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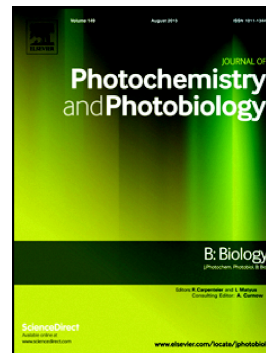
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Exploring the reactivity of retinol radical cation toward organic and biological molecules: a laser flash photolysis study

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Abstract

Vitamin A (retinol) and various natural retinoids are essential for life. Under oxidative conditions, vitamin A radical cation (RET^{•+}) can be formed. Many deleterious effects were reported about the formation of carotenoid radical cations in biological environments, on the other hand, little is known about the consequences of the RET^{•+} formation in these environments. Therefore, it is important to explore the reactivity of RET^{•+} toward various biological substrates. Here, we employed nanosecond laser flash photolysis (LFP) to generate RET^{•+} ($\lambda_{\text{max}} = 580 \text{ nm}$ in methanol) and examine its reactivity toward a wide range of biological molecules including amino acids, vitamins, carotenoids, naturally-occurring phenols, neurotransmitters such as catecholamines, wide range of phenol derivatives and some selected electron-donors. The results show that the reactivity of RET^{•+} toward various substrates is strongly dependent on the polarity of solvent. In addition, RET^{•+} is able to oxidize amino acids, which subsequently can lead to protein damage. However, the presence of vitamins (vitamins E and C), carotenoids and naturally-occurring phenols (e.g. resveratrol, vanillin, dopamine hydrochloride and L-Dopa) can inhibit the damaging effect of retinol^{•+} by reducing it back to retinol. Vitamin E and carotenoids are the most efficient quenchers for the RET^{•+} (diffusion-controlled reactions). Importantly, our results clearly indicate that the reactivity of RET^{•+} is as strong as that of the powerful trichloromethylperoxyl radical (CCl₃O₂[•]). Thereby, formation of RET^{•+} in biological media is expected to induce bio-damage.

Keywords: Retinol radical cation; amino acids; vitamins; carotenoids; phenols; laser flash photolysis.

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