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# APPLICATION OF CHEMICAL PRESERVATIVES FOR ENHANCING SHELF LIFE OF *PLEUROTUS FLORIDA*

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## Abstract

Mushroom are exceptionally perishable produce with post-harvest life running from 24-48 hrs because of browning, textural changes, weight reduction and microbial rot. Effect of different chemical preservatives for enhancing shelf life of sporophores of oyster mushroom has been studied. Six chemical preservatives used alone or combination for preservation of harvested sporophores of *P. florida*. Amongst the combination of different chemical preservatives, treatment $T_1$ (5% salt, 0.2% CA, 0.1% KMS) and $T_6$ (0.1%AA, 0.2% PA, 0.1% KMS) these two preservative chemical were found suitable for maintenance of colour, texture and appearance and stored up to 120 days. $T_1$ (5% salt, 0.2% CA, 0.1% KMS), $T_8$ (1% salt, 0.1%AA, 0.1% CA, 0.05% SB, 0.05% KMS) $T_4$ (0.2%AA, 0.2% CA, 0.2% KMS) and $T_9$ (0.2%AA, 0.2% CA, 0.2% KMS) which was equally preserve up to 60 to 80 days. This investigation will help for prolong storage of oyster mushroom.

***Key words:*** *Pleurotus florida,* chemical preservatives, sporophores, texture, colour, appearance

## Introduction

Oyster mushroom (*Pleurotus* species) belonging to Class Basidiomycetes and Family Agaricaceae is prominently known as 'dhingri' in India and grows naturally in the temperate and tropical forests on dead and rotting wooden logs or sometimes on dying trunks of deciduous or coniferous woods. It might also grow on decaying organic substance. The fruiting bodies of this mushroom are distinctly shell or spatula shaped with different shades of white, cream, grey, yellow, pink or light brown depending upon the species. *P. florida*; a species of oyster mushroom growing easily in warmer condition may be the best substitute for the year round supply of Oyster mushroom supporting summer season.

During the recent years there has been an increased emphasis on the quality of fresh vegetables including mushrooms, which is reflected in the price of the produce. In India, the mushroom market is largely the contribution of small and marginal farmers with limited resources who are dependent on local market for the sale of their produce. The rate of respiration activity of the harvested mushrooms is high in comparison to the other horticultural crops and this result in a shorter post-harvest life.

Mushroom are exceptionally perishable produce with post-harvest life running from 24-48 hrs. because of browning, textural changes, weight reduction and microbial rot (Fernandes *et al.,* 2012). Oyster mushroom has very short time span of usability and maintenance at the dimension of producer, while merchant, retailer and customer for one season or the other may result in the deterioration in the quality of produce leading to almost 100 percent monetary loss. A few investigations have been led to expand the shelf life of oyster mushroom by chemical preservation. In any case, more efforts are required toward this path. Additionally, efforts are expected to upgrade the shelf life by subjugating the fruit bodies to low temperature and packaging materials of various densities.

The processing of mushroom is necessary to develop suitable post-harvest techniques for its prolonged preservation and usage. Many times grower faces problem of over saturation of market and distress at highly non-remunerative prices. The retention of fresh mushroom at various level such as grower, whole seller, retailers and consumers further results in deterioration in

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quality of the produce and economic loss. Presently, long-term preservation of mushroom by drying, canning and pickling are in vogue. These value added products not only reduces the post-harvest losses but also enhances the additional income to the mushroom growers and provide neutraceuticals low fat, protein rich food to the consumers (Muresan *et al.,* 2012).

Fruiting bodies of mushrooms are valued, for texture and flavour as well as for their chemical compound and nutritional qualities (Manzi *et al.,* 2001). Mushrooms are important healthy and nutritious food, low in calories and high in vegetable proteins, vitamins, iron, zinc, selenium, sodium, chitin, fibres and minerals (Ouzouni *et al.,* 2007). Keeping in view of the above, the present investigation was carried out with the objectives to application of chemical preservation for enhancing shelf life of *Pleurotus florida*.

## Materials and Methods

Freshly harvested mushrooms, chemicals and plastic container were required for mushroom processing and preservation. These mushrooms were used within 24 hours of harvest. The mushrooms were procured during the morning hours, immediately after harvesting. They were sorted for any visible signs of microbiological infection, discoloration and physical injury. Undesirable mushrooms fruiting bodies were removed during selection.

### Samples

Sample size of *Pleurotus florida* (150g) was used for each treatment. Total six chemicals were used alone and combinations with different concentration. Total 12 treatments were used for oyster mushroom (*Pleurotus florida)* preservation.

### Blanching of mushroom

Fresh harvested and washed mushroom was used for blanching. Blanching is a process in which fruiting body of mushroom was placed in a water at 98ºC for 5 minute, the foam developed during the process be removed constantly, followed by sudden transfer into cold water to bring the temperature to less than 36ºC. Blanching inhibit polyphenol oxidase enzyme activity, removes the air trapped inside the tissue and also remove the surface microbial load. This is done to inactivate microorganisms and thus maintains the whiteness in processed mushrooms.

### Steeping of mushroom in different chemicals

Steeping is a process of preserving blanched mushroom in different chemical concentrated and kept in a plastic container. This is convenient, economical, domestic and temporary method for extension of the shelf-life of mushrooms till 120 days. Steeping preservation of mushroom helps to extend shelf-life as well as to retain whiteness.

In order to study the quality and shelf life, the sporophores of oyster mushroom (*P. florida)* with blanching were steeped in solution of different chemical concentration. The fresh sporophores (150g) were blanched at 98°C for 4-5 min, using double layer of muslin cloth. Thereafter, the sporophores were transferred within the different steeping solutions ready from various chemicals and their concentrations forming sum of 12 treatments. The steeping solution of 500 ml was taken in a plastic container of 1000 ml capacity and lid was screwed. These containers were then stored at room temperature and observations on colour, texture and appearance (in days) were recorded following different scales at different time intervals.

## Results and Discussion

### Effect of chemical preservatives on colour of oyster mushroom (*P. florida*)

Effect of various chemical preservative solutions on storage and colour of the Oyster mushroom (*P. florida*) was studied and the data presented in table 3. The result showed that the treatments, $T_6$ (0.1%AA, 0.2% PA, 0.1% KMS) was maintained good colour (2) of the mushroom sporophores till 80 days. Thereafter, it turns out to be slightly dull (3) but it was accepted up to 120 days. It was followed by treatment $T_1$ (5 % salt, 0.2% CA, 0.1% KMS) where retain good colour (2) up to 60 days and there after it became slightly dull (3) till 100 days and accepted up to 100 days. It was followed by $T_8$ (1 % salt, 0.1%AA, 0.1% CA, 0.05% SB, 0.05% KMS) $T_4$ (0.2%AA, 0.2% CA, 0.2% KMS) and $T_9$ (0.2%AA, 0.2% CA, 0.2% KMS) which was equally preserved and retained good colour (2) up to 40 days then it became slightly dull (3) and turn light brown (4) in 60 and 80 days

**Table 1:** List of chemical preservatives for preservation.

| | |
|---|---|
| $T_1$ | 5 % salt, 0.2% CA, 0.1% KMS |
| $T_2$ | 2 % salt, 1% sugar, 0.3% CA, 0.1% KMS |
| $T_3$ | 2.5 % salt, 0.1%AA, 0.2% CA, 0.1% SB, 0.1% KMS |
| $T_4$ | 0.2%AA, 0.2% CA, 0.2% KMS |
| $T_5$ | 0.5% CA |
| $T_6$ | 0.1%AA, 0.2% PA, 0.1% KMS |
| $T_7$ | 0.1%AA, 0.3% CA, 1% ASA, 0.1% KMS |
| $T_8$ | 1 % salt, 0.1%AA, 0.1% CA, 0.05% SB, 0.05% KMS |
| $T_9$ | 0.2%AA, 0.2% CA, 0.2% KMS |
| $T_{10}$ | 1% salt, 0.1%CA |
| $T_{11}$ | 0.1% KMS, 0.2% AA |
| $T_{12}$ | Simple boiled water |

SB- Sodium Benzoate, ASA- Ascorbic Acid, CA- Citric Acid
KMS- Potassium Metabisulphite, AA –Acetic Acid
PA – Propionic Acid

**Table 2:** Scale for preservation and quality of mushroom.

| Scale used for colour, texture and appearance | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Scale for colour | White | Like white | Slight dull | Light brown | Dark brown | | |
| Scale for texture | Fresh | Like fresh | Less soggy | More soggy | Coarse | Rotting | Leathery |
| Scale for appearance | Fresh | Very good | Good | Fair | Slight fermented smell | Fermented smell | |

Sharma and Thakur (2012)

respectively. Treatment $T_2$ (2 % salt, 1% sugar, 0.3% CA, 0.1% KMS), $T_3$ (2.5 % salt, 0.1%AA, 0.2% CA, 0.1% SB, 0.1% KMS) and $T_7$ (0.1%AA, 0.3% CA, 1% ASA, 0.1% KMS) were retained good colour up to 20 days only but accepted up to 40 days. Remaining preservation solution *i.e.* $T_5$ (0.5% CA), $T_{10}$ (1% salt, 0.1%CA), $T_{11}$ (0.1% KMS, 0.2% AA) and $T_{12}$ (Simple boiled water) was not acceptable colour of sporophores even after 5 days of storage and rapid deterioration was observed for mushroom sporophores. In case of treatments chemical preservatives $T_5$ (0.5% CA), $T_{10}$ (1% salt, 0.1%CA), $T_{11}$ (0.1% KMS, 0.2% AA) and $T_{12}$ (Simple boiled water) mushroom was became turgid, little translucent and ample growth of fungal contaminant occurred on the top of the preservative solution and gave foul smell.

**Effect of chemical preservatives on texture of oyster mushroom (*P. florida*)**

Effect of different chemical preservative solutions on storage and texture of the sporophores of oyster mushroom (*P. florida*) was studied and the result is presented in the table 4.

Data presented in the table showed that chemical solutions 0.1%AA, 0.2% PA, 0.1% KMS ($T_6$) and 5 % salt, 0.2% CA, 0.1% KMS ($T_1$) were almost fresh texture (2) up to 80 days and accepted up to 120 days and same treatments after 80 days of storage sogginess of sporophores of mushroom increases. In chemical preservatives 0.2%AA, 0.2% CA, 0.2% KMS( $T_4$), 1 % salt, 0.1%AA, 0.1% CA, 0.05% SB, 0.05% KMS ($T_8$) and 0.2%AA, 0.2% CA, 0.2% KMS ($T_9$) the sporophores of mushroom were like fresh (2) till 40 days and was acceptable up to 100 days. Treatment $T_5$ (0.5% CA) and $T_{10}$ (1% salt, 0.1%CA) showed coarse texture within 40 days after preservation. Chemical preservative 0.5% CA ($T_5$), 1% salt, 0.1%CA ($T_{10}$) and 0.1% KMS, 0.2% AA ($T_{11}$) showed rotting within 60 days after preservation which was not accepted for consumption. In treatment $T_{12}$ *i.e.* simple boiled water the texture of sporophores of mushroom exhibited fast deterioration starting after one day onwards and sporophores was dissolved in preservative solution. Sporophores preserve in steeping solution of chemical preservatives 2 % salt, 1% sugar, 0.3% CA, 0.1% KMS ($T_2$) was well (2) up to 20 days whereas, in $T_{11}$ (0.1% KMS, 0.2% AA) and $T_5$ (0.5% CA) was fare up to 20 days of storage period. The sporophores preserved in treatment $T_5$ (0.5% CA), $T_{10}$ (1% salt, 0.1%CA) and $T_{11}$ (0.1% KMS, 0.2% AA) showed leathery texture within 80 days after storage.

**Table 3:** Effect of chemical preservatives on colour of oyster mushroom (*P. florida*)

| Treatments | *Colour of sporophores at different time intervals (days) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 5 | 20 | 40 | 60 | 80 | 100 | 120 |
| $T_1$ | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| $T_2$ | 1 | 2 | 2 | 4 | 5 | | | |
| $T_3$ | 1 | 2 | 2 | 3 | 3 | 4 | 5 | |
| $T_4$ | 1 | 2 | 2 | 2 | 3 | 4 | 5 | |
| $T_5$ | 1 | 3 | 4 | 5 | | | | |
| $T_6$ | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| $T_7$ | 1 | 2 | 2 | 3 | 4 | 5 | | |
| $T_8$ | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 4 |
| $T_9$ | 1 | 2 | 2 | 2 | 3 | 4 | 4 | 5 |
| $T_{10}$ | 1 | 3 | 4 | 5 | | | | |
| $T_{11}$ | 1 | 3 | 5 | | | | | |
| $T_{12}$ | 1 | 5 | | | | | | |

*Colour 1-White, 2- Like white, 3-Slight dull, 4- Light brown, 5-Dark brown

**Table 4:** Effect of chemical preservatives on texture of oyster mushroom (*P. florida*)

| Treatments | *Texture of sporophores at different time intervals (days) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 5 | 20 | 40 | 60 | 80 | 100 | 120 |
| $T_1$ | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| $T_2$ | 1 | 2 | 3 | 4 | 5 | 7 | | |
| $T_3$ | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 |
| $T_4$ | 1 | 2 | 2 | 2 | 3 | 4 | 5 | 6 |
| $T_5$ | 1 | 2 | 3 | 5 | 6 | 7 | | |
| $T_6$ | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| $T_7$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| $T_8$ | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 5 |
| $T_9$ | 1 | 2 | 2 | 2 | 3 | 4 | 4 | 5 |
| $T_{10}$ | 1 | 3 | 4 | 5 | 7 | | | |
| $T_{11}$ | 1 | 2 | 3 | 4 | 6 | 7 | | |
| $T_{12}$ | 1 | 5 | 7 | | | | | |

*Texture 1- fresh, 2- like fresh, 3-Less sogy, 4- more sogy, 5-coarse, 6-Rotting, 7-Leathery

**Table 5:** Effect of chemical preservatives on appearance of oyster mushroom (*P. florida*)

| Treat-ments | *appearance of sporophores at different time intervals (days) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1** | **5** | **20** | **40** | **60** | **80** | **100** | **120** |
| $T_1$ | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 |
| $T_2$ | 1 | 3 | 5 | 6 | | | | |
| $T_3$ | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 |
| $T_4$ | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 |
| $T_5$ | 1 | 3 | 4 | 5 | 6 | | | |
| $T_6$ | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| $T_7$ | 1 | 2 | 2 | 4 | 6 | | | |
| $T_8$ | 1 | 2 | 2 | 3 | 3 | 4 | 4 | |
| $T_9$ | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 6 |
| $T_{10}$ | 1 | 2 | 5 | 6 | | | | |
| $T_{11}$ | 1 | 2 | 4 | 6 | | | | |
| $T_{12}$ | 1 | 6 | | | | | | |

*Appearance 1- fresh, 2-very good, 3- good, 4- fair, 5-Slight fermented smell, 6- fermented smell

### Effect of chemical preservatives on appearance of oyster mushroom (*P. florida*)

Chemical preservative solutions were also maintained the storage and appearance of the sporophores of oyster mushroom (*P. florida*). Result presented in the table 5 shown that the sporophores of oyster mushroom treated with chemical preservatives 5 % salt, 0.2% CA, 0.1% KMS ($T_1$) and 0.1%AA, 0.2% PA, 0.1% KMS ($T_6$) were appeared well (2) up to 100 days after storage appeared good up to 120 days of storage. Whereas in chemical preservatives (2.5 % salt, 0.1%AA, 0.2% CA, 0.1% SB, 0.1% KMS ($T_3$), 1 % salt, 0.1%AA, 0.1% CA, 0.05% SB, 0.05% KMS ($T_8$) and 0.2%AA, 0.2% CA, 0.2% KMS ($T_9$) sporophores of mushroom very good (2) up to 40 days of storage and acceptable up to 80 days of storage after that it was unacceptable by the people due to it produced fermented smell. In treatments $T_5$ (0.5% CA), $T_{10}$ (1% salt, 0.1%CA) and $T_{11}$ (0.1% KMS, 0.2% AA) sporophores were good up to only 10 to 15 days and mushroom was accepted up to 30 to 40 days of storage only. Boiled water was kept as control for observation of shelf life of harvested mushroom and it was found safe up to 2 days only and after that its quality was deteriorate and it was unacceptable.

Our finding was supported by work of Sharma and Thakur (2019) who studied the effect of chemical preservatives, freezing and deep freezing and thickness of packaging materials on storage and shelf life of *Pleurotus florida*. They reported that chemical preservative 5% salt, 0.2% citric acid and 0.1% potassium metabisulphite and 1% salt, 0.1% Acetic acid, 0.1% citric acid, 0.05% sodium benzoate and 0.05% potassium metabisulphite (with blanching) were highly effective in preserving the sporophores of *P. florida* till 125-150 days.

Adsule *et al.,* (1981) reported the preservation of *P. sajor caju* fruit bodies only upto 3 months in chemical solution of 5% salt, 0.2% citric acid and 0.1% potassium metabisulphite with branching. Namdev (2000) reported the preservation of *P. flabellatus* fruit body up to 165-175 days in chemical solution of 5 percent salt, 0.2 percent CA, 0.1 percent KMS with blanching. Similar finding was also reported by Ramaswamy and Kandaswamy (1978) in paddy straw mushroom, while Sethi and Anand (1978) and Saxena and Rai (1988) in white button mushroom.

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