Study of the conditions of activated carbon preparation from an agriculture by-product for 4BA elimination in aqueous solution using full factorial design

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ABSTRACT

An activated carbon prepared from an agricultural by-product (apricot stones) is used as an adsorbent for 4-bromoaniline (4BA) elimination. Several activation chemical agents are tested; the hydrochloric acid is found to be the best choice with 79% of elimination yield. The main and interactive effects of four experimentally controlled elaboration activated carbon factors, which are the carbonization temperature, the carbonization time, the concentration of activating agent (% HCl), and the activation time, are investigated through model equations designed with a two-level full factorial design by using a batch experimental method. Statistical design of experiments for the manufacture of activated carbon from apricot stones for 4BA adsorption is an efficient and rapid technique to quantify the effect of variable parameters compared with the conventional optimization. The characteristics of the optimal adsorbent are studied using scanning electron microscope, energy dispersive X-ray analysis, and Brunauer–Emmett–Teller nitrogen adsorption technique. The equilibrium adsorption isotherms have been analyzed with the Langmuir and Freundlich models at 28˚C.

Keywords: Adsorption; Apricot stone carbon; 4-Bromoaniline; Factorial design

1. Introduction

Aniline and its derivatives are organic intermediates that considered as potential pollutants. Their presence in water at very low concentrations is harmful to aquatic life [1]. Various processes of water treatment have been developed for removing these pollutants from aqueous effluents. Adsorption is one of the purification and separation techniques used in this area. Algeria produces yearly 80,000 tons of apricot; therefore, a large amount of apricot stones is generated, and the conversion of this waste into adsorbent allows the valorization of agricultural residue and the preparation of activated carbon to clean water. Two steps are required to convert an apricot stones to an activated carbon: (i) the activation and (ii) the carbonization. The process of activated carbons preparation depends upon the nature of the raw materials, the nature of the activating reagent, and the conditions of carbonization. A large number of low-cost adsorbents such as skim almond [2], olives

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