International Journal of Applied Research 2016; 2(8): 301-304

ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2016; 2(8): 301-304
www.allresearchjournal.com
Received: 15-06-2016
Accepted: 15-07-2016

Chouhan MS
Department of Chemistry, Shri Ambika Adarsh College, Badnawar, Madhya Pradesh, India.

Chouhan RS
Department of Physics, Yash College, Badnawar, Madhya Pradesh, India.

Patil BR
Department of Chemistry, Government Girls College, Dhar, Madhya Pradesh, India.

Modi K
Department of Chemistry, P.M.B. Gujarati College, Indore, Madhya Pradesh, India.

Shrivastava BD
Department of Physics, Government P.G. College, Bioara, Madhya Pradesh, India.

Phadke S
Department of Physics, Government Girls College, Dhar, Madhya Pradesh, India.

Patil S
Department of Chemistry, Government P.G. College, Dhar, Madhya Pradesh, India.

Correspondence
Chouhan MS
Department of Chemistry, Shri Ambika Adarsh College, Badnawar, Madhya Pradesh, India.

Ultrasonic investigation of Aloe Vera juice, water, ethanol, n-Butanol and acetic acid at 298K temperature and 2MHz frequency by NDT

Chouhan MS, Chouhan RS, Patil BR, Modi K, Shrivastava BD, Phadke S and Patil S

Abstract
Ultrasonic investigation has become very popular tool nowadays. It is based on Nondestructive Testing[1-2] (NDT). Ultrasonic study has proved to be beneficial in understanding the chemical behavior of the particular system. Present study of pure Aloe Vera *barbadensis Miller* Juice (AV Juice) and some common solvents[3] such as Water, Ethanol (EtOH), n-Butanol (n-BuOH) and Acetic acid is important due to its wide range of application in medicinal and industrial field. Aloe Vera has chemically weak acidic nature. We have measured Density(ρ), Viscosity(η), Surface tension(γ) and Ultrasonic velocity (U) of Aloe Vera juice (AV Juice) first time than calculated Adiabatic compressibility (βa),Acoustic impedance (Z), Intermolecular free length (L_f), Viscous relaxation time (τ) and Gibb's free energy (ΔG). We have reported ultrasonic velocity of Acetic acid, Ethanol, n-Butanol and Aloe vera juice (AV juice) with compare to distilled water at 296K temperature and 2MHz frequency.

Keywords: NDT, ethanol, n-butanol, aloe vera juice, ultrasonic velocity

Introduction
In the field of herbal medicine research interest has been revival worldwide. In medicines Aloe Vera is known as "nature's tonic". Egyptians called it the plant of immortality. The name aloe Vera derives from the Arabic word 'Alloeh' meaning[4] shining bitter substance, while Vera in Latin means 'true'. In India it is found in Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu, Madhya Pradesh. It belongs to Kingdom plantae, class Monocot, Order Asparagales, family Liliaceae, genus Aloe and specie *barbadensis Miller*. Its leaves are long fleshy thick and serrated on the edges. Sometimes they are covered with spots. They grow upright and form a rosette. Aloe Vera is made up of wide range of compounds such as complex sugars, minerals, vitamins, essential, non-essential and semi essential amino acids, organic acids, enzymes, phospholipids, lignin, saponins and anthraquinones[5]. It is most widely used specie because of its therapeutic properties[6].It has been used for the manufacturing of ointment and gel as well as in the production of juice, syrup, tablets and capsules in pharmaceutical industries and soaps, face wash and hair gel in cosmetic industries.

2. Material and Methods
Fresh Aloe Vera leaves were collected from farm land near Village Bidwal, block Badnawar, District Dhar (M.P.) India. These were washed with water. The leaf can be divided into two major portions, the outer green rind and inner colorless part, which is sometimes called 'pulp'(organ less) and 'gel' (viscous liquid). Aloe Vera gel was obtained by removing the rind with sharp age knife. Gel was introduced in a mixer grinder[7] to get AV juice. Further it was filtered with cotton cloth. Juice obtained by above process without adding water was used as a sample material in ultrasonic interferometer (model Nanofluid interferometer NF-10X).

It consists of a high frequency generator and a measuring cell. The measurements of ultrasonic velocities[8-9] were made at a fixed frequency of 2MHz. The temperature was controlled by circulating water around the liquid cell from thermostatically controlled constant temperature water bath. The densities of pure Water (double distilled, prepared in our laboratory) Ethanol, n- Butanol[10-11] and Acetic acid (Qualikems fine chem. Pvt. Ltd.) were measured by using a 10 ml specific gravity bottle. Weights were measured with a digital electronic balance (Kerro BL- 3002).

3. Procedure

Unscrew the knurled cap of cell and in the middle portion of it pour experimental liquid and screw the knurled cap. Connect the high frequency generator with cell by co-axial cable provided with multi frequency ultrasonic interferometer. Move the micrometer slowly either clockwise or anticlockwise till the anode current on the ammeter shows maximum and minimum (λ/2).

4. Experimental Techniques

4.1. Aspects in experimental

4.1.1. Density Measurement

The Density of pure solvents was measured using a 10ml specific gravity bottle. The densities of pure liquids thus obtained are found to be in good agreement with standard values. The density was measured using the formula,

$$\rho = m/v$$

4.1.2. Viscosity measurement

The viscosities of the pure solvents were measured using a calibrated Ostwald's viscometer. Viscosity was determined using the relation,

$$\eta_2 = (t_2\rho_2/t_1\rho_1).\eta_1$$

4.1.3. Surface tension measurement

The surface tensions of the solvents were measured using a calibrated stalagmometer. The surface tension was determined using the relation,

$$\gamma_2 = (n_1\rho_2/n_2\rho_1).\gamma_1$$

4.2. Aspects in theoretical

4.2.1. Adiabatic compressibility (β_a)

The adiabatic compressibility is the fractional decrease of volume per unit increase of pressure when no heat flows in or out. It can be calculated from ultrasonic velocity and the density of the sample using following equation,

$$\beta_a = 1/\rho U^2$$

where U and ρ are ultrasonic velocity and density of liquid respectively.

4.2.2. Acoustic Impedance (Z)

The specific acoustic impedance is given by

$$Z = U\rho$$

4.2.3. Intermolecular free length (L_f)

$$L_f = K\sqrt{\beta}$$

Where K is Jacobson's constant that depends on temperature and is given by K= (93.875+0.375T) $x10^{-8}$, T being the absolute temperature.

4.2.4. Viscous relaxation time (τ)

Viscous relaxation time is the time taken for the excitation energy to appear as translational energy and it depends on temperature and on impurities. It can be calculated from the relation,

$$\tau = 4\eta/3\rho U$$

4.2.5. Gibb's free energy (ΔG)

Gibb's free energy is calculated by using following formula,

$$\Delta G = kT.\log(kT\tau/h)$$

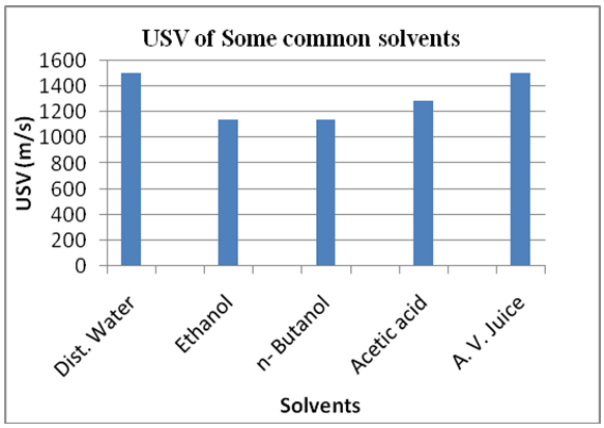
Where k is Boltzmann constant and h is plank's constant.

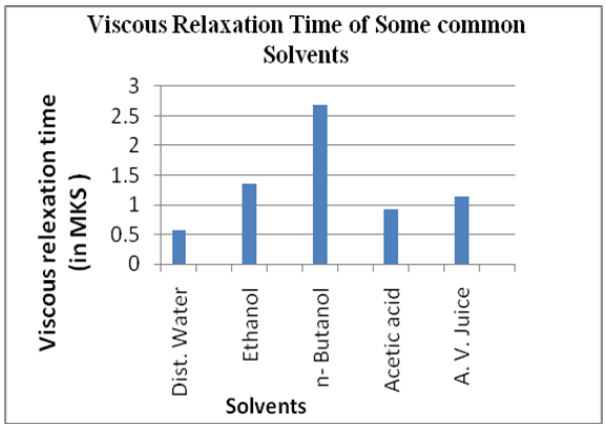
Table 1: Experimental values of density, surface tension and viscosity at 298K.

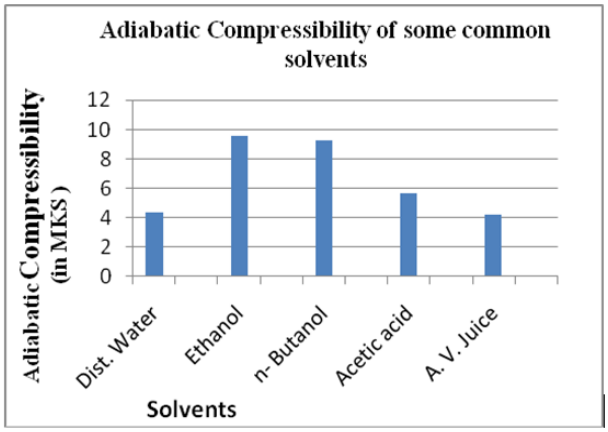
Solvents	Density $\rho \times 10^3 kg/m^3$	Surface tension $\gamma \times 10^{-2} Nm^{-1}$	Viscosity $\eta \times 10^{-3} Kg\ m^{-1}s^{-1}$
Distilled Water	1.009	7.275	0.957
Ethanol	0.801	2.332	1.056
n-Butanol	0.824	2.495	2.179
Acetic acid	1.064	2.777	1.234
Pure AV juice	1.039	6.292	2.027

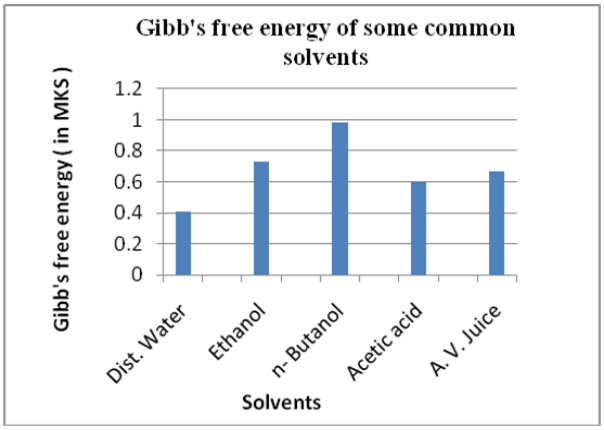
Table 2: Calculated values of β, Z, L_f, τ and ΔG for different solvents.

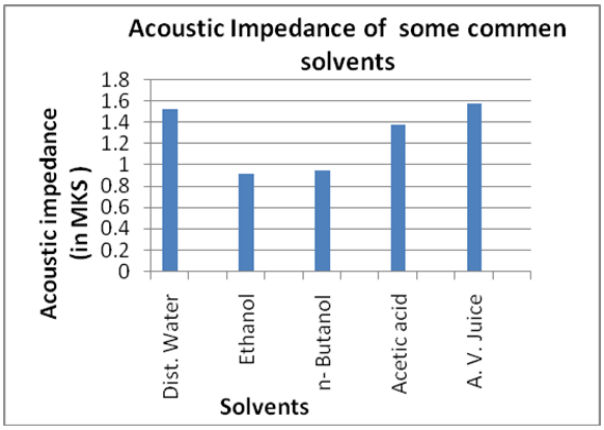
Common solvents	Ultrasonic velocity U(in m/s)	Adiabatic compressibility $\beta a \times 10^{-10}$(in $kg^{-1}ms^{-2}$)	Acoustic impedance $Z \times 10^6$(in $kgm^{-2}s^{-1}$)	Gibb's free energy $\Delta G \times 10^{-20}$ (in $KJmol^{-1}$)
Distilled Water	1504.61	4.377	1.518	0.409
Ethanol	1143.44	9.548	0.915	0.728
n- butanol	1145.24	9.252	0.943	0.981
Acetic acid	1289.61	5.651	1.372	0.594
Pure AV Juice	1508.01	4.232	1.566	0.669

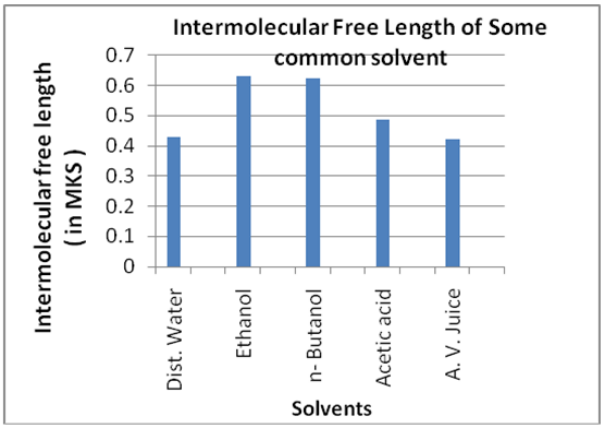












5. Result and Discussion

The experimental values of density (ρ), surface tension (γ) and viscosity (η) for dist. Water, Ethanol, n-Butanol, Acetic acid and AV juice at 298K are presented in Table 1 whereas Table 2 represent the experimental value of Ultrasonic velocity (U) and calculated values of some thermo acoustic parameters such as adiabatic compressibility (βa), acoustic impedance (Z), intermolecular free length (L_f), viscous relaxation time (τ) and Gibb's free energy (ΔG).

Table 1 show that the value of density of AV juice is higher than dist. Water, EtOH and n-BuOH but lower than Acetic acid. The value of surface tension of AV juice is higher than Acetic acid, EtOH and n-BuOH. The value of viscosity decreases in following order-

n-BuOH > AV juice > Acetic acid> EtOH > dist. Water

Table 2 shows that the Ultrasound propagation in AV juice rapidly than in other solvents used in present investigation. The values of adiabatic compressibility, Acoustic impedance and intermolecular free length of AV juice and dist Water are nearly same. It is just because AV juice contains 99% Water.

6. Conclusion

Ultrasonic investigation is a powerful probe for characterising the physicochemical properties and solvent selection. In addition the Density, Viscosity, Ultrasonic velocity and the derived acoustical and thermodynamical parameters provide evidence of confermation. Hence it is concluded that: (1) AV juice resembles with water in terms of Adiabatic compressibility, Acoustic impedance and intermolecular free length. (2) AV juice contains high amount of water.

7. Acknowledgement
The author is much indebted to his father Late Mr. Ramesh Chandra Singh Chouhan and mother Mrs. Brajesh Kunwar Chouhan for their continuous motivation. The auther wishes to express his gratitude to Mr. Krishan Kant Kheda, Mr. Manoj Saxena and Mr. Arvind Purohit for his many helpful suggestions and frequent advice during the research work.

8. Reference

1 Phadke S, Shrivastava BD, Mishra A. Thermodynamic, Acoustical, Volumetric and Viscometric study of *Borassus Flabellifer* at 313.15 K. Ultra Scientist of Physical Sciences. 2009; 21(3):499-504.
2 Phadke S, Shrivastava BD, Mishra A, Dagaonkar N. Comparative study of natural liquid NEERA with sucrose at different concentration. Journal of Environmental Research and Development. 2011; 5(3):591-596.
3 Kavitha R, Jayakumar S, Uma R. Ultrasonic Velocity, Density and Viscosity of Binary Liquid Mixtures of Acetone with Toluene, Chlorobenzene and Nitrobenzene. Int. J Che. Application. 2011; 3:19-33.
4 Surjushe A *et al*. Aloe Vera: A short review. Indian J Darmatol. 2008; 53(4):163-166.
5 Arunkumar S. Analysis of phytochemical constituents and antimicrobial activities of Aloe vera L. against clinical pathogens World. J Agric Sci. 2009; 5(5):572-576.
6 Sahu PK. Therapeutic and medicinal uses of Aloe vera: A review. Journal of Pharmacology & Pharmacy. 2013; 4:599-610.
7 Sharma HKr. A visionry*in vitro* analysis for antibectirial potential using seeds of a deciduos shrub Punica granatum. Euro. J Exp. Bio. 2014; 4(5):117-122.
8 Ubagaramary D, Neeraja P. Ultrasonic study of molecular interaction in binary liquid mixture at 308K. Journal of Applied Chemistry. 2012; 2(5):01-19.
9 Bhandakkar VD. Thermo Acoustical and nonlinear molecular interaction studies in binary liquid mixture at 303K. Arch. Applied Science and Research. 2012; 4(6):2546-2551.
10 Krishnamurthi P, Thenmozhi PA. Ultrasonic studies of molecular interaction of alcohol with non polar solvents. Journal of Chemical and pharmaceutical research. 2012; 4(11):4671-4676.
11 Mishra S, Paikaray R. Ultrasonic and theoretical study of binary mixture of two polar liquids at different temperatures. Research Journal of Chemical Science. 2013; 3(6):24-31.