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Study on natural drying techniques of papaya leaves

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Abstract

This research examines natural drying techniques for papaya leaves, emphasizing the assessment of moisture content and drying efficiency. To analyze moisture content, a sample was subjected to oven drying at 110°C for one hour, followed by a drying phase at 100 ± 5°C for approximately four hours, with weight measurements taken until a stable weight was achieved. Weights were recorded at 15-minute intervals for samples weighing 100 grams. The greenhouse drying method utilized a structure made of polypropylene plastic sheeting, equipped with an exhaust fan operating at a speed of 1 m/s. The drying process occurred between 10 AM and 4 PM, resulting in a moisture content of 4-6% on a dry basis. Additionally, the study explores the initial moisture content and drying kinetics of both blanched and unblanched papaya leaves under solar and greenhouse drying conditions. Freshly harvested papaya leaves from cultivated plants displayed an average moisture content of 74.56% (wet basis), with individual samples ranging from 73.00% to 76.00%. This elevated moisture content categorizes the leaves as highly perishable. The study highlights the notable influence of blanching on the drying kinetics of papaya leaves, revealing that blanched samples experienced a more significant reduction in drying rate during solar drying, whereas unblanched samples demonstrated a quicker decline in drying rate under greenhouse drying conditions.

Keywords: papaya, blanching, solar, greenhouse, drying

Introduction

The papaya (*Carica papaya* Linn.) is indigenous to the Americas and thrives in tropical climates. It is a sizable plant resembling a tree, yet it is classified as a herbaceous plant due to its soft, green, and minimally woody stem that remains pliable until it dies. The solitary stem can reach heights of 5 to 10 meters, with all the foliage concentrated at the top. The leaves are large, deeply lobed, and palmate, measuring 50–70 cm in width and supported by long petioles. Optimal growth conditions for papaya include well-drained, well-aerated soil rich in organic matter, with a pH range of 5.5 to 6.7; however, waterlogged conditions can lead to tree mortality within 3 to 4 days. In India, papaya is widely cultivated, with Andhra Pradesh leading in both area and production, followed by Gujarat. In the 2019-20 period, the total area dedicated to papaya cultivation in India was 149 thousand hectares, yielding 6050 thousand metric tonnes. In Gujarat, the area under papaya cultivation for 2020-2021 was estimated at 18.189 thousand hectares, with a production of 1107.880 thousand metric tonnes (Anonymous, 2021) [1]. The leaves of *Carica papaya*, often regarded as waste, are now recognized for their health benefits. Recent studies have investigated the effects of pre-treatment and various drying methods to better understand the physicochemical properties of leaf powder. Papaya is a significant source of the digestive enzyme papain, which finds applications in cosmetics, the brewing industry, meat tenderization, and pharmaceuticals. The raw fruit of papaya possesses laxative properties, while the leaves are valuable for managing diabetes, fever, syphilis, and wound healing (Sudhakar *et al*., 2014) [7]. Both leaf and fruit extracts of papaya demonstrate antimicrobial and antioxidant properties, attributed to their content of phenols, vitamins, and enzymes (Zuhair *et al*., 2013) [8]. Drying food is essential for keeping it fresh and safe to consume Sardar *et al*., 2024 [5].

Materials and Methods

Mandhubindu cv. of papaya plants were grown in the Horticulture Farm of College of Horticulture, Agricultural University, Anand. The seedlings variety were procured from the local nursery and grown in the month of November. The plant leaves were manually handpicked from the papaya plant for experiments.

Pre-treatment of Sample (Blanching)

Hot water blanching was carried out using the method described by Ranganna (1886) [3].

Moisture Content

The method described in AOAC (1990) was used to determine the moisture content. A metallic dish was dried in oven at 110 °C for a period of one hour. It was quickly covered, cooled in desiccator and weighed. A 5 g sample was kept in thin layer on the metallic dish and weighed as quickly as possible to avoid loss of moisture. The sample was kept in hot air oven maintained at 100 ± 5 °C. The sample was dried for about 4 h until two to three remained

consecutive weights constant and final weight was recorded.

Solar drying

The solar drying studies of papaya leaves was carried out in the commercial solar dryer (Plate 3.16) available at the College of Food Processing Technology & Bio-Energy. The modular size of the solar dryer was 1000 mm x 2000 mm. Total modules were two having loading capacity upto 10 kg per batch. The tray size and numbers were 400 mm x 424 mm x 24 mm and 8 numbers respectively. The trays were made of stainless steel with SS wire mesh. Inlet, outlet and ambient temperatures were recorded.

Each 100 g blanched and unblanched samples were uniformly spread in single layer on a perforated stainless steel wire mess tray and dried at the desired temperature. The moisture loss was recorded at every 15 min interval using top pan digital balance.

Greenhouse Drying

Greenhouse drying is a type of low cost and energy efficient drying which uses solar energy as its medium of drying. The green house dryer is made of poly propylene plastic sheets and fitted with an exhaust fan at the top front side of the dryer. The exhaust fan helps in removing moisture from inside the drying chamber.

The plastic sheets were washed thoroughly so as to remove dust and dirt from the surface. The exhaust fan was set at 1 m/s velocity. The drying experiment was conducted during the day time from 10 AM to 4 PM. The sample weight was recorded before loading them on the perforated trays. The trays were then loaded in the dryer and the weight loss of the sample was recorded after every fixed interval until the loss in weight was found to be constant, having moisture content of 4-6% on dry basis. The dried samples were made powder then packed in aluminium laminated pouches.

Results and Discussion

Initial Moisture Content

The papaya leaves were collected from the plants grown in the farm. Average moisture content of 16 samples of the fresh papaya leaves was 74.56% (w. b.) at the time of harvest. The range of moisture content varied from 73.00 – 76.00% (w. b.), which shows that the papaya leaves can be considered under highly perishable group.

Solar Drying

In the solar drying of papaya leaves, (temperature ranging from 42-65 °C), average drying rate decreased from 11.28 to 0.07% d. b./min for the drying of unblanched papaya leaves. Sayyad *et al*., 2015 [6] described solar drying trends. For the blanched leaves average drying rate was reduced from 11.89 to 0.15% d.b./min in the solar drying. The arithmetic decrement in drying rate was 11.21 for the unblanched leaves, while it was 11.74% d.b./min for blanched sample. This showed that the drying rate was rapidly decreasing in the blanched sample than the unblanched sample respectively. The trend of variation of drying rate with time is shown in Figs. 1, for blanched and unblanched drying respectively.

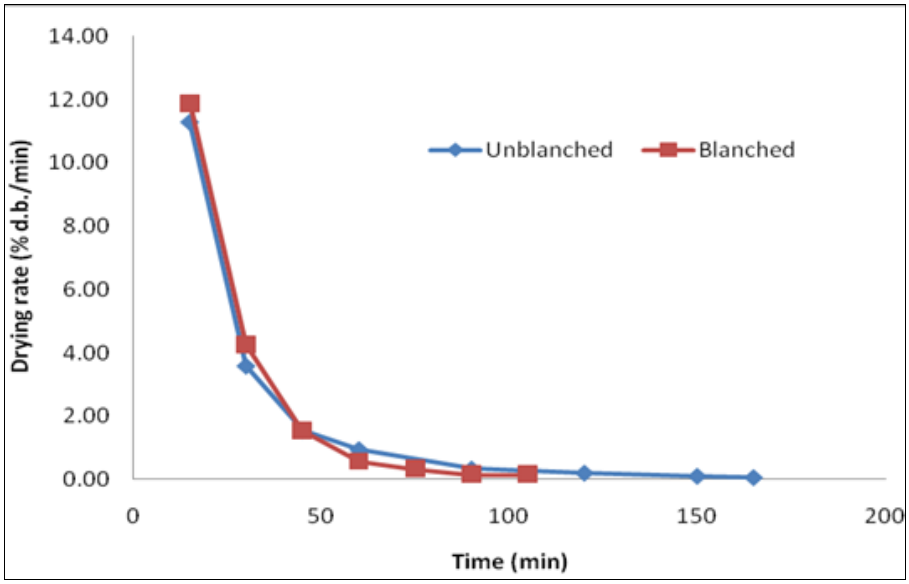

Fig 1: Drying rate vs drying time for solar drying

Green Housing Drying

In the green house drying of papaya leaves (temperature ranging from 40-60 °C), average drying rate decreased from 12.33 to 0.07% d. b./min for the drying of unblanched papaya leaves. For the blanched leaves average drying rate was reduced from 11.63 to 0.43% d.b./ min in the green house drying. The arithmetic decrement in drying rate was 12.26 for the unblanched leaves, while it was 11.20% d.b./min for blanched sample. Sardar, 2022 [4] studied on greenhouse drying of jamun.

This showed that the drying rate was rapidly decreasing in the unblanched sample than the blanched sample respectively. The trend of variation of drying rate with time is shown in Figs. 2, for blanched and unblanched drying respectively.

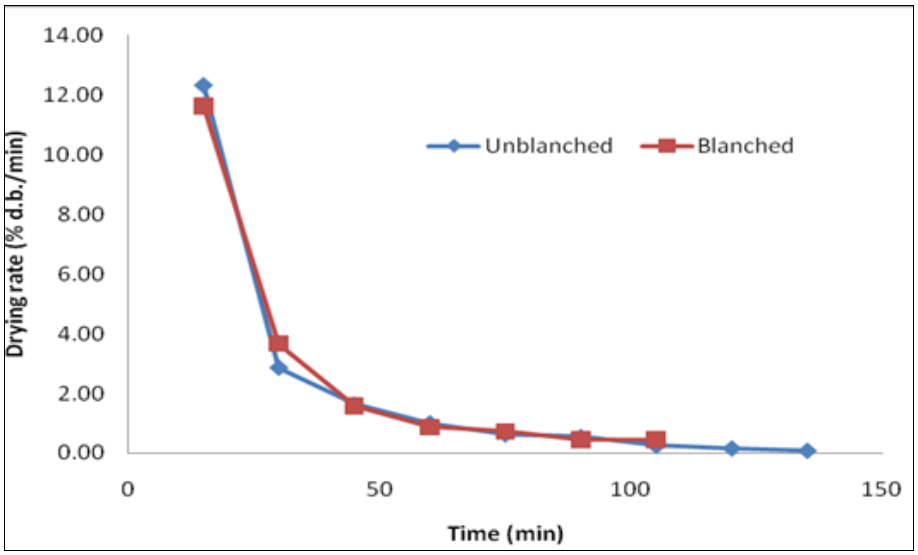

Fig 2: Drying rate vs drying time for green house drying

Conclusion

In experiments involving solar drying conducted at temperatures ranging from 42 °C to 65 °C, the drying rate of unblanched papaya leaves exhibited a significant reduction, decreasing from an average of 11.28% to 0.07% dry basis per minute (d.b./min). Similarly, blanched leaves followed a comparable pattern, with their drying rate diminishing from 11.89% to 0.15% d.b./min. The calculated arithmetic decrease in drying rate was found to be 11.21% d.b./min for unblanched leaves and 11.74% d.b./min for blanched leaves, suggesting that blanched samples experienced a more rapid decline in drying rate. In greenhouse drying conditions, where temperatures varied between 40 °C and 60 °C, the drying rate for unblanched papaya leaves fell from 12.33% to 0.07% d.b./min. In contrast, blanched leaves showed a decrease in drying rate from 11.63% to 0.43% d.b./min. The arithmetic decrement in drying rate was calculated at 12.26% d.b./min for unblanched leaves and 11.20% d.b./min for blanched leaves, indicating a quicker reduction in drying rate for unblanched samples under these specific conditions.

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