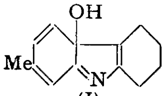
1 : 2 : 3 : 4-*Tetrahydro-6-hydroxy-7-methylcarbazole and 3-Hydroxy-2-methylcarbazole.*

By José A. Cummins, B. F. Kaye, and Muriel L. Tomlinson.

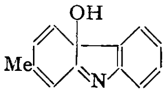
[Reprint Order No. 5020.]

1 : 2 : 3 : 4-Tetrahydro-6-hydroxy-7-methylcarbazole and 3-hydroxy-2-methylcarbazole have been synthesised and have been shown to be identical with a substance, $C_{13}H_{15}ON$ (isolated as a by-product in the preparation of 8-chloro-1 : 2 : 3 : 4-tetrahydro-5-methylcarbazole from *cyclo*hexanone 6-chloro-*m*-tolylhydrazone)*, and its dehydrogenation product, $C_{13}H_{11}ON$, respectively.

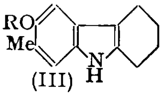
It was shown (Milne and Tomlinson, *J.*, 1952, 2789) that the so-called " 12-hydroxy-1 : 2 : 3 : 4-tetrahydro*iso*carbazole " and " 12-hydroxy*iso*carbazole " described by Barnes, Pausacker, and Schubert (*J.*, 1949, 1381) are actually 1 : 2 : 3 : 4-tetrahydro-6-hydroxycarbazole and 3-hydroxycarbazole, respectively. Earlier Pausacker and Robinson (*J.*, 1947, 1557) had very tentatively suggested the *iso*carbazole structures (I) and (II) for a by-product, $C_{13}H_{15}ON$, obtained while carrying out the Fischer reaction with *cyclo*hexanone 6-chloro-*m*-tolylhydrazone, and its dehydrogenation product, $C_{13}H_{11}ON$, because these compounds were apparently devoid of phenolic character. It has now been proved, as could be expected from Milne and Tomlinson's observations, that these two substances are, nevertheless, 1 : 2 : 3 : 4-tetrahydro-6-hydroxy-7-methylcarbazole (III; R = H) and 3-hydroxy-2-methylcarbazole, respectively, by comparison of them with authentic specimens.



(I)

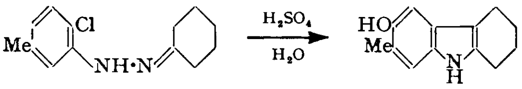


(II)



(III)

The compound (III; R = Me) was prepared by the Fischer reaction from 4-methoxy-*m*-tolylhydrazine and *cyclo*hexanone : only one product was isolated. It is assumed that this must be the 7- and not the 5-methyl derivative from its identity with the methoxy-derivative of the by-product from the cyclisation of *cyclo*hexanone 4-chloro-*m*-tolylhydrazone. This by-product must have arisen by ring-closure with the elimination of the chlorine atom, the main product of the reaction being, of course, 8-chloro-1 : 2 : 3 : 4-tetrahydro-5-methylcarbazole. Demethylation of (III; R = Me) afforded authentic 1 : 2 : 3 : 4-tetrahydro-6-hydroxy-7-methylcarbazole (III; R = H) and dehydrogenation and demethylation of (III; R = Me) gave 3-hydroxy-2-methylcarbazole.



Experimental

1 : 2 : 3 : 4-*Tetrahydro-6-hydroxy-7-methylcarbazole.*—(*a*) 4-Methoxy-*m*-toluidine * (4·7 g.) in hydrochloric acid (9 c.c.) and water (12 c.c.) was diazotised between −5° and 0° with sodium nitrite (2·5 g. in a little water). The violet diazonium salt solution was filtered through glass-wool into stannous chloride (18 g.) and hydrochloric acid (24 c.c.) at −10° to −5°. The hydrazine salt thus formed was collected after being kept at 0° for 1 hr. and then for 12 hr. at room temperature. After being washed with cold brine it was suspended in water and treated with *cyclo*hexanone (3·6 g.) and excess of sodium acetate. The crude hydrazone, which

---

* In these substituted toluenes, the group named as a suffix or, in the case of the tolyl radical, the free valency is numbered 1.

separated as a red paste, was collected, washed with water, and dissolved in alcohol and the solution filtered to remove inorganic matter. After precipitation with water the hydrazone was directly converted into 1 : 2 : 3 : 4-*tetrahydro*-6-*methoxy*-7-*methylcarbazole* by boiling it with sulphuric acid (2N; 75 c.c.). The product crystallised from alcohol as needles, m. p. 172° (Found: C, 78·4; H, 7·9. $C_{14}H_{17}ON$ requires C, 78·1; H, 7·9%). This compound (0·5 g.) was boiled with acetic acid (5 c.c.) and hydrobromic acid (50%; 1 c.c.) in an atmosphere of carbon dioxide for 2 hr. After the solution had cooled, water precipitated 1 : 2 : 3 : 4-tetrahydro-6-hydroxy-7-methylcarbazole which crystallised from benzene as plates, m. p. 208° (brown liquid and some softening at 200°).

This compound is practically insoluble in 2N-sodium hydroxide, although the mixture of the two darkens when kept; addition of a drop of aqueous ferric chloride to its alcoholic solution gives a brownish-violet colour. (*b*) The substance $C_{13}H_{15}ON$ was prepared as described by Pausacker and Robinson (*loc. cit.*); it was recrystallised from benzene and was now obtained as colourless plates, m. p. 208° (brown liquid and softening at 200°) unaltered on admixture with 1 : 2 : 3 : 4-tetrahydro-6-hydroxy-7-methylcarbazole prepared as under (*a*) above (Found: C, 77·4; H, 7·5. Calc. for $C_{13}H_{15}ON$: C, 77·6; H, 7·5%). It (1·2 g.) was mixed with acetone (10 c.c.) and potassium hydroxide (0·7 g. in a little water) and treated gradually with methyl sulphate (1·5 g.). Addition of water precipitated 1 : 2 : 3 : 4-tetrahydro-6-methoxy-7-methylcarbazole which crystallised from alcohol as needles, m. p. 169° raised to 170° by admixture with that compound prepared as under (*a*).

3-*Methoxy*-2-*methylcarbazole*.—(*a*) 1 : 2 : 3 : 4-Tetrahydro-6-methoxy-7-methylcarbazole (0·5 g.) was heated with palladised charcoal (0·15 g.; containing 10% of palladium on norite) at 200—220° in a stream of carbon dioxide for 2 hr. The product was extracted with acetone, precipitated with water, and collected. Recrystallisation from alcohol afforded 3-*methoxy*-2-*methylcarbazole* as needles, m. p. 179—181·5°. (*b*) Similar dehydrogenation of the tetrahydromethoxymethylcarbazole prepared as described under (*b*) above afforded 3-methoxy-2-methylcarbazole, m. p. 179—181·5° unaffected by admixture with that compound prepared from the synthesised tetrahydro-compound (Found: C, 79·9; H, 6·3. $C_{14}H_{13}ON$ requires C, 79·6; H, 6·2%).

3-*Hydroxy*-2-*methylcarbazole*.—(*a*) 3-Methoxy-2-methylcarbazole (0·45 g.; synthetic) was boiled with acetic acid (5 c.c.) and hydrobromic acid (50%; 1 c.c.) with frequent shaking during 1 hr. and then a further equal quantity of acetic and hydrobromic acids was added. Refluxing was continued for another hour. On cooling, the product crystallised, was collected, and recrystallised from benzene, from which 3-hydroxy-2-methylcarbazole separated as needles which began to darken about 270° and finally melted to a black liquid at 316°. It was practically insoluble in 2N-sodium hydroxide though the mixture darkened when kept; a green precipitate was formed when a drop of aqueous ferric chloride was added to its alcoholic solution. (*b*) The by-product, $C_{13}H_{15}ON$, from the Fischer reaction with *cyclo*hexanone 6-chloro-*m*-tolylhydrazone was dehydrogenated as above at 280—300°, and the product, after extraction with acetone and precipitation with water, was recrystallised from benzene. It separated as needles that softened at 260°, darkened, and finally melted to a black liquid at 316° (Found: C, 79·1; H, 5·7. Calc. for $C_{13}H_{11}ON$: C, 79·2; H, 5·6%). The m. p. was previously found to be 262° (decomp.). Comparison of the infra-red spectra of specimens made as described under (*a*) and (*b*) showed that the two are identical.

4-*Amino*-o-*cresol*.—This substance (used as an intermediate in the preparation of 4-methoxy-*m*-toluidine) has previously been prepared by reduction of 4-nitroso-*o*-cresol with ammonia and hydrogen sulphide (Jacobs and Heidelberger, *J. Amer. Chem. Soc.*, 1917, **39**, 3198) but the following is more convenient. Crude 4-nitroso-*o*-cresol, from *o*-cresol (30 g.) (Bridge and Morgan, *Amer. Chem. J.*, 1898, **20**, 766), was dissolved in cold sodium carbonate solution (2N) and filtered to remove unchanged cresol. To this was then added gradually, with stirring, sodium dithionite (50 g.). The amine (16 g.; m. p. 170—173°) separated and was collected.

The authors are very grateful to Sir Robert Robinson for helpful discussion and for his interest in this work.

THE DYSON PERRINS LABORATORY, OXFORD. [*Received, January 9th,* 1954.]