was checked by duplicating the results of Bursian on the pyridazine derivative from 3,6-cholestanedione.

**Dehydration of Chlorogenin.**—Numerous procedures for the dehydration of chlorogenin were tried but none gave a product which absorbed light of $\lambda = 236$ mμ as strongly as 3,5-cholestadiene prepared by the dehydration of cholesterol.[7] The procedure yielding a product having the strongest absorption consisted in the decomposition of the dimethanesulfonate in methyl alcohol solution.

To a solution of 2 g. of chlorogenin, m. p. 272–275°, in 10 cc. of dry pyridine was added 1 cc. of methanesulfonyl chloride. After standing overnight, water was added and the precipitate was filtered and crystallized twice from methyl alcohol, and twice from benzene–ligroin (60–70°) mixture. The colorless needles decomposed with evolution of gas at about 180°. *Anal.* Calcd. for $C_{29}H_{48}O_8S_2$: S, 10.88. Found: S, 10.96.

A solution of 0.5 g. of the dimethanesulfonate in 30 cc. of methyl alcohol was heated in a sealed tube at 140° for four hours. Evaporation of the solvent gave a light brown oil which solidified in an ice-bath but could not be crystallized from solvents. Solution in alcohol and precipitation with water gave a product having log $\epsilon_{max.} = 4.04$ at 236 mμ. Since log $\epsilon_{max.} = 4.36$ at 236 mμ for 3,5-cholestadiene, the dehydration product of chlorogenin appears to contain about 50% of the diene. All absorption spectra were determined in 95% ethyl alcohol, using a Beckman Quartz Spectrophotometer.

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[7] Mauthner and Suida, *Monatsh.*, **17**, 34 (1896).

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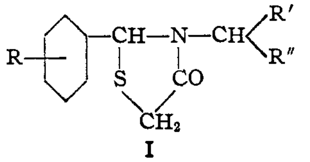
RECEIVED AUGUST 11, 1948

## The Preparation of 2,3-Disubstituted-4-thiazolidones. II. 3-Alkyl (and Aralkyl) 2-Aryl Derivatives

BY ALEXANDER R. SURREY

The reaction of thioglycolic acid with anils to give 2,3-disubstituted-4-thiazolidones[1] has been extended to include some 3-alkyl (and aralkyl)-2-aryl-4-thiazolidones,[2] I.



I

For this purpose the following anils were employed: benzylideneisopropylamine, 4-nitrobenzylidenephenethylamine and 4-ethoxy-3-methoxybenzylidenephenethylamine. In general, the reaction of thioglycolic acid with these anils is much faster than with the Schiff bases derived from an aromatic aldehyde and aromatic amine.[1] Two of the thiazolidones described were oxidized with potassium permanganate in acetic acid solution to yield the corresponding 1-dioxides.

### Experimental

**3-Isopropyl-2-phenyl-4-thiazolidone.**—To a well-stirred solution of 10.6 g. of benzaldehyde in 100 ml. of dry benzene was added dropwise 9 g. of isopropylamine. After stirring for thirty minutes, the mixture was poured into a separatory funnel and allowed to stand overnight. The benzene layer was separated and refluxed with 18 g. of thioglycolic acid for eight hours (1.3 ml. of water collected). After removing the benzene, the solid which formed on cooling was recrystallized twice from a mixture of ether–Skellysolve A; 6.5 g. (29%) m. p. 100.4–101.8° cor.

*Anal.* Calcd. for $C_{12}H_{15}NOS$: S, 14.49; N, 6.33. Found: S, 14.74; N, 6.21.

**3-Isopropyl-2-phenyl-4-thiazolidone-1-dioxide.**—A solution of 19.4 g. of potassium permanganate in 360 ml. of water was added dropwise with stirring to 13.5 g. of 3-isopropyl-2-phenyl-4-thiazolidone in 270 ml. of acetic acid at 30–35°. When the addition was completed, sodium bisulfite was added until the solution was practically colorless. More water was then added with continued stirring. The tan-colored solid which precipitated was filtered off and recrystallized from methanol; 10 g. (65%), m. p. 163–165°. Another recrystallization gave a white product melting at 169.6–171° cor.

*Anal.* Calcd. for $C_{12}H_{15}NO_3S$: S, 12.66; N, 5.53. Found: S, 12.66; N, 5.42.

**2-(4-Ethoxy-3-methoxyphenyl)-3-(2-phenethyl)-4-thiazolidone.**—A mixture of 12 g. of phenethylamine and 18 g. of 4-ethoxy-3-methoxybenzaldehyde was heated for thirty minutes on the steam-bath in a flask connected to a water pump. After dissolving the product in 100 ml. of dry benzene, 11 g. of thioglycolic acid was added and the solution was refluxed for three hours. The water (1.8 ml.) which formed was collected in a separator connected to the apparatus. The benzene was distilled off and the residue was taken up in ether, washed with sodium carbonate solution, then water, and dried over Drierite. The product crystallized on spontaneous evaporation of the ether. The solid was triturated with Skellysolve A and filtered to yield 22.5 g. (63%) melting at 57–61°. After recrystallization from a mixture of ether–Skellysolve A and then from ether alone, the product melted at 60.7–62.5° cor.

*Anal.* Calcd. for $C_{20}H_{23}NO_3S$: S, 8.97; N, 3.92. Found: S, 9.04; N, 3.88.

**4-Nitrobenzylidene Phenethylamine.**—Equimolecular quantities of 4-nitrobenzaldehyde and phenethylamine were heated *in vacuo* on the steam-bath for thirty minutes. On cooling the residue solidified. It was recrystallized from Skellysolve B, m. p. 70.8–72.3° cor.

*Anal.* Calcd. for $C_{15}H_{14}N_2O_2$: $N_{(NO_2)}$, 5.51. Found: $N_{(NO_2)}$, 5.55.

**2-(4-Nitrophenyl)-3-(2-phenethyl)-4-thiazolidone.**—A solution of 25 g. of 4-nitrobenzylidenephenethylamine and 12.5 g. of thioglycolic acid in 150 ml. of dry benzene was refluxed for eight hours, while removing the water as it formed. After distilling the benzene *in vacuo* the residue was dissolved in warm ethanol. The product which precipitated on cooling was recrystallized three times from ethanol to yield 26.5 g. (81%) melting at 124.6–125.2° cor.

*Anal.* Calcd. for $C_{17}H_{16}N_2O_3S$: N, 8.53; S, 9.76. Found: N, 8.44; S, 9.59.

**2-(4-Aminophenyl)-3-(2-phenethyl)-4-thiazolidone.**—A well-stirred mixture of 10 g. of 2-(4-nitrophenyl)-3-(2-phenethyl)-4-thiazolidone, 40 g. of iron filings, 60 ml. of ethanol, 50 ml. of water and 1 ml. of acetic acid was refluxed on a steam-bath for four hours. After adding an equal volume of ethanol and an excess of solid sodium carbonate the reaction mixture was filtered hot. The solid which precipitated from the cooled filtrate was recrystallized from ethanol, 6 g. (66%), m. p. 143–144.2° cor.

*Anal.* Calcd. for $C_{17}H_{18}N_2OS$: N, 9.38; S, 10.74 Found: N, 9.14; S, 10.69.

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[1] Surrey, THIS JOURNAL, **69**, 2911 (1947).

[2] After this work had been completed, a paper by Mr. H. D. Troutman and Dr. Loren M. Long on the synthesis of some 3-alkyl-(and aralkyl)-2-aryl-4-thiazolidones was presented before the Medicinal Division at the Chicago meeting of the American Chemical Society on April 21, 1948. These authors employed ethyl or methyl thioglycolate in their experimental work. The oxidation of several thiazolidones to the corresponding 1-dioxides by means of hydrogen peroxide was also reported.

**2-(4-Nitrophenyl)-3-(2-phenethyl)-4-thiazolidine-1-dioxide.**—Ten grams of 2-(4-nitrophenyl)-3-(2-phenethyl)-4-thiazolidone was dissolved in hot acetic acid (200 ml.) and cooled. The solution was treated with potassium permanganate as described for the 3-isopropyl compound above. The crude product (10 g.) was recrystallized from isopropyl alcohol, (7 g., 64%), m. p. 147–148° cor.

*Anal.* Calcd. for $C_{17}H_{16}N_2O_5S$: S, 8.89; N, 7.77. Found: S, 8.98; N, 7.89.

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## The Preparation of Methyl *p*-Benzyloxyphenyl Acetate

BY PHILIP WEISS[1]

During the course of an investigation on aryl oxyphenylacetic acids, it was necessary to synthesize methyl *p*-benzyloxyphenyl acetate. The preparation of this compound was effected in the following manner.

***p*-Benzyloxyacetophenone** was prepared according to the method of Priestley and Moness[2] by refluxing *p*-hydroxyacetophenone[3] with benzyl chloride in the presence of sodium ethoxide. This same product was obtained, in lower yields, by effecting the condensation in aqueous alkali. By means of a modified Willgerodt reaction[4,5] using morpholine and sulfur, *p*-benzyloxyacetophenone was converted to *p*-benzyloxyphenylthioacetmorpholide. Hydrolysis with aqueous potassium hydroxide yielded *p*-benzyloxyphenylacetic acid. In this conversion to the acid there was no advantage gained in purifying the crude thioacetmorpholide. Esterification was effected by refluxing *p*-benzyloxyphenylacetic acid in a methanol–chloroform solution using *p*-toluenesulfonic acid as a catalyst. A soxhlet apparatus was used to remove water that was produced in the reaction, thus increasing the yield by shifting the equilibrium to the right.

### Experimental[6]

***p*-Benzyloxyphenylthioacetmorpholide.**[4,5]—Twenty-four and nine-tenths grams (0.11 mole) of *p*-benzyloxyacetophenone reacted with 13.9 g. (0.16 mole) of morpholine and 5.1 g. (0.16 mole) of sulfur to yield 27.8 g. of the desired thioacetmorpholide. This was recrystallized from dilute methanol, m. p. 118–119°.

*Anal.* Calcd. for $C_{19}H_{21}NO_2S$: C, 69.72; H, 6.42; N, 4.28; S, 9.78. Found: C, 69.99; H, 6.65; N, 4.31; S, 9.71.

***p*-Benzyloxyphenylacetic Acid.**[4]—To 250 ml. of 10% potassium hydroxide solution was added 22.5 g. (0.07 mole) of *p*-benzyloxyphenylthioacetmorpholide and the mixture was refluxed for fourteen hours. The product was isolated as described by Schwenk and Bloch[4] for the *o*-isomer. Recrystallization of the crude product from benzene–petroleum ether (30–60°) yielded 6.5 g. of *p*-benzyloxyphenylacetic acid, m. p. 114°.

*Anal.* Calcd. for $C_{15}H_{14}O_3$: C, 74.38; H, 5.78. Found: C, 74.18; H, 6.03.

**Methyl *p*-Benzyloxyphenyl Acetate.**—Five grams (0.02 mole) of *p*-benzyloxyphenylacetic acid, 0.2 g. of *p*-toluenesulfonic acid, 25 ml. of methanol, and 25 ml. of chloroform were refluxed in a soxhlet apparatus for six hours. Anhydrous magnesium sulfate was placed in the thimble of the soxhlet apparatus in order to remove the water from the reaction mixture as it was being produced by the reaction. Water was added to the mixture until two distinct layers were formed. The chloroform layer was washed with water, and then extracted twice with a saturated sodium bicarbonate solution to remove any unreacted *p*-benzyloxyphenylacetic acid. The chloroform extract was again washed with water until neutral, and then dried over anhydrous sodium sulfate. After filtering the solution, the chloroform was removed by distillation under diminished pressure. The colorless oily residue solidified on cooling in an ice-bath, and was recrystallized from dilute methanol: m. p. 58.5–59°; yield 4.5 g.

*Anal.* Calcd. for $C_{16}H_{16}O_3$: C, 75.00; H, 6.25. Found: C, 75.28; H, 6.54.

Saponification of methyl *p*-benzyloxyphenyl acetate by means of alcoholic potassium hydroxide yielded *p*-benzyloxyphenylacetic acid, m. p., 113.5–114°; mixed melting point of this acid with a sample of *p*-benzyloxyphenylacetic acid gave no depression.

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[1] Present address: Wallace and Tiernan Products, Inc., Belleville 9, New Jersey.

[2] Priestley and Moness, *J. Org. Chem.*, **5**, 357 (1940).

[3] Rosenmund and Schnurr, *Ann.*, **460**, 56 (1928).

[4] Schwenk and Bloch, THIS JOURNAL, **64**, 3052 (1942).

[5] Newman, *J. Org. Chem.*, **9**, 521 (1944).

[6] All melting points given are uncorrected.

## Preparation of 1,1,1-Trichloro-2,2-bis-(4'-aminophenyl)-ethane

BY MOSHE WEIZMANN, SHALOM ISRAELASHVILI AND RAPHAEL PAPO

Kirkwood and Phillips[1] report the synthesis of 1,1,1-trichloro-2,2-bis-(4'-aminophenyl)-ethane (I) by catalytic reduction of 1,1,1-trichloro-2,2-bis-(4'-nitrophenyl)-ethane (II). Conditions have now been found permitting preparation of (I) by reduction of (II) with stannous chloride and hydrochloric acid (yield 71%). The 4,4'-diamino compound (I) responds to the characteristic reactions of aromatic amines, *i. e.*, diazotization and coupling. The structure of (I) is further proved by its conversion to the known compound 1,1,1-trichloro-2,2-bis-(4'-hydroxyphenyl)-ethane of m. p. 202°,[2] and acetylation to the 1,1,1-trichloro-2,2-di-(4'-acetaminophenyl)-ethane, m. p. 268°.[1]

### Experimental

**1,1,1-Trichloro-2,2-bis-(4'-aminophenyl)-ethane (I).**—Twenty-five grams of (II) was added with stirring over a period of two hours at 0° to a solution of 200 g. of anhydrous stannous chloride in 500 g. of glacial acetic acid saturated with gaseous hydrogen chloride. The resulting precipitate was filtered, washed first with concentrated and then with dilute hydrochloric acid. A dilute solution of sodium hydroxide was added to the suspension of the precipitate in water until pH 8 was obtained. The precipitate was washed with water, immediately extracted with acetone and dried over anhydrous sodium sulfate. The diamino compound residue (15 g.), after removal of the solvent, recrystallized from ethanol–water as colorless needles, m.p. 150° (dec.).

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[1] Kirkwood and Phillips, THIS JOURNAL, **69**, 934 (1947).

[2] ter Meer, *Ber.*, **7**, 1201 (1874); Elbs, *J. prakt. Chem.*, **47**, 60 (1874); Stephenson and Waters, *J. Chem. Soc.*, 399 (1946).