Protein-polysaccharide Mixtures as Wall Material in Fish Oil-loaded Nano-microcapsules Obtained by Electrospraying

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LOQ 3a: Lipid Oxidation and Antioxidants—Fundamentals and Applications

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Lipid Oxidation and Antioxidants: Fundamentals and Applications Fereidoon Shahidi*, *Memorial University of Newfoundland, Canada*

Oxidation is a deteriorative process that affects the wholesomeness and properties of fats and oils and products containing them. The oxidation process generally proceeds via autoxidation, photooxidation, thermal oxidation and enzymatic oxidation. While the processes involved dictate the outcome, antioxidants are generally employed to arrest oxidation and extend the shelf life of products. In general, the fatty acid composition, positional distribution, minor components, storage conditions and presence of antioxidants deliberately added to foods affect the oxidation of foods. As clean label is now most desirable, use of natural inhibitors of oxidation is preferred, but this may also face regulatory challenges. When consumed, the dietary antioxidants may exert a positive influence of oxidative stress condition in the body and contribute to health promotion. Examples will be provided to briefly illustrate different factors involved in lipid oxidation and its control by employing antioxidants.

Protein-polysaccharide Mixtures as Wall Material in Fish Oil-loaded Nano-microcapsules Obtained by Electrospraying Pedro J. Garcia-Moreno*, Andres Pelayo, Ramona V. Mateiu, Ioannis S. Chronakis, and Charlotte Jacobsen, *Technical University of Denmark, Denmark*

Omega-3 polyunsaturated fatty acids (PUFA) are highly susceptible to oxidation, which limits their use as nutritionally beneficial lipids in foods. Electrospraying is a promising technique for encapsulation of omega-3 PUFA since the process does not require the use of heat, which avoids deterioration of these thermosensitive compounds. Furthermore, nano-microcapsules with a reduced size are obtained by this technique, which makes their dispersion into food matrices easier when compared to traditional encapsulates (e.g. microcapsules produced by spray-drying). Biopolymers such as proteins (e.g. zein, whey protein) and polysaccharides (e.g. pullulan, dextran) are required for the production of food-grade nano-microcapsules. Wall materials consisting of both proteins, which exhibit emulsifying properties, and polysaccharides, which influence the glass transition temperature of the glassy matrix and thus the transport within it, have been suggested to improve the oxidative stability of traditional fish oil encapsulates. The aim of this work was to develop oxidatively stable fish oil-loaded nano-microcapsules by electrospraying with protein (e.g. zein, whey protein)-polysaccharide (e.g. pullulan, dextran) mixtures as wall materials. First, the influence of total concentration of biopolymers and polysaccharide to protein ratio on the morphology of the capsules and on the yield and productivity of the process was assayed. Secondly, the effect of the oil-incorporation approach (e.g. mechanical stirring or high pressure homogenization) on the ability of the capsules to entrap the oil and on the oil distribution was investigated. Finally, the oxidative stability of selected nano-microcapsules was monitored by determining the formation of lipid hydroperoxides and volatiles oxidation products.

Impact and Parameters of Active Oxygen Scavenging Packaging on the Oxidative Stability of Oil-in-Water Emulsions David Johnson*, and Eric A. Decker, *University of Massachusetts Amherst, USA*

The oxygen content of food systems is one of the most important factors influencing the rate and extent of lipid oxidation. Previous research in our lab has shown that greater than 90% systemic oxygen reduction is needed in order to meaningfully extend the oxidative stability of oil-in-water emulsions. In the present work, conditions were defined where oxygen scavenging packaging could inhibit lipid oxidation in a model fish oil-in-water emulsion system. The oxygen scavenging technology is based on an iron-based oxidation that consumes oxygen, but is still separated from the food contact by multiple layers of plastic. The active packaging was able to scavenge oxygen from the emulsion within the first 24 hours of storage at 32°C and oxygen reduction values were quantified simultaneously and non-destructively, by O2-sensitive fluorescent sensors. Lipid oxidation markers, as measured by PV and TBARS, suggested that the >90% reduction in systemic oxygen by the commercial active packaging lead to enhanced oxidative stability. The efficacy of this packaging was determined across ionic strength, pH, and fat concentration. Further, the activity of antioxidants under reduced oxygen atmospheres are discussed. Parameters for when oxygen reduction can be a successful antioxidant strategy for emulsions are outlined. The results of this study provide a reference and parameters where active oxygen scavenging packaging can be an effective and 'label friendly' option.