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Drying performance of blanched and unblanched basil leaves in a forced convection solar dryer

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Abstract

The present study was conducted to investigate the effect of solar drying temperatures and blanching pre-treatment on the drying behaviour of basil (*Ocimum sanctum*.) leaves. Freshly harvested basil leaves were dried in a forced convection solar dryer at three temperature levels: 45 °C, 55 °C, and 65 °C. Both blanched and unblanched samples were analyzed to evaluate moisture reduction rate, drying time, that solar drying, particularly when combined with blanching, is an and final product quality. The drying rate decreased progressively over time in all treatments. Blanched leaves exhibited faster drying compared to unblanched samples, with significantly reduced drying times at all temperatures. At 65 °C, blanched samples dried within 150 minutes, while unblanched samples required 240 minutes. The initial moisture content of the leaves (426–451% d.b.) was reduced to below 6% d.b. at all temperatures. Moreover, blanched samples retained better color, texture, and appearance than unblanched ones. These findings suggest effective method for improving drying efficiency and product quality in basil leaves.

Keywords: Basil (*Ocimum sanctum*), solar drying, blanching, drying rate, moisture content, drying temperature

Introduction

Ocimum sanctum (holy basil or Tulsi) derives its species name “sanctum” from its status as one of the most sacred plants in India. It is commonly cultivated near homes and temples, and holds deep religious significance in Hindu traditions. It is believed that placing a basil leaf in the mouth of a dying person or burying it with them helps attain salvation, which contributes to its revered status (Gupta, 2007) [3]. In English, it is commonly referred to as common basil, sweet basil, or holy basil, while in Indian languages it is known as Tulsi.

In addition to its cultural importance, basil also has considerable economic value. In Indian markets, *Ocimum sanctum* leaves are priced at approximately Rs. 200 per kg, while basil essential oil commands a much higher value. For instance, Egyptian basil oil has been reported to cost around Rs. 4000 per kg in international markets such as New York (Anon., 2008) [1].

Basil is rich in bioactive compounds present in its volatile oil, which impart several medicinal properties including antimicrobial, anti-inflammatory, and anti-allergic effects. It is particularly useful in treating respiratory tract infections. Compounds such as ursolic acid contribute to its anti-allergic activity, while eugenol is responsible for both antimicrobial and anti-inflammatory properties (Sulochanamma and Borse, 2009) [7]. Additionally, *Ocimum sanctum* has demonstrated insect-repellent activity, with complete repellency observed against *Callosobruchus chinensis* (Shrivastava *et al.*, 1993) [6].

Basil leaf powder has also been shown to reduce fasting blood glucose and postprandial glucose levels in patients with non-insulin-dependent diabetes mellitus (NIDDM). The leaves are rich in essential oils, particularly eugenol, which exhibits strong antioxidant activity and effectively inhibits lipid peroxidation (Sethi, 2004) [5].

For leafy vegetables such as basil, pretreatment prior to drying is essential to maintain quality. Van Arsdell *et al.* (1963) [8] reported that pretreatments improve color retention, enzyme inactivation, and drying rate, ultimately enhancing product quality and reducing processing costs. Blanching is commonly used to inactivate enzymes responsible for steam, or enzymatic and oxidative browning, and can be carried out using hot water, chemical methods. Blanched materials, especially those with high moisture content, tend to dry faster than unblanched ones.

Supporting this, Rocha *et al.* (2002)^[4] studied the effects of steam blanching and surfactant pretreatment on air-dried basil (*Ocimum basilicum*) and found improved chlorophyll retention and better preservation of green color. Similarly, Doymaz (2006)^[2] investigated the drying behavior of mint leaves and observed that increasing air temperature (35–60 °C) significantly reduced drying time, with drying occurring predominantly in the falling rate period.

Despite its importance, basil stored at high moisture content is highly susceptible to microbial deterioration. Drying is therefore one of the most widely used preservation methods for herbs and spices, as it reduces both weight and volume, thereby lowering transportation and storage costs. Drying involves simultaneous heat and mass transfer, and the drying behavior varies depending on the structure and characteristics of the crop.

In this study, the drying behavior of blanched and unblanched basil leaves was evaluated under solar drying conditions at 45 °C, 55 °C, and 65 °C. The aim was to investigate the effect of temperature and blanching on drying kinetics, moisture removal rate, and final product quality, contributing to the development of improved post-harvest processing strategies for basil and similar leafy herbs.

Materials and Methods

1. Plant Material

Freshly harvested basil leaves (*Ocimum Sanctum*) were collected from healthy plants grown under uniform agronomic conditions at the experimental farm. Leaves were manually sorted to remove damaged, diseased, or yellowing leaves and then cleaned thoroughly to eliminate dust and foreign particles.

2. Experimental Design

The experiment was designed to study the effect of solar drying temperatures (45 °C, 55 °C, and 65 °C) and blanching pretreatment on drying characteristics. The samples were divided into two groups:

- **Unblanched samples:** Fresh, cleaned leaves without any pretreatment.
- **Blanched samples:** Leaves were blanched in hot water steam for 30 second, followed by immediate cooling in tap water to stop enzymatic activity.

3. Solar Drying Set up

Drying was carried out in a forced convection solar dryer equipped with a transparent glass cover and an exhaust fan to facilitate uniform air circulation. The internal temperature of the dryer was adjusted to desired set points (45 °C, 55 °C, and 65 °C) by allowing passive regulation of heat based on solar intensity.

- **Temperature range inside dryer:** 50–70 °C during peak sunlight hours.
- **Drying temperatures maintained:** 45 °C, 55 °C, and 65 °C (±2 °C).

4. Drying Procedure

Approximately 100 g of both blanched and unblanched basil leaves were placed in thin layers on drying trays. The drying process was initiated at 10:00 AM and continued until the samples reached constant weight.

- Weight loss measurements were recorded at 60-minute intervals using a digital weighing balance (Shimadzu, accuracy: ±0.01 g).

- Drying continued until moisture content dropped below 6% (d.b.), suitable for safe storage.

5. Moisture Content Determination

Initial and final moisture contents were determined using the oven drying method at 105 °C for 24 hours. Moisture content was expressed on a dry basis (% d.b.) using the following formula:

$$\% \text{ Moisture content} = \frac{[(W_2 - W_1) - (W_3 - W_1)] \times 100}{(W_3 - W_1)}$$

Where,

W_1 = Weight of empty metallic dish, g

W_2 = Weight of metallic dish with sample, g

W_3 = Weight of metallic dish with dried sample,

6. Drying Rate Calculation

The drying rate (% d.b./min) was calculated based on the reduction in moisture content over each time interval using:

$$\frac{dM}{dt} = \frac{(M_t - M_{t+\Delta t})}{\Delta t}$$

Where,

$\frac{dM}{dt}$ = average drying rate, % d.b. /minute

t = time at any instant, minute

t + Δt = time after an interval of Δt, minute

7. Observations and Data Recording

- Moisture content and drying rate were recorded and analyzed.
- Drying time, arithmetic decrement in drying rate, and quality attributes (color, texture, appearance) were noted.
- Results were tabulated and graphically represented (Figs. 1–3 and Figs. 4–6).

Results and Discussion

Freshly harvested basil leaves were dried using a forced convection type solar dryer at set. The internal dryer temperature, naturally fluctuating between 50 and 70 °C during sunlight hours, allowing controlled drying at the desired temperature set points. Weight loss measurements were recorded every 60 minutes, and corresponding moisture loss data were calculated on a dry basis (% d.b.),

Drying at 45 °C was observed to be relatively slower, likely due to condensation effects within the dryer. The moderate temperature led to slower evaporation, and the accumulated water vapor within the enclosed space could have caused partial condensation, further reducing the drying rate.

From Figures 1,2,3, it was observed that blanched samples consistently dried faster than unblanched ones across all drying temperatures. The difference in drying time between blanched and unblanched leaves was most pronounced at lower temperatures (45 °C and 55 °C), suggesting that blanching significantly improves moisture diffusivity in basil leaves.

At 45 °C, unblanched leaves required a significantly longer drying time compared to 55 °C and 65 °C, indicating that temperature has a strong influence on drying efficiency. For blanched leaves, the drying process was notably faster at all temperatures, and the effect of temperature on drying time was more prominent than in unblanched samples.

The initial and final moisture contents and drying times for both treatments are summarized below:

These results clearly show that increasing drying temperature enhances the rate of moisture reduction, and this effect is more significant in blanched basil leaves. The faster drying in blanched samples can be attributed to cell structure modification during blanching, which facilitates internal moisture migration.

From Plates 1, 2, and 3, it was observed that blanched samples exhibited superior color, texture, and overall appearance compared to unblanched samples across all drying temperatures (45 °C, 55 °C, and 65 °C).

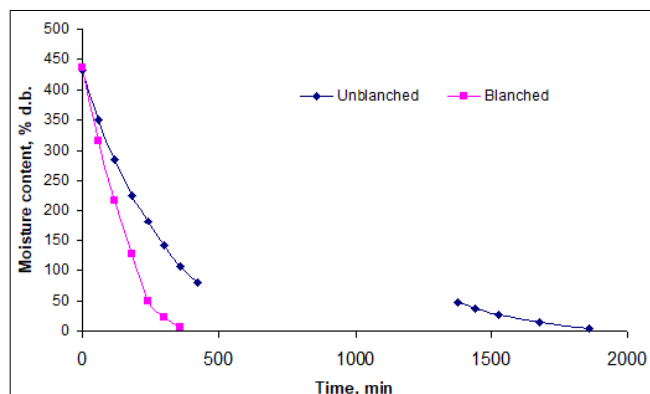


Fig 1: Variation in moisture content of basil leaves with drying time for solar drying at 45 °C



Plate 1: Basil leaves dried at 45 °C temperature in solar dryer

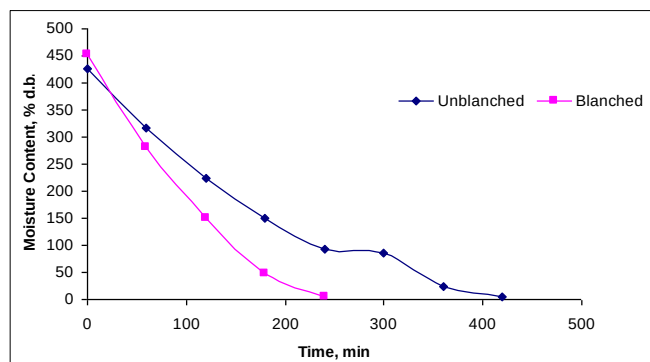


Fig 2: Variation in moisture content of basil leaves with drying time for solar drying at 55 °C

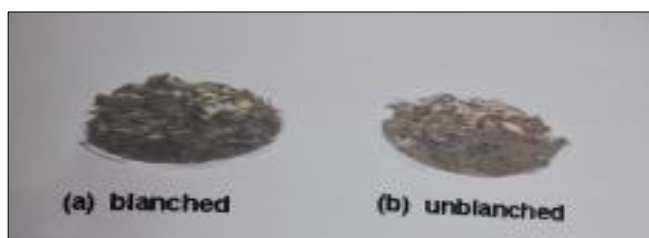


Plate 2: Basil leaves dried at 55 °C temperature in solar dryer

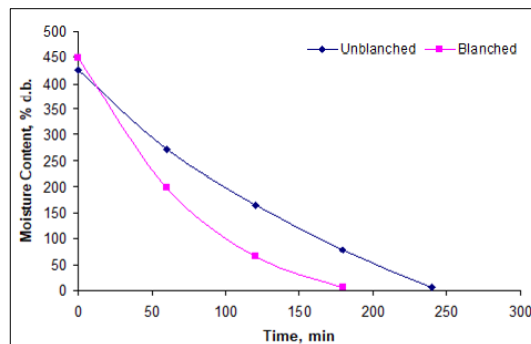


Fig 3: Variation in moisture content of basil leaves with drying time for solar drying at 65 °C

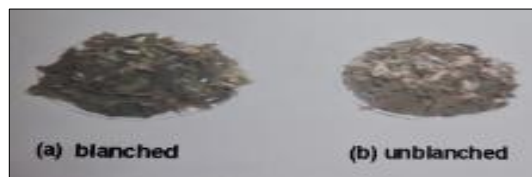


Plate 3: Basil leaves dried at 65 °C temperature in solar dryer

Solar Average Drying rate of Basil Leaves

In the solar drying of basil leaves, the average drying rate varied significantly with temperature and blanching treatment. At 45 °C, the average drying rate for unblanched basil leaves decreased from 1.36 to 0.06% d.b./min, with an arithmetic decrement of 1.30% d.b./min. In contrast, blanched leaves showed a reduction from 2.02 to 0.29% d.b./min, resulting in an arithmetic decrement of 1.73% d.b./min.

At 55 °C, the unblanched samples exhibited a drying rate decline from 1.81 to 0.38% d.b./min (decrement: 1.43% d.b./min), while the blanched leaves dried from 2.85 to 0.72% d.b./min, giving a decrement of 2.13% d.b./min.

At 65 °C, the drying rate of unblanched basil leaves reduced from 2.57 to 1.20% d.b./min, yielding a decrement of 1.37% d.b./min, whereas blanched leaves declined from 4.18 to 2.03% d.b./min, with an arithmetic decrement of 2.15% d.b./min.

The results clearly indicate that blanched basil leaves exhibited a higher drying rate initially, but also a more rapid decrease in drying rate compared to unblanched leaves across all tested temperatures. This suggests that blanching enhances the initial moisture removal but leads to faster moisture diffusion limitation in later drying stages. The trends of drying rate variation with time are graphically represented in Figures 4 to 6 for 45, 55, and 65 °C drying, respectively.

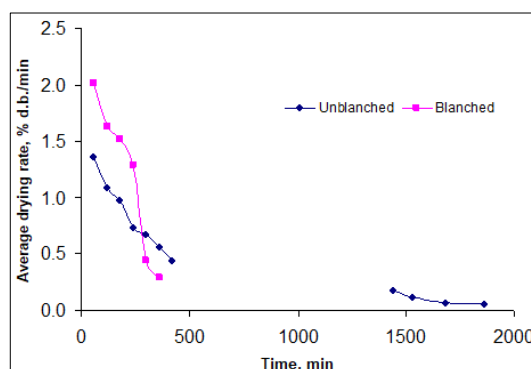


Fig 4: Variation in average drying rate of basil leaves with drying time for solar drying at 45 °C

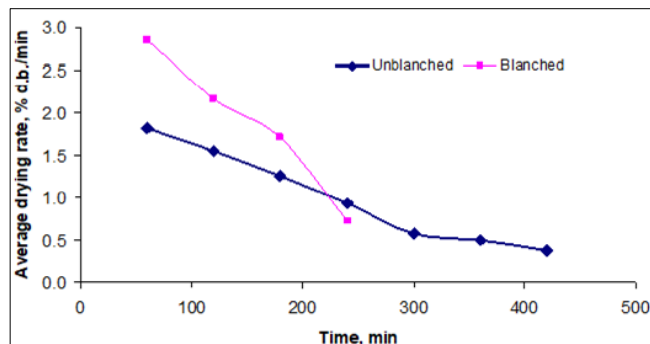


Fig 5: Variation in average drying rate of basil leaves with drying time for solar drying at 55 °C

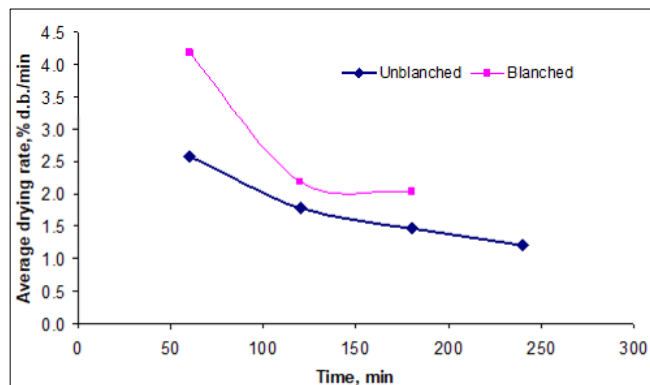


Fig 6: Variation in average drying rate of basil leaves with drying time for solar drying at 65 °C

Conclusion

The study demonstrated that solar drying temperature and blanching pretreatment significantly influenced the drying behavior and quality of basil leaves. Higher drying temperatures (55 °C and 65 °C) resulted in faster moisture removal and reduced total drying time compared to 45 °C. Blanched basil leaves dried significantly faster than unblanched ones at all temperatures, indicating improved internal moisture diffusivity due to cellular modifications during blanching.

The final moisture content of all samples was reduced to safe storage levels (<6% d.b.), with blanched samples achieving this in much shorter time. Additionally, the color, texture, and appearance of blanched dried leaves were superior to those of unblanched samples, making them more acceptable for culinary and medicinal use.

Therefore, solar drying combined with blanching can be considered an effective, low-cost, and sustainable technique for preserving basil leaves while maintaining quality and reducing post-harvest losses.

References

1. Anonymous. Market trends in production, price, export, import etc. Journal of Medicinal and Aromatic Plant Sciences. 2008;30:1-1.
2. Doymaz I. Thin-layer drying behaviour of mint leaves. Journal of Food Engineering. 2006;74:370-375.
3. Gupta SK. Tulsi: not only auspicious but a herb of medicinal excellence. Food Promotion Chronicle. 2007:29-33.
4. Rocha TA, Lebert A, Marty-Audouin C. Effect of pretreatment and drying conditions on drying rate and colour retention of basil. Journal of Food Engineering. 2002;26(5):456-463.

5. Sethi J, Sood S, Seth S, Anjana T. Evaluation of hypoglycemic and antioxidant effect of *Ocimum sanctum*. Indian Journal of Clinical Biochemistry. 2004;19(2):152-155.
6. Shrivastava R, Sharma CL, Saxena RC. Repellent activity of *Ocimum sanctum* against *Callosobruchus chinensis* (Coleoptera: Bruchidae). Bulletin of Pure and Applied Sciences Section A. 1993;12:51-51.
7. Sulochana G, Ramalaxmi K, Borse BB. Stabilizing of flavour volatiles of basil (*Ocimum basilicum* L.). Journal of Food Science and Technology. 2009;46(1):54-57.
8. Van Arsdel WB, Copley JJ. Food dehydration. Vol 2. 2nd ed. Westport (NY): AVI Publishing Co.; 1963.