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Experimental and Theoretical Studies on Water Activity: Aqueous Solutions of Amino Acids with Electrolytes

Isa C. Fernandes, Mário F. Vilarinho and Simão P. Pinho

Laboratory of Separation and Reaction Engineering
Departamento de Tecnologia Química e Biológica
Escola Superior de Tecnologia e de Gestão, Instituto Politécnico de Bragança
Campus de Santa Apolónia, 5301-857 Bragança, Portugal

Abstract

In the recent past a considerable body of work has been published on the measurement of activity coefficients and solubility data in aqueous amino acid solutions containing electrolytes [1]. However, no information on water activity in this type of system has yet been published [2].
In this work water activity (a_w) in DL-alanine, glycine or L-serine aqueous systems with ammonium sulfate, at 298.15 K, was measured. The *Lab*MASTER-a_w water activity instrument (Novasina, Switzerland) was used to perform the measurements. The instrument, with a controlled chamber temperature (± 0.2 K), shows high precision (± 0.001 a_w units).
The new experimental data was used to test different theoretical schemes such as Zdanovskii-Stokes-Robinson (ZSR) model [3] and its extension, or the Clegg-Seinfeld-Brimblecombe (CSB) approach [4], in the calculation of amino acid and electrolyte activity coefficients in those solutions. Comparisons between the different approaches are given.

Experimental Work

Amino acids (AA) with purity higher than 99% were kept in a dehydrator with silica gel to avoid water contamination. Potassium chloride and ammonium sulphate, 99.5% purity were dried to eliminate any water present. $CaCl_2.2H_2O$, 99.5% purity, was used as received. All the solutions were prepared by weighing the appropriate masses (±0.1 mg) of the used chemicals.
After, an humidity sensor instrument (*Lab*Master-Novasina) with a controlled chamber temperature (±0.2 K) was used to measure water activity in the aqueous solutions of DL-alanine, glycine or L-serine, with ammonium sulfate, molality ranging from 0.5 to 5.0, at 298.15 K.