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EVALUATION OF MALT BAGASSE CHARCOAL IN THE ADSORPTION OF PARACETAMOL IN A FIXED BED COLUMN: EFFECT OF FLOW RATE

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INTRODUCTION

Paracetamol is one of the most widely used pharmaceuticals (Randles et al. 2016, SCAN). Its constant presence in water resources, increases the environmental concern regarding the drug. Different studies proved the inefficiency of the conventional wastewater treatment in removing this contaminant (Jedrychowski 2011, Sci Total Environ). Thus, this work presents the effect of the flow rate in the adsorption of paracetamol from aqueous solutions in a fixed bed column packed with malt bagasse activated charcoal.

MATERIAL AND METHODS

Towards determining the point of zero charge for the charcoal (PZC), 0.2 g of adsorbent are added to a solution of 20 mL of NaCl 0.1 mol L^{-1} with pH values varying from 1 to 11, adjusted with 0.1 mol L^{-1} NaOH and HCl solutions. After 24 h under 80 rpm agitation at 25 ºC, the balance for the charcoal is achieved. At the end of the process the solution where filtered and the pH was measured. The adsorption occurred in a continuous process (25 °C) in a polypropylene column of 0.74 cm of internal diameter and 3.20 cm of height, until the saturation of column of the initial concentration (100 mg L^{-1}). The feed flow rates were analyzed at 2.5 and 5 mL min^{-1} with a charcoal mass of 0.38 and 0.75 g. The samples were analyzed by UV-VIS spectrophotometry at a wave-length of 243 nm.

RESULTS

The flow effect analysis, showed that the higher values of feed rate shorten the residence time of the adsorbate in the bed, thereby reducing the contact time with the surface of the adsorbent, making it difficult to achieve an equilibrium and causing a faster bed saturation. Analyzing the same period, a higher flow rate provides a higher quantity of solute with the bed, shortening the saturation time. Consequently, the higher breakthrough and saturation times were obtained for the lower flow rate used in the tests. The zero charge point of the adsorbent was determined to be 5.34, thus, where the surface of the adsorbent is neutrally charged.

CONCLUSIONS

The study verified that the feed rate had a negative effect over the saturation time, therefore, both are inversely proportional. Thus, the flow rate is higher than the mass transfer rate of the solute to the adsorbent, leading to not enough time for a strong interaction to occur between them, causing the most active sites to be occupied, and possibly initiating a decrease in the adsorption capacity.

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