CANDELILLA WAX NANO-EMULSION COATING WITH PHYTOMOLECULES OF TARBUSH IMPROVES THE SHELF LIFE AND QUALITY OF APPLES

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Nowadays, nanotechnology has quickly emerged as one of the most promising and attractive research fields in food industry. Nanoemulsions and nanoparticles may contribute to barrier properties and functionality of coatings for fruit preservation since these systems show an increased surface área (1). The properties of edible coatings may be improved by including additives such as antioxidants, antimicrobials, colorants, flavors, fortifying nutrients and spices in film formulation (2). There is currently consumers demand less use of chemicals on fruits and vegetables, more attention has been paid to search for naturally occurring substances able to act as alternative antimicrobials and antioxidants (3). *Flourensia cernua* (tarbush) is a plant traditionally used by the Mexican population for gastrointestinal disorders (4). It has been reported that components of tarbush extracts have antioxidant, anti-HIV, antimicrobial, antitumour and antidiabetic properties (5). Tannins are secondary metabolites present in these plants. Some of the principal components of these substances are the ellagic and gallic acids. Several medicinal and industrial applications have been found for these acids such as antitumoral, antioxidant, antimicrobial, antiviral and anti-inflammatory (6). In the present work was evaluated the effect of addition of phytomolecules of aqueous extract of tarbush in candelilla wax nano-emulsion coating for increasing of shelf life and quality of apples. Nano-emulsion coatings were prepared in two formulations named as follows: NECP, nano-emulsion coating with phytomolecules and NEC, nano-emulsion coating without phytomolecules. Particle size, number of particles, polydispersion index (PDI) and zeta potential were determined. The apples were dipped in the edible coatings nano for 10 s and then dried using a fan at room temperature (25±1ºC). Control treatments were apples without nano-emulsion coating. Changes in appearance, weight loss, water activity, pH, lightness, solid contents, water vapor resistance (WVR), topographical characterization by white light optical interferometry (WLOI), antifungal activity and firmness were monitored during 8 weeks at temperature of 5±1ºC and 90% HR and 2 weeks in marketing conditions at temperature room (27±1ºC). Candelilla wax nano-emulsion coatings were able to reduce the change in appearance, weight loss, water vapor permeability and maintain the solids content, pH, firmness and water activity of apples in addition of increasing the protection against fungi and yeasts. Phytomolecules of tarbush incorporated into the nano-emulsion coating appear to be a promising preservation alternative and effective method improve the quality and shelf life of apples. In the present work we found that using this new protection system is one effective barrier against the negative effects of fungi on fruits of postharvest.

References

1. Zambrano-Zaragoza, M.L., Mercado-Silva, E., Ramirez-Zamorano, P., Cornejo-Villegas, M.A., Gutiérrez-Cortez, E., Quintanar-Guerrero, D. (2013). Use of solid lipid nanoparticles (SLNs) in edible coatings to increase guava (*Psidium guajava* L.) shelf-life. *Food Research International* 51: 946–953.
2. Pranoto, Y., Rakshit, S., & Salokhe, V. (2005). Enhancing antimicrobial activity of chitosan films by incorporating garlic oil, potassium sorbate and nisin. *LWTFood Science and Technology*, 38: 859–865.
3. De León-Zapata, M.A., Sáenz-Galindo, A., Rojas-Molina, R., Rodríguez-Herrera, R., Jasso-Cantú, D., Aguilar, C.N. (2015). Edible candelilla wax coating with fermented extract of tarbush improves the shelf life and quality of apples. *Food Packaging and Shelf Life*, 3: 70-75.
4. Zavala, D., Carrillo M.L., Alvarado, B., Sánchez, A.O. 2010. Evaluación de la toxicidad aguda de un extracto alcohólico de hojas de hojasén (*Flourensia cernua*). *Revista Mexicana de Ciencias Farmacéuticas,* 41(3), pp. 50-54.
5. López A., López S.R., Vázquez M.E., Rodríguez S.A., Mendoza M., Padrón E. 2005. Inhibición del crecimiento micelial de *Fusarium oxysporum* Schlechtend. f. sp. *Lycopersici* (Sacc.) Snyder y Hansen, *Rhizoctonia solani* Kühn y *Verticillium dahliae* Kleb. Mediante extractos vegetales acuosos. *Revista Mexicana de Fitopatología,* 23(2):183-190.
6. Ventura, J., Belmares, R., Aguilera-Carbo, A., Gutiérrez-Sánchez, G., Rodríguez-Herrera, R. 2008. Fungal biodegradation of tannins from creosote bush (*Larrea tridentata*) and tar bush (*Fluorensia cernua*) for gallic and ellagic acid production. *Food Technol.Biotechnol*. 46, 211–215.