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Physico-Chemical Properties of Peeled Garlic Stored Under Refrigerated Condition

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Abstract

A study on effect of refrigerated storage on physico-chemical properties of peeled garlic cloves was carried out under $CaCl_2$, gingelly oil pretreatment and untreated garlic stored in HDPE and LDPE packages with ventilation (0.3%) and without ventilation under refrigerated condition. The treatments were evaluated for the physiological loss in weight (PLW) and its physico-chemical properties such as ascorbic acid,titrable acidity, pyruvic acid content,oleoresin, protein and total soluble solids. Gingelly oil pretreated cloves had a shelf life of 42 days, followed by $CaCl_2$ pretreated cloves 30 days and untreated cloves 18 days under HDPE package without ventilation in refrigerated condition. Ascorbic acid, titrable acidity, pyruvic acid (pungency), oleoresin, protein content of peeled garlic cloves were found to be decreased during storage and total soluble solids found to be slightly increased. Among the various treatments, T_5, T_{10} and T_{14} were found to be better with regard to all the sensory and quality parameters during storage days of 30, 42 and 18.

Key words : Peeled garlic, Minimal processing, Chemical, Physical properties, Storage.

Garlic (*Allium sativum* L) is the second most widely cultivated spice and used allium next to onion. Peeled garlic is one of the minimally processed produce. In recent years, the consumers are more health conscious in their food choice but have less time to prepare healthy dishes. As a result, the market demands for minimally processed/slightly processed products have rapidly increased. Undesirable physiological changes are one of the most crucial problems in minimal processing. Loss of cellular integrity at the wet surface of the product destroys the compartmentation of enzymes and substrates. Browning reactions and formation of unwanted secondary metabolism are often undesirable consequences. Senescence may accelerate and off-flavors may develop as respiration and ethylene production increases near the cut surface. Also, the exudate from the cut surface is a favorable medium for fungal and bacterial growth. Recently, consumption of garlic is continuously increasing because of various physiological effects on human beings such as anti-cancer, cholesterol-lowering and anti-oxidation activities. The medicinal values of garlic have boosted the scope for the production of the crop. The major objective of this investigation was to study the quality parameters of peeled garlic cloves for short-term preservation and to study the changes such as physiological loss weight and bio-chemical parameters.

Methods

The investigation was carried out on uniform sized, white color garlic bulbs procured from vegetable market in Bangalore. A study on peeled garlic cloves was undertaken to evaluate the effect of packaging material LDPE and HDPE packages of 200 gauge measuring 15 × 10 cm^2 with (ventilation 0.3% and without ventilation) perforation levels and pretreated with calcium chloride (2%), gingelly oil and untreated samples on the shelf-life under refrigerated storage (10C).

For determining the physiological loss in weight (PLW), weight of peeled garlic cloves with package was recorded using an electronic balance at periodic intervals. The PLW was computed from the difference in cloves weight on first day to the subsequent day. The PLW was expressed in per cent either on daily or on cumulative basis from one period to another. Physiological loss in peeled garlic cloves weight was calculated using the formula.

$$\text{PLW (\%)} = \frac{\text{Initial weight—Weight after known storage period}}{\text{Initial weight}} \times 100$$

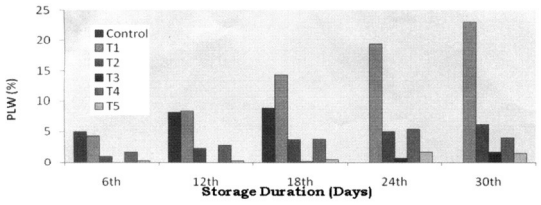

Figure 1. PLW in $CaCl_2$ pretreated of peeled garlic cloves stored at 10 C.

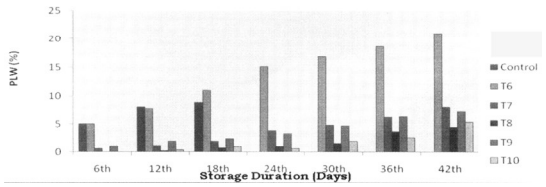

Figure 2. PLW in gingelly oil pretreated of peeled garlic cloves stored at 10 C.

The ascorbic acid content of peeled garlic clove samples was estimated according to the method suggested by Ranganna (1). Pyruvic acid (pungency) content in the peeled garlic clove samples was estimated by the spectrophotometric measurement. The total titrable acidity of peeled garlic clove samples was determined by visual titration method suggested by Ranganna (1). The protein content of peeled garlic samples was determined by using Kjeldahl method. Oleoresin of peeled garlic cloves was estimated by using solvent extraction method. The total soluble solids of peeled garlic clove samples were recorded in ^{0}Brix by using a hand refractometer (Erma Optical works Ltd., Japan). Peeled garlic cloves were organoleptically evaluated by a panel of experts for color, texture, aroma and overall acceptance. The quality was evaluated using 5 point Hedonic scale.

Results and Discussion

Physiological Loss in Weight (PLW)

The physiological loss in weight (PLW) of peeled garlic cloves showed a continuous increase irrespective of pre-treatment or the package material used with the increase in storage period (Figs. 1, 2 and 3). This is mainly attributed to the continuous moisture and other nutrient loss as the garlic cloves are alive and are actively involved in the physiological processes like respiration and traspiration (2). PLW had increased along with storage period at room temperature but it slowly increased at room temperature. The results are in line with the findings of Nuevo and Bautista (3).

Biochemical Analysis

The biochemical quality parameters of peeled garlic cloves were estimated immediately after removing peeled garlic cloves from refrigerated storage. The influence of different pretreatments and packages on quality parameters of stored peeled garlic cloves are presented in Tables 1.

Ascorbic Acid. The ascorbic acid content of peeled garlic cloves during storage was maximum (11.03 mg/100g) in $CaCl_2$ pretreatment (T_5), followed by 8.29 mg/100 g in gingelly oil pretreatment (T_{10}) and 8.06 mg/100 g in untreated sample (T_{14}). Also, the decrease in ascorbic acid content during ripening process may be due to oxidation of L-ascorbic acid into dehydro ascorbic acid (4). With garlic, it was found that dry peeling was better than wet peeling in reducing microbial populations and preserving ascorbic acid content.

Pyruvic Acid Content. The pyruvic acid content (pungency) of peeled garlic during storage showed a maximum value of 121.3 mg/100 g in $CaCl_2$ pretreatment (T_5), followed by 124.1 mg/100 g in gingelly oil pretreatment (T_{10}) and 96.70 mg/100 g in untreated treatment (T_{14}) at the end of shelf life. The anthocyanins are the most important group of natural pigments. Anthocyanins are water soluble pigments sensitive to both pH and heat. Garlic tissue contains a low level of pyruvic acid that is not a product of the allin to allicin reaction.

Protein Estimation. Protein content in fresh

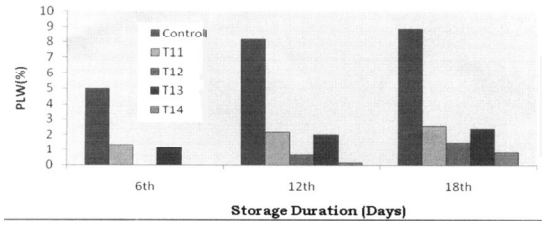

Figure 3. PLW in untreated peeled garlic cloves stored at 10 C.

Table 1. Effect of different pretreatments on bio-chemical properties of peeled garlic in LDPE and HDPE packages, during refrigerated storage condition.

Treatment	TSS (^{0}Brix)	Ascorbic acid (mg/100 g)	Titratable acidity (%)	Oleoresin (%)	Protein (%)	Pyruvic acid (mg/100 g)
T_1	51.0	5.70	0.315	0.47	2.70	70.35
T_2	43.4	8.70	0.393	0.60	3.57	98.41
T_3	41.0	9.87	0.246	1.01	5.25	110.1
T_4	40.8	9.05	0.393	0.71	4.25	98.83
T_5	38.6	11.03	0.295	1.13	5.58	121.3
T_6	48.0	3.52	0.424	0.42	2.52	80.75
T_7	42.9	4.71	0.344	0.73	4.28	86.03
T_8	39.0	7.05	0.321	1.22	4.55	115.0
T_9	42.2	5.88	0.420	0.84	3.83	98.81
T_{10}	37.9	8.29	0.333	1.32	5.68	124.1
T_{11}	43.4	6.47	0.322	0.44	3.07	79.25
T_{12}	41.0	7.58	0.274	0.62	4.37	92.53
T_{13}	40.8	7.30	0.367	0.43	3.83	86.06
T_{14}	38.0	8.06	0.318	1.09	5.05	96.70
Control	51.0	5.71	0.393	0.26	2.63	75.35
Fresh	32	13	0.6	1.94	6.30	145.3
Mean	41.93	7.62	0.36	0.82	4.21	98.67
F-test	*	*	*	*	*	*
SE	0.312	0.029	0.001	0.007	0.056	0.938
CD	0.901	0.085	0.005	0.022	0.164	2.70

peeled garlic cloves was 6.30%. The protein content of peeled garlic during storage showed a maximum value of 5.58% in $CaCl_2$ pretreatment (T_5), followed by 5.68% in gingelly oil pretreatment (T_{10}) and 5.05% in untreated samples (T_{14}) at the end of shelf life.

Titrable Acidity. In refrigerated storage conditions, titrable acidity of peeled garlic cloves was found to be slightly decrease with irrespective of packages and pretreatments (Table 1). The fresh peeled garlic showed 0.60% titrable acidity while in control garlic cloves, it was 0.39%. The decrease in acidity during ripening may be due to conversion of acids to sugars or it may be due to utilization of organic acid in respiratory process (5).

Total Soluble Solids (TSS). The peeled garlic cloves stored at 10C showed a marginal increase in total soluble solids (Table 1) due to pretreatment and package treatments. The total soluble solids of cloves increased as ripening of the cloves advances owing to the greater degradation or biosynthesis of the polysaccharides and accumulation of sugars. It was noticed that in case of fresh garlic peeled cloves, the extent of TSS was 32.1^{0}Brix, and for control, it was 52 ^{0}Brix. It was observed that TSS of peeled garlic increased as storage duration increased.

Oleoresin. Garlic oleoresin is a dark viscous liquid, having 12 times the flavor of that of fresh garlic cloves. It is observed that the oleoresin content decreased with significantly among various treatments. The fresh peeled garlic showed 1.94% oleoresin while in control garlic cloves, it was 0.26%.

Conclusion

Among three pretreated samples, gingelly + HDPE package without ventilation was found to be best treatment with regard to all sensory and quality parameters. The final finding is that gingelly oil treatment with HDPE package maintained good quality and long shelf life of 42 days with holding all biochemical qualities during storage of peeled garlic cloves.

References

1. Ranganna S. 1986. *Hand Book of analysis and quality control for fruit and vegetable products.* 2nd edition.

Tata McGraw-Hill Pub. Co., New Delhi, India.

2. Biale J. B. 1975. Synthetic and degradative process in fruit ripening. *In* N. F. Hard and D. K. Salunkhe (eds.). *Post harvest biology and handling of fruits and vegetables.* The AVI Publ. Co., West port, Connecticut, USA.
3. Nuevo P. and O. K. Bautista. 2001. Morpho-anatomical features and post-harvest changes in garlic (*Allium sativum* L.) harvested at different maturities. *Acta Horticulturae S* 6 : 555.
4. Mapson C. W. 1970. Vitamin in fruits. Pp. 369—383. *In Biochemistry of fruits and their products.* Volume 1. A.C. Hulme (ed). Academic press. London, UK.
5. Ulrich R. 1970. Organic acid. Pp. 89—115. *In* A. C. Hulme (ed). *The biochemistry of fruits and their products.* Volume 1. Academic Press, New York, USA.