“PRODUCTION AND SURFACE CHARACTERIZATION OF BIOPOLYMERIC FILMS FROM TOMATO CUTICLE, STARCH AND GLYCEROL MIXTURES”

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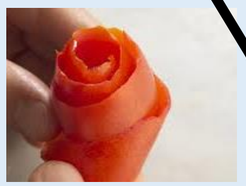
1. Introduction

Nowadays the use of agro-industrial residues to obtain products with added value is of great importance. In México, tomatoes are one of the main agricultural export products which have a high residue rate, as is the case of potatoes. Because of this we have used components of tomato cuticle and potato starch to make films with interesting characteristics of resistance and biodegradability that could have potential use in the industry.

2. Extraction Methodology

1. Tomato peeling



2. Enzyme hydrolysis reaction

3. Solvent extraction and dry process

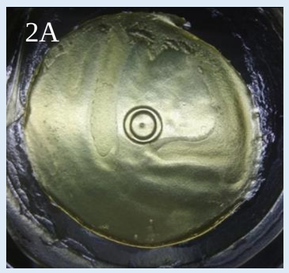
4. Final dried product

3. Film preparation

Films were prepared in several proportions of glycerol, starch and cuticle extract in an aqueous solution and heated above 85°C to ensure starch and cuticle solubilization. The solution was heated at 40°C during 3 days allowing water evaporation to produce a solid-film. Starch and cuticle components alone cannot produce a solid plastic film so glycerol was added to produce plasticity on it.

Figures 2A and 2B show images of good solid-plastic films composed of 5%w/v starch, 0.6%w/v cuticle and 3%v/v glycerol.

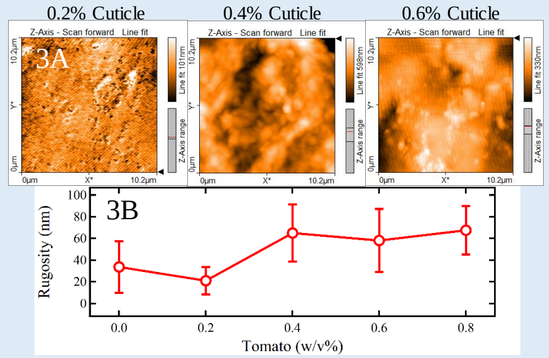
Increasing the cuticle composition above 1%w/v decreases the plasticity of the film and a higher glycerol amount does not produce a more flexible film but makes it a gel-like fluid.



3.Atomic Force Microscope (AFM)

Increasing the cuticle component produces a less homogeneous surface film as it can be observed with AFM images (Figure 3A, 10 x 10 μm) .

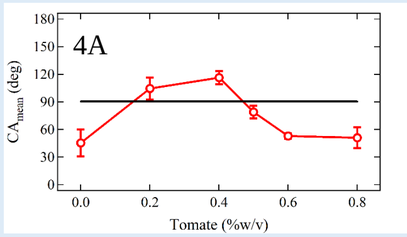
Since tomato cuticle is not entirely soluble in water at room temperature, when the water evaporates aggregates could be expected in the film, which can be observed as an increase in its rugosity from around 30 to 70 nm (see Figure 3B).

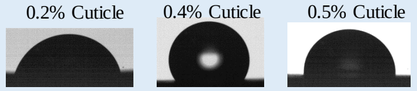


4. Contact Angle Analysis

Wettability is an important characteristic in plastics. Plastics normally have lower surface free energies and have either no polar fraction at all, or only a small one, this often results in poor wetting by aqueous system.

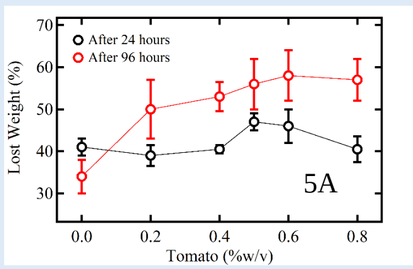
Our films show a higher contact angle (lower wettability) in the intermediate region of tomato cuticle extract concentration. This change in the contact angle is important since films in this region have higher plasticity and can be deformed without losing shape after deformation.





5. Solubility in water

Figure 5A shows how the material behaves after being immerse in an aqueous solution after 24 and 96 hours. After these periods of time , the films were heated at 30°C until all water was evaporated, then we measured t heir mass. There is not a considerable change in mass after 24 hrs of solubilization but there is a clear higher amount of mass lost after 96 hrs that also correlates with an increase in the tomato cuticle proportion in the film.



Conclusions

Films composed of starch, glycerol and a tomato cuticle extract were produced showing different characteristics depending on the tomato cuticle amount. A good plasticity of the films was observed with the best of them containing 0.4 %w/v cuticle tomato concentration. In addition, films could resist water solubilization for more than 24 hrs

References. [1] Selective Enzyme-Mediated Extraction of Capsaicinoids and Carotenoids from Chili Guajillo Puya (Capsicumannuum L.) Using Ethanol as Solvent, Santamaría et al J. Agric. Food Chem. 2000, 48, 7, 3063-3067

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