Development of new biopolymers with gelling and film-forming properties: an alternative to animal gelatin

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Résumé

Animal gelatin sometimes associated with chemical crosslinkers is used for its gelling and film-forming properties at temperatures close to room temperature. However, the health crisis related to the transmission of Bovine Spongiform Encephalopathy, BSE (more commonly known as "mad cow disease") (Ock et al., 2020) linked to its animal origin, together with ethical, religious, and dietary constraints of vegetarian or vegan consumers imply to substitute gelatin. In an environmentally responsible context, plant-based biopolymers (marine or terrestrial) derived from renewable, biocompatible, and biodegradable resources can replace gelatin.

Our work aims to combine algal polysaccharides with gelling and film-forming properties (carrageenans) and plant proteins (from pea) with emulsifying properties (Garcia Tasende and Manriquez-Hernandez; Nesterenko et al., 2013). The selected polysaccharide-protein formulation should offer mechanical and film-forming properties similar to those of gelatin.

Maillard reaction was used after protocol optimization (the Maillard reaction has been selected as an alternative to chemical cross-linking agents for improving the functionality of

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raw materials). Subsequently, an experimental design was implemented, varying the protein/carrageenan ratio, reaction time, and pH, to determine the formulation with physicochemical properties closest to our objectives: production of microspheres encapsulating a lipophilic active ingredient and films. Mechanical tests, active ingredient quantification and behaviour in aqueous or lipidic media were performed.
Ratio was identified as a key parameter, followed by reaction time and pH. Our formulas are now being produced and used at higher level (the formulations highlight an interesting potential on an industrial scale for microencapsulation applications).

Mots-Clés: nutraceutical, gelatin, gelatin alternatives, biopolymers, carrageenan, pea protein