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## 2D and 3D spectrums of $^1\text{H}$ LF NMR energy relaxation times of lipids to characterize the effect of their morphological and chemical domains on oxidation and antioxidant efficacy



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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  $^1\text{H}$  LF NMR spin-spin ( $T_2$ ) and spin-matrix ( $T_1$ ) energy relaxation time 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 2D and 3D  $T_1$  vs.  $T_2$  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 emphasize 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 triglyceride linseed oil's aggregate structure domains on a 2D  $T_1$  vs.  $T_2$  graph and formed a dictionary of the different  $^1\text{H}$  energy relaxation time peaks with different molecular sites, and compared the spectral changes of  $^1\text{H}$  relaxation times with the individual fatty acids or their esters due to different internal liquid crystalline type morphologies of the triglycerides vs. the fatty acid oils. The chemical and morphological effect on oxidation and antioxidant efficacy is shown

by changes in  $^1\text{H}$  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.

### Biography

Zeev Wiesman has completed his PhD from Hebrew University of Jerusalem, Faculty of Agriculture and Food Sciences. He is the Head of Phyto-Lipid Biotechnology Lab at the Faculty of Engineering Sciences, Ben Gurion University of the Negev, Beer Sheva, Israel. He has published more than 100 papers in peer-reviewed journals.

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