Pakistan J. Sci. Ind. Res., Vol. 27, No. 6, December 1984.

STUDIES ON THE PRESERVATION OF OYSTER MUSHROOMS *(PLEUROTUS SAPIDUS)*

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(Received February 2, 1984; revised November 13, 1984)

Pleurotus sapidus was preserved using different methods. The prepared products were subjected to analytical analyses and organoleptic evaluations. Analytical studies on the preserved materials have revealed that the basic composition of the mushrooms remains, by and large, unaltered. Organoleptic evaluations have shown a fair to good acceptability of the products.

INTRODUCTION

Species of the genus *Pleurotus*, commonly known as oyster mushrooms, have been regarded as the most interesting and most efficient users of straw [5]. This aspect has been further extended to the evaluation of these species for their ability to increase ruminant digestibility and nutritional content of wheat and rice straw [6, 10]. In addition to the production of upgraded cattle feed the fungi yield highly nutritious and profitable mushroom crops. However, in view of their high moisture content and short shelf-life the production of mushrooms on commercial scale is a hazardous undertaking. Therefore, an investigation of various aspects of mushroom preservation after different treatments and their effect on organoleptic qualities forms an important subject of study.

Canning and dehydration have been used for the preservation of mushrooms belonging to the various fungal genera [7,9]. However, no such report is available on the genus *Pleurotus*. Oil pickling as a method of mushroom preservation has also been suggested [8]. These studies, however, did not include the more widely cultivated *P. sapidus* species. In view of the above, oyster mushroom was preserved using various methods and the preserved products were evaluated for their keeping quality and organoleptic characteristics.

MATERIALS AND METHODS

P. sapidus used in the present investigation was cultivated as described earlier for *P. sajor-caju* [10]. Freshly harvested mushrooms, measuring about 8-10 cm in cross-section were sorted out, preserved, and evaluated using the following methods.

(a) *Simple Drying:* Mushrooms were subjected to simple drying in a hot air chamber for 6 hr. at 50 – 60°.

(b) *Freeze Drying:* Mushrooms were frozen dried in a Hungarian Laboratory Lyophylizing Apparatus Type DE-950 at 25, 30 and 50° for 18 hr.

(c) *Pickling in Oil:* The thalloid *P. sapidus* mushrooms were washed in running tap water, and gently squeezed to remove the excess water present between the gills and chopped into about 0.5 – 1 cm x 2.5 – 3.0 cm pieces using stainless steel knives. The chopped mushrooms were simmered in 250 ml oil for 30 min. Cumin, fenugreek, longitudinally split green chillies, and coriander seeds were fried in oil for 5 min. All the ingredients (Table 1) were then thoroughly mixed with mushrooms and the mixture allowed to boil. The preparation was bottled and sealed while still hot. The bottles were stored at ambient temperature.

Table 1. Ingredients used for the oil pickling of *Pleurotus sapidus*

1. Mushrooms	1 kg
2. Cumin seeds	8 g
3. Fenugreek seeds	15 "
4. Coriander seeds	9 "
5. Turmeric powder	7 "
6. Ground mustard seeds	10 "
7. Medium-sized green chillies	10 nos.
8. Vinegar	350 ml
9. Common salt	50 g
10. Bland oil	500 ml

(d) *Pickling in Vinegar:* Mushrooms were chopped into small pieces as above. These were thoroughly mixed with 2 g common salt and preserved in a wide mouth bottle containing 200 ml vinegar.

(e) *Analytical Procedures.* Mushrooms subjected to different types of preservation methods were analyzed for their proximate composition after a storage period of 3 months. Moisture contents, ash, protein, crude fibre, and fat were determined according to the standard methods mentioned earlier [10]. Mushroom pieces pickled in oil and vinegar were well dried between folded blotting papers before being subjected to analyses. In this case, however, ash was not determined in view of the addition of common salt.

(f) *Organoleptic Evaluation.* Sensory evaluations were made using 0-10 scale [4]. Hot air dried and freeze dried products were evaluated as a soup base using fresh mushroom soup as a reference [1]. Commercial mango pickle was used for evaluating the comparative acceptability of mushroom pickles in oil and in vinegar.

RESULTS AND CONCLUSIONS

No significant difference was observed in the proximate composition of mushrooms subjected to different preservation methods (Table 2). A slight decrease in the crude protein content of the mushrooms preserved in salted vinegar can be attributed to the possible leaching of soluble proteins and other nitrogenous substances during storage. In contrast to the proximate composition the appearance of the freeze dried and air dried mushrooms showed considerable variation (Table 3). The freeze dried mushrooms on rehydration attained physical characteristics that could be rated close to the fresh mushrooms. The hot-air dried mushrooms on rehydration were slightly inferior in quality to the freeze dried mushrooms.

It is apparent from Table 4 that soup preparations

Table 2. Proximate composition of *Pleurotus sapidus* mushrooms preserved* by various methods

Component	Fresh	Freeze-dried	Hot-air dried	Mushroom pickle in oil	Mushroom pickle in vinegar
Ash	11.8	11.9	11.4	**	**
Crude protein	25.2	25.1	25.0	20.6	19.8
Fat	1.6	1.6	1.4	***	1.7
Crude fibre	12.4	13.4	13.1	13.3	14.9
Cellulose	5.3	5.4	4.9	3.0	2.4

* Products stored for 3 months.
** Not analyzed for ash due to the addition of common salt in this preparation.
*** Not analyzed for fat due to the addition of oil in this preparation.

Table 3. Physical appearance of freeze-dried and hot air dried *pleurotus sapidus* mushrooms as compared to fresh mushrooms

Physical character	Fresh mushrooms	Hot air dried mushrooms	Freeze-dried mushrooms
Shape	Thalloid oyster-like	Thalloid oyster-like but margins completely wrinkled and shape distorted	Thalloid oyster-like
Colour	Cream	Light brown with margins slightly dark brown	Cream
Flavour	Typical mushroom flavour	Typical mushroom flavour slightly masked by burnt flavour	Typical mushroom flavour
Breakability	Easily breakable	Hard to break	Brittle; breaking into powdery mass

Table 4. Organoleptic evaluation of preserved and stored *Pleurotus sapidus* mushrooms evaluated as soup base

Material used as soup base	Colour (0-10)	Flavour (0-10)	Taste (0-10)	Palatability (0-10)	Mouth feel (0-10)	Acceptability (%)	Remarks
Fresh mushrooms (reference material)	6.8	7.1	8.0	7.4	7.4	73.4	Good
Hot air dried mushrooms	6.4	6.0	5.8	5.0	5.2	56.8	Fair
Freeze dried mushrooms	6.8	7.1	7.2	6.9	7.1	70.2	Good

Table 5. Organoleptic evaluation of pickled *Pleurotus sapidus* mushrooms

Type of pickle	General appearance (0-1)	Flavour (pickled pieces only) (0-10)	Taste (0-10)	Palatability (0-10)	Mouthfeel (0-10)	Acceptability (%)	Remarks
Mango pickle in oil (reference material)	7.6	7.8	7.3	7.6	7.8	76.2	Good
Mushroom pickle in oil	7.8	6.8	6.9	6.8	6.2	69.0	Good
Mushroom pickle in vinegar	8.0	6.2	6.3	6.1	5.8	64.8	Good

containing freeze dried mushrooms and fresh mushrooms had a rather comparable acceptability, whereas the taste, appearance and flavour of the soup containing hot-air dried mushrooms was slightly inferior to the other two preparations.

The two products of pickled mushrooms were evaluated for organoleptic characteristics against mango pickle as a reference material. Mango pickle was selected due to its general acceptability. It is evident from Table 5 that mushrooms pickled in oil as well as mango pickled in oil had a similar acceptability. Mushrooms pickled in vinegar had a slightly less acceptability than the oil pickles, which was due to its unfamiliarity. No off flavour or rancidity was detected in the oil pickled mushrooms. The taste of pickled mushroom pieces, whether in oil or vinegar, was rated as 'salty', slightly hot, acidic, and spicy which are the characteristics of an acceptable product. The typical mushroom flavour, although slightly masked by various pickling ingredients, was retained.

It can be concluded from the foregoing that all the four preservation methods yielded products that had fair to good acceptability. Mushrooms have a very delicate flavour, therefore obviously the freeze-dried mushrooms had the same acceptability as the fresh mushrooms. It may be further mentioned that mushrooms are a rich source of good quality protein, minerals and vitamins [2]. This is evident from the presence of 25.2% protein in oyster mushrooms (Table 2) as compared to 0.6% protein in the green mangoes used for pickling [3]. Therefore, the pickled products based on mushrooms will be highly nutritious and, consequently, will have an added advantage over the other conventionally used pickles.

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