

## Processing of Nutmeg

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### ABSTRACT

Nutmeg (*Myristica fragrans* Houtt.), belonging to the family Myristicaceae, is an important tropical tree spice valued for its aromatic seed (nutmeg) and aril (mace). In India, it is mainly cultivated in Kerala and Tamil Nadu. Harvesting peaks from June to August when fruits naturally split open. Post-harvest processing involves removal of the pericarp, separation of mace, drying, grading, and packaging. Proper drying using sun, hot air, or solar tunnel dryers prevents fungal contamination and aflatoxin development. Mace is often blanched and hot-air dried to retain color and quality. Value-added products such as nutmeg oil, mace oil, oleoresin, and nutmeg butter are produced through steam or hydro-distillation. The aromatic compounds, particularly myristicin and elemicin, determine its flavor and medicinal properties. Improved drying and extraction techniques enhance the quality and export potential of nutmeg and mace.

### INTRODUCTION

Tree spices constitute a group of diverse crops where the products of commerce are predominantly used as spice. Among the various tree spices grown in India,

the major ones are nutmeg, clove, cinnamon, cassia, allspice, cambogia, kokam, tamarind and curry leaf. Nutmeg (*Myristica fragrans* Houtt.) is one of the most popular

spices, which belongs to the family Myristicaceae (Periasamy *et al.* 2016). A dried kernel of broadly ovoid seed of the nutmeg is known for its aromatic properties. It is a tropical tree and commonly available in Malaysia, India, Indonesia and South East of Asia. Nutmeg's flavor varies depending on its origin. Its flavor can vary from a sweetly spicy to a heavier taste (Charles., 2013).

It is native of Indonesia (Moluccas Islands). Over 50% of the world's export of nutmeg and mace is from Indonesia. Grenada is the second largest exporter of nutmeg and mace in the world. In India, nutmeg is mainly cultivated in Thrissur, Ernakulam and Kottayam districts of Kerala and parts of Kanyakumari and Tirunelveli districts of Tamil Nadu. (IISR, Kerala). Karnataka, Goa, Maharashtra, North East India and Andamans.

#### **Harvesting:**

Seedling trees begin bearing after 5–8 years, while grafted trees yield within 4–5 years. Fruits are reported to ripe in 6-9 months after flowering, (Purseglove *et al.*, 1981). Since this crop is harvested during rainy season in Kerala. They attain full bearing stage after 15 to 20 years and may yield up to 60 years. Nutmeg trees flower throughout the year with a peak in certain months. Hence, though fruits are seen throughout the year, the peak season of harvest is from June to August. Nutmeg Fruits are harvested when they split open on ripening. The split fruits are either plucked from the tree with a hook bill or are collected soon after they drop onto the ground. Nutmeg is dried in large trays by various procedures. The unshelled nutmegs are dried in the sun until the seeds inside rattle on shaking. Normally nutmeg dries about in a week. The seed cover is removed by breaking the hard seed coat mechanically. Nutmeg is usually packed in double layered linen, jute, sisal or polythene bags. If other packing materials are used, care must be taken to avoid materials

which might lead to 'sweating' and mould development. Powdered nutmeg is prepared by grinding at ambient temperature. Since during traditional grinding, most of the volatile oil escapes and quality deteriorates, chill conditioning and cryogenic grinding are alternative methods followed at present. The myristicin fraction of the volatile oil together with elemicin is responsible for the hallucinogenic property of the seed. Mace is detached from the nut carefully soon after harvest, washed, flattened by hand or between boards and then sun dried until they become brittle. Hot air ovens can be used.

#### **Processing:**

After harvest, the pericarp/outer fleshy rind is removed and the mace, which envelops the shell, is peeled off. The fruits are opened by hand and the scarlet aril (mace) surrounding the nut is removed. This is removed by cutting with a small pointed knife the attachment of the mace to the base of the nut (nutmeg). Care needs to be taken to avoid damage to the nut, alternatively, the nuts can be shelled by tipping them onto a sloping cement floor from a height of three to four metres. Another option is to soak the nuts in water for four to twelve hours and then squeezed between the thumb and forefinger until the nut pops out. The separated mace is flattened by hand and dried on mats in the sun. This takes between two and four hours. Grenadian mace is cured by storage in the dark for four months. This produces a brittle, pale yellow mace that attracts a premium price and is graded according to size, the bigger the mace, the better the premium. After grading the mace can be classified and bagged. The mace will also need to be fumigated.

The nutmegs are dried in their shells in the sun and are turned each day to prevent fermentation. The nuts are sufficiently dry when they rattle. This takes about one week. Sometimes artificial dryers are used. To

produce shelled nutmegs, they should be cracked by tapping the end of the nuts with a small wooden mallet. If the nuts are tapped on the side there is a possibility that the kernel may be bruised. Once dried, the nuts can be stored for a considerable time. Cracking the shell is often done by machine. Often machines are of the centrifugal type in which the rotary motion of the machine forces the nut to be thrown at high speed against the inside of a drum. In good dry weather, the drying operation is accomplished in two or three days. Sun drying leads to a certain amount of color fading. To prevent such bleaching artificial drying is often resorted to. Exceptional care must be taken to prevent mace getting mouldy. A perfect sample of mace should consist of entire double blades, not broken, flattened and of large size, horny in texture and not too brittle and of a good, clear and bright color. Nut is left in the shell and dried in the sun or in drying ovens. Drying is complete when the seed rattles. (FAO,1995)

The aromatic ethers which are the chief components that determine the flavor and drug action in nutmeg oil was maximum one month prior to the fruit splitting stage. In mace oil it was found to be high two months prior to the fruit splitting stage. So, if nutmeg and mace oils are intended for medicinal purpose, then it may be worthwhile to harvest fruits at the sixth month for extracting kernel oil and at the fifth month for extracting mace oil.

### **Drying:**

Nutmeg and Mace fruits are dried in their shells under the sun and turned each day to prevent fermentation. The nuts are considered sufficiently dry when they rattle. Once dried, the nuts can be stored for a considerable period of time. Nutmeg when dried in solar tunnel drier showed a high reduction in drying time. Dryers took about 8 hours for drying from an initial moisture content of 42.6% to 7.2%, while the conventional drying practice took

about 13 days, (Joy *et al.*, 2000). The mace is separated and flattened by hand and dried on mats under the sun. This takes between 2-4 hours.

Sun drying is difficult resulting in improper drying of nutmeg and mace. Drying of medium to large quantities of nutmeg is done in drying rooms. The harvested nutmeg is spread on raised wire mesh floor and heated air is passed through pipes inside the drying room. Continuous drying of nutmeg is not recommended as the oil oozes out without proper drying. The local practice of drying nutmeg at Kalady, a prominent nutmeg growing area is to pass the hot air for one or two days (8 hours each) and then allow to dry at ambient conditions for one week. The heated air is again passed for a day or two and then dried for a week or 10 days. The nutmegs are dried until the seeds inside rattle on shaking. This takes about 15 days or more. The seed cover is removed by breaking the hard seed coat manually or mechanically. Some of the nutmegs are dried improperly by this process have lot of fungal infections and the problems of aflatoxins are also reported by the exporters. Nutmeg & Mace fruits are dried in their shells under the sun and turned each day to prevent fermentation. The nuts are considered sufficiently dry when they rattle. Once dried, the nuts can be stored for a considerable period of time. Nutmeg when dried in solar tunnel drier showed a high reduction in drying time. Dryers took about 8 hours for drying from an initial moisture content of 42.6% to 7.2%, while the conventional drying practice took about 13 days, (Joy *et al.*, 2000). The mace is separated and flattened by hand and dried on mats under the sun. This takes between 2-4 hours.

Mace is detached from the nut carefully soon after harvest, washed, flattened by hand or between boards and then sun dried until they become brittle. Hot air ovens can be used for drying and the colour retention is much better

than sun dried mace. Studies conducted at IISR, Calicut showed that blanching of mace in hot water at 75°C for two minutes preserved the qualities of mace during drying (Amaladhas *et al.*, 2002). Dried mace is graded and packed.

In Kerala the harvesting season coincides with the monsoon season. So, sun drying often becomes impossible. Freshly harvested mace can be blanched in water at 75°C for 2min to retain the scarlet colour. This is followed by hot air drying at 55-65°C which takes about 3-4hrs for drying to a moisture level of 8-10%. Nutmeg loses about 25 per cent of their weight by drying. Shell is then cracked with wooden hammers or mechanically in specially designed machines and discarded or used as fuel and the nutmeg removed and dried.

#### **Grading and Sorting:**

Once the cracking has been completed, the nuts are sorted. Whole kernels will be separated from the broken pieces of kernel. Floatation in water is used to remove unsound kernels, as these kernels are lighter than water and float to the surface. They can then be easily removed. The sound kernels can then be sorted based on their quality and size. Good quality whole kernels are separated from the lower quality and broken kernels. Sizing can be carried out using different mesh sized sieves. Sorted kernels are then bagged and labelled appropriately. For export, the bagged nutmeg is fumigated with methyl bromide.

#### **Grinding and Separation:**

Nutmegs are grouped under three broad quality classes. Sound: nutmegs that are mainly used for grinding and for oleoresin extraction. Substandard: nutmegs that are used for making powder, oleoresin extraction and essential oil distillation; and poor quality nutmegs for essential oil distillation. The shelling of nutmegs can be undertaken by hand or machine and care is necessary to prevent

bruising of the kernels. Floatation in water is used to remove unsound kernels, as these kernels are lighter than water and float. Nutmeg and Mace should not be ground until required because of the loss of volatile constituents when in uncontrolled storage. Improper storage of nutmeg oil may undergo significant composition changes if exposed to very high temperatures. Powdered nutmeg is prepared by grinding at ambient temperature. Unprotected powders and oils can also absorb unpleasant odours and powders should be stored in sealed containers.

#### **Packing:**

After drying, the nutmeg seeds are put into bags and transported to the processing factory for kernel separation and grading. After grading, nutmeg is bagged, labelled and fumigated prior to export. Nutmegs are usually packed in double-layered linen, jute, or woven bags. If another packaging is used, care should be taken to avoid materials that might lead to sweating and mould development. Mace follows a similar process but there is a need for three months curing before bagging and fumigation and top quality mace is packaged in plastic bags. For export, the bagged nutmeg is fumigated with methyl bromide.

#### **Value added products of Nutmeg and mace:**

Nutmeg oil and mace oil, Nutmeg oleoresin, Nutmeg butter are the main value added products. By utilizing nutmeg pericarp (rind), many value-added products have been developed viz., Nutmeg (rind) pickle, Nutmeg (rind) preserve from slices, Nutmeg (rind) preserve from shreds, Nutmeg (rind) candy, Nutmeg (rind) sweet chutney and Nutmeg (rind) powder. Nutmeg oleoresins that are obtained by solvent extraction from the dried spice of nutmeg are used in colourings and flavourings in the food industry and are a direct competitor of the dried spice. Nutmeg butter is a highly aromatic, orange coloured fat and contains between 25-40% of fixed oil.

Poor quality nutmegs are used for nutmeg butter production. The seed of nutmeg contains 8-15% essential oil obtained by steam distillation.

#### **Extraction:**

#### **Isolation of essential oils by steam distillation method:**

The plant material extraction was carried out (A. Koedam,1987). by using a steam generation source, the water and essential oil. After that the water essential oil mixture was transferred to a separatory funnel and kept in cooled place over night, the oil layer which was in the top could be then collected, dried over anhydrous sodium.

#### **Isolation of essential oils from nutmeg using Clevenger:**

The hydro distillation method had been used for the extraction of essential oils from nutmeg. Nutmeg which is the kernel of myristica fragrans were grounded into fine powder. The distillation flask of 500 ml contained water about 2/3 of its volume and 50 gm of the powder. The operation proceeded by heating the flask at 100 °C, heat was applied to the flask and the volatile oil was carried with the steam to a cold condenser, the lighter oil rises to the top of the separator. The essential oils collected was dried over anhydrous sodium sulphate, weighed and stored in a sealed vial dark colored at 4 °C. The yield percentage of essential oil was determined using the formula described by (Rao *et al.*, 2005).

$$\text{Yield (\%)} = \frac{\text{Amount of essential oil recovered(gms)}}{\text{Amount of plant material distilled (100gms)}} \times 100$$

#### **CONCLUSION:**

Nutmeg and mace are important tree spices valued for their aroma, flavor, and industrial uses. Scientific post-harvest handling, including proper drying, grading, and packaging, is vital for maintaining quality and

preventing fungal contamination. Modern extraction methods improve the yield and purity of essential oils and oleoresins. Utilization of the nutmeg pericarp for various value-added products further enhances economic returns. Adoption of improved drying and processing technologies ensures better quality, extended shelf life, and greater export potential of nutmeg and mace.

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