99. A Convenient Method for preparing γ-Picoline.

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A method has been worked out for the preparation of the inaccessible γ-picoline from 2 : 4-dimethylpyridine.

Although γ-picoline has been used by a few workers and in particular by Löffler (*Ber.*, 1909, **42**, 124) and Meisenheimer (*Annalen*, 1920, **420**, 190) for the synthesis of quinuclidine, it is generally inaccessible. We have needed it for research purposes for some time and have now worked out a method for its preparation from the easily procurable 2 : 4-dimethylpyridine. When this is treated with benzaldehyde, 2-*styryl*-4-*methyl*- and 2 : 4-*distyryl-pyridine* are formed. These are easily separated by distillation, and oxidation of the former gives the apparently hitherto undescribed 4-*methylpyridine*-2-*carboxylic acid*, which is readily converted into γ-picoline on heating above its melting point. In order to get the best possible yield of γ-picoline in this reaction, conditions would have to be found for reducing the considerable proportion of the distyryl compound now obtained, but even so 2·5 g. can be easily obtained from 10 g. of the lutidine.

Experimental.

2-*Styryl*-4-*methylpyridine and* 2 : 4-*Distyrylpyridine*.—2 : 4-Dimethylpyridine (12 g.), freshly distilled benzaldehyde (24 g.), and acetic anhydride (24 g.) were refluxed for 16 hours. The mixture was acidified with dilute hydrochloric acid (1 : 1), steam-distilled to remove the excess of benzaldehyde, and made alkaline with sodium hydroxide; after standing, the resulting solid was collected, washed with water, and dried. On distillation 11—12 g. passed over at 160—165°/1 mm., leaving 6·5 g.* in the flask. When the distillate was redistilled, almost the whole passed over at approximately 160°/1 mm. and set to a solid (m. p. 62°). Its *picrate* was sparingly soluble in acetic acid and acetone and separated in yellow prisms, m. p. 258° after slight softening (Found: C, 56·6; H, 3·95. $C_{14}H_{13}N,C_6H_3O_7N_3$ requires C, 56·6; H, 3·8%). The *base* regenerated from the picrate by alkali crystallised from light petroleum in colourless prisms, m. p. 70° (Found: C, 85·9; H, 6·3. $C_{14}H_{13}N$ requires C, 86·1; H, 6·7%). The residue*, which distilled at 250°/1 mm., was crystallised from benzene and then from alcohol, colourless prisms of the *distyryl* compound being obtained, m. p. 172—173° (Found: N, 5·1. $C_{21}H_{17}N$ requires N, 4·9%).

4-*Methylpyridine*-2-*carboxylic Acid*.—The above mono-condensation product (10 g.) was dissolved in acetone (100 c.c.), cooled in ice, and stirred while finely powdered potassium permanganate (20·5 g.) was added during 30 minutes. The reaction mixture was filtered, and the precipitate washed with acetone and extracted three times with hot water (about 60 c.c. each time). The aqueous filtrate was acidified with hydrochloric acid and after 1 hour the precipitated benzoic acid (3 g. approx.) was collected, and the filtrate warmed and stirred while copper carbonate (4·3 g.) was added. The blue copper salt was collected, washed with water, suspended in hot water, and treated with hydrogen sulphide. The filtrate was at once rapidly evaporated to dryness under reduced pressure; the *acid* * (4·5—4·8 g.) was then obtained as a colourless or very slightly coloured solid. It crystallised from benzene in colourless prisms, m. p. 136—137° (Found: C, 61·7; H, 5·2; N, 10·5. $C_7H_7O_2N$ requires C, 61·3; H, 5·1; N, 10·2%). The *ethyl* ester was obtained by dissolving the above crude acid * (4·8 g.) in absolute alcohol (40 c.c.), cooling the solution in ice, and saturating it with dry hydrogen chloride. Colourless crystals soon began to separate, but they had almost all dissolved after 20 hours at room temperature. The mixture was then refluxed for 1¾ hours, the alcohol removed under reduced pressure, concentrated aqueous potassium carbonate added, and the liberated ester extracted with ether and dried over potassium carbonate; distillation gave the ester (3·95 g.) as a colourless liquid, b. p. 105°/1 mm. (Found: C, 65·4; H, 6·4. $C_9H_{11}O_2N$ requires C, 65·5; H, 6·6%). The ester *picrate* separated from alcohol in well-defined prisms with solvent of crystallisation, which was lost on drying on the water-bath; the picrate then crystallised from benzene in yellow prisms, m. p. 126—127° (Found: C, 46·0; H, 3·3. $C_9H_{11}O_2N,C_6H_3O_7N_3$ requires C, 45·7; H, 3·6%).

γ-Picoline.—The crude acid (4·5 g.*) was divided into two portions and each was heated somewhat above its m. p. in a distilling flask with a trace of copper powder for 1 minute and then distilled. γ-Picoline (2·1 g.), which passed over, was redistilled over solid potassium hydroxide and obtained as a colourless liquid, b. p. 142—143°, which gave a picrate, m. p. 166—167°, as described in the literature (Found: C, 44·3; H, 3·0. Calc.: C, 44·7; H, 3·1%), and a *methiodide*, large colourless flat prisms, m. p. 149—150°, from acetone (Found: C, 35·7; H, 4·7. $C_7H_{10}NI$ requires C, 35·7; H, 4·3%).

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