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Study of Multiple Component Adsorption on the Surface of Activated Carbon Using a Model System of Benzyl Alcohol and Phenobarbital

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Abstract: The purpose of this work was to characterize the surface of activated carbon, and to study the specificity of interactions using multicomponent adsorption. The competition between phenobarbital and benzyl alcohol was studied by conducting multicomponent adsorption experiments. Benzyl alcohol and phenobarbital were combined to form a bisolute system. The adsorption of the bisolute system from simulated intestinal fluid (without pancreatin) by activated carbon was studied using the rotating bottle method. The concentrations, both before and after the attainment of equilibrium, were determined with the aid of an HPLC system employing a reversed-phase column. The modified competitive Langmuir-like model was fit to the data. A good correlation was obtained between the experimental and the calculated data, which indicates that benzyl alcohol and phenobarbital are competing for the same binding sites. The competition between benzyl alcohol and phenobarbital was not expected, and it suggests that benzyl alcohol is not interacting with the site having the theoretically highest enthalpy of interaction (carbonyl group on the activated carbon surface), due to the blockage of this site by the solvent (water). This unexpected result also indicates that the hydroxyl group is likely to be the most important group when the adsorption occurs from aqueous solution.