The effect of abiotic stress pre-treatments on quality attributes of fresh-cut carrot cv. Nantes

Carla Alegria[a,c], Joaquina Pinheiro[a], Margarida Duthoit[a], Elsa M. Gonçalves[a], Maria Teresa Coelho[b], Margarida Moldão-Martins[c], Marta Abreu[a]

[a] *UITA/INRB, Lisbon, Portugal (marta.abreu@inrb.pt)*
[b] *Escola Superior Agrária de Castelo Branco, Castelo Branco, Portugal (mteresacoelho@ipcb.pt)*
[c] SCTA/DAIAT. ISA. Technical University of Lisbon, Lisbon, Portugal (mmoldao@isa.utl.pt)

INTRODUCTION

Abiotic stresses, such as heat shock and UV-C radiation, can be used to induce the synthesis of bioactive compounds and prevent decay in fresh-cut fruits and vegetables. Among the preservation techniques that are currently in use by the fresh-cut industry, e.g. antioxidants, chlorines and modified atmosphere packaging, the use of heat shock and ultraviolet-C treatments, alone or in different combinations have proved useful to control microbial growth while maintaining quality during storage of fresh-cut produce [1].
The aim of this study was to evaluate the effects of heat shock and UV-C radiation stress treatments, applied in whole carrots, on the overall quality of fresh-cut carrot cv. Nantes during storage (5 ºC).

MATERIALS & METHODS

Raw whole carrots (*Daucus carota* L. cv. Nantes) without treatment (Ctr_samples) and submitted to heat and UV pre-treatments (HS_ and UV_samples, respectively) were subsequently minimal processed. Minimal processing (MP) included peeling, shredding, decontamination process (chlorinated water, 200 ppm /1 min), rinsing, drying and packaging operations. Heat shock was performed by immersion of whole peeled carrots in hot-water at 100 ºC for 45 s and paper dried. UV-C pre-treatment were prepared in a UV-C apparatus and the whole peeled carrots were placed in a single layer for 2 min (0.78±0.36 $kJ.m^{-2}$). After HS and UV-C pre-treatments, the whole carrots were held at 5 ºC for 24h until minimal processing operations without the decontamination step. Analytical procedures were carried out in triplicate on five sampling dates, *i.e.* days 0, 3, 5, 7 and 10. Total mesophilic aerobic count (TAPC) [2], headspace gas (O_2/CO_2, %) analysis (Abissprint), total phenolic content [3], total carotenoid [4], peroxidase (POD) [5] were determined and colour whitening index (WI) was calculated by the expression: $WI = 100 - \sqrt{(100 - L^{*2}) + a^{*2} + b^{*2}}$. Statistically significant differences ($P<0.05$) between samples were determined according to LSD test (ANOVA).

RESULTS & DISCUSSION

Heat shock (HS, 100 ºC/45s) and UV (0.78±0.36 $kJ.m^{-2}$) samples had higher phenolic content and exhibit reduced POD activities during storage regarding Ctr samples (200 ppm free chlorine/1 min). All analyzed samples showed reduced carotenoid contents considering raw

material (unprocessed carrot). Nonetheless, UV samples registered a three-fold increase in carotenoid content in subsequent storage. Colour of fresh-cut carrot showed a continuous increase in WI values during storage regardless of treatment without impairing quality acceptance. Respiratory metabolism was affected by both abiotic stress treatments since reduced O_2/CO_2 rates were found, more significant in HS samples. The decontamination effect of the tested stresses was more expressive in HS samples, where a ≈ 2 $Log_{10}cfu.g^{-1}$ reduction in initial microbial load was achieved and also provided reduced microbial development rate during storage. Both stress treatments show beneficial effects on the overall quality of fresh-cut carrot and proved to be more efficient than the industrial practice for fresh-cut carrot.

CONCLUSION

Both stress pre-treatments showed beneficial effects on the quality of fresh-cut shredded carrot, namely increases in phenolic and carotenoid contents and also reduced POD activity during storage. Moreover, heat shock pre-treatment promotes an effective decontamination effect and reduced respiratory levels.

REFERENCES

[1] Allende A., Tomás-Barberán F.A. & Gil M.I. 2006. Minimal processing for healthy traditional foods. Trends in Food Science & Technology, 17, 513-19.

[2] EN ISO 4833: 2003. "Microbiology of food and animal feeding stuffs - Horizontal method for the enumeration of microorganisms - Colony-count technique at 30ºC".

[3] Singleton V.L. & Rossi J.A. 1965. Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. American Journal of Enology and Viticulture, 16(3), 144-158.

[4] Biehler E., Mayer F., Hoffman L., Krause E. & Bohn T. 2010. Comparision of 3 Spectrophotometric Methods for Carotenoid Determination in Frequently Consumed Fruits and Vegetables. Journal of Food Science, 75(1), C55-C61.

Laboratory of Food C
Univ

INTRODUCTION

Milk and milk produ
series of processes i
content) and homoge
the milk fat globules
separation from the
application of extren
smaller. The most co
alternative method e
ultrasound causes vib
the milk fat globules
applied ultrasound in
reduce drastically in s
ultrasound treated r
fermentation process
strong gel structure, h
apply ultrasound on r
produce yogurt.

MATERIALS & ME

Raw bovine milk (3
ultrasound for 10min
85 °C for 20min, coo
culture of Streptococ
incubated in 45 °C un
After the ultrasound
fermentation pH was
properties, hardness, a

RESULTS & DISCU

Ultrasound homogeni
satisfactory homogen
milk. Medium amplit
average diameter was