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Storage and Processing of Edible Mushroom

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Abstract

Mushrooms are difficult raw materials for the processing industry: fresh mushrooms cannot be stored for long periods moreover during processing them readily change colour and texture. In order to guarantee acceptable quality of canned and processed mushrooms, fresh pilei should be kept at low temperatures. Before processing they should undergo preliminary treatment using substances preventing changes in colour and texture the storage conditions for finished products must be appropriate to the processing method applied. The most frequently used methods of processing are drying, marinating, sterilization and freezing.

Key words: edible mushrooms, storage, preliminary treatment, processing

Introduction

Many mushrooms are white to gray in colour while, they are growing. Under certain storage circumstances, however, the enzymes react with oxygen and form brown pigments. Such discoloration seriously decreases the quality of mushrooms. Mushrooms are 85-95% water. There are no barriers to water loss from their surface. Water loss in the mushrooms after harvesting is influenced by the status of the mushrooms the humidity, fresh air and atmospheric pressure. When mushrooms wilt and shrivel the quality of fresh mushrooms is lowered. Fresh mushrooms have a short shelf life. Therefore, it is necessary that they are either marked soon after harvesting or preserved with special care such as in cold storage or other controlled environment storage. Hence, following proper processing and storage methods is of supreme importance. Two types of preservation techniques are available:

1. Short term preservation
2. Long term preservation

Short term preservation

Low temperature is effective for short-term preservation. Mushrooms may be packed in wooden cases with three compartments; ice is placed in the central compartment and mushrooms are packed in the two other sections. Mushrooms may also be packed in bamboo

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baskets and transported by airfreight. An aeration channel is formed at the centre of the basket and dry ice, wrapped in paper is placed above the mushrooms. Mushrooms stored in a perforated plastic box at 10-15 ºC have excellent keeping quality for up to 4 days and the loss of moisture is less than 5 per cent. Straw mushroom can be stored more effectively at button stage than at any other stage. At temperatures below 10ºC however, the mushrooms liquefy rapidly, irrespective of type of packaging due to chilling injury. Cold-preservation of mushrooms is the most important aspect of the storage and can be classified in two categories:

Refrigeration and freezing:-

Household and commercial refrigerators usually run at 4– 7 ºC. Cold or chill storage may use a slightly lower temperature (–1 to –4 ºC) depending upon the freshness of the mushrooms to be refrigerated. Freezing is done at a temperature of below -18^{o}C. Chill storage will preserve perishables for days or weeks and frozen storage (deep freezing) will preserve for months or even years.

Refrigeration has certain advantages over freezing as it takes less energy to cool mushrooms to just above its freezing point than to freeze it. The temperature of the button mushroom after picking, which varies between 15 and 18 ^{o}C. rises steadily during the storage due to respiration and atmospheric temperature and the heat causes deterioration in quality; in addition, the respiratory rate increases with the increase in the storage temperature leading to a vicious cycle. It has been estimated that mushrooms at 10 ºC have 3.5 times higher respiratory activity than those at 0 ºC which necessitates immediate shifting of mushrooms to the refrigerated zone. Hence the heat should be removed immediately after the harvest and the temperature of mushrooms should be brought down to 4-5 ºC as quickly as possible.

Low temperature retards the growth of microorganisms reduces the rate of postharvest metabolic activities of the mushroom tissues and minimizes the moisture loss. The choice of the cooling system depends upon the quantity to be handled; it may be a refrigerator for a small grower or consumer a cold room with all the facilities for a commercial grower. Forced-chilled air, ice-bank or vacuum cooling systems are the other systems in vogue at commercial level. The size and shape of the packs play important role in the selection of the cooling room system and design. Packs with more than 10 kg mushrooms

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or with 15 cm thick layers of mushroom cause problems. Vertical flow of air is more suitable for cooling. The mushrooms should not be stored in the same cooler along with fruits as the gases produced by fruits cause discolouration of mushrooms. As the simple for ced chill air-cooling system is time consuming. Vacuum cooling is becoming popular. To ensure high quality mushrooms in the market place with enhanced shelf-life, these must be cooled as quickly as possible after picking and kept cool throughout the cold chain. Storage under low temperature is an excellent method for restricting deterioration of harvested mushrooms for a limited period of time. The maturation and textural changes in button mushrooms were slowed down at 0 ^{0}C ensuring the maintenance of excellent quality (Minamide *et al.* (1980) observed that the shelf-life of the button mushroom was about 14-20 days at 1 ºC about 10 days at 6 ºC and 2 to 3 days at 20 ºC. Also polyphenol oxidase activity and respiration rate were enhanced at 20 ºC storage. Baker *et al.* (1981) observed that in button mushrooms, forced air cooling resulted in a weight loss of about 2.5 per cent within 15-30 min. Minamide *et al.* (1985) reported that hydro-cooling of button mushroom near their freezing point for 3 h within 6 h of harvest, packing in 100 per cent nitrogen gas (N2) for 2 h and then transferring to room temperature (20 ºC) preserved them for 15 days. Chopra *et al.* (1985) recommended 100 gauge polythene bags with 0.5 per cent venting area for packing button mushroom in case of refrigerated storage. Nichols (1985) recommended optimum temperature and relative humidity for storage of button mushrooms as 0-2 ºC and 85-90 per cent respectively. Saxena and Rai (1988) however, reported the adverse effects of over-ventilation of polythene packs; mushrooms were best preserved in non perforated 100 gauge polypropylene bags kept at 5 ºC. Varszegi (2003) conducted an experiment to determine the relationship between the bacterial growth on mushroom cap and the pre-cooling methods (forced wet cooling and vacuum cooling) and found that vacuum cooling provided the longest period of time needed to reach the maximum value of microbial population and this method was found beneficial for the quality. Blanching for a short period is absolutely essential for producing good quality frozen mushrooms. Steam blanching for 3 min prior to freezing recorded retention of qualities of oyster mushroom also (Das and Pathanayak, 2003).

Long Term Storage

Canning, pickling, and drying, preparation of papads and use of chemicals are employed for long-term storage. These processes are not always suitable for all types of

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mushrooms. The quality of the finished product is rarely comparable with that of fresh mushrooms

- **Drying:** Drying is a method of preserving edible mushrooms such as shiitake and wood ear mushrooms. It is not often used for n button or oyster mushroom, but oyster mushrooms can also be stored and marketed in dried form. Drying preserves the mushrooms by removing enough water to inactivate the enzymes and microorganisms. Dried mushrooms prevents deterioration and convenient for long term storage and transportation. The moisture content of fresh mushrooms is 70-95% depending upon the harvest time and environmental conditions; that of dried mushrooms is near to 10%. There are several methods commonly employed for mushroom drying.
- **Sun drying:** In this drying method, mushrooms are spread on the shelves in such a way that the gills face upward and are directly exposed to sunlight. Drying time required will vary depending on the weather conditions. In genral, the quality of sun-dried mushrooms is lower than that of the mushrooms that are dried by the thermal power drying or hot-air drying. The moisture content is also higher and this means higher susceptibility to molds and pests.
- **Thermal power drying:** The process of thermal power drying should begin with mushrooms at a relatively low temperature. Mushrooms should be dried during sunny days at an initial temperature of 35 °C while mushrooms should be dried during damp days at an initial temperature of 30 °C. After five hours of heat for mushrooms under sunny conditions and seven hours of heat for those during the rainy season, the temperature can be raised gradually and then kept at 40-60 °C for 12-18 hours. In addition to preserving the product drying can enhance the flavor and appearance of the mushrooms.
- **Hot air drying:** In the hot air drying method, hot air is blown into the dryer and mushrooms on the shelves are exposed to hot air. The temperature and humidity of the air can be controlled to optimum conditions by use of heaters and recirculation vents. The size of the drying chamber varies depending on the production scale. The drying chamber should be heated up to 40-50 °C prior to loading the mushrooms. For

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prolonged storage, the mushrooms should be packed in crtons or wooden boxes and kept at 2-5°C in a low temperature storage area.

2. Canning and Bottling:

Canning is by far the most common process used for preserving mushrooms. In general terms, canning is divided into seven basic operations: cleaning, blanching, canning, sterilization, cooling, labeling and packing. This method is widely used by the industry. An appropriate level of sodium metabisulphite or ascorbate is incorporated for colour retention. The mushrooms are then rinsed and blanched for two minutes. Blanching is used to reduce the activity of enzymes.

After blanching, the mushrooms are placed in cans containing 2.5% sodium chloride and 0.24-0.5% citric acid. The cans are then sealed and sterilized. Sterilization methods vary according to the type of equipment used. The most commonly used method is the batch process in which the cans are placed in an autoclave and sterilized for one hour 120-130°C. The cans are then rapidly cooled in the wash sink. The principle of bottling is the same as canning but requires much less instrumentation and therefore bottling can be adopted by small-scale growers without difficulty. The mushrooms should then be sorted in terms of size and quality and then boiled in water containing 0.1% succinic acid and 1% salt for 4-6 minutes of blanching. During blanching a weight loss of 35-40% is likely. Brine should be prepared according to the salinity desired by the consumers. The bottles are filled with brine and the blanched mushrooms in a desired proportion. After closing the cap halfway in order to allow air to escape from the bottles are boiled for 30 minutes or more depending on the size of the bottles. The caps are then closed tight before the bottles are taken out and cooled.

3. Pickling*:*

In this process, the mushrooms are sorted and washed. They can be sliced if desired. Then they are blanched with 3% salt water for three to four minutes in boiling water. After the water drained off they are placed immediately in cold water to cool. They are then transferred to a jar or bottle, and brine (22% salt) is added with a little vinegar sugar and other spices such as vitamin C or citric acid to give the mushrooms some fresher color. The jars are then loosely closed and steamed for one hour. The lids are tightened when cooled and the contents chilled before eating. It is a useful mode of mushroom preservation

Ingredients

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1/2 kg fresh mushroom, 1/2 kg water chestnuts ,2 cup vinegar 40 gm ,jiggery (gud) ,2 tsp red chilly powder (lal mirch), 2 tsp spice blend (garam masala),2 tsp cumin seeds (jeera), 2 tsp salt (namak), 2 tbsp mustard seeds (raai), 2 tbsp aniseed (saunf), 2 tsp fenugreek seeds (methiana), a pinch asafoetida (hing) ,a pinch ginger (adrak), 250 gm mustard oil.

Processing

(1). Boil and peel singhade. (2) Wash mushrooms and cut them (3). Let mushroom and singhade dry (4). Grind jeera, raai, saunf, methidana (5). Make adrak paste (6) Heat 4 tbsp oil in a pan and fry singhade in it till it becomes light brown (7). Take them out (8) Now fry adrak and remove it from the flame. (9) Add all the spices in it. (10) Now mix mushroom and singhade well so that masala is mixed well. (11) After 2-3 hours mix gud in sirka and cook. (12) Let it cool and mix with aachar (13) Store in a jar and then put extra oil.

Papads

Utilization of dried & powdered oyster mushrooms into traditional foods has increased these days. Papad is the one of most popular Indian snack consumed either after deep-fat frying or roasting and it is one such snack where mushroom powder can be added. For the present study, experimental papads were prepared using oyster mushroom powder at 10% (E1), 15% (E2) & 20% (E3) levels with black gram & green gram dhals. Papads were sun dried and roasted on LPG gas-stove & deep fried and compared with control papad for palatability. Appearance of E3 papad received comparatively lower scores because of darker colour imparted by mushroom powder. E1 & E2 papads were well accepted for all sensory attributes. Mushroom papads prepared in the present study were good in protein, dietary fiber, iron, calcium and phosphorus. It can be concluded that oyster mushroom powder can be incorporated in papad without affecting the sensory quality.

Use of chemicals

This method of preservation can be used at places where facilities for canning, freezing and dehydration do not exist. Some work has been done at the Central Food Technological Research Institute (CFTRI), Mysore, on this aspect of the preservation of mushrooms. It is reported that mushrooms in the fresh condition may be possible to preserve for about 10 days at room temperature by steeping in a solution containing 2.5 per cent common salt 0.2 per cent citric acid 0.1 per cent ascorbic acid 0.1 per cent sodium bicarbonate and 0.1percent potassium meta-bisulphite. The blanched mushrooms and steeped

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solution of (1:2) are put into clean glass containers, which are covered with lids and sealed with paraffin wax and stored at room temperature (21-28 ^{0}C) This method of preservation can be used at places where facilities for canning, freezing and dehydration do not exist.

Conclusion

The above review of the literature shows that edible mushrooms are difficult raw materials for the processing industry. Owing to the presence of various enzymes, the technological issue is to adapt the preliminary treatment to the kind of the raw material and to the processing method. The basic aim of preliminary processing is to prevent adverse changes in colour and to minimize the weight loss in mushrooms and changes in their nutritive value and sensory quality. Of the numerous methods of mushroom processing the most popular are drying, preserving in air tight containers, salting and freezing. The last method is one of the most rapidly developing trends in food processing

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