

## Ultrasonic velocity studies on the influence of electrolytes on molecular interactions in aqueous solutions of ethylene glycol

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### REFERENCES

Density, viscosity and ultrasonic velocity of manganese sulphate, cobalt sulphate and nickel sulphate in 5,10,15 and 20% ethylene glycol (EG) - water mixtures have been measured at different molalities of the salts at 303,308 and 313K. Using these data, the parameters adiabatic compressibility ( $\beta$ ), acoustic impedance (Z), viscosity B-coefficient and solvation number ( $S_n$ ) have been calculated. The data have been analyzed using the Jone-Dole equation and the obtained parameters have been interpreted in terms of ion-ion and ion-solvent interactions.

**Key words :** Ternary electrolytes, Adiabatic compressibility, Acoustic impedance, Jone-Dole equation, Solvation number

In recent years, studies on ultrasonic velocities on ionic solutions have proved to be of great help in characterizing the structure and properties of solutions (Nano Rao *et al.*, 1973, Kannappan and Rajendran, 1992, Somanathan *et al.*, 1994, Ishwara Bhat and Shiva Kumar, 2000, Rita Mehra and Hema Sajani, 2000, Ezhil Pavai *et al.*, 2004, Ramanathan and Ravichandran, 2004, Malasane and Aswar, 2005, Sumathi, 2006, Meena, 2006) and are also helpful in the study of the ion-ion and ion-solvent interactions in aqueous and non-aqueous solutions. Ultrasound has been extensively used to determine the ion-solvent interactions in aqueous solutions containing electrolytes (Kannappan and Chidambara Vinayagam, 2006).

Various types of interactions exist between the ions in the solutions and of these ion-ion and ion-solvent interactions are of current interest. These interactions are helpful in better understanding of the nature of solute and solvent, *i.e.* whether the added solute modifies or distorts the structure of the solvent.

The addition of organic solvent to an aqueous solution of electrolyte brings about a change in ion's solvation and often results in a large change in the reactivity of dissolved electrolyte. The use of ethylene glycol (EG) + water mixture has attracted in recent years as solvents in the study of physico-chemical properties of electrolytic solutions. Now-a-days ethylene glycol is being used for the synthesis of nano particles. Thus, EG acts as dispersing, reducing as well as stabilizing medium. The nano particles are highly stable in EG and do not coagulate on long standing.

In the light of these observations, the present study was undertaken with a view to investigate the three

ternary systems namely manganese sulphate, cobalt sulphate and nickel sulphate in 5, 10, 15 and 20% EG-water mixtures.

### MATERIALS AND METHODS

Analar grade manganese sulphate ( $MnSO_4$ ), cobalt sulphate ( $CoSO_4$ ) and nickel sulphate ( $NiSO_4$ ) were used for preparing the electrolytes. Freshly prepared conductivity water was used for preparing aqueous mixtures of EG as well as standard liquid. All the aqueous mixtures of EG as well as the solutions of electrolytes were made by weight and molalities.

Ultrasonic velocity of the electrolytic mixtures was measured using ultrasonic interferometer (Mittal Enterprises, New Delhi) at fixed frequency of 3 MHz with an accuracy of  $\pm 0.1\%$ . The measuring cell temperature was maintained by using an electronically controlled thermostat having an accuracy of  $\pm 0.01K$ . The density of the mixtures was measured by 10ml specific gravity bottle and viscosity by the Ostwald's viscometer.

### Theory:

The acoustical parameters namely adiabatic compressibility, acoustic impedance, viscosity B-coefficient and solvation number have been calculated using the following relations:

*Adiabatic compressibility*

$$s_1 = (U^2 \dots)^{-1} \quad [1]$$

*Acoustic impedance*

$$Z = U \dots \quad [2]$$

where U and  $\rho$  are velocity and density of liquid, respectively.