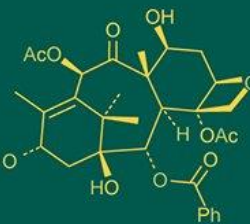
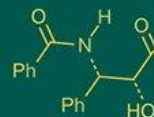
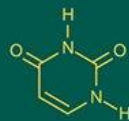
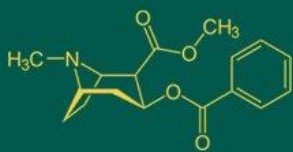


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Effect of drying and pretreatment on the quality attributes of oyster mushroom

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Abstract

Background: Drying is a widely used preservation approach for mushrooms because reduction of water activity improves microbiological stability and extends product usability. However, drying also alters colour, texture, rehydration behavior, nutrient composition and microstructure, which together determine consumer acceptance and suitability for further product development.

Objective: To evaluate the effect of selected drying pretreatments and drying conditions on the physicochemical, rehydration, colour and microstructural quality of oyster mushroom (*Pleurotus ostreatus*), and to identify the most suitable treatment for dried mushroom product applications.

Methods: Fresh oyster mushrooms were washed, cut into approximately 0.5 x 4 cm pieces and dried after different pretreatments: no pretreatment, steam blanching, microwave heating for 2 minutes and mushroom stalk drying. Texture-relevant quality was interpreted through rehydration behavior, colour difference and SEM-based microstructural observations.

Key findings: Untreated dried mushroom showed the highest rehydration capacity (6.42%) and the lowest colour difference (dE*ab 29.07) among the treatments. Steam blanching produced a darker and harder product with lower rehydration (3.81%) and the highest ash value (8.93%), while microwave treatment gave poor rehydration (1.63%) and unacceptable colour development. Stalk samples contained comparatively lower protein (11.45%) and higher carbohydrate (68.71%). SEM observations supported these results by showing greater structural collapse in pretreated samples than in the untreated control.

Conclusion: Drying without pretreatment preserved the most favorable balance of colour, rehydration and structural integrity, making it the preferred treatment for further development of dried oyster mushroom products.

Keywords: Vitamin D2, ergosterol, oyster mushroom, drying, rehydration, microstructure, colour

1. Introduction

Oyster mushroom (*Pleurotus ostreatus*) is valued as an edible mushroom because of its delicate flavour, fibrous texture and potential use in value-added foods. Like most fresh mushrooms, it contains high moisture and has a limited shelf life; therefore, post-harvest preservation becomes important for maintaining availability, reducing spoilage and supporting product diversification. Drying is among the most practical preservation methods because it lowers water activity and improves storage stability, but the process must be controlled carefully to retain quality.

During drying, mushroom tissue undergoes several physical and chemical changes. Textural attributes such as hardness or firmness, cohesiveness, springiness and chewiness may change as the internal structure shrinks and cell walls collapse. Colour changes may also occur because of enzymatic browning or non-enzymatic reactions between carbohydrates and amino acids, especially under high-temperature conditions. These changes directly influence visual appeal and rehydration performance, both of which are important for consumer acceptance and for using dried mushroom in soups, instant mixes, seasonings and other formulated foods.

The final quality of dried mushroom depends not only on drying temperature and duration but also on pretreatments applied before drying. Pretreatments such as steam blanching and microwave heating may inactivate enzymes or accelerate drying; however, they may also cause leaching of soluble solids, pigment changes, tissue collapse or reduced rehydration. Similarly, stalk portions may behave differently from cap tissue because of compositional and structural differences. Hence, comparative evaluation of pretreatments is necessary to select a drying approach that preserves both nutritional and functional quality.

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Several drying techniques are available for mushrooms, including conventional hot-air drying, thin-layer drying, vacuum drying, freeze-drying, microwave drying, fluidized-bed drying and microwave-vacuum drying. In practical industrial and semi-industrial settings, hot-air drying and solar or sunlight-assisted drying remain attractive because of their relative simplicity and accessibility. The present study therefore focuses on the effect of drying and pretreatment on oyster mushroom quality, with emphasis on composition, colour, rehydration and SEM-observed microstructure.

2. Materials and Methods

2.1 Sample preparation

Fresh oyster mushrooms (*Pleurotus ostreatus*) were washed thoroughly in clean water to remove adhering impurities and then cut into pieces of approximately 0.5 x 4 cm. After drying, the samples were ground into fine powder and used for physicochemical and HPLC-related analyses.

2.2 Drying and pretreatments

For pretreatment comparison, mushroom pieces were dried in a hot-air tray dryer for 2 hours at 60 °C. Untreated mushroom was also dried in a solar dryer for comparison of vitamin D2 enhancement potential. The pretreatment plan used for sample comparison is summarized in Table 1.

Table 1: Pretreatment and sample classification used for dried oyster mushroom evaluation.

Treatment	Pretreatment / sample description
T ₁	Dried without any pretreatment (control)
T ₂	Dried after steam blanching
T ₃	Dried after microwave heating for 2 minutes
T ₄	Dried mushroom stalks

3. Results and Discussion

3.1 Effect of pretreatment on dried mushroom quality

Pretreatments affected the main quality attributes of dried oyster mushroom, including moisture, proximate composition, rehydration behavior and colour difference (Table 2). The untreated dried sample (T₁) retained the most desirable functional quality because it showed the highest rehydration value (6.42%) and the lowest colour difference (dE*ab 29.07). These results indicate that the control treatment maintained a more open and water-absorbent tissue structure and produced comparatively better visual quality after drying.

Steam blanching (T₂) increased the measured moisture to 10.67% and was associated with a higher colour difference (44.23) and lower rehydration capacity (3.81%) than the untreated control. This suggests that blanching, although useful for enzyme inactivation in many vegetables, may promote leaching of soluble solids and softening or collapse of mushroom tissue before drying. The higher ash value in T₂ (8.93%) may also reflect compositional concentration or redistribution following pretreatment. Overall, blanching produced a darker and less rehydratable product in this trial. Microwave-treated samples (T₃) retained protein at a level comparable to the untreated sample, but rehydration was markedly reduced to 1.63% and colour difference remained high (37.83). This indicates that short microwave exposure may have accelerated structural modification in the tissue and reduced its ability to absorb water after drying. The result is important because a treatment that appears rapid may still be

unsuitable if it produces poor colour and rehydration quality. Mushroom stalk samples (T₄) showed a distinct composition profile, with lower protein (11.45%) and higher carbohydrate (68.71%) than the other treatments. Rehydration was also low (1.55%), indicating that stalk material may require separate processing conditions or could be better utilized in products where rehydration is not the main quality criterion. Based on the overall balance of colour, composition and rehydration, the untreated dried mushroom was selected as the most suitable sample for solar drying studies and further product development work.

Table 2: Physicochemical properties of pretreated dried oyster mushroom samples. Colour values were determined using a Hunter colour-difference meter, Minolta CM-5.

Treatment	Moisture (%)	Protein (%)	Lipid (%)	Ash (%)	Carbohydrate (%)	Rehydration (%)	Colour dE*ab (D65)
T ₁	7.85	31.15	1.60	3.13	53.31	6.42	29.07
T ₂	10.67	35.96	1.40	8.93	43.04	3.81	44.23
T ₃	8.54	31.92	1.40	6.04	52.10	1.63	37.83
T ₄	12.85	11.45	2.80	4.19	68.71	1.55	41.26

3.2 Microstructure

Scanning electron microscopy confirmed that pretreatment modified the tissue network of dried oyster mushroom (Figure 1). The untreated sample retained a comparatively open porous matrix, which is consistent with its higher rehydration capacity. In contrast, pretreated samples exhibited more collapsed or compacted structures, indicating that heat and moisture exposure during pretreatment can deform the cell-wall network before or during drying. The microstructural observations provide a mechanistic explanation for the physicochemical results. Samples with more collapsed tissue absorbed less water during rehydration, whereas a more open network allowed better water uptake. Therefore, microstructure, colour and rehydration results together support the selection of untreated drying as the most suitable treatment among the options evaluated in this study.

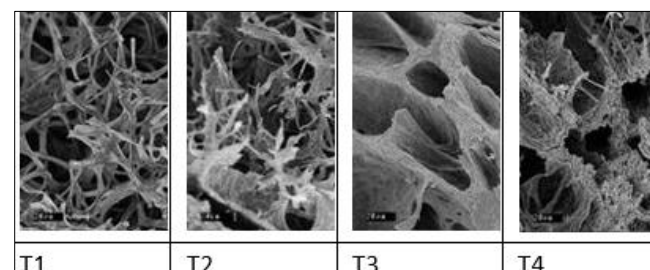


Fig 1: Representative SEM micrographs showing the effect of pretreatment on dried oyster mushroom microstructure.

4. Conclusion

Drying without pretreatment produced the most favourable quality profile for oyster mushroom, combining the lowest colour difference, the highest rehydration capacity and better structural retention than the pretreated samples. Steam blanching and microwave heating negatively affected colour and rehydration, while stalk samples showed a different composition profile and low rehydration. Overall, untreated drying is recommended for further development of dried oyster mushroom products where colour, texture and reconstitution quality are important.

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