Introduction

The increasing demand for tomato fruits cleaned, healthy, tasteful, nutritive and with longer shelf-life, led to the development and use of numerous effective preservation non-chemical methods. There is much interest in developing safer and more effective sanitizers for fruit and vegetable, and heat treatments (HT) appear to be one of the most promising postharvest treatments [1] (Boukobza and Taylor, 2002). The aim of this work was to evaluate the effect of an optimized water heat treatment (WHT - 40 ºC for 30 min [2]) on the tomato (Solanum lycopersicum, cv. Zinac) quality attributes at two maturity stages (turning and pink), followed by storage at 10 ºC during 14 days.

Materials & methods

<table>
<thead>
<tr>
<th>Turning maturity stage (TM)</th>
<th>Pink maturity stage (PM)</th>
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<tr>
<td><strong>Industrial decontamination (HIPO):</strong> 150 ppm chlorine, 5 ºC, pH 6.5, 2 min</td>
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<td><strong>Water heat treatment (WHT):</strong> 40 ºC / 30 min [2]</td>
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<td><strong>Drying:</strong> (Absorbent paper)</td>
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<td><strong>Storage:</strong> (10 ºC / 14 days) [3]</td>
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Quality attributes: pH, soluble solids content (SSC), firmness, colour, peroxidase (POD) [4] and pectin methyl esterase (PME) [5], mesophylic count [6], yeasts and moulds (Y&M) [7].

Results

2. Firmness

- Differences in firmness decreases were observed between treatments. After ca. 3 days, firmness of TM_HIPO samples was lost more rapidly, showing a decrease of 13% compared to initial value. Conversely, at the end of storage, WHT samples had slightly higher firmness (more 11%).
- No significant difference (P>0.05) was found among the treatments (HIPO x WHT) in PM tomato samples.
- Firmness of both treatment (HIPO and WHT) and maturity stage samples decreased ca. 26.4, 10.4 and 9.2, 10.5%, for TM and PM samples, respectively.

3. Colour

- During storage, a*b* values for both TM tomato treated samples increased steadily and significantly (P<0.05) until the end of storage, 0.5 and 0.3 units for HIPO and WHT, respectively.
- The a*b* color parameter of PM_WHT sample also increased, became more red with the storage time. However, this increase was not significant (P<0.05) due to dispersion of the measured values, revealing a non uniform color development.

4. Enzymatic activities

- Turning HIPO samples observed a significant increase in PME activity reaching highest activity by day 7 (2.8 Abs.min.ml⁻¹), followed by a decrease to the end of storage period. Regarding the PME activity level of TM_WHT samples, it was maintained throughout the storage (2.81 Abs.min.ml⁻¹, P<0.05).
- In PM tomato samples opposing behavior was observed. In WHT samples there was an increase in PME activity at day 7 (76.8%) followed by a significantly decrease in activity (25.8%) to the end (day 14). PME activity of PM_HIPO samples decreased uniformly during storage.

- In both fruits maturity stages, WHT tomato maintained the initial POD activity level until day 7, followed by a decrease up to the end (day 14). Nevertheless, by the end of storage, TM_WHT samples registered a higher POD activity (more 70%, P<0.05) than the respective control (HIPO samples).

- An exception to the decrease behavior of POD activity during storage was observed in TM_HIPO samples, where an increase in POD levels was found from day 0 to 7.

5. Microbial load

- At the end of storage, all WHT samples had lower counts of mesophyle and Y&M flora, revealing that WHT at 40 ºC - 30 min can be used to improve tomato shelf-life.

6. Kinetic data and shelf-life determination

- Taking into account the firmness criteria for tomato cv ‘Zinac’ shelf life (4.2 N; [3]) and the prediction based on Eq. 1 and kinetic parameters, the HIPO and WHT samples at TM and PM stage required approximately 24, 51 and 50, 43 days at 10 ºC, respectively.

- The WHT at 40 ºC / 30 min was effective to prolong twice as long the predicted storage period compared with HIPO treatment at TM tomato.

Conclusions

Our results provide strong evidence that postharvest water heat treatment (40 ºC - 30 min) for tomato fruits (cv. ‘Zinac’) at turning maturity stage guarantees the overall quality at 10 ºC, twice as long of fruits washed with chlorinated water.


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