acid.[14] The temperature of the resulting exothermic reaction was maintained at about 40°[15] by means of external cooling. After the addition was complete, stirring was continued for one hour and the resulting slurry of product and solvent cooled to 5°. The white crystalline solid was then collected on a suction filter, washed with fresh acetone and dried. In each case the sulfone was obtained in practically pure form directly from the reaction mixture. A mixture melting point determination of the sulfones thus produced indicated that each was identical with a sample of the same sulfone prepared according to the reaction sequence outlined in Chart I.

Racemic α-Dichloroacetamido-β-hydroxy-4-ethylsulfonylpropiophenone (XIII).—Prepared by the oxidation of racemic α-dichloroacetamido-β-hydroxy-4-ethylmercaptopropiophenone[1] according to the above procedure, m.p. 184.0–185.0°.

Anal. Calcd. for $C_{13}H_{16}Cl_2NO_5S$: Cl, 19.26; N, 3.81. Found: Cl, 18.96; N, 3.71.

RENSSELAER, NEW YORK

(14) Obtained from Buffalo Electro-Chemical Co., Inc.

(15) The temperature, except in the case of VII (see footnote 7), can be varied within fairly wide limits. Thus in some cases the temperature was allowed to rise to 55–60° without detrimental effects.

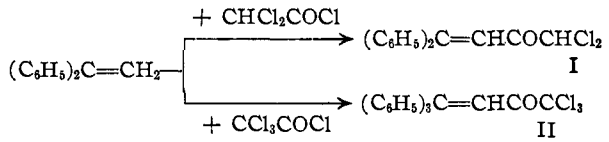
NOTES

The Uncatalyzed Condensation of 1,1-Diphenylethylene with Chlorinated Acetyl Chlorides

BY FELIX BERGMANN AND JOSEPH KLEIN

RECEIVED MARCH 4, 1953

The direct acylation of the β-carbon atom of 1,1-diphenylethylene is dependent on the presence of activating groups attached to the reacting COCl group. It has been shown, *e.g.*, that the –COCl[1] or the –COOR[2] radical, benzyl and aryl residues[3] exert such an activating influence, which decreases in the order given. From a comparison of phosgene[4] with oxalyl chloride it becomes evident that it is the neighboring carbonyl which increases the reactivity of the –COCl group in the substitution under discussion. Therefore it appeared probable that any α-carbonyl would exert such an influence. Since the chlorides of glyoxylic acids and its homologs are unstable compounds–if existing at all–we applied the reaction to acid chlorides, in which the α-carbonyl is replaced by the CCl_2 group. Thus dichloroacetyl chloride, which is derived from glyoxylic acid chloride, was condensed with 1,1-diphenylethylene to form the ketone I. In a similar way, trichloroacetyl chloride, which is related to oxalyl chloride, gave the ketone II, accompanied by large amounts of the open-chain dimer of the hydrocarbon.[5]



The ketone I behaved like a derivative of an α-ketoaldehyde, *e.g.*, with 2,4-dinitrophenylhydrazine two products were formed, a yellow hydrazone and a deep-red osazone. The keto group in the compound II, however, is sterically hindered and thus unreactive.

The absorption spectra of these ketones, when compared with β,β-diphenylacrolein (Table I), reveal that at short wave lengths the chlorinated side chain has practically no influence, whereas for the long wave maximum I shows a shift of 100 Å. and II of 280 Å. toward the red.

TABLE I

ABSORPTION SPECTRA OF β,β-DIPHENYL-α,β-UNSATURATED CARBONYL COMPOUNDS IN 95% ETHANOL

	Compound	Maxima at	
1.	β,β-Diphenylacrolein	2260 (4.3)	3000 (4.1)
2.	Ketone I	2310 (4.1)	3100 (4.1)
3.	Ketone II	2250 (4.0)	3280 (4.2)

Experimental

Condensation of 1,1-Diphenylethylene with Dichloroacetyl Chloride.—The ethylene (12 g.) and dichloroacetyl chloride (74 g., 7.5 equiv.) were heated in a current of hydrogen to 112–115° for 60 hours. The excess acid chloride was distilled off, the residue dissolved in benzene, washed with water and sodium carbonate, and then fractionated. The portion distilling at 170–195° (1.5 mm.) was redistilled, yielding a yellow oil of b.p. 178–182° (2 mm.). This fraction (5 g.) proved to be the expected ketone, 1,1-diphenyl-3-keto-4,4-dichlorobutene-1 (I).

Anal. Calcd. for $C_{16}H_{12}OCl_2$: C, 65.9; H, 4.1; Cl, 24.4. Found: C, 65.7; H, 4.1; Cl, 24.5.

The reaction with Brady's reagent at room temperature for 24 hours gave a mixture, from which first yellow crystals separated. The substance crystallized from butanol in yellow plates of m.p. 168°. It gave a positive Beilstein test and, according to analysis, represents a monohydrazone of I.

Anal. Calcd. for $C_{22}H_{16}O_4N_4Cl_2$: C, 56.0; H, 3.4; Cl, 15.0. Found: C, 56.0; H, 3.7; Cl, 14.4.

From the mother liquor a deep red precipitate was obtained on standing, which crystallized from dioxane–butyl acetate in microcrystals of m.p. 248°. This derivative is chlorine-free and corresponds to an osazone of I.

Anal. Calcd. for $C_{28}H_{20}O_3N_8$: C, 56.4; H, 3.35; N, 18.8. Found: C, 56.4; H, 3.8; N, 18.8.

Condensation of 1,1-Diphenylethylene with Trichloroacetyl Chloride.—The ethylene (12.8 g.) and trichloroacetyl chloride (64 g., 5 equiv.) were refluxed for 30 hours at a temperature of 116–118° in a current of hydrogen. The mixture was treated as above and yielded a fraction of boiling point 195–215° (3 mm.), which crystallized upon trituration

(1) M. S. Kharasch, S. S. Kane and H. C. Brown, THIS JOURNAL, **64**, 333 (1942).

(2) F. Bergmann and A. Kalmus, *J. Chem. Soc.*, 4521 (1952).

(3) F. Bergmann, S. Israelashvili and D. Gottlieb, *ibid.*, 2522 (1952).

(4) F. Bergmann, M. Weizmann, E. Dimant, S. Patai and J. Szmuszkowicz, THIS JOURNAL, **70**, 1612 (1948).

(5) Monochloroacetyl chloride failed to condense with 1,1-diphenylethylene.

with methanol. The m.p. of this material, 16.3 g., was 67–72° (unsharp). Since repeated recrystallizations from methanol did not give a substance with sharp m.p., we dissolved the material in petroleum ether and chromatographed it on alumina, collecting fractions of 50 ml. Fractions 5–8 gave a crystalline residue of m.p. 86–87°, which upon recrystallization from isopropyl alcohol formed yellow cubes of m.p. 87°.

Anal. Calcd. for $C_{16}H_{11}OCl_3$: C, 59.0; H, 3.4. Found: C, 59.1; H, 3.4.

The ketone II did not react with any of the usual carbonyl reagents.

DEPARTMENT OF PHARMACOLOGY
THE HEBREW UNIVERSITY-HADASSAH MEDICAL SCHOOL
JERUSALEM, ISRAEL

Reductions with Hydrazine Hydrate Catalyzed by Raney Nickel. I. Aromatic Nitro Compounds to Amines[1,2]

BY D. BALCOM AND ARTHUR FURST

RECEIVED APRIL 13, 1953

Hydrazine, though a powerful reducing agent is not used extensively to reduce aromatic nitro compounds to amines. The rate of reaction is too slow. If employed in a sealed tube[3] or in high boiling solvents[4] almost all functional groups are reduced.

With the addition of a small amount of Raney nickel catalyst, hydrazine hydrate will selectively reduce an aromatic nitro compound to an amine at room or steam-bath temperature. Yields are excellent ranging from 80 to 99%. Under these conditions other functional groups, namely, carbonyls, will not be affected. To eliminate loss due to foaming a large excess of solvent alcohol is necessary. We have confirmed Kuhn's[5] observation that no reduction takes place even after 18 hours if no catalyst is added. The mechanism of the reaction is unknown, but hydrazine when catalytically decomposed liberates only water and gases[6] so that elimination of by-products is not a problem.

Experimental

As all of the aromatic nitro compounds listed here were reduced by the same method, only a general procedure is given. In each case the amino compound listed was also obtained by the reduction of the nitro compound by a procedure obtained from the literature. Mixed melting points as well as fusion analysis[7] helped prove the identity of the amino compound. In some cases the hydrochloride rather than the free amine was isolated.

Generalized Procedure.—To the nitro compound dissolved in alcohol (10 ml./g.) was added 2–3 molar ratios of hydrazine hydrate 100%. The solution was placed on the steam-bath and when just warm a small amount of Raney Ni was added. The solution frothed. As the reaction proceeded (5 to 60 min.) the color changed from yellow to almost colorless. More catalyst was added to decompose the excess hydrazine and the solution was heated to boiling to drive off the dissolved gases. The hot solution was filtered to remove the Ni, boiled with decolorizing carbon and filtered again. The free amine was isolated by cooling the solution to *ca.* 50° and then pouring into a large excess of water; or the hydrochloride salt was obtained by evaporating the solvent to *ca.* 5-10 ml., adding *ca.* of 5 ml. ofconcentrated hydrochloric acid and cooling the mixture. The precipitates were isolated and dried.

Amines.—By this procedure *p*-aminobiphenyl ether[8] was obtained in 96.5% yield. Other amines obtained in yield between 80 and 99% were *p*-aminocinnamic acid,[9] *m*-aminobenzophenone,[10] 2-methyl-4′-aminobiphenyl,[11] 4,4′-diaminodiphenyl ether[12] and aniline.

Biological Testing.—These compounds were tested for their effect on the mouse Sarcoma-37. No inhibitory action was noted.[13]

(1) Presented before the Division of Organic Chemistry at the 123rd Meeting of the American Chemical Society in Los Angeles, California, March, 1953.

(2) This investigation was supported in part by a research grant from the National Cancer Institute of the National Institutes of Health, U. S. Public Health Service, and from the Catherine Stern Memorial Fund.

(3) (a) T. Curtius, *J. prakt. Chem.*, **76**, 233, 238, 281, 301 (1907); (b) E. Müller and G. Zimmermann, *ibid.*, **111**, 272 (1925).

(4) Huang-Minlon, THIS JOURNAL, **70**, 2802 (1948).

(5) L. P. Kuhn, *ibid.*, **73**, 1510 (1951).

(6) L. F. Audrieth and B. A. Ogg, "The Chemistry of Hydrazine," John Wiley and Sons, Inc., New York, N. Y., 1951, p. 145.

(7) N. Gotta-Luthy, *J. Chem. Educ.*, **26**, 109 (1949).

(8) H. I. Jones and A. N. Cook, THIS JOURNAL, **38**, 1534 (1916).

(9) F. Wollring, *Ber.*, **47**, 111 (1914).

(10) R. Geigy and W. Konigs, *ibid.*, **18**, 2400 (1885).

(11) H. France, I. M. Heilbron and D. H. Hay, *J. Chem. Soc.*, 1283 (1939).

(12) G. A. Reynolds, THIS JOURNAL, **73**, 4996 (1951).

(13) A. Furst and B. L. Freedlander, *Stanford Med. Bull.*, **10**, 308 (1952).

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF SAN FRANCISCO, AND
DEPARTMENT OF PHARMACOLOGY AND THERAPEUTICS
STANFORD UNIVERSITY SCHOOL OF MEDICINE
SAN FRANCISCO, CALIFORNIA

Preparation of 1-Methyl-3-phenyl-3-(γ-dimethylaminopropyl)-piperidine

BY F. F. BLICKE AND EU-PHANG TSAO

RECEIVED APRIL 9, 1953

Phenyldi-(γ-dimethylaminopropyl)-acetonitrile, prepared from phenylacetonitrile, γ-dimethylaminopropyl chloride and sodamide, was hydrolyzed to the corresponding acetic acid. The latter compound was refluxed with thionyl chloride, the excess thionyl chloride removed and the residue heated until the evolution of methyl chloride stopped. The 1-methyl-3-phenyl-3-(γ-dimethylaminopropyl)-2-piperidone was reduced with lithium aluminum hydride to the corresponding piperidine.

Experimental

Phenyldi-(γ-dimethylaminopropyl)-acetonitrile.—Phenylacetonitrile (35.2 g.) in 50 cc. of toluene was added, gradually, to a stirred mixture of 29.3 g. of sodamide in 100 cc. of toluene at 40–50°. The mixture was stirred for 1 hour, then 90 g. of γ-dimethylaminopropyl chloride[1] was added, dropwise, to the stirred mixture at 40–50°. The material was refluxed for 6 hours and treated in the usual manner. After fractionation 70.0 g. (81.3%) of nitrile was obtained, b.p. 155–158° (1 mm.).

The dihydrochloride, prepared from an ethereal solution of the base and hydrogen chloride, melted at 280–282° after recrystallization from absolute ethanol.

Anal. Calcd. for $C_{18}H_{31}N_3Cl_2$: N, 11.66; Cl, 19.72. Found: N, 11.55; Cl, 19.71.

Phenyldi-(γ-dimethylaminopropyl)-acetic Acid.—A mixture of 57.4 g. of the nitrile, 94 cc. of concd. sulfuric acid and 63 cc. of water was refluxed for 2 hours. The cold mixture was poured into water and sodium hydroxide was added until the mixture was only slightly acidic. It was then decolorized with Norite. The filtered solution was made alkaline whereupon an oil separated. A further amount of oil was obtained by extraction of the aqueous solution with chloroform and removal of the solvent. When the oil was warmed under 16 mm. pressure for some time, it be-

(1) A. Marxer, *Helv. Chim. Acta*, **24**, 209 E (1941).