SHORT COMMUNICATIONS

A MODIFICATION OF THE LAW OF CORRESPONDING STATES AS APPLIED TO ULTRASONIC PROPAGATION IN LIQUIDS

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THE law of corresponding states finds wide application to the solution of a number of scientific and technological problems connected with the investigation of liquid and gaseous states. A number of liquids belonging to homologous series[1,2] and those that differ widely in their chemical composition[3] have been extensively studied in this laboratory. As a result, it is established that all liquids, immaterial of their chemical composition, obey this law which has universal application[4] to the ultrasonic properties of all liquids.

Starting from the molecular kenetic theory of matter[5], the ultrasonic velocity C is expressed in reduced parameters as

$$\frac{C}{C_c}=\left[\frac{5}{2}\times\frac{T}{T_c}+\frac{3}{2(\nu-\mu)}\left\{\mu\left(\frac{V_c}{V}\right)^{\nu}-\nu\left(\frac{v_c}{v}\right)^{\mu}\right\}\right]^{1/2}, \quad (1)$$

where all the symbols have the usual meaning. ν and μ are constants with $\nu = 6$ and $\mu = 2$ for many liquids. The values of different terms in the above equation are evaluated and it is found that the contribution of the first term i.e. $\frac{5}{2}(T/T_c)$ is only about 0.5% of the second term. As such, neglecting the first term, expression (1) is simplified as

$$\frac{C}{C_c}=\left[\frac{3}{2(\nu-\mu)}\left\{\mu\left(\frac{V_c}{V}\right)^{\nu}-\nu\left(\frac{v_c}{v}\right)^{\mu}\right\}\right]^{1/2}. \quad (2)$$

Now, using the values $\nu = 6$ and $\mu = 2$, expression (2) is written as

$$\frac{C}{C_c}=\left[\frac{3}{8}\left\{2\left(\frac{V_c}{V}\right)^{6}-6\left(\frac{v_c}{v}\right)^{2}\right\}\right]^{1/2}. \quad (3)$$

The above expression, on further simplification, reduces to

$$C/C_c=\sqrt{3/2}\times(V_c/V)^3 \quad (4)$$

Expression (4) clearly shows that C/C_c, the reduced velocity, is predominantly dependent on (V_c/V) or (ρ/ρ_c), the reduced density and not on reduced temperature T/T_c. The contributions of different terms in expression (1) are calculated and shown in table 1. Eight substances namely formic acid, acetic acid, propionic acid, *n*-butyric acid, *n*-valeric acid, caprylic acid, pelergonic acid and capric acid are studied experimentally. It is clear that the values of the first term (column 3) is negligible compared to that of the second term (column 4).

Expression (4) however cannot be verified experimentally because of the difficulty in determing accurately the ultrasonic velocity at critical temperature. As such a suitable temperature ($= 0.6T_c$) was chosen at which all the substances are in liquid state and do not vaporize. Accordingly, the experimentally determined values of $(C/C_{0.6T_c})$ are shown in column (5) of table 1. The velocities are determined by composite ultrasonic interferometer, which is fully described elsewhere[6]. The densities are determined by hydrostatic bench method[7].

The value of $C_{0.6T_c}$ is much higher than that of C_c. As such, when the product $(C/C_{0.6T_c})\times(V/V_c)^3$ is evaluated, the constant is much lower than the

Table 1 *Values of different terms in expression (1)*

1	2	3	4	5	6
		Formic acid			
0.423	3.267	1.058	903	1.427	41
0.443	3.229	1.108	826	1.380	41
0.456	3.208	1.140	816	1.343	41
0.473	3.181	1.183	754	1.308	41
0.485	3.157	1.213	720	1.273	41
		Acetic acid			
0.510	2.965	1.275	490	1.223	47
0.526	2.928	1.315	453	1.179	47
0.543	2.897	1.358	424	1.139	47
0.560	2.860	1.400	392	1.098	47
0.577	2.836	1.443	372	1.057	46
0.611	2.764	1.528	317	0.975	46
		Propionic acid			
0.495	3.070	1.238	607	1.255	43
0.511	3.040	1.278	571	1.216	43
0.528	3.007	1.320	534	1.179	43
0.544	2.975	1.360	500	1.137	43
0.560	2.945	1.400	469	1.098	43
0.593	2.872	1.483	402	1.022	43

1	2	3	4	5	6
		n-Butyric acid			
0.482	3.126	1.205	678	1.285	42
0.498	3.091	1.245	633	1.248	42
0.514	3.069	1.285	606	1.207	42
0.530	3.033	1.325	563	1.169	42
0.546	3.006	1.365	533	1.131	42
0.578	2.927	1.445	452	1.055	42
		n-Valeric acid			
0.464	3.186	1.160	761	1.347	42
0.480	3.158	1.200	722	1.308	42
0.496	3.128	1.240	680	1.270	42
0.510	3.091	1.275	633	1.232	42
0.526	3.071	1.315	608	1.192	41
0.542	3.029	1.355	559	1.156	42
0.557	2.988	1.393	514	1.115	42
		Caprylic acid			
0.447	3.222	1.118	816	1.370	41
0.461	3.197	1.153	778	1.335	41
0.476	3.172	1.190	741	1.300	41
0.491	3.144	1.228	702	1.264	41
0.506	3.117	1.265	666	1.229	41
0.521	3.082	1.303	621	1.193	41
0.536	3.048	1.340	581	1.157	41
		Pelergonic acid			
0.441	3.233	1.103	833	1.384	41
0.456	3.209	1.140	796	1.347	41
0.471	3.171	1.178	740	1.313	41
0.485	3.150	1.213	710	1.275	41
0.500	3.129	1.250	682	1.243	41
0.514	3.085	1.285	625	1.206	41
0.529	3.060	1.323	595	1.173	41
		Capric acid			
0.439	3.234	1.098	835	1.390	41
0.449	3.220	1.123	813	1.372	41
0.463	3.191	1.158	770	1.339	41
0.477	3.165	1.193	731	1.305	41
0.491	3.441	1.228	702	1.270	41
0.506	3.103	1.265	648	1.234	41
0.521	3.077	1.303	615	1.198	41

1. T/T_c; **2.** V_c/V or ρ/ρ_c; **3.** $(5/2)\times(T/T_c)$;

4. $\frac{3}{2(\nu-\mu)}[\mu(V_c/V)^{\nu}-\nu(V_c/V)^{\mu}]$;

5. $C/C_{0.6T_c}$; **6.** $(C/C_{0.6T_c})\times(V/V_c)^3\times10^3$.

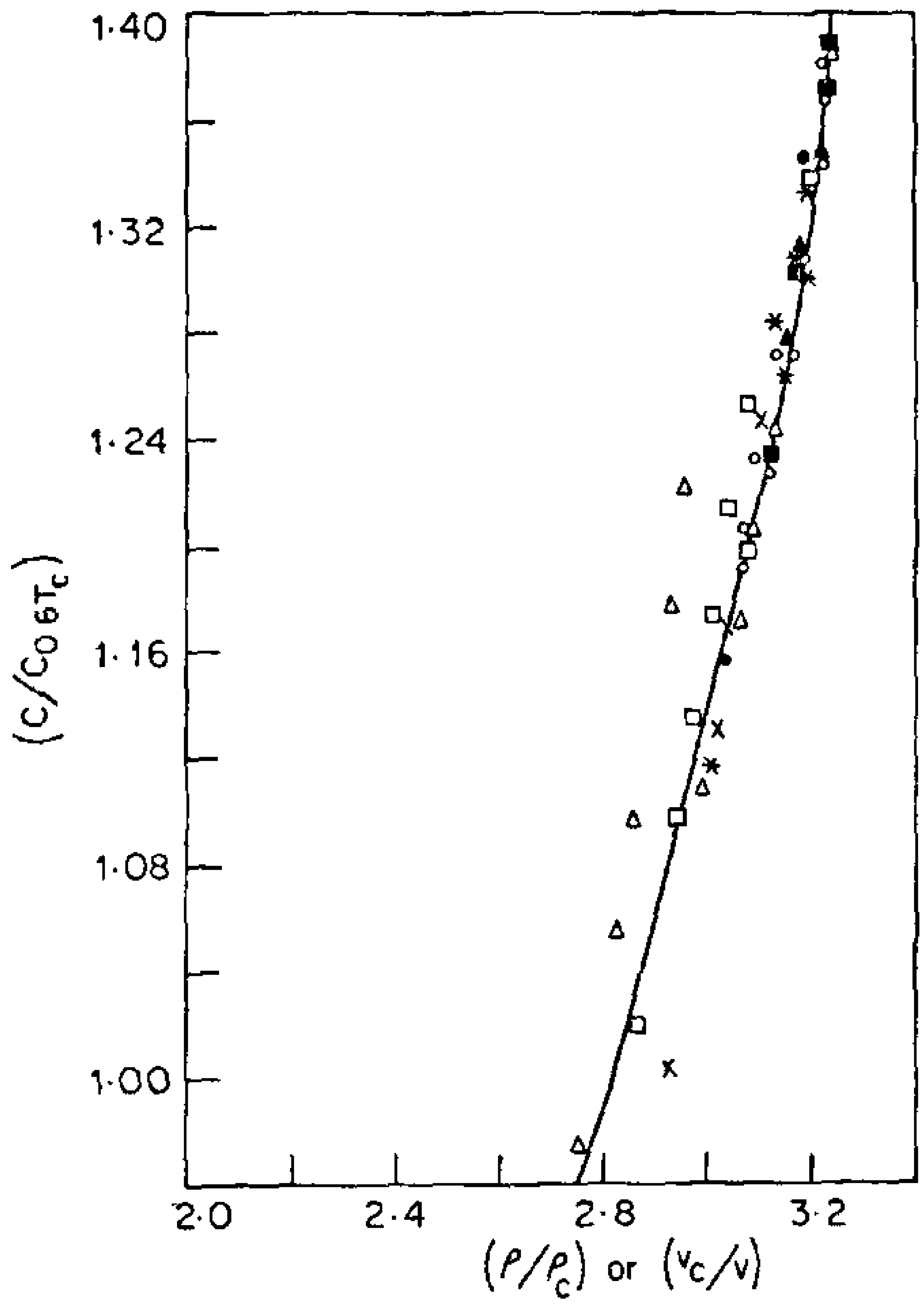

Figure 1. Dependence of reduced velocity on reduced density [○, formic acid; △, acetic acid; □, propionic acid; ×*n*-butyric acid; ●,*n*-valeric acid; *, caprylic acid, ▲, pelergonic acid; ■, capric acid].

theoretical constant of √3/2 in experession (4). The above product remains remarkably constant showing the validity of expression (4).

In view of the predominant dependance of (C/C_c) on (V_c/V), it is more meaningful to connect (C/C_c) with (V_c/V), rather than (C/C_c) with (T/T_c), as done by Nozdrev[9]. A plot of values of $(C/C_{0.6T_c})$ against (V_c/V) are shown in figure 1. All the values fit very well on a single curve showing that all the substances obey the law of corresponding states.

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N-α-PYRIDYL-N'-BENZOYL THIOUREA (PBT) AS A NEW REAGENT FOR THE DETERMINATION OF PLATINUM (IV) GRAVIMETRICALLY

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DURING the last few decades, a wide variety of gravimetric procedures for the determination of platinum have been reported, however, the reagents which furnish precipitate for direct weighing are few in number[1]. N-α-pyridyl-N'-benzoyl thiourea (PBT) has been recommended successfully[2] for determination of Os(VI) and Rh(III) gravimetrically. In the present paper, the analytical applicability of PBT in the gravimetric determination of platinum(IV) is investigated. A 1% reagent, dissolved in 50% acetic acid, is used to precipitate the metal. The reagent forms two distinct types of complexes of platinum under different conditions of acidity. Platinum(IV) forms a brown complex with the reagent at 60°–70°C in 0.5–2 N hydrochloric acid which corresponds to Pt $(C_{13}H_9N_3OS)$ (A) when dried at 110–120°C. The brown chelate is soluble in ethyl alcohol, chloroform, carbon tetrachloride and other common organic solvents. Complete precipitation of the complex occurs when the supernatant liquid contains about 0.01% (w/v) reagent in excess. The metal is also precipitated from hot (60–70°C) acetate solution at pH ranging from 4.0 to 8.2 and the yellow, chelate, dried at 110–120°C corresponds to Pt $(C_{13}H_{10}N_3OS)_2$ (B). The precipitation of the metal is complete when the supernatant solution contains 0.1% (w/v) of the reagent in excess. In both cases, the precipitate is washed with 1% hot acetic acid solution. The yellow complex is soluble in ethyl alcohol and chloroform, but less soluble in benzene, carbon tetrachloride, nitrobenzene etc. Both complexes (A) and (B), are suitable for direct gravimetric determination of the metal, but the complex (B) is preferred to (A), since the former has a higher molecular weight and could be filtered easily.

The metal complex (A) is used for some important separations such as separation of platinum from rhodium and iridium. The metal is separated from Co, Zn, Al, Cd, Mn, Ga, In, W, U, Mo, Th, V and Tl (500 mg added in each case) in the presence of tartrate and from Cu, Hg, Au, Ni (700 mg added in each case) in the presence of EDTA whereas Ti (500 mg) is masked with fluoride ion. Platinum is separated from rhodium(III) and iridium(III) (200 mg in each case) by prior precipitation of the former with PBT in acid medium. Os(VI) and Ru(III) are reduced by SO_2 and hydroxylamine hydrochloride respectively and then platinum is determined using the above procedure (B). Palladium(II) and cyanide ions, however, interfere with this determination.

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EFFECT OF HERBICIDE DPX-F6025 (CLASSIC), 2-(([(4-CHLORO-6-METHYL-PYRIMIDINE-2-YL), AMINO CARBONYL] AMINO SULFONYL)) BENZOIC ACID, ETHYL ESTER, ON CULTURED CELLS OF CORN AND SEVERAL GENOTYPES OF SOYBEAN

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A NEW herbicide DPX-F6025 (Classic), 2-(([(4-chloro-6-methyl-pyrimidine-2-yl) amino carbonyl] amino sulfonyl)) benzoic acid, ethyl ester, has