NOVEL FUNCTIONAL POLYSACCHARIDES AS EDIBLE COATINGS FOR FOODS

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INTRODUCTION

In the last years, the food and packaging industries joined efforts to reduce the amount of food packaging materials, once the environmental issues became important to the consumer. As an answer to that concern, several problems were addressed in order to foster the commercial use of bio-based primary food packaging materials. These problems include degradation rates under various conditions, changes in mechanical properties during storage, potential for microbial growth, and release of harmful compounds into the packaged food product (Karina et al., 1999).

The future generation of packaging materials will be derived from renewable resources. These materials will ideally be biodegradable. However, natural polymeric materials vary in their rate of degradation in the environment, and some proteins, for example, cannot presently be classified as degradable because of standard definitions (Cooke, 1990). Edible films and coatings can improve shelf life and food quality by providing good and selective barriers to moisture transfer, oxygen uptake, lipid oxidation, losses of volatile aromas and flavours (Kester & Fennema, 1986), better visual aspect, and reduction of the microbiobiological contamination (Nisperos-Carriedo, 1994).

EDIBLE COATINGS FOR CHEESE

In the cheese making industry, two of the main problems taking place during cheese ripening and later on, throughout the distribution chain, is the occurrence of molds and the loss of water. Usually, this problem is solved by the use of synthetic coatings where an antimicrobial agent is introduced; however, such compounds are being banned either by legislation or by consumer trends. Polysaccharide coatings are 100 % natural, have an oil-free appearance, a low caloric content and can be used to increase the shelf life of foods. The objective of this part of the work was to study the ability of polysaccharides from different and novel natural sources to be used as coatings for cheese. The tested materials were: chitosan, galactomannan from Gleditsia triacanthos and agar from Glacilaria birdiae. Different formulations were tested with the addition of a plasticizer (glycerol and sorbitol), vegetable oil and Tween 80. The surface properties of the cheese and the wetting capacity of the coatings on the cheese (in terms of the spreading coefficient) were determined.

The cheese has surface and critical tension values of 37.79 mN/m and 18.33 mN/m respectively. It is a surface of low energy and therefore the Zisman method was used to determine coatings’ wettabiliy as represented by the spreading coefficient \( W_s \). The best values of the \( W_s \) were obtained with chitosan for the solutions with lower values of chitosan concentration. When using G. triacanthos the solutions with better values of \( W_s \) were those containing oil. In the case of the solutions of G. birdiae, the solution containing 1.5 % polysaccharide, 0.5 % glycerol and 0.5 % oil was the best option in terms of \( W_s \). The three best coatings of each polysaccharide in terms of \( W_s \) were further evaluated for gas permeability (water vapour – WVP – oxygen - O\(_2\)P – and carbon dioxide - CO\(_2\)P), colour, opacity and solubility.

In chitosan coatings the WVP decreased with the addition of sorbitol, increasing with a high concentration of glycerol. For G. triacanthos and G. birdiae the lower WVP values were found for samples with higher concentrations of polysaccharide. The films of chitosan with higher concentration of plasticizer have values of O\(_2\)P statistically higher than those made from the solutions with lower concentration.

The solution containing 1.5 % polysaccharide of G. triacanthos, 2.0 % glycerol and 0.5 % oil has the lower value of O\(_2\)P, having a higher concentration of plasticizer when compared with the other samples. For the solutions of G. birdiae the increase of polysaccharide concentration generally decreased the values of O\(_2\)P.

In chitosan coatings, solutions with a higher concentration of plasticizer have a lower value of CO\(_2\)P. For G. triacanthos the increase of the polysaccharide concentration and the addition of sorbitol decreased the
value of CO₂P. For *G. birdiae* samples, there is a significant decrease of CO₂P with the increase of polysaccharide concentration and with the addition of sorbitol.

The opacity, solubility and L* values for the tested films change in the presence of sorbitol and mainly with the increase of polysaccharide concentration.

The better solution to coat the cheese was chosen by the lower value of WVP (related with the decrease of water loss) and the lower value of O₂P; this corresponded to the solution of *G. triacanthos*. This solution was used to coat the cheese and the gas transfer rates of O₂, CO₂ and the water loss (related with WVP) were measured. The cheese with coating generally presents lower gas transfer rates (in general corresponding to 11 % of the values without coating), therefore contributing to decrease the relative weight loss of the cheese.

**EDIBLE COATINGS FOR FRUITS**

In this second part of the work, seed galactomannans from *Caesalpinea pulcherrima* and *Adenanthera pavonina* were characterized as coatings to extend the shelf life of the tropical fruits acerola (*Malpighia emarginata*), cajá (*Spondias lutea*), mango (*Mangifera indica*), pitanga (*Eugenia uniflora*) and seriguela (*Spondias purpurea*). The galactomannans were obtained in an easy and cheap way. The intrinsic viscosity of the galactomannans was determined, both in the absence and in the presence of glycerol. Values of 7.22 ± 0.52 cm³/g and 6.47 ± 0.45 cm³/g were obtained for *C. pulcherrima* and *A. pavonina* without plasticizer (glycerol), respectively. In the presence of glycerol a 43 % decrease in intrinsic viscosity occurs. The wettability of aqueous galactomannan solutions (with or without glycerol) in the five fruits tested as well as the surface properties of the fruits were also determined. The tested fruit surfaces present a high dispersive component being surfaces of low energy. For all the fruits, with the exception of mango, the optimal values of the spreading coefficient (*Wₜ*) were obtained for solutions with lower concentrations of galactomannan.

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**REFERENCES**