

Influence of ozone pre-treatment on the quality of frozen red bell peppers (*Capsicum annuum* L.)



ALEXANDRE Elisabete M.C., FUNDO Joana, SANTOS Dora M., BRANDÃO Teresa R.S., SILVA Cristina L.M.*

Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Rua Dr. António Bernardino de Almeida 4200-072 Porto, Portugal

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



Summary

- The main objective of the work was to study the influence of ozone in aqueous solution, used as a pre-treatment to freezing and frozen storage, on red bell peppers' quality parameters (colour, pH and texture).
- Results were compared to the ones obtained with conventional blanching treatments.
- Ozone did not affect pH, colour and texture of red bell peppers.
- Blanching influenced significantly the colour and texture of the samples, which was also observed along storage under frozen conditions.

Introduction

Freezing is a proven efficient food preservation process. For maximum quality retention, some treatments may precede freezing. In the case of vegetables, one of the most common methods applied, before freezing and storage under frozen conditions, is blanching. Blanching may reduce considerably the microbial load of the food and also inactivate enzymes responsible for quality degradation, thus resulting in products with extended shelf life. However, this convenient thermal process in terms of food quality and safety, from an industrial point of view may be extremely energy consuming. Some sensory food attributes may also suffer the negative influence of the thermal impact at cellular tissues level. More recently, alternative non-thermal technologies have been emerging in the food processing domain. Due to the strong oxidising characteristics and powerful non-chemical disinfectant properties, ozone has been applied in the food industry, both in equipment or as wastewater sanitizer. In 2001, the Food and Drug Administration (FDA) approved the use of ozone as an antimicrobial agent for the treatment, storage, and processing of foods in gas and aqueous phases in direct contact with foods (Suslow, 1999). Proposed mechanisms of ozone action at cellular level involve oxidation of amino acids of enzymes, peptides and proteins to shorter peptides, and oxidation of polyunsaturated fatty acids to peroxides (Victorin, 1992). In such way, ozone treatments may increase the shelf life of vegetables (Rice *et al.*, 1982) and be used as an alternative to traditional thermal treatments.

Materials and Methods

- Red bell peppers (*Capsicum annuum* L.), acquired in a local market, were cut in small portions (4x10cm) and separated randomly in four groups, as follows:
 - Group I** freezing at -30 °C for 30 minutes (blast and fluidized bed freezer; FT36, Armfield, UK), storage at -7 and -30 °C for 72 days
 - Group II** treatment with ozonated water (2 ppm) at 15 °C for 2 minutes, followed by a procedure similar to group I
 - Group III** treatment with water at 15 °C for 2 minutes, followed by a procedure similar to group I (used as control of group II)
 - Group IV** blanching treatment at 100 °C for 2 minutes, followed by a procedure similar to group I
- Experiments of *group II* were carried out using a pilot equipment. An ozone generator (OZ5, SPO3, Sociedade Portuguesa de Ozono, Portugal) was interconnected to a container (158 L) filled with tap water.
- Ozone was continuously incorporated into water (at -15°C), and its content was indirectly measured by potential difference (SZ 265, B&C Electronics).

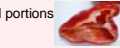


Figure 1. Ozone generator.

Red bell peppers, after treatment and at different storage periods, were analysed in terms of:

- pH** Measured by potentiometry (GLP 22, Crison), after samples homogenisation and filtration.
- Colour** Measured using the Hunter (L, a and b) scale, with a colourimeter (CR-300, Minolta) at both internal and external surfaces (10 replicates), and in homogenised samples (3 replicates).
The total colour difference [$TCD = \sqrt{(a-a_0)^2 + (b-b_0)^2 + (L-L_0)^2}$], being index 0 indicative of initial reference values of fresh product] was the parameter considered for colour evaluation.
- Texture** hardness, springiness, cohesivity and gomosity were evaluated through texture profile analysis, using a texturometer (TA - XT2plus, Stable Micro Systems Lda, UK), equipped with a 5 kg load cell and a 10 mm diameter cylindrical probe (30 replicates).
- The experimental results obtained, from all treatments, were compared by analysis of variance (two-way ANOVA, Analysis Tool Package, Excel 2000, Microsoft®, USA).

Results and Discussion

Influence of treatments and frozen storage on pH

- pH values were normalized in relation to fresh products' values (pH₀).
- No tendency was observed on pH values of samples submitted to the different treatments and during frozen storage at -7°C or -30°C.

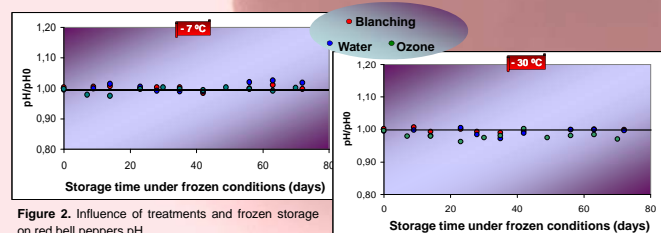


Figure 2. Influence of treatments and frozen storage on red bell peppers pH.

Influence of treatments and frozen storage on colour

- Samples treated with water or ozonated water did not show significant differences in colour, when compared to fresh red bell peppers.
- During frozen storage, the total colour difference of samples treated with water or ozonated water was identical to the ones observed for untreated samples (Figure 3).
- Blanched red bell peppers presented significant colour changes during frozen storage, when compared to untreated or ozonated samples.
- No significant temperature effect was detected.
- Conclusions were similar for colour measurements at product external surfaces or in homogenized samples.

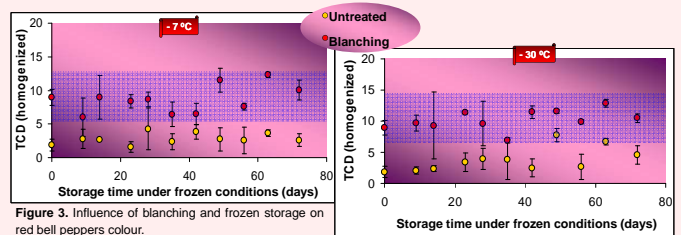


Figure 3. Influence of blanching and frozen storage on red bell peppers colour.

Influence of treatments and frozen storage on texture

- Ozone treatment did not affect texture parameters, when compared to fresh samples.
- Hardness and gomosity of red bell peppers decreased significantly after blanching. After the freezing process, blanched samples were the ones that presented the highest degradation of those texture parameters.
- This was also observed along storage at -7 or -30 °C.

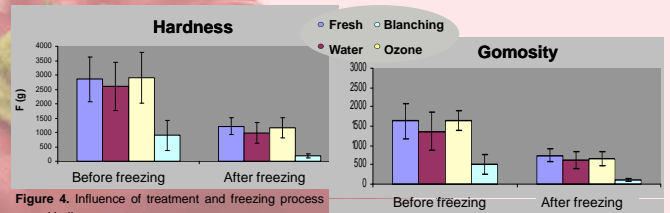


Figure 4. Influence of treatment and freezing process on red bell peppers texture.

Conclusions

- Aqueous ozone pre-treatment did not affect pH, colour and texture parameters of red bell peppers stored under frozen conditions.
- Blanching treatments affected negatively the colour and texture attributes, which was verified throughout frozen storage.

These results will complement studies concerning the effect of aqueous ozone on vegetables' safety, aiming at application of this technology as an alternative to thermal treatments.

References

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