**Encapsulation of rapeseed oil and rosemary aqueous extracts in calcium alginate beads: An Oxidative stability study**

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Rapeseed oil is recognized as one of the healthiest vegetable oils due to its unique fatty acid profile which is rich in MUFA (68.6%) and PUFA, mainly linoleic acid (17.4%) and γ-linolenic acid (6.8%). However, rapeseed oil is sensitive to oxidation1. *Rosemary officinalis* (rosemary) is a medicinal and aromatic plant, and several studies have revealed its distinguishing polyphenolic diversity and antioxidative potency; the main bioactive ingredients are carnosic acid, carnosol and rosmarinic acid. Rosemary is heavily exploited in the production of essential oil generating high amounts of solid residues. Current tendency leads to the valorisation of agro-industrial by-products and the recovery of valuable compounds. Previous studies suggested a potential use of the solid residue from the hydrodistillation of rosemary as good source of antioxidants2. The aim of the present work was to encapsulate in sodium alginate beads rapeseed oil loaded with polyphenols extracted from rosemary from two different streams (conventional and waste) and evaluate the effect of the recovered antioxidants on the storage stability of rapeseed oil. Sodium alginate has been chosen as a wall material due to its renewability, biodegradability, biocompatibility, and nontoxicity characteristics4. Alginates, being ionic polysaccharides, are capable to form hydrogels (Ca2+- induced) in various morphologies (e.g. beads) suitable to act as carriers of bioactive compounds and release them under the typical pH conditions encountered in the human GI track.

An eco-friendly extraction process of bioactives from the rosemary plant waste, before and after hydrodistillation (by-product), was applied using aqueous solutions of β-cyclodextrin as a solvent. The aqueous extracts were characterised by the total phenolic content (**TPC**), and their major phenolic compounds were identified and quantified by **HPLC**. Sodium alginate solutions (2%) with/without rosemary aqueous extracts were subsequently prepared at pH 5.0. For encapsulation, O/W emulsions were produced containing 20% rapeseed oil (as oil phase) and 80% sodium alginate solutions (as water phase), while Tween 80 (0.5%) was used as emulsifier. Alginate beads were formed by ionic gelation using at 2% w/v calcium chloride solution and once formed, the beads were stored at 20 °C for 28 days. The quality of the encapsulated oil was evaluated by measurements of peroxide value (PV), p-anisidine value (p-AV), free fatty acid (FFA), Totox value, total extractable phenolic content (TEPC), and fatty acid composition. The phenolic profiles between the two rosemary aqueous extracts differed. Polyphenols were extractable until the end of the stability study, whereas the oxidative changes observed were slower in the encapsulated oil made with the aqueous extract from rosemary distillate residues rather than the raw rosemary which wasn’t previously subjected to hydrodistillation. The results of the present study indicate that encapsulation of oil using alginate beads with inclusion of a polyphenolic extract obtained from rosemary may offer an additional protection to the rapeseed oil from oxidation upon storage.

*References:*

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