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Afaf Kamal-Eldin
United Arab Emirates University, UAE

The criticality in lipid oxidation and antioxidation

Deterioration of unsaturated fatty acids as a result of oxidation is a major problem in foods and other biological set ups including human organs and tissues. The accepted mechanism divides the course of lipid oxidation into induction, propagation, and termination periods. The induction period is the most important but until recently was the least understood. Our research has illustrated the importance of antioxidant polarity and concentration in agreement with the "Polar Paradox" theory suggested by William Porter in 1990. This theory was later refined by Edwin Frankel "Interfacial Phenomena" and by McClements & Decker to define the role "Association Colloids". We have defined the role of micelles as important microenvironments that, depending on the hydrophobic lipophilic balance (HLB) of their constituents, will affect the rate of lipid oxidation. The minor compounds those are present as part of the lipids individually plays a role according to their HLB, molecular size, and concentration. In other words, microenvironments (or micro-emulsions) act as nano-reactors for the oxidation of lipids auto-catalyzed by product lipid hydroperoxides. Our research have shown that the size of micelles increase during the induction period up to the critical point, critical micelle concentration (CMC), where micelles break down pointing the change to the propagation phase, where the rate of the reaction increases exponentially. Thus, a certain criticality associated with the stability of the micro micelles in lipids governs the induction period of lipid oxidation in bulk oils. This finding opens new doors for studying the supra-molecular chemistry of lipid oxidation in different settings.

Biography

Afaf Kamal-Eldin is a Professor in Food Science specialized in the area of bioactive compounds in foods. She has led research in the area of lipid oxidation and antioxidation since 1996 and has published a large number of original papers and review articles on the subject. After 20 years of research at the Swedish University of Agricultural Sciences, she has joined United Arab Emirates University in 2010. She has edited 3 books in the area of lipid oxidation and published a total of 175 publications including original research, reviews, and book chapters. She has supervised 17 PhD theses and 14 MSc theses.

Afaf.Kamal@uaeu.ac.ae

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