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Oxidative degradation of β -carotene and β -apo-8'-carotenal

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Abstract

In the self-initiated oxidation of β -carotene with molecular oxygen the rate of oxygen uptake was shown to depend on the oxygen partial pressure. Epoxides, dihydrofurans, carbonyl compounds, carbon dioxide, oligomeric material, traces of alcohols, and probably carboxylic acids were formed. The main products in the early stage of the oxidation were shown to be 5,6-epoxy- β -carotene, 15,15'-epoxy- β -carotene, diepoxides, and a series of β -apo-carotenals and -carotenones. As the oxidation proceeded uncharacterised oligomeric material and the carbonyl compounds became more important and the epoxides degraded. In the final phase of the oxidation the longer chain β -apo-carotenals were themselves oxidized to shorter chain carbonyl compounds, particularly β -apo-13-carotenone, β -ionone, 5,6-epoxy-gb-ionone, dihydroactinidiolide and probably carboxylic acids. The effect of iron, copper and zinc stearates on the product composition and proportions was studied, as was the effect of light. The oxidation was inhibited by 2,6-di-*t*-butyl-4-methylphenol and α -tocopherol. The oxidations of β -apo-8'-carotenal and retinal under similar conditions were studied briefly, and the main products from the former compound were characterized. The initiation, the formation of the epoxides, the β -apo-carotenals and -carotenones, the successive chain shortening of the aldehydes to the ketones, and the formation of dihydroactinidiolide are explained in terms of free radical peroxidation chemistry.

Autoxidation of β -carotene and β -apo-8'-carotenal gave epoxides, dihydrofurans, methylketones, aldehydes, carboxylic acids, carbon dioxide and oligomeric material. Mechanisms are suggested for formation of these products.

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