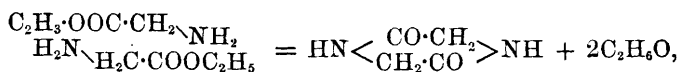


XX.—*Interaction of Benzylamine and Ethylic Chloracetate.*

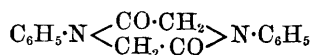
By ARTHUR T. MASON, Ph.D., F.I.C., and GOODLATTE R. WINDER, Ph.D., F.I.C.

AMIDOACETIC acid (glycocoll) and methylamidoacetic acid (sarkosine), as well as their ethylic salts, easily lose the elements of water, forming so-called anhydrides, which, as Curtius and Schulz have shown (*Ber.*, **23**, 3041), are derivatives of piperazine, formed by the union of 2 mols. of the compounds with elimination of 2 mols. of water or of alcohol,



the substances being $\alpha\gamma$ -diacipiperazine and dimethyl- $\alpha\gamma$ -diacipiperazine respectively.

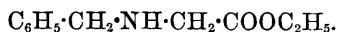
Rebuffat (*Gazzetta*, **17**, 231; *Ber.*, **21**, Ref. 136) has shown that the chief product of the interaction of aniline and chloractic acid is phenylglycocoll, $\text{C}_6\text{H}_5\cdot\text{NH}\cdot\text{CH}_2\cdot\text{COOH}$; by heating the latter at $140\text{--}150^\circ$, it is converted into a compound of the formula



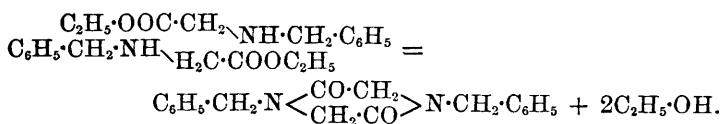
(Hausdörfer, *Ber.*, **22**, 1797), which is identical with P. J. Meyer's phenylglycine anhydride (*Ber.*, **10**, 1967), and with Abenius' diphenyl-

ketopiperazine (*Ber.*, **21**, 1665), and according to Bischoff's nomenclature is named diphenyl- $\alpha\gamma$ -diacipiperazine.

The experiments described in the sequel show that benzylamine acts on ethylic chloracetate in an analogous manner, the first product being the ethylic salt of benzylamidoacetic acid,



This compound, however, undergoes condensation so readily, that when kept for a few days, the gradual separation of diphenyl- $\alpha\gamma$ -diacipiperazine is noticed, and in a few months the liquid becomes filled with beautiful, white needles of that compound,



Ethylic Benzylamidoacetate, $\text{C}_6\text{H}_5\cdot\text{CH}_2\cdot\text{NH}\cdot\text{CH}_2\cdot\text{COOC}_2\text{H}_5$.

A mixture of 20 grams (2 mols.) of benzylamine, about 30 c.c. of absolute alcohol, and 11.4 grams (1 mol.) of ethylic chloracetate, was heated for half an hour on the water bath, in a flask connected with a reflux condenser; no change was noticed except a slight yellow colouring of the liquid, but on distilling off the alcohol, a semi-solid mass was obtained, consisting of benzylamine hydrochloride and an almost colourless oil. Ether was added to the cold mixture, when the oil dissolved easily, leaving the benzylamine salt as a white, crystalline powder; this, when collected by the aid of the pump and washed with ether, weighed 13 grams when dry (theory, 13.3 grams). The ether was removed from the filtrate by distillation, and the remaining oil submitted to distillation under reduced pressure (10–20 mm.); it came over as a colourless liquid between 155° and 170° (bath, 210–225°), and on rectifying under the same conditions, the greater portion distilled at 160–165° (bath, 220°). A complete distillation, however, was not possible, as the compound undergoes condensation easily at such temperatures, the piperazine derivative separating in white needles in the delivery tube. For analysis, a freshly distilled sample was taken, and, as the numbers show, the product was not quite pure.

0.1338 gave 0.3312 CO_2 and 0.088 H_2O . C = 67.50; H = 7.30.

0.1308 „ 0.3236 „ „ 0.094 „ C = 67.47; H = 7.98.

$\text{C}_{11}\text{H}_{15}\text{NO}_2$ requires C = 68.39; H = 7.77 per cent.

The compound is miscible in all proportions with alcohol, ether, benzene, and toluene. It dissolves easily in dilute hydrochloric acid, and platinic chloride precipitates from such a solution a yellow, semi-

solid platinum salt. On long standing, condensation takes place, and the piperazine derivative described below gradually separates in colourless needles.

Picrate, $C_6H_5 \cdot CH_2 \cdot NH \cdot CH_2 \cdot COOC_2H_5, C_6H_2(NO_2)_3 \cdot OH$.—A hot alcoholic solution of 1.18 grams (1 mol.) of picric acid was mixed with 1 gram (1 mol.) of ethylic benzylamidoacetate. As nothing separated on cooling, the solution was evaporated to a small bulk, and ether added, when the picrate separated as a bright yellow, crystalline powder. After recrystallisation from warm ether, it presented the same appearance, and melted at 154° . For analysis, it was dried over sulphuric acid.

0.2361 gave 28 c.c. moist nitrogen at 20° and 722 mm. $N = 12.87$.

$C_{11}H_{15}NO, C_6H_2(NO_2)_3 \cdot OH$ requires $N = 13.27$ per cent.

Benzylamidoacetic acid (Benzylglycocol), $C_6H_5 \cdot CH_2 \cdot NH \cdot CH_2 \cdot COOH$.—A boiling aqueous solution of the copper salt described below was decomposed with hydrogen sulphide, and the precipitated copper sulphide removed by filtration. The filtrate was reduced to a small bulk on the water bath, and then to dryness over sulphuric acid in a partial vacuum; the pale brown, crystalline residue, on extraction with boiling absolute alcohol, lost most of its colour, but ignition on platinum foil revealed the presence of inorganic matter. By treatment with 96 per cent. alcohol, in which the acid gradually dissolves, the greater part of the impurity could be removed, but even after repeated treatment in this manner small quantities still remained, and the numbers obtained on analysis were too low in the carbon. The purest specimen we prepared crystallised from water in thin, white needles, and melted sharply at $197-198^\circ$. The results of the analyses of the following salts are, we think, sufficient proof of the identity of the acid. The specimen above mentioned, although very easily soluble in water, was insoluble in all the other general solvents.

Sodium Salt, $C_9H_{10}NO_2Na$.—An alcoholic solution of ethylic benzylamidoacetate, and the theoretical quantity of pure sodium hydroxide, was heated for 12 hours on the water bath, using a reflux condenser; on cooling, the sodium salt separated as a white, gelatinous mass, which, as filtration was found impracticable, was spread on porous plates; after some days, the white, amorphous powder left was purified by warming it with a small quantity of absolute alcohol, and, after cooling, again spreading on porous plates. The salt was dried over sulphuric acid for analysis.

0.2075 gave 0.0805 Na_2SO_4 . $Na = 12.56$.

$C_9H_{10}NO_2Na$ requires $Na = 12.30$ per cent.

It is very easily soluble in cold water, but only sparingly in hot alcohol.

Copper salt, $(C_9H_{10}NO_2)_2Cu$.—On pouring a hot aqueous solution of the sodium salt into a hot dilute copper sulphate solution, a flocculent, blue precipitate was immediately formed; this was collected by the aid of the pump, and washed with warm water. It was recrystallised from a large quantity of hot water, and formed small, dark blue prisms. An analysis was made of a sample dried over sulphuric acid.

0.1525 gave 0.0314 CuO. Cu = 16.43.

$(C_9H_{10}NO_2)_2Cu$ requires Cu = 16.17 per cent.

Hydrochloride, $C_9H_{11}NO_2.HCl$.—Concentrated hydrochloric acid was evaporated on the water bath with ethylic benzylamidoacetate, a large excess of acid being present. A white, crystalline mass remained, which was washed with ether, and recrystallised from alcohol. Small, white plates were thus obtained, which melted at 214–215°.

0.2228 gave 0.1586 AgCl. Cl = 17.57.

$C_9H_{11}NO_2.HCl$ requires Cl = 17.57 per cent.

The salt is very easily soluble in cold water, sparingly soluble in cold, easily, however, in hot alcohol.

Dibenzyl- α - γ -diacipiperazine, $C_6H_5 \cdot CH_2 \cdot N < \begin{smallmatrix} CO \cdot CH_2 \\ CH_2 \cdot CO \end{smallmatrix} > N \cdot CH_2 \cdot C_6H_5$.

The white crystals which are formed during the distillation of ethylic benzylamidoacetate, and which gradually separate from the same liquid on long standing, consist of this compound. It is best prepared, however, by heating the ethylic salt previously described (p. 188) to boiling, for a considerable time, under reduced pressure; after cooling, the product is mixed with cold alcohol, in which the piperazine derivative is but sparingly soluble. The crystals thus obtained are redissolved in hot alcohol, from which the piperazine separates in white, prismatic needles melting at 170°. The substance was dried at 100° for analysis.

0.1288 gave 0.3485 CO_2 and 0.0723 H_2O . C = 73.76; H = 6.23.

0.1218 „ 10.25 c.c. moist N at 18.5° and 720 mm. N = 9.14.

$C_{18}H_{18}N_2O_2$ requires C = 73.47; H = 6.12; N = 9.52 per cent.

It is insoluble in water, ether, and light petroleum, easily soluble in benzene, and toluene, sparingly in cold, and easily in hot, alcohol. It dissolves easily in cold concentrated hydrochloric acid, and is reprecipitated unchanged on adding water; no change was produced by heating it with the acid for four hours at 180°. If the compound be heated to boiling, at the ordinary atmospheric pressure, it rapidly darkens, toluene and ammonia being formed. All attempts to obtain crystals from the dark brown residue proved futile, although by treat-

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ment with hot concentrated hydrochloric acid a small quantity of the original substance could be isolated. A molecular weight determination, by Beckmann's method, gave the following numbers.

	I.	II.
Weight of substance taken....	0·1551 gram	0·3746 gram
Weight of acetic acid	11·38 grams	11·38 grams
Observed depression	0·162°	0·3945°
Molecular weight found	0·328	0·325
Theory for $C_{18}H_{18}N_2O_2$		294

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