Thermal and non-thermal *Cantaloupe* melon juice pasteurization: Assessment of the impact of ozone exposure on microbiological, physicochemical and bioactive characteristics

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Introduction

Cantaloupe melon is a commonly consumed fruit worldwide due to its nutritional and organoleptic properties, being extensively used as raw material in fruit juices industry. However, when fresh fruit juices are not subject to any decontamination treatment, they become more susceptible to microbial spoilers and pathogens, which may affect human health.

Thermal treatments are traditionally used in fruit juice processing. However, the biological activity of the most health-related compounds are intensely reduced. Alternatively, ozone-based processes have been exploited due to their potential for inactivating spoilage and pathogenic microorganisms, while being effective in products' overall quality retention.

Objectives

The aim of this study was to evaluate the impact of ozone and conventional pasteurization processes on Cantaloupe melon juice, assessing:

- microbiological decontamination - *Listeria innocua* (non-pathogenic surrogate of *L. monocytogenes*) and intrinsic microflora (total mesophylls and yeasts and molds)
- quality attributes - physicochemical (color, pH and soluble solids content) and bioactive compounds (total phenolics and vitamin C)

Methods

Sample

300 mL melon juice

Cucumis melo* L. var. *reticulatus

Ozone treatment

Gaseous ozone exposure for 10 min at 4 ° C at 7.7 g/L

Thermal pasteurization

72 ° C for 15 seconds

Microbiological analysis

Juice samples were artificially inoculated with ***L. innocua***

L. innocua suspension ➡ $N_0 \approx 10^5$ CFU/mL

300 mL melon juice

Intrinsic microflora

total mesophylls ➡ $N_0 \approx 10^5$ CFU/mL

yeasts and molds ➡ $N_0 \approx 10^4$ CFU/mL

Quality analysis

Physicochemical parameters

pH

pH meter
GL 22

SSC (°Brix)

Refractometer
Palette PR-32

Color

Colorimeter
Minolta CR-400

- L^* lightness value: 0 (black) to 100 (white)
- a^* measures red (+) and green (-)
- b^* measures yellow (+) and blue (-)
- $Total\ colour\ difference = TCD = \sqrt{(L_0^* - L^*)^2 + (a_0^* - a^*)^2 + (b_0^* - b^*)^2}$

Total phenolics & Vitamin C

Extraction with methanol

Total phenolics λ = 750 nm

Spectrophotometer, Model 5625, ATI Unicam

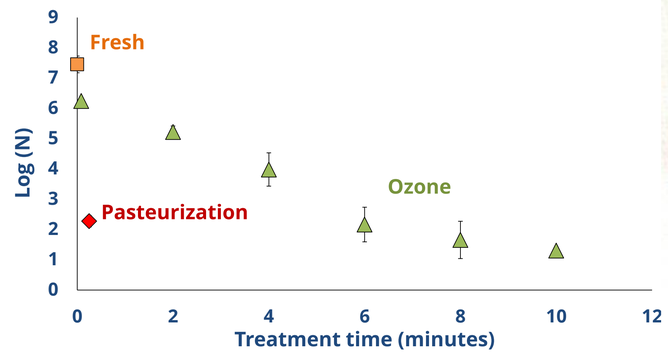
Vitamin C

HPLC Jasco

Data analysis **Three replicates were performed ; ANOVA + Post-hoc tests**

Results and Discussion

Decontamination



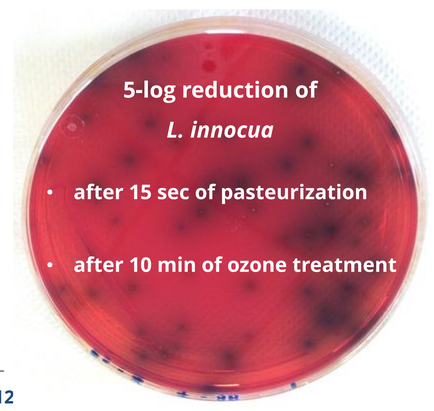


Figure 1. Inactivation of *L. innocua* in melon juice after ozone and pasteurization processing. Data represents mean values and bars the confidence intervals at 95%.

Table 1. Effect of thermal pasteurization and ozone treatment on juice microflora. The values are mean ± margin of confidence interval at 95%.

Intrinsic microflora	Juice		
	Fresh	Pasteurized	Ozonated
Total mesophylls (CFU/mL)	5.77 ±1.04^b	3.83 ± 1.01^a	5.60 ± 0.57^b
Yeasts and molds (CFU/mL)	4.33 ± 0.40^c	0.94 ± 0.19^a	3.43 ± 1.25^b

For a given microorganism group, values with different letters differ significantly ($p<0.05$).

Ozone treatment

- no impact on total mesophylls
- 1-log reduction of yeasts and molds

Quality

Table 2. Effect of thermal pasteurization and ozone treatment on juice quality attributes. The values are mean ± margin of confidence interval at 95%.

Quality attribute	Juice		
	Fresh	Pasteurized	Ozonated
Color (TCD)	-	2.35 ± 1.38	3.71 ± 2.93
pH	6.35 ± 0.13^a	6.53 ± 0.41^a	6.30 ± 0.23^a
SSC (° Brix)	10.65 ± 1.02^a	10.65 ± 1.02^a	10.65 ± 0.79^a
Total phenolics (μg/mL)	182.27 ± 24.81^a	173.81 ± 31.86^a	199.85 ± 48.79^a
Total vitamin C (mg/100mL)	23.84 ± 5.15^c	9.25 ± 2.27^a	16.11 ± 2.37^b

For a given attribute, values with different letters differ significantly ($p<0.05$).

When compared to pasteurization, **ozone** treatment allowed better **vitamin C** retention

Conclusions

- ✓ Ozone and thermal treatments did not affect soluble solids content, pH and total phenolics content, when compared to fresh juice samples.
- ✓ Distinct color differences were observed in juices after application of both treatments.
- ✓ Vitamin C was highly retained in ozone treated juices (68%), when compared to pasteurized ones (39%).
- ✓ Since ozone treatment was effective on *L. innocua* inactivation and allowed a retention of most of quality parameters analyzed, this technology can be considered as a promising alternative to traditional pasteurization of fruit juices.

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