Lipid Oxidation and Quality Interest Area
Technical Program Abstracts

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LOQ 5b: General Lipid Oxidation and Quality

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Lipid Oxidation in Powder Matrices: A Critical Assessment of Peroxide Value. L. Smith, DSM Nutritional Products, USA.

Increased use of microencapsulated oils has made understanding lipid oxidation in the powder matrix very important, but more complex relative to neat oil systems. The objective of this study was to assess the utility of the industry standard peroxide value (PV) test as a determinant measure of primary oxidation in a powder matrix. The study was conducted with oils representing a range of peroxide values, which were subsequently formulated into a model dry form. PV results before and after formulation and oil extraction were compared. Data suggest that peroxide values are impacted by extraction technique, and alternative analytical techniques are needed in order to gain an accurate picture of the oxidative status of microencapsulated oils.

The Nonlinear Effect of Alkyl Chain Length of Phenolipids in the Membrane Interactions and Oxidation: Evidence by X-ray Diffraction Analysis. E. Durand[1], R.F. Jacob[2], S. Sherratt[2], J. Lecomte[1], B. Baréa[1], P. Villeneuve[1], and R.P. Mason[2,3], [1]CIRAD, UMR IATE, France, [2]Elucida Research, USA, [3]Dept. of Medicine, Cardiovascular Div., Brigham & Women's Hospital, Harvard Medical School, USA.

Phenolics represent a large family of secondary metabolites, ubiquitous in the plant kingdom and highly diversified. Although under native form they are effective antioxidants, their hydrophilic nature may be sometimes prejudicial to their antioxidant efficacy. Indeed, in complex systems such as emulsions, membranes, and living cells, it is generally considered advantageous for antioxidants to exhibit surface-active properties. One strategy to obtain surface-active phenolics consists in their association via covalent bond with a lipophilic moiety to design a new class of molecule called "phenolipids". As tailor-made new bioactive molecules, the phenolipids have proved to be a promising way to enhance their natural antioxidant property. This grafted lipophilic domain kinetically modulated the ability of the phenolipid to interact and cross cell membranes. Despite the evidence supporting a relationship between phenolipid's alkyl chain length and their interaction/affinity with membrane bilayer, such a relationship has not been directly visualized. In this study, the membrane interactions of rosmarinic acid, considered as one of the most efficient antioxidant, and its corresponding alkyl esters have been examined via small angle x-ray (SAXS) diffraction approach in model membrane liposomes and correlate with the overall peroxidation of the membrane.

Oxidative Stability of Oleogels Produced by Ethylcellulose and Monoglycerides. R. Homma[1], Z. Haizhen[1], S.M. Ghazani[2], A.G. Marangoni[2], D.J. McClements[1], and E.A. Decker[1], [1]University of Massachusetts Amherst, USA, [2]University of Guelph, Canada.

Oleogel research is focused on the development of an alternative triacylglyceride-structuring method using liquid oil and gelators instead of saturated fats and trans-fatty acids. However, replacing hard fats with liquid oil can change the oxidative stability. To understand the impact of gel structure on lipid oxidation, oxidation rates of gels and non-gels which contained the same gelators were studied. As a model of food system, three types of oleogels such as oil gels, water-in-oil gels, and oil-in-water gels are produced. First, oils with and without gelators were compared. The ethylcellulose gel structure did not affect lipid oxidation while the monoglycerides gel structure increased the oxidative stability of oil. Second, water-in-oil systems with and without gelators were tested. Both ethylcellulose and monoglycerides gel structure slightly increased oxidative stability of water-in-oil emulsion. Third, oil-in-water systems with and without gelators were studied. MAG gel structure increased oxidative stability of oil-in-water emulsion. The effects of antioxidants with different polarities on lipid oxidation in oil gels, water-in-oil gels, and oil-in-water gels were also studied. Understanding how gel structure impact on lipid oxidation could provide important information of how the gel systems could impact shelf-life and could provide a new perspective to improve oxidative stability.

GC-MS Characterization of Hydroxy Fatty Acids Derived from Oxidation of Edible Oils. W. Xia and S.M. Budge, Dalhousie University, Canada.

Lipid alcohols are thought to form from alkoxy radicals through hydrogen abstraction during lipid oxidation and are expected to be major intermediate products in addition to hydroperoxides. However, there are few applicable methods for their determination in oils. This is due to the poor sensitivity of the available methods and the limited knowledge of the structures of hydroxy fatty acids produced during lipid oxidation. Previous studies measuring hydroxy fatty acids utilized hydrogenation to optimize signals in GC-FID, which led to a loss of information regarding number and positions of double bonds. Here, we report a sensitive method to characterize hydroxy fatty acids in oxidized oils without hydrogenation. Triacylglycerols in oils were first converted into fatty acid methyl esters (FAMEs) using a base-catalyzed esterification method and then subjected to solid