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Acceptability and Cold Storage of Fresh-Cut Eggplant (Solanum Melongena L.) using Edible Coatings and Antioxidants

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Summary

Due to the global increasing demand for minimally processed market, the uses of alternative techniques aimed at reducing the browning and maintain nutritional quality is necessary. Therefore, we studied a method that meets the demand of consumers and results in better conservation of fresh-cut eggplants. The aim was to evaluate the acceptability and the cold storage of fresh-cut eggplants when edible gelatin and cassava starch coatings in association with antioxidants were used. The application of these edible coatings and antioxidants was efficient and it delayed withering and browning signals until 12day of cold storage maintaining its acceptability.

Keywords: Cassava starch; Gelatin; Antioxidants; Acceptability; Quality

Introduction

Eggplant (*Solanum melongena* L.) or aubergine, in especially is a climacteric fruit that belongs to the Solanaceae family and it is originally from India and China. They are an important food both from the economic and nutritional points of view, and are cultivated and consumed worldwide. They are a rich source of pro vitamin A, thiamine, riboflavin, niacin, ascorbic acid and polyphenols. Due to these aspects, the eggplant exhibits a high antioxidant potential and consequently help to prevent chronic and degenerative illnesses as shown in clinical studies, and their increased consumption in recent years [1,7]. Eggplant is highly perishable due to the exposure of their internal cellular tissues caused by peeling and cutting that promote the increase of metabolism, respiratory rate, ethylene production, water loss, softening and microbial contamination, so promoting chemical reactions that cause modifications, consequently, they reduce its lifetime [3,4]. These aspects have demanded studies in order to extend the storage life and to assure the quality of this product [5,6].

Due to these factors, the market for minimally processed fruits and vegetables has significantly increased in recent years and their appeal derives from their convenience and the decrease of generated waste, therefore the use of alternative techniques aimed at preventing the waste of these fruits is necessary [7]. Several preservation technologies have been applied and among them there is the usage of edible coatings on vegetables, which aims to a functional performance, to preserve the texture and nutritional value, to reduce the respiratory rate and the ethylene production and moreover to limit the loss or the excessive gain of water and to preserve the freshness. These ingredients can be polysaccharides, proteins and lipids [3,8].

Edible coatings in association with acids has been used in some fresh-cut technology and shown to be effective. Citric acid is an acidulant commonly used in the food industry and the ascorbic acid, one of the main antioxidants used in vegetable products, has an important role in the enzymatic browning prevention due to its efficiency in containing the product metabolic reactions [9]. Actually, edible coatings have gained an enormous importance and they represent an alternative to reduce the harmful effects provoked by the fresh-cut process. The consumer, while assessing the product initially, verifies it by its visual aspect. Thus, the enzymatic browning that occurs in the fresh-cut fruits can jeopardize their acceptability. Browning is the most common and important symptom of chilling injury occurring in pulp and seeds of eggplant, accompanied by development of off-flavor [5,10].

Currently, they are few studies relating fresh-cut eggplant and the use of edible coatings as conservation method. Despite the great benefits from using edible coatings, commercial applications of this technology on a broad range are still very limited, because the coatings do not established, concentrations due to the change of the quality sensory of the product that limits the purchase of such by the consumer and lack of scientific evidence. This method represents low risk, low cost and the sensory quality maintenance with consequent technological renovation. The present study aimed to evaluate the usage of edible gelatin and starch coatings in association with ascorbic acid and citric acid about aspects physicochemical, nutritional and sensory of the fresh-cut eggplants, with the purpose to increase the shelf-life and maintenance the nutritional quality and promote its use in fresh-cut market with low-cost technology.

Materials and Methods

Sample and chemicals

Dark purple eggplants (*Solanum melongena* L.) were purchased in the local market (Alfenas, MG and Brazil) and afterwards transported in an adequate way. Ascorbic acid (C6H8O6, ascorbate, Synth®, PubChem CID: 54670067) and citric acid (C6H8O7, Synth®, PubChem CID: 311) were obtained in powder form for a later dilution and both of them with a high analytical grade. Cassava starch (Amafil®) and flavorless and colorless powder gelatin (Dr. Oetker®). They were immediately processed: sanitization with 200 mg.L^{-1} sodium hypochlorite/ 15 min. ; cutting in slices (7 mm); immersion in an acid solution (0,5g of ascorbic acid + 0,5g of citric acid/1 L of water) for 1 min. and control (only water). The samples that were going to receive treatments were subsequently dipped in 1% and 3% w/v coating starch solutions (cassava starch) and in 1% and 3% w/v gelatin solutions (powder gelatin) for 1 min. ; drying (forced ventilation); wrapped (6 slices/ package) in polyethylene terephthalate packages with a lid (15 x 10 x 8 cm); cold storage in BOD at 5°C for 12 days .

Physicochemical analyses

The content of soluble solids (SS) was assessed by refractometry (Atago®, Tokio, Japan) (°Brix); pH by potentiometry (210MS Technopon LTDA, Piracicaba, Brazil); titratable acidity (TA) by the potentiometric method (NAOH solution 0.1N), expressed in % of lactic acid [11]. The color parameters was evaluated by manual colorimeter (CR 400, Konica MINOLTA®, Sensingin INC, Japan) in CIE L*, a* and b* mode, Hue angle and chromaticity according to [12] and Browning Index according to [13].

Acceptability analyses

Fifty consumers were recruited to participate to the sensory test (approval protocol ethics committee nº 236) in Sensory Evaluation Laboratory (Federal University of Alfenas, Minas Gerais, Brazil). All the samples were presented every 3 days in a balanced order until the 12° day. They were oriented to open the plastic and evaluated the appearance, color, aroma and global aspect of each sample on a 9-point hedonic scale (1, "extremely dislike"; 9, "extremely like"). A five-point scale was used to measurement of purchase intention (5," certainly purchase"; 1,"certainly not purchase") [14].

Statistical analyses

Thirteen physicochemical and sensory variables were analyzed by an analysis of variance. The experiment was conducted in a completely randomized design and 5x6 factorial schemes. Regression models were fit and orthogonal contrasts were performed at 5% of significance level. Five storage times (0, 3, 6, 9, 12 days) were combined the following 6 treatments: Control with water (Ct), control with acid (Cta), 1% w/v (S1) and 3% w/v (S3) cassava starch; 1% w/v (G1) and 3% w/v (G3) gelatin. All analysis was performed in SensoMaker and SensoMineR [15] in software R [16]. For a global joint inference, Parallel Factor Analysis (PARAFAC) was performed considering the dimensions: treatments (six), times (five) and variables (thirteen). It was also used the software R, with the package Three-way [17].

Results and Discussion

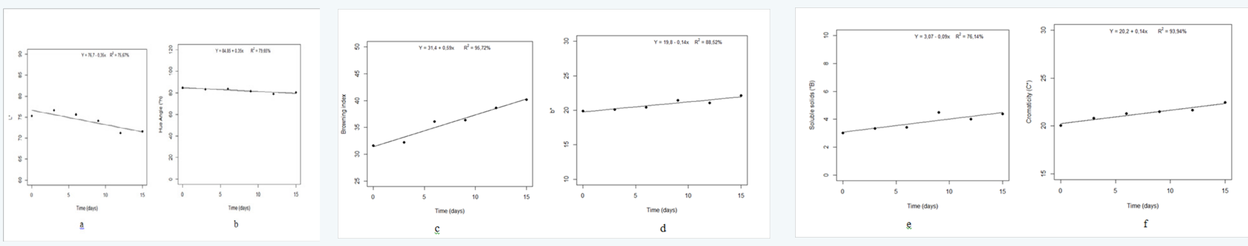

Figure 1: Physicochemical analysis of fresh-cut eggplant with edible coatings and antioxidants. a) Luminosity; b) Hue Angle; c) Browning Index; d) b* value; e) Soluble solids; f) Chromaticity.

All treatments showed a light browning starting from the 8th day of storage on according to the L* values and Hue as illustrated in (Figure 1a & 1b). There was a difference between G1% and G3% with a slight browning in the concentration of 1%. The darkest browning can be observed in Ct followed by G3%, once the most efficient treatments were S1% e G1%.

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The browning index varied in relation to time and to all the treatments, since a difference between the control and the acid control in the orthogonal contrast test was observed (Table 1). Furthermore, a difference between cassava starch and gelatin treatments. There was a difference between Ct and Ctac (Table 1) showing a higher browning in the samples without treatment. Regarding starch treatment and the gelatin a higher browning in G3% and G1% can be observed since starch was more efficient than gelatin in retaining the browning increasing over time in both concentrations (Figure 1c).

The coloration of pulp kept being yellowish showing a light decline over time according to b* values (Figure 1d &1e). The acid solution treatment demonstrated to be more efficient than the control in retaining the color intensity. Starch was more efficient than gelatin in delaying the browning intensity over time, without considering coating concentrations. There was a variation in the chromaticity over time and for all treatments (Figure 1f).

According to the contrast test there was a difference in chromaticity between Ct and Ctac (Table 1) and between cassava starch and gelatin treatments (Table 1). The use of protein films has represented a good alternative for the conservation, considering that they constitute a strong barrier against gases like CO_2 and O_2, even if they are weak against water vapor. Gelatin coatings of the present study constitute a good barrier against O_2, considering that they can be used in climacteric fruits as eggplants with the function of reducing the respiratory rate and, consequently, of delaying the senescence [9].

However, higher gelatin concentrations cannot be as efficient for this function as demonstrated in the present study where it is possible to observe that fruits coated with G1% concentration were more efficient in delaying the browning than G3%. Probably, these treatments were not able to preserve effectively the physicochemical characteristics.

One hypothesis that may explain such behavior for G3% is the fact that gelatin is an efficient barrier to O_2. Its higher concentration reduced the coating permeability to this gas, so favoring the anaerobic or fermentative respiratory pathway, which is an undesirable phenomenon in postharvest products because leads a quick deterioration, flavor loss, generating acetaldehyde, ethanol and CO_2 as byproducts [18]. Regarding browning index and hue angle there was a variation between time and treatments with a light browning starting from the 8th day on with higher browning in those which did not receive the treatment, followed by G1% and G3% treatments, meaning that, the eggplant browning can be observed by the action of enzymes and phenolics generated by the processing.

The cut stimulates PPO enzymatic activities, phenylalanine ammonia lyase (PAL) and peroxidase (POD). PAL activity stimulates the increase of the eggplant phenolic substrate synthesis, which are oxidized by PPO and POD enzymes turned into ortoquinonas responsible for browning [4]. The majority of the studies found in the literature relate the enzymatic browning to the substrate specificity effect, temperature, pH and to PPO antioxidants starting from the activity with eggplants [19-22].

However, an important strategy for the delay and the minimization of the enzymatic browning was the use of anti-browning agents such as ascorbic and citric acid which, due to the fact that they diminish pH and favor the inhibition of PPO enzyme activity, inhibit the formation of melanin compounds [23]. Beyond that [24] verified that cutting the eggplant with a sharp blade and dip it into water inhibits its fresh cut browning. Cassava starch in concentration of 1% and 3% was able to avoid browning. Several studies have described the effect of polysaccharides edible coatings in the reduction of respiratory rate in fresh products that attribute good oxygen barrier [3]. The acid solution treatment proved to be more efficient than the control in preventing the color intensification, and starch was more efficient than gelatin in avoiding browning over time, without considering the coating concentrations.

In relation to chemical physical parameters showed a lower SS values (Figure 1e and Table 1) than controls demonstrating that the application of coatings may have contributed to delay the ripening process. Respiration is an oxidative process which allows living cells to use their metabolic reserves as energy source, which causes modifications in vegetable tissues, ripening characteristics and in senescence. By this process, the starch present in the fruit is converted into sugars, increasing the soluble solid rate. Mechanical effects caused by cut, abrasion peeling or crush to which vegetable tissues are subjected can unchain several degrading reactions that stimulate respiratory activity and ethylene synthesis, with a consequent increase of sugar and organic acid consumption [9]. The S1% treatment showed a higher soluble solid rate than that with 3% S and G1% presented a higher soluble solid rate than that with G3%, demonstrating that respiration could have been higher in fruits with a lower coating amount.

SS registered a light increase over time and among treatments ($p<0.001$ and $p=0.0001$; overall average: 3.77) and this trend can be observed in the (Figure 1e). Treatments showed lower SS rate than controls, demonstrating that the application of coatings could have contributed to delay the ripening process demonstrating that respiration could have been higher in the fruits with smaller quantities of coatings (Table 1). Regarding acidity, there was a significant difference related to time and treatments. [25] verified that there was not any significant effect of the treatments for titratable acidity in intact eggplants with cassava starch coating or PVC film, observing this variation over the storage time. The titratable acidity oscillation over the storage time can be related to biochemical processes of the respiratory metabolism, that synthesizes acid and carbon skeleton in the same proportion as it consumes them. Only Cta treatment presented changes during the storage concerning TA

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(Figure 2) (Table 1). There was a decline followed by an increase since 10th day. As far as pH no significant differences observed (mean=5.21).

Table 1: Global Means and orthogonal contrast for the variables analyzed in fresh-cut eggplant with edible coatings and antioxidants.

Variables	Treatment	Means	Orthogonal Contrast *	Difference	p- Value1
	G1	75.27	Treated-controls		0.1519
	G3	72.55	Control -control + acid		0.2642
	S1	75.66	Starch- gelatin		0.2457
L*	S3	74.41	S1-S3		0.3642
	Ct	72.5	G1 - G3*	2.72	0.0495*
	Ctac	74.03			
	G1	20.17	Treated-controls		0.1132
	G3	21.28	Control -control + acid		0.1629
	S1	20.42	Starch- gelatin		0.7725
b*	S3	20.81	S1-S3		0.46
	Ct	20.82	G1- G3*	-1.11	0.0403
	Ctac	21.57			
	G1	21.602	Treated-controls		0.4084
	G3	21.672	Control -control + acid*	1.8538	0.042
	S1	21.101	Starch- gelatin*	-0.9	0.046
C*	S3	20.372	S1-S3		0.2491
	Ct	22.433	G1 - G3		0.9115
	Ctac	20.579			
	G1	37.428	Treated-controls		0.37
	G3	39.55	Control -control + acid*	4.77	0.0182
Browning Index	S1	35.061	Starch- gelatin*	-4.55	0.0017
	S3	32.81	S1-S3		0.258
	Ct	37.508	G1- G3		0.2862
	Ctac	32.736			
	G1	4.02	Treated-controls*	-0.3125	0.0217
	G3	3.58	Control -control + acid*	-0.6388	0.0044
	S1	3.88	Starch- gelatin		0.0906
Soluble solids	S3	3.19	S1-S3*	0.6944	0.0021
	Ct	3.66	G1 - G3*	0.4444	0.0447
	Ctac	4.3			
	G1	0.0111	Treated-controls	-0.0019	0.006
	G3	0.0111	Control -control + acid	-0.0038	0.001
	S1	0.0111	Starch- gelatin	0	1
Titratable acidity	S3	0.0111	S1-S3	0	1
	Ct	0.0111	G1 - G3	0	1
	Ctac	0.015			
	G1	5.261	Treated-controls		
	G3	5.205	Control -control + acid		
	S1	4.985	Starch- gelatin		
pH	S3	5.323	S1-S3		
	Ct	5.305	G1- G3		
	Ctac	5.197			

Legend: Control with water (Ct), control with acid (Ctac), 1% w/v (S1) and 3% w/v (S3) cassava starch; 1% w/v (G1) and 3% w/v (G3) gelatin. *No significant difference between groups. Empty cells: no statistical difference by ANOVA

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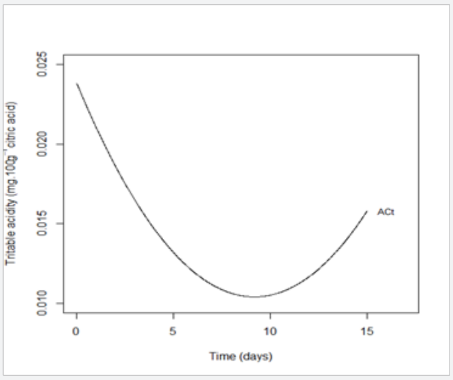

Figure 2: Changes in titratable acidity of treatment control with citric and ascorbic in fresh-cut eggplant with edible coating.

Acceptability Test

Appearance, color, global impression and purchase intention kept stable for S1%, S3% and G1% treatments along the storage time (Figure 3). Both S1% and S3% coatings were as efficient for the fresh-cut eggplant conservation as they were for the appearance attributes (A1% mean = 6.4; A3% mean = 6.7), color (A1% mean = 6.5; A3% mean = 6.7) and for the global impression (A1% mean = 6.351; A3% mean = 6.455), whose means remained constant over time. Concerning these attributes, G1% showed good results with constant average values over the storage time for the appearance (G1% mean = 6.2), color (G1% mean = 6.2) and global impression (G1% mean = 6.2). On the other hand, G3% was the treatment that suffered the highest decline, followed by acid control in appearance, color and global impression (Figure 3a,3b & 3e). Control suffered the most significant decline over the storage time in all evaluation parameters, demonstrating that the application of edible coatings was more efficient in the eggplant conservation than in the case of no application at all.

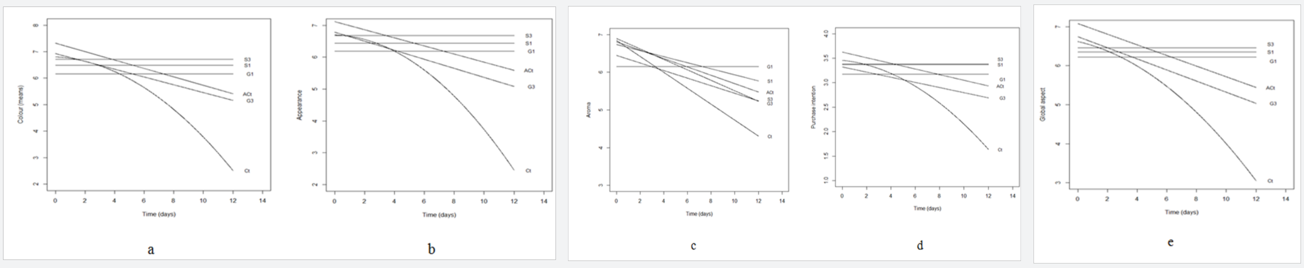

Figure 3: Sensory Evaluation and purchase intention of fresh-cut eggplant with edible coatings and antioxidants. Legend: Control with water (Ct), control with acid (Ctac), 1% w/v (S1) and 3% w/v (S3) cassava starch; 1% w/v (G1) and 3% w/v (G3) gelatin. a) color; b) appearance; c) aroma; d) purchase intention; e) global aspects.

This decline can be due mainly to the brightness loss, browning, peel depressions and a light fungal attack symptoms observed over the trial. Aroma remained stable only in the case of G1%. Control suffered the most significant decline over time in this attribute, followed by S3% and G3% (which showed very similar behaviors and values), acid control and finally by S1%. S1% and G1% showed the best results in this parameter, considering that starch began with acceptance means higher than the gelatin ones, but it declined slightly over time, while gelatin remained constant.

Although fruit respiratory rate and the production of CO_2, H_2O and fermentation byproducts have not been measured in this study, treatments with the lowest concentration were more efficient in the aroma conservation. Perhaps, a lower coating concentration has facilitated a respiratory behavior more similar to that one in natural fruit, so causing a major aroma conservation, which is lost when the fruit performs its normal anaerobic respiration. Observing the results, it can be verified that S1%, S3% and G1% are characterized by the variables predominant in time 0.

Luminosity, Hue angle are strictly related. Ctac was characterized by the variables predominant in the 9th and 12th day and this is in contrast with the other variables, which were highly related to the browning index. As far as sensorial variables are concerned, G3% concentration was not efficient either and did not maintain the appearance, color, global impression, and purchase intention and moreover it did not conserve the product aroma. S1% and S3% proved to be efficient in the fresh-cut eggplant conservation mainly related to appearance and global impression.

In a similar study, [25] verified that 3% cassava starch edible coating was efficient to prolong the post-harvest lifetime of intact eggplants for 12 days. This conclusion was based on the external intact fruit appearance, whose evaluation parameters were freshness degree, size, shape, color, hygiene, ripeness and absence of defects. However, there was a decline of appearance over time. In the present study, sensorial attributes were maintained only for S1%, S3% and G1% over time. Considering that eggplants are climacteric fruits, they show a rapid increase in determinate phases of the ripening which are marked in the respiration and in the ethylene production that cause modifications in texture, flavor and aroma.

The Parafac results are shown in Figure 4 which has evaluated simultaneously three dimensions: treatments, independent variables and times. It is suggest the superiority of cassava starch treatments, its correlation with luminosity, Hue angle

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and sensorial variables, as well as the correlation with fresh eggplants (time 0). As expected, cassava starch treatments were negatively correlated with browning index and large storage times. Therefore, the application of acids by itself is not sufficient to preserve the fruit until end of the storage period (12th day). The acids and the edible coatings agents are welcome for that goal, mainly cassava starch solutions variables that showed are to be fundamental to assess the quality of this product.

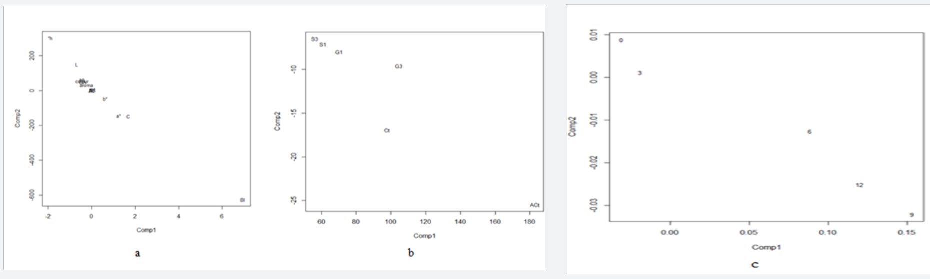

Figure 4: Parafac analysis by fresh-cut eggplants with edible coatings and antioxidants. Control with water (Ct), control with acid (Ctac), 1% w/v (S1) and 3% w/v (S3) cassava starch; 1% w/v (G1) and 3% w/v (G3) gelatin. a) variables; b) treatments; c) times.

Conclusion

An association of antioxidants (0,5% citric + 0,5% ascorbic acids) with cassava starch coating (S1% and S3% w/v) and/or gelatin 1% w/v are recommended as the most efficient in preserving the quality of fresh- cut eggplant stored at 5°C for 12 days.

References

1. Nisha P, Nazar A, Jayamurthy P (2009) A comparative study on antioxidant activities of different varieties of Solanum melongena. Food Chem Toxicol 47(10): 2640-2644.
2. Moretti CL, Pinelli OL (2005) Qualidade química e física de berinjelas submetidas a diferentes tratamentos pós-colheita. Ciência e Tecnologia de Alimentos 25(2): 339-344.
3. Ghidelli C, Mateos M, Rojas-Argudoa C, Pérez-Gago M (2014) Extending the shelf life of fresh-cut eggplant with a soy protein-cysteine based edible coating and modified atmosphere packaging. Postharvest Biology and Technology 95: 81-87.
4. Hu W, Jiang A, Tian M, Liu C, Wang Y (2010) Effect of Ethanol treatment on physiological and quality attributes of fresh-cut eggplant. J Sci Food Agric 90(8): 1323-1326.
5. Gao H, Kang LA, Liu Q, Cheng N, Wang B, et al. (2015) Effect of 24-epibrassinolide treatment on the metabolism of eggplant fruits in relation to development of pulp browning under chilling stress. Journal of Food Science and Technology 52(6): 3394-3401.
6. Li X, Jiang Y, Li W, Tang Y, Yun J (2012) Effects of ascorbic acid and high oxygen modified atmosphere packaging during storage of fresh-cut eggplants. Food Sci Technol Int 20(2): 99-108.
7. Zaro MJ, Chaves AR, Vicente AR, Concellón A (2014) Distribution, stability and fate of phenolic compounds in white and purple eggplants (Solanum melongena L.). Postharvest Biology and Technology 92: 70-78.
8. Trigo JM (2012) Effect of edible coatings on minimally processed papaya conservation. Brazilian Journal of Food Technology 15: 125-133.
9. Gonçalves AISR (2007) Efeito da aplicação de revestimentos comestíveis enriquecidos em antioxidantes na conservação de frutos minimamente processados. Tese de mestrado. Controlo da Qualidade e Toxicologia dos Alimentos. Faculdade de Farmácia. Universidade de Lisboa, Portugal.
10. Concellón A, Zaro MJ, Chaves AR, Vicente AR (2012) Changes in quality and phenolic antioxidants in dark purple American eggplant (Solanum melongena L. cv. Lucía) as affected by storage at 0°C and 10°C. Postharvest Biology and Technology 66: 35-41.
11. (2008) Métodos Físico-Químicos para Análise de Alimentos (4th edn), pp: 1020.
12. Mcguire RC (1992) Reporting of objective color measurements. Hort Science 27(12): 1254-1255.
13. Pineli LLO, Moretti CL, Almeida GC, Nascimento ABG, Onuki ACA (2005) Association of modified atmospheres and antioxidants reduce browning of minimally processed potatoes. Horticultura Brasileira 23(4): 993-999.
14. Villanueva N, Da Silva, MAA (2009) Comparative performance of the nine-point hedonic, hybrid and self-adjusting scales in the generation of internal preference maps. Food Quality and Preference 20: 1-12.
15. Husson F, Le S, Cadoret M (2014) Senso Mine R: Sensory data analysis with R. R package version 1.20.
16. R Development Core Team (2016) R: a language and environment for statistical computing. Vienna: R Foundation for Statistical Computing (software).
17. Giordani P, Kiers HAL, Del Ferraro MA (2014) Three-Way Component Analysis Using the R Package Three Way. Journal of Statistical Software 57(7): 1-23.
18. Maia LH, Porte A, Souza VF (2000) Filmes comestíveis: aspectos gerais, propriedades de barreira a umidade e o oxigênio. Boletim CEPPA 18 (1).
19. Almeida MEM, Nogueira JN (1995) The control of polyphenol oxidase activity in fruits and vegetables. Plant Foods Hum Nutr 47(3): 245-256.
20. Dogân M, Arslan O, Dogân S (2002) Substrate specificity, heat inactivation and inhibition of polyphenol oxidase from different aubergine cultivars. International Journal of Food Science and Technology 37: 415-423.
21. Cheriot SC, Billaud C, Nicolas J (2006) Use of experimental design methodology to repair Maillard reaction products from glucose and cysteine inhibitors of polyphenol oxidase from eggplant (Solanum melongena). J Agric Food Chem 54(14): 5120-5126.
22. Todaro A, Cavallaro R, Argento S, Branca F, Spagnaet, G (2011) Study and characterization of polyphenol oxidase from eggplant (Solanum melongena L.). J Agric Food Chem 59(20): 11244-11248.

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23. Silva MRV, Rosa CILF, Vilas Boas EVB (2009) Conceitos e métodos de controle do escurecimento enzimático no processamento mínimo de frutas e hortaliças. Boletim CEPPA 27(1): 83-96.

24. Mishra BB, Gautam S, Sharma A (2012) Browning of fresh-cut eggplant: Impact of cutting and storage. Postharvest Biology and Technology 67: 44-51.

25. Souza PA, Aroucha EMM, Souza AED, Costa ARFC, Ferreira GS, et al. (2009) Conservação pós-colheita de berinjela com revestimentos de fécula de mandioca ou filme de PVC. Horticultura Brasileira 27: 235-239.

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