

precipitate was dissolved in nitric acid (1:1), the solution evaporated to dryness in a platinum dish and the organic matter ignited. The residue was dissolved in concentrated nitric acid and the manganese determined colorimetrically by the periodate method. Satisfactory results were obtained for both manganese and magnesium.

The above work was done by the author in collaboration with H. F. Harwood and L. S. Theobald of the Imperial College of Science and Technology, London. Details will be published later.

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¹ Berg, *Z. anal. Chem.*, 1929, **76**, 191.

² Raikow and Tischkow, *Chem. Ztg.*, 1911, **35**, 1013.

³ Hillebrand and Lundell, *Applied Inorganic Analysis*, 1929, p. 119.

⁴ Miller and McLennan, *J. Chem. Soc.*, 1940, 653.

ON THE VELOCITY OF SOUND IN AND CHEMICAL REACTIVITY OF BROMINE AND IODINE

THE velocity of sound in metallic elements has been found to be dependent upon the atomic frequency and the least distance separating the atoms.¹ This least distance between the atoms concerned determines the chemical reactivity and approximates to "critical atomic approach value" for any type of action.² The direct formation of bromides and iodides suggest for the 'critical atomic approach' values which may be taken to be equal to the least distance separating the atoms of these two elements. With these values of least atomic distances and author's values of atomic frequencies, attempt may here be made to compute the velocities of sound in these non-metallic elements by applying the author's formula for the case of metals.

Element	Atomic Frequency	Distance of closest approach of atoms	Valency	Constant	S. calc.	S. obs.
Bromine	2.76 ⁽⁴⁾	1.88 ⁽⁵⁾	1	10	131.1	135.0
Iodine	2.1 ⁽⁴⁾	2.12 ⁽⁵⁾	1	10	113.1	107.7

It would be evident from the above table that the values so obtained are comparable with those observed.³ It would thus appear that the author's formula for the calculation of velocities of sound in metallic elements may be extended to such calculation at least in two non-metals. Further, there would appear to be a relationship between the velocity of sound in bromine and iodine and the 'critical atomic approach values' for the direct formation of bromides and iodides. So velocity of sound appears to be significant for bromide and iodide formation.

The formula proposed for the calculation of velocity of sound in metallic elements may be represented thus

$$S = L \left\{ \left(\frac{1}{2\pi} \sqrt{K} \sqrt{\frac{P-V}{V} \cdot \frac{Ze^2}{r^3} \cdot \frac{N}{M}} \right) \times \left(f_2 \times f_1 (V) \frac{P}{V_i \times d^{k_1}} \right) \right\}$$

where S is the velocity of sound in metallic elements, L a constant having value 2.54;

$\left(\frac{1}{2\pi} \sqrt{K} \sqrt{\frac{P-V}{V} \cdot \frac{Ze^2}{r^3} \cdot \frac{N}{M}} \right)$ the atomic frequency⁴ and $\left(f_2 \times f_1 (V) \frac{P}{V_i \times d^{k_1}} \right)$ the distance of the closest approach of atoms.⁵

In the factors $\left(\frac{1}{2\pi} \sqrt{K} \sqrt{\frac{P-V}{V} \cdot \frac{Ze^2}{r^3} \cdot \frac{N}{M}} \right)$ and $\left[f_2 \times f_1 (V) \frac{P}{V_i \times d^{k_1}} \right]$, P represents parachor, V the atomic volume, Z the valency, M atomic weight, e the elementary charge, N Avogadro's number, V the ionisation potential, K and \sqrt{K} constants having the values 0.925 and 0.415×10^{12} , and $f_2 \times f_1 (V)$ a constant depending upon valency having the dimension $\frac{M^{1/2}}{L^{1.575} \times T}$ which in the present instances takes the value .615.⁵

In the application of the above formula to obtain the velocities of sound in the two non-metals cited the value of the constant L is to be multiplied by 10.

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¹ Sen, B. N., *Gazetta*, 1938, **10**, (68), 662.

² —, *Proc. National Academy of Science, India*, 1937, **8**, 1, 6.

³ *International Critical Tables*, **6**, 465.

⁴ Sen, B. N., *Journ. Ind. Chem. Soc.*, 1934, **11**, (4), 243.

⁵ —, *Gazetta*, 1938, **10**, (68), 656.

THE MILK CLOTTING ENZYME OF *WITHANIA COAGULANS*

THE fruit of *Withania coagulans* contains an active rennet which can be obtained in highly concentrated form by the following procedure: The partially dried fruits are ground up with water, the extract filtered through paper pulp and the clear solution treated with ammonium sulphate. The precipitate formed at 25 per cent. saturation is discarded as it contains very little activity. The material that separates on further addition of ammonium sulphate to 65 per cent. saturation contains the whole of the enzyme. The precipitate is separated by centrifuging, redissolved in water, and the solution after being dialysed free from ammonium sulphate, is filtered through paper pulp. Ten volumes of acetone are now added, the precipitate is centrifuged, washed with small quantities of acetone and dried in the desiccator. 100 g. fruit pulp usually yield about 3 g. of enzyme. The material thus obtained is a brownish white powder which has a milk coagulating action nearly 30 times that of the original fruit pulp, 0.125 g. of powder being capable of bringing about the coagulation of 1 litre of fresh milk at 30° in 30 minutes. The preparation is quite stable and retains its activity unimpaired on keeping at room temperature for weeks.

For determination of activity comparison was made with a standard pepsin solution prepared according to Rona¹ (1931) the substrate being either freshly boiled milk (Michaelis and Rothstein)² or milk powder (Rona and Gabbe).³ The optimum temperature for the action of enzyme is 48°. Three minutes at 90° completely destroys it, the destruction being 40 per cent. at 70° and 75 per cent. at 80°. The main properties of the enzyme from *Withania coagulans* as compared to those of other well-known milk clotting enzymes are given in the following table.

	Enzyme from <i>Withania coagulans</i>	Papain	Pepsin
ACTIVITY (Quantity of enzyme for clotting 1 lit. of milk in 30 min.)	125 mg.	31 mg.	3.2 mg.
Optimum Temperature	48°	87°	37°
Proteolytic action	—	+	+

It will be seen that the preparation from *Withania coagulans* is only about 1/4 as active as papain and 1/40 as active as pepsin. In practical cheese making however it is doubtful if papain can be utilised as a substitute for gastric rennet on account of the bitter flavour it imparts to the clot even in minute concentration. The texture of the clot formed is dependent on the time taken which is in turn determined by the quantity of enzyme and the temperature. A firm compact clot is obtained when at the optimum temperature of 48° sufficient enzyme is added to give a clot in about 20 minutes.

A finding of considerable theoretical importance is the observation that the *Withania coagulans* enzyme has no proteolytic action, no increase in amino nitrogen being observed when it is allowed to act for a week on gelatin solution at various pH's. On account of the difficulty of separating gastric rennet from pepsin the individuality of the former has often been questioned. Further in discussions on the mechanism of clot formation a proteolytic fission