method for benzaldehyde, and to get further light on the extent of the reactions.

The author regrets that with a very limited amount of time available for this work he has not been able to analyze more samples and obtain more analytical results on those examined, and that, not being directly connected with essential oil interests, he has not had available the fresh samples he would have preferred, and all the varieties he would have liked to examine.

The author wishes, however, to express his thanks to Dr. F. D. Dodge for additional samples, besides those that had been kindly furnished previously.

LABORATORY OF SAMUEL P. SADTLER & SON.

[CONTRIBUTIONS FROM THE HAVEMEYER LABORATORIES OF COLUMBIA UNIVERSITY, NO. 113.]

THE SYNTHESIS OF 7-NITRO-2-ALKYL-4-KETODIHYDROQUINAZOLINES FROM 4-NITROACETANTHRANILIC ACID, AND FROM 4-NITROACETANTHRANIL.

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OF THE four possible Bz-nitro-2-methyl-4-ketodihydroquinazolines, three have been described already: the 5-nitro compound by Bogert and Chambers,[1] the 6-nitro by Dehoff[2] and Thieme,[3] and the 8-nitro by Zacharias.[4] In the present paper, the 7-nitro compound is described, thus completing the series.

We have also prepared the 4-nitroacetanthranil, and find that it resembles the 6-nitro isomer[5] in general properties.

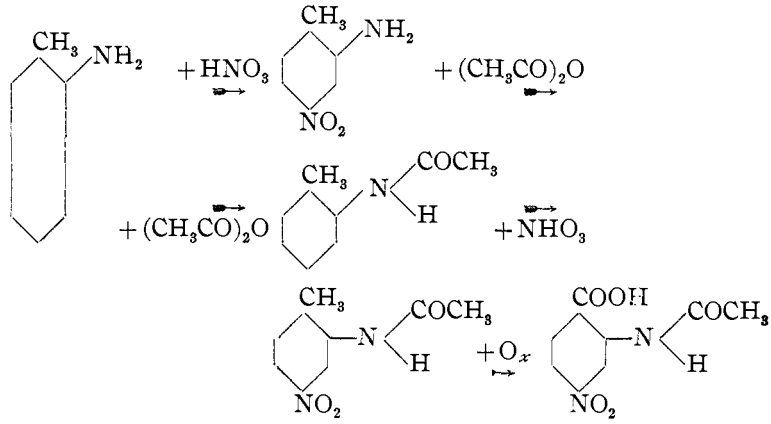
The starting-point for these syntheses was *o*-toluidine. This was converted into 4-nitro-2-acetaminobenzoic acid by two slightly different methods.

I. *o*-Toluidine was nitrated in presence of excess of concentrated sulphuric acid, the 4-nitro-2-toluidine thus produced acetylated, and the acetyl derivative oxidized to the nitroacetaminobenzoic acid.

[1] This Journal, **27**, 655 (1905).
[2] *J. prakt. Chem.* [2], **42**, 347 (1890).
[3] *Ibid.*, **43**, 473 (1891).
[4] *Ibid.*, **43**, 441 (1891).
[5] See Bogert and Chambers: this Journal, **27**, 649; Bogert and Seil: *Ibid.*, **27**, 1305.

II. *o*-Toluidine was acetylated, the acet-*o*-toluide nitrated, and the nitroacettoluide oxidized as before.

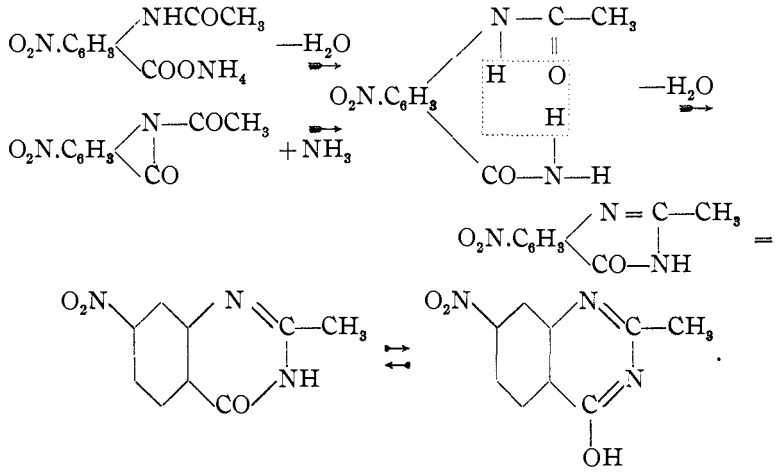
These steps may be expressed as follows:



Of these two methods, the first proved to be much the more satisfactory, both as to yield and purity of product.

The quinazolines were obtained by heating the ammonium salt of the nitroacetanthranilic acid,[1] and by the action of primary amines upon the nitroacetanthranil.[2]

The reactions involved may be outlined thus:



[1] Bischler and Burkart: *Ber.*, **26**, 1349 (1893).

[2] Anschütz, Schmidt and Greiffenberg: *Ber.*, **35**, 3480 (1902); Bogert and Chambers: *Loc. cit.*; Bogert and Seil: *Loc. cit.*

4-Nitro-2-acetaminobenzoic Acid, (4) $O_2N.C_6H_3\begin{cases}COOH\ (1)\\NHCOCH_3\ (2)\end{cases}$ —I. *o*-Toluidine was nitrated in presence of a large excess of concentrated sulphuric acid, by the method of Nölting and Collin,[1] and the product crystallized from alcohol. The 4-nitro-2-toluidine was thus obtained pure (m. p. 107°), and in a yield of 78 per cent. of the theoretical.

The nitrotoluidine was gently boiled for a short time with acetic anhydride, and the product crystallized from alcohol. The nitroacettoluide thus produced melted at 150–151°, as found by Nölting and Collin,[2] and the yield of pure product was 85 per cent. of the theoretical.

II. Acet-*o*-toluide was prepared from *o*-toluidine, by the action of glacial acetic acid, and the product crystallized from water.

This acettoluide was nitrated by the process of Nölting and Collin,[2] as described above, but gave very unsatisfactory results. This method of preparing the nitroacettoluide was, therefore, abandoned in favor of method I.

Oxidation of the nitroacettoluide to nitroacetanthranilic acid was attempted by various methods.

The process of Bedson and King,[3] oxidizing with potassium permanganate in neutral or alkaline solution, gave small yields and impure products. The modification of this process, used by Wheeler and Barnes,[4] by which the oxidation with permanganate is carried out in dilute acetic acid solution, gave a 30 per cent. yield of the desired product.

But the best method by far, proved to be that patented by the Badische Anilin u. Soda Fabrik,[5] in which the oxidation with permanganate is carried out in neutral solution in presence of magnesium sulphate. This gave an 80 per cent. yield of nearly pure nitroacetanthranilic acid.

The crude acid was dried at 70°, added to the least possible amount of boiling alcohol to dissolve it, filtered hot from a small amount of insoluble salts, and allowed to crystallize. The product thus obtained agreed in its properties with the acid described by Wheeler and Barnes.[2] Long boiling with alcohol tends to

[1] *Ber.*, **17**, 263 (1884).
[2] *Loc. cit.*
[3] *J. Chem. Soc.* (London), **37**, 752.
[4] *Am. Chem. J.*, **20**, 219.
[5] D. R. P., No. 94629.

color the product red, apparently from hydrolysis of the acetamino acid to the free amino acid, since the color could only be removed by recrystallization from acetic anhydride.

4-*Nitroacetanthranil*, (4) $O_2N.C_6H_3\begin{cases}CO\ (1)\\ |\\ N—COCH_3\ (2)\end{cases}$.—

4-Nitroacetanthranilic acid was gently boiled for from five to ten minutes with excess of acetic anhydride, and, on cooling, the anthranil crystallized out in pale greenish cubes, m. p. 137–138° (corr.). It is readily hydrolyzed by moisture, with regeneration of the nitroacetanthranilic acid. With primary amines, it condenses to substituted anthranilamides and quinazolines.

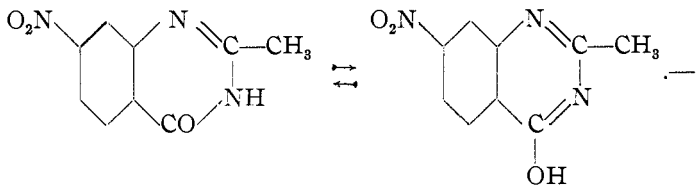
Found: C, 52.09; H, 3.18, 3.11; N, 13.80, 13.81. Calculated for $C_9H_6O_4N_2$: C, 52.39; H, 2.93; N, 13.62.

4-*Nitro-2-acetaminobenzamide*, (4) $O_2N.C_6H_3\begin{cases}CO.NH_2\ (1)\\ NH.COCH_3\ (2)\end{cases}$.—

When 4-nitroacetanthranil is treated with ammonia, some of this amide is apt to be formed, and precipitates. It is freed from any quinazoline by washing with ammonia and then with water, and purified by crystallization from alcohol. It separates from alcohol in small clusters of pale-yellow needles, difficultly soluble in acetic acid, somewhat soluble in ammonia, easily soluble in hot alcohol. When heated quickly, it melts at about 218–223° (corr.), then re-solidifies and does not melt again until the melting-point of the quinazoline (275–277°) is reached. Heated slowly, the loss of water is gradual, and it shows no definite melting-point below that of the quinazoline. Heating with dilute alkali also changes the amide to the quinazoline, and this is the better way of passing from the amide to the quinazoline, since fusion causes considerable decomposition.

Nitrogen found: 18.80, 18.92. Calculated for $C_9H_9O_4N_3$, 18.87.

2-Methyl-7-nitro-4-ketodihydroquinazoline (*2-methyl-7-nitro-4-oxyquinazoline*),



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I. *From Ammonium Nitroacetanthranilate.*—The nitroacetanthranilic acid was dissolved in excess of dilute ammonia, the solution evaporated to dryness on the steam-bath, and the residue heated at 225° until the reaction was completed. The cold melt was pulverized, any unchanged ammonium salt extracted with cold water, the insoluble residue dissolved in a little hot, dilute potassium hydroxide solution, and the quinazoline precipitated from the clear alkaline solution by a current of carbon dioxide. Long boiling with the alkali gives a darker colored and less pure product.

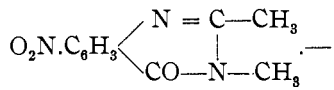
II. *From 4-Nitroacetanthranil and Ammonia.*—The anthranil was warmed with moderately dilute ammonia, and the mixture then acidified with acetic acid. A precipitate resulted consisting of a mixture of amide and quinazoline. By dissolving this precipitate in hot dilute caustic potash, the amide was changed to quinazoline, and by passing carbon dioxide into the alkaline solution the quinazoline precipitated.

The pure quinazoline is difficultly soluble in acetic acid, slightly soluble in hot ethyl acetate, soluble in hot water, in hot alcohol, or in ammonia; easily soluble in alkalies. It crystallizes from alcohol in long pale greenish needles, m. p. 275–277° (corr.).

Found: C, 52.44, 52.48; H, 3.57, 3.58; N, 20.67, 20.74. Calculated for $C_9H_7O_3N_3$: C, 52.64; H, 3.44; N, 20.53.

Hydrochloride, $C_9H_7O_3N_3.HCl$.—The quinazoline was dissolved in the least possible quantity of hot ethyl acetate, the solution filtered, and the filtrate saturated with dry hydrochloric acid gas. The hydrochloride separates in greenish white silky needles, which sinter at about 230°, darken at about 275°, and melt in the neighborhood of 290–295° (uncorr.).

2,3-Dimethyl-7-nitro-4-ketodihydroquinazoline,



4-Nitroacetanthranil was warmed with an aqueous solution of methylamine, the solution filtered hot, and on cooling the quinazoline crystallized out in light yellowish green crystals, melting at 144–145° (corr.); soluble in alcohol.

Nitrogen found: 19.35. Calculated for $C_{10}H_9O_3N_3$, 19.22.