

Food and Beverages

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Use of short-wave ultraviolet light (UV-C) under a hurdle approach to preserve turbid juices

Statement of the Problem: Consumers' demand for a preservation technology that retains fresh-like quality has resulted in a growing interest for non-thermal processing methods. Among them, UV-C light proved to reduce microbial contamination in various liquid foods. However, its efficacy in turbid systems is limited because suspended matter often contains absorbing molecules that can harbor microbial cells. To overcome this limitation, a hurdle approach should be addressed.

Objective: The objective was to obtain a carrot-orange juice blend (1:1 ratio (v/v)/pHadj:5.0/10.6 °Brix/absorptivity:0.32cm-1/7667 NTU particle size=D[3,2]:5.1±0.1 µm/D[4,3]:60.81±8.68 µm) processed by UV-C assisted by mild heat (H) and the addition of a natural antimicrobial extract with high Polyphenols Content (PC).

Methodology: For microbial challenge tests, the inoculated juice (*Escherichia coli* ATCC 35218, *Saccharomyces cerevisiae* KE162 or *Pseudomonas fluorescens* ATCC 49838) was recirculated in an annular UV-C reactor (254 nm; 1.6 L/min; 15 min; 10.6 kJ/m²; 50°C). For the antimicrobial extract (YME), yerba mate (*Ilex paraguariensis*) leaves were sonicated (20 kHz; 95.2 µm; ethanol; 25°C) freeze-dried and subsequently added to the juice (0.4% w/v). Native flora; sensory analysis; PC and total antioxidant activity (TAA) (Folin-Ciocalteu and DPPH methods) were also studied during juice storage (5°C).

Findings: UV/H provoked 3.5-6.0 log-reductions of inoculated flora, while 0.6-2.9 log-reductions were achieved by single UV-C and H treatments. Native flora was reduced by 5 log-cycles without any recovery during 20 days (5°C). Conversely, single treatments less reduced the native population. YME addition to the juice considerably increased PC (720±45 µg GAEq/mL) and TAA (5.5±1.0 µg Trolox eq/mL) compared to the non-additivated juice (PC=302±40 µg GAEq/mL; TAA=1.6±1.3 µg Trolox eq/mL), values which remained constant during 50 day storage (5°C). The additivated UV/H treated juice was described by consumers with optimal acidity, aroma, viscosity and sour flavor.

Conclusion & Significance: A method involving UV-C light and mild heat for the preservation of a turbid juice was found. Furthermore, YME addition increased juice antimicrobial capacity and bioactive compounds content.



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Recent Publications

1. García Carrillo M, Ferrario M and Guerrero S (2017) Study of the inactivation of some microorganisms in turbid carrot-orange juice blend processed by ultraviolet light assisted by mild heat treatment. *Journal of Food Engineering* 212:213-225.
2. Pagliosa C M, Vieira M A, Podestá R, Maraschin M, Zeni E R and Amboni R (2010) Methylxanthines, phenolic composition, and antioxidant activity of bark from residues from mate tree harvesting (*Ilex paraguariensis* A. St.Hil.). *Food Chemistry*, 122:173-178.
3. Gayán E, Serrano M J, Raso J, Álvarez I and Condón S (2016) Inactivation of *Salmonella enterica* by UV-C light alone and in combination with mild temperatures. *Applied and Environmental Microbiology*, 78:8353-8361.
4. Gouma M, Gayán E, Raso J, Condón S and Álvarez I (2015) Inactivation of spoilage yeasts in apple juice by UV-C light and in combination with mild heat. *Innovative Food Science and Emerging Technologies*, 32:146-155.
5. Martin J, Porto E, de Alencar S M, da Glória E M, Corrêa, C B and Cabral I S R (2013) Antimicrobial activity of yerba mate (*Ilex paraguariensis* St. Hil.) against food pathogens. *Revista Argentina de Microbiología*, 45(2):93-98.

Biography

Sandra Guerrero works as a Researcher and Professor at the Natural and Exact Science School, University of Buenos Aires and at the National Council of Scientific and Technical Research (CONICET) as Main Researcher in Buenos Aires, Argentina. In 2015, she received the Certified Food Scientist credential given by the International Food Science Certification Commission, USA. She is a coauthor of one book edited by FAO and translated to four languages devoted to the implementation in rural areas of hurdle strategies for tropical fruit preservation. During the last 25 years, her research activity has been focused on the use of emerging technologies for food preservation. She has published 50 papers in high impact peer-reviewed journals, 19 chapters in books and 170 presentations in scientific events. Her latest projects had to deal with the use of the non-thermal technologies under a hurdle approach to enhance food safety as well as organoleptic and nutritional quality.

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