THERMODYNAMIC PROPERTIES OF AQUEOUS SOLUTIONS OF UREA AND ITS ALKYL DERIVATIVES IN A WIDE RANGE OF THE PARAMETERS OF STATE

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The values for the volume change during the formation of a liquid-phase mixture depend upon the changes in its intermolecular and intramolecular interactions as well as upon the interaction energy, the presence of H-bonds, hydrophobic or hydrophilic groups etc. When varying the external state parameters (pressure and temperature), the bulk properties of a mixture are dependent upon both its molecular geometry and packing of the molecules, as well as upon their ability to transform.

This report focuses on the bulk properties and structural organization of aqueous solutions of urea and its alkyl derivatives. Urea is known to act as a denaturing agent for proteins and to play a substantial role in many other biological processes. Alkyl derivatives of urea act similarly, all being protein destabilizers. The mechanism of urea denaturation of proteins in aqueous solutions has not yet been fully explained: whether urine molecules directly interact with the macromolecule or they affect the protein stability through the surrounding water by changing its properties. Research findings in this field have been contradictory thus far. Some findings show that urea can be incorporated into water structure as a "water-like" molecule, thus not affecting the water-water interaction at all, other findings consider urea as a "structure-breaker" of water structure, the third ones consider it to be a "structure-maker".

This report presents the results of an experimental research of the density of aqueous solutions of urea and its alkyl derivatives at atmospheric pressure and compression (relative volume variation) at pressures ranging between 0.101 and 100 MPa and at temperatures between 278.15 and 323.15 K. The report discusses the calculated values of molar isothermal compressibility and molar isobaric expansibility, isochoric thermal pressure coefficients and the internal pressure of the mixture. The report also addresses the partial molar volumes of components as well as the limiting partial molar volumes..

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