

Antifungal and antioxidant efficacy of *Aloe vera* and its potential incorporation in chitosan-based coatings for blueberries preservation

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Common problems related with food such as foodborne outbreaks, precocious decaying and economic losses related with fresh food retention have led to the development of novel edible coatings based on natural compounds such as chitosan. This biopolymer possesses several valuable characteristics: high antimicrobial activity, biocompatibility, biodegradability and non-toxic profile.

The innovative character of this project is based on the potential incorporation of bioactive ingredients, *Aloe Vera* gel and juice, in chitosan coating solutions. The synergies so obtained between these two components may be useful to avoid a chain of changes at biochemical and nutritional levels that could lead to food spoilage.

The increasing rate of blueberries consumption allied to the excellent harvesting conditions that Portugal can offer, have created a remarkable opportunity to increase the production competitiveness of this product while offering a product with high added value that can better resist to the challenges of fruit processing, transport and refrigeration. Thus, this novel approach could be further applied on blueberries, often affected by problems such as fungal infections and losses of water and nutritional properties, in order to extend their shelf life.

The objectives of this work were 1) to choose the best chitosan-based formulation to be applied on blueberries and 2) to evaluate the antimicrobial and antioxidant activities *in vitro* of different concentrations of *Aloe vera* fractions (i.e. gel and juice). The best composition of the chitosan-based coating solution in terms of the improved adhesion of the edible coating on blueberries surface was 0.5% Chitosan, 0.5% Glycerol (plasticizer) and 0.1% Tween 80 (surfactant).

The total phenolic content (TPC) was determined using a colorimetric assay [1]. To complete the evaluation of the antioxidant activity of the *Aloe vera* gel and juice fractions (0.1 %, 0.5%, 1%, 5% and 10%), DPPH radical scavenging activity was evaluated [3]. It was noticed that both the juice and gel offer considerable antioxidant potential. For values of concentration of 0.1% of gel and juice, the values of radical scavenging activity were 71% and 84%, respectively.

Antifungal activity was evaluated following the procedure reported by Konan et al. [2]. 0.5%, 5%, 20% and 100% of each *Aloe vera* fractions were tested against 3 fungal species typically present in blueberries: *Botrytis cinerea*, *Penicillium expansum* and *Aspergillus niger*. The results obtained for *Botrytis cinerea*, the main fungus causing blueberry deterioration, showed a percentage of inhibition above 90%, for 5% of gel and juice concentrations, after 72 h of growth; on the other hand, 5% *Aloe vera* gel and juice fractions inhibited 50% of *P. expansum* and *A. niger* after 72 h of growth.

These results suggest that *Aloe vera* gel and juice fractions may have high potential to be incorporated in chitosan coatings and could successfully improve shelf life stability and retard early-stage deterioration of blueberries.

The next step in this research will be to evaluate physicochemical changes (e.g. water loss) during shelf life of blueberry with or without chitosan-based coating.

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References:

- [1] N.G.T. Meneses, S. Martins, J. A. Teixeira, S. I. Mussatto, "Influence of extraction solvents on the recovery of antioxidant phenolic compounds from brewer's spent grains", Separation and Purification Technology, 2013, vol.108, pp. 152-158.
- [2] K. Konan, N. J. David, M. Souleymane, Y. Ahoua, Y. H. Félix, D. A. Joseph, "In Vitro Antioxidant Activity and Phenolic Contents of the Leaves of *Oxalis subscorpioidea* and *Distemonanthus benthamianus*", Research Journal of Pharmaceutical, Biological and Chemical Sciences, 2013, vol.4, pp. 1419-1429.
- [3] W. B. Williams, M. Cuvelier, C. Berset, "Use of a free radical method to evaluate antioxidant activity," Lebensm-Wiss Technol, 1995, vol. 28, pp. 25-30.