

Aggregation of Amphiphilic Molecules: From Solution to Phase Separation

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William McBain introduced the idea of aggregation of amphiphilic molecules in solution in 1913 at a Faraday Society Meeting on “colloidal electrolytes” in London [1]. McBain used the word, micelle, for aggregates of soap molecules in aqueous solution identified through the measurement of colligative properties and solution conductivity. This phenomenon, signalled by several other physical properties, has been extensively studied for large amphiphilic molecules ($M_r \geq 200$) and phase separation phenomena have been identified even in dilute solutions at low and high temperatures depending on amphiphile molecular structure [2]. Over the last 30 years, the hydrophobic interactions, clustering phenomena in aqueous solutions of smaller amphiphiles has been identified in volumetric and compressibility studies of dilute solutions [3-5]. However, a direct link between the solution supramolecular assemblies and the isolated solid-state structures has only been established for very few organic crystals [6].

In this work a volumetric and acoustic study of dilute aqueous solutions of 4'-hydroxyacetophenone (4HAP) for $0.001 < x_{4HAP} < 0.007$, between 295 K and 343 K, allowed the identification of two types of aggregates in aqueous solutions (Figure 1). This system was chosen to try to confirm the liquid phase transitions (solution-colloidal) and check for correlations between the identified solution aggregates and the previously isolated and characterized solid structures [6].

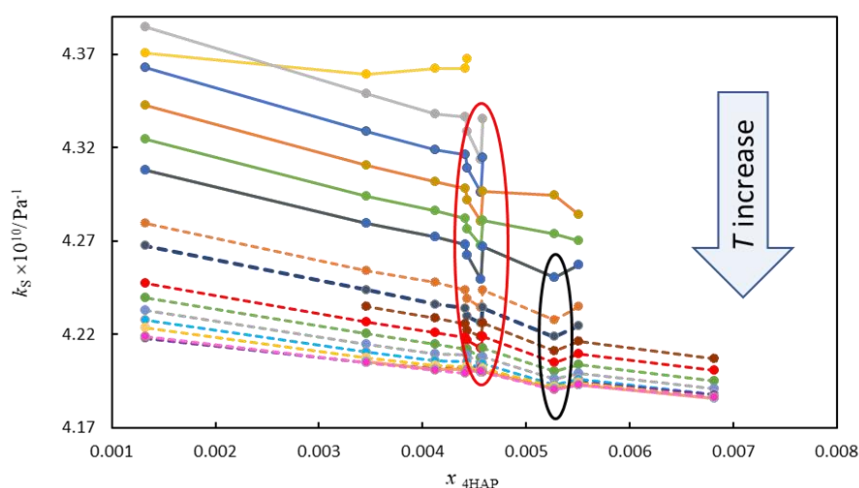


Figure 1. Dependence of isentropic compressibility of 4-HAP aqueous solutions on temperature and composition.

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