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# Effect on Lipid Oxidation and Microbial Growth of Bulk and Interfacial Composition in Rich Omega-3 Oil-in-Water Emulsions

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The fatty acids' profile of industrial food products has been modified over the last decades in order to respect nutritional recommendations. In particular, the proportion of omega-3 is higher, leading to a potential increase of lipid oxidation and growth of some pathogenic microorganisms. The addition of molecules having both antioxidant and antimicrobial properties can be a solution to limit this instability. Phenolic compounds, naturally present in ingredients of plant origin, provide this opportunity and can be exploited in food products such as oil-in-water (o/w) emulsions rich in omega-3. Many studies already deal with the oxidation of such systems and their protection by antioxidants<sup>1</sup>. Nevertheless, in order to control these phenomena and offer safe and healthy products, further works need to focus on the understanding of the associated chemical mechanisms occurring when many compounds are in interaction<sup>2</sup>. Our study aims to better understand the impact of composition and structure parameters of o/w emulsions rich in essential long chain polyunsaturated fatty acids from omega-3 family, by quantifying the oxidation of several realistic models. The chosen systems are composed of a fish oil phase, containing 25 % w/w of docosahexaenoic acid (DHA), and an aqueous phase supplemented with polysaccharides (guar gum, 0 to 0.6 %, w/w) to reach a range of viscosities related to food products and with whey proteins as surfactant molecules widely used in food industry or tween 80 as a reference surfactant. A part of them is also enriched in phenolic antioxidants alone or in mixture ( $\alpha$ -tocopherol, eugenol, ferulic acid). The behavior of these complex systems is analyzed from several physico-chemical markers and phenomena influencing lipid oxidation (viscosity, interface, phenolic compounds alone or in synergy) are pointed out. Finally, in emulsions enabling the growth of a food pathogen (*Listeria monocytogenes*), the dual antioxidant and antimicrobial activity of phenolic compounds is challenged.

<sup>1</sup>Di Mattia C.D., Sacchetti G., Mastrocola D., Sarker D.K. and Pittia P., 2010. *Food Hydrocoll.* 24: 652-658

<sup>2</sup>Sorensen A.D.M., Villeneuve P. and Jacobsen C., 2017. *Eur. J. Lipid Technol.* 119: 1-14