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Apple Puree Pasteurization by Pulsed Electric Fields: From Microbial Safety to Financial Viability Assessment



Enrique Pino-Hernández , Paula Valério, Sara Dias, Marta B. Evangelista,
and Marco Alves

Abstract Food industries have been developing more sustainable preservation processes that maintain the nutritional value of foods and meet consumers' demands by providing safe and healthy products with a long shelf-life. Thus, it was necessary to study and take on challenges throughout the production process. The goal of this work was to evaluate the effect of pulsed electric fields (PEF) on the apple puree quality and to present a model that supports investment decisions taken by Portuguese agri-food companies on using PEF equipment to pasteurize the fruit product. PEF treatment ($E = 10$ kV/cm and $q = 644$ kJ/kg) was applied to apple puree at a laboratory scale. The processing conditions established resulted in 5-log CFU/g reduction of *Escherichia coli*. Puree PEF-treated and stored at 4 °C for 30 days was compared to puree without treatment regarding aerobic bacteria and yeast and mold. Moreover, financial viability assessment was developed using *Banco de Portugal* data (year 2021) for the classification of economic activities, namely 10320. The results of the technical and financial analysis indicate PEF pasteurization is suitable for upgrading pasteurization process. The investment required on PEF equipment for upgrading pasteurization process under study showed an internal rate of return of 21.54% and a payback of 4 years. In what concerns the final product, PEF treatment ensures the microbial stability of puree for at least 30 days. In conclusion, this study established the PEF conditions for puree non-thermal pasteurization and also showed a suitable model to support a decision investment on PEF technology.

Keywords Decision investment · Non-thermal pasteurization · Reineta Apple

These authors (Enrique Pino-Hernández and Paula Valério) contributed equally to this study and share first authorship.

E. Pino-Hernández · S. Dias · M. B. Evangelista · M. Alves (✉)

INOVLINIA, Agri-Food Technology Transfer and Valorization Center, TagusValley Science and Technology Park, 2200-062 Abrantes, Portugal

e-mail: marco_alves@tagusvalley.pt

P. Valério

INOV.POINT, Business Hosting and Entrepreneurship, TagusValley Science and Technology Park, 2200-062 Abrantes, Portugal

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Effect of High-Pressure Processing Combined with Propolis Extract on the Quality and Microbiological Safety of Apple Puree



Diogo A. Gonçalves, Enrique Pino-Hernández, Jorge A. Saraiva,
Carlos A. Pinto, Marta B. Evangelista, and Marco Alves

Abstract The aim of this study was to evaluate the influence of high-pressure processing (HPP) combined with natural extract on physical–chemical (Total soluble solids (TSS), moisture, pH, water activity (a_w), color parameters) and microbiological characteristics (Total mesophilic aerobic microorganisms count at 30 °C, molds and yeast count at 37 °C) of apple puree, during 90 days under refrigerated conditions. Three processes were applied: HPP (600 MPa, 3 min) with and without the addition of propolis extract (2.5% w/w); and conventional pasteurization (75 °C, 10 min), as a reference method in the industry. The results showed that immediately after the application of the three processes, the load of aerobic microorganisms decreased from 3.40 to < 1 Log CFU/g. At the end of the shelf-life study, in all treatments, the count of aerobic microorganisms and of molds and yeasts was less than 2 and 1 Log CFU/g, respectively. Likewise, in the evaluation of TSS, moisture and a_w no significant differences were found between processes. In the color analysis, HPP increased the stability over the shelf-life but promoted a higher initial change. The addition of extract enhanced color and pH stability, being the only treatment in which the product's color did not change significantly during shelf-life. In conclusion, HPP is a good alternative to conventional pasteurization in the production of apple puree. The addition of propolis enhances the quality of puree while providing differentiation to the product.

Keywords High hydrostatic pressure · Propolis extract · Development of food products · Food safety

D. A. Gonçalves · E. Pino-Hernández · M. B. Evangelista · M. Alves (✉)
INOVLINIA - Agri-Food Technology Transfer and Valorization Center,
TAGUSVALLEY—Science and Technology Park, 2200-062 Abrantes, Portugal
e-mail: marco_alves@tagusvalley.pt

J. A. Saraiva · C. A. Pinto
Chemistry Department, LAQV-REQUIMTE, University of Aveiro, Campus Universitário de
Santiago, 3810-193 Aveiro, Portugal
e-mail: jorgesaraiva@ua.pt