

THE POLARIMETRIC ESTIMATION OF CAMPHOR IN CAMPHORATED OIL.

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IN a previous note on the examination of liniment of camphor (*Analyst*, 1898, xxiii., 272) we described two methods for the estimation of camphor in camphorated oil, one of which, yielding only approximate results, depended on a determination of the specific gravity of the liquid, whilst in the second and more accurate method the camphor was determined from the loss of weight on heating. Further experiments have shown us that by means of the polariscope the assay of camphorated oil may be effected both accurately and expeditiously.

The rotatory power of camphor in its solutions in alcohol, benzene, and some other organic liquids has been studied by Landolt and others, but, so far as we are aware, no experiments have been made with olive or other oils as solvents. We have therefore examined a number of solutions prepared by digesting known weights of camphor and olive oil together at the ordinary temperature until complete solution had been effected. In the table below are given: (1) The weight of camphor contained in 100 parts of the solution; (2) the specific gravity of the liquid at 60° F., compared with water at the same temperature; (3) the angular rotation for sodium light observed in a 200-millimetre tube with a Schmidt and Haensch half-shadow instrument; (4) the amount by which the specific gravity is raised by each 1 per cent. of camphor; (5) the angular rotation per 200 millimetres for each 1 per cent. of camphor. The olive oil used in the preparation of the solutions had a specific gravity 0.91666, and a rotatory power +0.13° per 200 millimetres. The latter figure was deducted from the observed rotations of the solutions in calculating the numbers in the fifth column of the table. The last solution was a saturated one prepared by gently warming olive oil with excess of camphor, cooling to about 10° C., and filtering; the camphor in it being determined from the loss of weight sustained on heating at 110° to 120° C.:

1. Camphor per cent.	2. Specific Gravity at 60° F.	3. Rotation per 200 Millimetres.	4. Specific Gravity raised per 1 per cent.	5. Rotation per 200 Millimetres per 1 per cent.
5.32	0.91903	+ 5.26°	0.000446	0.964°
11.26	0.92173	+ 11.35°	0.000450	0.996°
20.66	0.92604	+ 20.74°	0.000454	0.998°
26.78	0.92911	+ 26.79°	0.000465	0.996°

It will be seen from these results that the rotation is increased by nearly 1° for each per cent. of camphor present, and that the observed rotation of a sample of camphorated oil in a 200-millimetre tube gives at once, without calculation, the percentage of camphor with sufficient accuracy for most purposes. The rotation appears not to be appreciably influenced by ordinary variations of temperature. According to Bishop (*Journal of the Society of Chemical Industry*, 1887, p. 750), olive oil has a rotatory power +0.13° per 200 millimetres, and several specimens examined by us have given values closely approximating to this, values too small to affect

seriously the optical estimation of camphor dissolved in such oils. In the case of some other oils which are occasionally substituted for olive oil in liniment of camphor the rotatory power is greater. Thus, we have found the rotation of two specimens of rape oil to be -0.16° and -0.3° , and of sesame oil $+1.6^{\circ}$, per 200 millimetres, results which are in accord with those of Bishop, whilst two samples of fluorescent mineral oil gave rotations of $+0.12^{\circ}$ and $+0.42^{\circ}$. Experiments with rape oil and mineral oil have shown us, however, that the increased rotation caused by the solution of camphor in the oils is practically the same as with olive oil, so that if the nature of the oil used in the preparation of the sample is known, the process is still applicable. With regard to the identification of the oil used, we have found that the sample may be examined directly with the refractometer, the refractive index of the oil being apparently almost unaffected by the presence of dissolved camphor.

It is worthy of notice that the specific rotation of camphor in its solutions in olive oil is shown by our experiments to be about $+54^{\circ}$, a higher result than is given by any of the solvents examined by Landolt, and approximating to the value ($+55.4^{\circ}$) calculated by him for the absolute specific rotation of camphor.

Since writing the above, our attention has been called to an account of some experiments by E. Dowzard (*British Food Journal*, 1900, p. 69), who finds, by comparing the rotatory power of a number of samples of camphorated oil with the amount of camphor "ascertained by the gravimetric process," that the angular rotation per 100 millimetres multiplied by the factor 1.962 gives the percentage of camphor in the sample. This result is in fair agreement with our own experiments.

We are indebted to Dr. Thomas Stevenson for permission to use results obtained in his laboratory.

NOTE.—We are indebted to Mr. A. H. Allen for informing us, in a private communication, that P. Chabot (*Compt. rend.*, cxi., 231, and *Journal of the Chemical Society*, Abstracts, 1890, 1427) had previously determined the rotatory power of camphor when dissolved in various oils. A 20 per cent. solution in olive-oil gave the value $+55^{\circ} 12'$, and this also agrees fairly with our own results.
