Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5859

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 965-970 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Retention of Ascorbic Acid Content of Selected Greens in Different Drying Methods and Across Storage

Sushmita Khatoniar*, Mridula Saikia Barooah and Premila L. Bordoloi

College of Home Science, Assam Agricultural University, Assam

*Corresponding Author E-mail: sushmitakhatoniar@gmail.com

Received: 9.10.2017 | Revised: 14.11.2017 | Accepted: 21.11.2017

ABSTRACT

Ascorbic acid is an important and essential nutrient for humans and it acts as an antioxidant. The present study was conducted to evaluate the retention of ascorbic acid of six green leafy vegetables after drying by four different drying methods and degradation of ascorbic acid during storage. The green leafy vegetables selected were Amaranthus spinosus, Chenopodium album, Rumex vesicarius, Spinacia oleracea, Hibiscus sabdariffa and Diplazium esculentum. Among the green leafy vegetables, ascorbic acid content was highest in Amaranthus spinosus (32.29 mg/100g). After dehydration, shade dried Amaranthus spinosus showed highest retention of ascorbic acid (11.47 mg/100g). The cabinet dryer dried greens were studied for its shelf life using different packaging materials. It is observed that the retention of ascorbic acid was maximum in HDPE pouches, followed by plastic bottles. Degradation of ascorbic acid was maximum in PP pouches across 6 months of storage. Among the greens, Amaranthus spinosus retained highest amount of ascorbic acid as compared to other greens after the end of storage period of 6 months.

Key words: *Dehydration, Ascorbic acid, Areen leafy vegetables*

INTRODUCTION

Ascorbic acid is one of the essential nutrients for human being and certain other animal species, in which it functions as a vitamin. Ascorbate acts as an antioxidant in living organisms, while ascorbic and other organic acids have been known to enhance mineral uptake and solubility[5]. Many animal species are capable to synthesize vitamin C, but it is not possible by humans. Humans are not capable to manufacture the enzyme L-gulolactone oxidase, which is responsible for the synthesis. Ascorbic acid has four isomers and among them only L-ascorbic and araboascorbic (or erythorbic) acids have physiological activity as vitamin C. Ascorbic acid is a white crystalline and odorless in nature. Due to its polar characteristics, it is easily soluble in water. The crystalline and pure ascorbic acid is stable to exposure of air, light, and ambient temperature for a long period. However, in aqueous solutions or in foods, its stability is related to the storage conditions and to the composition of the matrix.

Cite this article: Khatoniar, S., Barooah, M.S. and Bordoloi, P.L., Retention of Ascorbic Acid Content of Selected Greens in Different Drying Methods and Across Storage, *Int. J. Pure App. Biosci.* **6(1):** 965-970 (2018). doi: http://dx.doi.org/10.18782/2320-7051.5859

Ascorbic acid can be easily degraded, depending on many variables such as pH, temperature, light, and presence of enzymes, oxygen, and metallic catalyzers[1]. Green leafy vegetables are treasure trove of micronutrients, one of them being ascorbic acid. Hence, the present study was conducted to observe the impact of different drying methods in retention of ascorbic acid content of selected green leafy vegetables.

MATERIAL AND METHODS

Collection of sample:

Six commonly consumed green leafy vegetables were randomly selected and collected from local market of Jorhat city, Assam and were placed in sterile poly-bag to prevent loss of moisture during transportation to the laboratory.

Preparation of sample:

The collected samples were washed properly in running tap water and finally distilled water. These were drained completely and surface moisture was dried using filter paper. The samples were then dried using four different drying methods namely sun drying, shade drying, cabinet drying and microwave oven drying. Cabinet drying was done at 60° C using MEVISH cabinet dryer while microwave drying was done at 450w and 100% power using Samsung ce13501 model.

Estimation of ascorbic acid:

Ascorbic acid content of the selected samples was determined by volumetric method[1]. In this method, 5 ml of the working standard solution was pipette out into 100 ml conical flask, 10 ml of 4% oxalic acid was added to the solution and titrate against the dye (V_1ml). The end point is noted when pink colour appears which remains for few minutes. The amount of the dye consumed is equivalent to the amount of ascorbic acid. Five gram of the sample is extracted in 4% oxalic acid and made up to a known volume (100 ml) and centrifuged. 5 ml of this supernatant was pipetted out; 10 ml of 4% oxalic acid was added and titrated against the dye (V_2 ml).

RESULTS AND DISCUSSION

Effect of different drying methods:

The effect of drying on ascorbic acid content is discussed in the Table 1. From the Table 1, it can be seen that ascorbic acid was found reduced during different drying methods as compared to fresh condition. Ascorbic acid is a heat labile water soluble vitamin which decreases in heat treatment. Sun drying caused maximum loss in ascorbic acid and shade dried samples showed better retention of ascorbic acid which may be due to absence of heat treatment. There was significant difference among different drying methods and retention of ascorbic acid irrespective of the greens. The retention of ascorbic acid being highest in shade dried greens, followed by microwave oven dried greens. Among the greens, ascorbic acid content was highest in *Amaranthus spinosus* (32.29 mg/100g). After dehydration also shade dried *Amaranthus spinosus* showed highest retention of ascorbic acid (11.47 mg/100g).

Botanical Name	Ascorbic acid content (mg/100g)						
	Fresh greens	Sun drying	Shade drying	Cabinet drying	Microwave drying	CD (0.05)	S.Ed
Amaranthus spinosus	32.29	8.42^{d}	11.47^{a}	10.07^{c}	10.68^{b}	0.17	0.07
Chenopodium album	23.73	5.05^{d}	6.74^{a}	5.33^{c}	5.56^{b}	0.15	0.06
Rumex vesicarius	32.11	7.55^{d}	11.52^{a}	8.23^{c}	9.68^{b}	0.13	0.06
Spinacia oleracea	26.67	5.73^{d}	10.06^{a}	7.54^{c}	8.75^{b}	0.16	0.07
Hibiscus sabdariffa	21.21	4.26^{d}	6.55^{a}	5.21^{c}	5.48^{b}	0.12	0.05
Diplazium esculentum	12.60	0.85^{d}	2.43^{a}	1.92^{c}	2.07^{b}	0.09	0.04

Mehta[3], reported the ascorbic acid content of *Daucus carota* and *Brassica olerecea* leaves to be 69.84 mg/100g and 7.32 mg/100g in fresh sample. The ascorbic acid content of *Daucus carota* was decreased to 42.65 mg/100g and in *Brassica olerecea* to 5.62 mg/100g in oven dehydrated sample. Results suggested that after processing, there was a reduction in ascorbic acid content in comparison with their fresh counterparts. Per cent decrement of both the processed samples, prepared by *Daucus carota* and *Brassica olerecea* was approximately 20 to 50 per cent. Ukegbu and Okereke, revealed that solar dried *Amaranthus hybridus*, *Telferia occidentalis* and *Hibiscus esculentus* had significantly higher ascorbic acid content than sun dried vegetables. Ascorbic acid content of *Amaranthus hybridus was* 33.44 mg/100g (solar dried) and 17.61 mg/100g (sun dried), *Telferia occidentalis* 29.16 mg/100g (solar dried) and 28.12 mg/100g (sun dried) and *Hibiscus esculentus* were 19.70 mg/100g (solar dried) and 18.83 mg/100g (sun dried) in his study. In all the samples, ascorbic acid was most depleted in sun dried vegetables which is in accordance with the present study. This could be attributed to oxidative destruction in the presence of heat, light, oxygen, moisture and metal ions[7]. Sakhale and Pawar[8], studied dehydration of curry leaves and reported that the percent ascorbic acid content of tray dried curry leaves decreased significantly in different drying conditions. The percent retention of ascorbic acid was found maximum in tray-dried leaves (46.42%) where as minimum in sun drying method (28.57%). This decrease might have been because of oxidation of ascorbic acid during dehydration. The decrease in vitamin and mineral contents during processing has also been noted earlier by Ranganath and Dubash[6], and Singh *et al.*[9].

The exposure of the green leafy vegetables to direct sunlight resulted in highest loss in ascorbic acid content as compared to shade, tray and microwave drying. This is associated with high sensitivity of ascorbic acid to most assessable atmospheric constituents like oxygen, light and temperature. The maximum retention of ascorbic acid in tray dried greens may be due to controlled drying conditions and least exposure of green leafy vegetables to temperature and air[2].

Impact of packaging materials:

Though shade dried greens showed better retention in ascorbic acid content, but the other nutritional and physical parameters of the selected greens were more acceptable in cabinet dried greens only. Hence cabinet dried greens were selected for storage study for a period of 6 months using 3 different packaging materials. The degradation of ascorbic acid content during storage is described in the Fig 1-6.

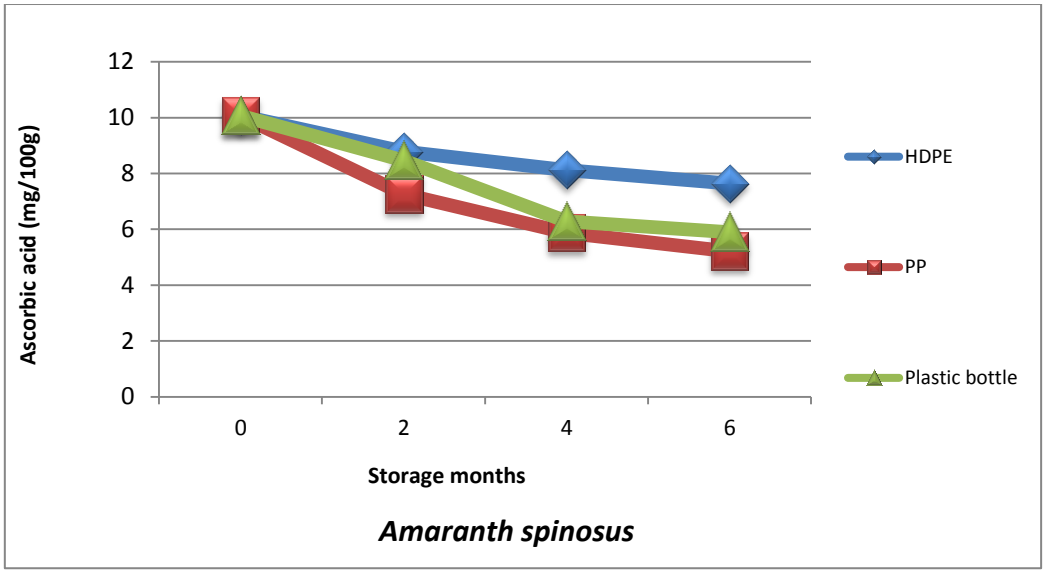

Fig. 1

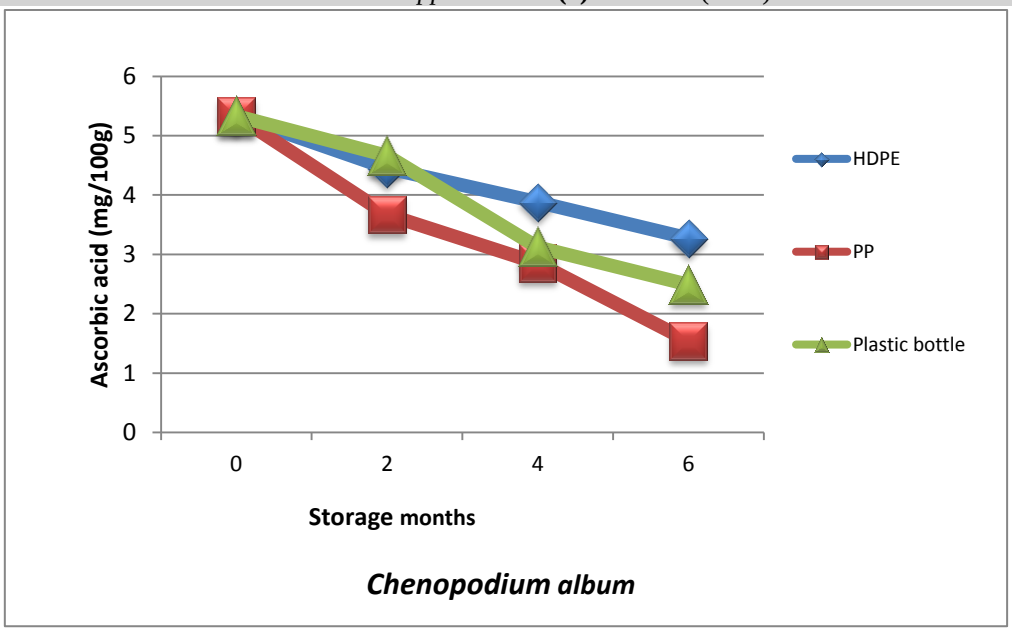

Fig. 2

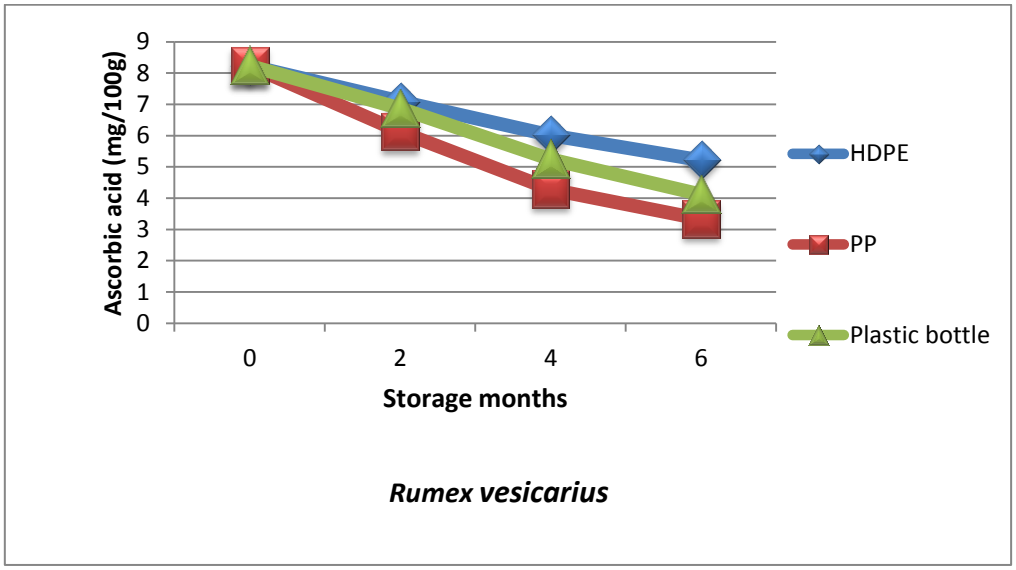

Fig. 3

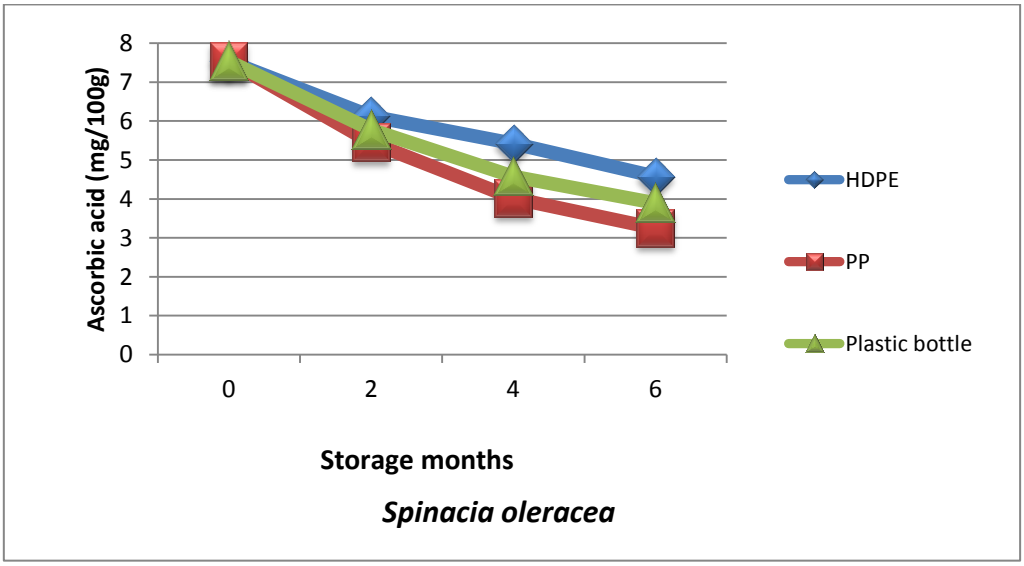

Fig. 4

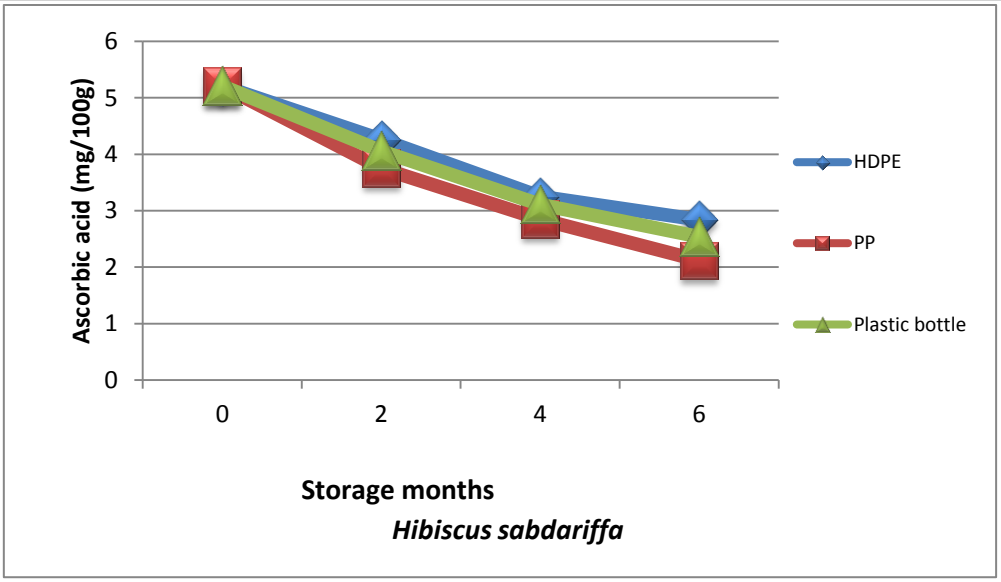

Fig. 5

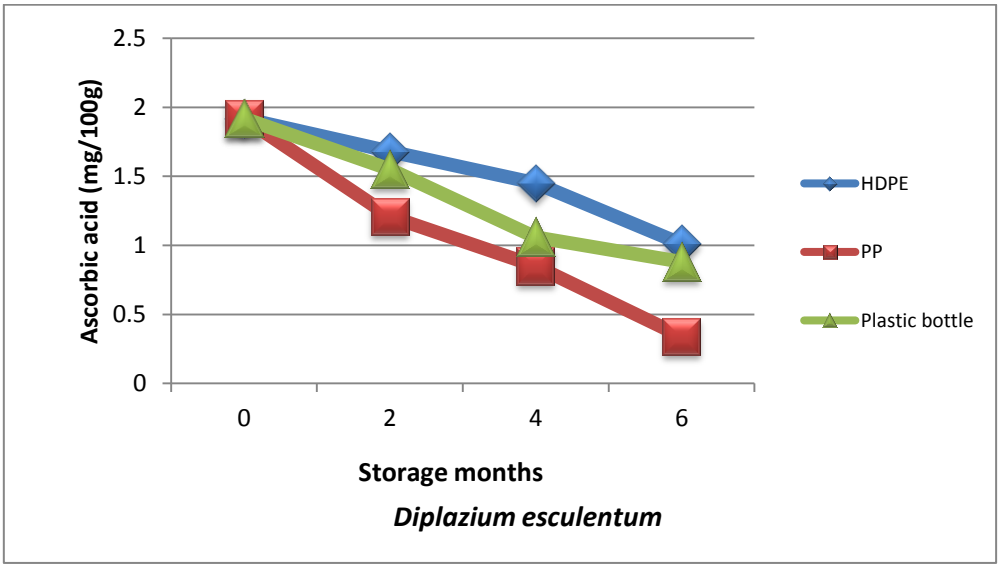

Fig. 6

From the Figures 1-6, it is observed that the retention of ascorbic acid was maximum in HDPE pouches, followed by plastic bottles. Degradation of ascorbic acid was maximum in PP pouches across 6 months of storage. Among the greens, *Amaranthus spinosus* retained highest amount of ascorbic acid as compared to other greens after the end of storage period of 6 months.

CONCLUSION

From the present study, it can be concluded that not only the drying conditions affect the degradation of ascorbic acid during drying of fruits and vegetables, several variables influence this degradation, which make this phenomenon quite complex. During the drying process, there are different environment variables and the composition and physical structure of the product change as the process continues. The packaging materials used also greatly influences the retention of ascorbic acid. Hence, by using appropriate drying methods and packaging materials, the degradation of ascorbic acid can be minimized.

REFERENCES

1. Freed, M., Method of vitamin assay. Interscience Publication Inc., New York. (1966).

2. Goyal, M. and Mathew, S. Physico-chemical charateristics of cauliflower dried under different drying conditions. *J. Nutr. Dietet.* **27(2):** 39 (1990).
3. Mehta, D. Effect of Processing on Nutrient Composition of Selected Green Leafy Vegetables and Development of Value Added Products. Ph.D (H.Sc.) Thesis. IIS University, Jaipur. (2014).
4. Moser, U. and Bendich, A. Vitamin C. In Handbook of Vitamins; Machlin, L.J., Ed.; Marcel Dekker: New York; 195–224. (1991).
5. Padayatty, S.J., Katz, A., Wang, Y., Eck, P., Kwon, O., Lee, J.H., Chen, S., Corpe, C., Dutta, A., Dutta, S.K. and Levine, M., Vitamin C as an antioxidant: evaluation of its role in disease prevention. J. Am. Coll. Nutr. **22(1):** 18-35 (2003).
6. Ranganath, D.R. and Dubash, P.J., Loss of color and vitamins on dehydration of vegetables. *Indian Food Packer*, pp. 4-10. (1981).
7. Russel, L. and McDowell, R.L., Vitamin in animal nutrition, comparative aspects to human nutrition. Academy Press Inc; New York, pp. 340-352. (1989).
8. Sakhale, B.K. and Pawar, V.N., Studies on Effect of Drying Modes on Quality of Dehydrated Cabbage. *Jurnal. Teknol. Dan Indust. Pangan*. **18(1):** 55-58. (2007).
9. Singh, G.; Kawatra, A., Sehgal, S. and Pragati, Effect of storage on nutritional composition of selected dehydrated green leafy vegetable powders. *Plant Fd. Hum. Nutr*. **58:** 1-9 (2003).