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Ultrasound Study of Binary Liquid Mixtures Allyl Acetate with Di-Oxane at 30^0c

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Abstract: ***The density, viscosity and ultrasonic velocity have been measured for binary mixture of Allyl + Dioxane of fixed equal volumes of the components at temperatures of 30^0. The experimental data have been used to calculate some thermodynamic and acoustic parameters such as isentropic compressibility, specific acoustic impedance, intermolecular free length, molar volume, available volume, viscosity and excess values of above parameters by practically determined ultrasound velocity, density and viscosity. and internal pressure. It was observed that adiabatic compressibility (β), free length (Lf), and free volume (Vf), increased with increase in temperature, whereas internal pressure (πi) decreased with increase in temperature. Some probable reasons on the increase or decrease of acoustic and thermodynamic parameters with temperature change are presented.***
Keywords: Binary mixtures, Ultrasonic velocity, Acoustic/Thermodynamic Parameters temperature.

I. INTRODUCTION

The molecular interaction is the current field of theoretical research. It represents one of the most important branch of the molecular science. One reason for this is that the topic is important in chemistry, physics, biology, medicine and also in agriculture. Molecular interaction is that theoretical research branch in which solvent-solvent and ion-solvent interaction specially discussed in solvents as well as solutions. The solvent interaction is specially binary, ternary and quaternary solvents which are miscible.

The organic compounds are most popular in the use of mankind and are easily available in nature as well as can be prepared by synthesis. The saturated esters have been studied very well in the so far researches. The scientist do not touch the unsaturated esters. We have emphasized to select that the unsaturated ester for molecular interaction in other organic solvents. The selected unsaturated esters are specially used for preservation of the essential long term food. So the selection of allyl acetate,allyl benzoate and allyl formate have been done for the molecular interaction studies in polar and non-polar organic solvents as binary systems.

II. MATERIAL & METHODS

The molecular interaction is advanced study of the ion-solvent and solvent-solvent liquid mixture and their solutions are the main properties which create great interest of the researchers. Various techniques such as electromotive force, conductance colligative properties, polarography, dielectric constants, X-ray, Nuclear magnetic resonance relaxation times vapour pressure have been employed to study binary and ternary system.

Ultrasonic Velocity: In the present study interferometic techniques has been used and in base on wave determination method. This method is advantageous due to its availability of measuring the ultrasonic velocity over the wide range of temperature i.e. -30^0c to + 80^0c and used by Delgrosso. Ultrasonic Velocity is measured by the ultrasonic interferometer, which is manufactured by M/S Mittal Enterprises, New Delhi. It has the accuracy of about ± 0.05%.

Ultrasonic volumetric and viscometric studies on 2- hydroxyl-5-methyl acetaphenone and 2, 4 dihydroxy acetaphenone have been carried out in THF-water, DMF-water and dioxane-water co-solvents at 303.15K. Various thermodynamic parameters such as apparent molar volume apparent molar compressibility and their limiting values have been determined the results are discussed in terms of solute-solvent interaction. The study indicate maximum interactions in dioxane-water co-solvent.

Vankateswarlu et.al. have been calculated various thermodynamic parameters in binary mixture of 1- chloro butane with benzene tolune, 0.

Density Measurement: A double walled bi-capillary pyknometer is used for the measurement of the density of the solvents and solutions. Capillaries have a narrow bore provided with well fitting glass stoppers in order to avoid change in connection because of evaporation of more volatile solvent.

Uncertainly in density measurement is within the range ±0.0005 gm/ml. Capillary are graduated and iso-diametric throughout their length. The pyknometer is calibrated with distilled water, benzene and toluene.

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Temperature Control: The temperature is maintained throughout the experiment i.e. while making measurements of ultrasonic velocity, density and time of flow for the viscosity. A thermostat with electric relay system was used to maintain constant temperature. Water at the temperature of the experiment was circulated around the ultrasonic cell and jacket containing pyknometer and viscometer and it was tried that during the measurement of density, velocity and viscosity the temperature of the solutions was maintained constant. The thermostat manufactured by scientific instrument Company Ltd., consist of 230 volts and 2000 watts, types D.B.S. It contains a motor, which is manufactured by Remi Udyog, Bombay, 230 volts, Type 183, RPM 1800.
Chemical Used: Chemicals used in the present work are of AR grade and were purified by the standard methods before use. These chemical were used & their purity was checked by measuring their densities, which compared well with the literature values.
The liquid mixture of different composition were prepared by mixing calculated amount of chemicals, the velocity, density and viscosity of which were measured by method describe above.

Following best standard quality chemicals were used in experiments:

1) Allyl acetate E-merck
2) Allyl benzoate B.D.H
3) Allyl formate
4) Di-oxane B.D.H
5) THF (Tetra Hydrogen Floride)B.D.H
6) Westrol

III. RESULT AND DISCUSSION

In the present study we have practically observed ultrasound velocity, density, viscosity of pure liquids, and their binary mixture. From above observation some acoustic and thermodynamic parameters have been computed by described standard relation in the following binary systems.

1) Allyl acetate + di-oxane
2) Allyl acetate + THF
3) Allyl acetate + Westrosol
4) Allyl formate+ Di-oxane
5) Allyl formate+ THF
6) Allyl formate+ Westrosol
7) Allyl benzoate+ Di-oxane
8) Allyl benzoate+ THF
9) Allyl benzoate+ Westrosol

We have computed thermodynamic and acoustic parameters such as isentropic compressibility, specific acoustic impedance, intermolecular free length, molar volume, available volume, viscosity and excess value of above parameters by practically determined ultrasound velocity, density and viscosity.
To compute the molecular interaction between the unlike molecules, the computed excess values of the acoustic and thermodynamic parameters focus light on nature and extend of interaction. The negative values of β^E_{s1} $V^E_{M\ 1}$ V^E_a and positive value n^E indicates the strong interactions between the components of the mixtures, while positive values of β^E_{s1} $V^E_{M\ 1}$ V^E_a and negative value n^E decide the weak interaction between the liquid molecules due to dispersion forces. The strong interaction will be due to dipole-dipole interaction, dipole induced interaction and also associating nature of like molecules, which is due to H-Bonding.

Table No. 1
Allyl Acetate + Di-oxane at 30^0c

Mole Fraction of Allyl Acetate	Density (exp.)	Density (add.)	Density (excess)	Ultrasound Velocity	β_s (Exp) $cm^2/dyne.10^{12}$	β_s (Add) $cm^2/dyne.10^{12}$	B_s (Excess) $cm^2/dyne.10^{12}$
0.0000	0.8610	0.8610	0.0000	1282	70.67	70.67	0.00
0.1258	0.8646	0.8649	-0.0003	1280	70.59	70.86	-0.27

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0.1641	0.8654	0.8662	-0.0008	1278	70.75	70.92	-0.17
0.2518	0.8676	0.8689	-0.0013	1276	70.79	71.05	-0.26
0.3437	0.8701	0.8718	-0.0017	1274	70.81	71.19	-0.38
0.4349	0.8727	0.8748	-0.0021	1272	70.82	71.33	-0.51
0.5409	0.8762	0.8780	-0.0018	1266	71.16	71.49	-0.33
0.6470	0.8799	0.8813	-0.0014	1262	71.36	71.65	-0.29
0.7586	0.8839	0.8848	-0.0009	1256	71.71	71.82	-0.11
0.8761	0.8881	0.8885	-0.0004	1252	71.83	71.99	-0.16
1.0000	0.8924	0.8924	0.0000	1246	72.18	72.18	0.00

The Acoustic and thermodynamic parameters and their excess values have been computed with the observed physical properties such as ultrasound velocity, density and viscosity of allyl acetate as common component with dioxane, tetrahydrofuran and westrol at variable temperature 30^0C. The isentropic compressibility, intermolecular free length, specific acoustic impedance, molar & available volume, viscosity and their excess values with sear's relaxation time and Rao's constant have computed in above three binary systems.

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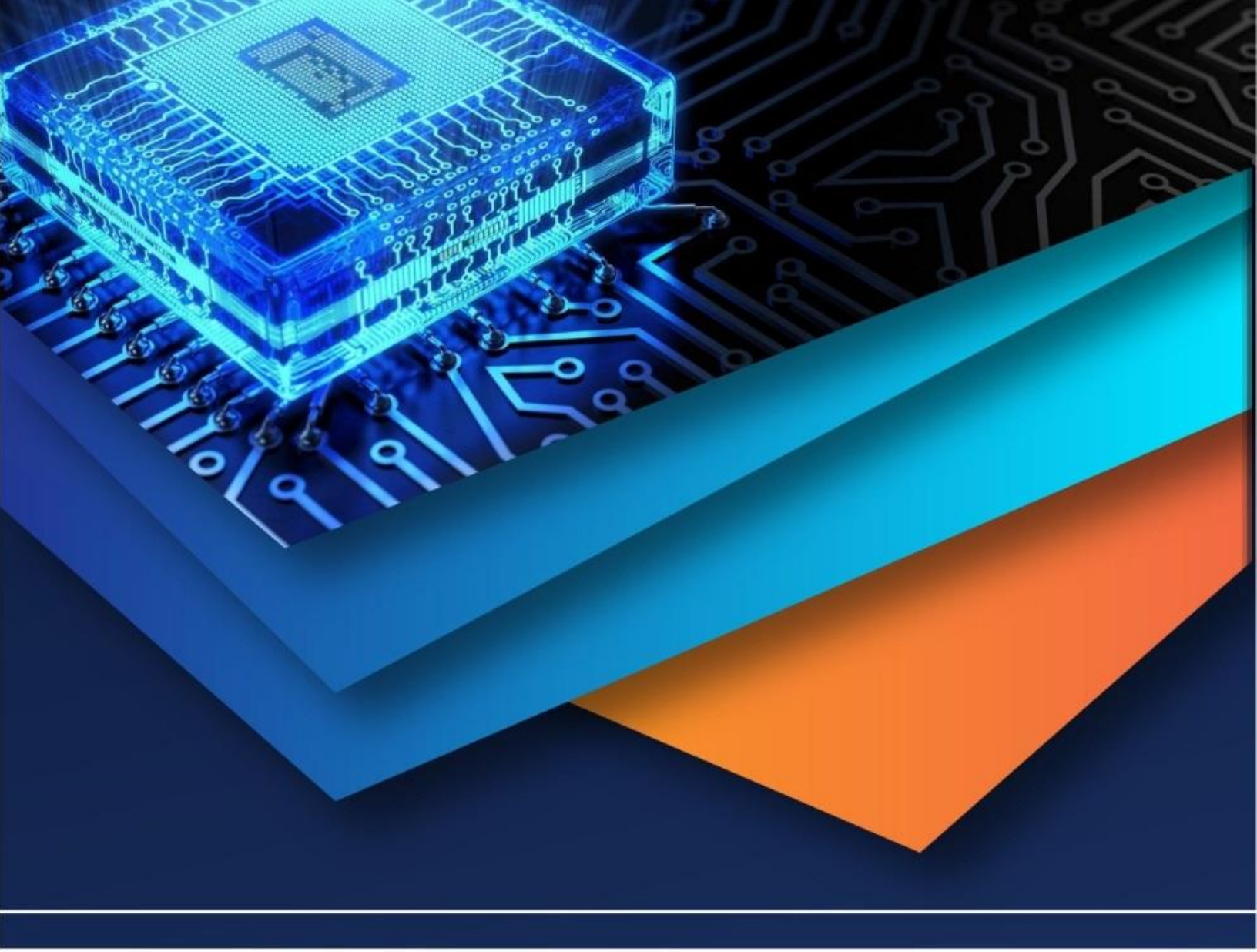

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