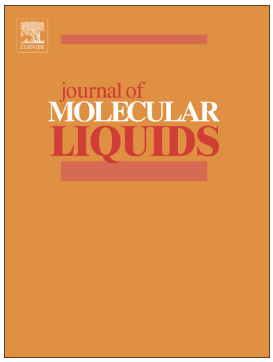

Differences in physico-chemical properties and behavior of urea and 1,1,3,3-tetramethylurea in the mixture of water with N,N-dimethylformamide at temperature range T=(293.15–308.15)K

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Differences in physico-chemical properties and behaviour of urea and 1,1,3,3-tetramethylurea in the mixture of water with *N,N*-dimethylformamide at temperature range T = (293.15-308.15) K

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Abstract

The apparent molar volumes of tetramethylurea (TMU) in the mixture of *N,N*-dimethylformamide (DMF) and water (W) have been determined within the temperature range: T = (293.15–308.15) K from density measurements. Based on Redlich-Meyer equation partial molar volumes and b_V coefficient describing the character of interactions were calculated. The results obtained for TMU showing hydrophobic properties have been compared with the corresponding results for urea that shows hydrophilic properties. This allowed us to analyze the solvation process of the investigated substances as well as to show an opposite behavior of urea in relation to TMU in the mixture DMF+W, particularly in the area of high water content.

Keywords: *N,N*-dimethylformamide+water mixture, tetramethylurea, density, apparent molar volume, partial molar volume, excess partial molar volume

1. Introduction

Urea (U) is a molecule with a particular significance and activity in various biological processes. Its structural features in gas [1] and solid phases [2] have been well recognized. Also the structure of aqueous urea solutions is of remitting interest due to their interesting properties, especially those of concentrated solutions [3]. Urea showing hydrophilic properties is well soluble in water, while its aqueous solutions contribute to the formation of metal transient complexes [4], showing also nonlinear optical properties [5]. Urea increases the solubility of gaseous hydrocarbons in water [6] and influences the stability of protein structures [7]. The presence of U in the system influences the hydrophilic and hydrophobic interactions determining the stability of the protein structure [8]. However the denaturizing properties of urea have not been yet well understood [9].

It has been observed that opposite to U its alkyl derivatives efficiently contribute rather to reinforcing the protein structure [10]. What's more, changes in the water structure caused by the presence of denaturizing agent are of great importance [11,12]. The simplest four-substituted alkyl derivative of U is tetramethylurea (TMU). There are available reports that compare the U properties with those of TMU in aqueous solutions [13]. Among others, there