

Value addition in mushroom

Mushroom with its immense health and nutritional benefits can solve many problems of under-nutrition and malnutrition. Despite this fact, mushroom cultivation and its utilization is not catching up fast because of its highly perishable nature. Thus, there is an urgent need of developing technologies to process mushrooms immediately into value added products which will not only cater to the protein and micronutrient requirement but at the same time will also solve the problem of postharvest losses of mushrooms. This article discusses some of the technologies developed by ICAR-Directorate of Mushroom Research, Solan to process mushrooms into value-added products with extended shelf life.

MUSHROOMS are nutritious, medicinal and functional food which are considered as a health food as they contain low calories, high protein, dietary fiber, vitamins (particularly vitamin D and B complex), and minerals (particularly calcium, magnesium, sodium, potassium, phosphorus, copper, iron, manganese and zinc) with high antioxidant capacity. Therefore, mushrooms act as an excellent food source to alleviate malnutrition in developing countries. But fresh mushrooms cannot be stored for more than two to three days due to its perishable nature because of high water content, which is a limiting factor for mushroom marketing as the quality deterioration starts just after harvesting. Producers are not able to hold it as fresh for more days to market. Thus immediate marketing and sale of mushrooms becomes a necessity which is not yet organized in India. Fresh mushroom market is largely catered by the seasonal growers who do not have cool-chain storage and transport facilities and sell the produce in highly localized markets; needless to mention that such seasonal players at times face the consequences of over-saturated market and understandably resort to distress sales at un-remunerative prices. Although, mushrooms in our country are mainly consumed in their fresh state, but trading mushrooms totally at fresh status seems unfeasible for every point of the chain and for all year around. Processing into value added products is one option producer can adopt to save the produce from spoilage as well as to earn more money. There is a worldwide trade in the processing of mushrooms (through canning, pickling, drying, etc.) that alters their nature and extends shelf-life, allowing the transportation of processed mushrooms to be traded internationally as a commodity. Following are some technologies to process mushrooms into value added products with extended shelf life.

Drying of mushrooms

Drying is one of the most important methods to decrease the water content and the dried produce can be utilized for preparing a number of value added products.

Mushroom contains about 85-90% moisture at the time of harvesting and is dried to a moisture level down below 10-12%. Besides sun drying, mushrooms can also be dried in cabinet dryers at a drying temperature of 55-60°C which gives dehydrated final product of lower moisture content with longer shelf life and better quality. The dehydrated mushrooms can easily be powdered and used in several food formulations including instant soups, bakery products etc.

Canning of mushrooms

Canning is a technique by which the mushrooms can be stored for longer periods (up to a year) and most of the international trade in mushrooms is done in this form. Mushrooms can be canned whole, sliced and stems and pieces as per demand. The canning process can be divided into various unit operations namely cleaning, blanching (5-6 minutes at 95-100°C), filling into can with brine solution (2% salt with 0.1% citric acid or 100 ppm ascorbic acid), sterilization by heat (118°C), cooling, labeling and packaging.

Steeping preservation of mushrooms

This method is simple and economical and the mushrooms can be preserved for short period by steeping them in solution of salt or acids. Solution consisting of 2% sodium chloride, 2% citric acid, 2% sodium bicarbonate and 0.15% KMS is used for steeping preservation of blanched mushrooms for 8-10 days at 21-28°C.

Radiation preservation of mushrooms

Low doses of gamma radiation can be used to reduce contamination and extend the shelf life of mushrooms. Irradiation can delay maturation and also reduces the loss of water, colour, flavour, texture and hence delays the quality losses. A dose of 10 KGy (Kilo Gray) will completely destroy microorganisms. An enhancement in shelf life of *Agaricus bisporus* up to a period of 10 days can be achieved by application of gamma ray close to 2 KGy and storage at 10°C.



Dried button mushroom



Canned button mushroom



Steeped button mushrooms

Processed Mushroom Products

Value-added products of mushroom

Various value added products such as mushroom pickle, jam, sauce, candy, preserve, chips etc. can be prepared from fresh mushrooms whereas from the dried mushroom powder value added products like instant soup mix, bakery products, papad, nuggets etc. may be prepared. Many such value added products of mushrooms have been developed by post-harvest section of ICAR-Directorate of Mushroom Research (Solan) and some of those have been discussed below.

Mushroom Pickle

Pickling of mushrooms is an easy home scale process for preservation of mushrooms to a value added product of high market acceptability. For preparing mushroom pickle, mushrooms are washed, sliced and blanched for 5 min in 0.05% Potassium metabisulphite (KMS) solution. The blanched mushrooms are washed in cold water for 2-3 times and the excess water is drained off. Then the mushrooms are subjected to salt curing process, in which 10% sodium chloride is added and kept overnight. The excess water oozed-out of mushroom is removed on the next day and spices and preservatives are mixed to the desired taste and quality of mushroom pickle. This pickle can be stored up to one year in the airtight bottles.

Mushroom Biscuit

Both button or oyster mushroom can be used to prepare delicious and nutritious mushroom biscuits using ingredients, viz. refined wheat flour (*maida*) and mushroom powder (in 80:20 ratio), sugar (30%), ghee (bakery fats) (45%), baking powder (0.6%), ammonium bicarbonate (0.3%), salt (0.6%), milk powder (1.5%) and vanilla essence (0.02%). For making biscuits all the ingredients are mixed well in a dough kneader to prepare cohesive and homogenous dough. Then dough is kept covered with wet cloth for 10 minutes. Thin sheets of dough (1.25 cm thick) are made and cut into different shapes of biscuits using different steel dies. These raw cut biscuits are then baked in hot oven (at 180°C) for 20 minutes and after cooling biscuits are ready for packaging.

Mushroom soup powder

For preparing mushroom soup powder, dried oyster or button mushrooms are finely ground in a pulveriser to pass through 0.5 mm sieve. This mushroom powder (20 g) is then mixed with milk powder (25 g), corn flour (40 g), salt (8 g), sugar (3 g), black pepper (2 g) and oregano (2 g). This soup mix has to be boiled for 5 minutes with 10

times quantity of water for the preparation of good quality mushroom soup with characteristic aroma and taste.

Mushroom nuggets (Badi)

For preparation of mushroom nuggets, mushroom powder (dried and coarsely ground mushrooms) is mixed with the Black gram (*Urad*) dal powder (1:8) and a paste is prepared by adding required quantity of water. Salt (2%) and red chilli powder (1%) are added to the prepared paste and round balls of 2-4 cm diameters are made. The prepared balls are spread over a steel tray and are sun dried. These mushroom nuggets can be straightaway deep fried and used as snacks or can be used in vegetable curry preparation.

Mushroom papad

Papad is a thin, crisp disc-shaped Indian snack food usually made from seasoned batter of peeled black gram flour (urd flour), lentils, chickpeas, rice, tapioca or potato, fried or cooked with dry heat. Papads can be supplemented for protein with mushroom either in the form of paste or dried powder in the batter prepared from other sources as mentioned above. This can make papad a wholesome food with high protein content.

Mushroom sauce or ketch-up

Freshly harvested button mushrooms are washed, sliced and cooked in 50% of water for 20 minutes. Mushroom paste is prepared using a mixer grinder. Then salt (10%), sugar (25%), acetic acid (1.5%), sodium benzoate (0.065%), onion (10%), garlic (0.5%), ginger (3%), cumin (1%), black pepper (0.1%), red chilli powder (15%) and arrarote (0.2%) are mixed in the paste and cooked to bring its TSS to 35 °Brix. The prepared ketch-up is filled in the sterilized bottles or jars.

Mushrooms preserve (Murabba)

For preparing mushroom preserve, fresh button mushrooms are graded, washed, pricked and blanched in 0.05% KMS solution for 10 min. Blanched mushroom is then dipped in 50°Brix sugar solution and refrigerated overnight. Next day mushroom is strained out of sugar solution and the solution is added with 0.1% citric acid and sufficient sugar to attain strength of 60°Brix by heating. Mushrooms are then dipped into it and kept overnight. This process is repeated to raise the concentration of syrup to 70°Brix and mushrooms are dipped into it for 1 week to prepare preserve. The preserve is then drained out of sugar syrup and filled in a container with freshly prepared sugar syrup of 68°Brix. The containers are then

Value-added products of mushrooms



Mushroom pickle



Mushroom biscuits



Mushroom soup powder



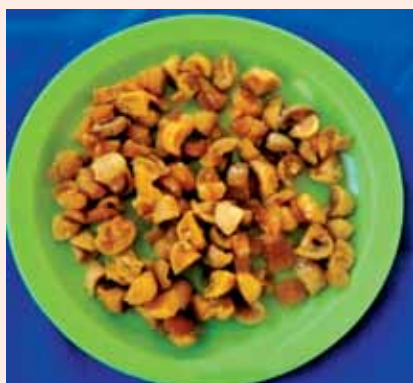
Mushroom chips



Mushroom nuggets



Mushroom papad



Mushroom candy



Mushroom Sauce



Mushroom jam

sealed airtight and stored.

Mushroom candy

The process for making candy is practically the same as that employed in the case of mushroom preserve, with the difference that the produce is impregnated with a higher concentration of sugar (75°Brix) and is also partially dried under shade to attain the chewable consistency. The mushroom candy can be stored up to 8 months with excellent acceptability.

Mushroom chips

For preparing mushroom chips, freshly harvested button mushrooms are washed, sliced (2 mm) and blanched in 2% brine solution. The mushrooms are dipped overnight in a solution of 0.1% citric acid + 1.5% NaCl

+ 0.3% red chilli powder. After draining off the solution, the mushrooms are subjected to drying in cabinet dryer at 60°C for 8 h. Then it is fried in the refined oil and good quality chips are prepared. After spices mixing, the chips are packed in polypropylene packets and sealed after proper labeling.

Mushroom Jam

Development of mushroom jam would aid in preserving mushrooms for a year as a product that is nutritious as well as widely acceptable. For preparation of mushroom jam, washed and blanched mushrooms are ground into a paste. This mushroom paste is then added with sugar (1:1 to paste), pectin (1% of pulp) and citric acid (1% of pulp) and heated with continuous stirring to

avoid sticking to pan till it reaches a TSS of 68°Brix. This prepared jam is hot filled in sterilized glass bottles leaving a head space of 0.8-1.0 cm. The bottles are then sealed and stored in a cool and dry place.

SUMMARY

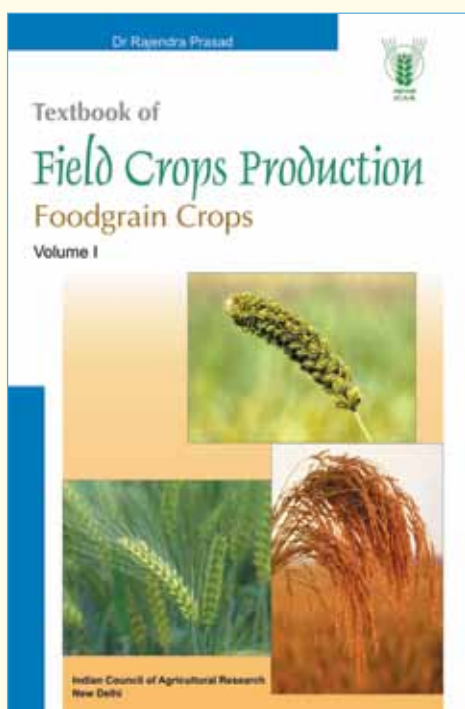
Processing and value addition in mushroom is the need of the hour not only to reduce the losses, but also to enhance the income by value-addition and boost the mushroom consumption. Increase of out-of-home consumption (hotels, restaurants, pubs, etc.) and institutional catering (workplace canteens, universities, schools, etc.) has led in increased requirement for fresh, prepared and processed mushrooms from these sectors.

Moreover, women empowerment and lack of time for cooking also increased demand for convenient products of mushrooms. The above discussed processed mushroom products developed by ICAR-Directorate of Mushroom Research, Solan can cater to all these demands and prove to be convenient, nutrient rich and healthy food items for people of all age groups combating malnutrition among women and children.

For further interaction please write to:

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Textbook of *Field Crops Production* – Foodgrain Crops



(Volume I)

The first edition of Textbook of Field Crops Production was published in 2002 and there has been a heavy demand for the book. This book is now being brought out in two volumes. The chapters cover emerging trends in crop production such as System of Rice Intensification (SRI), export quality assurance in the production technology of commodities like Basmati rice, organic farming, resource conservation technologies, herbicide management etc. Good agronomic practices must judiciously inter-mix the applications of soil and plant sciences to produce food, feed, fuel, fibre, and of late nutraceuticals while ensuring sustainability of the system in as much possible environment and eco-friendly manner. The advent of hydroponics, precision farming, bio-sensors, fertigation, landscaping, application of ICT, GPS and GIS tools, micro-irrigation etc. is in the horizon. The textbook covers both the fundamentals of the subject and at the same time inspire and prepare both teachers and students for the emerging frontiers.

TECHNICAL SPECIFICATIONS

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