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Effect of chitosan-based coatings with bioactive compounds from tangerines agricultural waste on cherries shelf life

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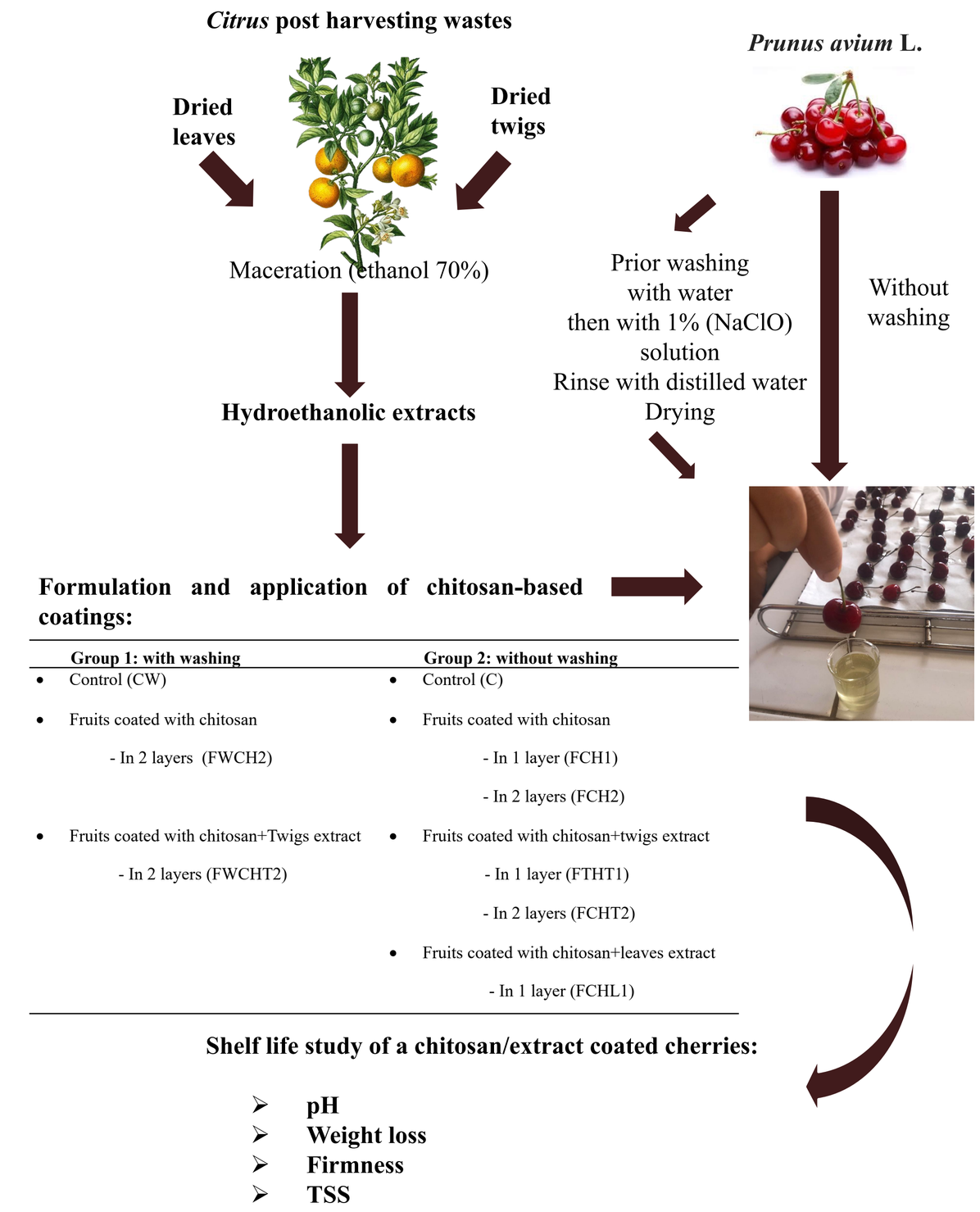
INTRODUCTION & AIM

Agricultural or crop waste is generated throughout the plant life cycle, from planting to production. This waste comes mainly from pruning operations, post-harvest residues, and post-packaging residues. In the case of citrus fruits, this includes stems and leaves. Given the large quantities produced each year (40 gigatons of biomass), and in the context of a circular and sustainable economy, this waste should be exploited. This undervalued biomass constitutes an important source of bioactive compounds with antioxidant and antimicrobial properties. These natural biocompounds can thus be incorporated into edible coating formulations designed to extend the shelf life of perishable fruits. This is the case with cherries, *Prunus avium* L. (Rosaceae family), which are non-climacteric fruits with a relatively short post-harvest shelf-life due to their high respiratory activity, susceptibility to fungal decay, and rapid aging. Several methods have been implemented to delay the deterioration of cherry quality. Edible coatings are an alternative means of maintaining post-harvest quality, and for greater effectiveness, coatings enriched with bioactive compounds are being increasingly studied.

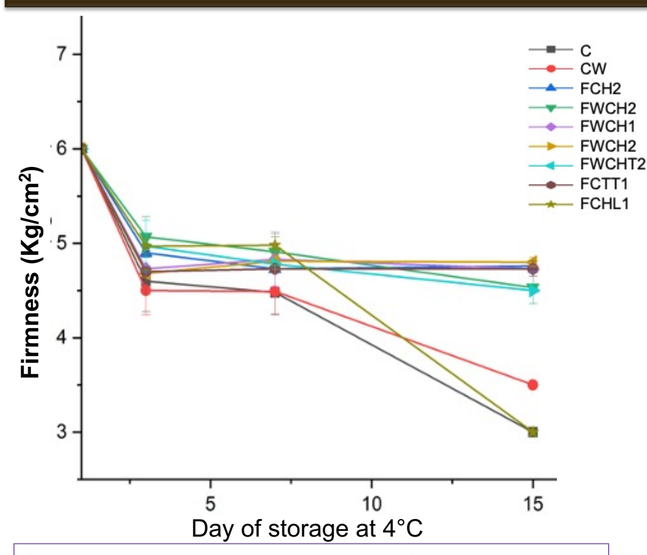
Otherwise, chitosan is one of the most promising biopolymers due to its antimicrobial activity and biocompatibility. Chitosan-based film properties can be enhanced by the association with bioactive compounds.

Therefore, to contribute to the valorization of agricultural waste, the development of sustainable solutions for plant wastes management, the transition to a circular economy and the extension of fruits shelf life, this study focused on the evaluation of bioactive compounds from Citrus agricultural waste, specifically leaves and stems, as bioconservatives. The extracted bioactive compounds were incorporated in the formulation of chitosan-based edible coatings and then tested on cherry preservation with or without prior fruit washing, and in single- or double-layer form.

METHOD

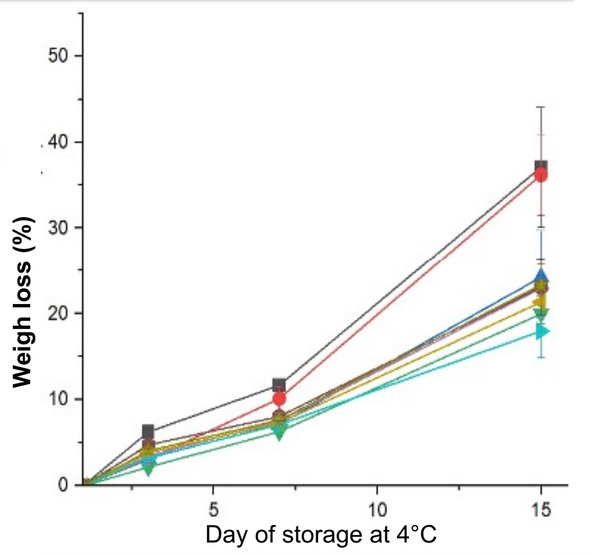


RESULTS & DISCUSSION



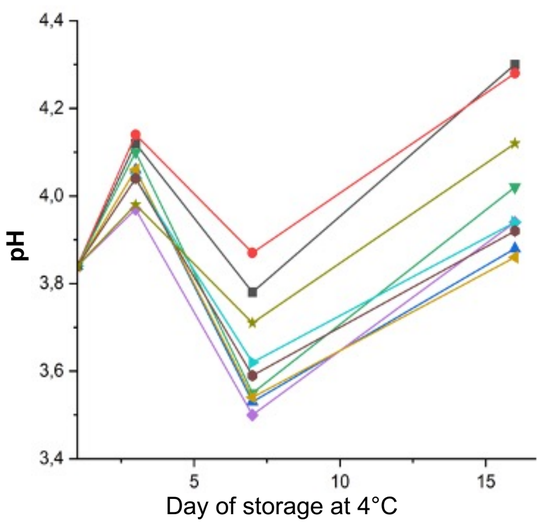
Firmness was more preserved with coating solutions except chitosan coating+leaf extracts (FECF1)

Ability to reduce respiration rates, cell wall-degrading enzymatic activity, metabolic activity and fruit ripening



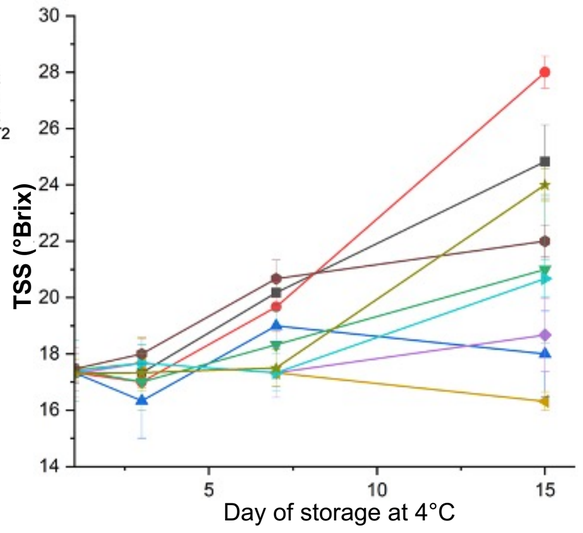
Coated fruits : a loss of mass less than 25%

Physical barrier



pH

The use of organic acids in the respiration process during storage



TSS

Polysaccharide hydrolysis

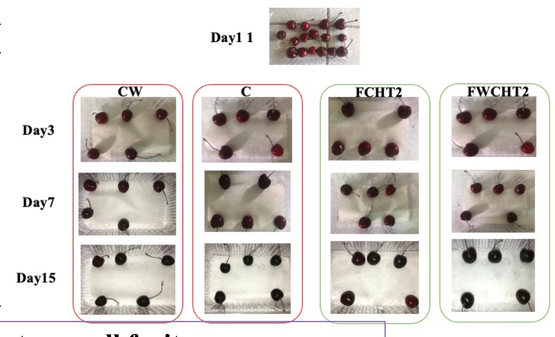
Increase in DM content

Figure 1: Variation in quality parameters of uncoated and coated cherries during storage: loss of mass, firmness, pH, and TSS

Table 1: Average color parameter values for cherries coated with different coating formulations on the 15th day of storage

Traitement	L*	a*	b*
C	28,92 ± 0,75[a]	7,62 ± 1,64[a]	1,03 ± 0,20[a]
CW	29,24 ± 0,54[a]	10,11 ± 1,60[a]	1,31 ± 0,41[ab]
FCH2	30,1 ± 1,17[a]	11,46 ± 3,69[a]	1,11 ± 0,54[ab]
FWCH2	30,25 ± 1,32[a]	12,63 ± 5,47[a]	1,9 ± 1,61[ab]
FCH1	29,64 ± 1,20[a]	10,24 ± 2,35[a]	1,07 ± 0,65[a]
FCHT2	30,36 ± 0,50[a]	12,09 ± 4,51[a]	1,36 ± 0,85[ab]
FWCHT2	31,77 ± 3,28[a]	13,45 ± 4,62[a]	3,1 ± 1,86[b]
FCHT1	30,61 ± 0,79[a]	9,05 ± 1,47[a]	1,41 ± 0,80[ab]
FCHL1	29,28 ± 2,40[a]	8,6 ± 1,86[a]	0,94 ± 0,25[a]

Figure 2: examples of color variation of cherries coated or not with different coating formulations on 15th day of storage



- **No significant difference between all fruits**
- **The red color of cherries was not preserved**

CONCLUSION

Results on the effect of incorporating extracts into the chitosan-based film showed a positive impact on fruit quality during storage at 4°C. The coatings reduced mass loss and total soluble solids; while maintaining a pH around 4.

Chitosan enriched with stem extract will be particularly favored in coating formulations.

The encouraging results of this study pave the way for numerous research perspectives to further valorize agricultural waste and improve the performance of edible coatings.