Rehydration Characteristics of Mushrooms using Different Drying Techniques

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Authors’ contributions

This work was carried out in collaboration between both authors. Autho YV designed the study, performed the lab analysis, wrote the methodology, and wrote the first draft of the manuscript. Author NY managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Mushroom may be baked, fried, boiled, creamed, roasted, pickled and stuffed. In India, it is mainly consumed fresh and a negligible amount is used for processing. They can be processed as canned, dried and frozen mushrooms. The dried mushrooms are packed in hermetically sealed air tight tins for quality retention and stored in a cool dry place. The study's main objective is to know the effect of different drying methods on the quality of mushrooms and its dehydration, rehydration characteristics. Sun-drying and Cabinet tray drying methods were selected in the study. The rehydration ratio and coefficient of rehydration were calculated and compared for both the drying methods. An expert Committee did an Organoleptic evaluation. The results showed that cabinet tray dried mushrooms were reconstituted better compared to the sundried ones. The values of coefficient of rehydration and the rehydration ratio for cabinet dried mushrooms were found as 0.498 and 1:3.3 which were higher than sundried mushrooms. Cabinet tray dried mushrooms showed it's superiority in sensory assessment. The study concluded that mushrooms dehydrated by the cabinet tray drying have better rehydration characteristics than sun drying.

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1. INTRODUCTION

Mushroom is an edible fungus that is used as food since ancient times. It raises on decomposed organic matter, and the edible part cultivates above the surface of the substrate. Mushrooms grow in the dark and propagate by releasing spores. Mushrooms are grown worldwide and have been considered honour food in many cultures \[1\]. These are not only used for consumption but also used for medicinal purposes \[2,3,4,5\]. Out of large varieties of mushrooms, less than 25 species are accepted as food and some of them have assumed commercial significance \[6\].

Drying is a mass transfer process consisting of the removal of water. Drying process is used in mushrooms to remove the moisture content and to increase the shelf life \[7,8\]. Mushrooms are perishable, and several physiological and morphological changes occur after harvest, making these mushrooms unacceptable for eating. Due to the drying process the consumption of mushrooms is accessible and acceptable. The advantage is that almost all kinds of mushrooms can be conserved by drying. Rehydration is the process of restoring lost water (dehydration) to the body tissues and fluids. Prompt rehydration is imperative whenever dehydration occurs, from diarrheal, exposure lack of drinking water, or medication use. The dehydrated mushrooms can be rehydrated by water immersion before feeding. The rehydration characteristics of dried products indicate physical and chemical changes occurred during the drying process \[9\].

Experiments conducted in many countries have clearly shown that drying of mushrooms can increase the essential properties for beneficial use \[10\]. Keeping in view all the aspects, a study is planned to assess different drying methods regarding product quality obtained and analyze the drying and rehydration characteristics of mushrooms using different drying methods.

2. MATERIALS AND METHODS

In this section description of entire procedure followed in this study, complete knowledge of different drying methods and calculation procedure of dehydration and rehydration of fruits were given.

The fresh button mushrooms were purchased from local market. Post-harvest operations such as grading, washing and cleaning was done to remove the hard soil particles adhering to them. Blanching was done in the medium of hot water for a period of 5 – 6 min at the temperature of 95 to 100°C to kill the microbial activity of mushrooms. Sun drying and Cabinet tray drying methods were selected for this study \[11\]. Mushrooms were sliced into half inch pieces depending on its size and were dried under sun radiation. Mushrooms were dried in cabinet tray drier where mushrooms kept in series of trays and warm air temperature of 50°C was passed with air velocity of approximately 1m/sec. Weight of mushroom slices was noted regularly. Readings were taken at interval of 2 hours till constant weight was obtained. Drying time required in cabinet tray drier was 10-12 hours.

The samples of different drying treatments (2g) were soaked in distilled water at 35°C. After a time, interval of half an hour, the mushrooms were removed from water and excess water gently blotted out with paper towel. The samples were weighed and then placed back into water. Readings were taken until there was no further change in weight, at which time the mushrooms were considered to have reached full rehydration capacity.

Dehydration of mushrooms takes place in both open sun and cabinet tray dryer. Measurement of weights was taken in fixed interval of time. The decrease in the moisture content was calculated at each step. Dehydrated mushrooms can be rehydrated by procedure mentioned earlier. Rehydration ratio and coefficient of rehydration was also calculated for mushrooms dried using both the drying methods according to the formulas given in earlier section. Drying of mushrooms using open sun and cabinet tray dryer was shown in Fig. 1.

The rehydration ratio can be calculated by the following formula.

\[
\text{Rehydration ratio} = \frac{\text{Weight of rehydrated Sample}}{\text{Weight of dehydrated Sample}}
\]
The rehydration coefficient is one of the important parameters in rehydration characteristics of fruits and vegetables. The rehydration coefficient can be calculated by the following formula.

\[
\text{Coefficient of Rehydration} = \frac{W_r}{W_d - W_u} \times 100
\]

Where, \(W_r\) = Weight of rehydrated sample (g); \(W_d\) = Weight of dried sample (g); \(W_u\) = Weight of moisture (g) and \(A\) = weight of raw material (g).

The organoleptic quality can be tested using hedonic scale 1-9 (1- most disliked and 9- most liked). The format of the evaluation report is given in below table. Organoleptic evaluation of dried mushrooms was performed by a panel of 2 judges of Vikas College of Engineering and Technology, Nunna, Vijayawada, India.

| Sample code | Taste | Smell | Appearance | Texture |
|-------------|-------|-------|------------|---------|
|             |       |       |            |         |
| 1           |       |       |            |         |
| 2           |       |       |            |         |

3. RESULTS AND DISCUSSION

The section deals with the results of experimental observation that have been carried out, analyzed and discussed in relation to the mushroom dried by different drying methods.
Table 1. Quality parameters of rehydrated button mushroom dried by different methods

| Drying Method       | Moisture Content (% wet basis) | Co-efficient of Rehydration | Rehydration Ratio |
|---------------------|--------------------------------|-----------------------------|-------------------|
|                     | Fresh | Dehydrated | Rehydrated |                |                  |
| Sun drying          | 89.8  | 10.2       | 78.1       | 0.466           | 1:2.9           |
| Cabinet Tray drying | 89.8  | 10.0       | 79.5       | 0.498           | 1:3.3           |

Table 2. Organoleptic evaluation of mushrooms using different drying methods

| Drying Method        | Flavour | Smell | Appearance | Texture | Organoleptic Quality |
|----------------------|---------|-------|------------|---------|----------------------|
| Sun drying           | 6       | 5     | 4          | 5       | Satisfactory         |
| Cabinet Tray drying  | 7       | 6     | 8          | 7       | Good                 |

The results obtained from the rehydration characteristics were given in Table 1. It is clear from the Table 1 that Cabinet Tray dried mushrooms registered highest rehydration ratio of 1:3.3 where Sun dried mushrooms exhibit lower rehydration ratio of 1:2.9. Highest coefficient of rehydration value was also obtained for the cabinet tray dried mushrooms having the value of 0.498 and it was 0.466 for sundried ones. Cabinet Tray dried mushrooms are reconstituted well and its moisture content value is somewhere closer to the fresh mushrooms when compared to the sun-dried mushrooms.

The results obtained from organoleptic evaluation were given in Table 2. The organoleptic evaluation of rehydrated product showed that the texture, appearance and flavour of the rehydrated samples of cabinet tray dried mushrooms were very good and was followed by sun dried mushrooms. The texture and appearance of the rehydrated samples of the sun-dried mushrooms were rated only satisfactory as the parameters seems to have been adversely affected by the drying method.

The present study indicates that the mushrooms dehydrated by the cabinet tray drying have better rehydration characteristics than sun drying.

4. CONCLUSIONS

Mushrooms dried using different drying methods can be evaluated for their quality, dehydration, rehydration and organoleptic characteristics.

From the above study the following conclusions can be drawn:

1. Sun dried mushrooms exhibit lower rehydration ratio than the cabinet tray dried mushrooms.

2. Cabinet tray dried mushrooms are reconstituted well and their moisture content value is closer to the fresh mushrooms when compared to the sun-dried mushrooms.

3. The organoleptic evaluation of rehydrated product showed that the texture, colour and flavour of the rehydrated samples of cabinet tray dried mushrooms were very good and was followed by sun dried mushrooms.

4. The present study indicates that the mushrooms dehydrated by the cabinet tray drying have better rehydration characteristics than sun drying.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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