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Solid-liquid equilibrium measurements on aqueous ternary systems composed of amino acids and tetraalkylammonium bromides

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The solution behavior of amino acid + electrolyte aqueous systems provides valuable information about the complex behavior of proteins in biological systems [1]. Further, ternary solutions of {water + amino acid + solute 2} could undergo the soluting-out phenomenon as aqueous biphasic systems formation [2] or precipitation [3]. In this respect, the liquid-liquid and solid-liquid equilibria (LLE and SLE) studies are essential for designing, optimizing, and scaling up separation processes handling with amino acid-based systems.

In this work, to obtain thermodynamic information about the soluting effect in aqueous ternary systems of amino acid + tetraalkylammonium bromide (TAAB) salt, solid-liquid equilibrium (SLE) behavior was studied by measuring the solubility of tetramethylammonium bromide (TMAB) and tetrabutylammonium bromide (TBAB) in aqueous solutions of S(-)-proline, as well as the solubility of S(+)-serine and S(-)-proline in aqueous solutions of TMAB. The SLE results revealed that the water-solubilities of TMAB and TBAB decrease in the presence of S(-)-proline, while the water-solubilities of the amino acids are not meaningfully affected by the addition of TMAB. The soluting-out coefficient obtained by correlating the solubility data with the Setschenow equation is positive and whose value for TBAB is more than TMAB. From the gathered results, the investigated amino acids (S(+)-serine and S(-)-proline) act as the soluting-out agent in amino acid + TAAB aqueous solutions, and the strength of the soluting-out effect increases with increasing the difference between the hydrophobic character of the solutes.

Keywords: Solid-liquid equilibrium, Soluting-out effect, Amino acids, Tetraalkylammonium salt

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