Reduction product and yield		per cent
trans-Dibenzoylethylene	Diphenacyl	70
cis-Dibenzoylethylene	Diphenacyl	60
trans-Di-*p*-toluylethylene	4 : 4'-Dimethyldiphenacyl	75
cis-Di-*p*-toluylethylene	4 : 4'-Dimethyldiphenacyl	95
trans-Di(*p*-chlorobenzoyl)-ethylene	4 : 4'-Dichlorodiphenacyl	80
cis-Di(*p*-chlorobenzoyl)-ethylene	4 : 4'-Dichlorodiphenacyl	90
trans-Di(*p*-bromobenzoyl)-ethylene	4 : 4'-Dibromodiphenacyl	75
cis-Di(*p*-bromobenzoyl)-ethylene	4 : 4'-Dibromodiphenacyl	90

It is noteworthy that the *cis*-compounds react more rapidly with this reducing agent. With the *trans*-isomers some unchanged substance was always found in the product.

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[1] Conant, J. B., and Lutz, R. E., *J. Amer. Chem. Soc.*, **45**, 1047 (1923); Lutz, R. E., *ibid.*, **51**, 3008 (1929); Lutz, R. E., and Palmer, F. S., *ibid.*, **57**, 1947, 1953, 1957 (1935).
[2] Lutz, R. E., and Reveley, W. G., *J. Amer. Chem. Soc.*, **61**, 1854 (1939).
[3] Allen, C. F. H., and Blatt, A. H., Gilman's "Organic Chemistry", **1**, 603 (1938).

Total Conjugation of Linoleic Acid in Oxidation with Lipoxidase

Bolland and Koch[1] postulated the mechanism of autoxidation of linoleate to be :

$$-CH_2.CH : CH.CH_2.CH : CH.CH_2-$$
$$(13)\ (12)\ (11)\ (10)\ (9)$$

(I) $- H^*\ \longrightarrow$

$$\begin{bmatrix} -CH_2.CH : CH.\overset{*}{CH}.CH : CH.CH_2- \\ -CH_2.CH : CH.CH : CH.\overset{*}{CH}.CH_2- \\ -CH_2.\overset{*}{CH}.CH : CH.CH : CH.CH_2- \end{bmatrix}$$

(II)
(III)
(IV)

$\xrightarrow[+ H^*]{+ O_2}$

$$-CH_2.CH : CH.CH.CH : CH.CH_2-$$
$$|$$
$$OOH$$
(V)

$$-CH_2.CH : CH.CH : CH.CH.CH_2-$$
$$|$$
$$OOH$$
(VI)

$$-CH_2.CH.CH : CH.CH : CH.CH_2-$$
$$|$$
$$OOH$$
(VII)

From the ultra-violet absorption due to the conjugation of the double bonds and from the active hydrogen content of the resulting mixture of peroxidic products, they concluded that it consisted of approximately equal parts of the hydroperoxides V, VI and VII, indicating that the free radical structures II, III and IV contribute equally to the free radical resonance hybrid.

Other workers' results are in agreement with the general outlines of the mechanism[2,3]. In the hydrogenated products, Bergström[2] identified comparable amounts of 9- and 13-hydroxystearate, but was unable to detect the 11-isomer.

The oxidation of linoleates in aqueous solution with crude soya-bean lipoxidase seems to follow the same general course as the autoxidation[2,3]. It was observed that the extinction at 234 mμ per absorbed oxygen increased when the enzyme was purified[4].

When crystalline lipoxidase[5] became available, the problem was reinvestigated under conditions least likely to promote side reactions or decompositions. The oxidations were carried out in Warburg vessels under air, using sodium linoleate substrate[4]. The reactions were stopped by addition of alcohol, and light absorption was measured using the Beckman spectrophotometer.

Apparent molar extinction coefficients of the primary oxidation product at 234 mμ were found to be 23,000 at 37°, 27,800 at 8° and 31,400 at 0°, indicating that reaction temperature affects the formation or decomposition of conjugated diene to a marked degree. Reduction of the extinction by elevated temperature is accompanied by increased absorption at 270 mμ. The extinction coefficient at 234 mμ remains near 30,000 up to 30 per cent oxidation at 0°, whereas at 37° it has decreased to 20,000 at 10 per cent oxidation.

Thus in the rapid enzymatic oxidation of linoleate at low temperature, one pair of conjugated double-bonds is formed for every oxygen absorbed. This indicates that III and IV are the main contributing structures to the free radical resonance hybrid, resulting in oxygen addition at the ends of the resonating system, giving only the conjugated hydroperoxides VI and VII. Variable amounts of products, other than conjugated hydroperoxides, formed at higher temperatures, with longer reaction times, or with impure enzyme, appear to be attributable to decompositions or secondary oxidations of conjugated peroxides.

Our evidence suggests that a similar mechanism may account for the low extinction coefficients observed in the autoxidation of linoleates.

A full report will appear in due course (*Arch. Biochem.*).

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[1] Bolland and Koch, *J. Chem. Soc.*, 445 (1945).
[2] Bergström, *Nature*, **156**, 717 (1945); *Arkiv Kemi, Min.-Geol.*, **21**, A, 14, 15 (1945).
[3] Holman, *Arch. Biochem.*, **10**, 519 (1946).
[4] Theorell, Bergström and Åkesson, *Pharm. Acta Helv.*, **21**, 318 (1946).
[5] Theorell, Holman and Åkesson, *Arch. Biochem.*, **14**, 250 (1947).

Ammonium Salts of Sulphanilamides and Sulphonic Acids

SULPHANILAMIDE salts of a few sulphonic and carboxylic acids have been described[1,2,3], but they have not been isolated in pure form and characterized. In the course of our work on surface-active compounds, and with the object of examining their activity as intestinal bacteriostatic agents, we have prepared sulphanilamide salts of di*iso*propyl naphthalene sodium sulphonate (m.p. 220–22°), sodium dioctylsulphosuccinate, and lauryl-*p*-toluidide-2-sodium sulphonate. Suitable experimental conditions were first determined by the preparation of (*a*) salts of naphthalene-β-sulphonic acid and sulphanilamide (m.p. 263–64°), sulphathiazole (214–15°), sulphapyridine (152–53°), sulphadiazine (188°), sulphamerazine (118–120°), sulphaguanidine (225–26°), N¹-acetylsulphanilamide (254–55°), and *p*-aminobenzoic acid (decomp. above 260°); and (*b*) sulphanilamide salt of phenol-*p*-sulphonic acid (241–42° decomp.). The last salt, described earlier[1] as giving m.p. 216–220° (decomp.), was apparently a mixture containing sulphanilamide hydrochloride.