EXPERIMENTAL INDICATION OF TRANSITION BETWEEN NADES AND MINAC

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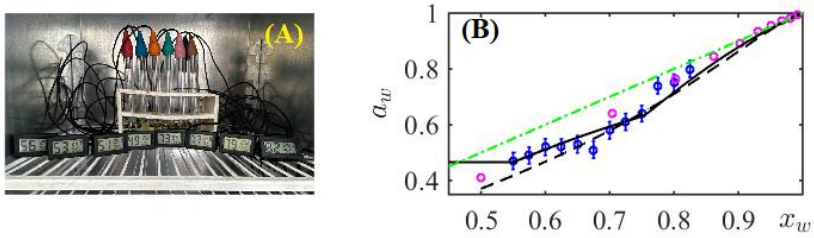
For the preparation of some types of natural deep eutectic solvents (NADES), a small amount of water must be added to the mixture to reduce the viscosity for practical applications. In such cases, an important feature of these aqueous systems is the possibility of a gradual transition from a deep eutectic solvent to a so-called Mixture of Natural Compounds (MINAC), i.e., a regular aqueous solution based on natural components. This transition is controlled by maintaining specific molar ratios of all components, in particular the molar fraction of water, at which noticeable deviations from the behavior of ordinary solutions are observed.

In this work, the fructose–citric acid–water system with a molar ratio of the main components of 1:1 is studied. The aim of the study is to investigate the dependence of the water activity, which is argued [1] an important indicator of molecular interactions in such mixtures, on the molar fraction of water plot. The figure below depicts the experimental setup developed for this purpose and results obtained.

By the comparison with model calculation curves, the range of responses to the water molar fraction, which either preserve the DES character of the system or exhibit transition between NADES and MINAC are revealed.



(A) The created experimental setup for determining water activity. (B) The data obtained (blue circles with error bars) in comparison with literature data [2] (magenta circles) and models: Norrish–Ross (solid black line) and PC-SAFT.

1. Postnikov E.B., Vanina A.S., Wasiak M., Sychev A.V., Chorążewski M. Thermodynamic properties of natural deep eutectic solvents and their aqueous solutions exemplified by fructose-citric acid-water mixtures // Molecular Thermodynamics of Aqueous Systems: Binary and Ternary Solutions/Mixtures, eds. T. Letcher and E. Wilhelm. RSC Press, 2026 (in press).

2. Gómez A.V., Tadini C.C., Biswas A., Buttrum M., Kim S., Boddu V.M., Cheng H.N. Microwave-assisted extraction of soluble sugars from banana puree with natural deep eutectic solvents (NADES) // LWT. 2019. Vol. 107. P. 79–88. https://doi.org/10.1016/j.lwt.2019.02.052