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Analysis of zein / propolis based films by AFM and DMA

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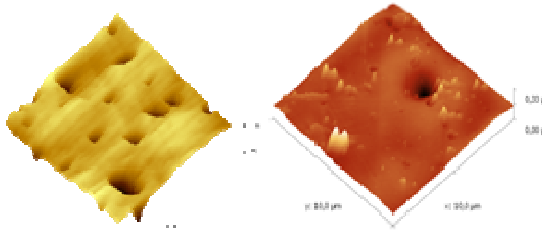
Abstract – Film or edible coatings applied to fruits and foods act in the control of breathing or gas exchange, preserving the quality of food and reducing losses. Propolis is a substance collected by bees,which has great bactericide and fungicide potential. Thus, the films of zein with propolis were analyzed using atomic force microscopy to observe the physical and morphological characteristics. Through a dynamic mechanical analysis the resistance could be evaluated.

The use of edible films and coatings, applied directly to fruits and other foods, may increase their shelf life resulting in reduced losses. The addition of propolis in the formulation of edible films is of great interest since it has been widely studied for its antimicrobial and antifungal potential. So the objective was to prepare and analyze zein films with the addition of propolis by the techniques of atomic force microscopy (AFM) and dynamic mechanical analysis (DMA).

The precursor solutions of the films were prepared from 4% zein obtained from maize gluten [1] in a solution of 70% ethanol with agitation, with addition of different concentrations of plasticizer (oleic acid) at 0.25, 0.5 and 1%. 1 mg / mL of propolis was added to the solution, because it was observe a bacteriostatic effect in this concentration [2]. The solutions were then deposited on acrylic plates and dried in desiccators. The resulting films were detached and analyzed using two different techniques: the DMA for mechanical resistence and the AFM for physical and morphological characterization.

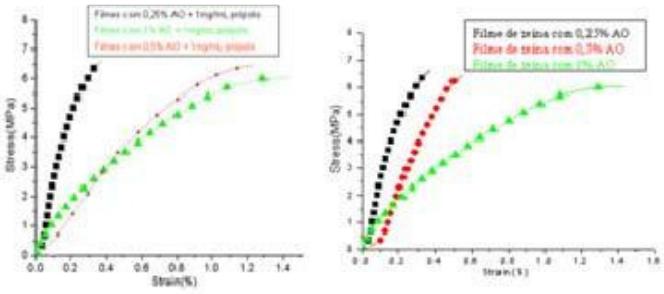
With the AFM technique it was possible to observe that the zein films, after the addition of propolis, were more porous (figure 1a). The analysis by DMA showed a significant increase in resistance and deformation of the films containing 0.25% OA + propolis. For films containing 0.5 and 1% OA + propolis, there has not been a significant increase in resistance and deformation.

Thus, we conclude that although the propolis when used at the concentration mentioned here has bacteriostatic capacity, it causes increased porosity which should be related to lower resistance observed by the technique of DMA. In Figure 2 we can see the behavior of the formulations with and without addition of propolis. The samples showed in figure 2b are more reistant.



(a) (b)

Figure 1: Atomic force microscopy of the films containing 0,25% OA. **(a)** With própolis **(b)** Without própolis.



(a) (b)

Figure 2: Deformation curves and rupture for formulations containing 0.25, 0.5 and 1% the films. **(a)** With própolis **(b)** Without própolis

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