

Interaction of Secondary Lipid Oxidation Products and Amino Acids

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In order to evaluate the course of lipid oxidation it is common use to determine the formation of primary and secondary lipid oxidation products. As key compounds for secondary lipid oxidation products hexanal and propanal have been widely used as indicators for the oxidation of omega-6- and omega-3- fatty acids. In the presence of amino acids (incl. proteins and peptides) it has been found that aldehydes may undergo further reactions and do not accumulate in the course of oxidation.

The present paper demonstrates interactions of aldehydes with amino acids during storage at ambient conditions or moderated rise of temperature in food related model systems (e.g. cooked ground meat) and in homogenous solvent based model systems. Mono- or diunsaturated aldehydes – in particular alpha, beta-unsaturated - are able to interact with amino acids resulting in the formation of typical Strecker aldehydes or vinylogous products. E.g. in the presence of leucin or phenylalanine the secondary lipid oxidation products heptadienal or heptenal resulted in the formation of 3-methylbutanal and phenylacetaldehyde, respectively. The intermediate products found so far suggest that monounsaturated aldehydes react with amino acids via an addition reaction. In contrast, condensation reaction products have not been detected.

For saturated aldehydes, such as hexanal or heptanal, it was found that in the presence of amino acids aldol condensation reactions resulting in a decrease of the secondary lipid oxidation products. A crucial factor in the reaction is the presence of water, i.e. decreasing the water content in a system under a critical value may inhibit the interaction of aldehydes with amino acids.

In summary, our study shows that the reaction of secondary lipid oxidation products with amino acids is not restricted to polyunsaturated aldehydes that undergo oxidation but may occur also for monounsaturated and saturated aldehydes.