

Morphology and Differential Scanning Calorimetry of composite starch based films

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The need for renewable materials to reduce dependence on polymers from petroleum for flexible packaging production has increased considerably in recent years. The use of edible and biodegradable films is a good alternative to replace the market for polymers made from non-renewable raw materials. The most used starches for the production of commercial films of edible films are maize, potatoes, rice, wheat and cassava [1]. Edible films and coatings based on starch are brittle, which justifies the use of polyols, such as glycerol, sorbitol and polyethylene glycol, to give them flexibility and elongation [2]. The choice of plasticizer added to the edible films must guarantee compatibility with the polymer and solvent used. In addition to food grade, the plasticizer should be miscible in macromolecules to avoid separation during the film drying process [3]. The aim of this work is the development of flexible, edible films obtained by casting, made from pea starch and gelatin by casting followed by the characterization of their structural and thermal properties.

The films were obtained by dispersing 3g of pea starch in 100 ml of distilled water. After total dispersion, 10% of the plasticizer (glycerol) was added in relation to the mass of the starch, and the suspensions were heated to 85°C for 5 min, while stirring constantly. The gelatine (GEL) solution was prepared by hydrating 10 g of GEL in 100 ml of distilled water for 1 hr. After this period, the solution was heated to 70°C for 10 min. Subsequently, glycerol was added, under magnetic stirring, until the homogenization of the sample at a concentration of 5% was compared to the mass of the GEL. This agitation was carried out smoothly to avoid formation of bubbles in the sample and to keep the natural pH of the solution. The filmogenic solutions (pea starch and gelatine), were mixed in the following ratios: 1:1(a), 1:4 (b) and 4:1 (c). Aliquots of 20 ml of the resulting solutions were distributed on 11.8 cm diameter Plexiglas plates. Then, the films were dried for 24 hours at room temperature (25°C) and stored in this temperature and 52% of relative humidity, for 48 hours prior to characterization.

The morphology of the films' surface was observed using a scanning electron microscope (SEM) from LEO, Model 440i, operated at 10 kV and 50 pA. Before the tests, the samples were covered with a thin

layer of gold for thermal conduction. Measurements of glass transition temperature and the variations of the fusion enthalpy of the films were performed by analysis of differential scanning calorimetry, using a calorimeter from TA Instruments (EUA), Model TA 2010.

Edible films produced by casting were visually transparent, homogeneous and bright, and easily removed from the drying molds. Sample morphologies are shown in Figure 1

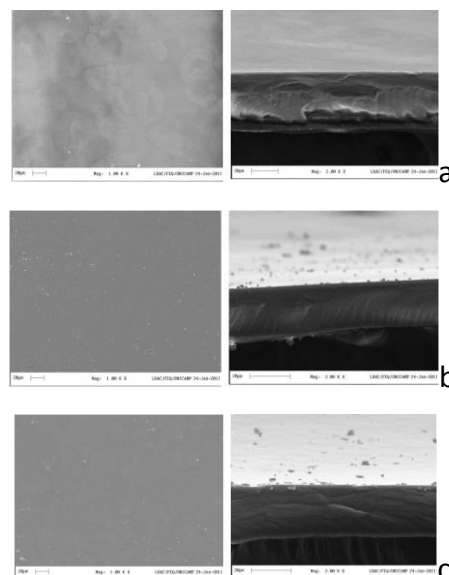


Figure 1. Morphology of starch pea biofilms

The micrographs obtained for the films produced by casting show a homogeneous surface without cracks, suggesting a cohesive matrix. The results of the DSC for the films prepared by casting were similar. There was one intense endothermic transition between 80 and 95°C. 87, 5°C for sample a, 86,2 °C for sample b and 91,4 °C for sample c (Figure 2). The results suggest an increase in glass transition temperature with increasing concentration of starch.

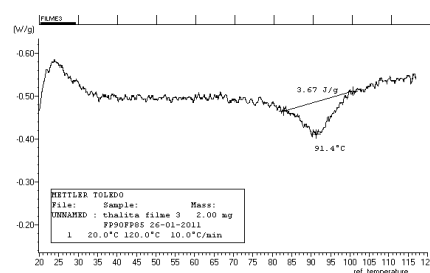


Figure 2. DSC of starch pea biofilms

References

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