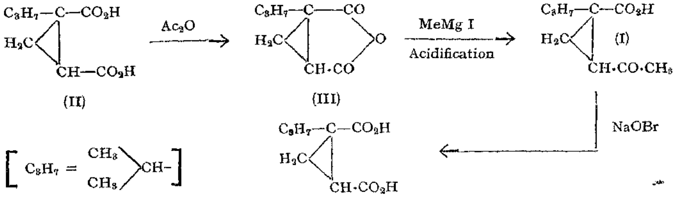
SYNTHETICAL INVESTIGATIONS IN THE THUJANE SERIES PART IX.

A new method of Synthesis of Umbellulonic Acid.

By P. C. Guha and M. S. Muthanna.

Umbellulonic acid, an oxidation product of the naturally occurring bicyclic terpene ketone umbellulone, has been synthesised (Guha and Muthanna *Ber.*, 1938, **71**, 2665) by the action of diazoacetone upon ethyl isopropyl acrylate. The acid yielded an oxime and a semicarbazone melting respectively at 145-146° and 169-170°. Tutin (*J. C. S.*, 1906, **89**, 1113) ascribed the melting point 169-170° to the oxime of umbellulonic acid obtained from umbellulone by oxidation. This discrepancy in the m.p. of the oxime could only be solved by comparing the m.p. of our sample with that derived from umbellulone. But, owing to the non-procurability of a sample of natural umbellulone, the identity of our synthetic acid (I) with umbellulonic acid could not be established. The ketonic acid (I) has been successfully converted to umbellularic acid (II) by sodium hypobromite oxidation and the latter identified with a specimen of umbellularic acid obtained by synthesis in this laboratory (Ranganathan, *J. Indian Chem. Soc.*, 1936, **13**, 419; Guha and Muthanna, *Ber.*, 1938, **71**, 2668). Umbellulonic acid has now been synthesised by another new method according to the following scheme :



The anhydride of umbellularic acid (III) reacts with one molecular proportion of methyl magnesium iodide and the ketonic acid obtained yields an oxime and a semicarbazone melting at 145-146° and 169-70°, respectively. The mixed melting points of the oxime and semicarbazone with those obtained by the older method, remained undepressed.

EXPERIMENTAL.

The starting material umbellularic acid was prepared according to Rydon's method (*J.C.S.*, 1936, 829).

Isopropyl fumaric acid.—Ethyl isopropyl acetoacetate (102 g.) was taken in absolute ether (175 c.c.) and dry bromine (197 g.) added dropwise in about half-an-hour. The HBr and ether were removed under suction on a water-bath and the residue after cooling added to potassium hydroxide pellets (188 g.) in absolute alcohol (110 c.c.), during 20 minutes. The vigour of the reaction was controlled by cooling under tap. The product was refluxed for half-an-hour on water-bath and then steam distilled, about 750 c.c. of the distillate being collected. The residue on acidification yielded a crude acid which after treatment with animal charcoal and crystallisation from water melted at 184-185° ; yield 42 g.

The ethyl ester of the above acid was obtained by refluxing a mixture of the acid (42 g.), absolute alcohol (122 g.), dry benzene (189 c.c.) and chemically pure conc. sulphuric acid (28 c.c.), and working up the product as usual. 50 Grams of the ester (88% of theory) was thus obtained, b.p.115-116°/20 mm.; the yield according to Rydon being 69 per cent.

Conversion of trans *into* cis *umbellularic acid.*—A mixture of the *trans* acid (20 g.) and acetyl chloride (50 g.) was heated in an autoclave at 200° for 9 hours. The acetyl chloride was removed under suction on water-bath and the residue distilled at 138-140°/20 mm. A test sample on digestion with water yielded *cis*-umbellularic acid monohydrate, m.p.95°, which on drying over P_2O_5 yielded the anhydrous *cis*-acid, m.p.124-25° (cf. Rydon, loc.cit.).

Action of magnesium methyl iodide on umbellularic anhydride: Formation of umbellulonic acid (I).—Methyl magnesium iodide was prepared by treating dry magnesium ribbon (0.8 g.) with an ethereal solution (25 c.c.) of methyl iodide (4.75 g.). The ether was removed under suction and the reagent taken in dry benzene (20 c.c.) solution. The benzene solution containing magnesium methyl iodide was added dropwise to a boiling solution of umbellularic anhydride (5 g.) in dry benzene (75 c. c.) and the mixture heated under reflux for one hour. The cooled product was treated with ice cold water and the benzene layer extracted with dilute sodium carbonate solution. The alkaline solution was acidified and extracted with ether which yielded a thick oil distilling at 190-191°/50 mm. The acid yielded an oxime which after crystallisation from alcohol melted at 145–146°; the mixed m.p. with the sample of the oxime obtained by our previous method remained undepressed (Found: N, 7.51. $C_9H_{15}O_3N$ requires N, 7.57 per cent.). The semicarbazone prepared in the usual way melted at 169-170°; mixed m.p. with a sample prepared by our previous method remained undepressed (Found: N, 18.32. $C_{10}H_{17}O_3N_3$ requires N, 18.5 per cent.).

Department of Pure & Applied Chemistry,
Indian Institute of Science,
Bangalore.