KOREAN J. FOOD SCI. TECHNOL.
Vol. 18, *No.* 4 (1986)

Postharvest Changes in Quality and Biochemical Components of Perilla Leaves

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들깻잎의 수확후 품질 및 성분변화

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Abstract

This study was carried out to determine the shelf-life and quality changes of perilla leaves (*Perilla ocimoides* L.) in relation to changes in the concentration of biochemical components during storage. The shelf-life of perilla leaves was 2 to 3 days at room temperature and 6 days at 3°C. This was extended to 12 days at room temperature and 20 days at 3°C by packaging in a 0.01 *mm* thick polyethylene film sack (PEFS). The ascorbic acid concentration of fresh perilla leaves was 23 *mg* per 100 *g* fresh weight. This declined to 16 *mg* per 100 *g* fresh weight on the 4th day of storage in all treatments. Ascorbic acid concentrations decreased further to 7 *mg* on the 8th day at room temperature and 8 *mg* per 100 *g* on the 16th day at 3°C in PEFS. Total and reducing sugar concentrations in the controls were higher than those in the PEFS storage at room temperature. Protein and free amino acid concentrations gradually increased during storage. A higher protein level was maintained in the control than in the PEFS treatment. Changes in nucleic acid concentration and peroxidase and polyphenoloxidase activities during storage were also measured in relation to the changes in quality of perilla leaves.

Introduction

Among fresh vegetables consumed in Korea, perilla leaves are popular. Figures on the production of perilla leaves as a fresh vegetable are not available, but most families and restaurants in Korea often serve this with leaf lettuce and meat. Annual production of perilla leaves is estimated to be about ten thousand metric tons, one quarter of the leaf lettuce production of 1983.[1] Seeds of the perilla plant are a source of vegetable oil in Manchuria, Korea, Japan, and Northern India.[2] However, studies on the perilla leaf as a vegetable are very few.

The objectives of this study were: 1) to determine the shelf-life of perilla leaves at different temperatures and 2) determine the changes in concentration of several biochemical components and enzyme activities related to the shelf-life over the storage period.

Materials and Methods

Perilla leaves (*Perilla ocimoides* L.) of a local leading cultivar in Suweon were used for this study. The leaves were harvested and immediately transported to laboratory. Ten to 15 sheets of uniform leaves (7 to 10 *g*) were packaged in a sack of high density polyethylene film (PEFS; 25 *cm* width, 30 *cm* length, and 0.01 *mm* thickness, manufactured by Honam Oil Refining Co.). The sacks containing the leaves were transferred to an enameled metal vat and stored in an Incubator at 3 ± 1°C or in a dark room at about 20°C. Control treatments were prepared without PEFS packaging. Visual rating of quality was made by the method used in the previous report.[3] Scores of three and below are unmacketable and would not be eaten.

Five grams of leaves were ground in a mortar with an adequate volume of metaphosphoric acid-acetic acid solution for the determination of ascorbic acid. The slurry was filtered, and 2.0 *ml* aliquots of filtrate were titrated with 2, 6-dichloroindophenol.[4] A spectrophotometric

method was used to measure chlorophyll concentration.[5] The determination of sugar, protein, free amino acid, nucleic acids and activities of peroxidase (PO) and polyphenoloxidase (PPO) were conducted as described earlier.[3] Chemical reagents were purchased from Sigma, Merck, Wako, and Kanto Chemical Companies.

Results and Discussion

The effect of storage upon quality of perilla leaves is shown in Fig. 1. Lower storage temperature and packaging in PEFS lengthened the marketable and edible life of perilla leaves. Leaves packaged in PEFS could be stored about 12 days at room temperature and 20 days at 3°C. The storage period of perilla leaves in PEFS packaging was longer at room temperature but shorter at 3°C than that of leaf lettuce.[3]

Ascorbic acid concentrations greatly decreased during storage (Fig. 2). The initial concentration of ascorbic acid was 23 *mg* per 100 *g* fresh weight, almost the same as leaf lettuce.[3] After storage at 3°C for 4 days for controls, 8 days in PEFS at room temperature, and 16 days in PEFS at 3°C, the ascorbic acid concentrations were 18 *mg*, 6 *mg*, and 8 *mg* per 100 *g* fresh weight maintaining edible quality, respectively.

The chlorophyll concentration of perilla leaves was 5.6 *mg* per *g* dry weight. This changed slightly during storage at 3°C, but decreased greatly in control leaves at room temperature (Fig. 3). According to Hosoda *et al.*,[6] Imamura and Shimuzu,[7] and Eskin *et al.*,[8] the breakdown of cholorophyll is closely associated with lipoxygenase and chlorophyllase activities. An increase or stabilization of

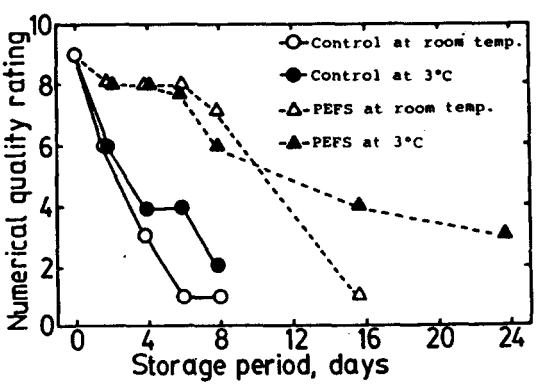

Fig. 1. Changes in quality of perilla leaves, scored by visual observation, during storage at room temperature and 3°C
PEPS; polyehylene film sack packaging

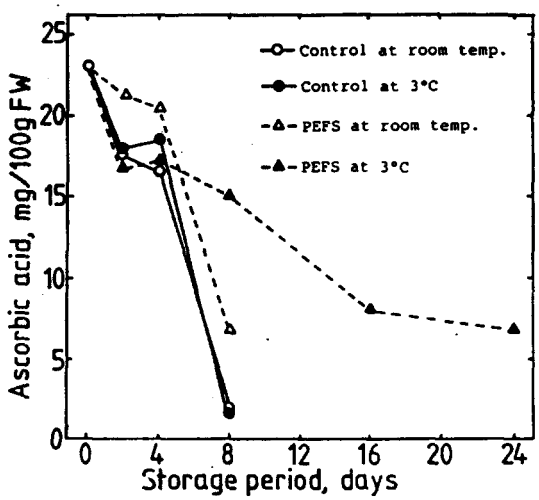

Fig. 2. Changes in ascorbic acid concentration of perilla leaves during storage

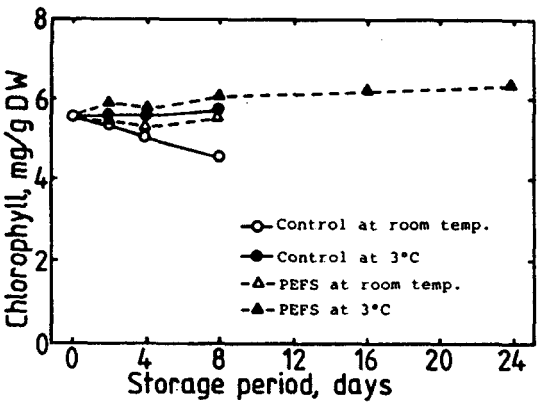

Fig. 3. Changes in chlorophyll concentration of perilla laeves during storage

the activities of these macromolecules may indicate a stimulation of leaf senescence during storage.

Total and reducing sugar concentrations gradually increased during storage (Table 1). This trend was also found by Singh *et al.*[9] for lettuce. The concentrations of sugars at room temperature were higher in the control than for PEFS storage.

Protein and free amino acid concentrations gradually increased during storage (Fig. 4). These trends agree with the results of Nawa *et al.*[10] for Chinese cabbage. Control leaves had higher protein levels than those in PEFS at both 3°C and room temperature. The concentrations of free amino acids in the control at room temperature were lower than those of PEFS, but at 3°C, the concentrations in the control were a little higher than those of PEFS, and showed a small increase during storage.

Table 1. Changes in total and reducing sugar concentrations of perilla leaves during storage at 3° and 20°C

Storage period	Treatment	Low temp., 3°C		Room temp., 20°C	
		Total sugar	Reducing sugar	Total sugar	Reducing sugar
Day		% dry weight base		% dry weight base	
0	Control	6.10	4.05	6.10	4.05
2	Control	7.32	5.95	7.52	5.91
	PEFS*	5.76	4.13	6.61	4.77
4	Control	7.03	5.80	7.13	6.04
	PEFS	8.62	6.55	6.18	5.11
8	Control	9.15	7.51	8.34	7.12
	PEFS	8.79	6.66	5.47	5.43

* Packaging of polyethylene film sack, 0.01 *mm* thickness, 30 *cm* length, and 25 *cm* width.

RNA concentrations remained nearly constant during storage except on the second day (Fig. 5). DNA levels increased during storage. At room temperature, DNA concentrations were similar for the control and PEFS treatment. At 3°C, however, DNA levels were higher in the control than the PEFS treatment. These trends were almost the same result of Nawa *et al.*[10] for Chinese cabbage in storage.

The activities of peroxidase (PO) and polyphenoloxidase (PPO) increased with the progress of the storage period after a slight decrease at the beginning (Fig. 6). PO activity in control leaves at 3°C were higher than those in PEFS. At room temperature, this relationship was reversed. PPO activities were higher in PEFS than in the control at both 3°C and room temperature. The PO and PPO activities increased with the progress of leaf senescence.[11] The results, therefore, suggest that the increase in activity of PO and PPO at the later stages of storage might be related to leaf senescence and result in poor quality.

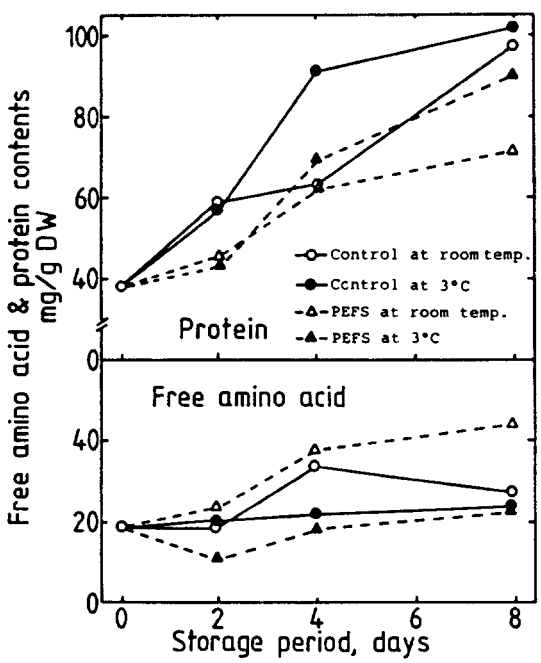

Fig. 4. Changes in total free amino acid and alkali soluble protein concentrations in perilla leaves during storage

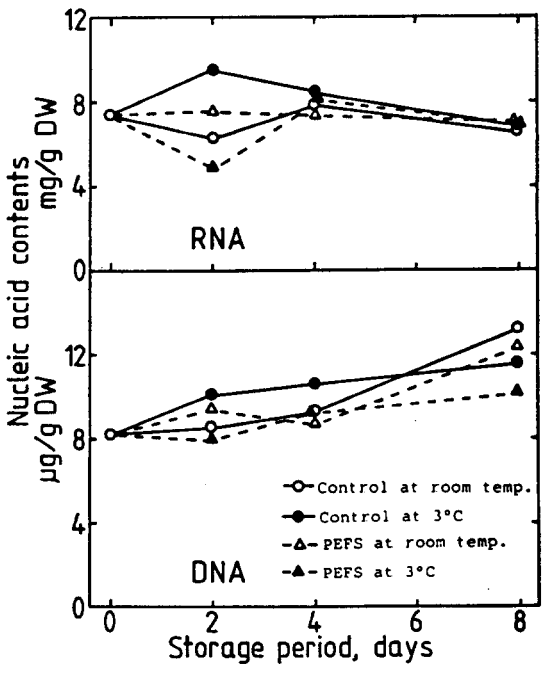

Fig. 5. Changes in nucleic acids of perilla leaves during storage

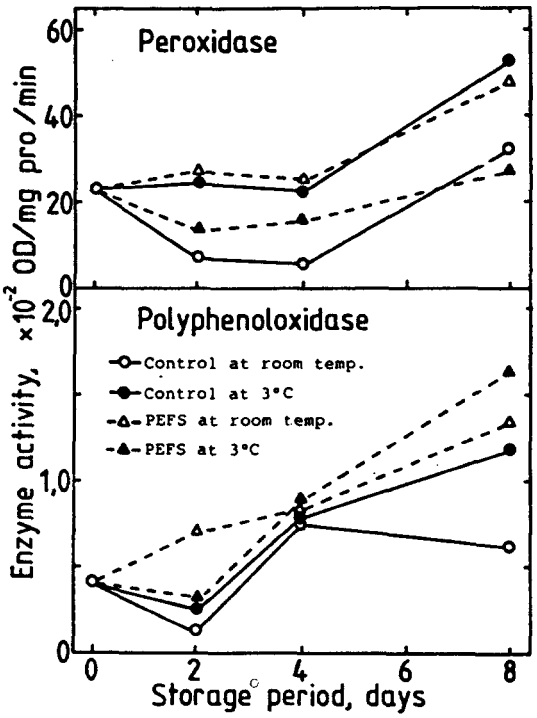

Fig. 6. Changes in peroxidase and polyphenoloxidase activities of perilla leaves during storage

요 약

들깻잎(*Perilla ocimoides L.*)의 수확후 저장온도에 따른 채소로서의 shelf-life와 저장기간중의 생화학적인 성분변화를 품질변화와 관련하여 분석하였다. 들깻잎은 실온(20℃)에서 2~3일간, 저온(3℃)에서는 6일간 저장이 가능하였고 비닐포장에 의하여 실온에서는 12일, 저온에서는 20일간 저장이 가능하였다. 신선한 들깨잎의 비타민 C 함량은 생체중으로 23*mg*%이었고 저장 4일째까지는 모든 처리구에서 16*mg*%이상이었으나 그 후에는 크게 감소하였으며 비닐포장에 의하여 저장 8일후에 실온에서 7*mg*%, 16일후에 저온에서 8*mg*% 유지되었다. 엽록소함량은 실온의 대조구에서는 저장중에 감소하였으나 저온에서는 큰 변화가 없었다. 환원당 및 전당함량은 실온저장에서는 비닐포장에 의하여 낮아졌고 저온저장에서는 증가하는 경향이었으며 처리간의 차이는 뚜렷하지 않았다. 단백질과 유리아미노산 함량은 저장중에 서서히 증가하였고 비닐포장처리구보다 대조구에서 높은 단백질수준을 유지하였다. 핵산함량, peroxidase, polyphenoloxidase 활성의 변화 등을 측정하였고 들깻잎의 품질변화와 관련하여 고찰하였다.

감사의 말

본 연구를 할 수 있도록 격려해 주신 농촌진흥청 농업기술연구소 정태영박사님과 실험을 도와준 김동헌군에게 깊이 감사하는 바입니다.

References

1. Ministry of Agriculture and Fisheries, Republic of Korea: *Statistical Year Book of Agriulture, Forestry and Fisheries*, Ministry of Agriculture and Fisheries, Seoul Korea (1983)
2. Kirschenbauer, H.G.: *Fats and Oils*, Reinhold Publishing Corp., New York, p. 178 (1960)
3. Kim, S.Y., Hong, Y.P. and Choi, W.Y.: *Res. Rep. Agri. Sci. Tech. Chungnam Natl. Univ. Korea*, **12**(1), 128 (1985)
4. A.O.A.C.: *Official Methods of Analysis*, 13th ed., Association of Official Analytical Chemists, Washington, D.C., p. 746 (1980)
5. Arnon, D.I.: *Plant Physiol.*, **24**, 1(1949)
6. Hosoda, H., Nawa, Y. and Kurogi, M.: *Rept. Natl. Food Res. Inst.* (Japan) **37**, 47 (1980)
7. Imamura, M. and Shimuzu, S.: *Plant Cell Physiol.*, **15**, 187 (1974)
8. Eskin, N.A.M., Henderson, H.M., and Townsend, R.J.: *Biochemistry of Foods*, Academic Press, New York, p. 240 (1971)
9. Singh, B., Wang, D.J., Salunkhe, D.K. and Rahman, A.R.: *J. Food Sci.*, **37**, 52 (1972)
10. Nawa, Y., Hosoda, H. and Kurogi, M.: *Rept. Natl. Food Res. Inst.* (Japan). **37**, 25 (1980)
11. Thomas, H. and Stoddart, J.L.: *Ann Rev. Plant Physiol.*, **31**, 83 (1980)

(1986년 2월 22일 접수)