

STUDIES IN THE GENUS *MENTHA*.IX. THE REDUCTION OF *d*-PULEGONE BY PALLADIUM AND HYDROGEN.¹BY G. C. JENISON² AND R. E. KREMERS.³

As will be elucidated in a subsequent paper, the occurrence of menthenones in the oils of the Genus *Mentha* has been made the basis for a working hypothesis concerning genetic relationships in the formation of certain compounds. These speculations involve the reduction of a menthenone, $C_{10}H_{16}O$, to a saturated ketone, $C_{10}H_{18}O$. Since *d*-pulegone is the quantitatively important isomer according to our present knowledge of these oils, an understanding of its behavior on reduction is very desirable.

Inasmuch as catalytic reductions at room temperature have at least certain superficial analogies to biochemical processes, attention was turned to this type of reaction. Skita⁴ has reduced *d*-pulegone by the Pt-H catalyst under 2 atmospheres pressure and has reported *d*-menthol as the product. Since the reduction of *d*-pulegone by the Pd-H catalyst appeared not to have been reported, to undertake it was a logical development. Our initial experiments were performed as follows.

The hydrogen used was withdrawn from a commercial bomb and led into a gasometer under little more than atmospheric pressure. Before passing into the reaction mixture, it was washed through bottles containing respectively alkaline pyrogallol, alkaline permanganate, distilled water, and sulphuric acid. The bottle serving as reaction chamber was fitted with a twice-bored rubber stopper which carried the inlet tube and a stop cock to permit displacement of air.

The proportions of the reaction mixture were taken as follows: 0.2 Gm. of palladium recently converted into the chloride was dissolved in 5 mls. of water; there were added 0.5 ml. of 10 per cent gum arabic solution and of 0.5 *N* sodium hydroxide a quantity equivalent to the chlorine present. Finally 10 mls. of pulegone dissolved in 10 mls. of 95 per cent ethanol were introduced. After the air had been displaced, the reaction mixture was shaken mechanically until hydrogen was no longer appreciably absorbed. This interval was usually about 30 hours.

At the completion of the reaction the oil and catalyst were best separated by steam distillation. Of 113 mls. of pulegone reduced in varying amounts, 83 mls. were recovered from the aqueous distillate. This oil was treated according to the assay technique with sodium sulphite to free it from pulegone, again steam distilled, and finally dried over anhydrous sodium sulfate. The resultant oil measured 64 mls.

$$d_{20} = 0.9002; \quad n_{22} = 1.4601; \quad \alpha = +21.19^{\circ}$$

Ester number after acetylation = 33.6, corresponding to 9.6 per cent menthol. The oil was twice fractionated.

¹ Contribution from the Wisconsin Pharmaceutical Experiment Station, Madison.

² Fritzsche Brothers Fellow.

³ National Research Council Fellow in Chemistry, 1922-1923.

⁴ Skita, *Ber.*, 48, 1496 (1915).

Frac.	B. p.	d_{20}	n_{20}	Vol.	$\alpha_{D_{20}}$
1	200-05°	0.8936	1.4535	8.8 ml.
2	205-10	0.9020	1.456	30.0	+21.15°
3	210-15	0.8975	1.461	7.0
4	215-22	0.9204	1.4701	4.4
5	222+	residue			

Ten mls of fraction 2 were converted into the semicarbazone. The reaction product was resolved into two fractions. The higher melting fraction showed a melting point of 183-84° C.; mixed with *l*-menthone semicarbazone the result was m. p. 183° C.; 0.5 g. of the semicarbazone dissolved in 100 mls. of absolute ethanol showed $\alpha = -0.25^\circ$ in a 10 cm. tube, whence $[\alpha]_D = -50^\circ$.

Three grams of the semicarbazone were mixed with 10 Gm. of oxalic acid and distilled by steam. The regenerated ketone was separated mechanically from the aqueous distillate. One Gm. in 10 mls. of 95 per cent ethanol showed $\alpha = -0.67^\circ$ in a 10-cm. tube, whence $[\alpha]_D = -6.7^\circ$.

The regenerated ketone was reconverted into its semicarbazone, m. p. 184°, thus proving that isomerization had not occurred during hydrolysis.

The lower melting fraction of the original semicarbazone showed a melting point of 99° C. One Gm. dissolved in 20 mls. of chloroform showed $\alpha_D = +1.57^\circ$ in a 10-cm. tube, whence $[\alpha]_D = +31.4^\circ$. The ketone was regenerated in the same manner as the preceding. One Gm. in 10 mls. of 95 per cent ethanol showed $\alpha_D = +2.57^\circ$, whence $[\alpha]_D = +25.7^\circ$.

The semicarbazone obtained from the regenerated ketone melted at 175-176° C.

Fraction 3 was examined for menthol by means of phenyl-isocyanate in the usual manner. Crystals separated slowly and were filtered out at the end of three days. They proved to be diphenylurea, m. p. 234° C.

SUMMARY.

d-Pulegone obtained from the oil of the "Japanese Peppermint" grown at the Wisconsin Pharmaceutical Experiment Station was reduced by palladium and hydrogen. The reaction product consisted essentially of saturated ketonic material. The semicarbazone prepared therefrom yielded a levo-rotatory fraction similar to *l*-methone and a dextro-rotatory fraction which was not identified. No positive evidence of the presence of menthol was obtained.

EXTRACTION OF ALKALOIDS FROM ANIMAL MATTER.

For the extraction of alkaloids and other organic compounds from viscera or other animal organs, R. Fabre suggests submitting the tissues to the action of pancreatin. The organs are pulped and then mixed with 5 parts of water; the mixture is heated to boiling, and on cooling to 50-55°, it is transferred to a wide-mouthed flask, adding 1 gram of pancreatin for every 50 grams of pulp. The

flask is maintained for 10 to 12 hours at a temperature of 50-55°, at the end of which the proteolytic action is complete. The contents of the flask are now heated to boiling and filtered; the resulting clear liquid is then treated with the usual solvents to extract the alkaloid. The author found that by this method strychnine, narcotine, veronal, and sulphonal are not altered by pancreatin.—R. FABRE in *Répertoire de Pharmacie*, August 10, 1925; through *Chemist & Druggist*.