

## Effects of sodium metabisulphite and citric acid on the shelf life of fresh cut sweet potatoes

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### Abstract

Minimally processed vegetables are products susceptible to chemical and biological changes, thus becoming highly perishable. During sweet potatoes (*Ipomoea batatas* Lam.) processing, some deteriorative reactions occur affecting quality, mainly change of color. The purpose of this research is to avoid or minimize this deterioration, so the effects of application of chemical agents to fresh cut and refrigerated stored sweet potatoes were studied, evaluating the occurrence of major organoleptic, physicochemical and nutritional changes and assessing the sensory acceptability. Tests were done with sweet potato variety 'Colorada Correntina', which were treated with sodium metabisulphite/citric acid (pH=2.91), arranged in polystyrene trays film, coated with PVC, and stored at 5°C and 10°C. Variations on the titratable acidity, pH, total sugars and ascorbic acid were registered and the surface color was evaluated through digital image analysis. The final product acceptability was determined through sensory evaluation and microbiological counts carried out at the beginning and at the end of the assays. During storage, there were slight changes in physicochemical characteristics such as ascorbic acid and sugar content and in surface color as well. The microbial counts were lower than the fixed levels established by the Spanish legislature. The sensory attributes were rated as «acceptable» by consumers. Finally it is possible to assert that sweet potato 'Colorada Correntina' minimally processed and treated with sodium metabisulphite 2%/citric acid can be preserved, packaged and stored at 5°C for 14 days.

**Additional key words:** browning, *Ipomoea batatas*, physicochemical characteristics, sensory evaluation.

### Resumen

#### Efectos del tratamiento químico en la vida útil de batatas frescas cortadas

Los vegetales mínimamente procesados son productos susceptibles a alteraciones fisicoquímicas y biológicas, resultando altamente perecederos. Durante el procesamiento de batatas (*Ipomoea batatas* Lam.), ocurren reacciones de deterioro que afectan la calidad, especialmente el cambio de color. Con el objeto de evitar o minimizar este deterioro, se estudiaron los efectos de la aplicación de agentes químicos a batatas frescas cortadas almacenadas refrigeradas, evaluando la ocurrencia de los principales cambios organolépticos, fisicoquímicos y nutricionales, y estableciendo la aceptabilidad sensorial. Los ensayos se realizaron con batatas variedad 'Colorada Correntina', tratadas con sodio metabisulfito/ácido cítrico (pH=2,91), dispuestas en bandejas de poliestireno recubiertas con film de PVC, y conservadas a 5°C y 10°C. Se registraron las variaciones de pH, acidez titulable, azúcares totales y ácido ascórbico y se evaluó el color superficial por análisis de imágenes digitales. Mediante evaluación sensorial se determinó la aceptabilidad del producto final y se realizaron recuentos microbiológicos al inicio y final de los ensayos. Durante el almacenamiento ocurrieron ligeros cambios en las características fisicoquímicas, el contenido de azúcares y ácido ascórbico, y el color superficial fue ligeramente modificado. Los atributos sensoriales fueron calificados «acceptables» por los consumidores y los recuentos microbiológicos fueron inferiores a los niveles establecidos por la legislación española. Se concluye que es posible conservar batatas 'Colorada Correntina' mínimamente procesadas, tratadas con metabisulfito de sodio 2%/ácido cítrico, envasadas y conservadas a 5°C durante 14 días.

**Palabras clave adicionales:** características fisicoquímicas, evaluación sensorial, *Ipomoea batatas*, pardeamiento.

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## Introduction

Sweet potato (*Ipomoea batatas* Lam.) is a vegetable of the *Convolvulaceae* family, whose global production is around 140 million tons, being at second place in world volume production (CIP, 2004). In Argentina its crop represents 4% of the total surface of vegetable crops, with an area of 9,700 ha (SAGPyA, 2005), and its consumption is relatively low (3 kg per capita year<sup>-1</sup>) (Martí, 2009). Moreover, it is an economically important crop, showing few agronomic requirements for its cultivation and a good production in medium and low soil (Infoagro, 2003).

The chemical composition of sweet potato makes culinary and nutritional quality significant, depending these on cultivation and agronomic conditions. Total carbohydrates, which are mainly starch (Mazzei *et al.*, 1995; FAO, 2002), represent the 19% to 28% of the root. While the 86% (on dry basis) of total soluble sugars are glucose, the remainder are fructose and sucrose (Zhang *et al.*, 2002), besides the fact of having a significant fiber content. Protein content is 1% to 2% and it has high biological value due to its high lysine content, whereas lipid level is reduced (0.1 to 0.4%) (Mazzei *et al.*, 1995; FAO, 2002). Other minor components in sweet potato are vitamins, pigments and antioxidant compounds ( $\beta$ -carotene, vitamin B, C, E, phenolic acid) (Martí, 2000; Aina *et al.*, 2009; Picha and Padda, 2009) being good energy providers as well, 111 kcal/100g (Martí, 2000). Moreover, Miyazaki *et al.* (2005) reported that the consumption of white skinned sweet potatoes is an effective alternative to the prevention and improvement of the symptoms of diabetes because it stimulates human immunity. This food is beneficial because it increases immune activity in addition to its antidiabetic effects. These roots must be peeled, cut, washed and cooked before their consumption. After that, its industrialization in a minimal processed vegetable form could become an interesting product for the consumer. During minimal processing, sweet potatoes suffer damages that affect the quality of the final product, which are evident in a suberization and dehydration of the surface tissue and an increase in respiratory activity (Picha and Erturk, 2004). In addition, the cut generally produces an increase in the activity of enzymes associated with the phenomenon of browning (Moretti *et al.*, 2002) producing significant changes in the organoleptic properties and nutritional value of the product. A high activity of peroxidase (POD) has been reported in sweet potatoes. Peroxidase is an enzyme that would

induce the first changes of color as a result of the process (Sakharov *et al.*, 1999) and which usually appears quickly if the tissues are not treated with inhibitors (Cacace *et al.*, 2002).

Various techniques have been applied to prevent browning in fresh cut vegetables, such as the addition of sulphites, ascorbic acid and derivatives, sulfur, carboxylic acids, phenolic acids, 4-hexylresorcinol, honey, either individually or in combination among them or with other inorganic compounds, acids, etc. (Sapers and Miller, 1998; Gil *et al.*, 2005; Rocculi *et al.*, 2007). However, an efficient method for replacing the industrial application of sulphites to prevent browning has not been found yet (Marshall *et al.*, 2000); since it requires a concentration of less than 50 mg L<sup>-1</sup> of free SO<sub>2</sub> in vegetables (Gil *et al.*, 2005). It is assumed that sulphites inhibit enzymatic browning by reducing o-quinones to colorless diphenol (Grothuer *et al.*, 2008) or by reacting irreversibly with o-quinones to form stable colorless products (Marshall *et al.*, 2000). Sulphites and their derivatives (sulfur dioxide, sulphite, bisulphite and metabisulphite) are oxidizing agents that act as preservatives, color and taste stabilizers in some products, but cause allergies to some people.

The Spanish legislation as well as the American, in some places of USA, has no objections to the use of sulphite in vegetables, despite the fact that the USA, in 1995, banned its application in fresh salads and allowed it only at levels exceeding 300 mg L<sup>-1</sup> for fruit juices and dehydrated vegetables. While there is a global tendency to replace chemical agents for other natural products, it has not been possible to carry them out at industrial levels yet. On the other hand, it must be considered that in products subjected to cooking the residual sulphite contents are eliminated by heating (Marshall *et al.*, 2000).

In fresh cut sweet potatoes, Cobo *et al.* (2003) studied the effect of blanching and the treatment with disinfectants and preservatives on the color and texture during storage at refrigeration temperatures. In sliced apples, the combined addition of sulphites and calcium ions improved the firmness and color (Ponting *et al.*, 1971). McConnell *et al.* (2005) reported smaller microbiological load in shredded sweet potatoes stored in modified atmosphere packaging (MAP) when compared to shred sweet potatoes stored in air and no changes in color,  $\beta$ -carotene and sugars were found regardless of package atmospheres. Other authors reported the reduction of population of mesophiles, psychrotrophs and yeast-moulds during 14 days in sweet potatoes

slices dipped with 200 mg L<sup>-1</sup> chlorine stored at 1°C (Erturk and Picha, 2006).

In this paper we studied the effects of applying a mixture of additives (sodium metabisulphite and citric acid) in fresh cut sweet potatoes on the development of its organoleptic and physicochemical characteristics, and the content of total sugars and ascorbic acid during storage at two refrigeration temperatures.

## Material and methods

### Vegetable material

The tests were performed with sweet potatoes from the variety 'Colorada Correntina' harvested between April to August during 2005 and 2006. This variety presents red skin, yellow flesh and elongated shape and it is produced in the province of Corrientes, Argentina. The roots were purchased at local market and selected by their shape and size, without external damage, using batches of 20 kg per test.

### Treatments and storage

The roots were washed with tap water and cleaned with a gently abrasive brush. After that they were rinsed with tap water and sanitized by immersion in chlorinated tap water (100 mg L<sup>-1</sup>/10 min). Then, potatoes were pre-cooled by immersion in icy water (2 to 5°C/30 min), peeled by hand and diced in pieces of 2 cm side and immediately treated with a mixture of anti-browning agents selected previously. Roots were immersed for 30 min in sodium metabisulphite solution (SMB) 2%, adjusting the pH to 2.91 with citric acid (CA). Pieces, drained and dried by centrifugation (600 rpm, 3 min) were arranged in trays of polystyrene (PS) containing 200 g each and coated by a polyvinyl chloride (PVC) film. The assays were conducted under refrigeration at 5 ± 1°C and 10 ± 1°C during 14 and 10 days respectively and repeated twice. The units were stored at constant temperature until the final time of the tests, removing samples for analysis at 0, 4, 8, 10, 14 storage days.

### Determinations

pH was measured in sweet potatoes cubes with a pocket pH-meter, Testo model 206-PH1, (Lenzkirch-

Germany), with an electrode for solid food and ±0.02 accuracy in 6 cubes each time. Titratable acidity was determined potentiometrically with 0.1 N sodium hydroxide at pH 8.1 and was expressed as g citric acid/100 g of fresh tissue. Total sugars were determined spectrophotometrically (Metrolab 1700, Quilmes, Argentine) from an alcoholic extract prepared with 10 g of the sample. One milliliter of the alcoholic extract and 4 mL of anthrona solution (0.2% in 66% H<sub>2</sub>SO<sub>4</sub>) were mixed, heated at 100°C for 15 min and let in dark during 20 min, then, its absorbance was read at 620 nm (Southgate, 1976), expressing the results in mg glucose/100 g of fresh tissue. The determination of ascorbic acid was performed by high efficiency liquid chromatography (HPLC, Shimadzu LC-10A, Tokyo, Japan) on a extract of phosphoric sample prepared with 10 g of fresh tissue (Nisperos-Carriedo *et al.*, 1992) and before injection, sample were filtered with 0.45 µm membrane. Mobile phase acetonitrile: water (30:70 pH = 2.8), Supelcosil RP C<sub>18</sub> column (Supelco, LC 18, Pennsylvania, USA) and UV-visible detector (Shimadzu, SPD-10A, Tokyo, Japan) at 260 nm were used. Results were expressed as mg ascorbic acid/100 g fresh tissue. Two extracts were done for each determination and measurements were performed in triplicate.

Microbiological counts of aerobic mesophilic flora were performed (Plate Count Agar method), at 37°C for 48 hours and molds and yeasts (potato dextrose agar), at 37°C for 5 days in duplicate at the beginning of treatment and at final time (ICMSF, 1982). Samples were prepared with 10 g of fresh tissue and homogenized with 0.1% peptone solution.

Measurements of parameters of surface color were made by a digital analysis of images obtained with a Fujifilm Digital Camera, Model Fine Pix S 3100 (Tokyo, Japan), 4.0 Megapixels, 6x Optical Zoom. Digital photographs of the chilled samples were taken, displaced at a distance of 30 cm within a closed room, illuminated with two fluorescent light bulbs/day 20 W France, 30 cm long, with color temperature close to 5,727°C (Sgroppo *et al.*, 2007). The images obtained were analyzed using Adobe Photoshop software version 8.0.1 (Yam and Papadakis, 2004). Parameters L (luminance or lightness component), a (component from green to red) and b (component from blue to yellow), were recorded and correlated with the values of the parameters of standard plate's surface color (L\*, a\*, b\*), obtained with a colorimeter (Minolta, Model CR-300, Osaka, Japan). Nine images were taken of the

«pool» of sweet potatoes each time, and then four readings of parameters were performed for each image. Based on these results, the corresponding values of the tone ( $\text{hue} = \tan^{-1} b^*/a^*$ ) and saturation [ $\text{chroma} = (a^{*2} + b^{*2})^{1/2}$ ] were calculated.

The sensory evaluation of minimally processed raw sweet potatoes was conducted by means of a descriptive test (Hough and Fiszman, 2005). A panel of seven semi-trained evaluators, which were previously trained (four sessions of 35 min) was used, defining in the sessions the meaning of each of the evaluating parameters and agreeing the score to assign. By direct visual observation, they evaluated overall appearance and color, giving a score of 1 = bad, 2 = regular, 3 = acceptable, 4 = good, 5 = very good and for descriptors exudates, surface dehydration and browning, 1 = not acceptable, 2 = acceptable, 3 = absence. Moreover, a panel of 43 untrained evaluators conducted a test of acceptability of the flavour of sweet potatoes at the end of storage time (14 days/5°C) with pre-cooked sweet-potatoes. A method of subjective response was used, applying a test of differences between the treated and untreated sweet-potatoes and a second trial to measure the acceptability (Hough and Fiszman, 2005).

### Statistical analysis

All quantitative determinations were analyzed statistically using an analysis of variance (ANOVA) for a significance level of 0.05. The differences found were tested by multiple range least significant difference (LSD). The statistical package SYSTAT v.10 (SPSS Inc. 2000, Chicago, USA) was used.

## Results and discussion

### pH and titratable acidity

In general, the pH of vegetables is relatively high, 5.5 to 6.5 and titrated free acid content is 0.2 to 0.4 g citric acid/100 g of fresh tissue. Results of this study are presented in Table 1 for samples withdrawn at different times and two storage temperatures. A decrease in pH was observed immediately after treatment; values close to the initials at day 4 and continued to decline gradually until the end of treatment, taking values higher than  $5.75 \pm 0.18$ .

The main organic acids which are present in vegetables are citric and malic acid and the sweet potato's initial titrated acidity was  $0.086 \pm 0.0021$  citric acid/100 g fresh tissue. Titratable acidity showed a slight increase after treatment and then remained almost constant until the end of storage. Similar trend was observed for both test temperatures.

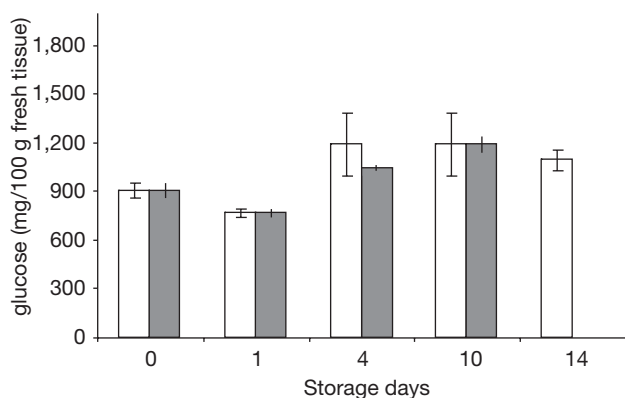
### Total sugars

In 'Colorada Correntina' sweet potatoes, the level of total sugar was  $907 \pm 42.8$  mg/100 g fresh tissue, close to those reported by Zhang *et al.* (2002) for six cultivars of sweet potatoes produced in Colombia. Twenty-four hours after cutting, sugar contents decreased 15% and it was probably due to an increase of metabolic activity, as were informed by Rocculi *et al.* (2007) in potato slices treated with L-cysteine, ascorbic and citric acid. On the fourth day of storage at 5°C, significant increases were detected ( $P=0.001$ ) in sweet potatoes, remaining then, virtually unchanged until the

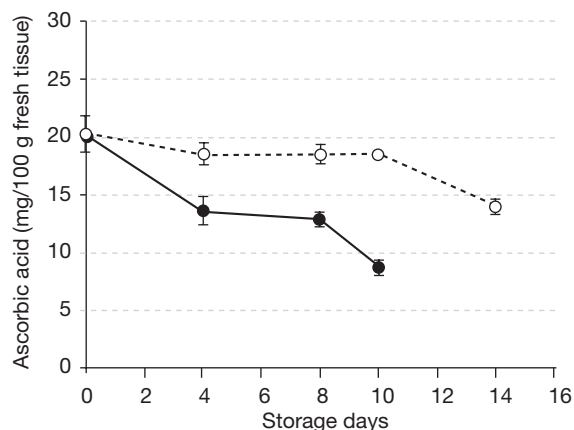
**Table 1.** Variation of pH and acidity in treated cut sweet potatoes 'Colorada Correntina' stored at 5°C and 10°C

Time (days)	pH <sup>1</sup>		Acidity <sup>2</sup> (g citric acid/100 g tissue)	
	5°C	10°C	5°C	10°C
Fresh sweet potato	6.20 ± 0.16	6.20 ± 0.16	0.08 ± 0.002	0.08 ± 0.002
After treatment <sup>3</sup>	5.74 ± 0.02	5.74 ± 0.02	0.15 ± 0.02	0.15 ± 0.016
4	6.18 ± 0.02	6.15 ± 0.21	0.12 ± 0.03	0.11 ± 0.003
8	6.08 ± 0.105	5.85 ± 0.10	0.13 ± 0.004	0.11 ± 0.004
10	6.08 ± 0.105	5.75 ± 0.18	0.13 ± 0.004	0.10 ± 0.008
14	5.94 ± 0.21		0.12 ± 0.008	

<sup>1</sup> Results corresponding to the average values from six determinations. <sup>2</sup> Average values from two determinations. <sup>3</sup> Immediately after treatment with 2% SMB, adjusting the pH to 2.91 with CA.



**Figure 1.** Effects of the sodium metabisulphite treatment on 'Colorada Correntina' cut sweet potatoes stored at refrigeration temperature. Each value is the mean of two replications and error bars indicate the standard deviation. White bar T = 5°C; grey bar T = 10°C.



**Figure 2.** Evolution of the ascorbic acid content during refrigerated storage in fresh cut sweet potatoes 'Colorada Correntina' treated with sodium metabisulphite. Data are the mean of two replications. ○: T = 5°C. ●: T = 10°C.

end of the trial. During storage of sweet potatoes at 10°C sugars followed a similar trend ( $P=0.87$ ) (Fig. 1).

### Ascorbic acid

In 'Colorada Correntina' sweet potatoes, the contents of ascorbic acid were 12.11 to 25.00 mg/100 g which are within the range reported for other cultivars of sweet potatoes (Mazzei *et al.*, 1995; FAO, 2002). Although sulphites are oxidizing agents, non significant changes in sweet potato ascorbic acid content were detected ( $P=0.37$ ) within the first 12 hours after the immersion treatment. The levels of ascorbic acid in sweet potatoes stored at 5°C decreased during storage, reaching values 30.3% lower than the initial at 14 days ( $P=0.001$ , Fig. 2). McConnell *et al.* (2005) working with mashed sweet potatoes multilayer polyolefin bags packed, with an average permeability of O<sub>2</sub> and MAP, found decreases of 11% to 15% in the ascorbic acid content after 14 days at 4°C. In six cultivars of stripped potatoes packed in MAP, on the sixth day of storage at 4°C, Tudela *et al.* (2002) reported a loss between 14% and 34% and it was different when product was stored in contact with air. At 10°C, changes in the ascorbic acid content of stored sweet potatoes were more remarkable than at 5°C, since on the fifth day decreased by 32.5% reaching an 56.4% from initial content at day 10<sup>th</sup> ( $P=0.001$ ) The differences are statistically significant ( $P=0.001$ ) for both temperatures, distinguishing a very important effect of temperature on the speed of loss of ascorbic acid in cut sweet potatoes besides the oxygen permea-

bility of films used, in addition to the likely residual effect of the applied treatment.

### Microbiological counts

To show the sanitary quality of food, the most commonly method used is to count the mesophilic aerobic bacteria, which are considered indicators of contamination (ICMSF, 1982). Deterioration of fresh cut fruit and vegetables has been characterized by the development of soft rot, discoloration of the cut surface, and production of abnormal flavors and odors, detectable by sensory methods when the number of microbial cells reach a threshold of 10<sup>7</sup> to 10<sup>8</sup> CFU g<sup>-1</sup>, depending on the species and the characteristic components of vegetables (Marchetti *et al.*, 1992). Recommendations and legislation in effect about fresh cut vegetables set upper limit 10<sup>7</sup> CFU g<sup>-1</sup> for the count of total aerobic mesophilic.

Initially, the cut sweet potatoes had a count of mesophilic aerobic microorganisms of 2.2 log CFU g<sup>-1</sup> and remained virtually unchanged after treatment and until 14 days of storage at 5°C (Table 2). The molds and yeast counts were 2.38 log CFU g<sup>-1</sup> and a significant decrease after treatment was registered, having no changes in them at the end of refrigerated storage. The sodium metabisulphite treatment (pH = 2.91) had a more effective control on the development of molds and yeasts than on total mesophilic microorganisms at 5°C. However, at 10°C an increase of 1 log cycle in mesophilic aerobics and molds and yeasts was produ-



**Table 2.** Microbiological ( $\text{Log}_{10}$  UFC  $\text{g}^{-1}$ ) counts in cut sweet potatoes ‘Colorada Correntina’ stored at 5°C and 10°C

Sample	5°C		10°C	
	Aerobic mesophiles <sup>1</sup>	Molds and yeast	Aerobic mesophiles <sup>1</sup>	Molds and yeast
Fresh sweet potato	2.20 <sup>a2</sup>	2.38 <sup>a</sup>	2.20 <sup>a</sup>	2.38 <sup>a</sup>
After treatment <sup>3</sup>	2.15 <sup>a</sup>	1.95 <sup>b</sup>	2.15 <sup>a</sup>	1.95 <sup>b</sup>
Final time <sup>4</sup>	2.13 <sup>a</sup>	1.93 <sup>b</sup>	3.18 <sup>b</sup>	3.52 <sup>c</sup>

<sup>1</sup> Upper limit in Spain for aerobic mesophiles counts:  $1.0 \times 10^7$  UFC  $\text{g}^{-1}$  (BOE, 2001). <sup>2</sup> In the same column, values followed by same letters do not differ significantly ( $P < 0.005$ ). <sup>3</sup> Immediately after treatment with 2% SMB, adjusting the pH to 2.91 with CA. <sup>4</sup> Final time: 14 days/5°C, 10 days/10°C

ced, although the levels were lower than those established by law. Similarly, Erturk and Picha (2006) reported for cut sweet potatoes stored 14 days at 2 and 8°C, good microbiological quality and mesophilic microorganisms’ preponderance. Meanwhile, McConnell *et al.* (2005) reported increases in total counts of total mesophilic above 3 log cycles during 14 days of storage at 4°C in mashed sweet potatoes packed in MAP.

### Superficial color

In ‘Colorada Correntina’ sweet potato, we have registered values of  $L^* = 91.5 \pm 2.7$ ,  $\text{chroma} = 31.3 \pm 2.3$  and  $\text{hue} = 104.84 \pm 0.02$ , close to those reported by Martí (2003) for flesh of 8 pale skin sweet potato clones. According to McConnell *et al.* (2005), low luminosity or brightness values ( $L^*$ ) would indicate a greater degree of browning in cut vegetables. In experiences done in mashed sweet packed potatoes and stored at refrigeration temperatures, they did not detect changes in the  $L^*$  value. In cut sweet potatoes after the treatment, a decrease in the  $L^*$  value were detected. Then it remained constant during storage at 5°C and 10°C, as well as  $a^*$  and  $b^*$  values. Hue and saturation have showed significant changes, indicating a slight shift

toward the red and yellow and an increase in the saturation ( $P < 0.001$ ) (Table 3). Besides Cobo *et al.* (2003) informed that in sliced sweet potatoes (3 × 40 mm) treated with various additives (citric acid, ascorbic acid, chlorine and sulphites) and blanched in water at 90°C for 1 min not color changes were observed.

### Sensorial analysis

At the end of storage, the evaluators rated minimally processed sweet potatoes stored at 5°C with 4 (good) for the overall appearance descriptor, giving a lower score to the products stored at 10°C, being these differences significant ( $P = 0.001$ ) (Table 4). The color had a score upper of the limit of acceptance, near to non detection of browning or superficial dehydration, with superior scores in sweet potatoes stored at 5°C ( $P = 0.001$ ). The remaining descriptors considered had acceptable scores at days 14 and 10 respectively. During the refrigerated storage, the loss of sensory quality in cut sweet potatoes was determinant of their shelf life.

Moreover, by conducting different tests with a control it was found that 77% of the consumers detected flavor differences between treated and control potatoes. At 14 days of storage at 5°C, the product was acceptable for 72% of the evaluators.

**Table 3.** Color parameters in fresh cut sweet potatoes ‘Colorada Correntina’ stored at 5°C and 10°C during 14 and 10 days

Sample time	$L^*$ <sup>1</sup>	$a^*$	$b^*$	Hue*	Chroma*
Fresh	$91.5 \pm 2.7$	$-8.0 \pm 0.9$	$30.2 \pm 2.2$	$104.84 \pm 0.02$	$31.3 \pm 2.3$
After treatment <sup>2</sup>	$85.9 \pm 1.3$	$-4.9 \pm 1.4$	$42.8 \pm 1.5$	$96.60 \pm 2.2$	$43.1 \pm 1.6$
Final time at 5°C/14 days	$85.7 \pm 0.6$	$-4.5 \pm 1.0$	$41.1 \pm 1.4$	$96.2 \pm 1.4$	$41.3 \pm 1.6$
Final time at 10°C/10 days	$85.2 \pm 2.0$	$-4.1 \pm 1.1$	$41.9 \pm 2.8$	$95.7 \pm 1.8$	$42.1 \pm 3.0$

<sup>1</sup>  $L^*$  ranges between 0 and 100;  $a^*$  and  $b^*$  range between +120 and -120. <sup>2</sup> Immediately after treatment with 2% SMB, adjusting the pH to 2.91 with CA.

**Table 4.** Sensorial descriptors for sweet potatoes treated with sodium metabisulphite during 14 days at 5°C and 10 days at 10°C

Descriptor	5°C	10°C	Limit of acceptance
General appearance	4.0 ± 0.9	3.3 ± 0.7	3
Color	3.9 ± 1.0	3.2 ± 1.0	3
Exudate	1.7 ± 0.8	1.7 ± 0.8	1.5
Browning	2.6 ± 0.6	2.5 ± 0.5	1.5
Surface dehydration	2.2 ± 0.9	2.0 ± 0.9	1-5

## Conclusions

At refrigeration temperatures, treatment with 2% sodium metabisulphite, adjusted to pH 2.91 with citric acid resulted effective for conservation of sweet potatoes 'Colorada Correntina' variety. During storage, pH and titratable acidity had slight changes and levels of total sugars increased by almost 20%. The contents of ascorbic acid were affected, falling by over 30% and 56% at the end of the period of storage at 5 and 10°C respectively, and microbiological counts were less than internationally accepted levels. The superficial color was slightly modified and the sensorial attributes were rated as «acceptable» by the evaluators, having a greater shelf-life and organoleptic acceptability the sweet potatoes stored at 5°C.

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