**Development and characterization of nano-emulsion-filled gels intended to supply omega-3 fatty acids into food products**

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The replacement of saturated fat (natural or hydrogenated) by healthy fat (e.g. polyunsaturated fatty acids - PUFAs) without affecting the properties of the products represents a challenge for the food industry. One of the strategies aiming at this purpose is the development of new textures by structuring liquid, unsaturated, oils, which can be an interesting approach for functional food products. In this context, emulsion-filled gels enriched with PUFAs may be used as texture modifiers in processed food and also as new biomaterials for controlled-release. Consumption of sufficient levels of omega-3 (ω-3) FAs was reported to present several health benefits, especially those against cardiovascular diseases. However, due to the ω-3 FAs unsaturated nature, these compounds are highly susceptible to lipid oxidation and unsuitable for incorporation into long shelf life foods1. In order to improve the physical-chemical stability of ω-3 FAs, bio-based nanoemulsions composed by two different types of surfactants (tween 20 or sunflower lecithin) were evaluated to encapsulate linseed oil (rich in ω-3 FAs) and produce a stable nano-emulsion gel composed by konjac glucomannan. Nanoemulsions were optimized using a high energy method (homogenization by ultra turrax followed by ultrasound-assisted emulsification) and were characterized in terms of size and zeta-potential by Dynamic Light Scattering, morphology by Transmission Electron Microscopy and lipid stability by the TBARS test. Each type of nanoemulsion was incorporated into a konjac glucomannan matrix and compared with a free oil gel. The final emulsion gels were characterized in terms of texture profile analysis, syneresis and colour measurements. Emulsion gels composed by tween and sunflower lecithin nanoemulsions revealed lower syneresis (1.367 ± 0.035 % and 1.846 ± 1.231 %, respectively) when compared with free oil in konjac gels (5.132 ± 1.257 %). Furthermore, gels with non-encapsulated oil were significantly harder (*p<0.05*) in comparison with nanoemulsions-filled gels and no significant differences were observed among tween 20 and sunflower lecithin. TBARS test demonstrated that nanoemulsions composed by sunflower lecithin are more susceptible to the oxidation process and, consequently, the konjac gels prepared with this type of nanoemulsions exhibited higher TBARS values. The incorporation of tween 20 based nanoemulsions within konjac gels proved to be the most effective mean of inhibiting lipid oxidation. Therefore, these results provide valuable information for the development of new systems to improve ω-3 FAs stability and its incorporation into innovative functional foods.

*References:*

1 Walker R., Decker Eric A., McClements D. (2015). Development of food-grade nanoemulsions and emulsions for delivery of omega-3 fatty acids : Advances and obstacles. *Food & Function.* 6,41–54.

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