International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
© 2021 | IJSRST | Volume 8 - Issue 1

A Parametric Study of Acoustical Properties of Salicylamide Drug at Different Temperature

Sanjay P Ramteke
Department of Physics, S. P. College, Chandrapur, Maharashtra, India

ABSTRACT

This research paper is to pin out the various molecular interactions of molecules in the alcoholic salicylamide drug at the different temperature. Evaluations of molecular interactions of alcoholic salicylamide drug at different temperature have been investigated under ultrasonic technique at 2MHz. Ultrasonic data of drug solutions has been estimated at various desired thermo-acoustical parameters. A significant existence of solute-solvent and solute-solute interactions present in the system. Hence it is evident that the ultrasonic velocity measurement in the given medium serves as a careful probe in characterizing the physico-chemical properties of the medium

This research paper has said the various types of possible molecular interaction in the drug solution. This investigation has been thoroughly analyzed and eventually interpreted at the possible molecular interactions such as structure making and structure breaking effect and also solute-solvent, ionic interaction, H-bonding effect in the alcoholic salicylamide drug solution. The results obtained from these studies can thus be helpful for pharmacological application of drugs.

Keywords : Ultrasonic velocity, Density and Acoustical parameters, Salicylamide drug, Alcohol

I. INTRODUCTION

In the pharmaceutical and chemical industries, the wide application of ultrasound to promote Chemical processes. The physical and chemical interaction of ultrasound with molecular species has been thoroughly studied (1,2) and is an important tool for promoting reactions used for synthetic and medicinal chemistry as well as for improving drug extraction processes (3-6). Ultrasound is being explored to solve pharmaceutical manufacturing and formulation issues (7) dispersion of solids, the deagglomeration of solids in liquid and the preparation of colloids. In addition, ultrasound has been used in the development of novel catalysts, nanomaterials, nanocrystals and nanoscale catalysts (8-10). Diagnostic imaging is the most widespread medical application of ultrasound.

The wide ultrasonic sense has been adequately employed in understanding the nature of molecular interactions in pure liquids and liquid mixtures. The ultrasonic characterizations are highly sensitive to molecular interactions and used to demonstrate qualitative nature and strength of molecular interaction in the drug solution [11-14]. Incorporating the pharmacokinetics and pharmacodynamics play vital role in medicine and drug chemistry to carry out the interferometry, isometric and refractometric measurements [15, 16]. This information deals with the transport properties of drugs and ion-solvent

interactions. Drug action is the ultimate consequence of physico-chemical interaction between drug and receptor. The results ultimately zero in on the dipole association, inter-molecular attraction between the solute and solvent, dielectric constant of the medium, polarizability and mutual compensation of dipoles. It also directs transmission stability, its activity and effect of drug [17-19]. Alcohols are strongly self-associating and polar behavior of attraction with any other such a group of compound. Alcohols and aromatic compounds exist as associated structures in liquid state. Thus interaction of drug with alcohols give interesting properties arising from charge-transfer, dipole-dipole, donor-acceptor and hydrogen bonding may be observed.

These research paper thermo-acoustic parameters of the mixture of salicylamide and butanol are examined at various temperature ranges i.e. 278.15K-293.15K. Explore the various interactions and their subsequent consequence on transport properties of salicylamide drug. The research of physicochemical activities of drug can be the great attention from academic as well as physiological intellect [20-23].

II. METHODS AND MATERIAL

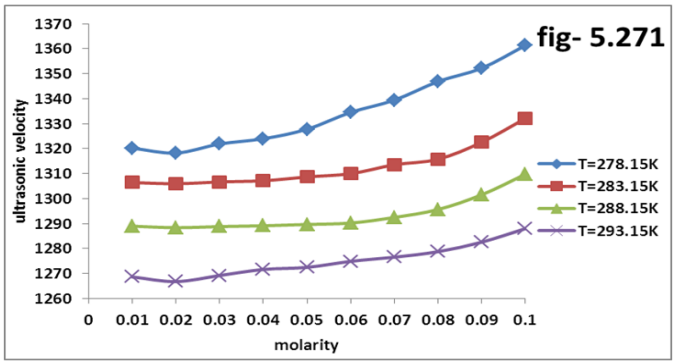
The solvents alcohols like butanol and analgesic drug salicylamidel were used AR grade (E-Merck chemicals, Germany) without further purification. The purity of chemicals has been verified out by comparing the ultrasonic data with standard literature value [24]. The measurement of ultrasonic parameter of the solution by using ultrasonic interferometer supplied by Vi-Micro system, Chennai (Model VCT: 71) having frequency at 2 MHz with an accuracy of 0.0001 m/s. The densities are measured using 10 ml specific gravity bottle. Specific gravity bottle having accuracy of ± 2 $X10^{-2}$ kg/m^3.Automatic temperature controller water bath supplied by Lab-Hosp Company Mumbai having an accuracy ±1K temperature. Viscosities were measured at particular temperature by using Oswald's viscometer; the calibration of viscometer by using doubled distilled water with literature value. The time rate of doubled distilled water and experimental mixture are measured with digital stop clock having accuracy of 0.01 sec (Model: RACER- 10W).Weights were measured with an electronic digital balance (Contech CA-34) having accuracy 0.0001gm. Such a set up make use of to determine the ultrasonic and thermo-acoustic evaluation in butanol and salicylamide at T=278.15K-293.15K at various molar range.

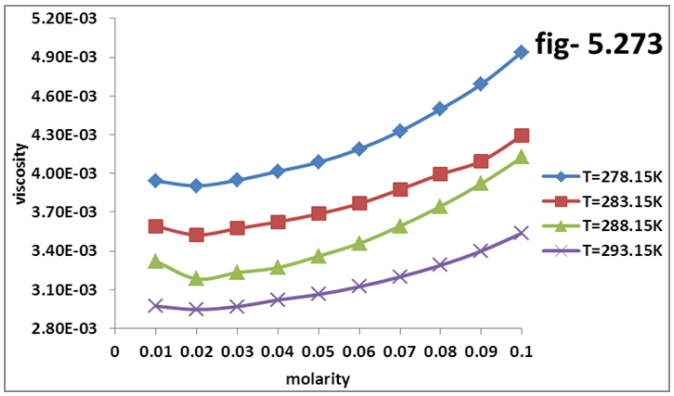
Ultrasonic and thermo-acoustic parameters are formulizing as follows:

Adiabatic Compressibility $(\beta) = 1 / U^2\rho$ ..... (1)
Specific Acoustic Impedance $(Z) = U\rho$..... (2)
Intermolecular Free Length $(L_f) = K_T \beta^{1/2}$ ..... (3)
Relaxation Time $(\tau) = (4/3)*\beta*\eta$..... (4)
Relative association $(Ra) = (\rho/\rho_0)(U_0/U)^{1/3}$ ..... (5)
Classical Absorption $(\alpha/f^2) = (8\pi^2\eta)/(3U\rho)$ ..... (6)
Internal Pressure $(P) = bRT(K\eta/U)^{1/2}x(\rho^{2/3}/M^{7/6}eff)$. (7)
Free Volume $(V_f) = (M_{eff}U/\eta K)^{3/2}$ .....(8)
Molar volume $(Vm) = Meff/\rho$..... (9)
Molar Sound Velocity or Rao Constant $(R) = Meff/\rho(U)^{1/3}$. (10)
Molar compressibility or Wada constant $(W) = V\beta^{-1/7}$..... (11)
Isothermal Compressibility $(\beta i) = \gamma\beta$..... (12)
Surface Tension $(\sigma) = (6.3 \times 10^{-4})\rho U^{3/2}$ ..... (13)

Data interpretation by graphical tactic as follows

Following figures are various ultrasonic and thermo-acoustic parameters V/S molarity





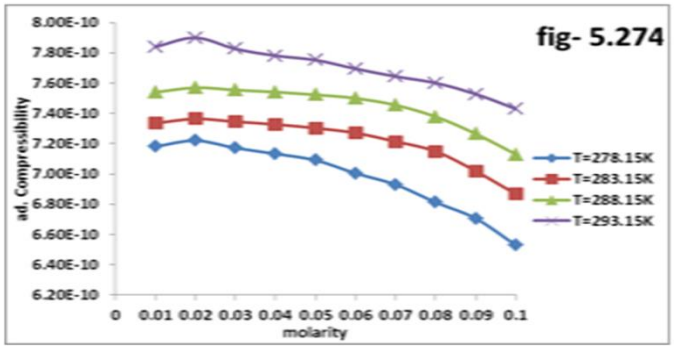


fig- 5.274
ad. Compressibility
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

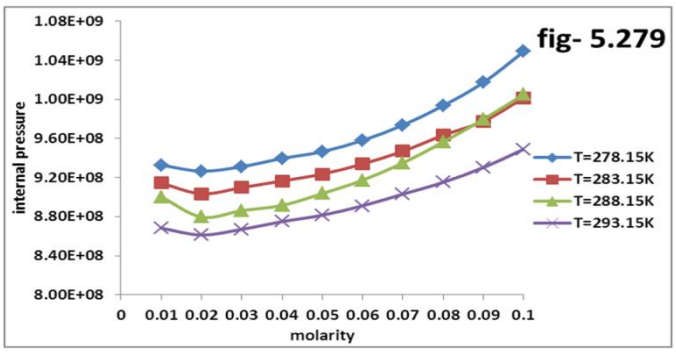


fig- 5.279
internal pressure
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

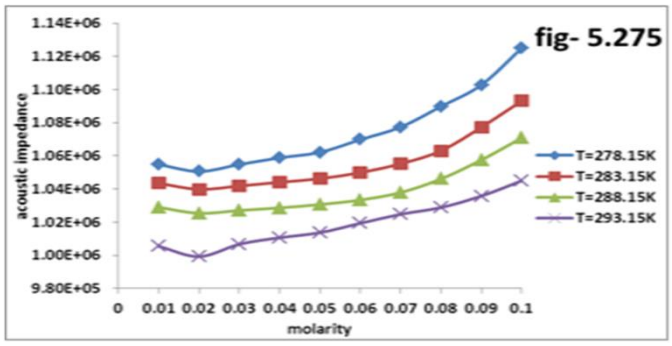


fig- 5.275
acoustic impedance
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

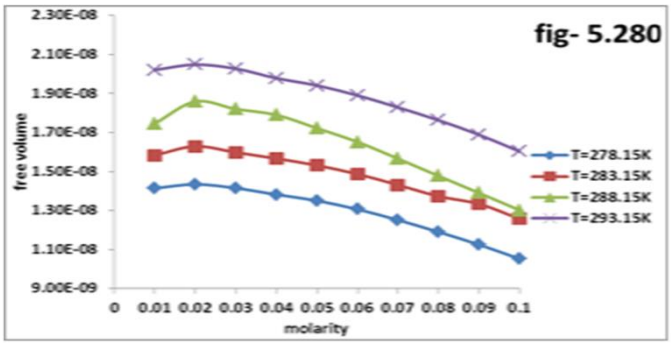


fig- 5.280
free volume
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

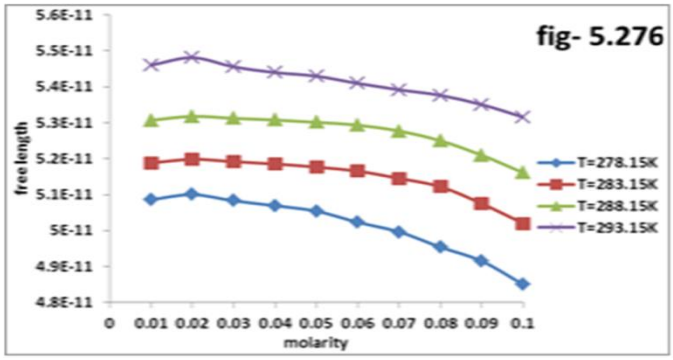


fig- 5.276
free length
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

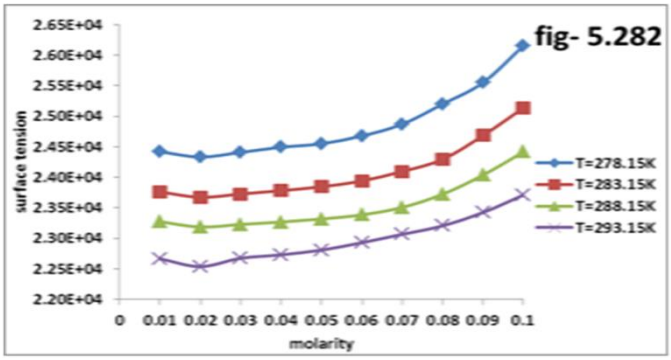


fig- 5.282
surface tension
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

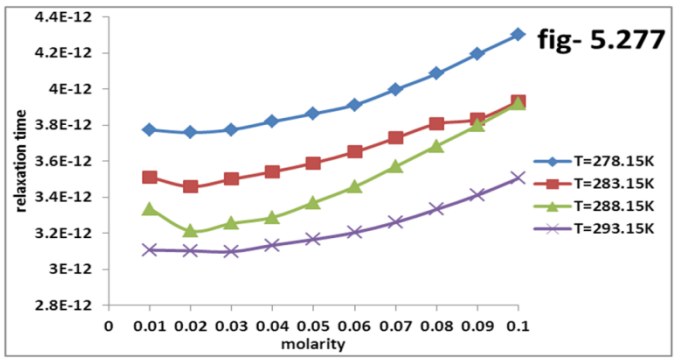


fig- 5.277
relaxation time
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

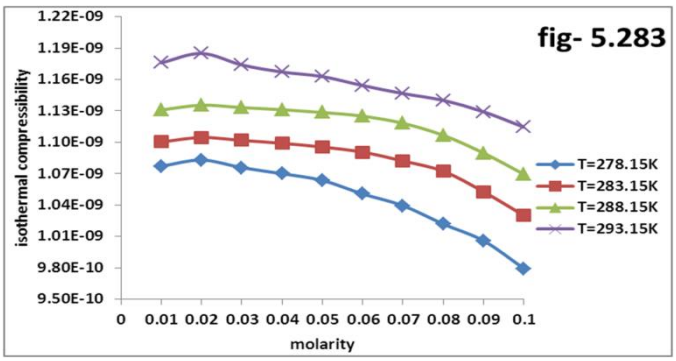


fig- 5.283
isothermal compressibility
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

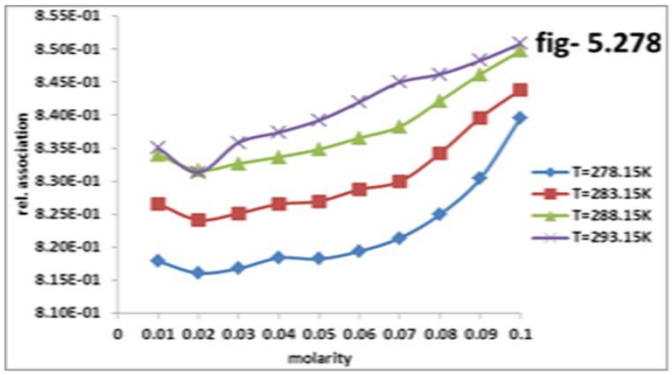


fig- 5.278
rel. association
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

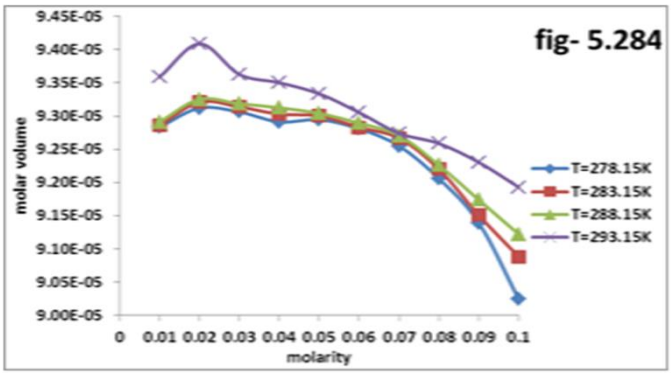
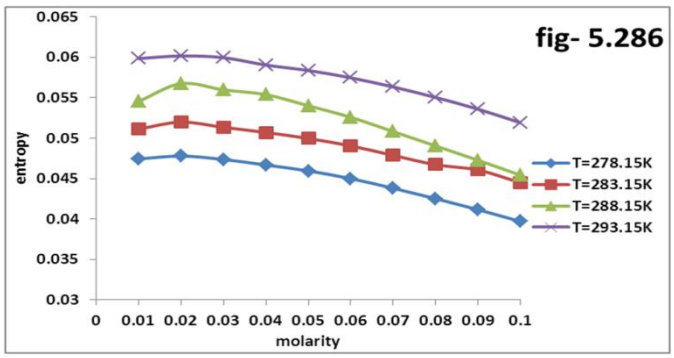
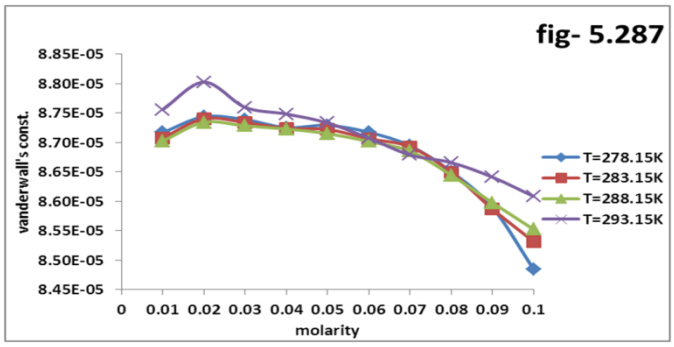


fig- 5.284
molar volume
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K





III. RESULTS AND DISCUSSION

The outcome of experiments analyzed by Ultrasonic and allied parameters with different concentration of salicylamide with butanol at temperature T=278.15K-293.15K it has been revealed graphically. Nonlinear sense of ultrasonic velocity with increase in mole fraction of salicylamide gives the dipole-dipole interaction or hydrogen bonded complex structure between unlike molecules which leads to increase in sound velocity and decrease in compressibility. At low molarities, the number of hydrogen bonds formed may less and at high molarities it may more because of solute-solute interactions and it forms a tightly bounded system. Adiabatic compressibility is a wide measure of intermolecular association or dissociation or repulsion. Free length decreases as the mole concentration increases; these considerable interactions between solute and solvent molecules.

Ultrasonic velocity rises on decrease in free length and vice-versa. A sudden decrease in molecular free length shows a tightly packing molecules or strong interaction. Increase behavior of acoustic impedance with molarities may provide the strength of inter molecular interaction so it reveal on the basis of the interaction between solute and solvent molecules. The linear changes of Relative association observe the particular interaction exists in the solution and quite it is strong in nature. Internal pressure gives an outstanding examination of the solution phenomenon and evaluating various properties of the liquid state. The changes in the internal energy of liquid mixtures, it seems to undergo a very small isothermal change. So it is a measure of cohesive or binding forces between solute and solvent molecules. The internal pressure may provide essential information regarding the nature and strength of forces exist between the molecules. The variation of surface tension also supports the significant associative nature in the solution.

Loss of di-polar associating nature and difference in size and shape of the molecules, which provide to decrease in velocity and increase in compressibility. Increase in the compressibility value indicates the weakening of molecular interactions. The positive value of entropy indicates the reaction must be spontaneous process of flipping of molecule over each other. Increase in temperature of drug solution increases the disorder of the molecules; hence there is a reduction in molecular interaction and cohesive forces between the molecules. Effect of temperature produced destruction in hydrogen bonding between the molecules and hence weakens the molecular interaction. As the effect of this drug solution behaves dissociative nature

IV. CONCLUSION

The outcome of ultrasonic measurements reveals knowledge of a number of the thermophysical properties towards the strong intermolecular interaction provides the structure making property in the liquid mixture. The various kinds of intermolecular interactions are the micro analysis of the drug in terms of solute-solute, solute-solvent, ion-ion, dipole-dipole interactions which can directly signify the utility of the drug.

V. REFERENCES

[1]. Knights K, Bryant B (2002). Pharmacology for Health Professionals. Amsterdam: Elsevier. ISBN 0-7295-3664-5.

[2]. Chilowski C, Langevin P, inventors. Production of submarine signals and the location of submarine objects 1923.

[3]. Flannigan DJ, Suslick KS. Plasma formation and temperature measurement during single-bubble cavitation Nature 2005 Mar 3;434(7029):52-55.

[4]. Skauen DM. Some pharmaceutical applications of ultrasonics J Pharm Sci 1967 Nov;56(11):1373-1385.

[5]. Shirsath SR, Sonawane SH, Gogate PR. Intensification of extraction of natural products using ultrasonic irradiations:A review of current status. Chemical Engineering and Processing: Process Intensification 2012 /3;53(0):10-23.

[6]. Higgins DM, Skauen DM. Influence of power on quality of emulsions prepared by ultrasound J Pharm Sci 1972 Oct;61(10):1567-1570.

[7]. Mason TJ. Ultrasound in synthetic organic chemistry. Chem Soc Rev 1997;26(6):443-451.

[8]. Shah RB, Zidan AS, Funck T, Tawakkul MA, Nguyenpho A, Khan MA. Quality by design: characterization of self-nano-emulsified drug delivery systems (SNEDDs) using ultrasonic resonator technology Int J Pharm 2007 Aug 16;341(1-2):189-194.

[9]. Skrabalak SE, Suslick KS. Porous MoS2 synthesized by ultrasonic spray pyrolysis J Am Chem Soc 2005 Jul 20;127(28):9990-9991.

[10]. Hill CR, Bamber JC. Methodology for clinical investigation. Physical Principles of Medical Ultrasonics, Second Edition 2004:255-302.

[11]. Essentials of Pharmacology, Surender Singh, General Pharmacology (Academa publishers), 1st edition, 2004.

[12]. K.D.Tripathi, Essentials of Medical Pharmacology, 4th Edn.,Jaypee Brothers Medical Pub.New Delhi,(1999).

[13]. A Kar, Medicinal Chemistry (Wiley Eastern Ltd.), 1993.

[14]. S. Nagar, H. Singh, J. Med Chem.;,Vol.16, pp.178-180, 2007.

[15]. Kannappan A.N. and Rajendran V., Ind.J. Pure & Appl. Phys. 29, 451.1991.

[16]. Kannappan A.N. and Rajendran V., Ind.J. Pure & Appl. Phys., 30, 240.1992.

[17]. Manoj Ku. Praharaj,Abhiram Satapathy and Prativarani Mishra, International Journal of

[18]. Chemical and Pharmaceutical Sciences Vol.3 (3),pp.6-14,2012.

[19]. S.Jain, D. Bhambi, G.L. Talesara, Ind. J. Pharm. Sci.,Vol.69(1), pp.28-32. 2007.

[20]. M. Garcia, V. Morgante, M. Perez, P. Noe, Indian J Chem; Vol.11(5), pp.589,2008.

[21]. Syal, V.K., S. chauhan and P. Sharma, J. of Electrochem Soc. India 1(53),2004.

[22]. Saneel K. Thakur and Shivani Chauhan J. Chem. Pharm. Res. 3(2):657-664,2011.

[23]. Weast, R.C CRC Hanbook of Chemistry and Physics, 51st.Edn.(CRC Press, Cleaveland),C-405,1970.

[24]. Wankhede, D.S., Lande M.K and Arbad B.R. Jof Chem Engg Data,50:260,2005.