Effect of Drying on Biochemical Properties of Papaya Leaves

Mittal Prajapati, S.H. Akbari, H.G. Bhatt, K.S. Damle

College of Food Processing Technology and Bio Energy, Anand Agricultural University, Anand, Gujarat, India

https://doi.org/10.5281/zenodo.7017988

Abstract

Each part of papaya plant is popular for its medicinal importance. Papaya leaves are responsible for several therapeutical activities due to the presence of a mixture of phytochemicals. Drying increases the shelf life of product and it also ensures easy and safe storage of the product. Papaya leaves were dried using tray dryer at different temperatures i.e., 45, 50, 55, 60 and 65° C to find optimum drying condition for papaya leaves with maximum retention of biochemical properties like ascorbic acid, total phenolic content and antioxidant activity. It was found that papaya leaves dried at 50° C for 80 min, showed better retention of biochemical properties.

Keywords: Papaya Leaves, Ascorbic Acid, Phenolic Content, Antioxidant Activity

Introduction

Papaya is a soft single-stemmed, semi-woody and giant herbaceous plant. Large palmate leaves with five to nine pinnate lobes are clustered spirally in the upper side of the plant. (Jiménez *et al.*, 2014). Papaya plant is a powerhouse of nutrients and also the whole plant has exclusive medicinal properties. Different parts of the plant like leaves, seeds, latex, roots, shoots and fruit have important medicinal properties (Aravind *et al.*, 2013; Yogiraj *et al.*, 2014). Phytochemicals like alkaloids, glycosides, saponins, tannins, flavonoids, proteins, amino acids and other compounds are present in papaya leaves (Varisha *et al.*, 2013; Adachukwu *et al.*, 2013), which are responsible for different therapeutical properties and makes it a valuable medicinal plant.

In ancient time, the leaves were used for the treatment of malaria, dengue, colic fever, beri beri, asthma, cancer, diabetes, high blood pressure, jaundice, stomach troubles, urinary ailments, constipation and obesity. The leaves are also responsible for digestive system promoter, weight loss and abortion (Patil *et al.*, 2014). Nowadays, several people are using papaya leaves as a home remedy or supporting remedy with regular treatment. In some parts of Asia, the young papaya leaves are steamed and eaten like spinach (Aravind *et al.*, 2013).

Blanching increases the drying rate as well as reduces the loss of antioxidants and phenolics during drying (Akila *et al.,* 2018; Parmar *et al.*, 2018). Drying reduces the deterioration of the product and allows stable storage, so it increases the shelf life of the product. But, it changes in the product qualities mainly associated with aroma, appearance and also it negatively affects the nutritional quality

(Kripanand and Guruguntla, 2015). So, it is important to choose proper drying parameters to retain maximum quality parameters of the product.

Hence, the present study was carried out to determine best drying condition in terms of preservation of biochemical properties for papaya leaves.

Materials and Methods

Sample Preparation

The study was conducted in the month of February, 2022. Fresh and young papaya leaves of *Madhubindu* variety were collected from the Horticulture Farm, Anand Agricultural University, Anand. The leaves were washed with tap water to remove dust particles and the main veins were removed from the leaves. Then, the leaves were steam blanched for 60 sec. Pretreated leaves were air dried to remove surface moisture.

Drying

Pretreated leaf samples were spreaded in aluminium trays and dried using tray dryer at different temperatures (45, 50, 55, 60 and 65° C) keeping 1 m/s air velocity. Drying was carried out till 4-6% (db) moisture content. The dried leaves were then ground to make powder.

Estimation of Ascorbic Acid

It was estimated by the method given in Ranganna (2007). About, 5 g of sample was weighed and blended with 3% HPO_3 to make extract and volume was made up to 50 ml using 3% HPO_3 before centrifugation. From which 5 ml extract was mixed with 5 ml of 3% HPO_3 and titrated with the standard dye to a pink end point. The dye was standardized using standard ascorbic acid (0.1 mg/ml) to calculate dye factor.

$$Dye\,factor = 0.5/titer\ value$$

$$Ascorbic\,acid\,(mg/100\,g) = \frac{Dye\,factor \times V_1 \times Voume\,made\,up \times 100}{V_2 \times W}$$

Where, W = Weight of the Sample (g), V_1 = Volume of the Dye Required (ml), V_2 = Volume of the Sample Extract (ml)

Estimation of total phenolic content

Total phenolic content was measured by Folin-Ciocalteu (FC) method given in Thimmaiah (2012), with some modifications. About 1 g of sample was weighed and ground in a mortar pestle with 10-20 ml of methanol (80%). It was kept in the dark for overnight and then centrifuged for 20 min at 10,000 rpm. The supernatant was evaporated to dryness which was diluted by 10 ml of distilled water. From which about 0.1 ml of the aliquot was taken in test tube and the volume was increased to 8 ml with distilled water. In which 0.5 ml of Folin-Ciocalteu (FC) reagent was added. After 10 min, 1.5 ml of 20% Na_2CO_3 was added to the same test tube. The tubes were incubated at 40° C for 20 min in water bath. The absorbance was measured in UV Visible Spectrophotometer against blank at 755 nm. Standard curve was prepared using Gallic acid at various concentrations to calculate concentration of total phenolic content of sample.

Estimation of Antioxidant Activity

It was measured by DPPH method according to Joshi *et al.* (2019) with some modifications. About 2 g of material was extracted with 20 ml of methanol and kept overnight and then centrifuged for 15 min at 10,000 rpm. In test tubes, 0.1 ml of the extract was added with 2.9 ml of DPPH (0.1 mM) solution. The mixture was vortexed for one minute and then it was incubated for 30 min in the dark. The absorbance was taken at 517 nm. DPPH solution was used as a blank (control). The activity was calculated using the formula:

$$\%\,Inhibition = \frac{(AB - AA)}{AB} \times 100$$

Where, AB = Absorbance of Blank, AA = Absorbance of Sample

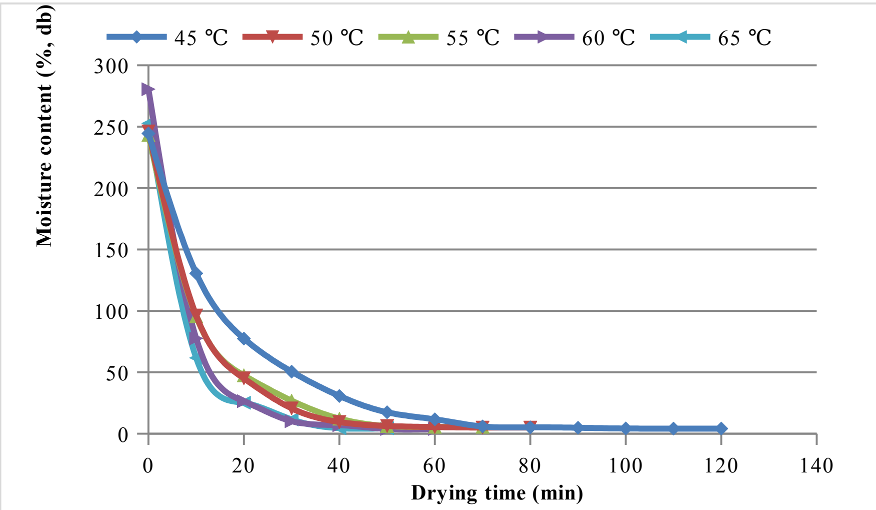
Statistical Analysis

All the experiments were carried out in triplicate. Experimental data were analyzed by one way ANOVA using Completely Randomized Design with 5% level of significance.

Results and Discussion

Drying of Papaya Leaves

Figure 1: Moisture Content vs. Drying Time Curve



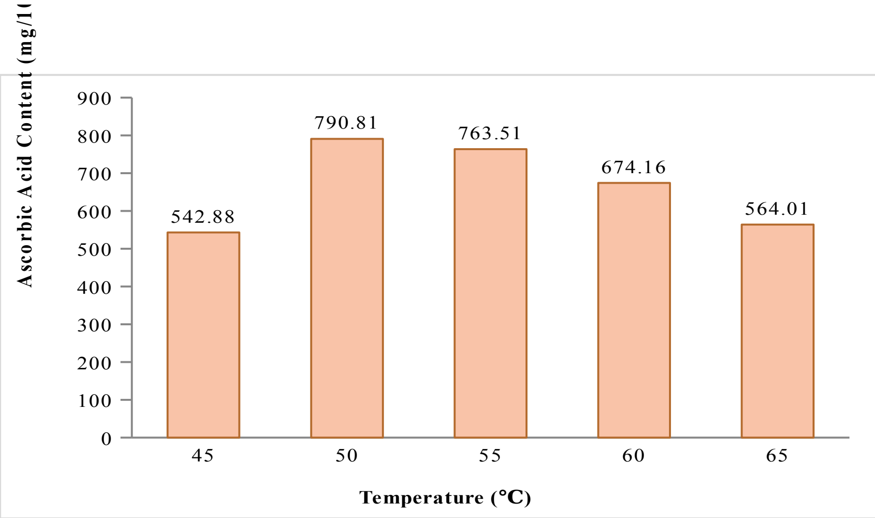
Drying time was decreased with increase in temperature. Drying at 45° C required longest time (120 min) while at 65° C required shortest time (50 min).

Ascorbic Acid

The highest ascorbic acid content (790.81 mg per 100 g) was found in the sample dried at 50° C, whereas the lowest (564.01 mg per 100 g) was found at 65° C (Figure 2).

The amount of ascorbic acid was increased from 45 to 50° C, as drying time was considerably higher at 45° C than 50° C. But, further it was decreased from 50 to 65° C, though the drying time was decrease. It may be attributed to thermal degradation with increase in temperature above 50° C.

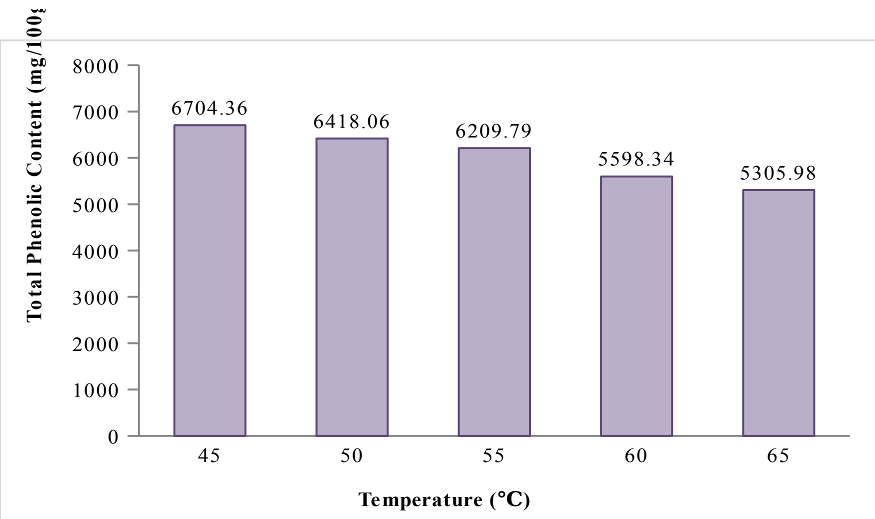
Figure 2: Effect of Drying Temperature on Ascorbic Acid Content



Total Phenolic Content

Phenolic compounds are also heat sensitive. The highest and lowest retention of total phenolic content were observed at 45 and 65° C, respectively. Figure 3 shows that the temperature increased from 45 to 65° C; the total phenolic content decreased from 6704.36 to 5305.98 mg/100g. Similar pattern of decrement was found by Lemus-Mondaca *et al.* (2016) for stevia leaves above 50° C.

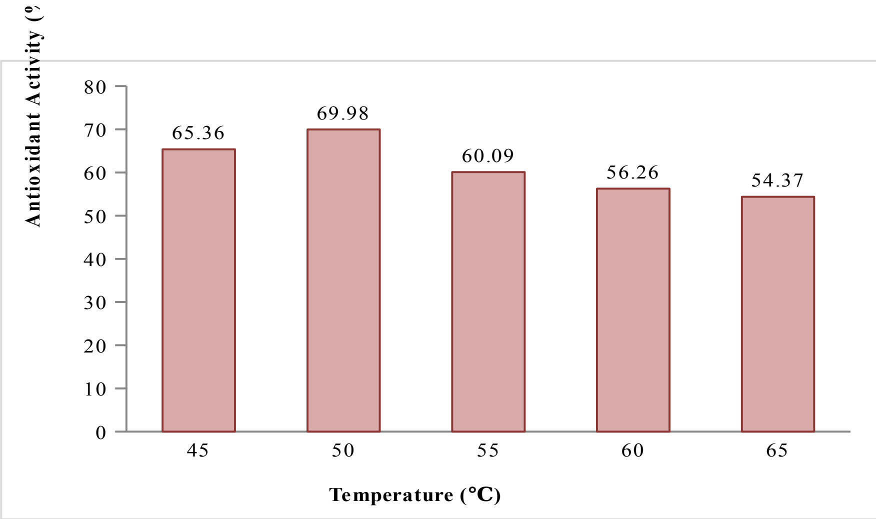
Figure 3: Effect of Drying Temperature on Total Phenolic Content



Antioxidant Activity

The compounds like phenols, ascorbic acid etc. possesses antioxidant activity. The Figure 4 shows the change in antioxidant activity of dried papaya leaves with change in drying temperature. Figure also shows that antioxidant activity was increased from 45° C (65.36%) to 50° C (69.98%) and was gradually decreased from 50 to 65° C as the antioxidants like ascorbic acid and phenolics are heat sensitive. Antioxidant activity was found to be 54.37% at 65° C. It was observed that antioxidant activity was increased with increase in phenolic content, which was also observed by Martínez-Las Heras *et al.* (2014) for drying of persimmon leaves.

Figure 4: Effect of Drying Temperature on Antioxidant Activity



Standardization using CRD

Table 1 shows the mean values for biochemical properties of papaya leaves with different temperatures along with statistical parameters.

Table 1: Effect of Drying Temperature on Biochemical Properties of Papaya Leaves

Temperature (° C)	Ascorbic Acid Content (mg per 100 g)	Total Phenolic Content (mg per 100 g)	Antioxidant Activity (%)
45	542.883	6704.36	65.36
50	790.81	6418.06	69.98
55	763.513	6209.79	60.09
60	674.163	5598.34	56.26
65	564.013	5305.98	54.37
SEm	4.44	96.91	0.64
CD	13.99	305.35	2.02
CV %	1.15	2.78	1.82

From above table, it is observed that tray drying at 50° C was found as best temperature for drying of papaya leaves, as it retained significantly higher ascorbic acid and antioxidant activity among all the temperatures and total phenolic content was statistically at par with the sample dried at 45° C temperature with 5% level of significance.

Conclusion

It is concluded that pretreated papaya leaves, tray dried at 50° C for 80 min retained higher amount of total phenolic content, ascorbic acid and antioxidant activity.

References

1. I. Adachukwu, O. Ann, E. Faith. (2013). Phytochemical analysis of paw-paw (Carica papaya) leaves. International Journal of Life Sciences Biotechnology and Pharma Research, 2, 347-51.

2. B. Akila, R. Vijayalakshmi, G. Hemalatha, R. Arunkumar. (2018). Development and evaluation of functional property of guava leaf based herbal tea. Journal of Pharmacognosy and Phytochemistry, 7(3), 3036-3039.
3. G. Aravind, D. Bhowmik, S. Duraivel, G. Harish. (2013). Traditional and medicinal uses of Carica papaya. Journal of Medicinal Plants Studies, 1(1), 7- 15.
4. V.M. Jiménez, E. Mora-Newcomer, M.V. Gutiérrez-Soto. (2014). Biology of the papaya plant. Genetics and Genomics of Papaya, In R. Ming & P. Moore (Eds.), New York, Springer, 17–33.
5. N. Joshi, K. Bains, H. Kaur. (2019). Optimization of drying time and temperature for preparation of antioxidant rich vegetable powders from unconventional leafy greens. Chemical Science Review and Letters, 8(29), 70-78.
6. S. Kripanand, S. Guruguntla. (2015). Effect of various drying methods on quality and flavour characteristics of mint leaves (Mentha spicata L.). Journal of Food and Pharmaceutical Sciences, 3(2), 38-45.
7. R. Lemus-Mondaca, K. Ah-Hen, A. Vega-Gálvez, C. Honores, N.O. Moraga. (2016). Stevia rebaudiana leaves: Effect of drying process temperature on bioactive components, antioxidant capacity and natural sweeteners. Plant foods for human nutrition, 71(1), 49-56.
8. R. Martínez-Las Heras, A. Heredia, M.L. Castelló, A. Andres. (2014). Influence of drying method and extraction variables on the antioxidant properties of persimmon leaves. Food Bioscience, 6, 1-8.
9. M.R. Parmar, V.B. Bhalodiya, S.S. Kapdi. (2018). Temperature effect on drying and phytochemicals of basil leaves. International Journal of Engineering Science Invention, 7(1), 34-44.
10. T. Patil, S. Patil, A. Patil, S. Patil. (2014). Carica papaya leaf extracts–An Ethnomedicinal boon. International Journal of Pharmacognosy and Phytochemical Research, 6(2), 260-265.
11. S. Ranganna. (2007). Handbook of analysis and quality control for fruit and vegetable products. 2nd ed. New Delhi, India: Tata McGraw-Hill Publications.
12. S.R. Thimmaiah. (2012). Standard methods of biochemical analysis. Kalyani Publishers, New Delhi, 287-288.
13. A. Varisha, S.H. Ansari, K.J. Naquvi, A. Poonam, A. Adil. (2013). Development of quality standards of Carica papaya Linn. leaves. Der Pharmacia Lettre, 5(2), 370-376.
14. V. Yogiraj, P.K. Goyal, S.S. Chauhan, A. Goyal, B. Vyas. (2014). Carica papaya Linn: An overview. International Journal of Herbal Medicine, 2(5), 1- 8.