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Prediction of multicomponent adsorption by activated carbon using single solute parameters

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Abstract: The adsorption of 3 barbiturates ? phenobarbital, mephobarbital, and primidone- from simulated intestinal fluid (SIF), without pancreatin, by activated carbon was studied using the rotating bottle method. The concentrations of each drug remaining in solution at equilibrium were determined with the aid of a high-performance liquid chromatography (HPLC) system employing a reversed-phase column. The competitive Langmuir-like model, the modified competitive Langmuir-like model, and the LeVan-Vermulen model were each fit to the data. Excellent agreement was obtained between the experimental and the predicted data using the modified competitive Langmuir-like model and the LeVan-Vermulen model. The agreement obtained from the original competitive Langmuir-like model was less satisfactory. These observations are not surprising because the competitive Langmuir-like model assumes that the capacity of the adsorbates are equal, while the other 2 models take into account the differences in the capacities of the components. The results of these studies indicate that the adsorbates employed are competing for the same binding sites on the activated carbon surface. The results also demonstrate that it is possible to accurately predict multicomponent adsorption isotherms using only single-solute isotherm parameters. Such prediction is likely to be useful for improving in vivo/in vitro correlations.