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Thermodynamic Study of TiO_2/SBA-16-NH_2 as Drug Delivery System

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In this work, thermodynamic parameters related to carbamazepine loading on TiO_2/SBA-16-NH2 nanocomposites were investigated. Thermodynamic factors were calculated to understand the loading process. ΔH^0 and ΔS^0 values were obtained from $\ln K_c$ versus 1/T data. Thermodynamic values for CBZ drug adsorption on TiO_2/SBA-16-NH_2 were calculated. The values of ΔH°, ΔS° and ΔG° have been determined for the five studied temperatures of 30, 40, 50, 60 and 70 ℃. The negative values of ΔG° indicate that the adsorption process on the nanocarrier is spontaneous. It can be seen that the values of ΔG° become very positive with increasing temperature, therefore, increasing temperature is not always favorable in the adsorption process. The negative values of ΔH° indicated that the adsorption of CBZ on the nanocarrier is an exothermic process. ΔS° values play a vital role in reflecting whether the order of absorption during the absorption process will become less random ΔS°<0 or more random ΔS°>0. In addition, the negative value of ΔS° includes the decrease in the degree of freedom of CBZ drug inside the solution. Furthermore, the sign of ΔS° indicates whether the adsorption reaction is an associative or dissociative process. Therefore, given that ΔS° has a negative charge, it could be an associative mechanism. According to the value of ΔH°, the adsorption between drug and nanocarrier can be classified as physical adsorption. Physical adsorption is based on weak interactions between the adsorbent and the surface sites of the adsorbent.

Keywords: TiO_2/SBA-16-NH_2; Carbamazepine; Drug loading; Drug delivery system; Thermodynamic parameters.

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