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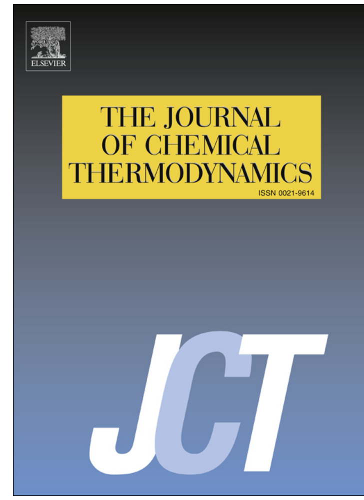

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Soluting-out effect of carbohydrates on the surface active ionic liquid 1-decyl-3-methylimidazolium bromide in aqueous solutions

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Abstract

Herein, with the aim of shedding light on the effect of nonionic cosolute (carbohydrate) stereochemistry on the aggregation and surface behaviors of ionic liquid-based surfactant 1-decyl-3-methylimidazolium bromide ([C_{10}mim][Br]) in aqueous solution, we studied the surface tension, electrical conductivity, volumetric and compressibility properties for the aqueous solutions of [C_{10}mim][Br] in the presence of different sugars containing pentose monosaccharides (xylose, ribose and arabinose), hexose monosaccharides (glucose, and mannose), disaccharides (sucrose and lactose) and trisaccharide (raffinose) at different temperatures. From the electrical conductivity measurements, the values of the degree of ionization of the counter ion on the micelles (α) and thermodynamic properties of micellization (ΔG_m) for [C_{10}mim][Br] in aqueous carbohydrate solutions were obtained. The various parameters such as apparent molar volume (V_ϕ), isentropic compressibility (κ_s), apparent molar isentropic compressibility (K_ϕ) and the change of apparent molar properties upon micellization ($\Delta V_{\phi,m}$ and $\Delta K_{\phi,m}$) were derived from the experimental density and speed of sound data. The surface tension measurements provided a series of parameters, including surface tension at the cmc (γ_{cmc}), effectiveness of surface tension reduction (Π_{cmc}), maximum surface excess concentration (Γ_{max}) and minimum surface area per molecule (A_{min}) at interface of air/solution for the investigated surfactant in the presence of different sugars at 298.15 K. All the investigated carbohydrates have soluting-out effect (favoring the micelle formation) and their abilities to

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