GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES
STUDY OF ACOUSTIC PARAMETERS OF CHLOROSUBSTITUTED PROPANEDIONE

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ABSTRACT

The present investigation enlighten the certain acoustic parameter of 2 of Chlorosubstituted propanedione in Dioxane at different percentage of Dioxane by measuring ultrasonic velocity at 2 MHz, by using in the concentration range of 0.01 M at 32 0C. The acustic parameters which are investigation are in the study are ultrasonic velocity (u), adiabatic compressibility (βs), intermolecular free length,(Lf) Apparent molal volume(Φv), Apparent molal Compressibility(Φk), The solute–solute interactions and solute solvent interaction are studied by using these Parameters. The ultrasonic velocity shows a decrease in value with respect to concentraction and adiabatic compressibility show corresponding increase in value with respect to concentraction for these ligands . The results indicate the occurrence of complex formation between unlike molecules through intermolecular hydrogen bonding between oxygen atom of dioxane molecule and hydrogen atom of ligands. The variation of these parameters with percentage indicates the possibility of the complex formation in these systems.

Keywords: Ultrasonic, Dioxane-water mixtures chloro substituted propanedione.

I.   INTRODUCTION

Ultrasonic is of waves of high frequencies. The interaction of waves with systems involved to study certain parameter which is called as acoustic parameters.

Acoustical parameters such as specific impedance (Z), isentropic compressibility (κs), Rao's molar sound function (Rm), the van der Waals constant (b), molar compressibility (W), intermolecular free length (Lf), relaxation strength (r), relative association (RA), free volume (Vf), etc. and apparent molar volume and apparent molar compressibility were calculated for some derivatives of 4-amino antipyrene in 1,4-dioxane and dimethylformamide at 318.15 K [1]. By using the **Single Film Bulk Acoustic Wave Resonator with Temperature Modulation as a Multiparameter Virtual Sensor Array are used for Detection and Discrimination of Volatile Organic Compounds [2]** Acustic parameters are widely used in various fields like medicine, biology, material science, agriculture, industry,oceanography, sonochemistry research due to its non-destructive nature[3] also to study the ion-solvent interactions in aqueous and non aqueous solutions[4]. Recent developments have made it possible to use ultrasonic energy in medicine, engineering, agriculture and other industrial applications [5-6]. Analysis and Characterization of soil and soil sample was carried out by photoacoustic and photothermal method [7] The strength of ion-dipole attraction is directly proportional to the size of the ion, charge and the magnitude of the dipole, but inversely proportional to the distance between the ion and the dipolar molecule.The accurate measurement of density, viscosity, ultrasonic velocity and hence the derived parameters such as adiabatic compressibility, apparent molal compressibility and apparent molal volume will give significant information regarding the state of affairs in a solution[8]. Prakash Satya[9], Cadaldo[10], have made ultrasonic study of electrolytic solutions and discussed about the variation of ultrasonic velocity with ion concentration.

II. EXPERIMENTAL

Material and Methods -

a) Synthesis of -1-(5-chloro-2-hydroxyphenyl)-3-(2-chlorophenyl) propane-1,3-dione [L1]-

Chloro substituted benzoyloxy acetophenones prepaired from 4-chloro-2-hydroxy acetophenone (1) (0.04 mol) and chloro substituted benzoic acid (0.05 mol) was dissolved in dry pyridine (40 ml). The solution was warmed up to about 600c and pulverised KOH (0.15 mol) was added slowly with constant stirring. After four hours the reaction mixture was acidified by adding ice cold dilute HCl (1:1). The solid product thus separated was filtered, washed with sodium bicarbonate solution (10%) and finally with water. It is then crystallised from ethanol acetic acid mixture to get 1-(5-chloro-2-hydroxyphenyl)-3-(2-chlorophenyl) propane-1, 3-dione [L1]
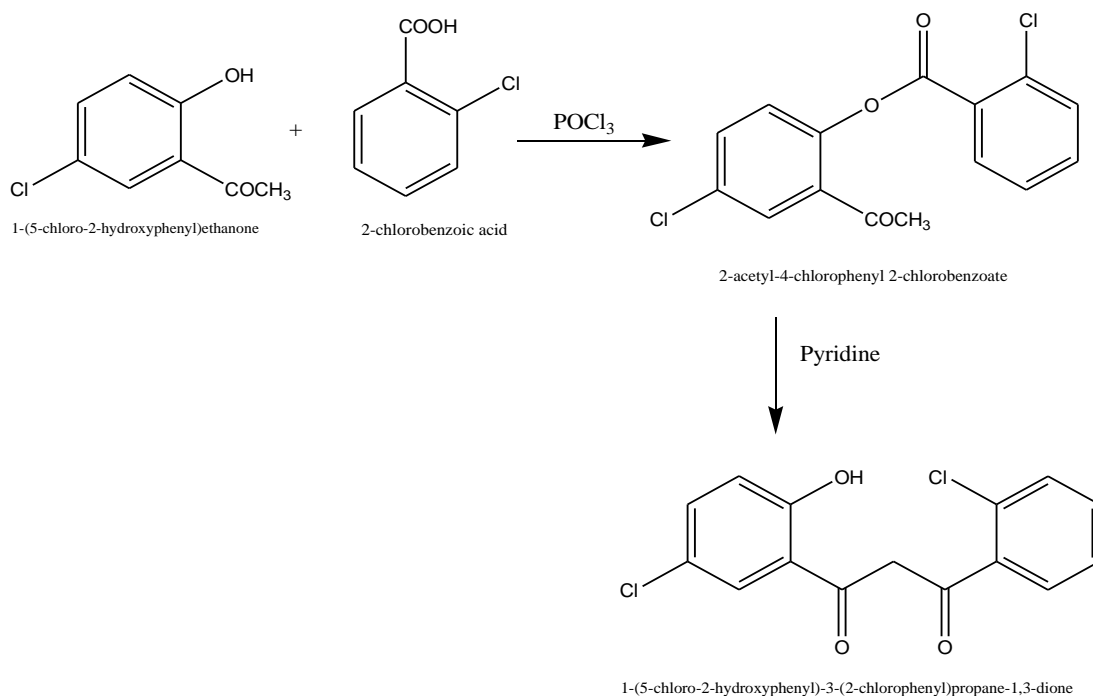

1-(5-chloro-2-hydroxyphenyl)ethanone   2-chlorobenzoic acid   2-acetyl-4-chlorophenyl 2-chlorobenzoate

1-(5-chloro-2-hydroxyphenyl)-3-(2-chlorophenyl)propane-1,3-dione

Table 1- Acoustic parameters of (L1)

Mole fraction of Dioxane	Ultrasonic velocity U_s (m/sec)	Density ds (g/m³)	Adiabatic compressibility β_s (bar⁻¹) x 10⁻⁷	Intermolecular free length L_f (A°) x 10⁻⁹
1	1698.8	1.088666	3.1828	1.1600
0.6563	1660.8	1.010628	3.5872	1.2315
0.4584	1584	0.967151	4.12	1.32
0.3305	1465.2	0.917885	5.0747	1.4648

0.24098	1424.8	0.898445	5.4827	1.5225

Apparent molal volume Φ_v (m³/mole) x 10⁻³	Apparent molal compressibility $\Phi_{k(s)}$ (m³ mol⁻¹ bar⁻¹) x 10⁻⁴	Relative association (R_A)	Specific acoustic impedance Z_s (kg m⁻² s⁻¹)x10⁻³
4.2232	4.57	1.0599	1.8494
8.2431	5.24	1.4322	2.6111
8.7182	5.88	1.4976	1.6429
10.7204	7.24	1.7412	1.3448
12.8725	7.88	1.8193	1.2800

III. RESULTS AND DISCUSSION

The ultrasonic velocity of the ligand is going to decrease with decrease in percentage of dioxane this indicates that the hydrogen bonding responsible for cohesion of molecules. The value of adiabatic compressibility (βs) increase with decrease in percentage of solution may be due to departure of solvent molecules around ions supporting weak ion-solvent interactions. The value of apparent molal volume(**Φv)** is high indicates the polar substituent. The apparent molal volume φv values increases with decrease in concentration of propandione in binary mixtures this represents strong solute –solute and solute solvent interactions.

The value of apparent molal compressibility (Φk) increases with decrease in percentage of all systems, showing weak electrostatic attractive force in the vicinity of ions causing electrostatic salvation of ions. Compressibility is more in case of bulky substituent's.

IV. CONCLUSION

From the experimental data, the acoustic parameters of chloro substituted propanedione in binary liquid (dioxane+water)at 32^0C the results have been used to study the ion-solvent interaction exists in the mixture.

V. ACKNOWLEDGEMENT

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