

## THE EFFECTS OF HOT AIR-DRIED AND FREEZE-DRIED TREATMENTS ON SHIITAKE MUSHROOM (*Lentinula edodes*): A REVIEW

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**Abstract:** The total world production of mushrooms were 11 million metric tons and 73.9% of the production was from Asian region as they are being consumed throughout the world for their specific aroma, texture and taste. During storage and transportation fresh shiitake mushrooms are prone to texture softening thus declining its quality as fresh shiitake have a high-metabolic rate after plucking and have high water content. Thus, two out of the various drying techniques which are hot air-drying (HAD) and freeze-drying (FD) that are being used as a preservation method for shiitake mushrooms were reviewed in this paper. HAD provided a simple drying mechanism to dry food products but the prolonged time and high drying temperature were the major drawbacks as it produced an extensive deterioration of final product structure. While, FD is able to produce a final dried product resembling the fresh product state but has a higher production cost compared to HAD. In this review, the comparison between HAD and FD on the qualities of shiitake mushrooms were discussed. Based on the literature, there is a lack of research being done that describes the qualities such as physicochemical properties, sensorial, nutritional and microbial safety of HAD and FD on shiitake mushrooms. Overall, HAD and FD have their own advantages and limitations, further research should be done to compare and optimize HAD and FD in order to produce good qualities of dried shiitake mushrooms.

**Keywords:** Shiitake mushrooms, freeze-dried mushrooms, hot air-dried mushrooms, qualities of dried mushrooms

### 1. Introduction

Freshly harvested mushrooms immediately start to deteriorate after harvesting (Tian et al., 2016). Thus, an appropriate preservation method needs to be applied to extend their shelf life. An optimal drying method is also crucial in order to improve the quality of the mushrooms as each drying method has its own advantages and limitations (Schrawat et al., 2018; Tian et al., 2016).

Hot air drying and freeze drying methods have their own unique characteristics and drawbacks. Thus, the qualities of dried shiitake mushroom in terms of moisture content, colour, microstructure, volatile composition, sensory properties, nutritional component and microbial after undergoing HAD and FD were discussed.



## 2. Discussion

### 2.1. Overview and drying methods

Different methods of drying are associated with their own advantages and limitations. Hot air drying is the simplest and most popular drying method (Cui et al., 2018) but cause many unfavourable changes in plant products (Kurata et al., 2020) Freeze drying in general produces the highest quality of final produce as the dried product usually resembling the original food (Politowicz et al., 2018) but higher in cost.

### 2.2. Physicochemical properties

HAD products exhibit a lower moisture content compared to freeze-dried products. FD treatment gives the larger volume retention ratio and a fast rehydration rate but exhibits the dry matter lost value. HAD treatment will hugely contribute to the formation of dark colour in the final dried product. While, FD has a better overall colour of the final dried product which is closer to the original colour of fresh shiitake mushroom. Wang et al. (2019) also reported that the increasing of the temperature resulting the surface cellular structure to collapse as shiitake mushrooms that treated by HAD had a tight microstructure as the hyphae, and a less collapsed and more uniform microstructure image was found in the FD sample.

### 2.3. Sensorial properties

Hu et al. (2021) stated that FD samples show a lower rating for taste despite it can mimic the original taste of fresh mushroom while HAD sample gives more umami taste compared to FD as it has higher EUC (equivalent umami concentrations) (Harada-Paderno et al., 2020). Apart from that, both of the drying treatments provide a different aroma profile for the dried shiitake mushroom (Luo et al., 2021).

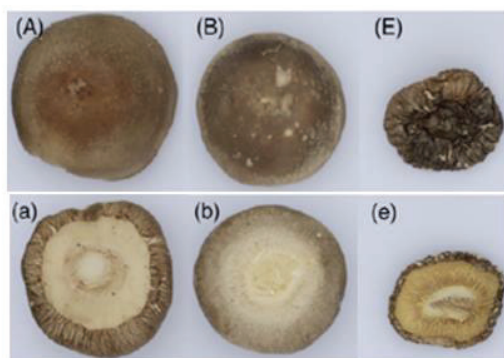
### 2.4. Nutritional properties

FD has a better drying method as it is able to preserve protein content and polysaccharide compared to HAD (Zhao et al., 2019a) and FD treatment can retain a higher vitamin D content compared to HAD treatment.

### 2.5. Microbiological safety

In terms of microbiological safety, HAD sample was contaminated with bacteria based on the total viable bacterial counts that significantly exceeded the total yeast and mould count even though the value was still permissible by WHO (Pewlong et al., 2019).





**Figure 1.** The appearance of shiitake mushroom.

Note: A, B and E means the caps of mushrooms in fresh state and the samples dried by freeze-drying and hot-air drying respectively, a, b and e corresponding to the inner pleats of fresh shiitake and those that undergo freeze-drying and hot-air drying respectively.

Source: Zhao et al. (2019).

### 3. Conclusion

The qualities of dried shiitake mushroom in terms of moisture content, colour, microstructure, volatile composition, sensory properties, nutritional component and microbial after undergo HAD and FD can be concluded based on the presentation of the scientific researches that have been conducted previously.

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