EVALUATION OF ARABINOXYLAN OLIGOSACCHARIDES ON PHYSICOCHEMICAL PROPERTIES OF CHITOSAN BASED FILMS

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Hemicelluloses are known to have good gas barrier properties, making them of huge interest for edible film applications. They are obtained from renewable and worldwide available materials, mostly from biomass residues, often low cost sources. Focusing on the decrease of accumulation of non-degradable packaging waste and the use of natural resources, the utilization of hemicelluloses extracted from agricultural residues for film production is an interesting emerging field [1, 2, 3].

The aim of this work was to evaluate the physico-chemical properties of films formed with chitosan and different arabinoxylans (AXs). AXs were obtained using five different processes and were used to produce five different films (1, 2, 3a, 3b, 4). The treatments used to obtain the five different AX samples were as follows:

1. by NaOH treatment of destarched wheat bran (DWB), then 100 kDa ultrafiltration
2. by NaOH treatment of enzymatically treated DWB with a xylanase, then 100 kDa ultrafiltration
3a. by xylanolytic treatment of DWB, then 10 kDa ultrafiltration, ground and freeze-dried
3b. by xylanolytic treatment of DWB, then 100 kDa ultrafiltration, ground and freeze-dried
4. by hydrothermal treatment of DWB treated with a xylanase, then ethanol-precipitated.

The incorporation of AXs in the films was previously evaluated using different concentrations of chitosan, AXs, plasticizers and surfactants, in order to understand if they would be miscible and would not influence in the manufacture of films. It led to films with a surface and a thickness relatively equal and smooth in all parts. These preliminary experiments allowed defining a film composition of 1.5 % of chitosan (in 1 % lactic acid solution), 0.5 % of glycerol, 0.1 % of tween 80 and 0.2 % of AXs for all the five samples. Glycerol (plasticizer) and Tween 80 (surfactant) were used to avoid brittleness and to improve the mechanical
properties of the films. The self-supporting films were formed by the casting evaporation method, dried at 30 ºC during 60 h. Films with chitosan and without AXs were used as control. Films were characterized in terms of water vapour permeability (WVP), opacity, thickness, moisture content and solubility.

The process that appeared more effective relatively to a homogeneous thickness was the extraction by hydrothermal treatment of DWB previously treated with a xylanase (type 4), with values of 0.105 mm. Concerning the WVP, the film that displayed the lowest values was the type 3b with a value of 3.78 E-07 g (m s Pa)-1. Moisture values were between 25 and 30 % for all five studied films and their solubility values were around 1 % (w/w). The films with incorporation of AXs type 4 were more opaque, presenting values of 15.49 %. The lowest opacity was observed in the film with type 2 AXs, presenting values of 6.87 %.

In conclusion, wheat bran AXs can be incorporated into chitosan-based edible films. WVP is increased with the presence of AXs, demonstrating an increase of water affinity of the films. For all the other studied properties, no significative differences with the control were evidenced. Thus, AXs can be successfully added to chitosan-based films and can be used as material for edible packaging.

References