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NOTE

Ultrasonic Velocity, Viscosity and Density of 2-Hydroxy Acetophenones in Ethanolic Solution at 303.15 K

SANJAY UBALE†, N.G. PALASKAR‡, MAZAHAR FAROOQUI*, R.K. PARDESHI** and M.K. LANDE††
Aurangabad College for Women, Aurangabad, 431 001, India

Density, ultrasonic velocity and relative viscosity of 2-hydroxy acetophenone in ethanolic solutions have been measured as a function of electrolyte concentration at 303.15 K. The experimental data is used to calculate molar volume, apparent molar compressibility etc. These parameters are used to interpret the solvent-solvent, ion-solvent and solute-solvent interactions.

o-Hydroxy acetophenone is widely used in the preparation of Schiff bases, oximes and many other complex compounds. Literature survey reveals that a systematic study of its density, ultrasonic velocity and viscosity is yet to be made and reported. Therefore in the present investigation it was decided to have a systematic study of the above mentioned physical properties of *o*-hydroxy acetophenone. An attempt was made to understand them through their properties like partial molar volume and partial molar compressibility. These are the important parameters in interpreting molecular interactions in solution phase.[1,2]

o-Hydroxy acetophenone was prepared and purified by the standard methods.[3] Spectrograde ethanol (BDH) was used as a solvent. The density of pure ethanol was determined in a 15 mL bicapillary pycnometer. Speed of sound was obtained by using a variable path single crystal interferometer (Mittal Enterprises, New Delhi, model M-81). The viscosity measurements were performed by using Schoff Gerate (AVS 350) viscosity measuring system equipped with a series of Ubbelhode viscometers. In all the determinations kinetic energy correction has been taken into account.

The apparent molar volume (Φ_v), apparent molar compressibility (Φ_k) and the relative viscosity (η_r) of the solutions were calculated by equations (1), (2) and (3) respectively.

†Deogiri College, Aurangabad, India.
‡Dept. of Chemistry, Dr. B.A.M.U., Aurangabad, India.
**C.S.C., Umerga, India.
††N.M.U., Jalgaon, India.

$$\Phi_v = \frac{1000(d_0 - d)}{cdd_0} + \frac{m}{d} \quad (1)$$

$$\phi = \frac{1000(\beta d_0 - \beta d_s)}{cdd_0} + \frac{\beta_s m}{d_s} \quad (2)$$

$$\eta_r = \frac{dt}{d_0 t_0} \quad (3)$$

where C is the molarity, d and d_0 are the densities, β_s and β_0 are the adiabatic compressibilities of solutions and solvent respectively, M is the molecular weight of the solute and t and t_0 are the flow times in seconds of solutions and solvents through the viscometer, respectively. The partial molar volume (Φ_v^0), partial molar compressibility (Φ_k^0), viscosity β-coefficient, were derived by equations (4), (5) and (6) respectively.

$$\phi_v = \phi_0^v + S_v C \quad (4)$$

$$\phi_k = \phi_k^0 + S_k C \quad (5)$$

$$\eta_r = 1 + BC \quad (6)$$

TABLE-1
DENSITY (d), ULTRASONIC VELOCITY (v) AND FLOW TIME (t) OF *o*-HYDROXY ACETOPHENONE IN ETHANOL AT 30°C

Conc. (mol dm^{-3})	d (g cm^{-3})	V (m s^{-1})	t (s)
0.00	0.78075	1148.00	130.50
0.02	0.78177	1149.40	132.87
0.04	0.78281	1150.75	135.24
0.06	0.78387	1152.10	137.61
0.08	0.78495	1153.15	139.47
0.10	0.78605	1154.90	142.33

TABLE-2
APPARENT MOLAR VOLUME (Φ_v), APPARENT MOLAR COMPRESSIBILITY (Φ_k), RELATIVE VISCOSITY OF *o*-HYDROXY ACETOPHENONE IN ETHANOL AT 30°C

Conc.	$\Phi_v \times 10^6$ (m^3 mol^{-1})	$\Phi_k \times 10^{16}$ (m^3 mol^{-1} Pa^{-1})	η_r (s)
0.00	90.75	1.385	–
0.02	90.40	1.410	1.0194
0.04	89.46	1.419	1.0390
0.06	88.53	1.431	1.0586
0.08	87.59	1.470	1.0783
0.10	86.65	1.478	1.0980

Ultrasonic velocity, relative viscosity and apparent compressibility increase with increasing concentration. This clearly shows that there are strong solute-solvent, solvent-solvent and ion-solvent interactions[1-6]. It is also clear from the values of Φ_v^0 (90.75×10^6 m^3 mol^{-1}), S_v (38.87×10^6 m^3 mol^{-1} lit^{-1}), Φ_k^0 (1.385×10^{16} m^3 mol^{-1} Pa^{-1}), S_k (0.935×10^{16} m^3 mol^2 Pa^{-1}) and B (0.982 dm^3 mol^{-1}).

The negative value of Φ_k is due to electrostatic effect which leads to decrease in the compressibility of the solution.

The S_v parameters observed in the present case are much larger than generally reported for inorganic salts. These values show strong solute-solute interactions.

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