MAH/MUL/ 03051/2012 ISSN :2319 9318

आंतरविद्याशाखीय बहुभाषिक शोध पत्रिका

विद्यावार्ता™

April To June 2022
Spacial Issue

Date of Publication
01 June 2022

Editor
Dr. Bapu g. Gholap
(M.A.Mar.& Pol.Sci.,B.Ed.Ph.D.NET.)

x¾Ö³êx¾Ö-ÖÖ ´Öx¸Ö ÖêÖß, ´Ö¸ÖßÖx¾Ö-ÖÖ -ÖßÖx¸Ö ÖêÖß
-ÖßÖx¸ÖÖx¾Ö-ÖÖ ÖÖx¸Ö ÖêÖß, ÖÖx¸Ö×¾Ö-ÖÖ x¾Ö¢Ö ÖêÖê
x¾Ö¢ÖÖx¾Ö-ÖÖ ¿Öæ¦ü Ö"Ö»Öê, ‡¸Ö êú †-Ö£ÖÔ < úÖ †x¾Ö³ê-Öê êú»Öê
-´ÖÆüÖ¸´ÖÖ •µÖÖêŸÖß¸üÖ¾Ö ±ãú»Öê

"Printed by: Harshwardhan Publication Pvt.Ltd. Published by Ghodke Archana Rajendra & Printed & published at Harshwardhan Publication Pvt.Ltd.,At.Post. Limbaganesh Dist,Beed -431122 (Maharashtra) and Editor Dr. Gholap Bapu Ganpat.

Reg.No.U74120 MH2013 PTC 251205
Harshwardhan Publication Pvt.Ltd.
At.Post.Limbaganesh,Tq.Dist.Beed
Pin-431126 (Maharashtra) Cell:07588057695,09850203295
harshwardhanpubli@gmail.com, vidyawarta@gmail.com
All Types Educational & Reference Book Publisher & Distributors www.vidyawarta.com

PRINCIPAL
Art, Science & Commerce
College Chikhaldara

Date of Publication
June 2022

Vidyawarta™

International Multilingual Research Journal

www.विद्यावार्ता.कॉम

YouTube Channel

Vidyawarta is peer reviewed research journal. The review committee & editorial board formed/appointed by Harshwardhan Publication scrutinizes the received research papers and articles. Then the recommended papers and articles are published. The editor or publisher doesn't claim that this is UGC CARE approved journal or recommended by any university. We publish this journal for creating awareness and aptitude regarding educational research and literary criticism.

The Views expressed in the published articles,Research Papers etc. are their writers own. This Journal dose not take any libility regarding appoval/disapproval by any university, institute, academic body and others. The agreement of the Editor, Editorial Board or Publicaton is not necessary. Editors and publishers have the right to convert all texts published in Vidyawarta (e.g. CD / DVD / Video / Audio / Edited book / Abstract Etc. and other formats).

If any judicial matter occurs, the jurisdiction is limited up to Beed (Maharashtra) court only.

Indexed

IMPACT 8.14 IIJIF FACTOR

Govt. of India,
Trade Marks Registry
Regd. No. 2611690

Harshwardhan Publication Pvt.Ltd. • International Multilingual Research Journal • ISO 9001:2015

PRINCIPAL
Art, Science & Commerce
Colle[illegible]Chikhaldara

INDEX

13

An Ultrasonic Study of 3-(2-Methoxyphenoxy) -1, 2-Propanediol in Different Binary Mixtures of SolventAt 308 K.

Ravi Jumle
Shri Shivaji Arts, commerce and Science College, Akot, Dist. Akola (M.S.)

Usha Wasnik
Arts, Science and Commerce College, Chikhaldara Dist- Amravati

ABSTRACT :

The ultrasonic velocity, density, viscosity and absorption have been measured for solutions of 3-(2-methoxyphenoxy)-1, 2-propanediol are presented at308K. By taking measurements of 3-(2-methoxyphenoxy)-1, 2-propanediol atthe concentration range is 0.002 to 0.01 mol dm^{-3} of each solution. The ultrasonic velocity, density and viscosity have been measured at 2MHz for the aqueous solutions of (i)3-(2-methoxyphenoxy)-1,2-propanediol+ Acetonesolvent (ii)3-(2-methoxyphenoxy)-1,2-propanediol+Ehtanol solvents, at different concentrations at308K. The acoustical parameters such as adiabatic compressibility (β), intermolecular free length (L_f), andacoustical impedance have been computed.The aim of the study is to increase the solubility, stability of the drugs by the formation of complexation. These properties are attributed to solute-solvent interactions through hydrogen bonding, molecular association, Solvent-solvent interaction etc. The results are interpreted in terms of molecular interactions occurring in these solutions.

Introduction :

In recent years acoustic and thermodynamic behavior inmany binary liquid mixtures has been analyzed by several researchers more than 5 decades. The analysis has been adequately employed in understanding the nature of molecular interactions in pure liquids and liquid mixtures.

Ultrasonic propagation parameters yield valuable information regarding the behaviors of liquid systems, because intramolecular and intermolecular association, dipolar interactions, complex formation and related structural changes affect the compressibility of the system which in turnproduces corresponding variations in the ultrasonic velocity. The acoustical and thermodynamical parameters obtained in ultrasonic study show that the ion solvation is accompanied by the destruction or enhancement of thesolvent structure[1-4].Excess thermodynamic properties of liquid mixtures are of great interest to conveniently design industrial processes and also to provide useful information on the molecular interactions required for optimizing thermodynamic models[5]. When two or more liquids are mixed there occur some changes in physical and thermodynamic properties because of free volume change,change in energy and change in molecular orientations.Derived thermodynamic and acousticalparameters like internal pressure, free volume and acoustic impedance are of considerable interest in understanding the intermolecular orientations in binary liquid mixtures[6-8]. Excess thermionic properties of mixtures are useful in the study of molecular orientations and arrangements[9-10].

The scientific investigation in the field ultrasound velocity measurement in3-(2-methoxyphenoxy)-1,2-propanediol drug solution in various solvent system presented. This drug is used as treat coughs and congestion caused by the common cold, bronchitis, and other breathing illnesses infections. The acoustic properties of 3-(2-methoxyphenoxy)-1,2-propanediol have been studied in 20%Acetone -water and 20% Ethanol-water solutions at 308K.

Experimental :

All the studied chemicals which were purchased from S.D. fine chemicals Mumbai, India,with on purityof 99.6% were used as such without further purificationsolvents acetone and ethanol used in the present work were of AR grade. Densities, viscosities and ultrasonic velocities were measured at 308 K over a wide range of composition. The densities were determined by using specific gravity bottle by relative measurement method with accuracy ± $1x10^{5}$ gm. /cm³. The viscosities were measured by precalibrated Ostwald type viscometer. Ultrasonic velocity measurements were made by using an ultrasonic interferometer (Mittal Enterprises, New Delhi) at a frequency of 2MHz with a tolerance of ± 0.005%. All the measurements were carried out at 308 K.

Acoustic parameters-

Acoustic parameters such as apparent molar compressibility (ϕ_k), apparent molar volume (ϕ_v), adiabatic compressibility (β_s), specific acoustic impendence (Z), intermolecular free length (L_f), Limiting apparent molar volume (ϕ^0_v) Limiting apparent molar compressibility (ϕ^0_k)were determined using following relations.

Ultrasonic velocity $u = \lambda n$ ——— 1

Adiabatic compressibility $\beta_s = 1/u^2\rho$ ——— 2

Apparent molar volume $\phi_v = 10^3(\rho_0-\rho)/m\rho\rho_0 + M/\rho$ ——— 3

Apparent molar compressibility $\phi_k = 10^3(\rho_0\beta_s-\rho\beta_{s0})/m\rho\rho_0 + \beta_s M/\rho$ ——— 4

Intermolecular free length $L_f = K(\beta_s)^{1/2}$ ——— 5

Specific acoustic impendence $Z = \rho u$ ——— 6

Limiting apparent molar volume $\phi_v = \phi^0_v + S_v C^{1/2}$ ——— 7

Limiting apparent molar compressibility $\phi_k = \phi^0_k + S_k C^{1/2}$ ——— 8

Table no.1

Experimental Data of Density, Ultrasonic Velocity and Viscosity of 3-(2-methoxyphenoxy)-1,2-propanediol in different solvent at 308K

Solvents	Conc mol dm⁻³	Density ρ kg m⁻³	Ultrasonic Velocity m/s	Viscosity η×10⁻³ Nsm⁻²
20% Acetone-Water Medium	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
20% Ethanol-Water Medium	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]

Table no.2

Variation of some acoustical parameters with concentration of 3-(2-methoxyphenoxy)-1,2-propanediol in different solvents at 308 K

Solvents	Conc mol dm⁻³	β_s ×10⁻¹¹ m²N⁻¹	ϕ_v×10⁻⁴ m³mol⁻¹	ϕ_k×10⁻¹¹ m³mol⁻¹Pa⁻¹	L_f×10⁻¹¹ (m)	Z×10⁵ Kg m⁻² s⁻¹
20% Acetone Water Medium	0.01	4.605	0.99108	90.6286	1.2939	14.74582
	0.008	4.619	1.24135	83.0413	1.2960	14.72175
	0.006	4.637	1.65514	72.[illegible]	1.2983	14.68855
	0.004	4.650	2.48272	65.[illegible]	1.3003	14.66754
	0.002	4.662	4.96543	55.9573	1.3020	14.64617
20% Ethanol Water Medium	0.01	4.571	0.99105	120.8666	1.2894	14.42304
	0.008	4.585	1.24135	124.7388	1.2912	14.39986
	0.006	4.599	1.65514	129.6[illegible]	1.2932	14.37101
	0.004	4.614	2.48272	132.52[illegible]	1.2951	14.34185
	0.002	4.624	4.96543	129.9747	1.2967	14.32347

Table-3

Limiting values of ϕ_v and ϕ_k along with slope (S_v&S_k) for 3-(2-methoxyphenoxy)-1,2-propanediolin different medium at 308K temperature

Temp T(K)	Medium	Parameters			
		ϕ^0_v×10⁻⁴ m³mol⁻¹	ϕ^0_k×10⁻¹¹ m³mol⁻¹pa⁻¹	S_v×10 m³mol⁻³/²dm³/²	S_k×10⁻¹¹ m³mol⁻³/²dm³/²pa⁻¹
308K	20% Acetone-W	12.258	-23.11	623.1	185.7
	20% Ethanol-W	11.698	521.2	46.22	-1258.1

Table-4

A and B, coefficient values at 308K in different medium for3-(2-methoxyphenoxy)-1,2-propanediol

Medium	Coefficient	Temp 308 K
20% Acetone-Water medium	A	0.512
	B	-0.112
20% Ethanol-Water medium	A	0.486
	B	-0.115

Results and discussion:

Table 1 shows that ultrasonic velocity (u),density (ρ), and viscosity (η) increases with increase in concentration for all systems. The increase in ultrasonic velocity is due to decrease in intermolecular free length (L_f) as shown in table 2. This suggests that there is a strong interaction between 3-(2-methoxyphenoxy)-1,2-propanedioland solvent molecule. Adiabatic compressibility (β_s) is a measure of intermolecular association or repulsion calculated from the measured ultrasonic velocity (u) and density (ρ). Adiabatic compressibility is found to decrease with increase in concentration. Since adiabatic

compressibility is inversely related to the product of density and ultrasonic velocity based on this the compressibility is expected to decrease which has observed in the present case. When the sound waves travels through the solution, certain part of it travels through the medium and rest gets reflected by the ion[11] i.e. restriction for flow of sound velocity by the ions. The character that determines the restriction movement of sound waves is known as acoustic impendence (Z). It has been found that acoustic impendence increases with increase in concentration. The apparent molar compressibility ($_k$) explains the solute-solvent and solute-solute interactions in solution and was calculated by using the equation no. 4. The apparent molar volume (ϕ_v) is defined as the change in volume of solution for the added one mole of a particular component at constant temperature and pressure. It is thermodynamic property which helps in elucidating solvation behavior of electrolyte in solution. Apparent molar volume was evaluated from the density of solution and solvent.

It is evident from the table 3 that ϕ^0_k values are negative for 20% Acetone-water and for 20%Ethanol-water ϕ^0_k values are positive. The negative ϕ^0_k values are suggest solute- solvent interaction whereas positive values are due to solute- solute interaction, is further confirmed by ϕ^0_v values which are positive for both solution 20% Ethanol-water and for 20% Acetone-water of the drug. S_v is a measure of solute – solvent interaction. It is observed from the table 3 that S_v values are higher in 20% Acetone-water and low in 20% Ethanol-water solution. This confirms that in 20% Ethanol-water solution solute-solute interactions and in20% Acetone-water solute – solvent interaction predominate.

The viscosity B-Co-efficient has been derived from Jones-Dole equation

$(c > 0.1m)\eta_r - 1 / C^{1/2} = A + B\ C^{1/2}$

Where η_r is the relative viscosity. A and B are the characteristics of the solute and solvent. A is Falkenhagen coefficient represent the contributor from solute-solute interaction and B is Jones Dole coefficient known to depend on the size of the solute particle and on the interaction between solute and solvent.

They were obtained by a least – squares treatment as intercept and slope of the linear plot of $\eta_r - 1 / C^{1/2}$ Vs $C^{1/2}$. The graph for each system given linear straight line showing validity of Jones-Dole equation. The slope of straight line gives value of B co-efficient.

The viscosity A coefficient represent the ion-ion interactions and negative values have shown some physical significance. However negative A values have also been reported to be in other solvents in some studies.[22-23]

The large and small value of 'A' shows the stronger and weaker solute – solute interactions respectively. When solute is introduced into solvent of organic-water mixture it will interfere with the ordered structure of water in the solutes co-sphere. As only one solute is present so such variation in the values of A can be explained.

In the present study viscosity of liquid solutions increases with increase in concentration of drugs solution in 20% Acetone -water 20% ethanol-water mixture. The increase in viscosity with increase in concentration may be attributed to the increase in solute solvent interactions.

Viscosity B coefficients have been established to arise from ion- solvent interactions and are responsible for introducing order or disorder in the structure of the solvent.. Solute with negative B Coefficient is characterized as structure breakers indicating weak solute-solvent interactions. Such type of results is also shown by Reddy et al.[24-26]

REFERENCES

1. Ali, A., Nair, A.K., Shaner, V.K., Ahmed, S., 2004. Study of molecular interaction in ternary mixtures through ultrasonic speed measurements.

Phys. Chem. Liq. 42 (2), 375–383.
2. S. C. Bhatt, R. S. Rawat and B. S. Semwal, Acoustical investigation on some binary organic liquids, Journal of the Acoustical Society of India, vol. 27, pp. 297-300, 1999
3. N. Karunanidhi, D. Subramanian and P. Aruna, Acoustical parameters of binary liquidmixtures, Journal of the Acoustical Society of India, vol.27, pp.305-307, 1999.
4. ¼Dhondge, S.S.,Paliwal, R.L.,Bhane, N.S.,Pandhurnekar, C.P.,2012.Study of the rmodynamic properties of aqueous binary mixtures of glycine, l-alanineand β-alanine at low temperatures (T275.15,279.15, and 283.15) K.J.Chem.Thermodynamics 43,114–121.
5. Farid B. Belaribi, Ghenima Boukais-Belaribi, Amir H. Mohammadi, and Dominique Richon, J. Chem. Eng.Data, vol.55, pp.303307, 2010.
6. S. Thirumaran& J. Earnest Jayakumar, Ultrasonic study of nalkanols in to lune with nitrobenzene, Indian Journal of Pure & Applied Physics, vol.47, pp.265-272, 2009.
7. Pankaj K.Singh and S. C. Bhatt, Investigation of acoustical parameters of polyvinyl acetate, Applied PhysicsResearch, vol.2, no.1, pp.35-38, 2010
8. A. Tadkalkar, P. Pawar, G. K. Bichile, Studies of acoustic and thermodynamic properties of citric acid in double distilled water at different temperatures, J. Chem. Pharm. Res., vol.3, pp.165168, 2011.
9. T. Sumathi, S. Priyatharshini& S. Punithasri, Physico-chemical and excess properties of ketones with propanol and cyclohexane by measurement of ultrasonic speed, Indian Journal of Pure & Applied Physics, vol.49, pp.328-334, 2011
10. J. N. Ramteke, Ultrasonic study of molecular interaction in binary liquid mixture containing α-picolin in ethanol at 301.15K and 305.15K, Advances in applied science research, vol.3, no.3, pp.1832-1835, 2012.
11. D Bala Karuna Kumr, K Rayapa Reddy, G Srinivasa Rao, G V Rama Rao and C Rambabu, Ultrasonicinvestigation of molecular associations in the binary mixtures of NMP with substituted benzenes at 308.15, 318.15K and atmospheric pressure, J. Chem. Pharm. Res.,vol.3, no.5, pp.274-280, 2011.
12. G. Sridevi, International journal of Research in Chemistry and Environment, vol.3, no.3, pp.70-80, 2013
13. Pal,A., Kumar, S., 2004. Viscometri can dvolumetric studies of some aminoa cidsin binary aqueous solutions of ureaatvarious temperatures.J.Mol.Liq.109,23–31.
14. þþ Santhosh, M.S., Krishna Bhat, D.,2011. Excessand deviation properties of (glycylglycine ZnCl2) in aqueous methonal mixtures. J.Chem. Ther modynamics. 43,622–626.
15. Syal, V.K., Gautham, R., Chouhan, R., 1998. Ultrasonic velocity measurements of Sucrosein binary solvent mixtures of waterAcetonitrile at 25, 35 and 450 C, Ind. J.Pur.Appl.Phys.36,108
16. Rathnam,M.V., Mankumare,S.,Jain, K.,Kumar, M.S.,2012.Densities, viscosities and speeds of sound of binary mixtures of ethylbenzoate hydrocarbonsat (303.15,308.15 and 313.15)K.J.Solut.Chem.41,475–490

❑❑❑