

Canthaxanthin – the strong modifier of the lipid membrane properties

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Canthaxanthin (b,b-carotene 4, 4' dione) is a pigment widely used as a food and cosmetics colorant. Although considered safe, canthaxanthin may produce some undesirable effects on human health caused mainly by the formation of crystals in the macula lutea membranes of the retina of an eye. Experiments show that canthaxanthin toxicity towards the lipid membranes can be the result of its molecular interactions with the lipid molecules. All the results of experiments done on model systems such as monolayers of pure canthaxanthin as well as mixtures of canthaxanthin and lipids, oriented bilayers or liposomes indicate a very strong effect of canthaxanthin on the physical properties of lipid membranes. As compared to other xanthophylls the striking difference is that the effects of canthaxanthin at a molecular level are observed at much lower concentration of the pigment in the lipid phase (as low as 0.05 mol% with respect to lipid). Analysis of the molecular interactions of canthaxanthin showed a molecular mechanisms such as: strong van der Waals interactions between the canthaxanthin molecule and the acyl chains of lipids introducing an ordering effect of canthaxanthin on the lipid membranes, restrictions to the segmental molecular motion of lipid molecules, modifications of the surface of the lipid membranes, effect on the membrane thermotropic properties such as forming new thermotropic phases and finally interactions based on formation of the hydrogen bonds both between the keto groups of canthaxanthin and ester carbonyl group of lipid as well as between the keto groups of canthaxanthin and the lipid acyl chain directly or with the mediation of the water molecules.