Processed Products from Black Pepper

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Spices are pungent or aromatic substances obtained from dried seeds, fruits, roots, bark or leaves. They are used as additives to add flavour, colour or preserve food. These are high value export-oriented crops extensively used to add flavour in food and beverages, medicines, cosmetics, perfumery etc. Spices constitute a significant and indispensable segment of culinary art and essentially add flavour, colour and taste to the food. The farm level processing operations are of utmost importance for value addition and product diversification of spices. India is the largest producer, consumer and exporter of spices in the world. India produces more than 65 spices, out of 109 spices listed by International Standards Organisation (ISO) in different diversity. India produces around 7.08 MT of spices annually (Spice Board; 2016-17), out of which 0.947MT tons of spices and spice products valued Rs.17664.61 crore (US$2633.30 Million) has been exported from the country. USA, Vietnam, Malaysia, China, UAE, UK and Sri Lanka are the major importers of Indian spices.

Black Pepper *(Piper nigrum)* takes about 180 to 230 days after flowering to reach full maturity. Harvesting is generally done when the berries are fully mature and few starts turning from yellow to red in each spike. The stage of maturity at which black pepper is harvested depends on the final value added product to be prepared. Generally black pepper is harvested at full maturity and the berries are separated either manually or by mechanical threshers. The separated berries are dried on clean concrete floors for 5 days and the moisture content is reduced from about 70% to less than 10% wherein, the recovery varies from 33-37%.

The dried berries are cleaned to remove extraneous matters like broken spikes, pinheads, stones, soil particles etc. and finally packaged in jute gunny bags or woven polypropylene bags and stored. Variety of products have been made from pepper and are classified as;

(I) Green pepper based products
(II) Black pepper and white pepper based products
(III) Pepper by- products.

A. Green pepper based products:

I. Canned green pepper: For preparation of canned green pepper, the berries are harvested one month before attaining the maturity. The de--spiked and cleaned berries are immersed in 2% hot brine containing 0.2% citric acid exhausted at 80°C, sealed properly and processed in boiling water for 20 minutes. The canned pepper is cooled immediately in a stream of running cold water.

II. Green pepper in brine: Freshly harvested green berries or spikes are used for preparing pepper in brine. After proper cleaning and washing, berries are stored in brine solution of 17± 2% salt and 0.6 ± 0.02% vinegar. Stored pepper is washed three times in a period of 45 days at an interval of 20, 30 and 35 days, respectively followed by change of brine solution at each interval. The pepper is then packed in high density polyethylene (HDPE) food grade cans with sufficient quantity of freshly prepared brine solution of the same concentration. Major applications of green pepper in brine are in making sauces, meat processing industries and in food service sector.

III. Dehydrated green pepper: Slightly immature green pepper is preferred for producing dehydrated green pepper. Freshly harvested cleaned pepper berries are subjected to blanching for 15 minutes so as to inactivate polyphenol oxidase, an enzyme responsible for blackening of pepper and to wash it out of berries. Blanching time may vary depending upon the maturity of berries. The berries are cooled immediately and dried in a cabinet drier at 70°C.

IV. Frozen green pepper: Frozen green pepper is considered far superior to 'green pepper in brine' or 'dehydrated green pepper' owing to better retention of flavour, colour, texture and natural appearance. It is packed in poly pouches and

hence the cost is much less compared to cans and containers. Though freezing is expensive, it is gaining popularity because of its superiority in every aspect.

V. **Freeze dried green pepper:** The moisture content of fresh tender green pepper is removed by freeze drying at -30°C to -40°C under high vacuum. As a result, a product with its natural colour, texture and of far superior quality to those of sun dried, solar dried or mechanically dehydrated green pepper is obtained. It is very much lighter in weight than frozen green pepper, since its moisture is reduced to 2-4%. The demand for freeze dried green pepper is growing and is likely to go up in due course.

VI. **Green pepper pickle:** Green pepper pickle is popular in many states notably in Kerala, Karnataka, Tamil Nadu, Gujarat and Maharashtra etc. People relish it with rice as an appetizer.When mixed with shredded fresh ginger, it becomes more tasty and piquant.

VII. **Mixed green pepper pickle:** Green pepper berries are mixed with lime pickles, mango pickles, mixed cauliflower and carrot pickles, brinjal pickles, bitter gourd pickles with or without green chillies and sliced fresh ginger.

They are quite popular, however their preparation is mostly limited to domestic scale.

VIII. **Green pepper sauce:** It is made from selected green pepper berries, which are first ground into puree and then blended with vinegar, salt, sugar and other ingredients. It has natural flavour and is often used as a dip for chips or fries.

IX. **Green pepper flavoured products:** Green pepper is advantageously used in soups, *rasam* etc. Green pepper in *Biriyani, Rice Pulao* and *Upma* is very much liked since its appealing colours make the product more attractive. The berries give the exotic taste to Westerners while eating it in conjunction with other products. Green pepper is also used in garnishing of salads and other food.

B. Black pepper and white pepper based products

I. **Whole black pepper:** Fully mature green pepper is dried under sun for 5 days to obtain whole black pepper. In the modern spice processing unit, black pepper is first passed through a cleaning cum grading unit which consists of a specific gravity separator/ destoner for removal of stones, an aspirator for removal of light impurities like the pin heads, husk, light berries, dust etc. and a multiple sieve grader for grading the dried black pepper.

The pepper is then passed through a spiral separator to remove flat impurities like broken spikes etc. Pepper are than passed through a magnetic separator for removal of metallic impurities.The cleaned pepper is graded into different sizes as 4.75 mm, 4.25 mm, 4.0 mm, 3.25 mm etc., and packaged in bulk or consumer packages for domestic or foreign market.

II. **Sterilized black pepper:** The cleaned black pepper is subjected to sterilization to eliminate microbial contamination and to ensure high quality, clean and dried product. In continuous steam sterilization method, the spice is subjected to a rapid flow of superheated steam for a predetermined period of time followed by drying, dehumidification and packaging. Microbial levels as well as the enzyme activity are considerably reduced to safe and acceptable levels. In countries where the sterilization by chemical method is not permitted, steam sterilization is the best alternative. The chemical sterilization involves the use of permitted chemicals like ethylene oxide for destroying pathogenic microorganisms. Effectiveness of sterilization depends on the moisture content of the pepper, concentration of the gas, temperature and time of contact.

III. **Ground pepper:** Ground pepper is obtained by grinding cleaned black pepper without addition of any foreign matter. Grinding is accomplished by employing equipment like hammer mill, pin mill or plate mill. The ground product is further sieved and material is packed according to the particle size of powder. The overflow is sent back to the grinding zone for further size reduction.

IV. **Cryo-ground pepper powder:** In the conventional grinding of spices, the mill and product temperature can rise to as high as 90°C and results in considerable loss of volatile oils. Cryogenic grinding overcomes this problem and helps in retaining more volatile oils besides reducing oxidation, improving fineness and posing minimum distortion in thenatural composition of powder. The usual practice during the cryogrinding is to inject liquid nitrogen (-80°C) into the grinding zone. A temperature controller maintains the desired product temperature by suitably adjusting the nitrogen inflow. The exhaust gas is recirculated for pre-cooling of the spice, reducing the process cost.

V. **Pepper oil:** The characteristic aroma of

black pepper is due to the presence of volatile oil which ranges from 2-5% and can be recovered by steam or hot water distillation. Industrial process for the recovery of essential oil involves flaking of the black pepper using roller mills or grinding into coarse powder and distilling it in a stainless steel extractor. The steam comes in contact with the ground pepper particles and vaporizes the oil present in the pepper. On cooling, the oil is separated from water. It is observed that slightly immature pepper berries are more suitable for oil extraction owing to higher oil content.

VI. **Oleoresin:** Oleoresins is the concentrated product of all the flavour components (aroma, taste, pungency) of black pepper and is obtained by cold extraction with solvents like hexane, ethanol, and acetone. For processing, pepper is flaked to a thickness of 1 to 1.5 mm and packed in stainless steel extractors for extraction with the organic solvent. Normally, solid to solvent ratio of 1:3 is employed and the oleoresin recovery ranges between 10-13%.

VII. **Piperine:** Piperine is principle alkaloid of black pepper and widely known for its medicinal use as remedy of constipation and diarrhoea. The alkaloid is responsible for characteristic biting taste of pepper and amounts to 3-6% of its weight.

VIII. **Microencapsulated spice flavour:** Micro--encapsulation is the technique by which the flavour component is entrapped in a solid matrix and is ready for release as and when required. Encapsulation is achieved mostly by spray drying. In the production of spray dried spices, the essential oils and oleoresins are dispersed in the edible gum solution. Gum

acacia or gelatin, spray dried and then blended with dry base such as salt or dextrose is most commonly used for encapsulation of volatile compounds of spices into food. As water evaporates from the spray dried particles, the gum forms a protective film around each particle of extractive components. The protective capsule prevents the spice extractive from evaporating and deterioration due to exposure to oxygen.

IX. **White pepper:** White pepper is the white inner corn obtained after removing the outer skin orpericarp of pepper berries. The traditional method of preparation of white pepper is by retting that involves soaking in running water. Fermentation tanks are also widely used for the purpose wherein the water is changed every day for 7-10 days. Retting converts only ripe and fully mature green berries to white pepper accounting for 22-27% recovery. White pepper is preferred over black pepper where dark coloured particles are undesirable such as in preparation of light coloured sauces, cream soups etc. It imparts modified natural flavour to food stuff.

X. **White pepper powder:** White pepper powder is processed in the same way as the black pepper powder, except the starting material is white pepper. White pepper powder can also be produced from black pepper by selective grinding followed by sieving. Before the pepper is subjected to grinding, it is conditioned by adjusting the moisture content.

There is assured market and demand for value added spice products like processed oils, oleo-resins and curry powders. The worldwide demand for spices as nutraceuticals is showing an increasing trend. Spices and their derivatives offer great promises for further improvement and exploration under food related small and medium scale agriculture industries development. Current international trade scenario favours the adoption of Good Agricultural Practices (GAP) and wide scale adoption of appropriate post-harvest management practices in need of hour.