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Encapsulation of Active Ingredients in Microbeads: Characterization and Effect of Polymer Concentration

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ABSTRACT

Sodium alginate is a natural anionic polymer widely used as an encapsulating agent for bioactive compounds, including polyphenol plant extracts [1, 2] ,which has been widely applied in the pharmaceutical, nutraceutical and food industries to intensify the stability of these bioactive compounds[3,4].In this work, alginate and chitosan microbeads were prepared by extrusion and loaded with grape pomace seeds and skin polyphenols. The effect of alginate (1%-2%) and grape pomace extract (2%-4%) concentrations was studied. The grape polyphenols were effectively encapsulated and the microbeads regained a spherical shape 800 µm to 1100 µm in diameter; their morphology was studied by optical microscopy, the additional swelling capacity of the hydrogels of the hydrogels obtained was determined; the increase in alginate quantity with the polyphenols resulted in regular microbeads, with very high encapsulation high encapsulation efficiency (>96%).

Keywords: Sodium alginate, polymer, encapsulating agent, bioactive compounds

1. Introduction

Phenolic compounds are considered a source of bioactive compounds. These constituents are known for their therapeutic properties, notably their antioxidant, anti-inflammatory, antibacterial and antiviral properties. [1] However, the astringent taste and instability of polyphenols limit their use. Microencapsulation is a conceivable technique that offers the possibility of masking the taste of polyphenols, optimizing their assimilation by the body and improving the conservation of their properties during the manufacturing process and storage by coating the active ingredients or particles with protective membranes [5].

2. Experimental

In this study, we focused on the microencapsulation of grape pomace phenolic extract, in order to preserve the polyphenols and adapt this valuable material to a variety of uses. Several formulations containing grape pomace phenolic extract as an active ingredient were prepared using the microencapsulation process. The microspheres were based on phenolic extract and a polymeric matrix (sodium alginate) with different compositions. The active ingredient and the different formulations were characterized by different techniques.

Phenolic compounds in grape pomace were quantified using appropriate universal techniques (total polyphenol content, antioxidant activity).

3. Results and Discussion

3.1 IR analysis of chitosan:

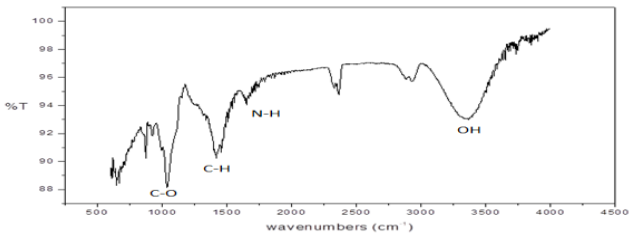

Figure 1: FTIR analysis of chitosan

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3.2 Calculation of the degree of deacetylation

We use the formula **: A 1597 / A2865 = 0,0125*DD + 0.2**
The DD of the chitosan used in this study is estimated at 80.1%.

3.3 Characterization of microbeads:

3.3.1 Morphology :

Wet microbead 1.535mm Dry microbead 1.369mm

Figure 2: Optical photograph of wet and dried microbeads

3.3.2 Swelling test :

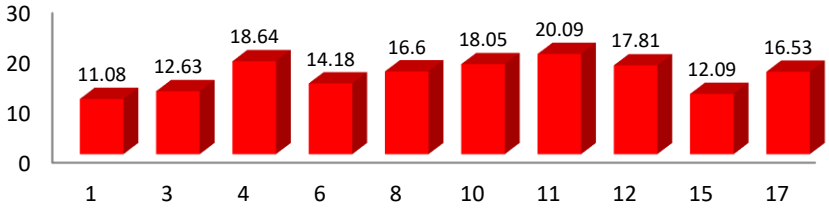

Figure 3: Swelling rate of phenolic seed extract encapsulated in microbeads

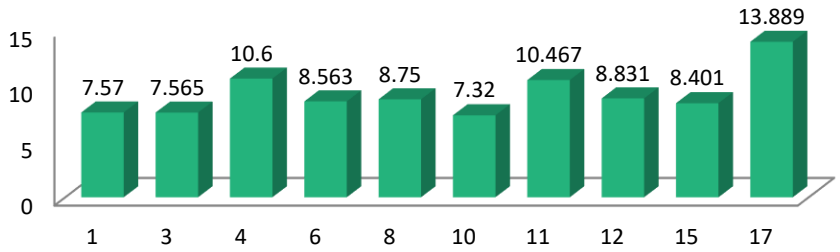

Figure 4: Swelling rate of phenolic extract encapsulated in microbeads

3.3.3 Encapsulation efficiency

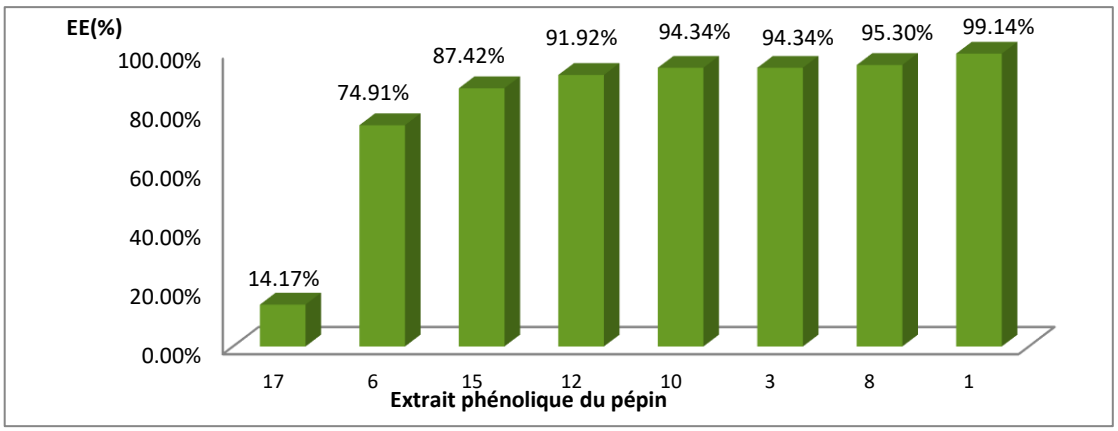

Figure 5: Histogram showing the encapsulation efficiency (EE) of phenolic seed extract in microbeads.

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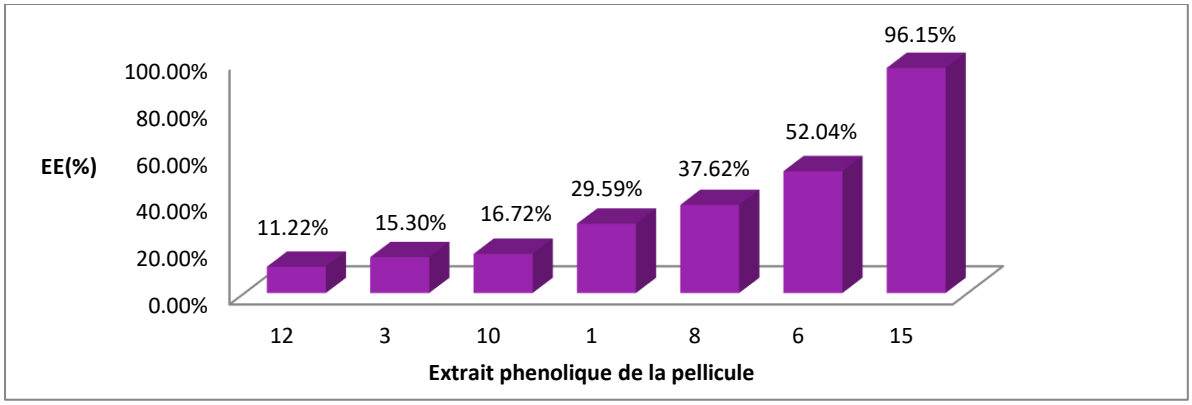

Figure 6: Histogram showing the encapsulation e fficiency (EE) of phenolic film extract in microbeads.

4. Conclusions

In the light of the results obtained in the course of this study, we can conclude that alginate-based microbeads encapsulated with phenolic seed extract and produced by the so-called "extrusion" technique are satisfactory both in terms of the effectiveness of this method, for use in various fields.

Finally, we propose to continue this study, based on the mechanical characterization of the microbeads obtained, with the aim of valorizing the phenolic compounds on the one hand, and seeing their effect on the other.

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