expected for C_{4v} symmetry of oxovanadium(IV), in view of the previous assignments[8,9]. Amongst, these three bands, the band in the region 770–800 mμ is a prominent one and is assigned to the $d_{xy} \rightarrow d_{yz}, d_{zz}$ transition. The shoulder at 680–690 mμ may be due to the $d_{xy} \rightarrow d_{x^2-y^2}$ transition. The third band in the region 350–370 mμ is assigned to the $d_{xy} \rightarrow d_{z^2}$ transition. This band occurs as a shoulder to the intense charge transfer band of oxovanadium(IV) species having C_{4v} symmetry.

All these observations make us to regard these complexes to have co-ordination number five. Generally five co-ordinate oxovanadium(IV) complexes have square-pyramidal structures[10].

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1. Harkins, T. R., Walter, J. L., Harris, O. E. and Freiser, H., *J. Am. Chem. Soc.*, 1956, 78, 260.
2. Lane, T. J. and Quinlan, K. P., *Ibid.*, 1960, 82, 2994.
3 *a*. —, Nakagawa, I., Walter, J. L. and Kandathil, A. J., *Inorg. Chem.*, 1962, 1, 267.
b. Eilbeck, W. J., Holmes, F. and Underhill, A. E., *J. Chem. Soc.* (*A*), 1967, p. 757.
4 *a*. Artemenko, M. V. and Chistyakova, E. A., *Russ. J. Inorg. Chem.*, 1970, 15, 1254.
b. Das, A. K. and Ramana Rao, D. V., *Indian J. Chem.*, 1971, 9, 480.
c. Bose, K. S., Sharma, B. C. and Patel, C. C., *J. Inorg. Nucl. Chem.*, 1970, 32, 1742.
d. — and Patel, C. C., *Ibid.*, 1971, 33, 5.
e. — and —, *Ibid.*, 1970, 32, 1141.
5. Dutta, R. L. and Lahiry, S., *J. Indian Chem. Soc.*, 1964, 41, 62.
6. Phillips, M. A., *J. Chem. Soc.*, 1928, p. 2393.
7. Morgan, K. J., *Ibid.*, 1961, p. 2343.
8 *a*. Ballhausen, C. J. and Gray, H. B., *Inorg. Chem.*, 1962, 1, 111.
b. Jorgensen, C. K., *Acta Chem. Scand.*, 1957, 11, 73.
c. Ortolano, T. R., Selbin, J. and McGlynn, S. P., *J. Chem. Phys.*, 1964, 41, 262.
d. Wentworth, R. A. D. and Piper, T. S., *Ibid.*, 1964, 41, 3884.
e. Selbin, *J.*, *Chem. Rev.*, 1965, 65, 153.
9. Ballhausen, C. J., Djurinskij, B. F. and Watson, K. J., *J. Am. Chem. Soc.*, 1968, 90, 3305.
10 *a*. Sathyanarayana, D. N. and Patel, C. C., *J. Inorg. Nucl. Chem.*, 1966, 28, 2277; *J. Sci. Ind. Res.* (*India*), 1968, 27, 348.
b. Dey, K. and Chatterjee, K. K., *Z. anorg. allgem. Chem.*, 1971, 383, 199.

ESTIMATION OF PROTEIN CONCENTRATION OF BODY FLUIDS BY VISCOSITY METHOD

NORMALLY very little fluid is present in the serous cavities and tissue spaces of the body and the protein present in the fluid is negligible. But in diseases in which there is accumulation of fluids, the protein concentration can vary from below 100 mg/100 ml to about 6g/100 ml. Using protein concentration as one of the parameters, the fluids are classified as exudates and transudates. Exudates are encountered in inflammatory conditions which allow considerable amounts of protein to pass through by changing capillary permeability. Hence, exudates will have higher concentration of proteins. On the other hand transudates do not require inflammatory condition and contain relatively less amount of protein. To find out whether there is inflammation or not, it is customary to estimate protein in body fluids like pleural and ascitic fluids.

Various chemical methods are available for the estimation of proteins in fluids[1]. Recently estimation of protein concentration of body fluids using retractive index has been reported[2]. Studies relating viscosity of serum with protein concentration have been done in certain diseases[3]. The present work uses viscosity measurement for the estimation of protein in body fluids. Pleural and ascitic fluids were obtained from patients admitted to the hospital of Jawaharlal Institute of Postgraduate Medical Education and Research, India. The protein concentration in the fluid was estimated by the biuret method[1]. The relative viscosities of the same samples with respect to water were determined by capillary microviscometer[3] at $30 \pm 1°$ C. The relative viscosities of the different samples were plotted against protein concentration.

Pleural and ascitic fluids contain in addition to protein, glucose, urea and electrolytes like sodium chloride and sodium bicarbonate as chief components. It was found that addition of these substances in physiological amounts did not alter the relative viscosity of fluids significantly. Hence change of relative viscosity was due to protein concentration.

The relative viscosity could be correlated linearly with the protein concentration (Fig. 1). It is reported that viscosity depends on size and shape of proteins in addition to their concentration and the relation between viscosity and protein concentration was non-linear in the case of serum[3]. This may be due to a heterogeneity of proteins of different types and size in serum while it may not be the case with the fluids. The statistically

calculated regression line[4] may be expressed by the equation

$$P = 5 \cdot 196\ V - 4 \cdot 811.$$

where

P = gm of protein per 100 ml
V = relative viscosity.
the standard error of estimate of P = 0·29 gm/100 ml.

This equation could be used to determine the protein concentration in pleural and ascitic fluids. Recovery experiments using bovine albumin gave results within an error of 0·34 g/100 ml of the fluid.

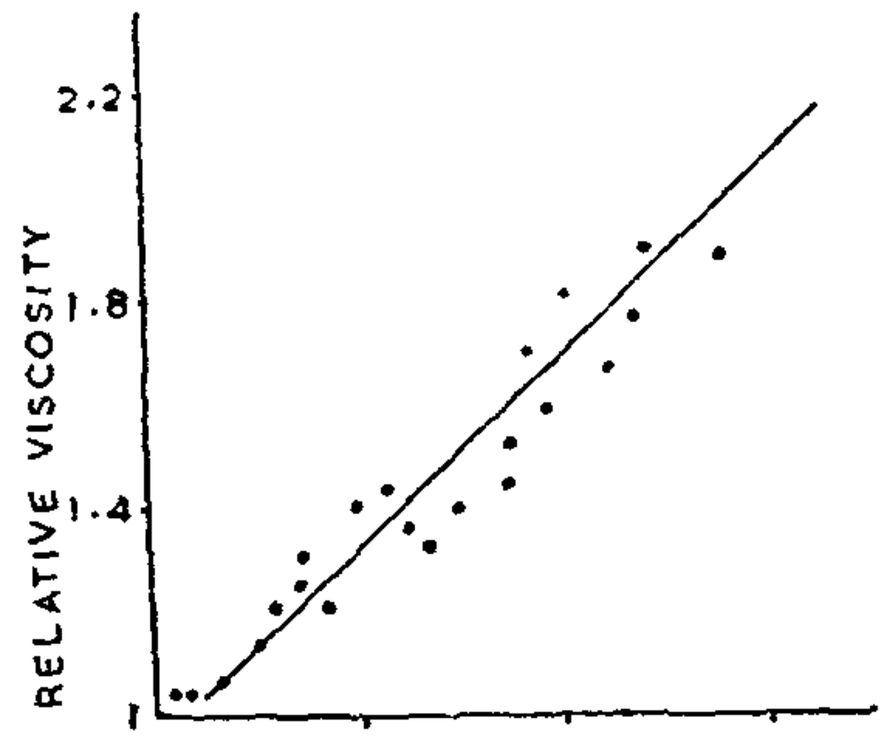

FIG. 1. Relative viscosity values plotted against fluid protein. The equation for the statistically calculated regression line is $P = 5 \cdot 196\ V - 4 \cdot 811$.

The calculated regression equation for the relative viscosity may be expressed as

$$V = 0 \cdot 109\ P + 1 \cdot 083$$

standard error of estimate of V = 0·04.

It is known that if a fluid is a transudate the protein level will be less than about 2 gm/100 ml[5]. For a sample with a protein concentration of 2 gm/100 ml the relative viscosity calculated on the basis of the above equation is $1 \cdot 3 \pm 0 \cdot 04$. Hence, the relative viscosity of $1 \cdot 3 \pm 0 \cdot 04$ may be taken as a border for transudate and exudate. Any sample having higher relative viscosity may be considered an exudate resulting from inflammation.

The viscosity method provides a rapid determination of protein concentration in pleural and ascitic fluids and assists in classifying them as transudate or exudate. This is required to know whether there is inflammation or not and to treat the patient accordingly. As this method requires neither chemicals nor electricity it could be used in mobile hospital units to advantage.

The authors thank the Principal, JIPMER and Dr. K. Subrahmanyam, Professor of Biochemistry, for encouragement.

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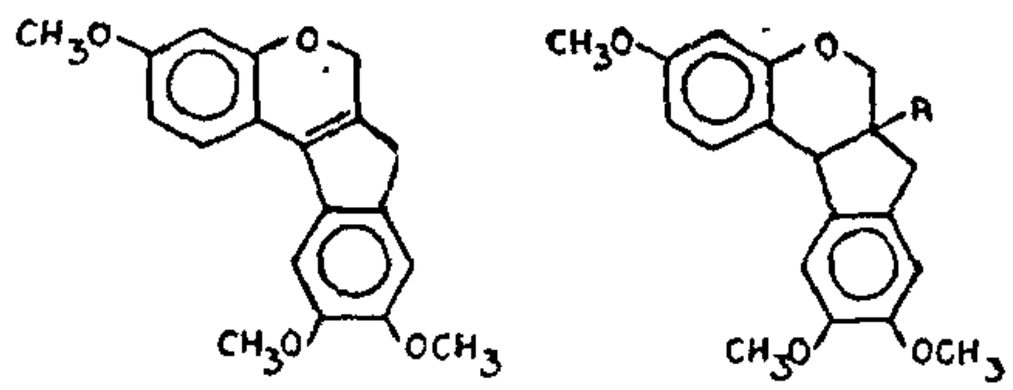
1. Varley, M., *Practical Clinical Biochemistry*, The Eng. Lang. Book Soc. and William Heinemann Medical Books Ltd., London, 1969, pp. 236, 701.
2. Krishnan, B. and Ramakrishnan, S., *Amer. J. Med. Tech.*, 1972, 38, 193.
3. Barth, W. F., "Viscosimetry of serum in relation to the serum globulins," In *Serum Protein and the Dysproteinemias*, edited by Sunderman, F. W. and Sunderman, F. W. (Jr.), Pitman Medical Publishing, Co., (Ltd.), London, 1964, p. 102.
4. Johnson, P. O., *Statistical Methods in Research*, 1st Modren Asia Ed., Prentice Hall, Inc., Englewood Cliffs, N.J., 1961.
5. Eastham, R. D., *Biochemical Values in Clinical Medicine*, 3rd ed., John Wright and Sons Ltd., Bristol, England, 1967, p. 158.

A SYNTHESIS OF (±) O-TRIMETHYL-BRAZILIN AND (±) O-TETRAMETHYL-BRAZILIN

EARLIER attempts towards the synthesis of brazilin were contemplated by way of anhydro-O-trimethyl-brazilin (I) by addition of elements of water to the double bond. Thus although two groups of workers[1,2] were able to synthesise (I) almost simultaneously, all attempts to add elements of water proved abortive. This is because (I) in itself is the *leuco*-base of quinonoid oxonium salts and so passes into them with great ease in presence of acids. Even dry hydrogen chloride in cold chloroform converts (I) into trimethoxybrazilium chloride[1].



I

II, R = H
III, R = OH
IV, R = OCH_3

It occurred to us that hydroboration of the double bond in (I) should be feasible on general grounds and indeed when (I) was hydroborated in ether ($AlCl_3 + NaBH_4$) and the product worked up, an excellent yield of *cis* O-trimethylbrazilane (II), m.p. 109–10°, was obtained. When (I) was hydroborated in tetrahydrofuran and the resulting