Letters to the Editor

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RELATIONSHIP BETWEEN ULTRASONIC VELOCITY AND OTHER PHYSICAL PROPERTIES OF PURE ORGANIC LIQUIDS

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While investigating the possibility of finding out a relation between ultrasoni velocity(V) and concentration of solutions, specially solutions of electrolytes, the author found a relation between V and the internal pressure P as :

$$V\rho^{\frac{1}{4}} = kR^{\frac{1}{4}}P \qquad \ldots \quad (1)$$

where ρ is the density of the liquid and R is molar refraction. K is a constant equal to (7 ± 1). Internal pressure may be related with boiling point of the liquids

$$P = (-1400+24.5T)4.5/V_m \qquad \ldots \quad (2)$$

where V is molar volume and T is the boiling point of the liquid in degrees absolute. The relation has been verified for 75 liquids (from the data of Parthasarthy given by Vigoreaus (1952) and of Natta (1949) and has been found to be true for as many as 60 liquids. In the remaining 15 liquids 8 are alcohols, 2 acetone, and the rest water, etc. for which there is a deviation probably because of high association or polarit

A better relation is observed when data are compared in the similar class of liquids. For a few of them average ratio of $V\rho^{\frac{1}{4}}/R^{\frac{1}{4}}P$ has been shown in Table I which may also be termed as constant of linearity between $V\rho^{\frac{1}{4}}$ and $R^{\frac{1}{4}}P$. The range of variation has also been shown in each case.

Equation (1) may also be kept with the help of equation (2) as

$$V\rho^{\frac{1}{2}} = k_1 R^{\frac{1}{2}} V_m^{-\frac{1}{2}}(k_2 T - 1)$$

where k_1 and k_2 are constants
and will automatically hold good, if (1) is true.

TABLE I

Class of Liquids B	No. of Liquids	Mean slope (average ratio $V.\rho^{\frac{1}{2}}/R^{\frac{1}{2}}P$)	Range of variation of mean slope
Mono Olefins	8	7.52	+.25, −.29
Paraffins	12	7.53	+.19, −.09
Alkyl Chlorides	4	7.56	+.32, −.19
Aliphatic Esters	6	7.85	+.41, −.30
Alkyl Bromides*	3	7.11	+.08, −.07

The equation may be helpful in deriving an equation for the velocity of ultrasonic waves in solutions.

The author owes his sincere thanks to Prof. S. R. Palit for his valued suggestions and keen interest in the problem.

REFERENCES

Vigoreaus, P., 1952, Ultrasonics, Chapman and Hall.
Natta, G. and Baccaredda, M., 1949, *Die Makromole Chemie*, **14**, 134.

* Bromoform has abnormaliy low ratio of $V\rho^{\frac{1}{2}}/R^{\frac{1}{2}}P$ and therefore has not been included.

N.B. Six alcohols were also tested and have the mean ratio $V\rho^{\frac{1}{2}}/R^{\frac{1}{2}}P$ as 6.06 with a wid variation as +1.10, −.70 which is beyond the desired value.