CXXV.—*Aminobenzthiazoles. Part XII. The Mobility of 1-Amino-3 : 5-dimethylbenzthiazole. A Case of Complete Reactivity in the Aminothiazole Form.*

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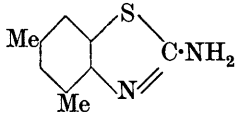
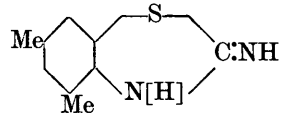
THE symmetrical triad system in 1-amino-3 : 5-dimethylbenzthiazole responded satisfactorily to the symmetry test of mobility, since the hydrolysis of 1-*imino*-2-*acetyl*-3 : 5-*dimethyl*-1 : 2-*dihydrobenzthiazole* and of 1-*acetamido*-3 : 5-*dimethylbenzthiazole* yielded the same base (I ⇌ II) (compare Hunter, J., 1926, 1385; Hunter and Styles, J., 1928, 3019).

(I.)  ⇌  (II.)

On the other hand, the methylation of this single individual with methyl iodide under mild, and also under vigorous, conditions yielded exclusively the *hydriodide* of 1-imino-2 : 3 : 5-trimethyl-1 : 2-dihydrobenzthiazole, no trace of the hydriodide of the isomeric 1-methylamino-base being obtained.

Attempts to isolate intermediate products in these methylations were unsuccessful. When 1-amino-3 : 5-dimethylbenzthiazole was treated with methyl sulphate in benzene, however, a *methosulphate* was obtained which was decomposed by strong alkalis with regeneration of the amino-base.

EXPERIMENTAL.

m-Xylylthiocarbimide, b. p. 262—263°/760 mm. (corr.), was prepared in 95% yield from *s*-di-*m*-xylylthiocarbamide (m. p. 152—153°; Dyson and George, J., 1924, **125**, 1705, give 149—150°)

by the method used in the case of the *o*-tolyl compound (Hunter and Styles, *loc. cit.*).

1-Amino-3 : 5-dimethylbenzthiazole was prepared by reduction of the bromo-addition compound obtained from *m*-xylylthiocarbamide (0·7 c.c. of bromine and 6 c.c. of chloroform to 1 g. of the thiocarbamide), suspended in sulphurous acid, with sulphur dioxide. The base separated from 50% alcohol in needles, m. p. 139—140°. The lower m. p. originally assigned to this base (J., 1926, 1400) was due to a trace of solvent, which is removed by drying at 100°. The intermediate bromo-addition *compound*, which is usually very unstable, was isolated by using dried materials; it formed orange needles, m. p. 273° (decomp.) (Found : Br, 46·9. $C_9H_{10}N_2Br_2S$ requires Br, 47·3%).

Synthesis of 1-*Amino*-3 : 5-*dimethylbenzthiazole from* 1-*Imino*-2-*acetyl*-3 : 5-*dimethyl*-1 : 2-*dihydrobenzthiazole and from* 1-*Acetamido*-3 : 5-*dimethylbenzthiazole.*—Labile *acetyl*-m-*xylylthiocarbamide* was prepared from 5 g. of *m*-xylylthiocarbamide and 11 c.c. of acetic anhydride at 75° (compare Hugershoff, *Ber.*, 1899, **32**, 3649) in short needles, m. p. 121—122° (Found : S, 14·6. $C_{11}H_{14}ON_2S$ requires S, 14·4%). Difficulty was frequently experienced in obtaining it, owing to the ease with which it passed into the stable isomeride, the change being catalysed by acetic anhydride.

1-*Imino*-2-*acetyl*-3 : 5-*dimethyl*-1 : 2-*dihydrobenzthiazole* was prepared in the same manner as the *o*-tolyl homologue (Hunter and Styles, *loc. cit.*), and separated from dilute alcohol in small granules, m. p. 118° (Found : S, 14·1. $C_{11}H_{12}ON_2S$ requires S, 14·5%). It was recovered unchanged after being heated under reflux with 60% sulphuric acid for 3 hours, but yielded the aminobenzthiazole when heated with 30% hydrochloric acid for 4 hours. Stable *acetyl*-m-*xylylthiocarbamide* crystallised from alcohol in long prisms, m. p. 181—182° (Found : S, 14·7%).

1-*Acetamido*-3 : 5-*dimethylbenzthiazole hydrotribromide*, obtained by treating a suspension of 1·5 g. of stable acetyl-*m*-xylylthiocarbamide in chloroform (10 c.c.) with bromine (1·1 c.c. in 3 c.c. of chloroform) and heating the mixture under reflux for a few minutes, crystallised in orange needles, m. p. 167° (decomp.) (Found : Br, 52·1. $C_{11}H_{13}ON_2Br_3S$ requires Br, 52·1%). The *acetamidobenzthiazole*, obtained by reduction with sulphurous acid, separated from alcohol–ethyl acetate in plates, m. p. 259—260° (Found : S, 14·7%), and was identical with the product obtained by heating a solution of 1-amino-3 : 5-dimethylbenzthiazole (8 g.) in acetic anhydride (33 c.c.) and alcohol (100 c.c.).

Methylation of 1-*Amino*-3 : 5-*dimethylbenzthiazole.*—(A) A mixture of the amino-base (8 g.) and methyl iodide (9 c.c.) was heated at

100° for 24 hours and the product was finely ground and extracted with 250 c.c. of boiling alcohol. The residue (11·5 g.) consisted of the hydriodide of the iminomethyl base, m. p. 265° (decomp.), and was identical with the product of methylation in benzene. Fractional crystallisation of the alcoholic extract yielded a hydriodide (1 g.) and 1·1 g. of a dark-coloured solid, m. p. 185—190°.

The insoluble hydriodide was decomposed by heating with 30% sodium hydroxide solution for an hour; the base, which was isolated by extraction with ether or chloroform, formed a clear tenacious gum which sometimes solidified on keeping in a vacuum. On recrystallisation from 70% methyl alcohol, 1-*imino*-2 : 3 : 5-*trimethyl*-1 : 2-*dihydrobenzthiazole* was obtained in small colourless crystals, m. p. 105—106° (Found : S, 16·9. $C_{10}H_{12}N_2S$ requires S, 16·7%). On treatment with acetic anhydride, the gum gave an almost quantitative yield of the *acetyl* derivative, which crystallised from alcohol–ethyl acetate in plates, m. p. 186° (Found : N, 12·3; S, 13·9. $C_{12}H_{14}ON_2S$ requires N, 12·0; S, 13·7%). The *hydriodide* obtained from the iminomethyl base and hydriodic acid was identical with that obtained in the methylation; on recrystallisation from alcohol (animal charcoal), it formed soft plates having a silvery-green lustre, m. p. 274° (decomp.) [Found : C, 37·7; H, 3·9 (Pregl's method); I, 39·6; S, 9·7. $C_{10}H_{12}N_2S$, HI requires C, 37·5; H, 4·1; I, 39·7; S, 10·0%].

The hydriodide and the dark-coloured product, m. p. 185—190°, obtained by fractional crystallisation of the alcoholic extract, when decomposed in the same way, did not yield any trace of the methylamino-derivative; the latter yielded some unchanged 1-amino-3 : 5-dimethylbenzthiazole (identified as the acetyl derivative).

In attempts to isolate the intermediate methiodide through which methylation is assumed to take place (Hunter and Styles, *loc. cit.*), either the original materials were recovered unchanged, or the iminomethylbenzthiazole derivative was formed.

(B) The quantity of material methylated in benzene solution was inappreciable in the first few hours; the following experiment is typical of a number. A mixture of 10 g. of 1-amino-3 : 5-dimethylbenzthiazole, methyliodide (20 c.c.), and benzene (30 c.c.) was heated under reflux for 16 hours. The hydriodide (2·3 g.; m. p. 266°) separated in the later stages. On fractional crystallisation, the mother-liquor yielded unchanged 1-amino-3 : 5-dimethylbenzthiazole, and an iodine-free *substance* which crystallised in needles, m. p. 156—157° (Found by Pregl's method: C, 62·2; H, 6·0%), and has not yet been identified.

1-*Methylamino*-3 : 5-*dimethylbenzthiazole and its Derivatives.*—s-m-*Xylylmethylthiocarbamide*, prepared from *m*-xylylthiocarbimide

(6 g.) in alcohol, and methylamine (30% excess), crystallised in plates, m. p. 152° (Found : S, 16·6. $C_{10}H_{14}N_2S$ requires S, 16·5%). 1-*Methylamino*-3 : 5-*dimethylbenzthiazole* was prepared by reducing the orange bromo-addition compound (m. p. 129°) obtained from the methylthiocarbamide (4 g.), chloroform (20 c.c.), and bromine (3·5 c.c.); it separated from alcohol in needles, m. p. 124—125° (Found : S, 16·8%). The *acetyl* derivative crystallised from alcohol–ethyl acetate in needles, m. p. 156—157° (Found : S, 13·7%). The *hydriodide*, which was much more soluble in ordinary solvents than the iminomethyl isomeride, crystallised from alcohol in needles, m. p. 225—227° (decomp.) (Found : I, 39·3%).

1-*Amino*-3 : 5-*dimethylbenzthiazole methosulphate* was prepared by heating a solution of the aminothiazole (5 g.) in benzene (25 c.c.) and methyl sulphate (10 c.c.) under reflux for 3 hours; it separated from methyl alcohol in colourless needles, m. p. 216—217° (Found : S, 20·8. $C_{11}H_{16}O_4N_2S_2$ requires S, 21·05%). Decomposition of 0·8 g. of this compound with 20% potassium hydroxide solution yielded 0·35 g. of 1-amino-3 : 5-dimethylbenzthiazole (m. p. 137—138° after recrystallisation).

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