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Research Article

STUDIES OF ACOUSTIC BEHAVIOR OF 3-(2-BENZIMIDAZOL)-3-NITRO-6-METHYL-CHROMEN-4-ONE (BNMC) IN A DIFFERENT SOLVENTS SYSTEM BY USING ULTRASONIC INTERFEROMETER

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ABSTRACT

By using various acoustic parameters ultrasonic velocity of3-(2-benzimidazol)-3-nitro-6-methyl-chromen-4 one (BNMC) in different solvent mixtures has been investigated to understand the effect of (BNMC) in interaction with water and organic solvent.

Keywords: Apparent molal adiabatic compressibility, Hydration numbers, 3-(2-benzimidazol)-3-nitro-6-methyl-chromen-4-one(BNMC),dioxane-water mixture, Interferometer.

INTRODUCTION

Vibrational waves of frequency above hearing range of normal ear are referred as Ultrasonic waves. All waves of frequencies more than 20 KHz are Ultrasonic waves. The waves are being used for detected of flaws of materials, mechanical cleaning of surface etc,in the field of technology. In medicinal science too, the waves are being used to detect cancer tumors, bone fractures, cardiology etc. In present day applications of Ultrasonic are emerging in the field of forensic sciences, space research and in wars.Studies of stability constants and thermodynamically parameters (ΔH, ΔG, ΔS) of inner transition metal ions complexes with substituted chromoneschiff bases 70% dioxane – water solvent1.Studies of some acoustic parameters of cu (No3)2 in water-dioxane mixture at 298.150k by physico -chemical method2.Adiabatic molal Compressibility and apparent molal volumes of many electrolytes in mixed organic solvent are found out earlier3-8. Recently some co-workers have investigated acoustic parameters of some binary liquids mixture at different temperatures 9-15. Narwade et a16have studied the adiabatic compressibility and apparent molar volume of substitute pyrazoles in water-dioxane mixture.Deosarkar17have investigated the adiabaticcompressibility, apparent molar compressibility and other parameters of pyrazoles in aqueous acetone-mixture. Hydration numbers are calculated using partial molal volume and adiabatic compressibility data. Pawar18 have studied the apparent molal adiabatic compressibility andhydration numbers of some peptides. Khobragadeet al19have investigated apparent molal compressibility for isoxazoline

in 70% dioxane-water mixture.This paper is in continuation to our research work on ultrasonic investigation of adiabatic molalcompressibilities and apparent molal volume of 3-(2-benzimidazol)-3-nitro-6-methyl-chromen-4-one(BNMC), dioxane- water mixture.

EXPERIMENTAL SECTION

Instruments

Pyknometer:

Pyknometer (Borosil make) are used in the present investigation for measuring the densities. Pyknometer were standardized by the standard procedure20.

Balance

Weighing was made on MechanikiZaktadyPrecyzyjnej Gdansk balance, made in Poland (±0.001 gm).

Ultrasonic Interferometer:

An ultrasonic interferometer MX-3 model (Mittal Enterprises, Delhi) having frequency 2MHz and accuracy ±0.03% was used for the measurement of ultrasonic velocity in solutions.

Thermostat

A special thermostatic arrangement was done for density and ultrasonic velocity measurements. Elite Thermostatic water bath was used, in which continuous stirring of water was carried out with the help of electric stirrer and temperature variation was maintain within ±0.10C.

Solvents and chemicals

All chemicals are analytical reagent (AR) grade with were obtained from SdFine chemicals, India which is used as such without further purification. Water used in the experiment was demonized, distilled and degassed prior to making solutions. The cell of ultrasonic interferometer was filled fully with the solution and needle of ammeter was adjusted in the range of 20 to 60 with the help of "Adj" knob. It was warmed for 10 minutes so that the range should remain steady. Micrometer reading was noted. Screw was moved anticlockwise to get the maximum deflections of needle. To movement of screw was co untied to gate 5 deflection. After retuning back to its original position, Micrometer screw was noted. The difference between these two readings gave the distance travelled by screw for getting five maxima. From this distance required though which micrometer screw should move for one maximum was calculated by dividing it by 5. Same procedure repeated many times. The apparent molal volume (Φv) and apparent molar adiabatic compressibility (Φ K(s)) of (BNMC) in solution are determined from density (dS) and adiabatic compressibility (βs) of solution calculated by using following equations.

Φ K(s) = ((βsdo-βods) 〖 10 〗 ^3)/(m×ds×do) + βsM/ds …… (1)

Table – 1 Ultrasonic Velocity in Distilled Water; Ultrasonic Frequency = 2 MHZ; Temp. 27± 0.1°C

Sr. No.	Number of rotation of Screw	Micrometer Reading (mm)	Difference between Reading (mm)	Distance traveled by Screw for one maxima [(D)mm]	Ultrasonic Velocity [(U)msec-1]
1	5	25.15		0.392	1649
2	10	23.17	1.86	0.393	1645
3	15	21.21	1.8	0.393	1645
4	20	19.25	1.84	0.392	1641
5	25	17.34	1.83	0.391	1637
6	30	15.32	1.82	0.3905	1633

Table - 2 Ultrasonic Velocity In 20% of ethanol-water, acetone-water & Dioxane-water mixtures

System - (BNMC) Ultrasonic Frequency = 2 MHz

Temp. 27± 0.1°C Molality =0.0091

Sr. No.	Number of rotation of Screw	Micrometer Reading (mm)	Difference between Reading (mm)	Distance traveled by Screw for one maxima [(D)mm]	Ultrasonic Velocity [(U)msec-1]
Ultrasonic Velocity In 20% Ethanol-Water Mixture					
1	5	22.75		0.3840	1650
2	10	21.50	1.96	0.3825	1645
3	15	21.20	1.92	0.3878	1635
4	20	18.90	1.90	0.3844	1630
5	25	17.85	1.87	0.3851	1627
6	30	17.20	1.84	0.3867	1622
		Average		0.3850	1634
Ultrasonic Velocity In 20% Acetone- Water Mixture					
1	5	27.15		0.3750	1540
2	10	26.90	1.98	0.3720	1535
3	15	25.21	1.94	0.3770	1535
4	20	23.95	1.92	0.3740	1531
5	25	22.34	1.90	0.3750	1527
6	30	21.30	1.87	0.3760	1523
		Average		0.3748	1531

Contd.

Ultrasonic Velocity In 20% Ethanol-Water Mixture					
Number of rotation of Screw	Micrometer Reading (mm)	Difference between Reading (mm)	Distance traveled by Screw for one maxima [(D)mm]	Ultrasonic Velocity [(U)msec-1]	
Ultrasonic Velocity In 20% Dioxane- Water Mixture					
1	5	26.10		0.3950	1544
2	10	25.90	1.99	0.3920	1552
3	15	24.25	1.97	0.3970	1536
4	20	22.91	1.96	0.3940	1539
5	25	21.30	1.93	0.3950	1528
7	30	20.35	1.89	0.3960	1526
		Average		0.3944	1537.5

Table 3 Φ K(s) &Φ v values along with other parameters in 20% of ethanol-water, acetone-water &dioxane-water mixtures of ligand (BMNC) Ultrasonic frequency: 2MHz Temp 27+0.1^{0}C

Parameters	Solvent percentage (v/v) 20		
	Ethanol-Water	Dioxane- Water	Acetone- Water
Molality	0.0091	0.0091	0.0091
D_0	0.4680	0.4623	0.4666
d_0	1.0651	0.0398	0.0365
U_0	1570.0	1592.0	1559.0
B_0	46.5551	44.8001	48.6050
D_S	0.4850	0.4948	0.4632
d_S	1.0743	1.0203	1.0091
U_s msec^{-1}	1610.0	1657.0	1582.0
$\beta s \times 10^8$	44.30	40.91	48.23
$\beta s\ d_s \times 10^8$	47.5213	45.6740	45.8760
$\beta s\ d0 \times 10^8$	45.2543	43.4876	49.5678
$\Phi K(s) \times 10^4$	0.8932	-26.4237	49.76521
Φv	540.87	2457.32	7321.10

$\Phi v = ((do-ds) \llbracket 10 \rrbracket ^3)/(m\times ds\times do) + M/ds$ ……. (2)

Where, do is the density of pure solvent.

M is the molecular weight of solute

βo is adiabatic compressibility of pure solvent & βs is adiabatic compressibility of solution.

The adiabatic compressibility is calculated from ultrasonic velocity using the equation

$\beta o=1/ \llbracket \llbracket U0 \rrbracket ^2 \rrbracket \_d0$ ……for solvent

$\beta s=1/ \llbracket \llbracket Us \rrbracket ^2 \rrbracket \_ds$ ……for solution

Velocity of ultrasonic wave in solvent is represented by UO & in solution by US.

RESULTS & DISCUSSION

After the study of following observation table 1, 2 & 3 the values of ΦK(s) Φv is higher in case of acetone-water mixture than ethanol water of methanol water mixture due to electron releasing group present in acetone and difference in functional group and hydration numbers. The values of Φvis in the order as follows,

Acetone-Water >Dioxane-water >Ethanol-water at 20% solutions. After the investigation it is to be concluded that there is no regular order of ΦK(s) and Φv values for all the system.

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