Giovedì 24 Ottobre 2019 ore 14:30
Aula conferenze Area CNR Montelibretti

Title:

Magnetic Resonance Relaxation Sensor Application for Quality Control of Food Lipids Oxidation

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Abstract

A major stability issue of food and other products containing lipids is their susceptibility to oxidation and the efficacy of antioxidants which are a complex function of chemical structure, multiphase morphologies, and the effect of water interfacial forces on morphology and molecular distribution. These material parameters are difficult to characterize with current analytical methods, and for this objective we recently developed 2D and 3D ^{1}H LF NMR spin-spin (T2) and spin-lattice (T1) energy relaxation time sensorial signal analysis for chemical and morphological mapping of liquid or solids containing lipids, for mechanistic studies of lipid oxidation and antioxidant efficacy in complex food materials. We shall discuss the T1 vs. T2 graphs for lipid samples such as linseed oil, soya and rapeseed oils in comparison to their individual fatty acid components such as oleic, linoleic and linolenic oils. Furthermore we shall emphasis how the fatty acid chemical structural variations from saturated, monounsaturated or polyunsaturated alkyl chains affect the oil's chemical and internal morphological domains and resultant susceptibility to oxidation. For example we characterized the linseed oil's aggregate structure domains on a T1 vs. T2 graph and formed a dictionary of the different Time Domain peaks with different molecular sites, and compared the spectral changes of with the individual fatty acids or their due to different internal liquid crystalline type morphologies. The chemical and morphological effect on oxidation and antioxidant efficacy is shown by changes in 1H energy relaxation times on 2D and 3D graphs. An example of the 2D energy relaxation spectrum for a lipid water emulsified food product mayonnaise will be described. This smart NMR relaxation sensor opens the way to provide an efficient supportive tool to decision makers in food industry field.
Keywords: Food oils; PUFA Magnetic resonance; H relaxation; Time domain

Biography

Zeev Wiesman is a full professor at the Department of Biotechnology Engineering, Faculty of Engineering Sciences, Ben Gurion University of the Negev, Beer Sheva, Israel. He is the head of Phyto-Lipid Biotechnology Lab (PLBL). His current research is focused on the development of Facile LF ^{1}H NMR Morphological-Chemical Relaxation Sensor Applications for cost effective Food Quality Control. Emphasis is given to application of sensorial rapid and accurate monitoring of polyunsaturated fatty acids (PUFA) oxidation in food products.

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