Effect of postharvest treatment (hot water and thermosonication) on tomatoes (*Lycopersicum esculentum* L.) physical-chemical and nutritional quality during storage

J. Pinheiro[1], C. Alegria[2], M. Abreu[2], E.M. Gonçalves[2], C.L.M. Silva[1*]

[1]CBQF – Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Rua Dr. António Bernardino de Almeida, 4200-072 Porto, Portugal

[2]DTIA – Instituto Nacional de Engenharia, Tecnologia e Inovação, Estrada Paço do Lumiar n.º 22, 1649-038 Lisboa, Portugal

*e-mail: clsilva@esb.ucp.pt

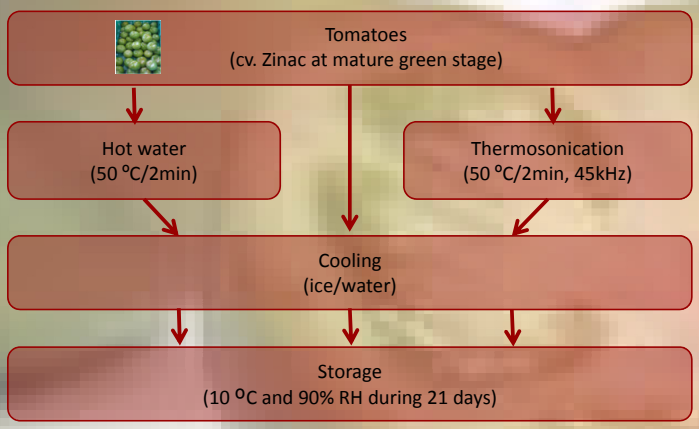
OBJECTIVE

To evaluate the effect of hot water (HW, 50 ºC at 2min) and thermosonication (TUS, 50 ºC at 2min, *80%* power level and 45kHz) treatments, and compare it with untreated tomatoes, on physical-chemical and nutritional properties, such as colour CIE Lab (a* and *hue (ºh)*), texture (firmness, N), total phenolic content (TPC, mGAE.100g^{-1}) and antioxidant activity (AO, µmol.TEAC.100g^{-1}) of whole tomatoes stored at 10 ºC and 90% RH during 21 days.

Introduction

Postharvest heat treatment (HT) applied to whole fruits has been used mainly to eliminate superficial microorganisms and to ensure their quality during storage [1]. The fruit exposure to temperature and time must be precisely tested in order to prevent damage. Heat can be combined with other technologies, e.g. ultrasounds, in order to reduce its intensity and, consequently, its negative effect. Thermosonication (TUS) has some advantages compared with HT, such as fruits quality improvement in terms of taste, texture and appearance.

Materials & Methods



Quality attributes

- Colour evaluation (CIELab colour and hue (ºh), 16 determinations),
- Texture evaluation (firmness, N, 16 determinations),
- Total phenolic content (TPC, mGAE.100g^{-1}, 6 determinations) [2]
- Antioxidant activity (AO, µmol.TEAC.100g^{-1}, 6 determinations) [3]

Data analysis:

- Analysis of variance (two-way ANOVA) by Statistica software [4]; significant difference at p<0.05 (Scheffé test)

Table 1 – Initial values (average ± standard deviation) of quality parameters of untreated and after treated (HW and TUS) tomatoes.

Tomato	a*	hue	Firmness (N)	TPC (mGAE.100g^{-1})	AO (µmol.TEAC.100g^{-1})
Untreated	-10.33±0.71^{a}	115.35±0.97^{c}	13.19±1.22^{d}	21.07±1.31^{f}	706.45±27.80^{g}
HW	-11.01±0.43^{b}	116.21±1.80^{c}	11.72±1.15^{e}	20.46±0.60^{f}	679.00±18.01^{g}
TUS	-11.17±0.88^{b}	115.04±3.01^{c}	12.75±1.50^{d,e}	21.23±0.63^{f}	750.25±25.14^{h}

Note: Values with different superscript letters are significantly different.

Results and Discussion

Table 1 shows the initial values (average ± standard deviation) of physical-chemical and nutritional properties of untreated and after treated tomatoes (HW and TUS). Immediately after HW and TUS treatments, *ºh* and TPC were not affected significantly (p>0.05). On TUS tomatoes an improvement of AO (7%) was observed when compared with untreated tomatoes.

Fig. 1 (a) and (b) show the behaviour of a* value and firmness, of untreated and treated tomatoes, during 21 days of storage.

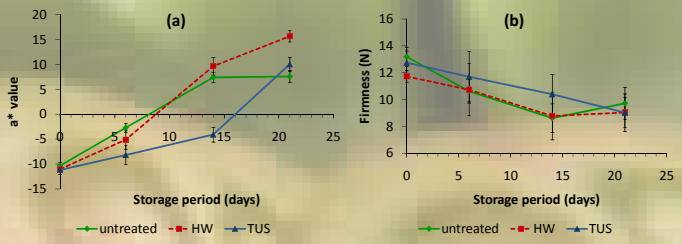


Fig. 1 – Tomatoes a* value (a) and firmness (N) (b) of all samples (untreated, HW and TUS) during storage at 10 ºC. Vertical lines represent standard deviation.

In the first 6 days of storage, a delay in red colour development in both treated tomatoes were observed, compared with untreated samples. However, after the 21th day, an increase on a* values on HW tomatoes were obtained, indicating a faster maturation.

Untreated and HW firmness presented a similar decreasing behaviour during storage period. TUS tomato denoted the highest firmness in the first 15 days of storage, when compared with other samples.

Fig. 2 (a) and (b) show the behaviour of TPC and AO, of untreated and treated tomatoes, during 21 days of storage.

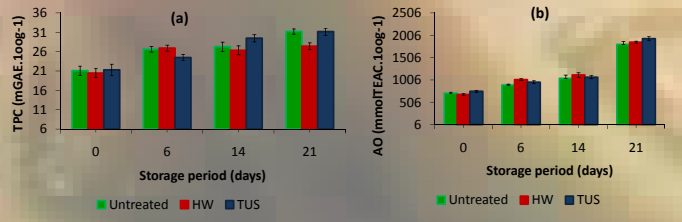


Fig. 2 – Tomatoes TPC (mGAE100g^{-1}) (a) and AO (µmol.TEAC.100g^{-1}) (b) of all samples (untreated, HW and TUS) during storage at 10 ºC. Vertical lines represent standard deviation.

As observed in Fig. 2, TPC and AO increased (up to 46% and 170%, respectively) during storage in all tomatoes, so the applied treatment did not lead to significant effect on these parameters.

CONCLUSIONS

Physical-chemical and nutritional changes during tomato ripening process are inevitable. However, the delay of these alterations can be achieved through postharvest treatment, such as HW and TUS. Although promising results have been obtained, further studies are required.

References:

[1] Lurie, S. (1998). Postharvest heat treatments. *Postharvest Biology and Technology*, 14: 257-269. **[2]** Singleton, V.L. & Rossi, J.A. (1965). Colorimetry of total phenolics with phosphomolybdicphosphotungstic acid reagents. *American Journal of Enology and Viticulture, 16(3): 144.* **[3]** Re, R. Pellegrini, N., Proteggente, A. Pannala, A., Yang, M., Rice-Evans, C. (1999). Antioxidant activity applying an improved ABTS radical cátion decolorization assay. *Free Radical Biology & Medicine*, 26(9): 1231 **[4]** StatSoft, Inc. (2004). STATISTICA (data analysis software system), version 7. www.statsoft.com.

Acknowledgements:
The author Joaquina Pinheiro would like to thank Fundação para a Ciência e a Tecnologia (PhD grant SFRH/BD/24913/2005).