CCCCXXXII.—*Preparation of Diethylaminoethanol Esters of Diphenyl-2-carboxylic Acid and Derivatives.*

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ROBERTS AND JOHNSON (*J. Amer. Chem. Soc.*, 1925, **47**, 1399) have directed attention to the marked anæsthetic action of diethylaminoethyl diphenate, and it was thought of interest to make the diethylaminoethyl esters of several related carboxylic acids.

Diphenyl-2-carboxylyl chloride reacted with diethylaminoethyl alcohol to give an *ester hydrochloride* with a well-marked anæsthetic action. The chlorides of diphenyl-4-carboxylic, fluorenone-4-carboxylic, and 2′-cyanodiphenyl-2-carboxylic acids furnished esters of perceptible but smaller action. *2′-Cyanodiphenyl-2-carboxylyl chloride* was obtained together with about 10% of diphenimide by the action of thionyl chloride on diphenamic acid (compare the action of thionyl chloride on diphenic acid; J., 1927, 1698).

$$\begin{matrix} C_6H_4\cdot CO_2H \\ C_6H_4\cdot CO\cdot NH_2 \end{matrix} \longrightarrow \begin{matrix} C_6H_4\cdot COCl \\ C_6H_4\cdot CN \end{matrix} + \begin{matrix} C_6H_4\cdot CO \\ C_6H_4\cdot CO \end{matrix}\!\!>\!NH$$

Diphenyl-2-carboxylyl chloride shows a great tendency to change into fluorenone during distillation. On the other hand, diphenoyl dichloride seems quite stable, although its boiling point is almost 50° higher. 2′-Cyanodiphenyl-2-carboxylyl chloride decomposed to only a slight extent; the 4-cyanofluorenone produced was found in the distillate. The considerable stability of this acid chloride is of interest, because the convenient process for obtaining 4-cyanofluorenone by the action of phosphorus pentachloride on phenanthraquinone monoxime (Borsche and Gander, *Ber.*, 1914, **47**, 2818) must depend on its intermediate formation.

EXPERIMENTAL.

Diphenyl-2-carboxylyl chloride was obtained as a pale yellow liquid, b. p. 163°/10 mm., when a solution of diphenyl-2-carboxylic acid in warm thionyl chloride was distilled in a vacuum (Found: C, 72·0; H, 4·1. Calc.: C, 72·1; H, 4·2%) (compare Schlenk and Bergmann, *Annalen*, 1928, **464**, 33). In two subsequent experiments the chloride decomposed completely during distillation with the formation of pure fluorenone. Bretscher, Rule, and Spence (this vol., p. 1502) have apparently had the same experience and are investigating the reaction in detail.

Interaction of this chloride and 2-aminodiphenyl in pyridine solution gave the corresponding *amide*, which crystallised from acetic acid in needles, m. p. 194° (Found: C, 85·5; H, 5·5. $C_{25}H_{19}ON$ requires C, 85·9; H, 5·4%).

Diethylaminoethyl Diphenyl-2-carboxylate.—Diethylaminoethyl alcohol (5 g.) was added to a solution of the acid chloride (9·2 g.) in benzene (20 c.c.). The semi-solid product was warmed on the water-bath for ½ hour and evaporated in a vacuum, and the residual gum dissolved in cold water. The base was liberated with ammonia, extracted with ether, and distilled in a vacuum, giving a colourless liquid, b. p. 183°/1 mm., which contained some impurity (Found: C, 75·9; H, 7·6. $C_{19}H_{23}O_2N$ requires C, 76·8; H, 7·8%). It was treated in dry ether with hydrogen chloride (slightly less than the theoretical amount), the *hydrochloride of* diethylaminoethyl diphenyl-2-carboxylate being precipitated as a white powder, m. p. 109—110° (Found: HCl, 11·0. $C_{19}H_{23}O_2N$,HCl requires HCl, 10·9%). This hydrochloride is slightly hygroscopic, dissolves in a small amount of water to give a clear solution which becomes milky on dilution, and is markedly anæsthetic to the tongue.

Diethylaminoethyl Diphenyl-4-carboxylate.—4-Methyldiphenyl (Gomberg and Pernert, *J. Amer. Chem. Soc.*, 1926, **48**, 1375) was converted by oxidation with 2% aqueous permanganate solution (Jacobson, *Ber.*, 1895, **28**, 2547) into the corresponding acid, and this into the acid chloride (m. p. 114°) by thionyl chloride. When the acid chloride (4·6 g.) in benzene was treated with diethylaminoethyl alcohol (2·5 g.), a crystalline deposit was immediately obtained; the reaction was completed by warming the mixture for ½ hour. The product was collected and dissolved in water, impurities were removed by extraction with ether, the base was liberated with dilute sodium carbonate solution and extracted with ether, and the extract was dried with sodium sulphate and treated with hydrogen chloride, the *hydrochloride* of diethylaminoethyl diphenyl-4-carboxylate being precipitated as a white powder, m. p. 183° (Found: HCl, 11·2. $C_{19}H_{23}O_2N$,HCl requires HCl, 10·9%). This hydrochloride is extremely soluble in water, but the solution becomes milky on dilution.

2′-Cyanodiphenyl-2-carboxylyl Chloride.—Diphenamic acid (16·7 g.) and thionyl chloride were warmed together for ½ hour and the resultant solution was evaporated in a vacuum. A solution of the residual paste in a little benzene was filtered from the needle crystals of diphenimide (1·5 g.), m. p. 217—219°, and diluted with light petroleum, *2′-cyanodiphenyl-2-carboxylyl chloride* being precipitated as a white powder, which crystallised from carbon tetrachloride in stout prisms (10·6 g.), m. p. 84° (Found: C, 69·8; H, 3·2. $C_{14}H_8ONCl$ requires C, 69·6; H, 3·3%). On heating in a vacuum, it gave a pale yellow distillate, b. p. 222°/15 mm., containing about 3% of 4-cyanofluorenone, which remained undissolved by treatment with warm ether and then crystallised from alcohol in long, yellow needles, m. p. 243—244° (Borsche and Sander, *loc. cit.*, give 240°).

Alternatively, the distillate was dissolved in warm sodium hydroxide solution; the 4-cyanofluorenone remained undissolved, and the filtered solution, when poured into dilute hydrochloric acid, gave 2′-cyanodiphenyl-2-carboxylic acid, which crystallised from alcohol in stout needles, m. p. 173° (Werner and Siguet, *Ber.*, 1904, **37**, 4311, give 170—172°).

Diethylaminoethyl 2′-cyanodiphenyl-2-carboxylate was prepared in a similar way to the diphenyl-4-carboxylate. The *hydrochloride* was obtained as white plates, m. p. 189° (Found: HCl, 10·3. $C_{20}H_{22}O_2N_2$,HCl requires HCl, 10·2%), not hygroscopic though moderately easily soluble in water.

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