# Determining Stoichiometries and Equilibrium Constants of Supramolecular Complexes from Surface Tension, Isothermal Titration Calorimetry and Molecular Dynamics Simulations

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The most widely employed technique to determine equilibrium constants of supramolecular complexes formation is the Isothermal Titration Calorimetry (ITC), combined with some thermodynamic model. The results obtained in this way are reliable in the simplest case, when only one stoichiometry is present and the formation of the structures is enthalpically driven. However, most of the actual solutions have several chemical species in equilibrium with each other. For such complex systems the use of a single technique does not suffice since the number of adjustable parameters increases substantially and results unmanageable. In this work, three different stoichiometries are simultaneously considered for the complex formation of the three native cyclodextrins with Octyl-ß-D-glucopyranoside in aqueous solution at 298.15 K. A combination of surface tension and ITC measurements resulted to be suitable for a precise thermodynamic characterization of the complexes in the solution. A new thermodynamic model developed in this work was employed to analyze the surface tension data. Molecular dynamics simulations of the same systems were performed to identify in an independent way both, the stoichiometries and the structures of the different species. The results from the three techniques agreed very well. The analysis of the simulations showed to be useful to understand the thermodynamic parameters.