Ministry of Food Processing Industries
Government of India

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Reading Manual for Mint and Mint Product Processing Under PMFME Scheme

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CONTENTS

CHAPTER 1

INTRODUCTION

Spices are high value export-oriented crops extensively used for flavoring food and beverages, medicines, cosmetics, perfumery etc. Spices constitute a significant and indispensable segment of culinary art and essentially add flavor, colour, and taste to the food preparations. India is the largest producer, consumer, and exporter of spices in the world. India produces more than 65 spices out of the total 109 spices listed by International Standards Organization (ISO). India produces around 5.8 million tons of spices annually (2012-13), of this about 10% of the total produce is exported to over 150 countries. The USA, Europe, Australia, Japan, the Middle East and Oceanic countries are the major importers of Indian spices. The estimated world trade in spices is 1.05 million tons valued at 2750 million US $, out of which India has a significant share of 48% in quantity and 43% in value.

1.1. MINT DESCRIPTION

Mint is an aromatic perennial herb, popularly known as “Pudina” in India and scientifically known as “Mentha”. Mint is an energizing herb that can add flavour to many dishes. Mint is used in cooking as a flavouring agent and mint oil used for flavouring mouth washes, toothpastes.

Mints belong to the genus *Mentha*, in the family *Labiatae* (*Lamiaceae*) which includes other commonly grown essential oil-yielding plants such as basil, sage, rosemary, marjoram, lavender, pennyroyal and thyme. Within the genus *Mentha* there are several commercially grown species, varying in their major chemical content, aroma and end use. Their oils and derived aroma compounds are traded world-wide.

1.2 LOCAL NAMES FOR MINT IN INDIA

Pudina Patta (Hindi), Puthina/Pudhinaa (Tamil), Pudina (Telugu), Pudina (Kannada), Pudina (Marathi), Hara Pudina (Punjabi), Fudino / Phodina (Gujarati), Putiyina/Pudhinaa (Malayalam), Pudyanu (Kashmiri).

1.3 COMMON VARIETIES

The four most commonly cultivated species are:

- Japanese Mint/Menthol Mint (*M. arvensis*)
- Peppermint (*M. piperita*)
- Spearmint (*M. spicata*)
- Bergamot mint (*M. citrata*)

Japanese mint (*Mentha arvensis var piperascens***)** is an aromatic herb of temperate region. The oil and its principal aroma-compound menthol have cooling and gastro-stimulant properties, for which it is used in pharmaceuticals, food flavour, confectionery, cosmetics, beverages and related industries. In India, it is grown over around 50,000 ha land. The area has grown enormously during the last 3 years in tarai districts of Uttar Pradesh, and parts of Punjab and Haryana. India has emerged as a large exporter of its oil and menthol to world market, particular to the USA.

Peppermint (*Mentha piperita*) is an allied mint crop with relatively long- stalked opposite lanceolate leaves. The plants are 50-80 cm tall, bearing globular flowering spikes. It bears purplish blossom in terminal spikes. The common black Mitcham variety (introductory) is vigorous growing hardy plant and prefers cool sub-temperate climate. Since growth and yield of peppermint is not very high in tarai track of Uttar Pradesh, it is not grown here in large areas. It is cultivated on a small scale in Punjab and parts of Himachal Pradesh. The cultivation practices

are similar to those of Japanese mint. It has lower oil content (0.25%), the average oil yield being 80kg/ha from a fertile land having well-managed plantation. The oil has 50-50% menthol, sweet in taste and of superior odour. It is mainly used in pharmaceutical preparations. It fetches much higher price than oil of Japanese mint.

Spearmint (*Mentha spicata*) is another important mint. Its oil is rich in carvone (65%) content and emits caraway like odour. The oil is useful in dentifrice, confectionery and pharmaceutical products. It bears lanceolate stalkless, light green leaves and narrow, long, terminal flowering spikes with lilac flowers, attaining a height of up to 60 cm. Two commercial varieties have been evolved in India. Of them, Punjab Spearmint is an erect growing with quadrangular purple-green, hairy stem, production 20q/ha of fresh herb. It contains 0.57% oil, the oil yield being 120 litres/ha containing 68% carvone. The other variety MSS 5 is relatively vigorous in growth, yielding 250-300q/ha of fresh herb or 150kg of oil from commercial plantations. It is cultivated in smaller area in Punjab and foothills of Uttar Pradesh. It fetches higher price.

Bergamot mint Bergamot mint or lemon mint (*Mentha citrate*) is a fluorescent aromatic herb, robust in growth like Japanese Mint. It has similar broad ovate leaves but 2without a distinct inflorescence. The flowering vertices are borne in upper part of the stem in axil of leaves. The oil has an odour reminiscent of lavender oil due to its containing high linalool (45-50%) and linalyl acetate (45%) contents. The yield of herb and oil is similar to Japanese mint. A high-yielding variety, Kiran, produces 150kg of oil/ha, containing 48% linalool. The Cultivation practices are similar to those of other mints. It grows well in subtropical, fertile plains of north India. About 50-60 tonnes of oil is produced in the country annually, fetching price akin to oil Japanese mint. The oil mainly used in perfumery industry.

For the past four decades, mints are commercially cultivated in India. Of these, the Japanese Mint, yielding menthol is grown extensively in northern India. Other major producing countries are China and Brazil and to a smaller extent in Thailand and Vietnam. Commercial or hybrid varieties of Japanese Mint are: MAS-1, Hybrid-77, Shivalik, EC-41911, Gomti, Himalaya, Kosi, Saksham and Kushal. The cultivation of Japanese or corn mint originated from Brazil and China. Subsequently, China and India overtook Brazil and more recently India has taken the leading position in cultivation of this essential oil yielding plant.

1.4 BOTANICAL DESCRIPTION

Japanese mint is a perennial ascending herb growing about 60-80 cm. in height and under favourable conditions may attain a height up to 100 cm. It is propagated mainly by its stolon's. Leaves are lanceolate-oblong, sharply toothed; petiole is small about 5mm. in length. The leaf lamina varies from 5 to 15 cm. The leaf surfaces mainly lower side is covered with dense hairy growth of glandular trichomes. Flowers are borne in axillary and terminal verticillate, abundant in number, purplish in colour. The flowers are small with corolla measuring 4-5mm., calyx 2-3mm., narrowly deltoid and acuminate. It does not produce seed and propagation is through vegetative means only.

Japanese mint is a vigorously growing branched, hardy perennial, attaining up to 1m height in rich fertile lands. The herb is covered with soft tomentum all over and bears broadly ovate leaves over terete, violet tinged quadrangular stems. It gives out long, narrow, axillary flowering spikes profusely, containing lilac flowers. Being of hybrid origin, it rarely sets seed. The crop is commercially raised through underground stems called stolon's, though suckers given out in rainy season also easily give out roots on planting, producing new plants.

A number of improved varieties MAS 1, Hybrid 77, EC 41911, Kalka, Gomti, Himalaya and Kosi are grown, producing high oil yields. However, Shiwalik is most popular variety amongst farmers, covering nearly total area in our country. It produces compact bushy growth with thick leathery leaves, producing high oil yield. The oil has high menthol content (75-85%). The newly bred culture, Kosi, has the greatest yield. The oil has high menthol content than Himalaya and Shiwalik.

1.5. ECONOMIC IMPORTANCE

Japanese Mint (*Mentha arvensis var piperascense*) is grown as an annual herb in sub-tropical parts of north India. The over-ground herb (foliage) on distillation yields an essential oil, containing high (75 – 80%) menthol content. The oil has a bitter cooling taste, harsh odour and is the principal source of menthol. It is used in combating cold, used as an ingredient in cough drops and related pharmaceuticals, dentifrices, cosmetics, mouth washes, scenting of tobacco products and flavouring of beverages. Synthetic menthol has also come in market but its volumes

are meagre due to high cost of production. Besides, natural menthol is preferred in food and flavour industry.

Indian production of arvensis rose rapidly from the start of the 2000's. From a production of around 10,000 tons in 2000, production is now estimated to be close to 50,000 tons. India dominates global production with around 80% of global supply, followed by China and Japan, each producing around 10%. India exports around 25 to 30,000 tons in a range of forms (menthol crystals and powder, dementholized mint oil, arvensis oil etc.), with the balance of production used domestically. India domestic consumption accounts for around 40% of global consumption, with China (20%), Europe (15%, with Germany and Netherlands the major users) and the USA (15%) accounting for the bulk of consumption.

In 2020, the area under mint cultivation is estimated to touch 3,00,000 hectares, according to a scientist with the Central Institute of Medicinal and Aromatic Plants (CIMAP), a constituent laboratory of the Council of Scientific and Industrial Research.

Mint growers consider Mentha as a bonus crop as it does not disturb or replace the cultivation of any major winter (Rabi) or rainy season (Kharif) crop. Being a labour-intensive crop Mentha provides various employment opportunities in cultivation, distillation, processing field particularly in rural areas. The large-scale commercial cultivation of Mentha is done in Indo-Gangetic plains i.e., in the states of Uttar Pradesh, Punjab and Haryana. About 95 per cent of the crop is grown in Uttar Pradesh and rest 5 per cent in other states. Uttar Pradesh is the leading Mentha producing state in terms of area and production with 1.30 lakh ha acreage and an annual production of 20,000 tonnes of oil (Singh and Khanuja, 2007). In Uttar Pradesh, major Mentha producing districts are Barabanki, Rampur, Moradabad, Bijnor, Jyotiba Phule Nagar, Pilibheet, Bareilly, Badaun, Shahjahanpur, Sitapur, Hardoi, Unnao, Faizabad, etc.

1.6 AGRO-CLIMATIC CONDITION REQUIREMENTS

Normally, tropical climate is not suitable for mint cultivation. Mints favour well-drained, deep, organic, sandy-loam to clay-loam soils of 6-7 pH with copious irrigation. However, Japanese mint can be cultivated in both tropical and sub-tropical regions. Clay soils, high pH (>8.50) and frosty locations are unsuitable. Since it is a shallow-feeder, high water table between 60 and 100cm with efficient drainage is favourable. It is a long day plant, grown as a long duration (240

days) annual crop, growing up to 1,000m elevation in subtropical north India. Annual fluctuation in temperature of 40°C and 0°C with sunshine all-round the growing season is ideal; shade is undesirable. The suitable temperature for mint cultivation is between 20°C to 40°C and rainfall should be between 100 cm to 110 cm. Light showers at planting time and good sunny days at harvesting stage is best for its high yield and good quality of leaves.

1.6.1 SOIL REQUIREMENT FOR MINT FARMING

Mint can be cultivated in wide range of soils. However loam or sandy loam or deep soils rich in organic matter are best for its cultivation. The soil must be well drained and loose textured for better growth of mint leaves. Mint leaves thrive well in fertile soil with pH range of 6.5 – 8.0 and as it does not grow in clay soils, therefore avoid these soils for mint farming. Water stagnation should be avoided in the field. Mint can also be cultivated on both black and red soils. Liming is recommended, in case of acidic soil having pH value less than 5.5.

1.6.2 LAND PREPARATION IN MINT FARMING

The land is repeatedly ploughed and harrowed to make a fine seed bed, free of all perennating weed roots. Should plough and give two cross harrowing to bring the soil to fine tilth. About 25-30 tonnes/ha of farmyard manure together with 25kg of BHC (10%) is applied at land preparation, Whereas NPK is added@ 40,60 and 40 Kg N, P and K/ha during planting time in February. Seed rate of 250kg/ha of fresh juicy stolon's is enough. Planting is done when temperature is around 20°C. About 8-10 cm long stolons with 2-4 growing points should be planted, 1-2cm deep in furrows at 40cm x 10cm spacing. They should be dipped in 0.1% Agallol or Captan solution for 2 minutes. These sprout in 10 days. A day temperature of 20°C-25°C and light showers favour their rapid growth. Generally, 80kg of N is given in 2 doses. The first dose is given deep in rows 40 days after sprouting, while remaining after taking the first flush. As part of land preparation, add Farm Yard Manure (compost) about 50 to 60 cart loads per hectare. Zinc deficiency is common in Gangetic plains. Therefore, 20 kg of $ZnSO_4$ should be mixed in the soil at the time of land preparation. Usually, 3 treatments are given before each harvest. The expenditure can be reduced by using wheel hoes or bullock-driven hoes in between the rows in the first crop but high soil moisture makes it unworkable during rainy season. Pre-emergent application of Terbacil of Diuron at 2 Kg in 100 L of water or 2.5kg of Delapon or Gramoxone

could be given in between rows evenly to control weeds. However, these are contact herbicides and farmers needs much more care in choosing efficient spray machine and its fine nozzle. The crop needs 6-9 irrigations during dry season and 2-3 after rains in late September till second harvesting is done. Mint-maize-potato, mint-early paddy-potato and mint-late paddy-sweet pea are common crop rotation in Uttar Pradesh, whereas mint-maize-rapeseed or mustard or mint-paddy are popular in Punjab.

1.6.3 PROPAGATION IN MINT FARMING

Mint can be propagated by vegetative method through stolon's and runners.

1.6.4 PLANTING SEASON IN MINT FARMING

Before starting monsoon season (or) in northern India, planting of Japanese mint is suitable from 1st week of Feb to 2nd week of March.

1.7 HARVESTING AND YIELD

The crop planted through stolons in January and February is harvested twice i.e., in June and October months. It is harvested at flowering on dry sunny days. The crop maturity is determined by distillation of crop sample in Clevenger's apparatus. If it gives is reached in 105-110 days of sprouting for first harvesting and 80-90 days after the first cut is taken for the second crop. The crop is cut 10 cm above through sickle and left in the field for 4-6 hr for wilting. It loses 50% of its moisture and then chopped into small pieces and distilled in a steam distillation unit. Harvesting on cloudy or rainy day decreases menthol content in its oil significantly. An average of 30 tonnes/ha of herbage yield in 2 cuts is takes in a year, producing 150 kg of oil. Higher yields are obtained from a well-managed plantation. The oil, golden-yellow in colour, is a mobile liquid, contains 70-80% menthol. The oil is dried of adhering moisture and stored in aluminium or mild steel containers. Filled up to the brim and stored in a dry cool godown. The first crop is harvested after 100-120 days of growth and the second harvest in about 80-90 days following the first harvest. The fresh herbage at harvesting stage contains 0.5 to 0.68% of oil and is ready for distillation after wilting for 6-10 hrs. The wilted crop is cut 10cm. above the ground by means of a sickle on bright sunny days, since harvesting on cloudy or rainy days decrease the menthol

content in the oil. The average yield is 20 tonnes of fresh herbage per ha. in two harvests, which, in turn, yields around 250 kg. of oil in a year.

1.8 POST HARVEST MANAGEMENT

1.8.1 STORAGE OF HARBAGE

Mint herbage should be shade dried for about a day before it is distilled. Care should be taken so that decomposition of the herbage does not initiate during the drying process. There would be some reduction in oil yield if wilted herbage crop is stored for a longer period of 2-3 days. As such, storage of herbage for a longer period is not recommended.

1.8.2 DISTILLATION

The recovery of oil from the herb is 0.5-0.8%. Oil is obtained through steam distillation. The oil is of golden yellow colour, containing not less than 75% menthol. The duration of steam distillation is 2-2.5 hours for complete recovery of the oil. About 80% of the oil is received in the receiver in about one hour's time. The oil that is received later is richer in menthol. The fresh or semi dried herbage is placed in a tank and treated with passing steam under pressure. The steam that comes out of the tank is then passed through a condenser. The condenser receiving the steam, carrying the oil extracted from the herbage in the tank is kept constantly cool by circulating cold-water over/around it. The condensed oil and water mixture is collected in a receiver. Since the water and oil have different densities, oil floats on the surface of the water in the receiver. The oil is skimmed off and collected.

1.8.3 PURIFICATION OF OIL

The oil that is skimmed off must be cleaned of traces of water that it may carry. For this purpose, a separator funnel is used. Treating with anhydrous sodium sulphate and decanting removes any remnant moisture in the oil. The whole process is highly critical. Steam rectification process may be applied in case the colour of the oil changes due to rusting.

1.8.4. STORAGE AND PACKAGING OF OIL

PVC drums of good quality (20-200l capacity) and galvanized iron (GI) drums or aluminium containers are suitable for short-term and long-term storage respectively. The containers should be kept in cool and dark place.

CHAPTER 2

PROCESSING Of MINT AND MINT PRODUCTS

Mints are perennials that spread rapidly and grow quickly. The mint family is called Labiatae and includes about 160 genera, of which *Mentha* includes the true mints. Spearmint and peppermint are grown extensively in a surprisingly robust health mint industry that produces mainly oil.

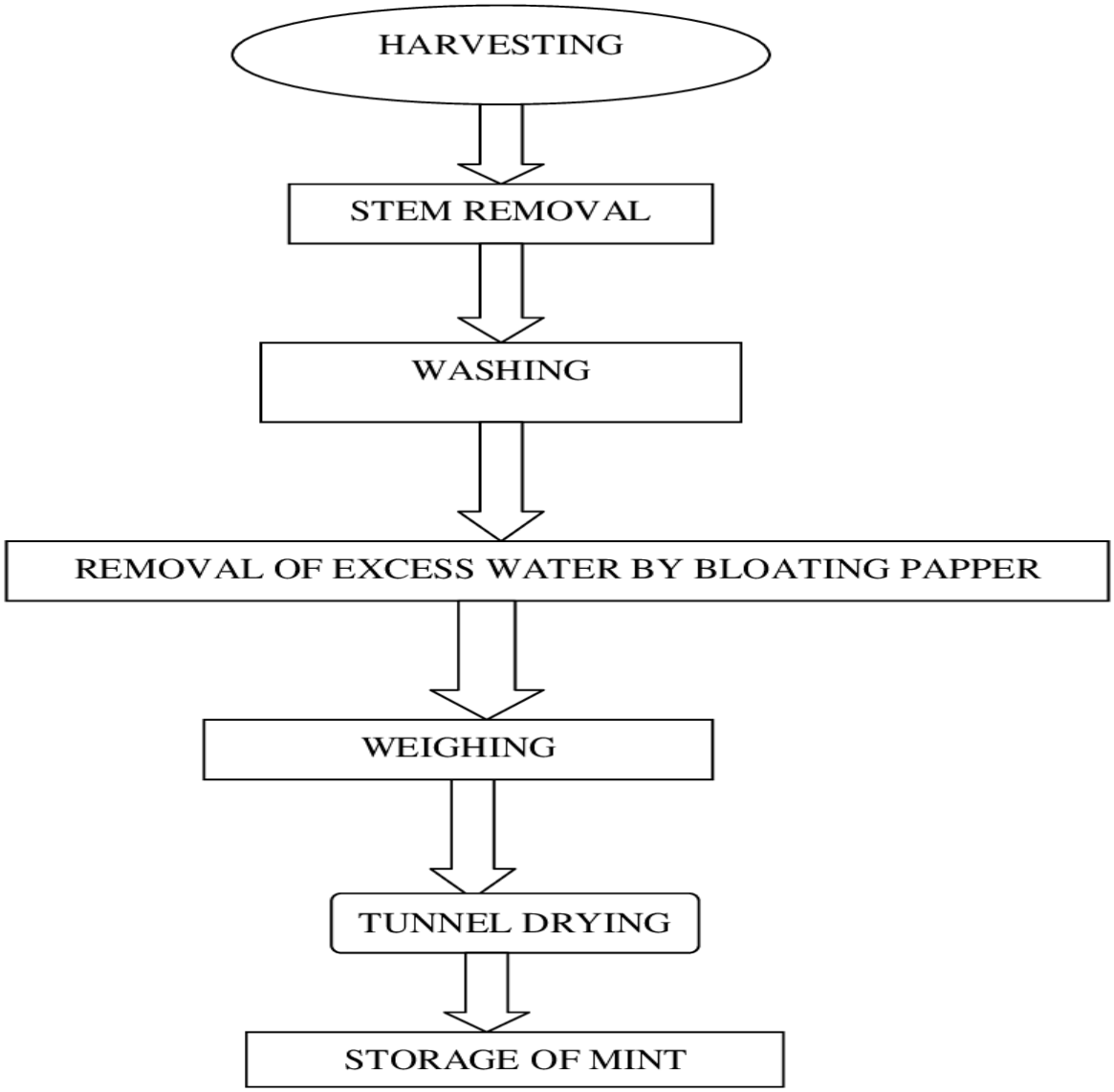
North America is the largest market for mint and breath fresheners, followed by Europe and Asia-Pacific. North American region of the mints market is driven by an increase in the consumption of breath fresheners by smokers and alcohol consumers.

2.1 PEPPERMINT (*MENTHA PIPERITA L.)*

One of the most widely consumed single ingredient herbal teas, or tisanes. Peppermint tea, brewed from the plant leaves, and the essential oil of peppermint are used in traditional medicines. The phenolic constituents of the leaves include rosmarinic acid and several flavonoids, primarily eriocitrin, luteolin and hesperidin. The main volatile components of the essential oil are menthol and menthone.

In vitro, peppermint has significant antimicrobial and antiviral activities, strong antioxidant and antitumor actions, and some antiallergenic potential. Animal model studies demonstrate a relaxation effect on gastrointestinal (GI) tissue, analgesic and anaesthetic effects in the central and peripheral nervous system, immunomodulation actions and chemo preventive potential.

Human studies on the GI, respiratory tract and analgesic effects of peppermint oil and its constituents have been reported. Several clinical trials examining the effects of peppermint oil on irritable bowel syndrome (IBS) symptoms have been conducted. However, human studies of peppermint leaf are limited and clinical trials of peppermint tea are absent. Adverse reactions to peppermint tea have not been reported, although caution has been urged for peppermint oil therapy in patients with GI reflux, hiatal hernia or kidney stones.



FLOWCHART ON MINT STORAGE

2.2 STORAGE OF MINT LEAVES

Wrap the mint leaves gently in a dampened paper towel. Place the mint in a plastic bag, not sealing all the way so that air can circulate. Do not wrap tightly; trapped moisture will cause the herbs to mould.

2.3 DRYING OF MINT

Cut the mint about 1/3 down the main stem, including the side branches.

2.3.1 DEHYDRATOR

Wash lightly in cold running water. Drain thoroughly on absorbent towels or hang plants upside down until the water evaporates. Strip leaves off the stalks and remove blossoms. Follow directions for your dehydrator.

2.3.2 NATURAL AIR DRYING

Dry in the dark by hanging bunches upside down in paper bags. Choose a well-ventilated, dust-free area (although the bags will help keep out dust and other surprises). Leaves are ready when they are dry and crumbly, in about 1-2 weeks.

2.3.3 OVEN DRYING

Use low heat (less than 180 degrees). Spread leaves on a cookie sheet for 2 to 4 hours. Leaves are ready when they are dry and crumbly.

2.3.4 MICROWAVE DRYING

Place the leaves on a paper towel and microwave for 1 to 2 minutes (check after 1 minute and microwave in additional 10 second increments as needed). When completely dry, leaves may be crushed or stored whole in airtight containers (canning jars, for example). Check daily for moisture – if any, repeat the drying process. Herbs will mould quickly if exposed to moisture. Store the mint in a cool, dry place, away from light.

2.4 FREEZING MINT

2.4.1 ICE CUBE METHOD

Pick through the fresh mint, removing damaged leaves and tough stems and rinse. Gently spin dry or pat dry between two kitchen or paper towels.

Chop the mint leaves (remove stems) and place 1-2 teaspoons into each compartment of an ice cube tray, filling about halfway.

Top off with water and freeze. Once the cubes have frozen, remove and store in an airtight freezer bag or container in your freezer, up to 3 months. Don't forget to label and date.

2.4.2 BAKING SHEET METHOD

Follow step one from Ice Cube Method

Place leaves on a baking sheet and freeze 2-3 hours

Place mint into freezer bags, label, date and store in freezer up to 3 months

2.4.3 VACUUM SEALER METHOD

Follow step one from Ice Cube Method

Make a bag from the roll material large enough to hole the sprigs of mint and allow space between the herb and final seal. Seal one end.

Label bag with contents and date

Place herb sprigs in bag

Place bag end into the sealer and vacuum seal, following manufacturer's directions

2.5 MINT PRODUCTS

2.5.1 MINT PRODUCTS AND ITS USES

Mentha Piperita (Peppermint) Oil, Mentha Piperita (Peppermint) Leaf extract, Mentha Piperita (Peppermint) Leaf, and Mentha Piperita (Peppermint) Leaf Water are obtained from the Mentha

piperita plant. The oil is composed primarily of menthol and menthone. Mentha Piperita (Peppermint) Oil is a colourless or pale-yellow liquid having a strong, penetrating odour which is used as flavouring agent in food and cosmetics. It also has a pungent taste that is followed by the sensation of coldness when air is drawn into the mouth. This property is utilized in mint flavoured chewing gums.

Mint has a variety of uses. The plant is usually steam-distilled for its oil which is located in glands on the undersides of the leaves. The oil is used to flavor a variety of foods such as gum or candy and is also used in perfumes, cosmetics, and health care products. The leaves are also harvested and either dried or used fresh - for teas, flavoring and/or decorating food.

In cosmetics and personal care products, these ingredients are used in the formulation of dentifrices, mouthwashes and breathe fresheners, skin care products, bath products, and makeup. They impart a distinct odor or flavor to products. In cosmetic and personal care products, these ingredients may also function as skin conditioning agents. Example: Mint flavored tea powder, mint oil, cosmetic mint creams soap, conditioners, sanitizers etc.

Mint essential oil and menthol are extensively used as flavouring in breath fresheners, drinks, antiseptic mouth rinses, toothpaste, chewing gum, desserts, and candies, such as mint (candy) and mint chocolate. The substances that give the mints their characteristic aromas and flavours are **menthol** (the main aroma of peppermint and Japanese peppermint) and **pulegone** (in pennyroyal and Corsican mint). The compound primarily responsible for the aroma and flavour of spearmint is **L-carvone**

Menthol and mint essential oil are also used in aromatherapy which may have clinical use to alleviate post-surgery nausea. Mint oil is also used as an environmentally friendly insecticide for its ability to kill some common pests such as wasps, hornets, ants, and cockroaches.

Essential oil	Species	Main compound
Peppermint oil	Peppermint	menthone, menthol
Spearmint oil,	Spearmint	carvone, dihydrocarvone
Cornmint oil	Cornmint	Menthol
Pennyroyal oil	Pennyroyal	Pulegone
M. citrate oil	Citrata	linaool, linalyl acetate

Approximately 45% percent of the mint oil produced in the USA is used for flavouring chewing gum with another 45% used to flavour dentifrices (toothpaste, mouth wash, etc). The remaining 10% is used for flavour in the confectionery, pharmaceutical, liqueur, and aroma therapy industries.

For the past four decades, mints are commercially cultivated in India. Of these, the Japanese Mint, yielding menthol is grown extensively in northern India. Other major producing countries are China and Brazil and to a smaller extent Thailand and Vietnam.

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Approximately 45% of the mint oil is used for flavouring chewing gum with another 45% used to flavour dentifrices (toothpaste, mouth wash, etc). The remaining ten percent is used for flavour in the confectionery, pharmaceutical, liqueur, and aroma therapy industries.

2.6. MINT OILS

The mint oil is mainly produced in the region of Uttar Pradesh, Bihar, Madhya Pradesh & Himalayan region, which is extracted by the Mentha leaves with the help of water steam distillation method and the yield obtain is about 0.3% to 0.5% .The major demand is the Menthol crystals which are mainly used by tobacco, pan masala, and pharmaceutical industries. These crystals are prepared by following two methods.

2.6.1 CONVENTIONAL METHOD

This method practice into the deep freezer which is at -45°C about 48 hours. Further the freeze oil is transferred into basket centrifuge in which the menthol crystals are separated in the form of flakes which is also known as DMO (dementholized oil).

2.6.2 IMPROVED METHOD

- **SELECT A LIQUID TO USE IN EXTRACTION**

This process is basically used for the separation of undesirable products like monoterpenes & menthone. The oil which is remaining is further rectified and known as terpene less oil

Vodka, or another high-proof grain alcohol, is perfect for this, since it has both water and alcohol to dissolve the oils. While apple cider vinegar or glycerine can be used instead, the final tincture will be much less strong and have a shorter shelf life. White vinegar will also work, but have the

same effect. These are good for children that cannot drink alcohol, although if you use this for baking, the alcohol bakes out. Homemade tinctures, just like vanilla extract you would buy in a store, are normally used in such small doses that the alcohol does not have a noticeable effect.

For dried mint leaves, use vodka containing 45–60% alcohol (90–120 proof).

For fresh mint leaves, since they already contain water, use vodka or Ever clear with 90–95% alcohol (180–190 proof).

- **CHOP OR BRUISE THE MINT LEAVES**

Chop a bundle of fresh mint leaves into two or three pieces, or mash the leaves with a clean cup base, so more oils will be exposed to the liquid. Dried mint leaves can be crumbled by hand instead, or left mostly whole.

Wash fresh mint leaves before chopping.

There's no need to remove the stems, but throw away any slick or dark leaves, as these may be rotting.

- **PACK THE MINT AND THE LIQUID INTO THE SEALING JAR**

Stuff the jar with mint, leaving as little as ½ inch (1.25 centimetres) of space if you want the option for a stronger tincture. You may use a smaller amount of mint leaves if you like, but you may end up with a less aromatic or flavourful result. Once the mint is in, pour the alcohol or other liquid into the jar, completely covering the leaves. Close the lid of the jar tightly. The leaves may float at first. Push them down with a spoon, but they should sink on their own after a few days.

- **ALLOW THE JAR TO SIT FOR SEVERAL WEEKS, SHAKING OCCASIONALLY**

The exact length of time simply depends on how strong you want your tincture to be, but it usually takes between four and eight weeks. Most people prefer to store the jar in a dark place, since sunlight could lower the tincture's shelf life. Once or twice a week, shake the jar for a couple minutes to speed up the dissolving process.

- **STRAIN THE LIQUID INTO A BROWN GLASS CONTAINER**

Pour the liquid through a coffee filter to remove the leaves and sediment. Store the tincture in a brown glass container to protect it from sunlight and increase its shelf life. It can last for six months or more, although it may lose its potency gradually.

2.7 MENTHOL FROM MINT OIL

Menthol is a monocyclic, saturated secondary terpene alcohol. In nature it occurs as l - menthol, but the former has commercial application. It has a distinct peppermint flavour. When placed on the tongue the material imparts a biting sensation and slightly bitter taste followed by a pleasant feeling of cold. It finds application in various pharmaceutical formulations and in condiment industry. The demand of menthol both in India and abroad has increased substantially due to increase in the cosmetic products. The economics of menthol production greatly depends on the availability of mint oil which again depends on the cultivation of the herb and extraction of the oil by steam distillation.

2.7.1 PROCESS

Menthol is generally obtained by chilling mint oil and subsequent centrifuging to separate out the menthol crystals. The process may be divided into two steps, firstly menthol flakes are produced by chilling mint oil and secondly menthol flakes mixed with mint oil again chilled to produce bold crystals of menthol. The total recovery of menthol in the first step is around 70%. The time cycle for first step is around 6-7 days. In the second step, menthol flakes mixed with certain proportion of mint oil kept under temperature control for about 25 days. The mother liquor (conc. mint oil) is a bye product and can be used again till decolourisation of oil occurs. Total recovery of bold menthol crystals is about 50%.

2.8 PEPPERMINT OIL EXTRACTION

The invention discloses a peppermint oil simple extraction method. The peppermint oil simple extraction method comprises following steps: mint stem and leaf are crushed into powder; obtained mint powder is added into hydrochloric acid, pH value of an obtained solution is adjusted to 1 to 3, and immersion is carried out for 4 to 6h; the solution is delivered into a distillation tower made of stainless steel or glass fiber reinforced plastic for steam distillation; an

effluent is collected, and is subjected to extraction with benzene for 2 times so that peppermint oil enters into an organic phase; the organic phase is collected, and is subjected to dewatering and pressure reduction separation so as to obtain peppermint oil; and the extraction agent is recycled. The peppermint oil simple extraction method is capable of increasing extraction yield and product purity of peppermint oil greatly, is simple, and is easy for operation; and less environmental pollution is caused.

2.9 BREATHMINT

Obviously, the most common herbal breath mints are the mints. A leaf or two from any of the commonly grown mint plants, including peppermint, can be eaten to freshen the breath and aid digestion. Many references about herbs provide recipes for making toothpaste and mouthwash from pepper-mint and other herbs and natural ingredients that avoid the detergents and sugar found in commercial products.

2.10 TABLETED CANDIES AND MINTS

Tableted candies and mints are an offshoot of the pharmaceutical industry that makes pills. The same accuracy that produces just the right dose in a lozenge or tablet for medicinal purposes also makes mints efficiently with the right distribution of flavour and breath freshener. Tablets are made with rotary presses that use a rotating die table and compression rollers to turn out as many as 10,000 mints per minute.

The ingredients for tableted mints are in powder form. They are granulated in a mixing and bonding method that helps them flow through a tablet press. The process involves pulverizing (pounding) them to a fine consistency, mixing (most often in a dry process, although wet mixing can be used), compacting the ingredients, sizing the finished grains (sorting out the coarse particles), mixing the ingredients, and flowing them into the tableting machine. The moisture content is controlled throughout the process (whether it is wet or dry), and the granules are dried on bed dryers (flat systems) or rotary dryers. Mixing—one of the last steps—is the process in which flavours and active ingredients like breath fresheners are added for the most uniform distribution. Lubricants are mixed last so they coat all the other ingredients well.

The prepared, granulated, mixed ingredients are conveyed to the tableting machine. While this sounds straightforward, the conveyors cannot have any bends or turns that might sort the materials, and temperature and moisture have to be strictly controlled along the route. Some ingredients, particularly the lubricants, begin to separate from the other ingredients if conditions aren't correct. Some flavours like grape react with sugars if there is too much moisture in the air and begin to turn brown; gelatin also browns if conditions are too warm or dry.

The rotary tablet press consists of four punches that move along an upper belt paired to four dies that move along a bottom belt. The belts themselves are continuously turned around large rollers. The punches and dies are pushed up toward each other and pulled down by adjustable cams. As the ingredients enter the rotary tablet press, the granulated ingredients are channelled into a feeder (the upper punch) that fills a die seated in the bottom of the pair. The cavity of the die has to be filled with the volume of granulated ingredients. The second stage of the press adjusts the weight and scrapes excess material off the top of the die. In the third, compression stage, the cams drive the upper punch and the lower die together, compressing the ingredient into a tablet. The punch and die have been designed to have the shape of the breath mint and possibly its name cut into it, so the compressed result has the identity of the mint firmly stamped in place. In the fourth step, the lower cam pushes out (ejects or extrudes) the stamped mint and the upper part pushes it out of the press where it is collected in a bin.

The bin funnels the compressed mint tablets to the next process. This may be panning or packaging. Some mints are made much like hard candies, and are cooked as a batch that flows in a continuous process that shapes and sizes the batch ingredients into the shape of the mint. In a dry, uncooked process, a dry dough with a sugar base is made. The batch or the dry dough is funnelled through a roller with a general shape much like a pointed ice cream cone but with the opening shaped to the desired form of the candy, perhaps a triangle, a diamond, or a barrel. Either the cooked batch or the extruded dry dough is forced through this roller, and each candy length is cut as the ingredient emerges. Extruded dough mints can be recognized by their irregular surface.

Panning is not usually used to make an entire candy or mint but to give a mint a finished coating. Hollow globe-shaped pans with a hole in one side are made of copper and are rotated much like small cement mixers so the hole stays angled upward. Mints made by compression, batching, or

extrusion are placed in relatively small quantities in the pans. Sugar, flavours, and colours are added; as the pan rotates, a hard shell of the sugar forms on the outside of the mint. In the same process or another panning operation, wax or a polishing agent may be put in the pan with the mints to give them an attractive lustre. The rotation of the pan can also help develop the finished shape of the mint; the oval shape of many of the mini mints is created during panning.

When the mints are finished by the processes described above, they are carried to packaging machines to be wrapped. Usually, they are carried a short distance on conveyors, and inspectors watch the passing flow of mints and pick out broken or imperfect examples. Depending on the type of packing, the mints may be simply channelled into a funnel that deposits them in small boxes or tins. If they are wrapped in tubes of paper, they are vibrated and gently pressed into line and wrapped with the pre-printed packaging. The packages must also be carefully designed to protect the product; an inner paper of foil, a foil/wax paper laminate, or odour-free plastic is needed for roll mints. Cellophane wraps over paper, tin, or plastic novelty boxes may be needed to keep the mints inside isolated from air and moisture.

CHAPTER 3

MACHINERIES FOR SPICE PROCESSING

3.1 DRYING

Dehydration is the most common method used to lower moisture content and hence the water activity to a safe limit which prolongs shelf life of spice.

Hot Air tray dryers are also used for drying. Tray type dryer is most suitable.

Hot Air tray dryer

Capacity: 300kg/hour

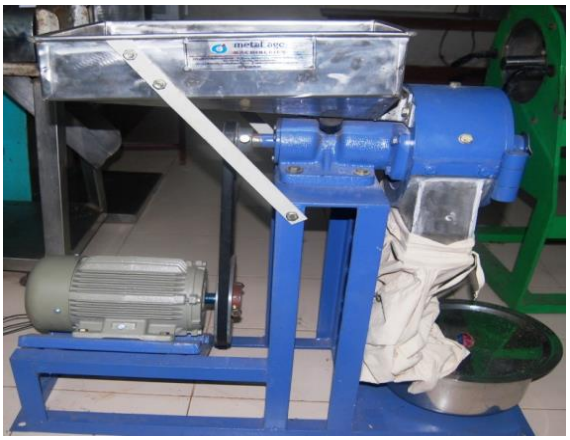
Material: MS

Motor: 2 of 1 Hp/3ph

Operating Temperature: 50°C to 250° C

Price: 60,000/-

3.2 GRINDING AND PULVERIZING: Spices are grinded in dry form in the pulveriser.



Pulveriser with Motor and Accessories

Motor: 3 HP

Width: 4 inch

Sieves: 4 Nos

Beaters: 4 Nos

Material: C I & MS

Price: 46,200/-

3.3 MIXING: After all the above operations, various spices for different purposes are mixed together. Disintegrator machine is used for mixing.

Disintegrator with Motor

Capacity: 100kg/hour

Material: MS

Power: 7.5 Hp Motor

Price: 63,000/-

3.4 SIEVING: Sieving is done to remove unwanted material or for characterizing the particle size distribution of Spice. Sieving Machine can be used for this purpose.

Sieving Machine

Voltage: 440 V

Material: SS

Motor: Single Phase

Price: 36,000/-

3.5 PACKAGING: At the end, spices powder are packaged in automatic form fill and sealing machine.

Automatic Form Fill Seal Machine

Maximum Output: 1000-2000 /hour

Pouch Capacity: 200-400 grams

Motor : 3Hp

Price: 1.50 Lakh

CHAPTER 4

PACKAGING OF MINT & MINT PRODUCTS

4.1 FACTORS TO BE CONSIDERED WHILE CHOOSING PACKAGING MATERIAL

4.1.1 REGULATION OF MOISTURE LEVEL: Depending on the food product, a high or even a low level of moisture can stabilize the product quality and enhance the shelf life. An adequate choice of packaging material and barrier properties regulates the moisture level and supports the end product quality. The moisture vapor transmission rate (MVTR) of the packaging materials (plastic, foil, etc.) is the most important factor and has to fit with the moisture requirements of the food.

4.1.2 PROTECTION FROM OXYGEN

Oxygen causes oxidation and promotes the enzymatic and non-enzymatic phenolic browning and the growth of microorganisms. Packaging without or with less oxygen (e.g. vacuum or modified-atmosphere packaging) extends shelf-life and inhibits deterioration. Hermetically sealed packaging requires oxygen-proof materials and seals that do not leak.

4.1.3 TEMPERATURE REGULATION

A combination of low temperatures and appropriate packaging can be used to extend the shelf life of perishable products. However, different mint products need different storage temperatures.

4.2 MATERIALS USED IN PACKAGING OF MINT AND MINT PRODUCTS

Package design and construction play a significant role in determining the shelf life of a food product. The right selection of packaging materials and technologies maintains product quality and freshness during distribution and storage. Materials that haven traditionally used in packaging include glass, metals (aluminum, foils and laminates, tinplate, and tin-free style), paper and paper boards and plastics. Moreover, a wide variety of plastics have been introduced in both rigid and flexible forms. Today’s packaging often combine several materials to exploit each material’s functional and aesthetic properties.

Processed herbal materials, mint preparations and mint dosage forms should be packaged as quickly as possible to preserve their quality. Packaging should prevent deterioration of the herbal medicines and they should be protected against exposure to pest infestations and other sources of contamination. When applicable, the maximal holding time of the unpacked herbal medicines should be established. Continuous in-process QC measures should be implemented to eliminate substandard materials, contaminants and foreign matter prior to and during the final stages of packaging. Processed mint preparations and herbal dosage forms should be packaged in clean, dry boxes, sacks, breathable bags or other containers in accordance with the SOP and should comply with national and/or regional regulations of the producer and the end-user countries. Materials used for packaging should be non-polluted, clean, dry and undamaged, and should conform to the quality requirements for the processed herbal materials, herbal preparations or herbal dosage forms concerned. Wherever possible, the packaging used should be agreed upon between the supplier and the buyer.

The type of packaging needed for mint depends on the product, the intended market and the types of climate that the food/ product will be exposed to. Mint product that is marketed in a cool dry area may only need simple packaging such as paper. The same product sold in a hot, humid area needs considerable protection against moisture pick-up. Producers may therefore need to decide on different packs for different markets. Selection of packaging requires much thought and attention as it represents the final defense for the product in the chain to the customer.

Most herbs are packed in plastic film as either large bulk bags or small retail packs. The processor may carry out a number of simple checks on films

Material for specific packaging and storage of raw mint herb: Stem, heartwood, bark - Gunny bags and woven sacks Creepers, leaves - woven sacks with ld liner, high gauge HMHD bags, woven sacks with LD liner, High Gauge polyethylene bags. Fruits and rhizomes - High gauge HMHD bags, woven sacks with LD liner, Wooden boxes. Flower, anthers, stigma, petals, seed - Corrugated box with polypropylene woven sacks, HDPE containers, Fiber board's liner. Herbal extracts and compounds - Air tight HDPE containers, corrugated box with polyethylene woven sacks and fiber board's drums with polyethylene bags separate store for different categories of medicinal and aromatic plants e.g. fresh herb, dry herb, volatile oil.

4.3 TYPES OF PACKAGES

BLISTER PACKS Blister packs are often used to hold formed solid unit doses of pharmaceuticals. Solid units of mint doses are packed in blister packaging. Blister packs are pre-formed plastic, paper, or foil. The main element of a blister pack is a cavity or pocket made from a thermoformed plastic. It usually has a backing of paperboard or a lidding seal of aluminum foil or plastic film that can be punctured by hand Eg**:** Mint flavored chewing gums, mint candies etc.

SACHET PACKAGING is a square or rectangular sealed pouch, often made of some type of plastic. They are most often used for powder dosages, but can also be used for liquids. They can be re-sealable or single-use sachets and are often perforated so they can be easily torn open by hand. Eg: Mint flavored tea powders, mind hand wash sachet, dried and powdered mint seasoning etc

BOTTLES Bottle are frequently used for liquid pharmaceuticals as well as formed tablets and capsules. Glass is most common for liquids because of its excellent barrier properties. Plastic is often used for tablets and capsules, especially for prescription bottles. They come in different colors, the most common being orange or light brown because these colors prevent ultraviolet light from harming the potentially photosensitive contents, while still letting enough visible light through for the contents to be easily visible.

Glass has been used for decades, and it offers a host of benefits. Glass bottles are transparent, they are tough and durable, they can be labelled and identified very easily and they come in a range of different shapes and sizes. Glass is also inert, which facilitates more comprehensive protection, and there is a lower risk of interaction with leachable substances. It is very common to come across amber glass bottles when looking at pharmaceutical packaging. Amber glass is used more frequently that clear glass because it protects the drug from UV rays, which can damage the product. There are three types of glass:

Type I: ultra-resistant borosilicate glass

Type II: surface treated soda lime glass

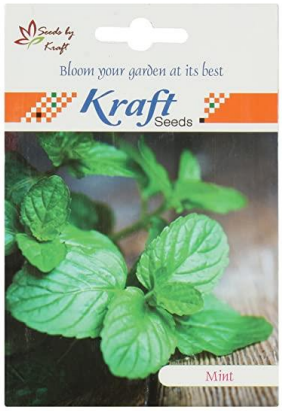
Type III: soda lime glass

Eg: Mint flavored syrups, Mint herbal oil, Mint flavored balms, Flavoring mint extract etc.

PILLOW BAGS Another common type of packaging is pillow bag. The bags get their name form their shape which resembles the pillow. They are found lying flat on grocery store.

Eg: Mint tea powder, crushed mint leaves

HANGING BAGS Hanging bags are frequently seen in grocery stores and other retail locations. They are a type of plastic nag that is sealed on both ends and sometimes with a back-middle seam as well. Hanging bags have a pre-cut hole that allows them to hang easily from hooks, so they can be displayed in an attractive way.Eg: Mint flavored air fresheners, mint tea powder, dried mint etc.



PLASTIC It is one of the most versatile substances in the world. Plastic is light in weight, it's flexible, it can be used to produce packaging of all shapes and sizes, cheap in price and it's very difficult to break. These are all advantages when exploring materials for pharmaceutical packaging.

PET: polyethylene terephthalate

HDPE: high-density polyethylene

PP: polypropylene

LAMINATION is common process in food manufacturing factories, as aluminum enhances permeable materials and therefore the products are soundly preserved in aseptic package. Aluminum foil is commonly combined with paper and cardboard materials to extend shelf life of products by providing sufficient barrier. Essential oils isolated from Mentha plants have a long history of use as improving the flavor of foods like confectionaries (such as candies and chewing gums) and beverages. Mint flavor, which includes spearmint, peppermint, and corn mint, is probably the third most important flavor used after vanilla and citrus.

ALUMINUM FOIL is more frequently used in food manufacturing than aluminum itself. It can

be used in its raw form as for example in chocolate package or included in another type of container as Tetra Pak where one layer of package consists of aluminum. The use of aluminum foil or film for endorsing other materials such as paper or polymer proved to be truly efficient, providing the benefits of aluminum together with low-priced, light materials. Another advantage of foil is that it protects food products from temperature changes as it has thermo-insulation features.

RE-CLOSABLE ZIPPER BAGS AND POUCHES Reusable bags and pouches are good for flavor because they give customers convenient access to their goodies while preserving freshness

GLASS has served Cosmetics industries as an efficient container for many centuries as glass is

economical, can be handled at high speed on production lines, and is inert thus giving excellent product pack compatibility. It provides good product presentation (clarity, sparkle, design and shades) and good product identification. Glass is completely impermeable to all gases, solutions

or solvents. If a product is sensitive to light, amber glass or cartoning can be used. Glass can be moulded into very attractive designs and provides excellent brand or product image. Glass is manufactured in many different formulations but the most common in packaging is soda lime

glass. Soda lime glass contain Silica (from sand), Calcium Carbonate (Limestone), Sodium Carbonate (soda ash), Aluminum oxide and Trace oxides. It is trace oxide that provide colour to glass. The only disadvantage which glass has is that it is fragile and it has weight.

METALS Today steel, tinplate and aluminum are used for packaging. Metal containers are strong, relatively unbreakable, opaque and impervious to moisture-vapour, gases, odours, bacteria; provided they are pinhole free. They are resistant to both high and low temperature. However, metals require the application of coatings and lacquers to prevent chemical reaction and corrosion from the inside or outside. Special coatings and coating techniques have therefore been developed for this purpose. Metal containers are available in a variety of shapes, sizes and styles ranging from small elongated collapsible tubes and shallow drawn containers to large built-up containers including steel-drums.

The use of collapsible aluminium tubes is extremely widespread and almost all varieties of semi-solid products, including emulsions, pastes and gel are marketed in collapsible tubes.

PAPER AND BOWL: It is mainly used for Secondary and Tertiary packaging. Rigid and semi-rigid paper board packages e.g. Cartons, Box, Corrugated Shippers are widely used in cosmetics industries.

Plain paper is not used to protect foods for long period of time because it has poor barrier properties and is not heat sealable.

When used as primary packaging (when in contact with food), paper is almost treated, coated, laminated, or impregnated with materials such as waxes, resins, or lacquers to improve functional and protective properties.

Plastics: The use of plastic for producing primary components and point-of-sale material now dominates packaging technology. There are two main groups that are used – Thermoplastic resin and thermosetting resin. Thermoplastics Resins can be extruded at their melt temperature and then blow moulded or injection moulded. After cooling the resin can be remelted by heating to the limits of thermal fatigue and oxidation. Polyvinyl Chloride (PVC), Low density polyethylene (LDPE), High Density polyethylene (HDPE), Polypropylene and Polystyrene are thermoplastic. Thermosetting resin are molded using an irreversible chemical reaction and the resins tend to be rigid, hard, insoluble and unaffected by heat up to decomposition temperature. Generic term "amino plastics" is used for plastics produced by reacting formaldehyde with amino compounds. Their applications range from electrical equipment such as switch plates, sockets or circuit breakers, work surface laminates, etc. It is generally processed by compression moulding.

ALUMINIUM FOIL packaging material are the best packaging material for long time preservation of dry mint leaves. Sundry condition and 40ºC are the best for the drying of Mint because at this temperature the colour, flavour and nutritional quality of mint will be maintained.

In case of retort sterilized cream containing peppermint, **tin cans and glass bottles** are the commonly used packaging formats. A number of different packaging options are available for packaging the UHT cream containing peppermint to pack and the following are some of the packaging options:

Aseptic canning was probably the first to be utilized with creams containing peppermint, Plastic (polythene), paper and foil laminate cartons, Plastic (polystyrene or polypropylene) form-fill-seal packages are also most widely used, Lacquered aluminium or tin-plate cans are used for Aerosol creams,

Preformed pots or with laminates and Plastic (polythene) bag contained within a cardboard carton (bag-in-box) is used for bulk packaging of UHT creams containing peppermint with unit volumes are in the range 5-1000 litres.

Collapsible packages like tubes, squeeze tubes, or collapsible tubes can be used for viscous liquids containing peppermint such as toothpaste, ointments, gels, other cosmetics and so on. Basically, a tube is a cylindrical, hollow piece with a round or oval profile, made of plastic, paperboard, aluminium, or other metal.

Sachets (aka packets) and pouches can be used for gel-like products containing peppermint like lotions, shampoos and energy gels. For face washes containing peppermint, materials made from PETG, PVC and PC plastics can be used.

The most commonly used materials for drug /pharmaceutical products containing peppermint are glass and plastics. Amber glass bottles like ultra-resistant borosilicate glass, surface treated soda lime glass and soda lime glass are the most common ones. Plastic materials like PET: polyethylene terephthalate, HDPE: high-density polyethylene and PP: polypropylene is also used.

Some of the soap packaging options containing peppermint, that are used by companies in the soap and detergent industry are small sachets, cartons, poly packs, plastic bottles, tubes and paper wrap.

CHAPTER 5

FSSAI REGULATIONS

In respect of **spices**, there are specifications for volatile content of the oil on dry basis, moisture, total ash on dry basis *(bleached / unbleached in case of ginger)*, calcium content as CaO on dry basis in case of ginger, extraneous matter, acid insoluble ash, total starch *(in case of turmeric)*, defectiveness, insect damage matter, and crude fibre.

5.1 REGULATION FOR SPICES

The following regulations are important for spices, tea, coffee, cocoa, etc.

(a) Quality Specifications for more than 40 products including the following are available in 3Food Safety and Standards *(Food Products Standards and Food Additives)* Regulations, 2011:

The FSSAI has notified the Food Safety and Standards (Food Products Standards and Food Additives) Second Amendment Regulations, 2019 related to revision of existing standards of coconut milk and coconut cream, standards for dried oregano (whole and powder), pimento (Allspice) (whole and powder), formulation of laurel (Bay Leaf) (Whole and Powder), Dried Mint, Dried Rosemary. These regulations shall come into force on the date of their publication in the Official Gazette. Food Business Operators will have to comply with all the provisions of these regulations by 1st July 2020.

5.2 REGULATION FOR DRIED MINT

Dried mint means dried leaves or broken or crushed leaves of *Mentha spicata* Linnaeus syn. /*Mentha Viridis* Linnaeus. It shall have characteristic odour and flavour and shall be free from mustiness and other foreign flavours. It shall be free from living insects and moulds and shall be free from dead insects, insect fragments and rodent contamination visible to the naked eye.

It shall conform to the following requirements

S. No	Characteristics	Requirements
1.	Moisture content, percent by mass (Maximum)	13.0
2.	Foreign matter, percent by mass, (Maximum)	1.0
3.	Extraneous vegetable matter percent by mass (Maximum)	3.0
4.	Total ash percent by mass on dry basis (Maximum)	12.0
5.	Acid-insoluble ash, percent by mass on dry basis (Maximum)	2.5
6.	Volatile oil content, ml/100g, on dry basis (Minimum)	0.5

Explanation

Foreign Matter means any matter or material not usually associated with the product.

Extraneous vegetable matter means any vegetative matter associated with the plant from which the product originates.

5.3 ASTA STANDARDS

The American Spice Trade Association (ASTA) is a private body of the spices traders in the US and their members, generally, prefer to accept spices in line with the ASTA standards. ASTA has established quality specifications for the presence of insects, excreta of mammals and others, mould, extraneous matter etc. in respect of spice, for instance, cardamom, coriander. ginger, black pepper, turmeric, etc.

ASTA has also established the following guidance documents for use by the producers and suppliers of spices:

- Prevention of adulteration and contamination
- Allergens
- Screening tools for contaminants

- Pesticide residues
- GAP, GMP and HACCP guidelines for spices
- Physical specifications and cleaning guidelines
- Microbial safety of spices
- Validation of process controls.

5.4. ESA QUALITY *MINIMA* FOR SPICES

Similarly, the European Spice Association (ESA), a private body of spices traders in Europe, has established quality specifications for moisture, total ash, acid insoluble ash, volatile oil content, etc. in respect of spice, for instance, cardamom, coriander. ginger, black pepper, turmeric *(whole and ground)*, etc.

ESA has also developed the following requirements and guidance documents for application by its members:

- Prevention of adulteration
- Allergens
- Labelling of allergens
- Dehydration factors for spices
- Contaminants and pesticide residues
- Good Agriculture Practices
- Analytical methods

It is important to note that for export of spices and other products to the developed markets, the legal requirements specified under their legislations is a mandatory requirement. However, the private standards, such as those of ASTA and ESA are the requirements established by the trade.