

because

$$\int_0^{c+\frac{dc}{d\theta}d\theta} z\psi(z)dz - \int_0^c z\psi(z)dz = \int_c^{c+\frac{dc}{d\theta}d\theta} z\psi(z)dz.$$

Hence

$$\frac{\frac{1}{T} \frac{dT}{d\theta}}{\frac{1}{\sigma} \frac{d\sigma}{d\theta}} = 2 \left[1 + \frac{1}{2} \frac{\frac{1}{\sigma} \frac{d\sigma}{d\theta} \int_c^{c+\frac{dc}{d\theta}d\theta} z\psi(z)dz}{\int_0^c z\psi(z)dz} \right]$$

$$= 2(1 + \epsilon)$$

where, according to the experimental results, $0 < \epsilon < \frac{1}{2}$. When $\epsilon = 0$, it means that

$$\int_c^{c+\frac{dc}{d\theta}d\theta} z\psi(z)dz = 0, \text{ and hence } \frac{dc}{d\theta} = 0, \text{ or there}$$

is no variation of c with temperature. But when $\epsilon = \frac{1}{2}$,

$$\frac{\int_c^{c+\frac{dc}{d\theta}d\theta} z\psi(z)dz}{\int_0^c z\psi(z)dz} = \frac{1}{\sigma} \frac{d\sigma}{d\theta}.$$

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Anomalous Magnetic Rotation of Uranyl Nitrate.

IN continuation of the work on magneto-optical rotation^{1,2} we have made at the suggestion of Prof. S. S. Bhatnagar, some observations on this property in the case of uranyl salts. It has been observed that uranyl nitrate shows a negative Faraday effect. The molecular magnetic rotation value is 5.2, assuming that of water to be 1, and it is constant over a wide range of concentration.

All known substances showing a negative Faraday effect with the exception of titanium chloride are paramagnetic (though the converse is not true). The result obtained is of particular significance in view of the

¹ Bhatnagar, Mathur and Jain, *Ind. J. Phys.*, 1930, 4, 503.

² Bhatnagar and Kapur, *J. Ind. Chem. Soc.*, 1934, 9, 767.

fact that this is another substance which in spite of being diamagnetic like titanium chloride shows negative rotation. In the formula of Ladenberg³ and others⁴ for the Faraday effect there exist two terms, one which covers the case of diamagnetic part of the molecule and the other the paramagnetic part. This anomalous effect may be attributed to the influence exercised by the paramagnetic term of these formulæ. Further work is in progress and the results will be communicated shortly.

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The Optical Rotatory Dispersion of α - and β -Pinenes in the Ultra-Violet.

IN our previous work⁵ it was found that the optical rotatory dispersion of α -pinene till $\lambda = 3000\text{\AA}$ could be satisfactorily expressed by a single term Drude's equation of the form $[\alpha] = \frac{k}{\lambda^2 - \lambda_0^2}$ the value of the characteristic frequency λ_0 being 1900\AA . This value is in satisfactory agreement with absorption spectrum measurements of α -pinene in the vapour state.⁶ Our measurements on the rotatory dispersion of β -pinene till $\lambda = 2784\text{\AA}$, which will be published shortly, also indicate the absence of any maximum on the positive side of its rotatory dispersion curve. These observations are in contradiction with those reported by Servant⁷ according to whom both α - and β -pinenes in dilute alcoholic solutions attain maximum values in the region $\lambda = 2800\text{\AA}$. Our measurements had been made on the pure liquids without the use of any solvent, but since a solvent effect of such magnitude seemed improbable in these cases we measured the rotatory dispersion in alcoholic solutions at approximately the same concentration as was used by Servant. In both cases our previous observations have been confirmed because no anomaly has been noticed till the limit of

³ Ladenberg, *Zeit. f. Phys.*, 1927, 46, 168.

⁴ Rosenfeld, *Zeit. f. Phys.*, 1930, 57, 835.

⁵ *J. A. C. S.*, 1935, 57, 334.

⁶ Stark, Steubing, Einklaar and Lipp, *Jahrb. Radioactivitat*, 1913, 10, 139.

⁷ Servant, *Compt. Rend.*, 1932, 194, 368.

transmission $\lambda =$ about 2600\AA . The absorption of β -pinene which had not previously been measured was found by a Hilger's "Spekker" spectrophotometer to be negligible till $\lambda = 2350\text{\AA}$. Moreover, if it is postulated that the anomalous rotatory dispersion of β -pinene in the visible spectrum is a superposition effect of two rotations of opposite sign and unequal dispersion, it will be very difficult to explain the second anomaly at $\lambda = 2800\text{\AA}$ in the absence of an absorption band in that region. These observations coupled with the fact that the specific rotations, so far as they can be calculated from the data given by Servant in his paper, are considerably below those usually ascribed to α - and β -pinenes in the literature would seem to suggest that the anomaly at $\lambda = 2800\text{\AA}$ is not characteristic of the pure substances.

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Pasteur's Principle of Molecular Dissymmetry: The *dextro*- and *laevo*-Camphoric Acids.

ACCORDING to Pasteur's principle of molecular dissymmetry, enantiomorphous molecular configurations must possess the same total energy. They must show similar mechanical stability and therefore have an equal chance of being produced. They must also possess identical scalar properties such as density, viscosity, solubility, refraction, dispersion, and Raman frequencies. But they must differ in those physical properties which are of the directional (vectorial) nature, such as, for example, direction of rotation of the plane of polarisation of polarised light, unsymmetrical distribution of the hemihedral facets in the crystal forms and also in the enantiomorphous distribution of pyro- and piezoelectrical polarity. The magnitude of these vectorial properties is, however, identical for the enantiomorphous forms. These results follow from classical mechanics. On the other hand, according to wave-mechanics,¹ the *dextro*- and *laevo*-form of a compound differ in energy and rotatory power although perhaps only to a very slight extent. The

same view was also expressed by Campbell² based on rather arbitrary assumptions regarding association in racemates and optically active compounds.

In support of the latter view, A. N. Campbell³ alleges to have produced evidence that the *d*- and *l*-camphoric acids are not identical in their physical properties. In anticipating the criticism which might be brought forward that his materials were not pure, he has taken elaborate pains in giving a detailed statement of the methods of preparation and purification of the two camphoric acids. But Pasteur's law of molecular dissymmetry is too fundamental to be dismissed by a few isolated observations. It seems impossible that the *d*- and *l*-forms of a compound could be other than an object and its non-superposable exact mirror image, agreeing precisely in every detail of structure and of properties except those of a vectorial nature which differ in sign but otherwise are identical in the numerical magnitude in all cases. Moreover it should be borne in mind that the wave-mechanics of rotatory polarisation is, at present, in a rather unsatisfactory condition.

With the object of testing the validity of Pasteur's law as regards the equality in the numerical value of the rotatory power of the opposite active forms, an extended series of investigations on the rotatory dispersion of the enantiomorphous forms was undertaken in this laboratory since 1926. The results of this work, which have gone to confirm Pasteur's law in an unequivocal manner, have been reported in several communications.⁴

In order to remove the above-mentioned discrepancy in the equality of the value of the rotatory power of *dextro*- and *laevo*-camphoric acids, the writer has re-examined their rotatory dispersions. Particular care was taken in following Campbell's methods of preparation and purification of these two acids for obvious reasons. Whereas Campbell found that the rotatory powers of *laevo*-form were systematically lower than those of the *dextro*- for three wave-lengths

² *Nature*, 1929, 124, 792.

³ *J. Amer. Chem. Soc.*, 1931, 53, 1661.

⁴ B. K. Singh and B. Bhaduri, *J. Indian Chem. Soc.*, 1930, 7, 54, 771; *Trans. Faraday Soc.*, 1930, 26, 347; B. K. Singh, H. P. Basu-Mallik and B. Bhaduri, *J. Indian Chem. Soc.*, 1931, 8, 95; B. K. Singh, B. Bhaduri and T. P. Barat, *ibid.*, 1931, 8, 915.

¹ G. Temple, *Trans. Faraday Soc.*, 1930, 26, 272.