CCXLV.—*The Isomeric Hydroxybenzyldimethylamines.*

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A SEPARATE problem necessitated the synthesis of the isomeric hydroxybenzyldimethylamines, which was effected by treating the methoxybenzyl bromides with dimethylamine and hydrolysing the methoxybenzyldimethylamines so prepared with hydrobromic acid —a method similar to that employed by Tiffeneau (*Bull. Soc. chim.*, 1911, **9**, 825) for the preparation of the *p*-isomeride. Previous unsuccessful attempts had been made to prepare these phenols from the nitrobenzyl chlorides. Dimethylamine converted the latter into the nitrobenzyldimethylamines, which, on reduction, gave the aminobenzyldimethylamines. These underwent smooth diazotisation, but no phenol could be isolated from the tarry product obtained by decomposing the diazo-compound in hot aqueous solution.

In the interaction between *p*-nitrobenzyl chloride and dimethylamine, a considerable quantity of di-*p*-nitrobenzyldimethylammonium chloride was produced, whilst only insignificant amounts (if any) of such quaternary salts were formed from the *o*- and *m*-isomerides. Although the reactions were not carried out under the same conditions of concentration, this result agrees with the recent experiments of McCombie, Scarborough, and Smith (this vol., p. 802), who have shown that the velocity coefficient for the formation of quaternary salts from trimethylamine and the nitrobenzyl chlorides is greater in the case of the *p*- than of the *o*- and *m*-isomerides.

EXPERIMENTAL.

o-, m-, *and* p-*Hydroxybenzyldimethylamine.*—A solution of the methoxybenzylbromide in benzene was prepared by saturating a benzene solution of the methoxybenzyl alcohol with dry hydrogen bromide, drying it over anhydrous calcium bromide, and distilling off benzene until most of the excess hydrobromic acid had been removed (compare Lapworth and Shoesmith, J., 1922, **121**, 1391). Excess of a solution of dimethylamine in benzene was then added and after 24 hours the dimethylamine bromide which had separated was removed by filtration and the methoxybenzyldimethylamine extracted from the benzene solution with hydrochloric acid. Traces of benzene were removed from the acid solution by extraction with ether, and the base was liberated with sodium hydroxide and extracted with ether. Evaporation of the dried ethereal extract gave the methoxybenzyldimethylamine, which, after being distilled under diminished pressure, was converted into the hydroxybenzyldimethylamine by boiling with constant-boiling hydrobromic acid. In the case of the *m*-compound, 4 hours sufficed completely to hydrolyse the methoxy-group. The hydrobromic acid was removed by distillation under diminished pressure, the residue dissolved in water and made alkaline with sodium carbonate, and the phenol shaken out with ether. The product obtained on evaporation of the dried ethereal extract rapidly crystallised. In the case of the *o*- and *p*- compounds, the treatment with hydrobromic acid was continued for 10 hours. Nevertheless, hydrolysis was incomplete and considerable decomposition occurred with the *p*-isomeride. In both cases, the product left after removal of the hydrobromic acid was dissolved in water, and the solution was extracted with ether before and after being made alkaline with sodium hydroxide in order to remove impurities and unchanged methoxy-compound. It was then made slightly acid and the phenol was precipitated with sodium carbonate and shaken out with ether. Evaporation of the dried ethereal extract gave the phenols in fairly pure form.

m-*Methoxybenzyldimethylamine* is a colourless oil, b. p. 105°/13 mm. The *hydrochloride* crystallises from acetone–alcohol in tablets, m. p. 173° (Found: Cl, 17·6. $C_{10}H_{15}ON,HCl$ requires Cl, 17·6%).

m-*Hydroxybenzyldimethylamine* crystallises from benzene in prisms, m. p. 108°. The *hydrochloride* crystallises from alcohol in flat prisms, m. p. 173° (Found: Cl, 18·9. $C_9H_{13}ON,HCl$ requires Cl, 18·9%).

p-Methoxybenzyldimethylamine has b. p. 109°/13 mm. (compare Tiffeneau, *loc. cit.*). The *hydrochloride* crystallises from acetone in prisms, m. p. 152° (Found: Cl, 17·6%).

p-Hydroxybenzyldimethylamine (compare Tiffeneau) has m. p. 106°. The *hydrochloride* separates from alcohol in macroscopic prisms, m. p. 185° (Found: Cl, 18·7%).

o-*Methoxybenzyldimethylamine* is a colourless oil, b. p. 113°/20 mm. The *hydrochloride* is hygroscopic. After crystallisation from acetone, it has m. p. 149° (Found: Cl, 17·7%).

o-*Hydroxybenzyldimethylamine* is a colourless oil, b. p. 99—100°/12 mm. The *methiodide* crystallises from alcohol in prisms, m. p. 169° (Found: I, 43·1. $C_9H_{13}ON,CH_3I$ requires I, 43·35%).

o-*Nitrobenzyldimethylamine.*—An alcoholic solution of 30 g. of *o*-nitrobenzyl chloride was treated with dimethylamine (slightly more than 2 mols.) dissolved in the same solvent. After 3 days, the alcohol was evaporated, and the residue treated with water and sufficient hydrochloric acid to produce a clear solution. After extraction with ether to remove any unchanged nitrobenzyl chloride, the solution was made alkaline with sodium carbonate and the oil thus precipitated shaken out with ether. Evaporation of the dried ethereal extract left 29·1 g. of an oil. This was converted directly into the hydrochloride (yield 33 g.). When recrystallised from alcohol–acetone, the *hydrochloride* of o-*nitrobenzyldimethylamine* forms long, almost colourless prisms, m. p. about 221° (Found: Cl, 16·4. $C_9H_{12}O_2N_2,HCl$ requires Cl, 16·4%).

o-*Aminobenzyldimethylamine.*—The hydrochloride (10 g.) of *o*-nitrobenzyldimethylamine was mixed with 17 g. of granulated tin, and 70 g. of concentrated hydrochloric acid were added slowly in small portions, with efficient cooling. The solution was finally heated on the water-bath for 30 minutes and then cooled. The crystalline stannichloride which had separated was filtered off and decomposed in aqueous solution by hydrogen sulphide, the filtrate from the tin sulphide was boiled to expel the excess of hydrogen sulphide and made alkaline with sodium carbonate, and the oil thus precipitated was extracted with ether. Evaporation of the dried ethereal extract left 4 g. of a somewhat brown oil which slowly crystallised. (A further 1·6 g. was obtained by working up

the filtrate from the stannichloride in a similar manner.) This was distilled under diminished pressure; o-*aminobenzyldimethylamine*, b. p. 107°/14 mm., then passed over as a colourless oil which crystallised completely on cooling. The crystals had m. p. 36—37°. The *dihydrochloride* separates from alcohol in blunt prisms, m. p. 205° after sintering at 193° (Found: Cl, 31·7. $C_9H_{14}N_2,2HCl$ requires Cl, 31·8%).

Action of Dimethylamine on p-*Nitrobenzyl Chloride.*—A mixture of dimethylamine (slightly more than 2 mols.) and *p*-nitrobenzyl chloride (30 g.) in alcoholic solution was kept for 3 days. The alcohol was then evaporated, and the residual brown oil treated with water and sufficient hydrochloric acid to produce a clear solution. Ether extracted from this a small quantity of a red oil. Addition of sodium carbonate to the aqueous solution precipitated an oil which partly solidified. Extraction with ether removed the oil, but not the solid. On evaporation of the dried ethereal extract, an orange oil (20·8 g.) was obtained. This was converted directly into the hydrochloride, but only 14 g. could be obtained in solid form. The *hydrochloride* of *p*-nitrobenzyldimethylamine thus prepared crystallised from acetone–alcohol in faintly yellow plates, m. p. 188° (Found: Cl, 16·3. $C_9H_{12}O_2N_2,HCl$ requires Cl, 16·4%). The base was recovered from the oily residue from the preparation of the hydrochloride and divided into two portions, one of which was treated with methyl iodide. This yielded p-*nitrobenzyltrimethylammonium iodide*, which crystallised from alcohol in yellow, wedge-shaped prisms, m. p. 198° (Found: I, 39·1. $C_9H_{12}O_2N_2,CH_3I$ requires I, 39·4%). The second portion of the recovered base was treated with an alcoholic solution of oxalic acid; the *oxalate* of *p*-nitrobenzyldimethylamine was thus obtained, which separated from alcohol in lustrous, yellow plates, m. p. 155°. The identities of the oxalate and methiodide were established by recovering the base from the oxalate and converting separate portions into its methiodide and hydrochloride. The salts obtained were identical with those described above.

The above-mentioned solid which was not extractable with ether was filtered off (yield 8·8 g.) and recrystallised from alcohol; it then formed stout prisms, m. p. about 176°. Its behaviour was that of a quaternary chloride, for it was soluble in water and its aqueous solution contained ionic chlorine, but gave no precipitate on addition of alkalis. Analysis indicated that it was *di*-p-*nitrobenzyldimethylammonium chloride* (Found: Cl, 10·1. $C_{16}H_{18}O_4N_3Cl$ requires Cl, 9·8%).

p-Aminobenzyldimethylamine, prepared as in the case of the *m*-isomeride, has b. p. 133°/16 mm. (compare Friedländer and

Mosczyc, *Ber.*, 1895, **28**, 1141). The *dihydrochloride* separates from alcohol in needles, m. p. 216° (Found: Cl, 31·7. $C_9H_{14}N_2,2HCl$ requires Cl, 31·8%).

m-*Nitrobenzyldimethylamine* was prepared from *m*-nitrobenzyl chloride (20 g.) and dimethylamine as in the case of the *o*-isomeride, 19·1 g. of a yellow oil being obtained. This was converted directly into the hydrochloride (yield 23 g.). When recrystallised from alcohol, the *hydrochloride* of *m*-nitrobenzyldimethylamine forms practically colourless, stout prisms, m. p. 230° (Found: Cl, 16·3. $C_9H_{12}O_2N_2,HCl$ requires Cl, 16·4%).

m-*Aminobenzyldimethylamine* was prepared by the method employed for the *o*-isomeride. 10 G. of the hydrochloride of the nitro-compound yielded a crystalline stannichloride which, on decomposition with hydrogen sulphide, gave 3 g. of the base. On distillation, it was obtained as a colourless oil, b. p. 129°/13 mm., which rapidly crystallised. The crystals had m. p. 46°. The *dihydrochloride* crystallised from alcohol in prisms, m. p. 225° after sintering at 210° (Found: Cl, 31·7. $C_9H_{14}N_2,2HCl$ requires Cl, 31·8%).

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