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Ultrasonic Studies on C_{10} DTT in Water and Aqueous Water Solutions at 303ºK

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Abstract: The present paper deals the structural behaviour of C_{10} DTT in water and alanine solution. This paper also deals the interaction of C_{10}DTT with alanine in its aqueous solution in terms of velocity, density, viscosity, adiabatic compressibility and hydrogen number acoustical parameter.
Keywords: Ultrasonic, Aqueous, Solutions; C_{10}DTT.

I. INTRODUCTION

Decyldimethyldiammonium iodide (C_{10}DTT) is a cationic detergent having molecular weight 989-.0. It is white crystal type solid and 100% soluble in water.

Alanine is hydrophobic molecule. It is ambivalent, meaning that it can be inside or outside of the protein molecule. The -carbon of alanine is optically active, in protein, on the L-isomer is found. Alanine is the -amino acid analog of the -ketoacid pyruvate and intermediate in sugar metabolism.

Alanine and pyruvate are interchangeable by a transmination reaction its molecular formula $C_3H_7NO_3$, weight 89.09. C_{10}DTT is used as household cleaner.

This is also used in preparing methyl 6, 6-dim ethyl-3-azobiccyclo [3.1.0] hexane 2-2 carboxylate free base and the process for preparing the bisulfite adduct intermediate it has medicinal value.

Zeng and Wu[1] measured the sodium transihione sulphonate are water-soluble derivatives of transhinones originated from tanshen. Feng Ruo[2] measured the velocity titration curve of several aminoacid solution in the pH range 1-13 at 20ºC and frequency 2MHz. Riyazuddeen and Afrin[3] worked on the ultrasonic velocity and density values of L-Phenylalanine, L-Levcine, L-glutamic acid and L-proline + 2mol^{-1} aqueous and NaCl and 2 mol^{-1} aqueous $NaNO_3$ solution. Riyazuddeen and Tausif[4] worked on the ultrasonic velocity and density values of L-glutamic acid.

Siddique[5] measured the ultrasonic velocity of three amino acids, namely L-Lysine, Monohydrochloride, L-Arginine and L-Histidine in solution of sodium acetate, potassium acetate and calcium acetate at different tem. The present paper deals the ultrasonic studies on C_{10}DTT water and in alanine solution. This study also deals the interaction of C_{10}DTT with alanine in its aqueous solution in terms of various acoustical parameter. Alanine is -amino acids and used in this work have numerous application in various fields of chemistry.

II. MATERIALS AND METHODS

All chemical used in work were either Sarabhai M chemical are CDH or BDH A-R grade with minimum asse 99.8%. Binary solutions of C_{10}DTT of different molarities (0-10m) were prepared by weight-dilution method using its aqueous stock solution of molarity (10mm) and double distilled ionized water.

The ternary solution of C_{10}DTT of different molarities were also prepared in similar way using its aqueous stock solution of molarity (10mm) and stock solution of 0.5 m alanine solutions.

In the present study, Ultrasonic inteferometer has been used for measuring ultrasonic velocity of solutions at 303K. Single crystal ultrasonic interferometer (Mittal enterprised, New Delhi Model F-81) was used at a fixed frequency of 1.5 MHz.

The densities of water and binary solution of C_{10}DTT in water and ternary solution (0.5M), alanine were measured at 303K bycalibrated bi-capilary pyknometer in conventional way.

Density data were found to be accurate within 10.2%.

The viscosity of C_{10}DTT solutions in water and in 0.5M- alanine solution were measured at 303K, by calibrated Ostward's Viscometer in conventinal way using same thermostate. The viscosity data were found in be accurate whtin $\pm$0.3%.

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III. RESULT AND DISCUSSION

The results of ultrasonic velocity vs C_{10}DTT molarity (mM) in water and in 0.5M alanine ternary solution at 303ºK are shown in the Table (1). The table indicates strong solute-solvent interactions. Solute which increases the ultrasonic velocity is called structure maker (SM) and solute which decreases ultrasonic velocity is called Structure Breaker (SB). The ultrasonic velocity is maximum at 3.0 mM in binary solution which indicates that the C_{10}DTT undergoes micellization having cmc=3.0 mM. Table also reveals that C_{10}DTT is structure maker (SM) in pre-micellar reagion due to slope $=\left(\frac{\partial U}{\partial c}\right)_T = +ve$. The ultrasonic velocity is maximum at 6.0mM for ternary solution which also indicates that C_{10}DTT undergoes micellization having cmc = 6.0 mM. The table also reveals that C_{10}DTT is structure maker (SM) in pre-micellar region due to slope $=\left(\frac{\partial U}{\partial c}\right)_T = +ve$. Table reveals that C_{10}DTT is Structure Breaker in post-micellar region due to slope $=\left(\frac{\partial U}{\partial c}\right)_T = -ve$. The ultrasonic velocity is minimum at 8.0 mM for ternary solution which indicates that C_{10}DTT does not undergo micellization. Table also reveals that C_{10}DTT is Structure Breaker (SB) is post-micellar region due to slope $=\left(\frac{\partial U}{\partial c}\right)_T = -ve$.

The diabatic compressibility is most significat thermodynamic and acoustic parameter related to ultrasonic velocity, the compressibility profile of C_{10}DTT is binary and in ternary colution of different concentrations are shown in the Table (2) at 303ºK. Data further support strong solute-solvent and solute-solute interactions.

The hydration Number (Hn) is a solution parameter related to systematic compressiblity (□s) of a solution. The variation of Hydration Number of C_{10}DTT in water and in 0.5M, alanine solution have been showni n the Table (2). Table revelas that C_{10}DTT shows the maximum hydration number at 8.0 mM and 3.0mM in binary solution and minimum hydration number at 8.0mM in binary solution.

IV. ACKNOWLEDGEMENT

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Table-1

Ultrasonic Velocity (U)/mS^{-1}, Density (□) × 10^{-3}/Kgm^{-3} and Viscosity (□) NM^{-2} of C_{10}DTT in Water and in 0.5M Alanine Solution at 303ºK

C_{10}DTT Molarity (mM)	0.0M Water			0.5M Alanine		
	U	□	□	U	□	□
00	1487	0.9956	0.8007	1546	1.0090	0.8549
01	1492	0.9972	0.7698	1542	1.0083	0.8883
02	1495	0.9959	0.7704	1533	1.0074	0.8873
03	1508	0.9956	0.7710	1529	1.0076	0.8883
04	1507	0.9957	0.7412	1538	1.0097	0.9182
05	1493	0.9966	0.7707	1542	1.0070	0.8876
06	1496	0.9949	0.7711	1552	1.0137	0.8881
07	1497	0.9948	0.7413	1538	1.0079	0.8892
08	1500	0.9956	0.7411	1528	1.0093	0.8888
09	1493	0.9955	0.7992	1539	1.0083	0.8882
10	1488	0.8855	0.7707	1545	1.0065	0.8902

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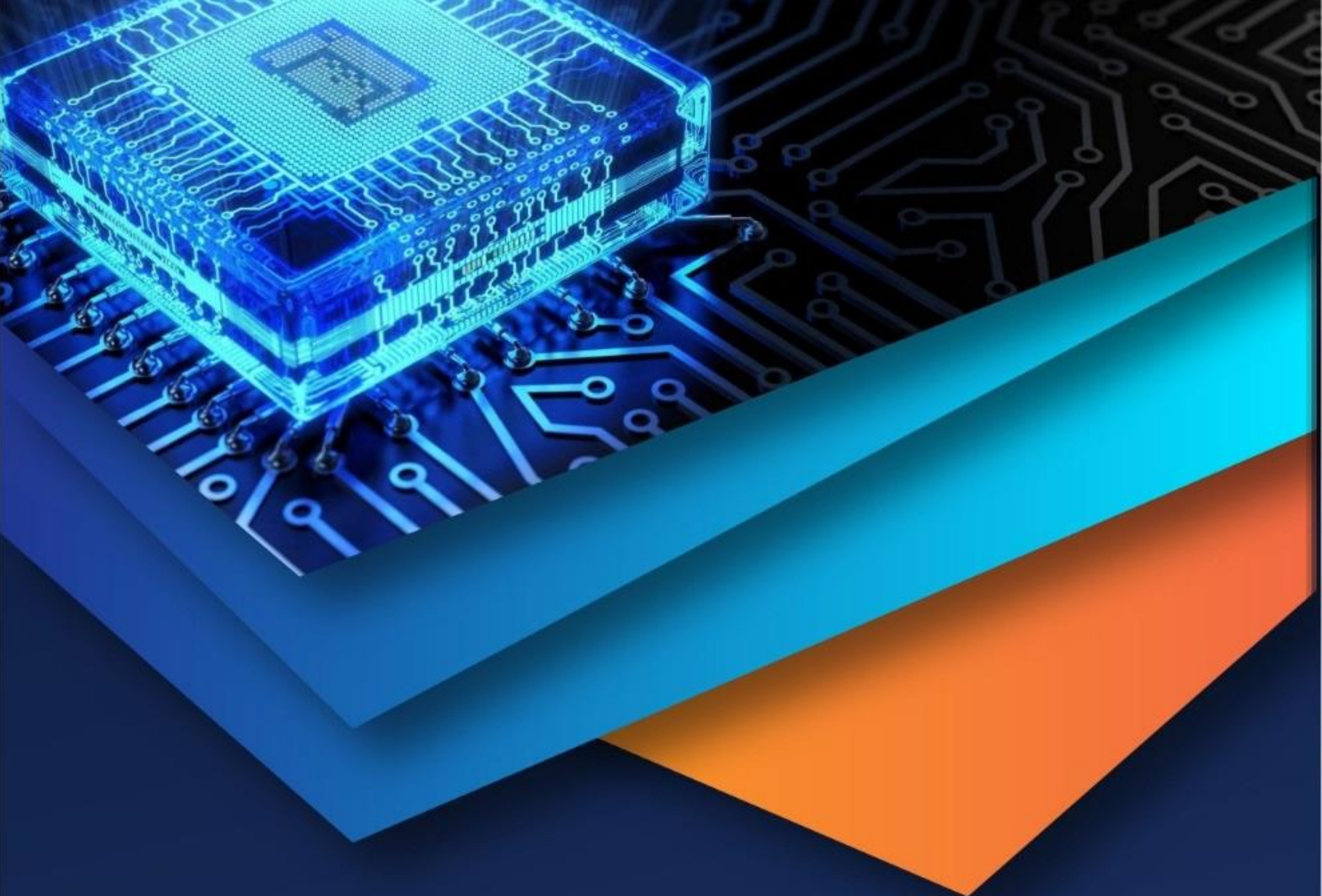
Table-2
Adiabatic Compressibility (□s) T□A^{-1} and Hydration Number (H_n) × 10^7 C_{10}DTT in Water and in 0.5M Alanine Solution at 303ºK

C_{10}DTT Molarity (mM)	0.0M Water		0.5M Alanine	
	□s	H_n	□s	H_n
00	455	0.00	415	0.00
01	452	1.18	418	0.07
02	449	3.95	423	-6.76
03	442	15.43	425	-12.80
04	443	19.04	419	-8.57
05	451	7.91	418	8.59
06	449	11.89	409	12.92
07	448	16.66	419	-14.97
08	446	25.37	425	-34.29
09	452	10.70	418	-15.46
10	454	3.96	415	-8.59



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