# THE 1920 COHOBATED OILS OF AMERICAN AND JAPANESE PEPPERMINTS.*

(A Contribution from the Laboratory of Organic Chemistry, Vanderbilt University, in coöperation with the Wisconsin Pharmaceutical Experiment Station.)

BY ROLAND E. KREMERS.

Through the courtesy of the Director of the Station and of Prof. W. O. Richtmann, Pharmacognosist in charge of the Gardens, the cohobated oils of American and Japanese peppermints produced during the summer of 1920 were placed at the disposal of the writer for investigation. The results for each species are reported below.

## JAPANESE PEPPERMINT.

*Material.*—The aqueous distillate resulting from the usual steam distillation of the partly wilted herb was saved after the oil had been separated by a florentine flask and was cohobated. That is, it was redistilled, the first one-fourth to one-third coming over as distillate being reserved for the repetition of the process, the residual three-fourths to two-thirds being discarded. This procedure was repeated until the final distillate was reduced to a volume too small for redistillation. The oil, separated from each run by passing the distillate through florentine flasks, is known as the cohobated oil. There were obtained:

| | | |
|---|---|---|
| 1st cohobation | 250 Cc. | (Fraction 1) |
| 2nd and 3rd cohobations | 50 Cc. | (Fraction 2) |
| Total | 300 Cc. | |

*Constants.*—The following physical and chemical constants were found:

| Constant. | Fraction 1. | Fraction 2. |
|---|---|---|
| $d_{18}$ | 0.938 | 0.953 |
| $n_{18}$ | 1.485 | 1.487 |
| Ester number | 39.2 | ..... |
| Ester no. after acetylation | 69.1 | ..... |
| Percent ester | 13.8 | ..... |
| Percent alcohol as ester | 10.9 | ..... |
| Percent total alcohol | 20.3 | ..... |
| Percent alcohol free | 9.4 | ..... |

*Fractionation.*—The entire amount of oil was fractionated *in vacuo* after heating to 100° at atmospheric pressure had shown the absence of any appreciable quantity of low boiling compounds. After the third distillation, the following series was obtained:

| Fraction. | B. p. 17. | $d_{18}$. | $n_{18}$. |
|---|---|---|---|
| 1 | −90° C. | ..... | 1.455 |
| 2 | 90–95 | ..... | 1.4736 |
| 3 | 105–08 | 0.936 | 1.4828 |
| 4 | 108–10 | 0.935 | 1.4845 |
| 5 | 110–12 | ..... | 1.4858 |
| 6 | 112–20 | ..... | 1.4860 |
| 7 | 120+ | residue | ..... |

*Aldehydes.*—Schiff's reagent showed that a small amount of aldehyde was present in Fractions 1 and 2.

*Pulegone.*—The constants of Fractions 3 and 4 suggested the presence of pulegone. The preparation of the nitroso-ketone was undertaken according to the directions in "Gildemeister," Vol. I, p. 465. Turbidity ensued almost immedi-

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ately after the mixing of the reagents. The melting point of the crystalline product obtained was found to be 83° C.; m. p. of bisnitroso-pulegone is given as 81.5°. Therefore pulegone was indicated.

A volumetric assay for pulegone was made by the neutral sulphite method; original volume, 5 Cc.; final volume, 2.1 Cc.; loss 2.9 Cc., corresponding to 58 volume percent. The reaction proceeded very slowly and may not have been complete when the reading was made.

Following these indications, a preliminary attempt to isolate a crystalline bisulphite addition compound was successfully made. Accordingly Fraction 108–10°, volume approximately 150 Cc., was diluted with 50 Cc. alcohol and was shaken with a solution of 100 Gm. sodium bisulphite in 200 Cc. of water. The addition product separated slowly. The latter was filtered off by suction, then washed with alcohol and ether. The pulegone was regenerated by the addition of alkali and separated by steam distillation. The recovered oil gave a good yield of semicarbazone, m. p. 167°. Pulegone semicarbazone melts at 167.5–168° C.

Therefore pulegone was the largest single constituent of the oil. It has not been possible to identify any other.

AMERICAN PEPPERMINT.

*Material.*—The cohobation of the aqueous distillate of *Mentha piperita* gave the following quantities of oil:

| | | |
|---|---|---|
| 1st cohobation | 810 Cc. | (Fraction 1) |
| 2nd cohobation | 245 Cc. | (Fraction 2) |
| 3rd cohobation | 70 Cc. | (Fraction 3) |
| 4th cohobation | 32 Cc. | |

*Constants.*—The following values were found:

| | Fraction 1. | Fraction 2. | Fraction 3. |
|---|---|---|---|
| $d_{24}$ | 0.916 | 0.931 | 0.940 |
| $n_{24}$ | 1.468 | 1.471 | 1.476 |
| Ester number | 21.65 | 22.4 | 29.9 |
| Percent ester | 7.7 | 7.9 | 10.6 |
| Percent alcohol as ester | 6.0 | 6.2 | 8.3 |
| Ester no. after acetylation | 195.0 | 192.0 | 160.5 |
| Total alcohol | 63.6 | 62.5 | 50.8 |
| Percent alcohol free | 57.6 | 56.3 | 42.5 |

*Aldehyde.*—With Schiff's reagent, Fraction 3 gave a faint reaction for aldehydes; nothing could be ascertained about this substance except that a negative test with aniline acetate proved it not to be furfural.

*Fractionation.*—After it had been shown that no low boiling constituents were present in quantity, the entire amount of oil was repeatedly fractionated, resulting in the series tabulated below.

| Fraction. | B. p. 11. | $d_{25}$. | $n_{25}$. |
|---|---|---|---|
| 1 | —75° C. | 0.915 | 1.4553 |
| 2 | 75–90 | 0.915 | 1.4610 |
| 3 | 90–95 | 0.909 | 1.4625 |
| 4 | 95–97 | 0.909 | 1.4646 |
| 5 | 97–99 | 0.908 | 1.4656 |
| 6 | 99–01 | 0.910 | 1.4672 |
| 7 | 101–04 | 1.913 | 1.4682 |
| 8 | 104–10 | 1.920 | 1.4725 |

| Fraction. | B. p. 11. | $d_{25}$. | $n_{25}$. |
|---|---|---|---|
| 9 | 110–20 | 1.928 | 1.4800 |
| 10 | 120–30 | 0.951 | 1.495 |
| 11 | 130–40 | ..... | 1.500 |
| 12 | 140+ | Residue | ..... |

*Menthol.*—The chief fractions, notably those boiling between 97 and 104° at 11 mm., crystallized on being exposed over night to temperatures below 0° C. By allowing the oils to freeze in separatory funnels or in percolators, the liquid portions could be drained with considerable success. By melting the crude crystals, refreezing, and draining again, pure menthol was isolated in some quantity. In a more severe winter than that of 1920–21, this method of isolation and purification should prove to be quite efficient.

*Menthone.*—A test portion of the fractions from which menthol had been frozen out was treated with semicarbazide solution. The semicarbazone thus obtained was purified by digestion with hot dilute alcohol; m. p. was 185°. Menthone semicarbazone melts at 184°; therefore menthone was present.

*Methyl-1 Cyclohexanone-3.*—The constants recorded for methyl-1 cyclohexanone-3 are: b. p. = 169° C.; $d_{21} = 0.915$; $n_D = 1.4430$. Those of Fraction 1 are in good agreement with these values. A preliminary trial yielded a semicarbazone which had a melting point of 180° after recrystallization, namely, that of methyl-1 cyclohexanone-3 semicarbazone. Accordingly the presence of this compound is indicated.

SUMMARY.

The results of this investigation of the composition of the cohobated oils of American and Japanese peppermints established the following:

1. The cohobated oil of American peppermint is composed largely of menthol and menthone; menthylesters and methyl-1 cyclohexanone-3 are lesser constituents.

2. The cohobated oil of Japanese peppermint contained no isolable quantity of menthol, which was contrary to expectation, but on fractionation yielded almost exclusively the pulegone fraction.

3. No explanation is offered for the fact that no alcoholic constituent was isolated from the Japmint oil after chemical assay had indicated the presence of 20 percent of alcohol calculated as menthol, unless the usual assay methods are not applicable to oils containing a high percent of pulegone.

## A RAPID ASSAY METHOD FOR THE DETERMINATION OF ASCARIDOLE IN OIL OF CHENOPODIUM.*

BY E. K. NELSON.

On account of the increasing use of oil of chenopodium as a treatment for hookworm in man and animals, it is desirable to have a quick, reliable method for the estimation of ascaridole, which is undoubtedly the active ingredient.

At present the oil is judged by its physical constants, and the Pharmacopoeia provides that it should have a specific gravity at 25° of 0.955 to 0.980, an optical rotation of —4° to —10°, and be soluble in 8 volumes of 70% alcohol.

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