EDIBLE COATINGS WITH POLYSACCHARIDES AND BIOACTIVE COMPOUNDS FROM EXHAUSTED OLIVE OIL POMACE TO EXTEND THE SHELF LIFE OF STRAWBERRY

V. Martins*, A. Lopes, M. Pintado, R.M.S.C. Morais, A.M.M.B. Morais

Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina — Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho, 1327, 4169-005 Porto, Portugal.
*s-vfrmartins@ucp.pt

Introduction

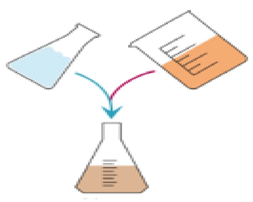
Exhausted or delipidified olive oil pomace (EOP) is a by-product generated from the olive pomace after air drying and hexane extraction of residual oil [1]. This by-product is rich in phenolic compounds, such as hydroxytyrosol, tyrosol and catechol, with associated properties: antioxidant, antimicrobial, anti-inflammatory, anti-diabetic, anti-carcinogenic and anti-HIV [1, 2].
Coatings and films are materials used for example to increase the shelf life of perishable fruits and vegetables. They can be made of polysaccharides, lipids and proteins from natural sources. It is essential to include bioactive compounds in the formulation to achieve bioactive properties, such as antimicrobial and antioxidant activities [3].
In this work a coating was performed using alginate and an extract rich in phenolics from EOP to increase the shelf life of strawberry (*Fragaria ananassa).*

Objectives

- To develop an edible coating using alginate and an extract rich in phenolics from EOP.
- To apply the coating to a perishable fruit, such as strawberry.
- To determine the moisture loss of the coated strawberry.
- To observe the natural decay of strawberry.
- To determine the growing curves of mesophilic aerobic bacteria, psychrophilic bacteria, *Enterobacteriaceae*, yeasts and molds in the coated strawberry.

Methods

The edible coating formulation was 2 % alginate and 5 % EOP extract.
The EOP extract was obtained by solvent extraction (hydroethanol 90 %, 50 ˚ C) assisted by ultrasounds [1]. The coated strawberry and the control were maintained in the freezer at 10 ˚C for 10 days.



Casting method

Deeping method

Decay observation was registered photographically at any sign of decay, lesion, and mycelia development on the fruit surface.

Moisture loss was determined using the formula:

Weight loss = ((initial weight (day 0) – current weight (day D))/initial weight (day 0)) x100

Microbiology assay the enumeration and differentiation of microorganisms were performed by using different culture media and culture conditions [4, 5]:

- Mesophilic aerobic bacteria on Plate Count Agar (PCA) incubated at 30–32 ˚C for 48–72 h;
- Psychrophilic bacteria on Plate Count Agar (PCA) incubated at 5–7 ˚C for 5–7 days;
- *Enterobacteriaceae* and total coliforms in Mac Conkey agar incubated at 30–32 ˚C for 24 h;
- Yeasts and molds in potato dextrose agar (PDA) at 25 ˚C for 5 days.

Results

✓ Its is possible to see the natural decay of the strawberry in figure 1.

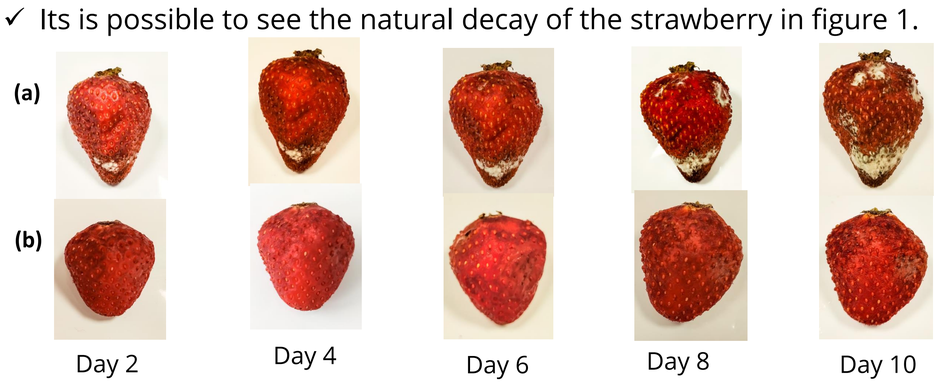


Figure 1 – Decay of uncoated strawberries (a) and coated strawberries (b) during storage at 10 ˚ C.

✓ The weight loss is an important characteristic to preserve the fruit quality. In figure 2 is possible see the effect of the application of the coating on this parameter.

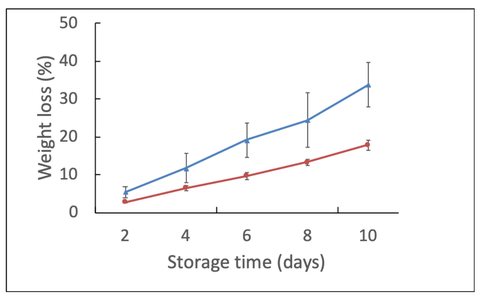


Figure 2 – Weight loss of strawberry during storage at 10 ˚ C (control in blue; coating in orange).

➢ The coating protects the strawberries from moisture loss, with significant differences from the 4th day.
➢ The weight loss is around 16 % lower in coated strawberry after 10 days.

✓ Figures 3, 4 and 5 represent the proliferation of pathogenic microflora responsible for fruit deterioration during storage at 10 ˚ C.

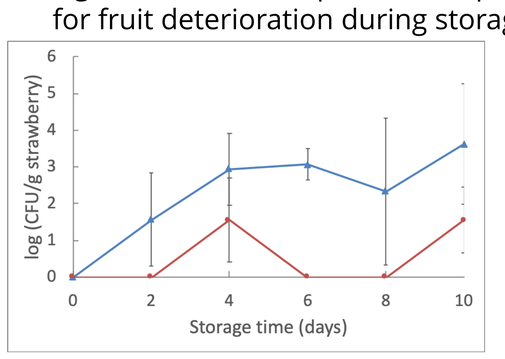


Figure 3 – Proliferation of mesophilic aerobic bacteria during storage (control in blue; coating in orange).

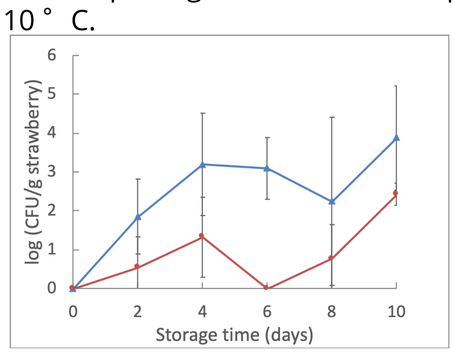


Figure 4 - Proliferation of psychrophilic bacteria during storage (control in blue; coating in orange).

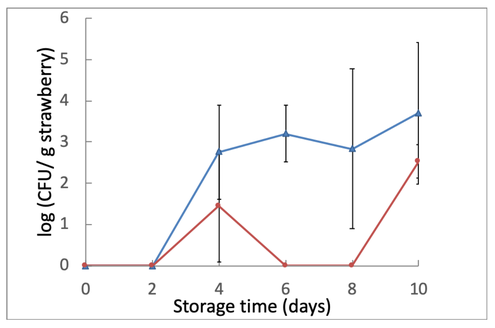


Figure 5 - Proliferation of yeast and molds during storage (control in blue; coating in orange).

➢ The coating positively affects the microorganism growth inhibition with significant differences from day 4 for mesophilic aerobic bacteria, day 8 for psychrophilic bacteria, and day 10 for yeasts and molds.
➢ The *Enterobacteriaceae* and total coliforms did not grow in any condition, coated and uncoated strawberry.

Conclusions

- The formulation 2 % alginate + 5 % EOP extract can be successfully used as an edible coating.
- The application of the coating on strawberry are effective to prevent moisture loss, maintaining the quality of the fruits.
- It prevents the proliferation of several bacteria, such as psychrophilic bacteria, mesophilic aerobic bacteria, yeasts and molds.

Acknowledgements

This work was supported by National Funds from FCT - Fundação para a Ciência e a Tecnologia through Project UIDB/50016/2020. Valter Martins thanks FCT for the PhD research grant, reference UI/BD/152825/2022. All authors acknowledge Casa Alta – Sociedade Transformadora de Bagaços for the gentle supply of the vegetable material.

References

[1] V.F.R. Martins; T.B. Ribeiro; A.I. Lopes; M.E. Pintado; R.M.S.C. Morais, A.M.M.B. Morais. Molecules, 29(9) (2024) 1935.
[2] P. Xie, L. Huang, C. Zhang, Y. Deng, X. Wang, J. Cheng, Food Chemistry, 276 (2019) 662–67.
[3] V.F.R. Martins; M.E. Pintado; R.M.S.C. Morais; A.M.M.B. Morais, Foods, 13, (2024) 318.
[4] M.R. Moreira; S.I. Roura; A. Ponce, Food Science and Technology, 44 (2011) 2335-2341.
[5] M.Z. Trevino-Garza; S. Garcia; M.S. Flores-Gonzalez; K. Arévalo-Nino, Journal of Food Science, 80 (8), 2015, M1823 – M1830.

Bragança, Portugal
24th and 25th July 2024