reaction of the CH_3CHO was decreased by treatment much more than that of the CD_3CDO, it means that the true ratio must be lower. As in the case of the kinetic equation, no accurate evaluation of this ratio is possible because of the lack of sufficiently extensive figures, but they indicate that the value over the temperature range of the present experiments is 1.3–1.4.

Summary

1. The thermal decomposition of mixtures of acetaldehyde and acetaldehyde-d_4 has been carried out and the resulting methanes have been analyzed by means of their infrared absorption spectra. The results indicate that the thermal decomposition of acetaldehyde is a true unimolecular reaction and that chain processes play a very minor part, if any.

2. This conclusion has been confirmed by studies on the absolute rate of the thermal decomposition of acetaldehyde, which show the true rates to be only half as great as those previously observed.

3. The relative rate of thermal decomposition of acetaldehyde to that of acetaldehyde-d_4 is approximately 1.3–1.4.

CAMBRIDGE, MASS. RECEIVED DECEMBER 3, 1943

[CONTRIBUTION FROM THE CHEMISTRY LABORATORY OF THE UNIVERSITY OF MICHIGAN]

Quinoidation of Triaryl Compounds—Hydroxyphenylbiphenylcarbinols

BY LEIGH C. ANDERSON AND W. A. FISHER[1]

Previous papers from this Laboratory[2] have presented data on the absorption spectra of several hydroxytriarylcarbinols and the corresponding fuchsones. A comparison of the absorption spectra of colored carbinols, of triphenylmethyl salts[3] and of triphenylmethyl[4] with those of quinone and the fuchsones indicated the existence of quinonoid structures for all these substances. Quinone, the free radical in ether solutions and the quinonoid carbinols have quinonoid bands which are low when compared to the corresponding bands in the fuchsones, the free radical in sulfur dioxide, and the triphenylmethyl salts. No attempt has yet been made to give an interpretation for the difference. This investigation presents data on triarylcarbinols wherein *p*-biphenyl groups have replaced one or both of the unsubstituted phenyl groups of *p*-hydroxytriphenylcarbinol. The absorption spectra obtained from these carbinols appear to offer an explanation for the variation in height of the quinonoid bands.

Two biphenylhydroxyphenylcarbinols have been studied: 4-hydroxy-4′-phenyltriphenylcarbinol and 4-hydroxy-4′,4″-diphenyltriphenylcarbinol. They were made by the condensation between phenol and *p*-biphenyldichlorophenylmethane and di-*p*-biphenyldichloromethane, respectively. Unless the correct conditions are adhered to, this condensation produces diphenoxymethane and tetraphenylmethane derivatives as chief products. The carbinols were also made by the aluminum chloride demethylation of the methoxy derivatives which were prepared by the reaction between *p*-anisylmagnesium bromide and 4-phenylbenzophenone and 4,4′-diphenylbenzophenone, respectively. The monobiphenylcarbinol was isolated in two forms: an intensely colored yellow form and a colorless modification. The dibiphenylcarbinol was isolated in two yellow modifications: one intensely colored and one which was considerably lighter in color. The fuchsone of each carbinol was prepared also.

The ultraviolet absorption spectra of ether solutions of these compounds show that a broad high band replaces the double band in the benzenoid portion of the spectrum when a *p*-biphenyl group is substituted for one of the phenyl groups of 4-hydroxytriphenylcarbinol (Fig. 1). This band is very similar to the one obtained from an hexane solution of biphenyl and is due, undoubtedly, to the biphenyl group in the carbinol. That its maximum is about 0.3 unit higher and its position about 200 mm.$^{-1}$ further toward the visible are effects easily attributable to the presence of the carbinol substitutent on the biphenyl. A second *p*-biphenyl group substituted in the carbinol merely increases the height of this band, emphasizing its source in the biphenyl groups.

The change in benzenoid absorption when a phenyl group in 4-hydroxytriphenylcarbinol is replaced by a biphenyl group seems to indicate that the biphenyl group acts as a unit in producing absorption and not as two phenyl groups. The absorption spectra of molecules containing both phenyl and biphenyl groups show that the phenyl absorption is completely blotted out beneath the biphenyl band (Figs. 1 and 2). The fact that the only appreciable change in this biphenyl band upon the introduction of more biphenyl groups into the molecule is in its height (Figs. 1 and 2) shows that each biphenyl group is acting more or less independently in producing the absorption

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[1] The material presented in this and the following paper constitutes a portion of a dissertation submitted by Willis Allan Fisher to the Horace H. Rackham School of Graduate Studies of the University of Michigan in partial fulfillment of the requirements of the Ph.D. degree, February, 1940.

[2] Anderson and Gomberg, THIS JOURNAL, 50, 204 (1928); Anderson, *ibid.*, 51, 1889 (1929); Anderson and Geiger, *ibid.*, 54, 3058 (1932).

[3] Anderson, *ibid.*, 52, 4567 (1930).

[4] Anderson, *ibid.*, 57, 1673 (1935).

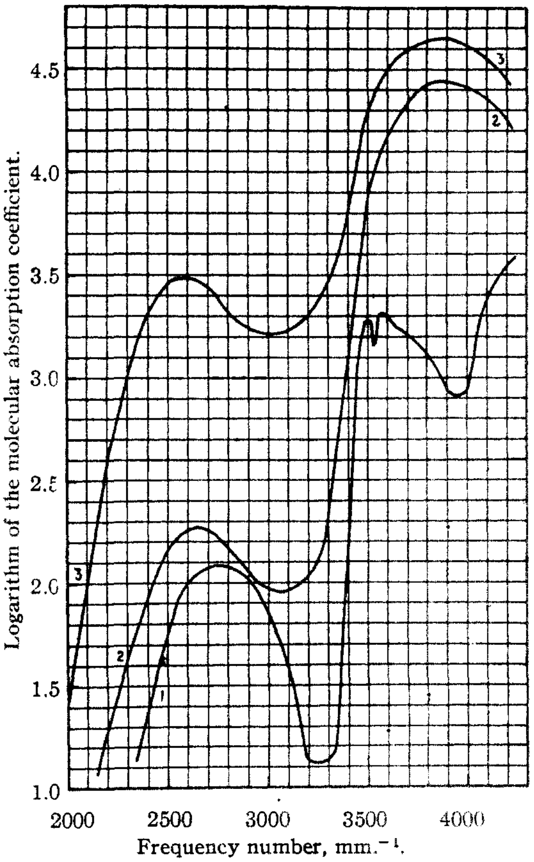

Fig. 1.—Absorption in ether solution of the quinonoid forms of: 1, 4-hydroxytriphenylcarbinol; 2, 4-hydroxy-4′-phenyltriphenylcarbinol; 3, 4-hydroxy-4′,4″-diphenyltriphenylcarbinol.

band. There is no great interaction with the rest of the molecule even in the quinonoid forms of the carbinols where a double bond is on the carbon next to the biphenyl group.

When a comparison is made of the absorption in ether of the three fuchsones: diphenylquinomethane, *p*-biphenylphenylquinomethane and di-*p*-biphenylquinomethane (Fig. 3), a regular shift of the two bands toward the visible is observed when the biphenyl groups are introduced. This is accompanied, as far as the band nearest the visible is concerned, by a slight regular increase in height. The higher frequency band in the fuchsones does not appear at the position where the biphenyl group absorbs in the carbinols nor does it have the shape of the biphenyl band.[5] Since the characteristic biphenyl band does not show up in this series of compounds, the electronic structure of the biphenyl group in the fuchsones is changed in some manner which does not occur with the carbinols. Resonance may occur with the fuchsones by a simple change in the nature of the double bond to the oxygen but the same type of resonance cannot occur with the hydroxycarbinols since there is no double bonded oxygen present. For example, the fuchsone of *p*-hydroxytriphenylcarbinol may be represented by

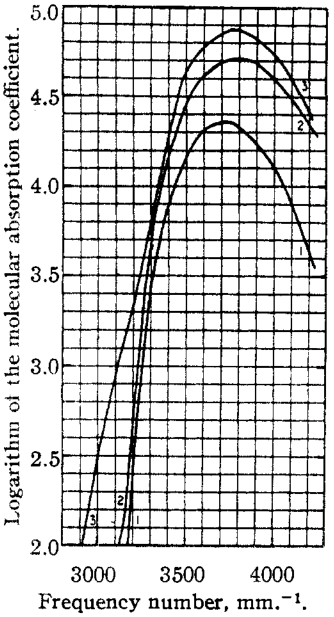

Fig. 2.—Absorption of ether solutions of: 1, 4-(*p*-anisyl)-triphenylcarbinol; 2, 4-(*p*-anisyl)-4′-phenyltriphenylcarbinol; 3, 4-(*p*-anisyl)-4′,4″-diphenyltriphenylcarbinol.

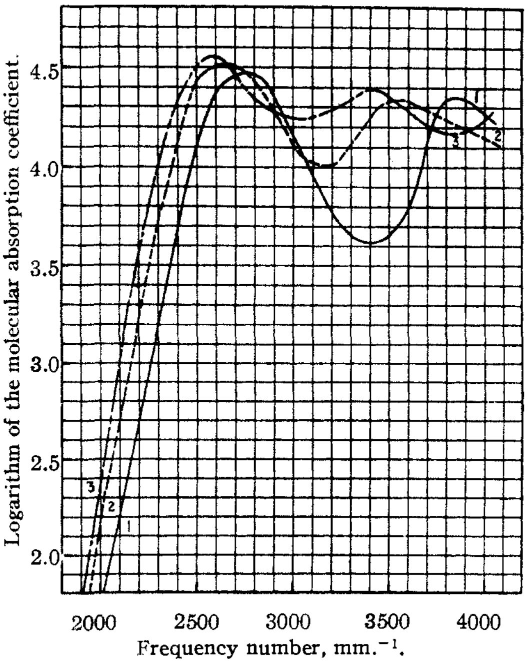

Fig. 3.—Absorption of ether solutions of: 1, diphenylquinomethane; 2, phenyl-*p*-biphenylquinomethane; 3, di-*p*-biphenylquinomethane.

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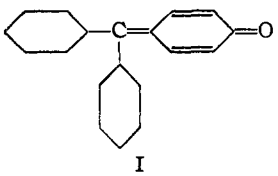
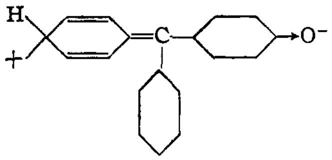
(5) A similar change has been observed in the absorption spectra of all the fuchsones from hydroxytriphenylcarbinols which have been made in previous work. Each of them has had a second band which was different in both shape and position from the benzenoid bands found in the corresponding methanes and carbinols.

the conventional structure (I) in resonance with electronically isomeric structures such as II

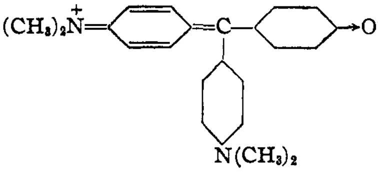


I

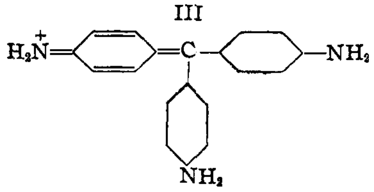


II

Because of this resonance in the fuchsones, the structure of the benzenoid groups is now altered while in the hydroxycarbinols any biphenyl group exercises its own absorption. A preferred position for the positive charge in II cannot be indicated. The introduction of biphenyl groups with the corresponding increase of possible resonance structures should increase the probability of occurrence of the phenolic ring structure. That any structure containing a biphenoquinone nucleus does not play a major part in the total makeup of the molecule is indicated because there is no abrupt change in the nature of the absorption in this series. It will be shown in the paper which follows that the absorption of 4-methoxy-*p*-biphenyldiarylmethyl cations is very different from *p*-methoxyphenyldiarylmethyl cations and that this marked change in absorption may be accounted for by a quinoidation which involves the biphenyl group. The above concept of resonance in the fuchsone molecules is in harmony with data obtained by Hantzsch from 4,4′-tetramethyldiaminofuchsone.[6] He found the absorption of this compound to be strikingly similar to that of a water solution of *p*-fuchsine, a salt, and not at all like that of fuchsone. This can be attributed to the presence of a resonance structure III like those in the salt cation IV



III



IV

According to this conception, there should be a similar relationship between the absorption of diphenylquinomethane and the triphenylmethyl ion. The curves for the latter two compounds do have almost identical absorption between 2000 and 3000 mm.$^{-1}$.

The light absorption of these fuchsones does not, then, occur in a manner which would be expected of the classical formula, but instead indicates that the molecule is the result of several resonance structures which may be similar to those indicated. Since, according to this hypothesis, the absorption of the fuchsones in the quinonoid region of the spectrum cannot be attributed to the carbonyl containing ring only, no surprise can be evidenced at the great increase in intensity of fuchsone absorption over that of quinone, whose absorption bands in this region are very low. Furthermore, the low intensity of the quinonoid carbinols may be explained by their lack of the resonance present in the fuchsone molecule and consequent dependence on the quinone ring only for absorption in this region.

The absorption curves for the quinonoid forms of these carbinols are from samples produced under similar conditions. The quinonoid forms were secured by crystallizing the carbinols from 60–70% acetic acid solutions. Since these carbinols undoubtedly exist as the corresponding cations in acetic acid solutions, the crystallization of the quinonoid variety from such solutions lends support to the idea that the hydroxy containing ring is quinonoid in the cations.

The benzenoid forms were made by precipitating the hydroxycarbinols from dilute sodium hydroxide solution by means of carbon dioxide and recrystallizing the products from aqueous alcohol containing a trace of ammonia. In an alkaline solution the phenolic character of the hydroxy containing ring is stressed and this results in the occurrence of the benzenoid form. If a very weak acid such as carbon dioxide is used to convert the salt of the phenol to the hydroxy compound and recrystallization is carried out in a slightly alkaline medium, there is little chance for conversion to the quinonoid cation and the solid benzenoid form is obtained.

In general, the conditions for producing the benzenoid forms of the carbinols which have been studied in previous investigations gave samples whose absorption in the quinonoid region was entirely removed or at least reduced in intensity to well below 1 unit. This is not true, however, in the case of 4,4′-diphenyl-4″-hydroxytriphenylcarbinol which was prepared under conditions which yield the benzenoid variety with other hydroxycarbinols. Though the height of the quinonoid band for this sample was almost 1.5 units less than in the case of the quinonoid variety, yet its peak was still at 2.1. Such a decrease with most of the other carbinols which have been studied would have meant the complete disappearance of the band. Other investigators have shown gradations in the ability of various hydroxytriarylcarbinols to exist in both the

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(6) Hantzsch, *Ber.*, **52**, 509 (1919).

benzenoid and quinonoid forms. Gomberg and Lange reported that 4-hydroxydiphenyl-α-naphthylcarbinol was not stable in the benzenoid form.[7] It may be pointed out that an α-naphthyl group or two *p*-biphenyl groups present on each of the ethane carbon atoms in a hexaarylethane strongly favor dissociation of the ethane[8]; apparently they are equally effective in inhibiting the formation of the benzenoid carbinols under discussion.

The fuchsones, *p*-biphenylphenylquinomethane and di-*p*-biphenylquinomethane, were made by heating the corresponding carbinols under reduced pressure until the vigorous evolution of water vapor had ceased and were then recrystallized from benzene.

Experimental

4-Hydroxy-4′-phenyltriphenylcarbinol.—A mixture of 10 g. of dichloro-*p*-biphenylphenylmethane[9] and 10.5 g. of phenol was allowed to react for fifteen hours at room temperature with exclusion of moisture. The excess phenol was then removed from the mixture by steam distillation. The residue was cooled, crushed, and extracted with 2.5% sodium hydroxide solution. The insoluble 4-phenylbenzophenone was removed by filtration. Some ketone is held in the alkaline solution and it cannot be satisfactorily removed by ether extraction as can be done in the case of 4-hydroxytriphenylcarbinol.[10] The alkaline solution was acidified with dilute acetic acid and the precipitated hydroxycarbinol was recrystallized from 60–70% acetic acid giving a light yellow material melting around 120° with evolution of water. The principal impurity in this crude carbinol is the ketone with a small amount of 4,4′-dihydroxy-4″-phenyltetraphenylmethane. The pure carbinol is best prepared by hydrolysis of pure phenyl-*p*-biphenylquinomethane.

Phenyl-*p*-biphenylquinomethane.—A sample of 4-hydroxy-4′-phenyltriphenylcarbinol was dehydrated by placing it in an evacuated flask heated by means of an oil-bath to 130–140°. The sample was maintained at this temperature until the vigorous evolution of water vapor had ceased. The product crystallizes from benzene–ether in orange needles, m. p. 166–167°. Its solubility in ether is 4 g. per liter. *Anal.* Calcd. for $C_{25}H_{18}O$: C, 89.79; H, 5.43. Found: C, 89.88; H, 5.54.

Quinonoid Form of 4-Hydroxy-4′-phenyltriphenylcarbinol.—Four grams of phenyl-*p*-biphenylquinomethane was dissolved in 100 cc. of warm 70% acetic acid and the solution allowed to cool. Water was added to the cold solution until a permanent cloudiness had appeared, and the material was allowed to crystallize. The resulting acid concentration was 60–65%. The precipitate was dried in a vacuum desiccator over soda-lime, m. p. 139–140°.

Benzenoid Form of 4-Hydroxy-4′-phenyltriphenylcarbinol.—To prepare the benzenoid form, either the pure quinonoid variety or the fuchsone was dissolved in 2.5% sodium hydroxide solution and the resulting solution acidified by passing in a stream of carbon dioxide. The precipitate was removed by filtration and dissolved in alcohol containing a trace of ammonia. Upon the gradual addition of water the carbinol crystallized with only a slight color, m. p. 155–157°.

4-Hydroxy-4′-phenyltriphenylcarbinol from 4-Methoxy-4′-phenyltriphenylcarbinol.—Six grams of anhydrous aluminum chloride was added to a hot solution of 4 g. of 4-methoxy-4′-phenyltriphenylcarbinol[11] in 100 cc. of benzene. This mixture was refluxed with exclusion of moisture for thirty minutes. The product was decomposed with ice and dilute hydrochloric acid, and the benzene was then removed by steam distillation. The residue was dissolved in 70% acetic acid and warmed on a steam-bath for an hour. Upon cooling, 3.7 g. of light yellow material was secured. It was recrystallized twice from 75% acetic acid, m. p. 134–140°.

Acetyl Derivative of 4-Hydroxy-4′-phenyltriphenylcarbinol.—This compound was prepared from the carbinol by means of acetic anhydride and anhydrous sodium acetate. It was recrystallized from benzene–petroleum ether, m. p. 134–136°.

Anal. Calcd. for $C_{27}H_{22}O_3$: C, 82.21; H, 5.62. Found: C, 82.26; H, 5.69.

Besides the carbinol, diphenoxymethane and tetraphenylmethane derivatives are produced by the condensation between phenol and ketone dichlorides.[12] The conditions under which the reaction is carried out determine the major product. These derivatives were made both in this case, the condensation between phenol and dichloro-*p*-biphenylphenylmethane, and in the subsequently described condensation between phenol and di-*p*-biphenyldichloromethane in order to determine their properties and thus facilitate their removal from the carbinols.

Phenyl-*p*-biphenyldiphenoxymethane.—Thirteen grams of dichloro-*p*-biphenylphenylmethane was added to a boiling solution of 14 g. of phenol in 250 cc. of anhydrous benzene. The mixture was refluxed with exclusion of moisture for one hour. At the end of this time hydrogen chloride evolution had ceased. The solution was then concentrated to one-half its original volume and 100 cc. of 60–75° petroleum ether was added to the residue. When the mixture had cooled, 12 g. of product precipitated. Upon recrystallization from alcohol, small white needles were obtained, m. p. 149–150°.

Anal. Calcd. for $C_{31}H_{24}O_2$: C, 86.89; H, 5.65. Found: C, 87.06; H, 5.70.

4,4′-Dihydroxy-4″-phenyltetraphenylmethane.—A mixture of 13 g. of dichloro-*p*-biphenylphenylmethane and 20 g. of phenol was heated on a steam-bath for five days. Moisture was excluded during this time. The excess phenol was then removed by steam distillation and the solid residue was extracted with 2.5% sodium hydroxide solution. After the insoluble material had been removed by filtration, the alkaline solution was acidified with carbon dioxide. The product became colorless after three recrystallizations from benzene–petroleum ether. A 55% yield of material which begins to soften at 157° and melts at 163–165° was secured.

Anal. Calcd. for $C_{31}H_{24}O_2$: C, 86.89; H, 5.65. Found: C, 86.65; H, 5.95.

Diacetyl Derivative of 4,4′-Dihydroxy-4″-phenyltetraphenylmethane.—This derivative was prepared from the dihydroxy compound by means of acetic anhydride and anhydrous sodium acetate. Upon recrystallization from alcohol it gave a product which melted to a cloudy liquid at 168–170° and became clear at 187°. *Anal.* Calcd. for $C_{35}H_{28}O_4$: C, 82.01; H, 5.51. Found: C, 81.82; H, 5.57.

4-Hydroxy-4′,4″-diphenyltriphenylcarbinol.—Di-*p*-biphenyldichloromethane was made from 4,4′-diphenylbenzophenone[13] using phosphorus pentachloride and following the procedure of Straus and Dutzmann.[14] In this latter reaction it was found more convenient to pour the warm reaction mixture, after removal of the phosphorus oxychloride, into 60–75° petroleum ether before allowing it to cool completely. By pouring it into the petroleum ether small crystals are obtained which are easier to work with than the hard mass which is obtained by allowing the product to cool alone. The crude dichloro compound (m. p. 130–135°) was used without further

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[7] Gomberg and Lange, THIS JOURNAL, **42**, 1879 (1920).

[8] Gilman, "Organic Chemistry," John Wiley and Sons, Inc., New York, N. Y., 1938, p. 504.

[9] Schlenk and Bergmann, *Ann.*, **463**, 120 (1928).

[10] Gomberg and Jickling, THIS JOURNAL, **37**, 2580 (1915).

[11] Anderson and Fisher, *ibid.*, **66**, 594 (1944).

[12] Gomberg and Snow, *ibid.*, **47**, 198 (1925); Gomberg and Anderson, *ibid.*, **47**, 2022 (1925).

[13] Bachmann, *ibid.*, **55**, 770 (1933).

[14] Straus and Dutzmann, *J. prakt. Chem.*, [2] **103**, 1 (1921).

purification; 25 g. of this material was mixed with 20 g. of phenol and the resulting reaction allowed to continue for fifteen hours at room temperature with exclusion of moisture. The excess phenol was then removed from the mixture by steam distillation. After the residue had been dried and crushed, it was digested with 200 cc. of cold alcohol and the mixture was left overnight; 6 g. of 4,4'-diphenylbenzophenone was removed by filtration. The residue after removal of the alcohol was recrystallized from 70% acetic acid. Crystallization occurs only with difficulty. The compound can be secured in a solid form by quickly pouring the dilute acetic acid solution into a large excess of water. The principal impurities are the ketone, which in spite of its insolubility in alcohol and dilute acetic acid is not entirely separated by the above procedure, and 4,4'-dihydroxy-4'',4'''-diphenyltetraphenylmethane. Preparation of the carbinol from the corresponding fuchsone gives a purer product but the method is not as easy as was found with 4-hydroxy-4'-phenyltriphenylcarbinol since separation of this fuchsone and ketone is not so readily carried out. The tetra compound is slightly more soluble in most solvents than the ketone or the fuchsone. The carbinol is readily soluble in ether, alcohol and benzene and is only slightly soluble in dilute alkali. *Anal.* Calcd. for $C_{31}H_{24}O_2$: C, 86.89; H, 5.65. Found: C, 86.59; H, 5.87.

Di-*p*-biphenylquinomethane.—A sample of 4-hydroxy-4',4''-diphenyltriphenylcarbinol was placed in an evacuated flask heated by means of an oil-bath to 130–140°. It was maintained at this temperature until the vigorous evolution of water vapor had ceased. The product crystallizes from benzene in orange needles. If it is heated gradually it melts over a range 140–155°. If it is placed in a melting point-bath at 150° and then heated, it melts at 159–161.5°. This compound is soluble in ether to the extent of about 2 g. per liter. *Anal.* Calcd. for $C_{31}H_{22}O$: C, 90.70; H, 5.40. Found: C, 90.49; H, 5.60.

Di-*p*-biphenylquinomethane from 4-Methoxy-4',4''-diphenyltriphenylcarbinol.—Two grams of anhydrous aluminum chloride was added to a boiling solution of 2.2 g. of 4-methoxy-4',4''-diphenyltriphenylcarbinol[11] in 50 cc. of benzene and the mixture was refluxed with exclusion of moisture for fifteen minutes. The product was decomposed with ice and dilute hydrochloric acid. The benzene solution was separated, dried, and evaporated to dryness. The resulting solid was dehydrated at 130–140° in an evacuated flask until water evolution had ceased. Recrystallization of the product from benzene yielded 0.5 g. of orange needles, m. p. 155–157°. The melting point of a mixture of this material with that prepared by dehydration of the hydroxycarbinol indicated the identity of the two products.

Quinonoid Form of 4-Hydroxy-4',4''-diphenyltriphenylcarbinol.—3.5 g. of di-*p*-biphenylquinomethane was dissolved in 300 cc. of 70% acetic acid by heating on a steam-bath for two hours. Sufficient water was then added to reduce the concentration of the acetic acid to 60–65% and the solution allowed to stand. Crystallization occurred after long standing. The product was red-orange in color, m. p. 106–107.5°.

Benzenoid Form of 4-Hydroxy-4',4''-diphenyltriphenylcarbinol.—Attempts to prepare the benzenoid form of this carbinol resulted in a product lighter in color than the quinonoid variety but by no means colorless. Though the solubility of this carbinol in dilute sodium hydroxide is not great, some solution will take place. An alkaline solution of a sample of the quinonoid variety was filtered and then acidified with carbon dioxide. Recrystallization of the precipitate from aqueous alcohol containing a trace of ammonia gave a yellow-orange product, m. p. 124–126°.

Acetyl Derivative of 4-Hydroxy-4',4''-diphenyltriphenylcarbinol.—This compound was prepared from the carbinol by means of acetic anhydride and anhydrous sodium acetate. It was recrystallized twice from benzene–petroleum ether mixtures, m. p. 149–152°. *Anal.* Calcd. for $C_{33}H_{26}O_3$: C, 84.23; H, 5.57. Found: C, 83.90; H, 5.76.

Di-*p*-biphenyldiphenoxymethane.—Fifteen grams of di-*p*-biphenyldichloromethane was added to a boiling solution of 10 g. of phenol and 5 g. of pyridine in 100 cc. of anhydrous benzene. This mixture was refluxed with exclusion of moisture for four hours. The product was extracted with water several times to remove pyridine hydrochloride, pyridine and phenol. The volume of the benzene solution was then reduced to 75 cc. and an equal volume of 60–75° petroleum ether was added. The ketone which precipitated was removed by filtration and the filtrate evaporated nearly to dryness. The product was crystallized from petroleum ether, yield 10 g., m. p. 118–120°. This compound is very soluble in benzene, high boiling petroleum ether and slightly soluble in alcohol. *Anal.* Calcd. for $C_{37}H_{28}O_2$: C, 88.06; H, 5.59. Found: C, 87.87; H, 5.86.

4,4'-Dihydroxy-4'',4'''-diphenyltetraphenylmethane.—A mixture of 20 g. of phenol and 12 g. of di-*p*-biphenyldichloromethane was heated on a steam-bath for five days with the exclusion of moisture. Water was then added and the excess phenol was removed by steam distillation. The residue crystallized slowly from a mixture of benzene and 60–75° petroleum ether giving 10 g. of material. Recrystallized from alcohol, m. p. 253–255.5°. This compound dissolves in hot 2.5% sodium hydroxide solution. It is moderately soluble in ether and in benzene and slightly soluble in alcohol.

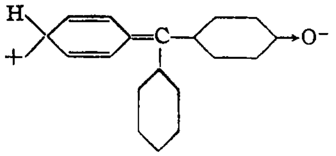
Diacetyl Derivative of 4,4'-Dihydroxy-4'',4'''-diphenyltetraphenylmethane.—This substance was prepared from the dihydroxy compound by means of acetic anhydride and anhydrous sodium acetate; recrystallized from benzene and 60–75° petroleum ether, m. p. 256–258°. *Anal.* Calcd. for $C_{41}H_{32}O_4$: C, 83.65; H, 5.48. Found: C, 83.20; H, 5.54.

Summary

1. 4-Hydroxy-4'-phenyltriphenylcarbinol and 4-hydroxy-4',4''-diphenyltriphenylcarbinol have been made. Each carbinol has been isolated in the benzenoid and quinonoid forms and various derivatives are described.

2. The ultraviolet absorption spectra of these carbinols and certain derivatives have been determined. The *p*-biphenyl group in these carbinols acts almost as an isolated unit in absorption, producing a characteristic, high, broad absorption band near 3800 mm.$^{-1}$ which resembles the band others have reported for biphenyl itself.

3. A study of the ultraviolet absorption for the fuchsones of the above carbinols indicates that resonance structures of the following type appear to be an important factor in the absorption of ether solutions of fuchsones



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