added when the terminal halogens were chlorine. Thus 10 g. of 4,4′-dichlorobutyl ether $(ClCH_2CH_2CH_2CH_2)_2O$ (0.05 mole) was added to a solution of 30 g. of sodium saccharin and 1 g. of potassium iodide in 55 cc. of dimethylformamide. After heating, the mixture was poured into 150 cc. of water. The yield was 22 g. or 90%. The one sulfur compound was prepared from mustard gas which was added to the cold solution of the sodium saccharin. Dioxane was used for recrystallizing this group.

The cyano alkyl halides reacted regularly under the standard conditions, except when the bromine was in the β-position, as has been mentioned above.

As the β-hydroxyethyl- and γ-hydroxypropylsaccharins are somewhat soluble in water, it was found better to evaporate off the dimethylformamide, after the reaction was judged to be complete, by heating the mixture under vacuum. The desired compound was extracted from the residue by boiling methanol from which it was recrystallized.

N-Alkylsulfamic Acids.—The alkylsaccharin was dissolved in a moderate excess of alcoholic sodium hydroxide. After standing overnight this solution was evaporated to dryness and the residue taken up in water, from which the sulfamic acid was precipitated by hydrochloric acid. The free sulfanic acids were recrystallized from mixtures of ether and petroleum ether.

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[CONTRIBUTION FROM THE CHEMISTRY DEPARTMENT, FACULTY OF SCIENCE, CAIRO UNIVERSITY]

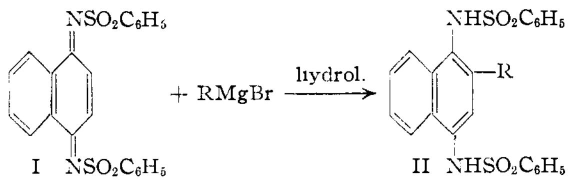
Experiments with Quinone Imides. II. A Novel Synthesis of 1,2-Diphenylnaphthalene

BY AHMED MUSTAFA AND MOHAMED KAMEL

RECEIVED MAY 2, 1955

1,2-Naphthoquinone-1-benzimide (III) reacts with arylmagnesium bromides, *e.g.*, phenylmagnesium bromide, to give the corresponding 1-benzamido-2-hydroxy-1,2-diaryl-1,2-dihydronaphthalene derivatives (IV), *e.g.*, 1-benzamido-2-hydroxy-1,2-diphenyl-1,2-dihydronaphthalene (IVa). When IVa is treated with a mixture of zinc dust, acetic acid and hydrochloric acid, 1,2-diphenylnaphthalene (VII) is obtained in an almost quantitative yield. With ethylmagnesium iodide, III is readily reduced to the corresponding amide derivative, namely, 1-benzamido-2-naphthol (V). The mixture (Mg + MgI_2) and thiophenol effect the reduction of III to V. III undergoes photochemical addition reaction with aromatic aldehydes in sunlight to give the photo-products, namely, 1-benzamido-2-naphthyl esters of aromatic acids (XIVa-c) or (XVa-c) (possibility of ring-chain tautomerism; scheme B).

Action of Grignard Reagents.—In part I,[1] Mustafa and Kamel have shown that 1,4-naphthoquinone dibenzenesulfonimide (I) reacts with Grignard reagents to give the corresponding 2-substituted naphthalene-1,4-dibenzenesulfonamide (II) together with naphthalene-1,4-dibenzenesulfonamide (II, R = H), presumably by 1,4-addition followed by rearrangement.



I II

We have now investigated the action of arylmagnesium bromides on *o*-quinonemonoimides, namely, 1,2-naphthoquinone-1-benzimide (III). Thus, when the orange III is treated with an excess of phenylmagnesium bromide, it reacts with two moles of the Grignard reagent to give, after hydrolysis, 1-benzamido-2-hydroxy-1,2-diphenyl-1,2-dihydronaphthalene (IVa).

The formation of the amino-alcohol derivative IV may be paralleled to the formation of glycols by the action of the same reagent on *o*-quinones.[2a,b] Similarly, 1-benzamido-2-hydroxy-1,2-di-(*p*-bromophenyl)-1,2-dihydronaphthalene (IVb) has been obtained by the action of *p*-bromophenylmagnesium bromide on III.

Compounds IVa-b are obviously of analogous structure. The constitution of IVa was established from the following facts: it is colorless and has the correct molecular weight. It does not give the ferric chloride test nor the Platkonskaya test,[3] for highly hindered phenols, is insoluble in aqueous sodium hydroxide solution and is stable toward acetic anhydride in the presence of fused sodium acetate, thus excluding the presence of a phenolic group.

When a solution of IVa in glacial acetic acid is treated with a mixture of zinc dust and concentrated hydrochloric acid in the presence of a few drops of platinum chloride solution, 1,2-diphenylnaphthalene (VII) is obtained in an almost quantitative yield together with benzoic acid and ammonium chloride.

One possible explanation of the formation of VII is the reduction of a tertiary alcoholic group (OH → H)[4] and the replacement of an amino group (formed by the hydrolysis of the benzamido group) attached to a tertiary carbon atom[5] by a hydroxyl group (*cf.* the intermediates VIa and VIb). For the easy dehydration of VIb to VII, reference should be made to the ready formation of 1,2-diphenyl-3,4-dihydronaphthalene when an alcoholic solution of 1-hydroxy-1,2-diphenyl-1,2,3,4-tetrahydronaphthalene is heated with a few drops of concentrated hydrochloric acid.[6]

This hydrocarbon VII has been prepared by Crawford[6] and Bergmann, *et al.*,[7] by long syntheses

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(1) A. Mustafa and M. Kamel, THIS JOURNAL, **75**, 2939 (1953).

(2) (a) A. Werner and A. Grob, *Ber.*, **37**, 2887 (1904); (b) E. Beschke, O. Beitler and S. Strum, *Ann.*, **369**, 184 (1909).

(3) V. M. Platkonskaya and S. G. Vatkina, *J. Appl. Chem.* (*U.S.S.R.*), **10**, 202 (1937); *C. A.*, **31**, 4232 (1937).

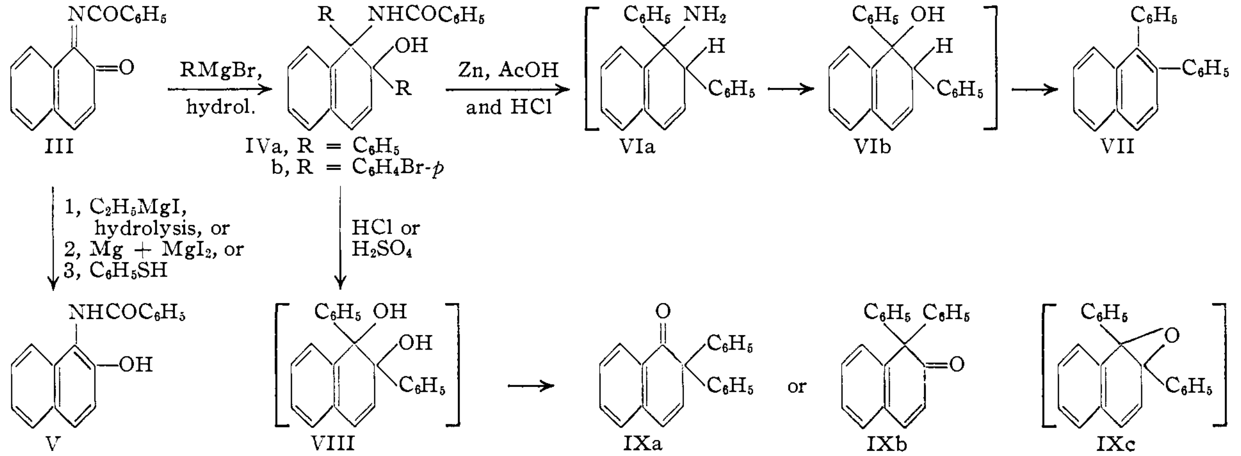
(4) *Cf.* D. Y. Curtin and S. Schmukler, THIS JOURNAL, **77**, 1105 (1955).

(5) *Cf.* the ready transformation of triphenylmethylamine to triphenylcarbinol and ammonium chloride by the action of hot dilute hydrochloric acid (K. Elbs, *Ber.*, **17**, 701 (1884)), and the ready cleavage of β-naphtholphenylmethylamine by the action of hot 0.05 *N* hydrochloric acid to benzaldehyde, β-naphthol and ammonium chloride (M. S. Kharasch and L. B. Howard, THIS JOURNAL, **56**, 1370 (1934)).

(6) H. M. Crawford, *ibid.*, **61**, 608 (1939).

(7) F. Bergmann, H. E. Eschinazi and D. Shapiro, *ibid.*, **64**, 557 (1942).

Chart I



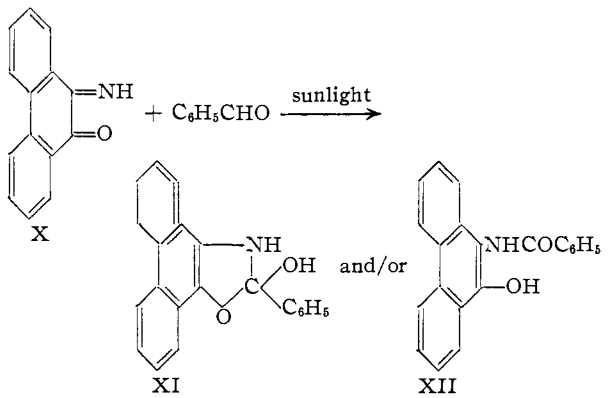
without mentioning the yield. We have now prepared VII, after the procedure described by Crawford, and obtained it in a poor yield. The action of phenylmagnesium bromide on III, followed by treatment with zinc dust and hydrochloric–acetic acid mixture, establishes a novel synthesis of VII. The investigation of the scope of this reaction for the synthesis of 1,2-diarylnaphthalenes is now in progress.

When IVa is treated with concentrated hydrochloric acid in the presence or absence of acetic acid, a nitrogen-free substance is obtained, believed to have structure IXa or IXb together with benzoic acid and ammonium chloride. Similarly, IXa or IXb could be obtained by the action of sulfuric acid (50%) on IVa, together with benzoic acid and ammonium sulfate. IXa or IXb is colorless, contains no active hydrogen atom and gives the correct molecular weight and analytical values. One possible approach for the explanation of the formation of IXa or IXb, and not the isomeric ethylene oxide IXc,[2a,b] is the assumption of the intermediate diol formation (VIII), followed by dehydration and rearrangement with shift[8] of a phenyl group from C_1 to C_2 or *vice versa* (pinacol–pinacolone rearrangement).

Reduction Reactions.—Excess of ethylmagnesium iodide cause decolorization of the benzene solution of III. Apparently, no normal addition reaction occurs and only the reduction product of III, namely, 1-benzamido-2-naphthol (V), could be isolated from the reaction mixture.[9]

A mixture of magnesium and magnesium iodide, which has been so effective in reduction of azobenzene,[10] benzil[11] and benzophenone anil,[12] to hydrazobenzene, benzoin and benzhydrylaniline, respectively, reduces III to V. The reaction proceeds probably by 1,4-addition of two –MgI groups.

Similarly, V is obtained in almost quantitative yield by the action of thiophenol on III. The reduction of III by thiophenol could be compared with its action on phenanthraquinone monoimine.[13]



Scheme A

Photochemical Addition with Aromatic Aldehydes.—*o*-Quinone monoimines,[14] *e.g.*, phenanthraquinone monoimine (X), react with aldehydes, *e.g.*, benzaldehyde, in sunlight to form 2-phenyl-2-hydroxyphenanthro-2,3-dihydroöxazole (XI) or (XII) (possibility of ring-chain tautomerism; scheme A).

We have now found that the orange III does not react with benzaldehyde in benzene solution in the dark but that reaction occurs in sunlight with the formation of 1-benzamido-2-naphthyl benzoate (XIVa). A similar reaction with *p*-tolualdehyde and with *p*-methoxybenzaldehyde leads to the formation of the photo-products XIVb and XIVc, respectively. The photo-products XIVa-c may show ring-chain tautomerism[15] XVa-c in solution (scheme B).

The photo-products XIVa-c are colorless, insoluble in cold aqueous sodium hydroxide solution, but soluble in alcoholic sodium hydroxide solution, in consequence of hydrolysis.[16] XIVa and XIVc are known substances and XIVb has now been, simi-

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[8] H. M. Crawford, This Journal, **61**, 3310 (1939); W. E. Bachmann, *ibid.*, 1969 (1932); and H. Kleinfeller and F. Eckert, *Ber.*, **62**, 1598 (1929).

[9] For the reducing action of ethylmagnesium iodide, *cf.* its action on 4-methyl-*o*-quinone dibenzenesulfonimide (ref. 1).

[10] W. E. Bachmann, This Journal, **53**, 1524 (1931).

[11] M. Gomberg and W. E. Bachmann, *ibid.*, **49**, 2584 (1927).

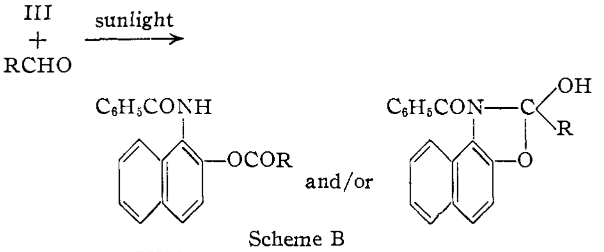
[12] W. E. Bachmann, *ibid.*, **53**, 2672 (1931).

[13] A. Mustafa and M. Kamel, *ibid.*, **76**, 124 (1954).

[14] A. Schönberg and W. I. Awad, *J. Chem. Soc.*, 197 (1947).

[15] *Cf.* The great tendency of 1,2-derivatives of naphthalene to form ring compounds, *e.g.*, naphthalene-1,2-dicarboxylic acid is unstable and forms the anhydride readily (A. Jeanes and R. Adams, This Journal, **59**, 2608 (1937)).

[16] For the easy hydrolysis of XIVa with alcoholic sodium hydroxide solution to give V: *cf.* (a) K. Auwers and F. Eisenlohr, *Ber.*, **41**, 415 (1908); (b) J. Scheiber and P. Prandt, *J. prakt. Chem.*, **78**, 92 (1908).



Scheme B

XIV XV

a, R = C_6H_5; b, R = $C_6H_4CH_3$-*p*; c, R = $C_6H_4OCH_3$-*p*

larly, prepared by the action of *p*-toluoyl chloride on V in the presence of aqueous sodium hydroxide solution.

Experimental

Reactions of 1,2-Naphthoquinone-1-benzimide (III). (a) **With Phenylmagnesium Bromide.**—To a solution of phenylmagnesium bromide (prepared from 0.9 g. of magnesium and 9 g. of bromobenzene in 50 ml. of dry ether) was added 1.5 g. of III,[17] followed by the addition of 50 ml. of dry benzene. The water was removed from the reflux condenser and the mixture was then heated for three hours on a steam-bath. By the end of this period, the green colored solution became brownish-red. After the mixture had stood overnight at room temperature, it was poured slowly into 100 ml. of saturated cold aqueous ammonium chloride solution, and the mixture was extracted with benzene (50 ml.). The benzene extract was washed twice with water, dried (Na_2SO_4), filtered and evaporated. The solid residue obtained was washed with 10 ml. of cold ethyl alcohol, filtered off and crystallized from a mixture of dioxane and light petroleum (b.p. 50–60°), in colorless crystals, m.p. 237–238°, *ca.* 60% yield.

Anal. Calcd. for $C_{29}H_{23}NO_2$: C, 83.5; H, 5.5; N, 3.4; mol. wt., 417. Found: C, 83.3; H, 5.5; N, 3.3; mol. wt. (micro-Rast), 393.

1-Benzamido-2-hydroxy-1,2-diphenyl-1,2-dihydronaphthalene (IVa) is soluble in hot benzene, chloroform, acetic acid, but sparingly soluble in alcohol and gives a pink color with sulfuric acid. It does not dissolve in aqueous sodium hydroxide (10%) and gives no color with an alcoholic solution of ferric chloride.

IVa was unaffected by acetic anhydride and sodium acetate.

(b) **p-Bromophenylmagnesium Bromide.**—One gram of III in 50 ml. of benzene was added to a solution of *p*-bromophenylmagnesium bromide (prepared from 1.2 g. of magnesium, 15 g. of *p*-dibromobenzene and 50 ml. of ether). The reaction mixture was worked up as described above. The benzene solution gave, on concentration, colorless crystals which were recrystallized from glacial acetic acid; m.p. 236°; yield *ca.* 72%.

Anal. Calcd. for $C_{29}H_{21}NO_2Br_2$: C, 60.5; H, 3.7; N, 2.4; Br, 27.8. Found: C, 60.5; H, 3.6; N, 2.3; Br, 27.2.

1-Benzamido-2-hydroxy-1,2-di-(*p*-bromophenyl)-1,2-dihydronaphthalene (IVb) is soluble in benzene, dioxane, but sparingly soluble in alcohol and light petroleum (b.p. 50–60°). Its behavior toward aqueous sodium hydroxide solution and ferric chloride solution is similar to IVa, but it gives a violet color with sulfuric acid.

Reactions of IVa. (a) **With Zinc Dust, Acetic and Hydrochloric Acids. Preparation of 1,2-Diphenylnaphthalene (VII).**—To a mixture of 1 g. of IVa, 30 ml. of glacial acetic acid, 5 g. of zinc dust and two drops of (0.5%) solution of platinum chloride, was added 15 ml. of concentrated hydrochloric acid at intervals. The reaction mixture was heated on a sand-bath for 15 hours. It was then cooled, decanted from the unreacted zinc and poured into 50 ml. of ice-cold water. Both the acidic mixture and the unreacted zinc dust were repeatedly extracted with ether. The combined ether extracts were washed with dilute aqueous sodium hydroxide solution (5%), then with water and dried. The ether solution, on evaporation, gave colorless crystals which on repeated recrystallization from ethyl acetate–ethyl alcohol mixture, melted at 114°, identified as VII (m.p. and it mixed m.p.[6] and the formation of the picrate[7]).

Anal. Calcd. for $C_{22}H_{16}$: C, 94.3; H, 5.8. Found: C, 94.2; H, 5.8.

VII is easily soluble in benzene, ether, ethyl acetate but difficultly soluble in alcohol. It gives no color with sulfuric acid. The yield is almost quantitative.

The original acidic solution was concentrated to a small volume, extracted with petroleum ether and evaporated. The crystals, so obtained, were identified as benzoic acid (m.p. and mixed m.p.). Ammonium chloride was detected in the mother liquor.

(b) **Sulfuric Acid.**—A suspension of 1 g. of IVa in 40 ml. of a 50% solution of sulfuric acid, was refluxed for 6 hours during which the solid IVa turned into a brownish oil. The reaction mixture was decanted from the oily substance which on cooling turned into the solid mass (A). The hot decanted solution gave on cooling colorless crystals, which were filtered off and identified as benzoic acid (*ca.* 0.10 g.) (m.p. and mixed m.p.). The filtrate proved to contain ammonium sulfate. (A) was dissolved in ether and the ethereal solution was washed with a cold aqueous solution of sodium carbonate, then with water, dried and evaporated. The oily residue obtained was washed with hot ethyl alcohol (*ca.* 10 ml.) and the insoluble solid (*ca.* 0.10 g.) which crystallized from glacial acetic acid in colorless crystals (m.p. 232°) is under further investigation. It is sparingly soluble in alcohol and petroleum ether and gives a yellow color with sulfuric acid.

Anal. Calcd. for $C_{44}H_{36}NO$: C, 86.8; H, 5.9; N, 4.1. Found: C, 86.6; H, 5.8; N, 4.0.

The alcoholic washings gave on cooling a further crop of the above-mentioned substance (*ca.* 0.05 g.); the filtered alcoholic solution was concentrated to *ca.* 3 ml., cooled, whereby colorless crystals, m.p. 118° of IXa or IXb (*ca.* 0.40 g.) were obtained. Recrystallization from ethyl alcohol raised the melting point to 122–123°.

Anal. Calcd. for $C_{22}H_{16}O$: C, 89.3; H, 5.4; mol. wt., 296. Found: C, 89.3; H, 5.4; mol. wt. (micro-Rast), 280.

It is easily soluble in benzene, ether, but moderately soluble in alcohol and petroleum ether and gives an orange color with sulfuric acid.

(c) **Hydrochloric Acid.**—The above experiment was repeated using 0.5 g. of IVa and 30 ml. of concentrated hydrochloric acid. The suspended solid (IVa) turned into a greenish viscous mass (A) after boiling for two hours. The reaction mixture was decanted from (A) and the decanted acid solution gave on cooling colorless crystals of benzoic acid (*ca.* 0.10 g.) and gave a positive test for ammonium chloride. (A) was dissolved in ether and the ethereal solution was worked up as described above. IXa or IXb forms colorless crystals (*ca.* 0.15 g.) (m.p. and mixed m.p. with a sample of IXa or IXb obtained as above, gave no depression).

Anal. Calcd. for $C_{22}H_{16}O$: C, 89.3; H, 5.4; mol. wt., 296. Found: C, 89.2; H, 5.3; mol. wt. (micro-Rast), 284.

Similar results were obtained when a solution of 0.5 g. of IVa in 20 ml. of glacial acetic acid was treated with 7 ml. of concentrated hydrochloric acid as described above.

IXa or IXb was unaffected when treated with hydroxylamine hydrochloride and sodium acetate.

Reduction Reactions.—When 1 g. of III was treated with ethylmagnesium iodide, (Mg + MgI_2) mixture, or with thiophenol, as described in Part I,[1] the reduction product V was obtained in an almost quantitative yield in each case.

Photo-reactions between III and Aromatic Aldehydes. General Remarks.—The photochemical reactions were carried out in Pyrex glass Schlenk tubes,[18] the air having been displaced by dry carbon dioxide. The benzene (thiophene-free) used was dried over sodium.

Parallel experiments were carried out in the dark under the same experimental conditions and proved to be negative.

(a) **Benzaldehyde.**—A mixture of 1 g. of III, 1 ml. of benzaldehyde and 30 ml. of benzene was exposed to sunlight for ten days (April). The benzene solution was concentrated and the crystals that separated out were collected and recrystallized from ethyl alcohol as colorless crystals (*ca.* 0.61 g.), m.p. 234°.

Anal. Calcd. for $C_{24}H_{17}NO_3$: C, 78.5; H, 4.6; N, 3.8;

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(17) R. Adams and J. M. Stewart, THIS JOURNAL, **74**, 5876 (1952).

(18) W. Schlenk and A. Thal, *Ber.*, **46**, 2840 (1913).

mol. wt., 367. Found: C, 78.4; H, 4.7; N, 3.6; mol. wt. (micro-Rast), 360.

The photo-product, namely, 1-benzamido-2-naphthylbenzoate (XIVa), is not depressed when admixed with an authentic specimen of XIVa.[16] It is soluble in benzene, but difficultly soluble in light petroleum. It is insoluble in cold, aqueous sodium hydroxide solution but soluble in alcoholic sodium hydroxide and gives no color with concentrated sulfuric acid.

When a solution of 1 g. of XIVa in 15 ml. of alcoholic sodium hydroxide (15%) was refluxed for ten minutes followed by cooling and acidification with dilute hydrochloric acid, a solid separated out. It was filtered off, washed thoroughly with water and crystallized from alcohol as colorless crystals, m.p. 248°; identified as 1-benzamido-2-naphthol (V) (m.p. and mixed m.p.[16]); yield is almost quantitative. It is readily converted in an almost quantitative yield, to XIVa by the action of benzoyl chloride in presence of aqueous sodium hydroxide solution (10%).

(b) **_p_-Tolualdehyde.**—A mixture of 1.5 g. of III, 1 ml. of _p_-tolualdehyde and 30 ml. of benzene was exposed to sunlight for 10 days (August). The reaction mixture was worked up as described above and the colorless crystals (_ca._ 0.39 g.), so obtained, were recrystallized from a mixture of benzene and light petroleum, m.p. 186°. It was identified by m.p. and mixed m.p. determination with a sample of 2-naphthyl _p_-tolyl (XIVb) (prepared as below). It is easily soluble in benzene and hot ethyl alcohol, but sparingly soluble in petroleum ether and is insoluble in cold aqueous sodium hydroxide solution.

XIVb was prepared from 1 g. of V and 1 ml. of _p_-toluoyl chloride (prepared by the action of thionyl chloride on _p_-toluic acid) in presence of aqueous sodium hydroxide (15 ml.; 10%). It was obtained as colorless crystals from ethyl alcohol, m.p. 186°, in almost quantitative yield.

Anal. Calcd. for $C_{25}H_{19}NO_3$: C, 78.7; H, 5.0; N, 3.7; mol. wt., 381. Found: C, 78.8; H, 4.8; N, 3.6; mol. wt. (micro-Rast), 374.

(c) **_p_-Methoxybenzaldehyde.**—One and one-half grams of III and 1 ml. of _p_-methoxybenzaldehyde in 30 ml. of benzene was exposed for 10 days (August). The dark brown benzene solution was evaporated and the oily residue was washed several times with cold light petroleum (_ca._ 60 ml.), then followed by washing with cold, dilute aqueous sodium hydroxide solution (5%) (_ca._ 10 ml.). The insoluble mass was extracted with ether, washed with water, dried and evaporated and the resulting oil dissolved in a few ml. of benzene. The benzene solution was allowed to evaporate slowly and the colorless crystals obtained were collected and recrystallized from light petroleum as colorless crystals (_ca._ 0.29 g.), m.p. 181°. The photo-addition product XIVc was identified as 2-naphthyl _p_-tolyl (m.p. and mixed m.p.[16]).

GIZA, CAIRO, EGYPT

[CONTRIBUTION FROM THE DEPARTMENT OF CHEMISTRY, NORTHWESTERN UNIVERSITY]

The Reaction of N-Bromosuccinimide with Cycloheptatriene[1]

BY HUGH L. DRYDEN, JR., AND BILL E. BURGERT

RECEIVED FEBRUARY 14, 1955

Cycloheptatriene reacts with N-bromosuccinimide to give N-(cyclohepta-2,4,6-trienyl)-succinimide, succinimide and a dibromide of cycloheptatriene. A new synthesis of cycloheptatriene from bicyclo[3.2.0]hept-2-ene-6-one is described. A comparison of the reactivities of cycloheptatriene and ethyl norcaradiene carboxylate toward maleic anhydride strongly suggests that cycloheptatriene exists largely if not entirely as the monocyclic triene rather than as its valency tautomer norcaradiene.

In an attempt to prepare cycloheptatrienylium bromide (I)[2] the reaction of cycloheptatriene (II) with N-bromosuccinimide (NBS) was investigated. When equimolar quantities of the two reagents were heated in boiling carbon tetrachloride containing a little benzoyl peroxide, a reaction occurred during several hours. None of the expected bromide I could be isolated from the reaction mixture. Instead a bromine-free nitrogen containing solid III corresponding in analysis to a cycloheptatrienylsuccinimide was obtained. That III was an N-substituted succinimide was indicated by the presence of two carbonyl bands in the infrared spectrum at 5.59 μ (m) and 5.82 μ (s). These bands seem to be characteristic of N-substituted succinimides since they have been reported[3] in the spectrum of N-(_n_-amyl)-succinimide and we have observed them in the spectra of N-phenyl and N-allylsuccinimides. A comparison of the ultraviolet spectrum of III ($\lambda_{\max}$ 256 mμ) with that of II ($\lambda_{\max}$ 260 mμ) showed that the succinimido group was on the allylic carbon atom of the cycloheptatriene ring. The chemical reactions described below confirmed that III was N-(cyclohepta-2,4,6-trienyl)-succinimide.

Hydrogenation of III in a variety of solvents using either platinum or palladium catalysts proceeded with the absorption of more than three mole equivalents of hydrogen presumably because of hydrogenolysis of the allylic carbon–nitrogen bond. It was not possible to isolate N-cycloheptylsuccinimide from any of the reduction mixtures.

The partial hydrolysis of III afforded N-cycloheptatrienylsuccinamic acid (IV). Although the hydrogenation of IV under a variety of conditions proceeded with concurrent hydrogenolysis, the hydrogenation of the sodium salt of IV in aqueous solution proceeded without cleavage three mole equivalents of hydrogen being absorbed. The N-cycloheptylsuccinamic acid (V) isolated from the reduction mixture was identical with a sample prepared from cycloheptylamine and succinic anhydride. V could also be isolated from the hydrogenation products of III following their partial hydrolysis.

In addition to III and succinimide a dibromide of II was isolated from the reaction mixture. This dibromide was unstable and evolved hydrogen bromide upon standing. Presumably it was identical with the cycloheptatriene dibromide described by

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[1] Presented at the 126th National Meeting of the American Chemical Society, New York, N. Y., September 12–17, 1954.

[2] Since this work was completed successful syntheses of this compound have been reported (ref. 4 and 5).

[3] H. M. Randall, R. G. Fowler, N. Fuson and J. R. Dangl, Infrared Determination of Organic Structures," D. Van Nostrand Co., Inc., New York, N. Y., 1949, p. 172.