Letters to the Editor

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6. RELATIONSHIP BETWEEN ADIABATIC COMPRESSIBILITY AND CONCENTRATION OF SOLUTIONS OF ELECTROLYTES

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It was pointed out by Mohanty and Deo (1955) that the ultrasonic velocity in magnesium and zinc sulphate solutions as well as the adiabatic compressibility vary linearly with concentration. Recently, Panda and Mohanty (1957) have concluded that the adiabatic compressibilities of cobalt and cadmium sulphate solutions vary linearly with concentration This may be represented by the following equations :

$$V = k'C + X \quad \text{.. (1)}$$

$$\beta = k'C + Y \quad \text{.. (2)}$$

where V is the ultrasonic velocity, β is the adiabatic compressibility, C is the concentration of the solution, k and k' are proportionality constants and X and Y are constants.

It is known that

$$\beta = \frac{1}{V^2\rho} \quad \text{... (3)}$$

where ρ is the density of the solution.

From (1) and (3) we may write

$$\beta = \frac{1}{(K.C+X)^2\rho} \quad \text{... (4)}$$

It seems clear that equation (2) and (4) can not hold good at the same time. Naturally, the statement that adiabatic compressibility for four electrolytes studied is linear with concentration seems to be incorrect. However, on plotting the graph it appears that there is very slight curvature and the plots are not exactly straight lines.

Bachem (1936), Brathel (1954), Krishnamurthi (1950) and many others have suggested different relations but at the same time there has been considerable amount of controversy.

Prakash and Srivastava (1958) themselves suggested one equation relating the velocity of ultrasonic waves in solutions of electrolytes with the ionic strength of the solution From the same relation the following equation may be derived :

$$\left(\frac{\rho}{\beta}\right)^{1/4} = \frac{P}{(2I)^{1/2}} + \frac{BZi^2(2\mu)}{D^2T(I)^{1/2}}$$

where $B = \frac{N^2.\epsilon^4}{1000.2\sqrt{2}.R.}$, N is avagadro number, e is electronic charge, R is gas constant.

Zi is valency of ions, D is dielectric constant of the solution,

T is temperature, I is ultrasonic intensity,

P is the pressure experienced by the solution internally if the salts are not ionised.

It is observed that the above equation holds good for the four bivalent sulphates studied by Mohanty and Deo (loc. cit) and Panda and Mohanty (loc cit). Also it is seen that the plot for all the four straight lines $\left[\left(\frac{\rho}{\beta}\right)^{1/4} \text{against } \mu\right]$ has almost the same slope as is expected from the equation itself. The equation is also valid for potassium nitrate and strontium nitrate as is seen from the data of Krishnamurthi (loc. cit), but for sodium nitrate it shows a minimum.

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