Effect of Blanching And Pre-Treatments on The Quality of Dehydrated Oyster Mushrooms (Pleurotus Spp.)

Gursharan Kaur[1], Sandeep Singh[2]
[1, 2] Dept of Food Science & Technology
[1, 2] Khalsa College, Amritsar (Punjab)-143401 India

Abstract- *Mushrooms are an exotic food source of vegetarian protein. Freshly harvested mushrooms are of perishable nature and they have a shelf life of less than a day under ambient conditions. The shelf life of fresh oyster species (Pleurotus sajor-caju) can be prolonged many times if they are given proper blanching and chemical treatments to inactivate the enzymes before dehydration. Mushrooms which were given the chemical treatment with 0.5 percent sodium bisulphate and 0.25 percent citric acid for 15 minutes and followed by blanching for 2 minutes was found to be adequately effective to inactivate the peroxidase enzyme activity in sliced mushrooms. Oyster mushrooms were than dehydrated in cross flow hot air cabinet drier at 50oC. The pretreatments and blanching of mushrooms produced dehydrated mushrooms with better colour, flavour and increased shelf life. The rehydration ratio was better in mushrooms prepared after blanching. The dehydrated mushrooms were found to be acceptable even after 9 weeks of storage period. The dried mushrooms can be ground to powder and can be supplemented into other traditional Indian foods as it is a rich source of proteins with essential amino acids.*

Keywords- Mushrooms, peroxidase enzyme, pretreatments, cabinet drier, organoleptic evaluation.

I. INTRODUCTION

Mushrooms are relished as a delicacy because of their subtle flavour, nice aroma and special taste appeal (Bano et al 1992). Technically, the mushroom is a fleshy reproductive structure of fungus which can be grown on compost in mushroom houses (under controlled temperature and humidity) producing 4 to 5 harvests during a 2-3 month period. Mushroom produces high quality of protein from worthless agro wastes. Total mushroom production in India is 50,000 tonnes with 85% of this production being of white button mushrooms (Anon. 2010). With increased production of mushroom, its preservation is essential for increased shelf life and higher return as mushroom is a highly perishable commodity and has a limited post harvest shelf life (Royse, 1997). Mushroom is processed to more stable forms that can be stored for extended period thereby reducing losses and making them available during off season. Dehydrated mushrooms are used as an important ingredient in several food formulations including instant soups, pasta salads, snack seasonings, stuffing, casseroles, and meat and rice dishes (Tuley, 1996). Mushrooms are soft textured and highly perishable. Dehydration, canning and freezing have been found to be suitable for its preservation (Maskan, 2003). Mushroom is the most priced commodity among vegetables not because of its nutritive value but because of its characteristic aroma and flavor. However, it is now a well-established fact that mushrooms are excellent sources of vitamins and minerals (Khader, 1999). Fresh mushrooms contain about 85–95% moisture content, 3% protein, 4% carbohydrate, 0.3–0.4% fat and 1% minerals and vitamins. They also contain appreciable amount of niacin, pantothenic acid and biotin. In addition, mushroom also contain folic acid and vitamin B_{12} which are absent in most of the vegetables.

Dehydration and quality characteristics of mushrooms are most important to improve product quality. Dehydration is the process of removal of surplus water without destruction of cellular tissues or important of energy values (Calín-Sánchez et al, 2020). Removal of water from food helps preservation by preventing microbial spoilage (Kumar and Parkash, 2012). Mushroom cultivation has a great potential as a cottage industry. Agricultural wastes like wheat or paddy straw can be used as bedding materials for cultivation of oyster mushrooms. Being a highly perishable commodity, processing and preservation of mushrooms is of vital importance. This study was therefore designed to see the effect of blanching and storage on the quality of dehydrated mushrooms.

II. MATERIAL AND METHODS

The freshly harvested oyster mushroom (*Pleurotus sajor-caju*) was procured from Mushroom Research Centre, Punjab Agricultural University, Ludhiana. Mushrooms were first cleaned by spraying water. The mushrooms were coarsely sliced (7mm thick) at the longitudinal axis and placed in various pretreatment solutions to prevent browning

a) 1 percent KMS + 0.2 percent citric acid for 24 hours
b) 3 percent KMS + 1 percent citric acid for 15 minutes
c) 0.1 percent KMS + 1 percent citric acid for 10 minutes
d) 0.5 percent sodium bisulphite + 0.25 percent citric acid for 15 minutes
e) 0.5 percent KMS + 0.25 citric acid for 15 minutes

The best results were obtained with pre-treatment (d) and after that the sliced mushrooms were blanched in hot water at 80ºC for different times to find the optimum time for adequacy of blanching. Freshly harvested as well as dehydrated mushrooms were analyzed for their proximate composition (AOAC, 2000).

Fresh mushrooms were subjected to blanching in hot water at 80ºC for zero and 2 minutes and then were spread uniformly on the drying trays at the density of 1Kg/m^2 and dehydrated in cabinet drier at a temperature of 50ºC in the Department of Food Science & Technology, Punjab Agricultural University, Ludhiana. The dehydrated mushrooms were ground to powder and were packed in PET jars and were analyzed for 3 months of storage for chemical composition (AOAC, 2000).

III. RESULTS AND DISCUSSION

Adequacy of Blanching

The sliced fresh mushrooms were blanched in hot water at 80ºC for various times. The results in Table 1 indicated that under these conditions a maximum time of 2 minutes was adequate for proper blanching of mushrooms as revealed by negative peroxidise test. Similarly, Kumar and Prakash (2012) reported that 2 minutes time was effective to inactivate peroxidise enzyme activity in mushrooms when blanched in hot water at 80ºC.

Table 1 Effect of blanching time on the presence of peroxidase activity in fresh mushrooms

Blanching time	Presence of peroxidase activity
0 minute	*****
1 minute	**
1.5 minute	*
2 minutes	-
5 minutes	-

***** - Heavy reddish brown colour
*- Trace reddish brown specks
**- Faint reddish brown colour -

Negative or no colour

The results in Table 2 showed the effect of different blanching times on the composition of dried mushrooms. Hot water blanching caused substantial decrease in fat, protein and ash contents with proportional increase in blanching time. On the other hand there was an increase in the crude fibre and starch contents of dried mushrooms with a proportional increase in blanching time.

Table 2 Effect of different blanching time on composition of dried mushrooms.

Blanching time	Moisture %	Fat %	Protein %	Crude fibre %	Ash %	Available carbohydrates %
0 minute	8.6	3.8	26.7	7.4	4.6	38.3
2 minute	9.2	3.5	27.0	7.2	4.3	41.5
5 minute	8.8	3.2	27.3	7.4	4.4	43.9

Similarly a considerable value of loss of water soluble nutrients in hot water blanching process was observed by Tran et al, (2020), Arora et al (2003) and Priestley (1984).

Effect of dehydration on the composition of mushrooms

The composition of mushrooms after and before dehydration is reported in Tables 2 and 3, respectively. The fresh and dried mushrooms respectively contained 92.3 % and 8.92% moisture, 0.47 and 3.8 % fat, 3.02 and 26.5 % protein, 1.04 and 7.8% crude fibre, 0.6 and 5.7 % ash, 4.7 and 38.3% available carbohydrates.

Table 3 Composition of fresh mushrooms

Constituents	Per cent
Moisture	92.3
Fat	0.47
Protein	3.02
Crude Fibre	1.04
Ash	0.6
Available carbohydrates	4.7

Results are expressed as mean values of three observations

The loss of moisture during dehydration made the resultant dried product a concentrate source of food nutrients.

As far as composition of fresh mushrooms is concerned the trend is similar to that of Priestly (1984) and Martínez-Soto et al. (2001).The dried product will not only require less space for stacking and transportation but will also have a good storage stability.

Effect of storage on the quality of dehydrated mushrooms

The storage effect on the quality of dehydrated mushrooms was studied when freshly prepared mushrooms were dried in cabinet drier after giving the pre treatments and hot water blanching.

Chemical composition

The results showing the effects of blanching and storage on the composition of dried mushrooms are presented in Table 4. The dried mushrooms without pre treatment gave 8.92 and 9.38 % moisture, 3.8 and 3.76% fat, 26.5 and 25.7 % protein, 7.8 and 7.6% crude fibre, 5.7 and 5.6% ash after 3 months of storage. Similarly the treated mushrooms contained (respectively at zero and 3 months) 8.41 and 8.77 % moisture, 4.10% fat, 27.2 and 26.6% protein, 8.00 and 7.95% crude fibre, 4.4 and 4.3% ash.

Table 4 Effect of pretreatment and storage on the composition of dehydrated mushrooms.

Constituents	Pre-treatments	Storage period in weeks				
		0	3	6	9	Mean
Moisture (%)	Untreated	8.92	9.24	9.35	9.38	9.22
	Pretreated	8.41	8.52	8.64	8.77	8.58
Fat (%)	Untreated	3.80	3.80	3.78	3.76	3.78
	Pretreated	4.10	4.10	4.10	4.10	4.10
Protein (%)	Untreated	26.5	26.2	26.0	25.7	26.1
	Pretreated	27.2	26.9	26.7	26.6	26.8
Crude Fibre (%)	Untreated	7.80	7.70	7.65	7.62	7.69
	Pretreated	8.00	8.00	7.95	7.95	7.97
Ash content (%)	Untreated	5.7	5.7	5.6	5.7	5.67
	Pretreated	4.4	4.4	4.4	4.3	4.37

Results are expressed as mean values of three observations

These results confirmed that hot water blanching caused losses in water soluble nutrients but at the same time there were less variations in individual constituents of dried mushrooms, the general chemical composition was not much affected by this storage.

Rehydration quality

The dehydrated mushrooms were first rehydrated for 1 hour in cold water (10g dried mushrooms in 100 ml water), then the weight after rehydration was divided by the weight of original dried product to obtain rehydration ratio. The rehydration ratio was higher in untreated mushrooms as compared to the treated mushrooms. The reason behind this is that blanching pretreatment yielded a structurally more compact product after dehydration (Rhoda, & Simate, 2016). This factor adversely influenced the rehydration of blanched mushrooms. Further deviation in rehydration was observed with advancement of storage of dehydrated mushrooms (Table 5). Similar trend was recorded by Suguna et al. (1995).

Table 5 Effect of blanching pretreatment and storage on composition of dehydrated mushrooms

Storage period	Rehydration ratio		Sensory scores after cooking of rehydrated mushrooms							
	1	2	Colour		Flavour		Taste & Texture		O.A.	
			1	2	1	2	1	2	1	2
0 weeks	3.50	3.80	7.82	8.21	7.12	7.42	7.87	8.21	7.62	7.91
3 weeks	3.40	3.75	7.63	8.01	7.00	7.36	7.80	8.15	7.60	7.82
6 weeks	3.35	3.79	7.34	8.00	6.92	7.36	7.57	8.00	7.58	7.81
9 weeks	3.35	3.79	7.20	7.99	6.72	7.30	7.45	8.00	7.50	7.79

O.A.-Overall acceptability
Sensory evaluation on the basis of 9-point hedonic scale

Organoleptic characteristics

Initially the scores were 7.82 and 8.21 for colour, 7.12 and 7.42 for flavour, 7.87 and 8.21 for taste and texture and 7.62 and 7.91 for overall acceptability in case of unblanched and blanched mushrooms respectively. The blanched mushrooms after rehydration were found to be superior to their unblanched counterpart in sensory quality in terms of colour, flavour, taste and texture. Similar trends were also reported by Oddson and Jelen (1981).

IV. CONCLUSION

The pretreated mushrooms were found to be more stable and acceptable than untreated mushrooms of *Pleurotus sajor caju* variety. Besides improving colour, flavour, etc. pre-treatments also increased the shelf life of the mushrooms. The dried mushrooms remained acceptable during 9 weeks of storage period.

REFERENCES

[1] Anonymous (2010) Button mushroom. www.nhb.gov.in.

[2] AOAC (2000) Official methods of analysis. Association of official analytical chemists. Washington D.C., USA.

[3] Arora, S., Shivhare, U.S., Ahmed, J. and Raghavan, G.S.V. 2003. Drying kinetics of *Agaricus bisporus* and *Pleurotus florida* mushrooms. *Amer. Soc. of Agricult. Eng.* 46(2): 721-724.

[4] Bano, Z., Rajaratham, S. and Shashirekha, M. N. 1992. Mushroom-Unconventional single cell protein for a conventional consumption. *Indian Fd Packer.* 46(5): 23-31.

[5] Calín-Sánchez, Ángel, Leontina Lipan, Marina Cano-Lamadrid, Abdolreza Kharaghani, Klaudia Masztalerz, Ángel A. Carbonell-Barrachina, and Adam Figiel. 2020. "Comparison of Traditional and Novel Drying Techniques and Its Effect on Quality of Fruits, Vegetables and Aromatic Herbs" Foods 9, no. 9: 1261.

[6] Khader, V. 1999. Mushroom processing. *In: Preservation of fruits and vegetables.* New Delhi: Kalyani Publishers, pp. 124–129.

[7] Kumar, D. and Prakash, V. 2012. Effect of pretreatment on dehydration and quality characteristics of mushroom. *Journal of Current Advances in Agricultural Sciences.* 4(1):94-97.

[8] Maskan Khalloufi, S., Giasson, J., Ratti, C. 2003. Water activity of dried mushrooms and berries. *Canadian Agricultural Engineering*. 42: 51-56.

[9] Martínez-Soto, G., Ocanã-Camacho, R., Paredes-López, O. 2001. Effect of pretreatment and drying on the quality of oyster mushroom (*Pleurotus osteratus*). *Drying Technol.*, 19: 661-672.

[10] Oddson, L. and Jelen, P. 1991. Food processing potential of the oyster mushroom (*Pleurotus florida*). *Canadian Institute of Fd. Sci. Technol.* 14(1) 36 cf. Fd. Sci. Abstracts, 13(8): 1221, 1981.

[11] Priestly, R. J. 1984. *Effects of heating on food stuffs*. Applied Sci. Publ. Ltd. London. pp. 327-328.

[12] Pruthi, J.S., Manan, J. K., Raina, B.L. and Teotia, M.S. 1984. Improvement in whiteness and extension of shelf-life of fresh and processed mushroom (*Agaricus bisporus*) and (*Volvariella volvacea*). *Indian Food Packer*. 38(2):55.

[13] Rhoda, A.N., Simate, I.N. 2016. Greenhouse Solar Drying and Thin Layer Drying of Fresh Kapenta (Stolothrissa tanganicae). *Intl. J Sci.-Engg Res.* 7(5): 749-756

[14] Royse, D. J. 1997. Speciality Mushrooms and their Cultivation, *Horticultural Reviews*, 19: 59–97.

[15] Suguna, S., Usha, M., Narayanan, V.V., Raghupathy, R., Gothandapani, L. 1995. Dehydration of mushroom by sun drying, thin layer drying, fluidized bed drying and solar cabinet drying. *J Fd Sci Technol*. 34:284–288.

[16] Tran, T. N. T., Khoo, K. S., Chew, K. W., Phan, T. Q., Nguyen, H. S., Nguyen-Sy, T., Nguyen, T. D. P., Chen, W.-H., & Show, P. L. (2020). Modelling drying kinetic of oyster mushroom dehydration – The optimization of drying conditions for dehydratation of Pleurotus species. Materials Science for Energy Technologies, 3, 840–845.

[17] Tuley, L. 1996. Swell time of dehydrated vegetables. *International Food Ingredients*. 4(1): 23.