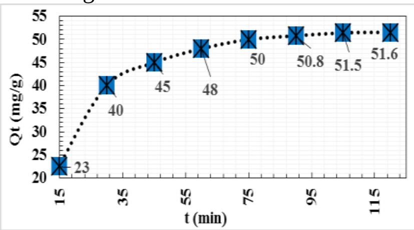
Materials and methods

Amberlite XAD 2 resin (XAD 2) is a hydrophobic copolymer obtained by polymerization of styrene with divinylbenzene, namely nonionic macroreticular resin with 20-60 mesh particle size. Also, the pore volume (0.65 mL/g) and surface area (300 m^2/g) of XAD 2 beads is known. The XAD 2 was washed with ultrapure water and 1M HCl in order to remove all impurity existing on the resin mass. The influence of the contact time (t) on the adsorption process of Acid Blue 193 (AB 193) in XAD 2 resin was examined in the 15-120 min using 0.02 g XAD 2 and 0.01 L of 120 mg AB193/L at 175 rpm. The separation of the liquid-solid phases was done by filtration and the absorbance of the solution obtained was determined at

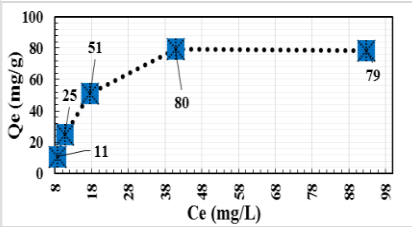
578 nm. Also, equilibrium adsorption experiments were performed in 100 mL Erlenmeyer flasks with 0.02 g XAD 2 and 0.01 L AB 193 solution that varied from 30 to 250 mg AB 193/L at 175 rpm for 90 min. At the end of experiment, the mixtures were filtered and the AB 193 concentration (C_e) was spectrometric determined.

Results and conclusions

The equilibrium adsorption experiments were tested in batch mode at T=25°C. The parameters that influence the adsorption of AB 193 onto XAD 2 mass as the influence of the contact time and the initial concentration of AB 193 were studied. In Figure 1 (a) is shown the influence of the contact time on the adsorption of the AB 193 in the aqueous solutions at different time intervals. From the results obtained it is obvious that the adsorption process takes place in two distinct stages. In the first stage up to 60 minutes the quantity (Q_t) of AB 193 removed on the XAD 2 mass were 23, 40, 45 and 48 mg AB 193/g. After 60 minutes in the second stage the adsorption rate was slowly and the Q_t values removed varied from 50 up to 51.6 mg AB 193/g.



(a)



(b)

Fig.1. (a) Effect of contact time on the AB 193 adsorption from aqueous solutions onto XAD 2 resin and (b) Experimental isotherm for the AB 193 adsorption from aqueous solutions onto XAD 2 resin

Thus, equilibrium time of 90 min was chosen for the next experiment as the optimal time to evaluate the equilibrium adsorption capacity (Q_e) of the XAD 2 tested. The Q_e values detect at equilibrium increased when the initial AB 193 concentration increase from 30; 60 up to 120 mg AB 193/L. At high concentrations of AB 193 in the initial solution, the quantity of AB 193 varies insignificantly and the plateau is obtained which leads us to the conclusion that the saturation capacity of the tested XAD 2 mass has been reached (see Figure 1 (b)). The significant quantities of AB 193 removed and also the short time to reach equilibrium suggest that the XAD 2 can be used efficiently in textile effluents treatment.

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