Adsorption of Carboxylate Anions on a $CaCO_3$ Surface

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The adsorption behavior of benzoate, citrate, tartrate and glutamate on calcite dispersed in water was studied. At r. t. and pH = 9, the molar amount of substrate adsorbed decreases with increasing number of carboxylic groups in the molecule. Thus, monofunctional benzoate adsorbs in significantly higher molar amounts than trifunctional citrate. A more alkaline environment (pH = 12.5) has almost no effect on the adsorption behavior whereas a temperature increase, particularly from 40 to 60 °C, results in notably lower adsorbed amounts except for benzoate. Enthalpy changes determined by applying a modified Clausius-Clapeyron equation indicate a slightly exothermic benzoate adsorption process, whereas adsorption of citrate, tartrate and glutamate represents an endothermic, entropy-driven process. Zeta potential measurements conducted with highly concentrated $CaCO_3$ suspensions (water/$CaCO_3$ = 0.413) containing 0 – 100 mmol substrate/m^2 confirm that the adsorption of substrates with a higher number of carboxylic groups and a higher anionic charge results in a particularly negative surface charge on $CaCO_3$.

Key words: Adsorption, Enthalpy, Carboxylic Acids, Zeta Potential, Calcite