Evaluation of bioactive coatings in post-harvest physical and mechanical properties of cherries

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In the Beira Interior region, cherry production is one of the most representative crops, revealing a high economic value for the region. The cherry, being a seasonal fruit, has great temporal demand, not only due to its nutritional properties but also highly appreciated for its flavor and texture. However, it is a very perishable fruit, and immediately after harvesting, it must be kept at low temperatures and high relative humidity. In an attempt to avoid this degradation, in recent years, there has been the development of edible coatings/films with bioactive properties to extend the shelf life of foods, namely perishable fruits.[1] On other hand, the increasing concern about pollution and food waste leads to the development of alternatives for this problem. Edible coatings based on biopolymers, such as chitosan, correspond to a perfect profile to solve part of this problem, as they are abundant in nature, are biodegradable, non-toxic, and have good physical and mechanical protection characteristics.[2] Additionally, to contribute to the bioactive properties of coatings, as an antioxidant and antimicrobial, plant extracts such as essential oils have been used as a functional additive.[3]

The objective of this work was to develop and characterize formulations of edible coatings with the incorporation of *Lavandula stoechas subsp. luisieri* essential oil, and its application in cherries, evaluating some physical and mechanical properties during the storage time at two different temperatures. Four formulations were made based on chitosan and other textural ingredients (Figure 1). Formulation FA was composed of chitosan 1.5% (w/w), 0.2% (w/w) glycerol, and 0.5% (w/w) tween 20; FB was composed of 1.5% (w/w) chitosan, 0.2% (w/w) glycerol, 0.5% (w/w) tween 20, and 0.5% (w/w) *L. stoechas* subsp. *luisieri* essential oil; FC was composed of 1.5% (w/w) chitosan, 0.2% (w/w) glycerol, 0.5% (w/w) tween 20, and 4% (w/w) beeswax; FD was composed of 1.5% (w/w) chitosan, 0.2% (w/w) glycerol, 0.5% (w/w) tween 20, 4% (w/w) beeswax, and 0.5% (w/w) *L. stoechas* subsp. *luisieri* essential oil. The water vapor barrier, solubility, thickness, color, surface tension, and elasticity were evaluated in these four formulations. Based on previous properties, we selected two formulations to apply to cherries. After immersion in the formulation solutions, the cherries were placed at room (22°C) and refrigeration (6°C) temperatures, with controlled relative humidity (90%). Weight loss (g), soluble solids content (°Brix), and firmness (N) of each treatment (Control, FA, and FB) were measured at day 0 (fresh fruits, T0), after 4 days (T1), and after 12 days (T2).

The results obtained for the films of formulations indicated that the coatings based on chitosan, FA and FB, showed better color (L*25.09 to 26, a*-1.52 to -0.94, b* 4.47 to 4.63) characteristics, thickness (0.2 to 0.1 mm), surface tension (15 to 48 MPa), elasticity (46 to 57), and water vapor barrier (5.67 E^{-7} to 9.46 E^{-7} g m^{-1} s^{-1} Pa^{-1}). As expected, in coated cherries it was found that the temperature significantly influences the textural properties of the fruit, being the refrigeration temperature the one that preserved the conservation conditions. The coated cherries with FA and FB, at both temperatures, showed better results in weight loss and firmness results, compared to the control (without coating).

Key Words: Cherry, Chitosan, Fruits conservation, Essential oil, *Lavandula stoechas* subsp. *luisieri.*

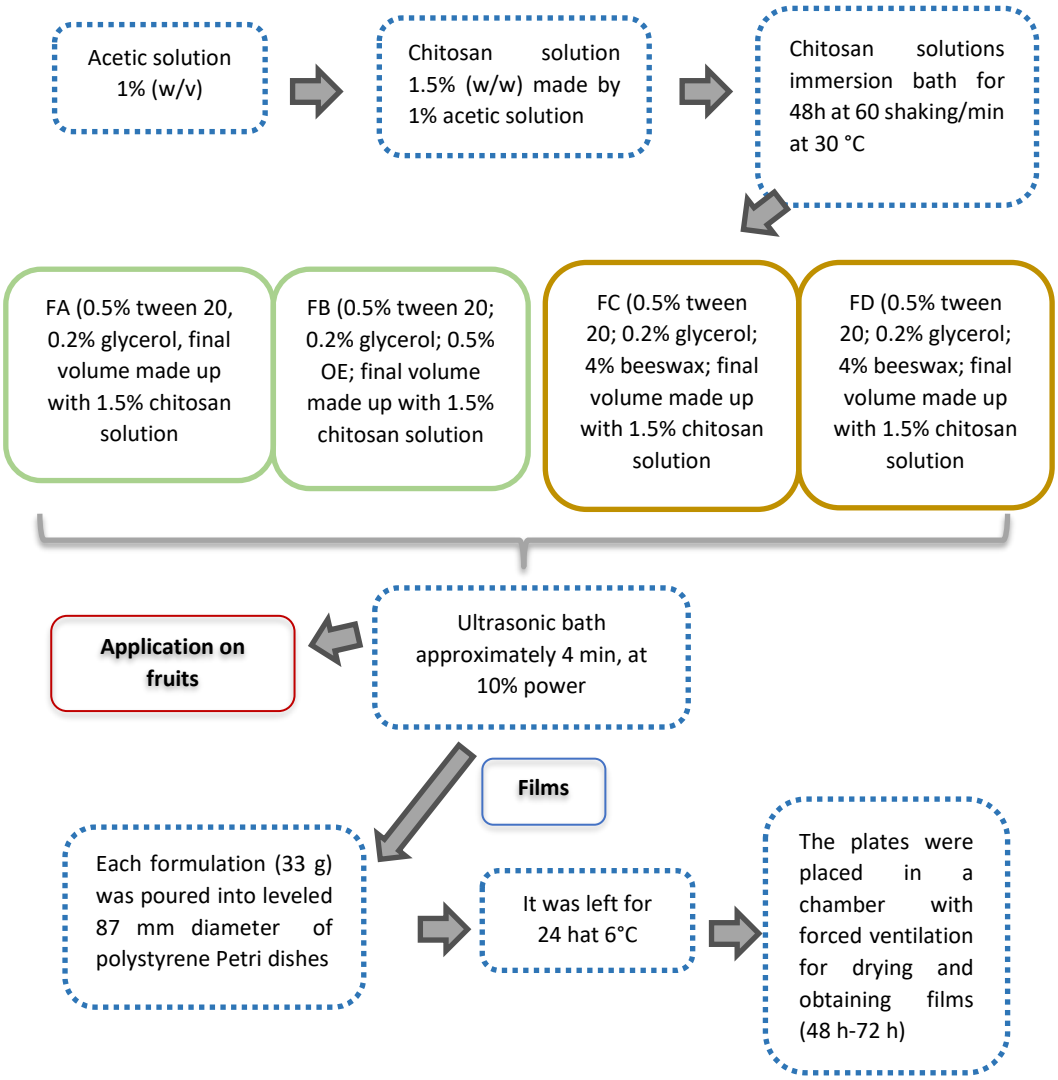

Figure 1: Experimental scheme for the preparation of formulations FA, FB, FC, and FD, and the respective films.

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References:

1. Chen, W., Ma, S., Wang, Q., McClements, D. J., Liu, X., Ngai, T., & Liu, F. (2021). Critical Reviews in Food Science and Nutrition, 1-27.
2. Shiekh, R. A., Malik, M. A., Al-Thabaiti, S. A., & Shiekh, M. A. (2013). Food Science and Technology Research, 19(2), 139-155.
3. Yuan, G., Chen, X., & Li, D. (2016). Food Research International, 89, 117-128.