IRJSE *Int. Res. J. of Science & Engineering,* 2020; Special Issue A7: 864-868 SJIF Impact Factor 6.68
ISSN: 2322-0015
RESEARCH ARTICLE **OPEN ACCESS**

Comparative Studies of Dichlofenac Sodium and (Paracetamol+DichlofenacSodium) Ultrasonically at 303.15k.

Dhote Aparna B[1], Aswale Sunanda S[2], Aswale Shashikant R[2]

[1]Nilkanthrao Shinde College, Bhadrawati, Dist. Chandrapur, Maharashtra.
[2]Lokmanya Tilak Mahavidyalaya, Wani, Dist. Yavatmal, Maharashtra.
Email: dhotea@rocketmail.com

Manuscript Details
Available online on http://www.irjse.in
ISSN: 2322-0015

Cite this article as:
Dhote Aparna B et al. Comparative Studies of Dichlofenac Sodium and (Paracetamol+DichlofenacSodium) Ultrasonically at 303.15k., *Int. Res. Journal of Science & Engineering,* February, 2020, Special Issue A7 : 864-868.

ABSTRACT
The Density (ρ), Viscosity(η) and Ultrasonic velocity (U) in aqeous solution of dichlofenac sodium and mixture of paracetamol + dichlofenac sodium have been measured at 303K using an ultrasonic interferometer at 2MHz frequency. The intermolecular free length decreases with decreases of temperature and hence the close packing of molecules which in effect decreases the sound velocity. From these experimental data, the , parameters such as adiabatic compressibility, intermolecular free length, acoustic impedance, have been computed. From these parameters extent of molecular interaction in aqueous solution will be predicted which is helpful to predict reactivity of the drug.

Keywords: dichlofenac sodium, adiabatic compressibility, reactivity, acoustical

INTRODUCTION

Ultrasonic velocity measurements and other acoustical parameters of liquid mixtures are the powerful technique in the understanding of chemical nature and the molecular interactions[1-4]. Many researchers used ultrasonic velocity measurement for studying solute-solvent interaction in a number of system including organic liquid , dilute solutions in organic acidsand complexes [5-7]. Ultrasonic study of molecular interactions in binary liquidmixtures is widely useful in industrial and biological process. Molecular interaction study found useful application in pharmaceutical industries.

The intermolecular free length (Lf) is an important physical property of liquid mixtures which mainly affects the sound velocity. The intermolecular free length decreases with decreases of temperature and hence the close packing of molecules which in effect decreases the sound velocity [8-9]. Paracetamol, also known as acetaminophen and APAP, is a medication used to treat pain and fever.[10-11] It is typically used for mild to moderate pain relief.[10] Diclofenac, is a nonsteroidal anti-inflammatory drug (NSAID) used to treat pain and inflammatory diseases.

In the present study we will measure ultrasonic velocity density , viscosity of aqueous solution dichlofenac sodium and mixture of paracetamol and dichlofenac sodium at different concentrations at 303K. From these data acoustical parameterssuch as adiabatic compressibility, intermolecular free length, acoustic impedance will be calculated. The effect of concentration on molecular interaction will be predicted which is helpful for predicting the reactivity of the drug.

METHODOLOGY

The chemicals used were of analytical grade. Double distilled water was used for preparation of solutions. A special thermostatic water bath arrangement was made for density, ultrasonic velocity and viscosity measurements, in which continuous stirring of water was carried out with the help of electric stirrer and temperature variation was maintained within ± 0.010C Single crystal interferometer (Mittal Enterprises, Model F-81) with accuracy of ± 0.03% and frequency 2 MHz was used in the present work for measurement of ultrasonic velocities of solutions. Densities of solutions were measured using specific gravity bottle of 10 ml volume. These values were accurate up to ± 0.1 kg/m3. All the weighing was made on Roy CCB-4 digital electronic balance having an accuracy of ± 0.001g. Viscosities of the solution were measured by Ostwald's viscometer.

RESULTS AND DISCUSSION

Adiabatic compressibility was calculated by using the equation

$$\beta = 1/v^2.d \quad .....(1)$$

Intermolecular free length (Lf) is one of the important acoustic properties to study the intermolecular interactions. It has been evaluated from adiabatic compressibility (□) by Jacobson's formula,

$$Lf = K\beta^{1/2} \quad ……..(2)$$

Specific acoustic impedance is determined from equations,

$$Z = vs.ds \quad .....(3)$$

From table 1and2 and fig.1 it shows that ultrasonic velocity increases with increase in concentration . But ultrasonic velocity is more in the aqueous solution mixture of paracetamol and dichlofenac sodium than that of pure dichlofenac sodium.Lagemann and Duban [12] were the first to point out the ultrasonic velocity approach for qualitative estimation of the interaction in liquids. Molecular interactions depend on the strength of the repulsive forces acting among solvent and solute molecules and hence intermolecular motion is affected accordingly[13]. Attractive forces result into molecular association. As in the solution of mixture of paracetamol and dichlofenac sodium more is the attraction between solute and solvent more is the association and hence strong solute solvent interaction exist in the solution .

The change in adiabatic compressibility value in liquids and liquid mixtures may be ascribed to the strength of intermolecular attraction. The effect of depolymerization increases the compressibility of the system [14] . Adibatic compressibility decreases with increasing concentration. In the solution of mixture of paracetamol and dichlofenac sodium more is cohesion exists which leads to formation of hydrogen bonding so strong molecular interaction between solute and solvent observed in it. It is shown in fig 2.

The intermolecular free length is the distance between the surfaces of the neighboring molecules. The interdependence of intermolecular free length and ultrasonic velocity was evolved from a model for sound propagation proposed by Kincaid and Eyring [15]. From fig.3 it shows that free length

decreases with increase in concentration in the solution of mixture of paracetamol and dichlofenac sodium indicates strong molecular interaction betwee solute and solvent. Acoustic impedance is more in mixture of paracetamol and dichlofenac sodium shows strong solute solvent interaction in the solution.

Table 1: Utrasonic velocity, density ,viscosity, Adiabatic compressibilit Intermolecular free Specific acoustic impedance of dichlofenac sodium at 303K

Concentration (M)	Ultrasonic Velocity (m/s)	Density (Kg/m^3)	Viscosity $\eta x10^{-3}$ (NSm^{-2})	Adiabatic compressibility $\beta x10^{-10}$	Intermolecular free length L_f (A^0)	Specific acoustic impedance $Z*10^4$
0.001	1524.48	1009.61	0.8215	4.26	0.0129	153.9130
0.01	1563.58	1020.58	0.8567	4.00	0.0125	159.5758
0.1	1601.30	1038.83	0.9642	3.75	0.0121	166.3478

Table 2: Utrasonic velocity, density ,viscosity, Adiabatic compressibilit Intermolecular free Specific acoustic impedance (paracetamol +dichlofenac sodium) at 303K

Concentration (M)	Ultrasonic Velocity (m/s)	Density (Kg/m^3)	Viscosity $\eta x10^{-3}$ (NSm^{-2})	Adiabatic compressibility $\beta x10^{-10}$	Intermolecular free length L_f (A^0)	Specific acoustic mpedance $Z*10^4$
0.001	1564.28	1020.51	0.8655	4.004	0.0125	159.6363
0.01	1585.38	1024.58	0.8827	3.883	0.0123	162.4348
0.1	1616.40	1041.83	0.9312	3.673	0.0120	168.4014

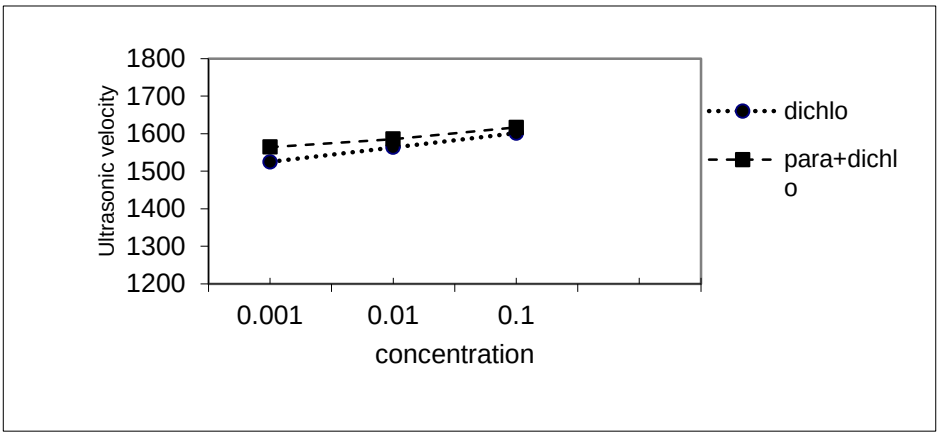

Fig:1 Ultrasonic velocities of Dichlofenac sodium and (Paracetamol+ Dichlofenac sodium)

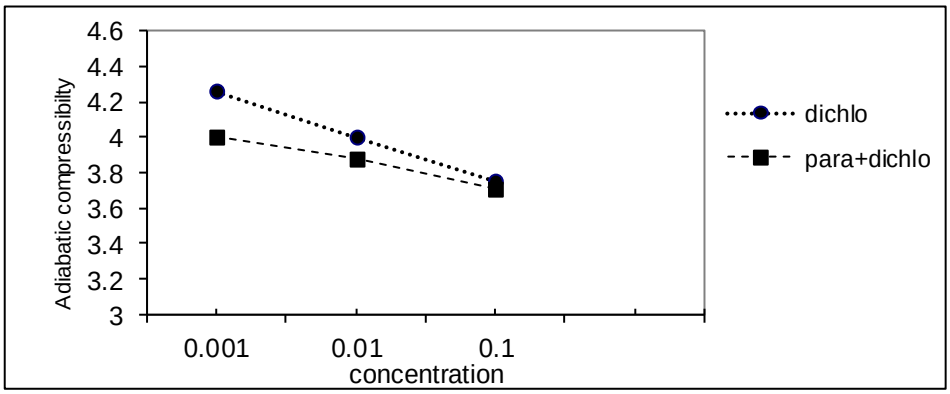

Fig:2

Adiabatic compressibity of Dichlofenac sodium and (Paracetamol+ Dichlofenac sodium)

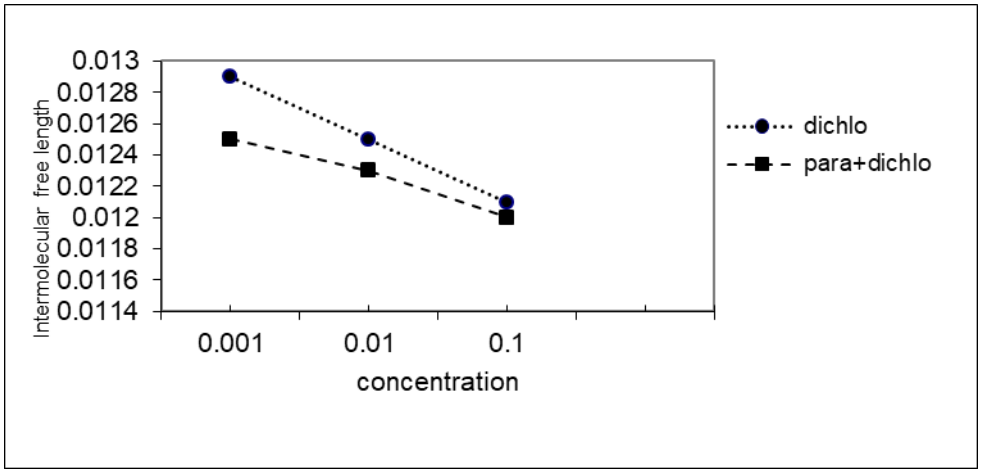

Fig:3 Intermolecular free length of Dichlofenac sodium and (Paracetamol+ Dichlofenac sodium)

CONCLUSION

From ultrasonic velocity, density ,viscosity, values and acoustical parameters it shows that strong solute solvent molecular interaction exist in the solution of mixture of paracetamol and dichlofenac sodium .

Conflicts of interest: The authors stated that no conflicts of interest.

REFERENCES

1. ParveenS., Shukla Divya , Singh Shashi ,.Singh K.P , Gupta Manisha and Shukla J.P., Ultrasonic velocity, density, viscosity and their excess parameters of the binary mixtures of tetrahydrofuran with methanol and o-cresol at varying temperatures, App. Acous.,70(3),507 2009.
2. Umadevi M. , Kesavasamy R. .Rathina K. and Mahalakshmi R., 'Studies on liquid-liquid interactions ofsome ternary mixtures by density, viscosity and ultrasonicspeed measurements', J. Mol. Liq., 219,820 2016.
3. Nayak N., Aralaguppi M.I. , and Aminabhavi T.M., Density, viscosity, refractive index, and speed of sound in the binary mixtures of 1,4-dioxane + ethyl acetoacetate, + diethyl oxalate, + diethyl phthalate, or + dioctyl phthalate at 298.15, 303.15, and 308.15 K, Journal of Chemical and Engineering Data, 48, (6), 1489–1494, 2003.
4. Steele W. V., Chirico R. D. , Cowell A. B., Knipmeyer S. E., and Nguyen A, Thermodynamic properties and ideal-gas enthalpies of formation for methyl benzoate, ethyl benzoate, (R)-(+)-limonene, tert-amyl methyl ether, trans-crotonaldehyde, and diethylene glycol, Journal of Chemical and Engineering Data, vol. 47, no. 4, pp. 667–688, 2002.
5. Reis, J.C.R., Santos, A.F.S., Disas, F.A., Lampreia, I.M.S.: Correlated volume fluctuations in binary liquid mixtures from isothermal compressions at 298.15 K. Chem. Phys. Chem. 9, 1178–1188 ,2008.
6. Khasanshin, T.S., Shchemelev, A.P.: The thermodynamic properties of n-tetradecane in liquid state. High Temp. 40(2), 207–211 (2002)7 T. N. Srivastava, R. P. Singh and B. Swaroop, Ind. J. Pure Phys., 21, 67-72 1983.
7. Kumar, A., Srivastava, U., Singh, A.K., Srivastava, K., Shukla, R.K.: Sound velocity and isentropic compressibility of binary liquid systems from various theoretical models at temperature range 293.15 to 313.15 K. Can. Chem. Trans. 4(2), 157–167 (2016)9
8. Ali. A., and Nain.A.K., Ultrasonic studies of formamide + 1,2-ethanediol and sodium iodide + formamide + 1,2-ethanediol mixtures at 298.15 K, Indian J. Pure Appl. Phys., 35, 729,1997.
9. Jayakumar. S., Karunanidhi, N, and Kannappan. V, Ultrasonic study of molecular interaction in binary liquid mixtures .Indian J. Pure & Appl. Phys., 34 , 761, 1996.
10. Acetaminophen". The American Society of Health-System Pharmacists. Archived from the original on 5 June 2016.

11. Lee, WM Acetaminophen (APAP) hepatotoxicity-Isn't it time for APAP to go away?". Journal of Hepatology. 67 (6): 1324–1331, 2017.
12. R. T. Lagemann and W. S. Duban, Journal of Chemical Physics, vol. 49, p. 423, 1945.
13. Kulkarni S. S. and Khadke U. V., Effect of Solvents on the Ultrasonic Velocity and Acoustic Parameters of Polyvinylidene Fluoride Solutions, Indian Journal of Materials Science, 1-6, 2016.
14. M. V. Kaulgud and K. J. Patil, Acustica, vol. 28, p. 130, 1973.
15. J. F. Kincaid and H. Eyring, "Free volumes and free angle ratios of molecules in liquids," The Journal of Chemical Physics, 6 (10),. 620–629, 1938.