ACHARYA N. G. RANGA AGRICULTURAL UNIVERSITY

B. Tech (Food Technology)

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THEORY STUDY MATERIAL

PROCESSING OF SPICES AND PLANTATION CROPS

Prepared by

Ms. Aruna Kumari Y

College of Food Science and Technology, Bapatla

Dr. Jessie Suneetha W

College of Food Science and Technology, Pulivendula

Table:

Common name	Scientific name	Family	Spice of common
Black pepper	Piper nigrum	Piperaceae	Berry / fruit
Long pepper	Piper longum	Piperaceae	Berry / fruit
Cardamon	Elettaria cardamom	Zingiberaceae	Capsule / fruit
Ginger	Zingiber officinale	Zingiberaceae	Rhizome
Garlic	Alum sativum	Liliaceae	Bulb / cloves
Vanilla	Vanilla fragrans	Orchidaceae	Beans/ pods
Nutmeg & mace	Myristica Fragrans	Myristicaceae	Kernel (N), Aril (M)
Turmeric	Crucuma longa	Zingiberaceae	Rhizome
Clove	Eugenia caryophyllus	Myrataceae	Unopened flower bud
Cinnamon	Cinnamomum zeylanicum	Lauraceae	Bark
Asafetida	Ferula asafetida	Apiaceae / umbelliferae	Latex / gum
Saffron	Crows sativus	Iridaceae	Stigma of flower
Bay leaves	Laurus nobilis	Lausaceae	Leaves
Cumin	Cuminum cyminum	Apiaceae	Seeds
Caraway	Carum carvi	Apiaceae	Seeds / fruit
Fennel	Foeniculum vulgare	Apiaceae	Seeds / fruit
Poppy seeds	Papaves somniferum	Papaveraceae	Seeds
Amchur	Mangifera indica	Anacardiaceae	Fruit
Mustard	Brassica nigra	Brassicaceae	Seed
Condiments			
Fenugreek	Trigonella foenum gracicum	Fabaceae	Seeds & leaves
Coriander	Coriandrum sativum	Apiaceae	Seeds & leaves
Tamarind	Tamarindus indica	Fabaceae	Pod/ fruit
Chillies	Capsicum annum	Solanaceae	Fruit
Onions	Alum cepa	Liliaceae	Bulb

Plantation crops			
Cashew nut	Anacardium – occidentale	Anacardiaceae	Kernel / nut
Cocoa	Theobrama cocoa	Sterculiaceae	Bean
Coffee	Coffee arabica	Rubiaceae	Beans/ fruits
Tea	Camellia sinensis	Camelliaceae	Leaves/ shoots
Coconut	Cocos nucfera	Palmaceae	Endocarp
Arecanut	Areca catechu	Pamae / Arecaceae	Nuts
Oil palm	Elacis guineensis	Palmaceae	Mesocarp
Aniseed	Pimpinella anisum	Apiaceae	Fruit
Star anise	Illicium verum	Illiciaceae	Fruit
Mint	Mentha longifolia	Lamiaceae	Leaf
Origanum	Organum vlgare	Lamiaceae	Leaf & flower top

Lecture No: 1
History

Excavations in the Indus valley revealed that spices and herbs have been used even before 1000 BC

- India is considered as kingdom of spices
- There are 107 spices with 20 countries being involved in the production and Export (India 50 spices)
- Total annual average production of spices in India is estimated as 2.49 million tones (30% world production)
- Of the total production 90% domestic, 10% export
- Indian export accounts for 30-40% world trade & nearly 20-37% of foreign exchange is from pepper alone. (black gold)
- India is the major producer of pepper, ginger, turmeric and seed spices
- India enjoys monopoly in the export of spice oils and oleoresins

Value addition

Definition: The maximum realization of the price of the product through processing, packaging and marketing.

Aromatic substances which enhance flavour are called as spices and condiments.

Spices: Dried roots/ barks / seeds whole, crushed or powdered

Herbs: Fresh leaves, stems or flowers of hebaceae plants.

Seasonings – Bulbous group, almost invariably used on fresh form Ex: Onion, Garlic

- Spices and condineuts in general applies to natural plants, produce in whole/ground form used to export flavour, aroma and pungency to the food usually spices dominate the other two in flvour.

Benefits of value added products over raw spices

1) Easy to carry
2) Long lasting flavours
3) More volume can be handled / per unit area
4) Easy to store , free from bacterial contamination.
5) Increases foreign exchange as they are used in food industry, preservatives and pharmaceutical industry

Regulatory Agencies on quality of spices:

"ASTA' – American spice trade association
"ESA" - European spice Association
"BIS" - Bureau of Indian Standards

Oleoresins:- Products obtained by solvent extraction containing flavour ingredients (soluble in the solvent)

"Oleoresin" → Volatile - Aroma
"Oleoresin" → Non volatile - Pungency / Taste flavour

Value added products from different spices

1) Black pepper – Oleoresin, Green pepper in Brine, dehydrated green peppers, canned green pepper, white pepper powder etc.

2) Paprika – colour, paprika flavour

3) Ginger – powder, wines, dry ginger starch from spent ginger preserves, gingiberin oil oleoresin

4) Turmeric – Natural pigments, curcuminoids, oleoresins

5) Coriander – Powder, oleoresins

6) Cumin – powder, oleoresin

7) Fennel – sugar coated fennel, oleoresin, whole etc

8) Fenugreek – powder, dried fenugreek leaves etc

9) Tree spices – obesity regulators, stimulators, neutraceuticals (cinnamom, cassia nutmug, cloves)

10) Chillies – powder, pickles, paste, oleoresin, oil, brined chilli, sauces.

Ground spices – cracked

- coarse ground
- fine ground

- Include spices milled to the degree of fineness
- Heat evolved during processing results in loss of flavour + Deterioration of Quality
- Solution to overcome this problem – cryogenic process of milling/ powdering has been developed
- This is done by feeding spices –liquid nitrogen simultaneously into the milling zone
- Cryomilled spices showed better retention of Aroma, colour – less loss of moisture.
- Quality factors like cleanliness, low pesticide residue levels, low microbial counts are essential.

Spice extracts : an alternative to whole / grounds

- Modified to suit the production needs like solubility, dispensability, aroma, flavour and colour
- Spice extractives – essential oil
    - Oleoresin
    - Micro encapsulated oil and oleoresin
- Essential oils: These are aromatic volatile components present in most spices recovered form plant / spice material by steam distillation.
- Essential oils are derived from
    - Leaves – rosemary, peppermint
    - Barks – cinnamom and cassion
    - Rhizome – ginger
    - And wood, flowers etc of the plant
- Essential oils are used in flavours and cosmetics development
- Essential oils are complex mixture of odourous and volatile compounds which are deposited in
    - Subcuticulae space of Glanduear hair

- Cell organelles
- Excretory cavities
- Canals
- Wood (exceptionally)

- Essential oils are composed of terpenes, Alcohols, Aldehydes, ketones, Esters, ethers, phenols, acids and nitrogenous and sulphur compounds
- Essential oils are highly volatile, hence water distillation, steam distillation / combination of both methods are generally adopted for manufacture of essential oils.
- Essential oils: - syrups
  - Confectionery
  - Tooth pastes
  - Mouth washes
  - Pharmaceutical industry
  - Dentistry
- These oils are highly concentrated compound to fresh spices.
- Used at a low level of 0.01 – 0.05% in a finished product.
- They are highly irritant to slain – toxic to CNS it taken internally

Oleoresins: Obtained by extraction of ground spices with an organic solvent as methylene bromide, Ethylene dichloride Acetone, Hexane or Alcohol.

Method of production

I. Raw material is
   Ground to desired $\rightarrow$solvent $\rightarrow$micella is thickness
II. Three stage method
   1. Voltrile oil is obtained from the raw material by steam distillation
   2. Dry the residue extract with a selected solvent
   3. Recovered extract volatdle oil an in any proportions as desired by the industry.
      - Residual solvent should be below 300 ppm
      - Stable highly concentrated, free from contamination
      - Used in oil based dressing, canned foods confectionery, processed meats, soups, sauces, chutneys, cheese etc.
      - Highly heat stable, freeze stable
      - Part of oleoresin is equivalent to 20-40 parts of ground spices

* Use of E.oil in various industries
* Industry % of use
* Flavouring (Food) 55-60
* Perfume/cosmetics 15-20
* Isolation of compounds 10-20
* Pharmaceuticals for 5-10
* Active substance
* Natural products 2-5

Different spices & their oil extracts:

1. **Pepper oil**
    * Obtained by dried, crushed pepper berries
    * Yield of oil ↑ses with maturity
      2% →immature/ Ripened berry →2-2.5
      4.5-5% →mature/ due ↑se in starch/fibre
    * Oil is concentrated in oil bearing cells of the skin
    * 6-8% piperin is present in the residue
    * Piperin has got geometric isomers i.e
      Chavicin, Isochavicin & Isopiperine

Functions:

1. Appetizers
2. Add flavour to insipid foods
3. Antioxidant, Antimicrobial / Antibiotic Ex: Turmeric in nature
4. Natural colourant Ex: paprika, turmeric, saffron.
5. Stimulate Salivation, acid secretion and digestive enzymes

Ptyalin CHO digestion.

6. Aids in digestion – reduce flatulence
7. Anti inflammatory Ex: Turmeric, Ginger
8. Anti diabetic Ex: Fenugreek
9. Hypocholesterolenic - Garlic
10. Anti mutageric & Anti carcino geric Ex: Turmeric, chilli capsicum
11. Food preservation Piperin

(pickling) Ex: mustard, Gingero

12. Improve immunity Garlic powder
13. Pungency Chillies
14. Preservative / Emulsifying agent Ex: Mustard powder
15. Souring agent Ex: Tamarind, Amatur
16. Thickening agent Ex: Poppy seeds

Nutritional Importance

Fe:- Cumin, mace, pepper, tamarind
Ca:- Cumin, pepper, clove
P :- Cumin, fenugreek, nutmeg, clove, mace
K :- Turmeric, coriander, fenugreek, cumin
Na:-
Vit. A & C:- Corriander, chillies, cloves
Thiamine:- Chilli, cumin, nutmeg, fenugreek
Riboflavin:- Chilli, cumin, garlic, cardamon
Niacin:- Cumin, Turmeric, chilli, pepper, mace, nutmeg

Classification of spices

i) Based on Economic importance:

1. Major spice:

This spice contributes major share to spice trade industry-75-95% of total foreign exchange

Ex: Black pepper, Chillies, Small Cardamom, Ginger, Turmeric

2. Minor spice:

Except the above 5 spices all other spices are grouped under minor spices.

a) Bulbous spice: Onion, garlic, leek, shallot

b) Seed spice: Coriander, cumin, fennel, djowarin, fenugreek, linseed, mustard and poppy.

c) Aromatic tree spice: Cinnamon, clove, aniseeds, nutmeg.

d) Acidulaut tree spice: Tamarind, Amchur

e) Leafy spices: Coriander, bay leaves, curry leaves, mint.

3. Other minor spices: Saffron, vanilla, asafoltida, etc

II. Based on origin & flavour:

1. Pingent spice: Pepper, ginger, chillies, mustard
2. Aromatic fruit: Cardamom, fenugreek, cumin, nutmeg
3. Aromatic bark: Cinnamon & cassia
4. Phelolic spices: Cloves, allspice.
5. Coloured spices: Paprika, Saffron, Turmeric

ii) Based on plant parts used:

Ø Aril - mace
Ø Bark - cinnamon

- Beny - black pepper
- Buds - clove
- Bulbs - onion, garlic
- Floral parts- saffron
- Pods - tamarind, vanilla
- Fruits - cardamom
- Kernels - nutmeg
- Leaves - mint/ coriander, bay, curry
- Rhizomes - ginger, turmeric
- Latex - safetida
- Roots - horse radish
- Seeds - fenugreek, mustard, cumin

IV Based on climatic requirements:

1. Tropical – High temperature and abundant pH

Eg:-Clove, Nutmeg, Cinnamon, Pepper, Ginger

2. Subtropical – 3 distinct seasons (winter, summer, mansoon)

i.e, Low Temp during – vegetatives

High temp during – reproductive / mo

Eg: Cumin : coriander, fenugreek, onion, garlic

Temperature:- Low temp/ frost conditions

Eg:- saffron, asfoetida

iii) Based on number of seasons:

iv) Annivals – 1 year/ 1 season [life cycle]

Eg: Coriander, fenugreek, fennel, cumin

v) Biennial: life cycle – 2 seasons

Eg: Onion, parsley

vi) Perennials: More than 2 seasons

Eg: Black pepper (Herbaceous perennial)

Saffron (Bulbous perennial)

Cloves

Cinnanon (woody perennial)

Lecture No: 2

Garlic

Scientific name : Allium sativum
Family : Liliaceae
Economically important parts : Bulb / cloves
Origin : Western Asia & Mediterranean Area
Utilization : Valuable condiment, flavouring agent

- ⇨ India is the largest producer, consumer & exporter of Garlic
- ⇨ Garlic is insecticidal, fungicidal & Bactericidal in nature

Commercial products of Garlic

Instant minced Garlic
Instant Garlic powder
Garlic oil
Garlic oleoresin & Garlic salt

1. **Garlic salt :**
   Garlic powder (20%) is mixed with Table salt (78% & Dessicant (calcium stearate 2%)
   Composition of Fresh Garlic and Dehydrated Garlic

	Fresh Garlic	Dehydrated garlic
Moisture	62.8%	5.2%
Protein	6.3%	17.5%
Fat	0.1%	0.6%
Fibre	0.8%	1.9
Mineral matter	1.0%	3.2%
CHO's	29.0%	71.4%
Calcium	0.03%	0.1%
Phosphorous	0.31%	0.42%
Fe	0.0001%	1.9%
Vit c	13 mg/100gm	12mg/100g
Food energy/calorific	142 cal/100gm	380 cal/100g
Niacin	0.4 mg/100 gm	0.7 mg/100 gm

Garlic oil & powder:

→ It is an essential oil from Garlic

→ On crushing the bulbs oil bearing cells burst releasing E.oil consisting of disulphides which are responsible for characteristic odour Garlic oil has following constituents:

1. Allyl propyl disulfide ($C_6H_{12}S_2$)
2. Diallyl disulfide ($C_6H_{10}O_2$)

→ Flavour strength of Garlic oil is 200-900 times that of dehydrated & fresh Garlic respectively

→ On steam distillation, fresh garlic bulbs yield 0.1 – 0.2% of volatile oil

→ For easy blending & mixing in seasoning mixtures oil is available in different dilution levels at 5, 10 & 20% in veg oil.

Garlic powder:

→ Garlic / dehydrated Garlic in ground form

1. Washing
2. Peeling
3. Dehydration
4. Pulverisation
5. Packing

Raw material (Garlic)
↓
Washing (water spraying/Rotary washers)
↓
Peeling (steaming, Radiant treat / Flames)
↓
Washing (spraying water)
↓
Dehydration (modern Dehydrators
↓
Pulverisation (Hammer mill)
↓
Coarse powder (Bo mesh sieve)
↓
Screening
↓
Dehydrated Garlic powder

↓

Packing (PE bags)

Garlic oleoresin:

Garlic oleoresin – highly concentrated product obtained by solvent extraction & vaccum concentration of extracted juice.

→ Methyl alcohol is the best solvent for this purpose
→ Extract time – 4 hr
→ Oleoresin from Garlic is dark, brown, soft Aromatic extract containing 5% of essential oil
→ One part of Garlic oleoresin is equivalent to 50 parts of fresh Garlic
→ On steam distillation of Crushed Garlic at 760 mm of Hg is decomposed to daily sulfide & other sulfides.
→ Allin (mother precursor) in intact Garlic is not Bactericidal but Alliicn is bactericidal Dehydrated Garlic:
Peeling → Slicing → dehydrated →Graded

Dehydrated Garlic slices / Ring – 4 mm slices Garlic Flakes →passes through 4 mm sieve but retained on 1.2 m aperture size

Garlic grits →passes through 0.25 mm sieve
Garlic paste:

Clove separation →mannual peeling →Blanching hot water /steam for 5-7 min

→Antioxidant treatment →chopping & Grinding
→Packing storage

Blanching – to prevent enzymatic activity responsilde for flavour alterations.

Antioxidant treatment : citric acid / sod bisulsite at the rate of igm/lt / 5 min)

Uses of Garlic

1. Condiment – for flovouring dishes
2. Garlic oil is used as an insecticide eg: Daillyl disulfide – larvicidal, & dially / trisultide
3. Biofungicidal

4. Adhesive
5. Garlic residue →responsible for anti bacterial property (allyl disulfide oxide)
6. Garlic is used for
    - Cancer →Allicin
    - ↑ses intestinal synthesis of vit B & B_1
    - Used as an antioxidant/Hypocholes terolemic acid

    Allicin blocks the enzyme by reacting with one of site (sulfydryl groups) presentat crucial site of enzyme responsible for cholesterol synthesis.

    Physio – chemical Quality specifications of Dehydrated spice / Garlic

	Garlic slice, ring Flakes	Garlic powder
Moisture (%)	8.0	6.0
Total ash (%)	5.5	5.5
Acid insoluble ash (%)	0.5	0.5
Extraneous matter (%)	0.5	0.5

Lecture No: 3

Nutmeg & mace

Nutmeg : Jaiphal

Mace : Javitri

Botanical name : Myristica fragrans
Family : Myristiaceae

Place of origin : Grown in Banca Islands in molud

→ Introduced in India by East India company in 18th century.

→ Nutmeg produces two products of economic important from the same plant — Dried kernel (Nutmeg)

Aril (Dried) Mace of the fruit

→ Worlds production → 7000 tonnes of Nutmeg 1000 tonnes of mace (60% From Indonesia)

→ Mace has little aroma & is brittle/ delicase

→ Myristic acid present in higher quantities in Nutmeg than in Mace

→ Appearance:

Nutmeg → avoid kernel which is hard brown & enclosed with in a thin shell

Mace → Surrounding the shell is the bracket like structure called Aril. Aril is scarlet in colour

→ They are valued for Flavour, Aroma & medicinal components.

→ Essential E oil present in both the spices is similar in organoleptic & physico – chemical ppts but flowour being different especially in intensity uses.

1. Mace is called commonly as Baking spice (used in bakery products) → cakes, pie etc.
2. Both Nutmeg & mace are used in soups, preserves, sauces & dairy products.
3. Nutmeg is effective against dysentery, stomachache sciatica & Early stage of leprosy.
4. In Indonesia Malaysia & singpore the succulent aromatic poicamp is used for making preserves jellies & sweet meats (candied fruit in Malaysia)
5. Salted sliced pericarp is used as a flavour adjunct in curries.
6. Nutmeg & mace are used to cure diarrhea flatulence, Diseases of liver & spleen, in unani system of medicine.
7. In Ayurvedic form of medice mace is used as Appetite stimulant, Bronchitis & Asthma
8. Nutmeg is antibacterial (Eugenol – reduces the gravity of lesion)
9. Two antimicrobial Resorcinol's have been identified – malabaricone B. mace
   Malabaricone C

   These are antifungal & also antibacterial eg: micrococcus. Aureus
10. Powdered mace is also used Hallucinoger ic drugs as excessive dose proved to be narcotic in nature. (myristicin & Elemicin) essential oil
11. It is used in perfumes, Aftershave lotions & cologne
12. It is used as a flavourant in Liquors

Essential oil :

→ Mace contains a volatile oil called " MACHINE"
→ Nutmeg E.oil contains 25-4% of fixed oil known as " oleum myristica Epressum" Aromat oil is butter like in consistency & orange in colour.
→ It contains 73% Trimyristic
12.5% Volatile oil
3.5% Glyceryl oleate & lineolate
→ Nutmeg fruit – average wt = 60 gm
→ It consists of 3 major parts
Pericarpl Rind -- 81 – 82%
Seed -- 16 – 17%
Mace -- 2 – 2.5%

Rind (waste) contains 16 – 1.7% pectin
→ V.oil of Nutmeg → two principal compounds myristicin & Elimitine
→ Natural colour as well as astringency of nutmeg is due to the presence of poly- phenols (2-2.5%) of which condensed Tannins & flavanoids constitute. The major part post Harvest Technology:
→ When the Fleshy rind of the drynut splits open, the fruits are ready for picking.
→ They are plucked from tree / or collected after they drop on the ground
→ Removal of outer fleshy rind is followed by detachment of scarlet red feathery aril (mace) by hand & then they are flattened out – nutmeg
→ Its then allowed to dry slowly in partial shade for 15 – 18 days.
→ During drying mace gradually become brittle & horny with a yellowish brown colour.

Curing / processing: It mainly consists of open sundrying & its effective- ness depends on the availability of bright sunshine – quality is not uniform hence Artificial drying is advisable.

→ Seeds are dried separately until kernels rattles inside the shell (& loose about 25% of it wt)
→ Shell is removed by breating with a wooden mallet & kernel is taken out
→ Suitably packed & stored with / without timing
→ The ratio of dry nutmeg to dry mace is 20:s

→ Fresh mace : 6.4% moisture content, 4.5% oil, 11.5% oleoresin, 122 mg lycopene
→ Mace is sensitive to light & heat. Hence drying of mace is a delicate task.
→ The attractive scarlet colour is due to lycopene (151 – 251 mg / 100 gm) at the time of Harvesting but on subsequent drying them they attain an unattractive appearance due to loss of colour
→ Dry mace: Moisture content: 485 – 5.05% volative oil = 11.5% - 12.4%, oleoresin – 21.25 – 22.5% , while lycopene is upto 149.0 – 182.2 mg/100g.

Technologies to retain natural characteriostics:

1. Drying at 50^0C for 28 hrs to reduce moisture content from 36 – 9% casehardening was eth defect encountered (Nutmet).
   Product was mould free (unlike sundrying)

   → Mild blanching for 1 min helps in retention of colour without affecting flavour principles accompanied by sulphitation / sulphur funingatino
   → In case of mace to reduce to the moisture to 5-5.5% the time required is
   5 – 6 hr, in case of mechanical drying
   24-48hr – shade drying
   15 hrs – sun drying
   → CPCRI method: (central plantation crop research Institute)
   Hot drying principle
   → The drier contains a heat exchanger & drying chamber.
   → Wood is burnt in heat exchanger & drying chamber.
   → Wood is burnt in heat exchanger & drying chamber.
   → Wood is burnt in heat exchanger while mace is layered over wire mesh separating the plenuim & drying chamber.
   → Temp of drying chamber – 50^0C
   → As a pretreatment the mace is blanched at 75^0C in hot water for 2 min.
   → Hot air requires 4 hr to complete the process
   → Blanching ↑ ses glossiness & ↓ses mould growth

Grading:

Commercial mace: Flattened lobed spices 2.5 cm in length, a bitless in breadth & 1 mm in thickness

→ On soaking retains original forms

World Grades:

a. Banda mace: Finest, bright orange colour
b. Java estate mace : Golden yellow with brilliant crimson streaks.
c. Siaun mace : Lighter than Banda & less in volatile oil
d. Papua mace: 4th Grade, less volatile oil – turpentine odour, unsuitable for distillation.
e. Western Indian mace: Comparatively inferior in all aspects for every 100 kg of Nutmeg from a tree the mace yield is around 3-3.5 kg.

Nutmeg:

1. White sound Nutmeg has 3 catagories
   a. Large -- 65 nuts/kg
   b. Medium -- 110 nuts/kg
   c. Small -- 275 nuts/kg

   200 nuts/kg is of great demand.

2. Sound shrivels : used for Grinding – powder
3. Rejections: lower priced & used for oil distillation
4. Broken & wormy : Broken/ loosened / cheapest/ infest usually

Commercial catagories

Nutmeg Category	Commercial designation	Description
I	Whole, sound	Whole, sound with good Size
II	Sound shrivels	Shrivelled but sound

		No insect infestation
III	Bwp / Defective	Brokens & wormy
Mace		
I	whole mace	should not contain
		More than 5% ($1/4^{th}$) of
		Broken pieces.
II A	Broken mace-I	7.5% pieces larger than $1/4^{th}$ size.
B	Broken mace – II	smaller than $1/4^{th}$ size
III A	Sifting – I	small broken pieces
B	Sifting – II	Very small broken

Iso Specifications :

S.No	Physico – chemical properties	Requirement
1.	Moisture (max)	10%
2.	Total ash	1.5%
3.	Acid insoluble ash	0.5%
4.	Volatile oil content (ml/100g)	5.0%
5.	"Cal" expressed as caloxide	0.35%

Value added products

Bark – 0.14% volatile oil

Volatile oil – oil content – 6—15% (Nutmeg ranks bolter compared to mace)

Leaves - .41 - .62% $\rightarrow H_2O$ distillation
Process: Dried leaves $\rightarrow\uparrow$ses oil content
Comminution steam pressing $\rightarrow$ steam distillation oil is mobile, colourless due to resinification

$\rightarrow$Fresh pericarp is acidic (2.3%) hence astringency can be removed by blanching.
Nutmeg butter: Aromatic fat:

- Nut contains 38-43% of ether extractable material containing Glycerides, volatile oil (6-13%) & Resin
  Kernel $\rightarrow$Ground $\rightarrow$Cooked/steamed $\rightarrow$pressing $\rightarrow$ 24 – 30% recovered.

$\rightarrow$ Product is soft, solid & yellow to red in colour
$\rightarrow$ Major constituent is Trimyristine.

Lecture No: 4

Cassia and Cinnamon

Botanical name : Cinnamomum aeylanicum (True cinnamon)
Blume (var)
Cinnamomoumaromaticum (cassia)

Family : Lauraceae
Place of origin : Srilanka
India : Kerala ,Karnataka, Tamilnadu

$\rightarrow$ Cassia (Jungli/wild dalchini)
True cinnamon (Gennine cinnamon/ Dalchini)
$\rightarrow$ " Dalchini" is derived from Arabianterm" Dar – al – chini which means "wood from chini"
$\rightarrow$ Cinnamon was in use even before 2000 Be used for culinary & for aromabath (spa)
$\rightarrow$ Cassia – cheaper, Inferior & is a substitute to cinnamon in quality.
$\rightarrow$ Cassia & cinnamon can be distinguished when "whole" from each other cassia – Coarser skin of great thickness & mild in flavour
$\rightarrow$ In ground form they are identical
$\rightarrow$ Quality is governed by elimatic conditions

→ Hence Ceylon & Seychelles inlands are considered to be best producers of cinnamon in terms of quality.
→ Good quality cinnamon is thin & light brow is color

Parts of Economic importance:
→ Cinnamon bark & leaves
→ Bark has a delicate fragrance & warm agreeable taste
→ Bark – oil & oleoresin
Leaf – Oil extraction
→ Bark oil has high (Eugenol) cinnam a_1 dehyde content.
→ Leaf oil has high Eugenol content

Harvesting & Processing

Steps:

1. Cutting: the branches /shoots in right size & shape
2. Scraping of outer rough corky layer
3. Peeling of bark from wood
4. Piping & preparation of quills, chips
Harvesting : cutting the branches shoots when red young leaves turn green & the sap is blowing freely.

* Peeling: Peeling is done with the help of a small knife having round edge at the end with a projection for scrapping of outer skin.
* Cut stem/sticks are given longitudinal slit from one end to the other.
* Working the knife bin the bark & the wood. The bark is ripped quickly & carefully
* The sticks are rubbed in bin hard pieces of wood so that to enable easy detachment of wood so that to enable easy detachment of the bark that does not peel easily.
* Peeling & harvesting should be completed on the same day.

Rolling:

* Barks are packed together & pressed well
* The bark as it dries assumes the shape of a pipe otherwise known as quills.
* The quills after rolling are dried on mats in hand

* Drying lasts for 2 – 5 days depending on weather & type of bark

Pipping:

* Rolled slips are used for piping
* During drying smaller quills are inserted into bigger ones forming smooth, pare brown cane like bundles or compound quills
* Quills of lm length are known as pipes
* Quills are graded based on thickness of bark
* Quills are further bleached by sulfur for 8 hrs & then sorted into grades

Grading:

a. Fine/Continuntal grade: Thickness ranges from 10-19 mm in diameter.
b. Hamburg grade: Thickness ranges from 23-2 in diameter.
c. Mexican grade: This is bin fine & Hamburg lower grades of cinnamon obtained as Byproducts in the preparation of pipes /quills
    i. Quills: Compound rolls of bark upto 1m in length
    ii. Quillings : Breakage of quills during grading transportations & leftovers during quill preparation generally are grouped under quillings
    iii. Featherings : Inner bark of twings & twisted shoots which cannot give straight pipes / quills.

Chips: Prepared by scraping & chipping the bark after removing outer bark (or) the most inferior cinnamon that cannot be quilled or pruned & waste bits are grouped under this "chips" category (mostly wood)

* Usually quillings & featherings are used for powder & oil extraction process yield:

    → 3-4 yr old (After planting) →65 – 125 kg/Hectare / 10-11 yr (after planting) →200-300/Hectare
    → About 1 tonn of leaves can also be obtained out of which 2.5 – 2.6 kg of c-oil can be ottained

Uses

1. Antiseptic, Stimulant, digestive, carminative
2. Works against Nausea
3. Flavouring in confectionary, Bakery pdts & liquors

4. Stem bark is found to play an important role in digesting sugars in Diabetics.
5. A mixture of powdered cinnamon, Ginger & black pepper in the ratio 2:1:4 is effective in treating cold.
6. Bark oil is fungicidal especially against Aspergillus Flaves, Asp niger at 400 ppm.
7. Leaves of cinnamon tamala are out India "Tejpat" (Biryani flavour) sunukar to Bay leaves of Europe.
8. Leaf oil is used as a flavouring in sweets
9. Rheumatism, liver, Dental problems, Diarrhoea it is beneficial

Oil & Oleoresin

Oil:

→ True cinnamon bark contains 0.5 – 2.5 % oil
→ 65% cinnamaldehyde & 5-10% Eugenol
→ Oil is usually steam distilled from left over / rejections of quilling process / chips
→ Fresh oil is light yellow in colour which changes red on storage.

Oleresin:

→ It is extracted from powdered cinnamon bark using solvents like acetone, Ethylene dichloride
→ Bark is distilled for the preparation of olecresin
→ Recovery is 10-12%
→ Dark brown liquid containing 50% volatile oil & should be diluted for use.

Leaf oil

→ Leaf →0.5 – 1.5% oil content
→ Main constituent is Eugenol (70 – 80%) – widely used for – Dental preparation & synthetic vanillir
→ Cassia oil : From bark & leaf main constituent : Cinnamal dehyde.

Lecture No: 5

RUBBER

Scientific name: Hevea braziliensis

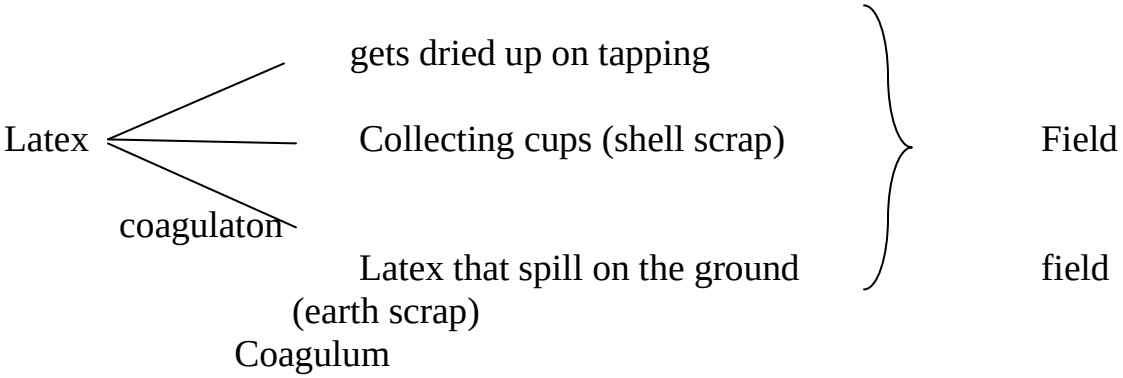
Family: Euphorbiaceae

→ Natural Rubber is found in the later of plants of over 895 species belonging to 31 genera of to families.
→ Some of them manihot glaziovi (ceara rubber)
Ficus elastic (Indian rubber)
Castiolla elastic (panama rubber)
Path enium argentatom (Guayul)
Taraxacum Koksaghyz & Hevea brasiliensis (para rubber) →province of Brazil.
→ Hevea is the most important commercial source of natural Rubber
→ Native of Brazil → moved on to Asia →1876 Srilanka →India
→ Malaysia, Indonesia, Thailand & S.Africa are the main rubber producing countries
→ 7-8% produce harvested from rubber plantation is in the from of later. The remaining portion is collected in coagulated forms collectively known as " Scrap Rubber"
→ Later is a milky white dispersion of rubber in water which is harvested by a procedure called Tapping.

Aping : It is the periodic removal of thin slices of bark to extract rubber later

→ Later vessel are arranged in a series of concentric rings of interconnecting vessels in soft layers of Bark.
→ While tapping cambium should not be damaged as otherwise callus formation will take place causing swelling
→ After 7 years of planting, generally Rubber tree attains Tappable stage
→ Puneture Tapping , Kappering slaughter Tapping Kj appering

→ Later is generally sterile but gets contaminated during tapping / collection & processing by bacteria leading to premature coagulation.



→ Latex – white / slightly opaque yellow ish liquid with Special gravity 0.974 - 0.986
→ Weal Lyophyllic colloideal system of spherical or pear shaped rubber globules suspendad in an aqueous serum.

Composition of latex

Rubber → 30 – 40%
Protein → 2 – 2.5%
Resins → 1- 2%
Sugar →1 – 1.5%
Water → 55 – 60%

Fresh latex is slightly alkaline/neutral but it is prone to become acidic due to bacterial action.

Preservation:

→ Anticoagulant : added to prevent precoagulation before it is processed
→ Anti coagulants — NH_3, Formalir, Sodium sulphate

NH_3 is recommended → latex concentrates $Naso_4$→sheet Rubber

Preservatives

→ Used to prevent Bacterial action & also stabilize the dispersion
→ NH_3 or 0.2% NH_3 with other preservatives are generally used.

1. Sodium penta chlorophenate + 0.2% NH_3
2. Sod penta chlorophenate 0.1% + EDTA + NH_3, 0.1%.
3. Zinc diethyl dithio carbonate 0.2 + NH_3 0.2
4. Bonic + launic + NH_3 (0.2%)
   (0.2 – 0.25%) (0.03 – 0.06%)
5. Zno + lauric acid + NH_3
   0.0125% 0.05% 0.2%

Fidld later with a suitable preservative is termed as preserved field latex.

Processed / Marketable Forms of Natural Rubber:

1. Ribbed smoked sheets (Rss)
2. Crepe rubber
3. Preserved latex and α- Concentrates
4. Block rubber / Gumb rubber

→ Field coagulation can be processed only into block & crape rubber where as crop collected as latex can be processed into any of the marketable forms.
   I. Latex concentrates produced by creaming & centritugation.
→ Preserved latex concentrate are marketed in two forms.

a. Later bin 36 & 50% drc
b. Latex bin 51 – 60% drc

* Latex concentration by creaming

Steps: Mixing of a suitable creaming agent such as ammonium alginate/tamarind seed powder with properly preserved field latex

→ Allowing the latex to separate into
   Two layers — upper layer with conc latex
   Lower layer with very little rubber skin
→ Creaming agent 0.2 – 0.3%

→ Slow process componed to centribugal

2. Latex conc. By centritugation
   →By centribugation P.F latex is separated into 2 fractions
      1. Con latex 50-60%
      2. Other containing 5-10%
   →A suitable centrituge is fed continuously with latex which results in the continuously collection of conc. Latex that can be drawn out through an outlet at the centre & serum fraction (skim latex) near the periphery through another outlet.
   →Skim fraction is generally coagulated with sulphuric aicd → Creped →dried →marketed as skim Rubber.

II. Sheet rubber (RSS) : Oldest method

→Latex coagulated in suitable containers into thin slabs of coagulation are sheeted through a set of smooth rollers followed by grooved set & then dried into obtain RSS.

Depending on drying method sheet rubbers are classified into two:

i. RSS
ii. Air dried sheets (pale, amber, unopened sheets)

About 67% of the natural rubber produced in this country is in the form of RSS steps involved:

1. Collection (using shell /cup → buckets)
2. Anticoagulation
3. Bulking & Dilution – Diluted in bulking tanks Dillution helps in setting denser & finer impurities at faster rate so that soft coagulm (sheetable) is obtained.
4. Adds of chemicals $NaHso_4$ (1.2 g/ kg) is added to improve the quality of sheet & to prevent blackening.
5. Coagulatin : Formic acid / Acetic acid is generally used for coagulaitn
6. Sheeting & Dripping:

They are sheeted either in smooth rollers to a thickness of 3mm & finally passed through grooved roller.

→Mold growth ↓ can be prevented by sprarking 0.05 – 0.1% paranitrophenol (pNP) – 100 it for 100 sheets

7. Dripping : The wet sheets are allowed to drip on reapers arranged in a dripping shed (well ventilated)
8. Drying : Should not be exposed to direct sunlight to avoid the development of stickiness.
9. Smoking: The sheets after 2/3 hrs of dripping in shade, sheets are carried into smoke house where the temp is bin 40 - 60^0

→Gradually drying will avoid devlpt of blisters.
→4 days of smoking under normal condition 5-6 days of smoking rainy season

Air dried sheets: Light amber colored sheets prepared in same way as Rss but dried in hot air tunnel instead of smoking

CREPE RUBBER

When coagulum from later or any form of field coagulum is passed through a minimum of 3 mills with heavy rollers a Ginkly laace – like rubber is obtained on air drying →Crepe Rubber.

Steps:

Collection
↓
Sieving
↓
Bulking & dilution
↓
Standar disation (0.5 kg dry.r.c/125 drc)
↓
Addn of chemicals (RPA s / $NaHSo_4$)
↓
Creping
↓

Drying (36.2^0C)

↓

Baling

↓

Packing

TSR (Technically specified Rubber) latex + field latex is blended to give rubber of desired consistency & texture using same machinery.

TSR is generally sold in solid block form hence called Block Rubber / crumb Rubber.

Size reduction

↓

Dewatering — Coagulum is disintegrated Into granules / pellet / crumbs

↓

Dirt removal

↓

Drying

↓

Balilng

↓

Grading

↓

Rubbers — Constant viscosity 0.15% (Hydrazine hydrate)

Low viscosity Rubber 0.15% Hydroxylanine Hydrochloride

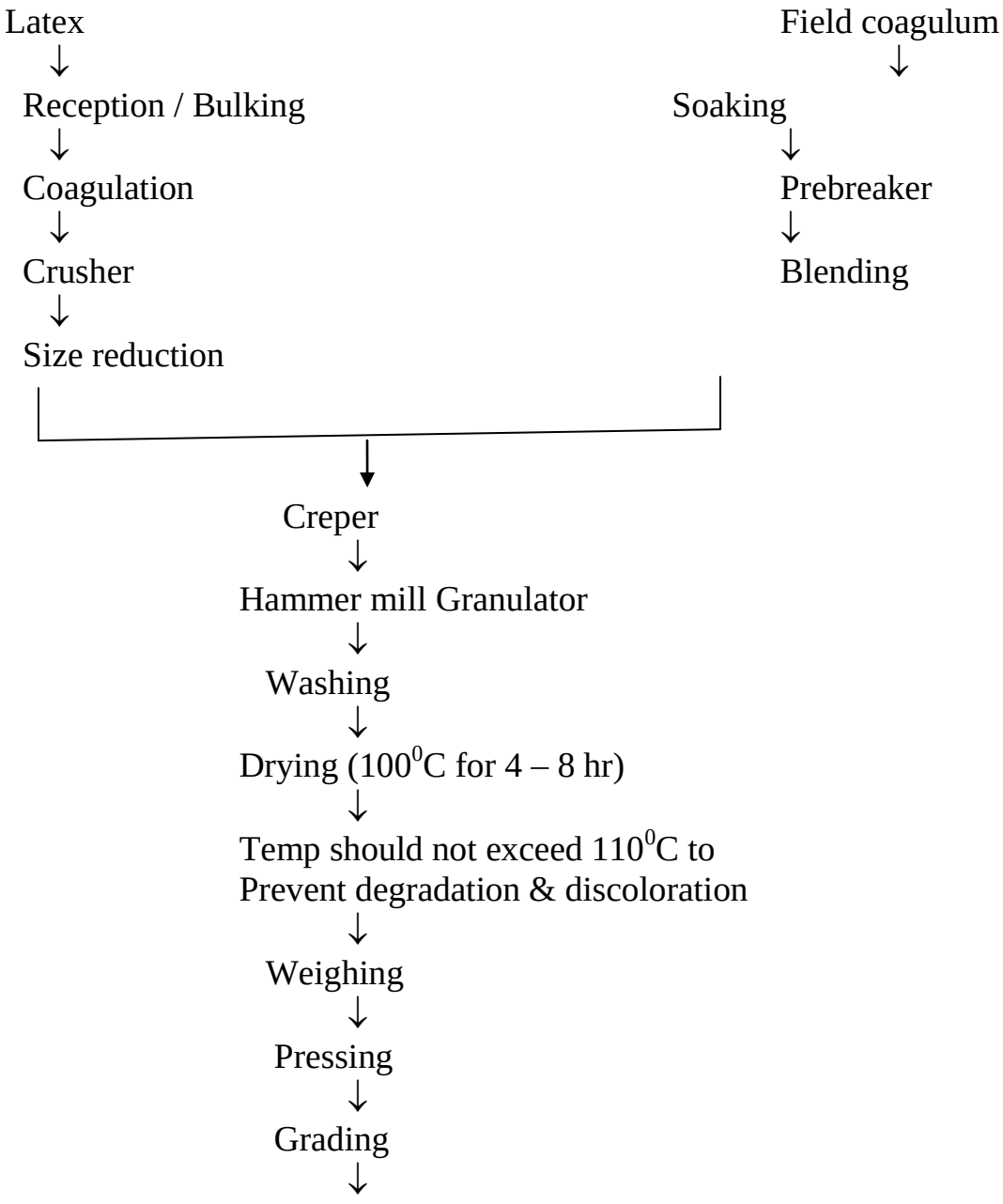
Equipment

1. Swcedder
2. H.mills
3. Crepers

4. Crumblers
5. Pelletiser

* Interplasticizer can also stabilize viscosity (Naphthenic rubber process oil)

Steps involved in TSR:



Packing

ENR (oil extended Natural Rubber)

→ Involves oil extension of Natural Rubber
→ Oil is added
To latex as an → Coagulated → Processed
Emulsion with acid Block rubber

Lecture No: 6

ONION

Indian Names

Assamese – Piyaz, Bengali – Palandu; Gujarati – Dunzari; Hindi, Punjabi and Urdu – Piyaz, Kannada – Nirulli; Erulli; Konkani – Kandu; Malayalam – Bawanj, Chuvannauli; Marathi – Landa; Sanskrit – Palandu; Sindhi – Dungari; Tamil – Vengayam, Irulli; Telugu – Nirulli, Ulligadda.

DESCRIPTION, DISTRIBUTION AND ECONOMIC IMPORTANCE

Onion is too well known to need any description. In the oldest recorded history, onions were depicted as food in Egyptian tombs as early as 20 BC. Onion is also mentioned in the Bible (si, 5) and in the Koran. It is used both for cooking as a food and as a condiment for flavouring or for pickling. It is grown almost all over India. The most important onion-growing states are: Maharashtra, Tamil Nadu, Gujarat, Uttar Pradesh, Andhra Pradesh, Orissa and Bihar. India is one of the world's largest producer of onions, followed by Japan, Spain and Egypt. Admittedly, onion is one of the most important commercial crops of India. Among the bulb crops, onion is by far the most important and occupies about 384,400 hectares; it needs further extension of area under improved varieties, which are disease-resistant, high –yielding, of good processing quality and of god keeping-quality. For bulb production, onion is a herbaceous annual, but for seed production, it is a biennial.

Types of Onions

The following are 6 different types of onions in India

i. Green onions are used in salads;

ii. Mild onions are used for cooking as food or as salad;

iii. Pungent varieties are used as condiment for flavouring of a number of foods;

iv. Pearl onions or small onions are used in pickles, including vinegar pickles;

v. White and yellow onions for dehydration purpose and for manufacturing onion powder; white onions of the desired quality are preferred; and

vi. Red and yellow onions are general purpose crops for culinary use.

Composition

Onion Bulbs:		**Onion Powder**	
Miustyre	86.8%	Moisture:	46%
Protein	1.2%	protein	10.6%
Fat	0.1%	fat	0.8%
Carbohydrates	11.6%	fibre	8.4%
Calcium	0.18%	carbohydrates	74.1%
Phosphorus	0.05%	Mineral matter (total ash)	3.5%
Iron	0.7 mg/100g	Calcium	0.3%
		Phosphorus	0.29
		Sodium	0.04%
		Potassium	1.0%
		Iron	0.002%
		Vit.A:	175iu/100g
		Vit.B_1	0.42
		Vit. B_2	0.06
		Nicotinic acid	0.6%
		Vit. C	14.7 mg/100g
		Calorific value	370cal/100g

The bulbs and fresh herb yield 0.005% of an essential oil (refractive index: 1.041; optical rotation:-5^0), which has an acrid taste and upleasant odour. The chief constituent of the crude oil is alyl-propyl disulphide, a sulphur compound responsible for tears.

Cold Storage

The onions are also kept in cold storages during summer. The best temperature for storing onion is 33^0 F-36^0 F (1^0 to 2^0C) with a relative humidity of 70-75%.

Inhibitors for Sprouting of Onions during Storage

A great variety of chemical compounds have also been tried to increase storage life of onions by inhibiting sprouting. The post-harvest application of growth inhibitors could not prevent sprouting of onions; due to the reason that the growing points in onion are so firmly enclosed and protected by layers of leaf bases that the chemical fails to penetrate meristems. Therefore, the inhibiting chemicals are applied as pre-harvest foliage spray; the intact growing point translocates chemicals or stimulus to the meristematic region, making possible a penetration of growth substances.

The best results are obtained by spraying maleic hydrazide in the concentration of 2,000 ppm, one week before the harvest of the onion crop. This spray checks sprouting, rooting, rotting and reduces total loss in weight of onion bulbs even when held at room temperature. Different varieties respond differently to storage. The high volatile sulphur content, which causes pungency and high dry matter, is associated with good keeping-quality of the onions.

Post –harvest Handling

It involves series of oprations right from curing, immediately after harvest, to neck-cutting, sorting, grading, packaging and transportation. All of these collectively influence ultimate extent of losses during storage.

Curing

Onion bulbs immediately after harvest are allowed to loose extra moisture, by keeping them in field under shade. It is necessary for having thin and closed necks and a firm outer skin. The period of curing may be from 2-3 days to up to a week, depending upon the season. Curing in sun should be avoided as causes heavy spoilage and losses in weight.

Neck-cutting

Leaf tops are removed after initial curing; 2-cm neck portion is left with the bulbs to obtain complete closure and thin neck. To avoid injury to bulbs, sharp implement is used. Final curing is again followed up after neck-cutting for die required period.

Sorting and Grading

For avoiding loss due to rot during transit, storage and marketing and also to get a good remuneration, the diseased thick-necked, damaged and bolted bulbs are sorted out and lots are then graded into different categories depending upon the size. The medium size (around 40-45 mm in diameter)

bulbs are preferred in general and hence get attractive prices as compared to extra big (over 60 mm diameter) and small bulbs of 20 mm diameter.

Packaging

Type of packing of onion depends upon the transportation distance and consumer requirement at the place of consumption.

Packing for Local Market. Onions are generally transported unpacked for local markets. Sometimes gunny bags are also used. Each bag contains about 80 kg of onions. However delayed storage in gunny bags should be avoided as it encourages rot.

Packing for Distant Market. Jute bags (hessian) having 8 × 8 mesh per square3 inch, weighing about 200-250 g each, are used in general. A 40-kg onion packing is commonly used for internal marketing, whereas 10 to 25 kg onion packet is used for export purposes.

Consumer Packing. Normal magazine paper is used for 1 to 5 kg onion supply. In foreign markets, 10 to 25 kg jute bags (open mesh) or nylon-netted bags are used. Some consumer packs of 2 to 5 kg are also made in paper mesh or kraft paper.

Filling and Closing of Bags

Filling and closing operations are undertaken manually after proper sorting and grading. For weighing 50 to 100 kg, platform balances and also counter balances are used as per the requirement.

Labelling

Marketing within the country does not need any labeling. For export purpose, labeling is done. The name of exporter, weight, destination and importer's name are mentioned on bags using stencils. Agmark labels specifying variety and size are put as a Quality Certificate.

PROCESSED PRODUCTS

A number of products are being manufactured on a commercial scale from white onions, wherein dehydration is involved, for example, dehydrated onion, onion flakes, onion rings, kibbled onions, onion powder and onion salt. Small pearl onions are used 'whole' in vinegar pickles. Of late, onion paste is also being manufactured for use in curries, etc.

Quality Parameters of White Onions for Dehydration Purposes

Desirable quality traits needed in white onions for dehydration or for manufacture of onion powder are:

i. White-coloured flesh

ii. Full globe to tall global shape of bulbs with 5-6 cm diameter

iii. High total solid content, above 15%, preferably 20%

iv. High degree cf pungency

v. High yield

vi. Good keeping-quality (at least 2-3 months)

vii. Freedom from joints

viii. Disease-free, etc..

Dehydration of Onion.

Dehydrated onion is produced by removing water from the raw onions to a maximum level of 4.25%, and then milling it to a specific particle size.

Onions arc dehydrated without blanching or sulfating in order to protect the enzyme system which develops onion flavour when onion cells are cut or broken. When the cells are broken, the onion enzyme alliance is free to contact certain onion compounds which reacts to form numerous volatiles; responsible for the characteristic onion flavour.

Prior to drying, onion is cleaned and peeted, roots and tops removed, eh peeled onion are washed and sliced. It is important to note that while blanching cannot be used to control bacteria, the thorough cleaning operation and the conditions of the drying remove a large number of micro-organisms. Those remaining are primarily of the spore-forming types which are resistant to time-temperature treatment of drying. None of these have been found to have any health hazard of significance.

Onions are dried on a stainless steel continuous conveyor belt, which passes them through 3 or 4 stages, following a carefully controlled time/temperature programme. The optimum amount of moisture is removed at each stage; the onions continue on to each successive belt maintained in a condition favouring circulation of heated air through the product. The conditions can be controlled to deliver onions with a maximum of 5% moisture, without any heat damage to the product.

Onion Powder

Onion powder is prepared by grinding dehydrated onion slices in a hammer mill to a suitable mesh. It is highly hygroscopic and hence the important precaution regarding its storage is to keep it in air-tight containers in a cool, dark and dry place, failing which it may absorb moisture, become granular, caky, pasty and ultimately get mould attack.

Composition

Composition of onion powder—moisture: 4.6%;protein: 10.165%; fat: 0.8%; fibre: 8.4%; carbohydrates: 74.1%; mineral matter (total ash): .5%;

calcium: 0.3%; phosphorus: 0.29%; sodium: 0.04%; potassium: 1.0%; iron: 0.002%; vit A: 175 IU/100g; vit B_1 : 0.042%; vit. B_2: 0.65; nicotinic acid: 0.06%; vit. C; 14.7 mg/100 g; carlorific value: 370 calories/100g.

Onion Salt

It is prepared by mixing 19-20% of onion powder with 78% free flowing pulverized refined iodized table-salt and 1-2% anti-caking agent like anhydrous sodium sulphate which prevents water absorption and caking of the onion powder during storage.

Physico-chemical characteristics	Dried slices, flackes, fieces and kibbled onions	Onion powder, grits.
Moisture content, % (m/m)., max. Total ash, % (m/m) (dry basis), max. Acid-insoluble ash, % (m/m) (dry basis), max. Extraneous matter (rots, papery skin etc.)	8.0 5.5 0.5 0.5	6.0 5.5 0.5 0.5

USES

Because of the presence of several sulphur compounds, onion has antiseptic properties. Onion is said to possess stimulant, diuretic and expectorant properties and is considered useful in flatulence and dysentery. Freshly expressed onion juice has moderate bactericidal properties. Onions are used as salad, and are cooked in several ways in all types of curries. They are baked, fried and used in fresh or dehydrated or powder form in soups, pickles, sauces, etc. They are also eaten raw as salad which helps in lowering blood pressure and blood cholesterol.

Lecture No: 7

Cashewnut

Scientific name : Anacarelium Occidentale

Family : Anacauliacial

→ drought resistant plant hence termal as " Goldmine of waste lands"

Introduciton

- Most important Export oriented Commercial crop in India.
- India (60) & Brazil (31%) are major countries meeting cashew demand in world market.
- Cashewnut vanks 3rd in World edible nut area with world production of about 3 million tones of nuts.
- India is largest producer of view cashew nuts (43%)
- Major importers – U.S, Netherlands, Germany, UK. Japan
- Cashewnut is considered as Expensive not traded in U.S market.
- 3 main cashew products are traded in international market rawnuts cashewkernels, CNSL(Cashew nut shell liquid)

4th Product → cashewapple – processed & consumed locally.

→ The national average /true yield is 1.7 kg
→ Each nut weighs about 2-16 gm.
→ Raw Cashewnut is main commercial product.

Structure

→ The fruit consists of Epicarp, mesocarp, Endocarp, Testa & kernel
→ Kernel/Raw cashewnut is covered with leathery outer skin (Epicarp) & thin imes hard skin (Endocarp)
→ The skin of nut is high in tannin used in tanning industry
→ Cashew apple is either made into juice with ↑se vit.c content & fermented to produce an alcoholic beverage.

"Feni"

→ 60% Cashewkernel →Snacks
40% → Confectionary & sweet
→ The mesocarp is the thickst of 3 lavers & is spongy & vacuolar.

→ In the mesocarp which has a noeny comb structure there are doct filled with a sticky resinous corrosive oil, the CNSL.

CNSL contain anacardion which is used to treat dermatological disorders.

Uses of cashew:

→ Rich in fat (46%) & protein (18%)
→ Good source of Ca, P, & Fe
→ High 5 pUSFA – F.fa. like Linoleic acid.
→ A good source of vit. C_1 ca & Fe
→ Cashewnut kernel
Shell
Adhering testa
→ The primary product of cashew nut is kernel which is Edible portion of nut & is consumed in 3 different ways
1. Directly by Consumers
2. Roasted & salted form
3. Contechionary & bakery products

→ Cashew apple is rich in vit.c (262 ng/1 ml) & contains 5 times more vit.c than orange

* **Cashew processing:**
  - Defined as the recovery of edible kernel from rawnut by maual/ mechanical means.

I. Rawnut procurement:

Cashewnut procured by
- Directly from farmers
- Local market
- Commission argents
- Import

While processing nuts 3 tests are conducted

1. **Visual test:** (Size & colour of nut is checked)
2. **Floating test** : (about 5 kg sample is put in a vessel containing water after cntinous stirring, floaters are collectral & counted % is calculated)

3. **Cuttingtest:** Raw cashew nut sample of 5 kg is collectral from different bags & pooled up.

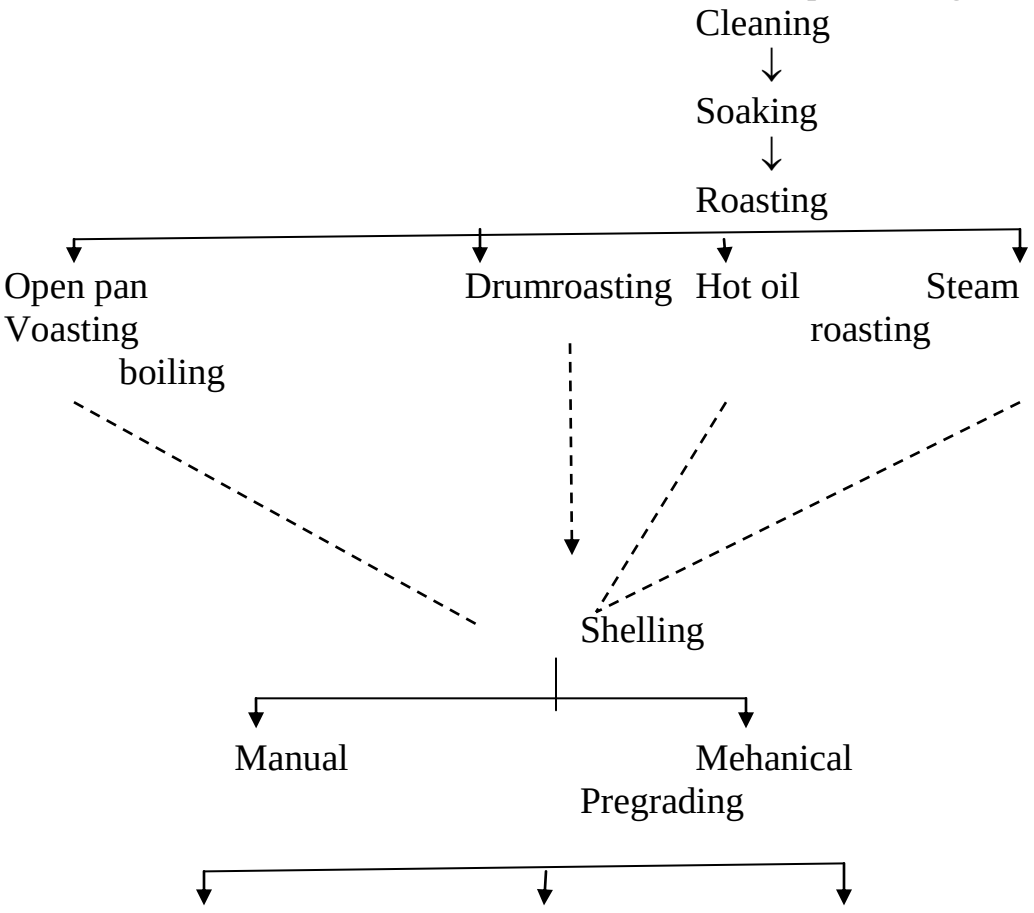
   Based on kernel appearance white, shriveled & vijects are separatul. Based on this % of good kernels is calculated.

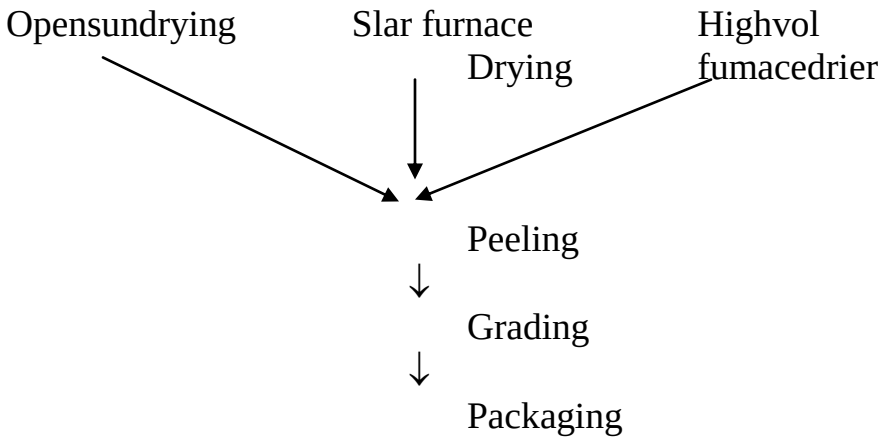
II. **Processing:** Initially traditional processing of Cashew included manual processing operations. But now roasting, CNSL intraction & shelling operation are mechanized.

Oldmethod:

- Sundrying of nuts until the shell becomes brittle usually carried out for 2 -3 days.
- Kernel is then removed from shell by striking eh nut with wooden baton to split shell along natural line of cleavage.
- The cashew kernels are removed from shell without being contaminatral by CNSL

Overall view of Cashewnut processing





1. **Cleaning, sizing & conditioning:**

→ Cleaning removes foreign matter & dust from nuts

→ Cleared nut veg conditioning in process of puep^{n} for shelling process (CNSL)

→ Conditioning ↑es brittleness →facilitate easy removal

→ Conditioning includes soaking in water in order to avoid scorching during reasting.

2. **Roasting:** 4 methods
   a. Openpan roasting: used by traditional cashew processors in India.
      →Care should be taken that the nut are not burnt
      →Roasted in open panl earthern pot supported yb fione
      →1-1.5 kg at a time can be weastrel
      →As the nuts are heated up the CNSL is exuded on to pan & eventually grits producing clouds of thide black smoke. After heating for about 2 min the not are thrown out on the floor & allowed to cool during which the shells & become brittle & can be readily removed

      Disadwan: Loss of CNSL (commercial by pdt)
      Adv: low cost

   b. **Drumroasting:** The drum roasting involves tilting the drum at an angle over fire & roasted during the heating process prevent the nut from burning.
      →During rotation the nuts pass through the cylinder & out from the poo. End of drum/ cylinder.
      →Duration of roasting is refulated by sperd of drum

→The cylinder is attachal to a chimney which draws the black smoke upward into the atmosphere.

→The temperature of frum is maintained due to burning CNSL oozing out of nuts. Because of CNSL ignition sheer becomes chareed.

→Roasting generally takes about 3-5 min & drums retatul by hand.

→The rats of shelling output of kernels is maximum in drum roasting companed to open pan method.

Rawnuts
↓
Drumroasting
↓
Hand/manual shelling →shells (fuel)
(using wooden malut)
↓
Tray drying
↓
Hand peeling →Testa →Tannin
Entraction (Tannern)
↓
Grading
↓
Packing

c. Hotoilmethod / oil bath Roasting:

In this method the nuts are held in wire traxs & are passed through a bath of Cashew shell oil maintained at a temperature of 200-202^{0}C for a period of about 3min where by shell oil is recovered frone the shells to maximum possible extent leading to the ↑in volume of CNSL in bath.

→This process ensures uniform roasting & Eliminate chasing of kernels.

→Alternate: 1.5 min at 185^{0}C

→After roasting the nuts are placed on a wire mesh screen over a tank for further draining & cooling prior shelling.

Rawnuts →waerconditioning → Peeling
↓ ↓ ↓
Centrifuging→ shelling—Traydrying → testa

d. Steamboiling:

Hard & leg shelling machines are used. The nuts after conditioning are given a mild reasting in an eqp for 20-25 min. @ 10-120 pzi to loosen the kernels from shell & make its removal easy.

Rawnuts→mildroasting→shelling→Traydrying
↑ ↓ ↑
Steam shells Hotair
↓
Expelled
↓
CNSL

→ Peeling →grading →Rehumidification
↓ ↓
Testa Packaging

3. **Shelling:** Objective is to produce clean, whold kernels free of cracks.
   → Generally performed manually in India.

Manual shelling:

→ 2-3 times nuts are knocked/beaten 2-3 times by a wooden mallet/light hammers taking cane that whole kernels are rehased without damage/breaking.
→ Each worker generally produces 15-20 kg /shells
→ Worker smaen ash/clay on hands to avoid contact with comosive shell with the skin.

Mechanical shelling:

→The objective is to remove kernel without damage
→Mechanical sheller → first designed by IIT – kharagpur

→Mech.Sheller works on priniciple of Compression & shear taking into account mechanical & physical charactersticks of cashewnut

→Mech. Sheller contains 4 chambers.

1. Power supply
2. Transmission
3. Feeding
4. Shelling & discharging.

→ Feeding section consists of hopper & horizontal screw convey or for feeding of reowtral nut to shelling section.

→ The design criteria of hopper & screw conveyor will use-size, bulk density co-efficient of friction & angle of repose.

→ Shelling takes place b/w 2 wooden discs of which one is stationary & other is mounted on to a shaft the reasting disc is so arranged that discs compress & shear the reasted nuts against the stationary disc.

→ Sheller capacity is 18kg/hr

Disadvantage: Different sizes of nuts when shelled need lot of care to be taken.

4. Separation:

After shelling, shellpieces & kernals are separately & unshelled are again sent for shelling.

→ Blowers & shakers

→ Certain shells with small portions of nut is often a problem.

5. Pre-grading:

Done in large scale processing – precedes ultimate grading.

6. Drying:

Shelled kernel is covered with testa the removal of which is facilitated by drying the shelled kernel to produce the balanced kernel.

→Drying causes shrinkage of testa-easy removal either by knife/mechanically.

Sundrying : spread out undersun.

→ Artificial drying is more reliable
→ 6 hr at 70^0C on mesh bottom trays shotted in a drying chamber.
→ Either heated by gas/Electric powered heater shell often used on fuel 6-12 hr is time & M.C of sample is 2-4%

7. Peeling

→ After drying the testa is britle & often removed by rubbing with hands. In case of testa being still attached to kernels bamboo knife is used.
→ 10-12 kg of kernels can be peeled by an individual / day
→ Gentle scraping of testa with a blunt knife is the most effective may of removing it.
→ Mechanical process includes air blasting, section, level of breakage can be high as 30%.

8. Grading

9. Rehumidification: % t 5% M.C is improved /↑ed to make them less fragile during transit.
→ Care should be taken moisture should not be more than 6% as it may lead to mould growth.

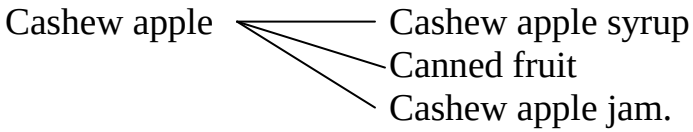
10.Packing:

Air tight cans of 11.34kg wt. capacity
→ Packaging material needs to be impermeable (O_2&H_2O) since there is a chance of rancidity & staling.
→ Vaccum packing, inertagas/MAP.

* **Cashewapple processing:**

It is rich in vitamin C.
→ Used in manufacture of "feni"
→ The major constraints – Tannins responsible for astringency
→ Tannins can be ppled by gelatin →to remove.

Cashew wine
Cashew apple juice



CNSL

- Hot oil bath – kerala- 50%
- Enpeller method – best – 90%
- Kilnmethod – TN
- S.E – 7 kg oil – 100 kg shell

- **Wine entraction:**
  Selection →slicing→crushing →Sterilization →filtering
  (85^0C)
  → Inoculation (S.crevisiae) →Fermentation (200 kg) →filtering
  → Pasteurization (50-60^0C) →Aging →wine 6 months)
- **Grading :**
  Cashew kernels are graded based on size & colour
  Grading (India) follows American studied.
  Kernels are categorized into 3 groups.

  - White wholes
  - White pieces
  - Scorched grades.

  Whitewholes:

1. W_{180} (Superlarge/Jumbo) – 226 – 395 kg/120 – 180/Ib
2. W_{120} (Large/Jumbo) – 395-465 kg/200-210/Ib
3. W_{240} (India) – 485 – 530/kg / 230-240/Ib
4. W_{280} (India) –575-620/kg/270-280/Ib
5. W_{320}(American)—660-706/kg/300-320/Ib
6. W_{450}(American) -880-990/kg/400-450/Ib

Scorched grades: Colour

Whole: Slightly scorched during roasting & drying
Butts: Butts that have been scorched
Pieces: Pieces that have been scorched.

* **Dessert grades:**
  Scorched whole grade-2: A whole kernel that is dis coloured but other wire sound.

  Dessert whole: A whole kernel that has a black spot/ more scorched than above.

  CEPC (Cashew Export Promotion Council)

  1. First grade : whole, good, Jumbo, Export quality
  2. Second grade : Whole, good, medium Export quality
  3. 3rd grade : broken, sold locally
  4. 4th grade : rejected sold locally

Composition of Cashewkernels:

Ash – 2.8%
M.C – 80%
Fat – 42.8%
Crudefibre – 104%
Protein – 20.9%
CHO – 24.1%
Na – 251.1mg
Ca - 652.9 mg
Mg - 452.0 mg
Fe - 150.7 mg
K - 251.1 mg
Zn – 652.9 mg
P – 502.3 mg
B_1 – 0.56 mg/100g
Niacin – 3.68
Tocopherol – 210

Fattyacid

Oleic -73.7%
Linoleic – 7.7%
Steaicacid – 11.2%

Lecture No: 8

Ginger

Scientific name : Zingiber officinale (latin)
Family : Singiberaceal
Origin : South East Asia (India), China

- → The name "Zingiber" is derived from Sanskrit name "Sringabera" means – "Horn-shaped".
- → In Chinese ginger is called "Kiang"
- → Ginger is the first oriental spice that entered Europe.
- → Ginger is a Rhizone (modified stem) perennial but Commercially annual crop.
- → Ginger has a distinct spicy flavour (penetrating) domestic culinary purpose.
- → VAP – Gingerpill, Ginger Essence, Ginger oleoresin, Gingerin, Gingerbrandy, wine, beer (England)
- → Starch is extracted from spent ginger.
- → India produces of world produce of ginger. In India, dominates the scenario producing tones of dryginger exports.
- → Indian ginger vanked second with occupying 1st place in terms of quality of Ginger.

Uses:

- ∗ 0.25 -3% volatile oil (Light yellow colour) : Essential oil Oleoresins are produced.
- ∗ Carminative, Gastro intestinal stimulant.
- ∗ Oleoresin used for flavouring softdrinks & in medicine.
- ∗ Appetizer, laxative, Indigestion, Asthma, Bronchitis.
- ∗ Provides relief in piles, Rheumatism, Head ache
- ∗ It reduces opacity of cornea
- ∗ Fresh ginger juice is useful for diabetics
- ∗ Ginger paste is effective against pains
- ∗ Ginger Tea, ginger concoction →Effective in Cold & coughs
- ∗ Warming effect on heart muscles & improves blood supply →CAD

* ↓es B.P & prevents internal blood clotting.

Utilization of Ginger

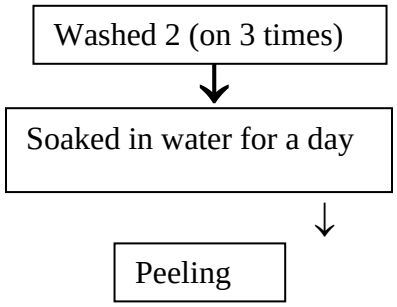
Total production is utilized into

17-18% → for planting Rhizomes
36% → Consumed as green ginger
42-43% → dried export – 20-23%
Domestic – 20%
3-3.5% →wastage (both raw & dried forms)

Composition of freshginger	Driedginger
M.C – 10.85	M.C – 6.9
Starch – 53%	CHO – 66.5
Crude fibre – 717%	CF – 5.9
Protein -- 12.4%	Protein – 6.6
V.oil -- 8%	Fat -- 6.4
Oleoresin – 6.5%	Ash -- 5.7
Calval – 360 cal/100 gm	Ca – 0.1
B_2—0.13	P – 0.15
Niacin – 1.9	Fe – 0.011
Vitamin C – 100gm	Na - 0.03
	K – 1.4
	Vitamin A – 1756 IU
	Vitamin B_1 – 0.05

Processing:

I. Dry ginger:



(mechanical wire mesh drum

On rotation)

↓

Washed

↓

Sundried (sun/drum drying 80^0C for 24hr 63^0C for 10-12% M.C

↓

Un bleached ginger (middle coast, India)

↓

Drying

↓

Packing in HDPE

* **Different forms of dried ginger:**

1. Hand: Stem having clumps of inter Connected & hizomes is known as Hand. Each hand has branches called as fingers.
2. Rough scrap: Partially skin Epidermallayer removed from flat sides
3. Unpeeled (on coated) : Dried with skin
4. Peeled /Scrapped /Uncoated: When skin is removed.
5. Blackginger: Boiled for 10-15 min before scrapping
6. Bleached (or) Limed: Treated with milk of lime of 2% for 6hr 4 So_2 fumes for 12 hr. (3.2 kg of So_2/ tone of rhizomes)
7. Splits : Longitudinally splitted for drying
8. Ratoons: dried secondary growths of Rhizomes when left in ground for more than 1 year →small dark in colour & fibrous.
9. Slices: made into slices to accelerate drying process A

1. Sundried ginger ⟵ unscraped/coated ginger
   Scraped/uncoated ginger

Lyepeeling: NaoH -20%, 25% & 50% →5 min, 1 min, 0.5 min, placed in citricacid for 2 hr →washed & dried

Again fresh salt 4 vinegar are added

Left for 7 days to pickle

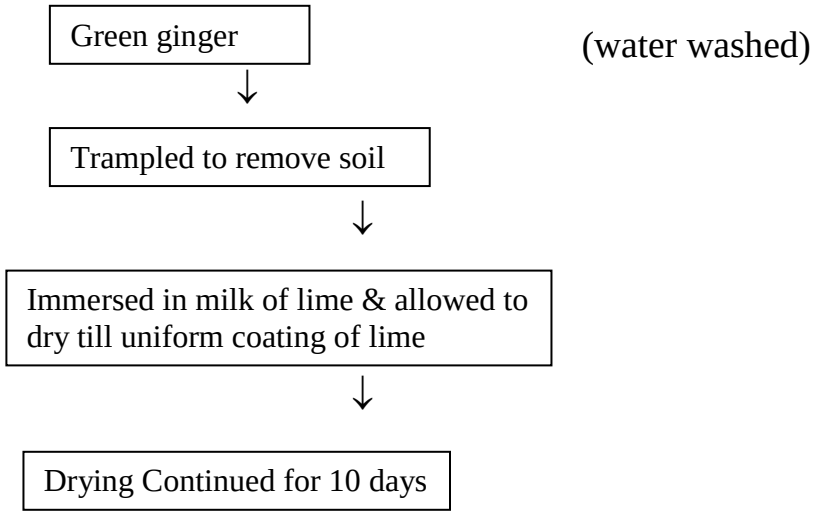
Preserved ginger in syrup (Gingermurabba)

- Fresh ginger peeled/dried/ salted ginger washed thoroughly in coldwater is taken
- Boiled in water for 10 min
- Second boiling is carried out in sugar syrup. 75% TSS for 45 min and then allowed to stay in syrup for 48 hr & again reboiled & packed →Crystalized ginger.

Ginger in syrup

- Cooked & drained ginger is added to biling sugar syrup (1.5 kg sugar- 1kg ginger)
- Boiling is continued for 2 hr
- Dioted to makeup loss by Evaporation with mild syrup.
- 3 days standing →Ginger boiled again for a period of 2 hr
- Transferred to containers & covered with syrup sterilized & sealed
- Apart from ginger oil, shagaoil, Zingiberone, paradol, Gingiberdiones & Gingedioles.

Bleached ginger (kerala) :



↓

Rubbed with gunny bags to remove vemnants of skin & to give smooth finish

↓

Bleached / lime ginger

So_2 fones are produced by burning suifor in specially constructed rooms thus providing a white product.

Salted Ginger:

Peeled

↓

Cut into appropriate sections

↓

shaped

↓

Graded + mixed with salt & is covered (18:1)

↓

After 24 hrs liquid is drained

Gingeroil & oleoresins : 1.5-3% Essential oil
2-12% fixed oil.

Ginger oil:

→ On steamdistillation, dried cracked & communited ginger yields .3 – 3.5% , 2% of pale yellow viscid volatile oil.

→ Oil is generally extracted from unscraoe dried ginger from ginger scrapings.

→ Jamaicanginger (1%) →2-.5%, Indian
→2-3% Africanginger

- → The physic chemical characteristicks of Ginger oil varies depending on age, variety, period, storage & method of Extraction.
- → Essential Oil from ginger is called Oil of ginger
- → Greenish yellow, warm & aromatic odour.
- → Essential oil Contains 110 compounds of monoterpenl, sesquiterpenes.

Oleoresin: "He" & oxygenated mono & sesquiterpenes (zingiberia). This is obtained by entraction of powered dried ginger with suitable solvents like acetone, alcohol, Ethylene dichloride.

- ■ Oleoresin Contains Oil & vesinoids i.e, it contains vesin

Volatile Oil & non-volatile pungent principles:

- → Con of actone entract under vacume to remove solvent completely would yield oleoresin.
- → Yield of Oleoresin mainly depends on raw material solvent used & method of Entraction.
- → Olecresin is commercially called "Gingerin"
- → It contains gingerol, Gingerone, shagoal, zingiberve, volatile oil, vesin & phenols.
- → Entraction of oleoresin by alcohol give better recovery compound to recovery by actone/others.
- → Major pungent principle of ginger oleoresin is Gingerol (oxy methyl phenol)
- → Besides pungent principles, oleoresin contains E.oil & non-pungent factors.
- → The amount of & oil is an important factor in Evalvatin of Oleoresins & has reported a content of 18-35 ml volatile oil/100g of oleoresins.
- → Non-pungent materials→CHO, palmiticacid, & other fatty acids.
- → Freshly Extracid oleoxsin contains Gingerol as a main constituent while on storage shagaol dominates due to chemical changes.

World varieties of Ginger:

1. **Jamaican type**

* Superior in appearance & anema
* 6-9 cm long, irregular, peeled whole form
* Volatile oil 1-1.3%
* Non volatile EtherEntract (NUEE)→4.4%

Grades : Based on size & colour

No.1 – Bold
No.2 – medium
No.3 – Small
No.4 – Ratoonginger (Inferior)
Oil distillation – flavouring.

Nigerian Ginger :

→ Superior in appearance & aroma
→ Coarser & posses a compharacous odour
→ Pungent: Volatile →2-2.5%
→ NUEE: 6.5%
→ Oleoresin production

Sierraleone Ginger:

→ Whole rhizomes either coated / rough scraped
→ Slightly comphoraceous
→ NUEE – 7%
→ V.Oil – 1.6%

Indian dried Ginger:
→ Whole rhizome either coated / rough scraped
→ Lemon like flaour
→ Malabar ~~Co~~chin
Calicut
Assamese
Himachal
→ V.oil – 1.9 to 2.2%
→ In pregency, they are equal to Jamaican type

→ Rhizomes are graded based on no. of fingers

3 export varieties – B,C,D
→ Bleached, coatul /Scraped.

5. Australian dried Ginger:

→ Lemon like arom a & flavour
→ Coatul artificially dried rhizomes
→ B/W Jamaican & sierroleon ginger

6. Chinese dried Ginger

→Marktrel as whole peeled & split
→Often bleached with So_2 which makes it unacceptable to western Countries.

7. Japanese:
→Marketral as whole, peeled & split
→Volatile oil – 15 – 2.5%

Lecture No: 9

Coriander

Coriander – Greekword "kories" – Bed bug

- Domesticgrade (seed)
- Aromatic grade (leaf powder)

Scientific name : Coriander sativum
Family: Apiaceae

- India is largest producer of coriander & consume
- It is annual herb
- Economically useful *seed.

Processing : Fruit contains *2 locules Containing 1 seed

Harvesting: Underripe, Coriander fruits often referrel to as seeds) have an unpleasant flavour.

- Harvesting should take place when ½ to 2/3rd of fruits are ripe.
  - To minimize breakage plants should be used during early morning in late evening.

Drying:

- Plants are wlthered for 2 days & dried to approach 18% M.C (wet basis)
- They are then threshed & fruits are dried in shade to a M.C (wet) of 9% winnowed screened.
- Artificially dried in some countries including USSR at temp of *80 – 90^0C.
- Temparature above 100^0C results in loss of volatile oils.

Uses:

- To flavour food
- Major ingredient in curry powder (24%)
- Chemical & pharmaceutical (USSR)

Coriandar dhal:

- It is mainly used as an adjunct supail / Masala
- It is obtained from seeds of coriander
- Coriander seeds are dehusked, flaked & given a mild heat trt. It is salted.
- Treated seeds are highly flavoured & consumed as a digestive chew.
- In this method, the coriander dhal is soaked overnight in salt H_2O & paitially dehydrated & husk removed manually.
- CFTRI has developed a process to obtain dhal from coriander see as with higher yield & less brokens
- In this process, indigenous milling Eqp are used along with improved Conditionaing technique
- The by-product in this method of processing are husk bran & brokens.
- This process can easily be adopted in rural areas where the rewmaterials are available plenty.

Oil & oleoresin:

Seeds contain volatile oil, fixed oil, Tannins, Cellulose, pnetoses pigments.

- Voltile content varies with spice type

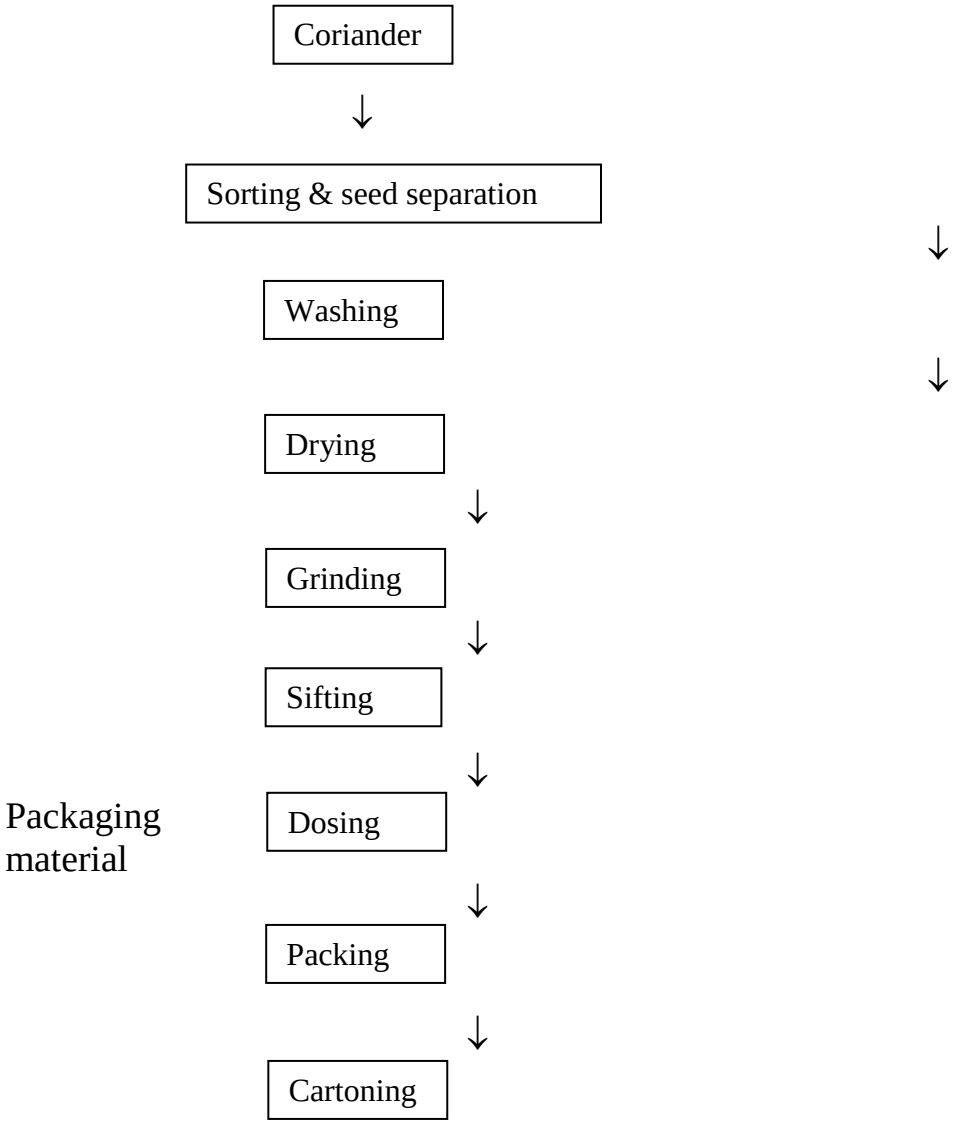
*Indian coriander – poor 0.2 – 0.8%
Nonway - 1.4 – 1.7%
Russion – 2.0%

* Low oil in Indian variety may be due to loss in during splitting & faulty harvesting & also due to firmness of Indian seeds.
* Oil cells are located in muicap of spice protechral by a thick cellwall & also due to firmness of Indian seeds.
* Oil cells are located in municap of spice protectral by a thick cell wall & also by high fat content which tends to occlude the colatile oil to reduce vapour pressure.
* Hence it is necessary to crush the spice before distillation.
* Volatile Oil canals present in all organs of coriander plant. In unsipe fruit 2 types of volatile oil canals are present.
* One type lacatral on periphery of fruit which contain oil
* Another type are buried in mesocarp of fruit kernel which contains 'linalol' along with other oxygenatral monoterpenes & monoterpene hydrocarbons.
* Volatile oil content of fruit reaches a max. While it has unripe & diminished during urp oinog owing to collapse of peripheral conals. At this stage the bulk of vol.oil.
* Indian coriander oil is colourless pals yellow with characterstic odour & taste.
    - Oil is made up of hydrocarbons (0-28%) & oxygenatral compounds – d-linalol/conandural (45-70%)
    - Indian coriander oil has low linalool
    - Fruits acquire on ripening a pleasant & sweet odour the major conshituent of vol.oil is monoterpene alcohol linalool (25-80%)
    - Seeds contain 19-21% of fatty oil of dark brownish given colour is an odour like coriander oil.
    - Dried ripe coriander seeds contains fibre (2336%) CHO (20%) & protein (11-7%)

- Oil can solidify on keeping. It is solidified sap of volatile oil. It had pleasant oidour & good latherning properties.
- Decyaldehyde obtained by treating the vol.oil (0.1%) with supphite is used in perfuniric.
- Oleoresin – flavour pickles, chocolate vesidue-cattle feed

Essential Oil Entraction:

- Ground seeds can be used for entraction of E.oils
- Seed is ground immediately prior to distillation ↑ the yield of oil & Ca. veduces the dislillation time.
- Oil →15% oil



(finished product)

Uses:

- Leaves are rich in *vitamin C (250 mg/100g), vitamin –A 5,200 Iu/100 g.
- Appetizer & flavouring agent culinary
  Wines, liquor
- Condiment
- Carminative, diuretic, tonic etc.,
- Dental-bad breath
- Infusion of seeds with cardomam is useful for flatulence, indigestion, vomting & intestinal disorders eliminating symptoms related to female reproductive parts.
- Roasted seeds are useful for dyspepsial
- Bleeding piles, Government, Indian ayurvedic unami medicinal preparations.
- Oleresin (5%) used in flavouring beverates, pickles, sweets & other delicacies.
- Seed ↓se intosicating effect of spiritual liquor.

Lecture No: 10

TEA

Scientific name: Camellia Sinensis
Family: Camelliaceal

- Tea is an ancient plantation native to southeast Asia Especially china.
- Tea is used as a stimulative beverage
- India, Srilanka, China, Japan, Jaiwan, Africa are some of leading producers of Tea.
- In India Nilgirls (1832;1859) Travancore kannan Devan Hills, wynad, coorg, Anamalais are some of places.
- Tea is the perennial shrub which are periodically pruned for continous activation of terminal shoot apex

- During plucking of tea leaves care is taken that a bud (unopened) with surrounding 2 tender leaves are generally plucked this is referred o/s " Two leaves & or bud" type of plucking.
- Types of Tea:
  Based on manufacturing process & the degree of fermeritation.

  1. Black Tea- fully fermented
  2. Green Tea – Does'nt require fermentation
  3. Oolong Tea / Red Tea – partially fermented (50%)
  4. Pouching / yellow Tea – 3%

  Composition:

1. Tannin substances:

   * Complex mixture of organic compounds considered to be derivatives of polyhydrony phenols.
   * Characteristic flavour, colour & anema are with interconversion of tea learf tannins
   * 4 forms of crystallized tannins
     i. Epicatichin
     ii. Epigallo catechin
     iii. Epicatichin Galleate
     iv. Epigallo catechin gallati – More active having high antioxidant property (1 times vitamin c; 25 times vitamin E)
2. Flavanols/ phenolic compounds:

   * 25-35% dry basis
   * 80% of phenols, while remaining are proanthocyanidins, phenolic acids & flavonols, flavanones.
   * During fermentation, the flavanols are oxidized enzymalically to compounds which are responsible for colour & flavour of black tea.
   * The veddish yellow colour is contributed of tea entract by theaflavins, theasubigins
   * Flavour intensity is correlated to with polyphenol content & polyphenol oxidose activity.
     Eg: In case of green tea – polyphenol osidation is prevented.
     Greenish yellow apearence is due to presence of flavanones/ flavanols.

Green Tea 17.5% ; Blacktea-144% polyphenols
The components – catichin (90% of polyphenol) (25% in vlack tea)
Theogallin – carectarral to tea quality.

3. Enzymes:

   - Polyphenol oxidase is located in cells of leaf epidermis
   - Activity ↑es during withering & rolling process & ↓es during fermentation & drying

4. Proteins & aminoacids:
   Free a.a 1.3% dry basis of which 50% is constituted by theanin than blacktea.

5. Alkaloids:

   Caffeine, Theobromine, Theophylline, Caffeine – 25 – 5.5% (dry)
   Caffeine + Tannin →Caffeine tannate (pleasant flavour)
   Caffeine is associated with an alkaloid. Theoflavin- briskness & flavour of tea infusion.

   Theobromine→0.07-0.17%; Theophyllin

6. Aroma forming substances:

   * Terpenes, Terpenealcohols, ketones, esters
   * Phenylacetaldehyde – Black tea, animal
   * Aroma of leaf – changes on fermentation process

   Withered leaf →Rolling→Acidsmell of grumleaf
   * Nuttyarema →sweetflowery smell

7. CHO : Glucose – 0.72%, fructose, sucrose, Arabinose & Ribose.

   - Polysaccharides : Cellulose, Hemicellulose & pectic substances

8. Pigments: Chlorophyll & carotenoids
   In fermented leaves chlorophyllides & pheophorbids are present.
   * During firing stage of processing these are converted to pheophytins.

- ∗ Carotenoids identified in tea leaves – xanthophylls, Neoxanthia, vailoxanthin & β-cartens during processing of black tea.
- ∗ Degradation of neoxanthion – β-damascenone (arema)
- ∗ Lipids & vitamins – insignificant amounts
- ∗ Minerals (5%) – Major is potassium

Processing / Black Tea processing:

1. Plucking : One bud two leaves
2. Withering: Involves bio-chemical & physical prepn of fresh tea leaves.

    - ∗ Moisture content is brought down to 50% (orthodox) & 60-70% for CTC process.
    - ∗ Duration 10-15hr for CTC & 18-24 hr in orthodos
    - ∗ Leaves undergo dehydration (78% to 55-65%) so that leaves become flaccid enough to get into rolling
    - ∗ Carried out in constructed shade of lefts where the leaves ae spread in tiers of gunny pieces arranged with fans (25-35^{0}C)
    - ∗ ↑es cell membrane permerbility caffeine ↑es with withering

3. Rolling / leaf masceration:

    - → Leaf masceration brings about contact b/w polyphenol oxidases present in cells & polyphenols
    - → Leafiuice gets adsorbed on to surface of leaf as a result of theaflavins & thurrubigins
    - → Leaves attain a twist hence the process is calual rolling.
    - → Rolled 2-3 times for 30-40 min
    - → After 1st roll leaf is spread over a sifter called Greenleaf sifer with a view to separate fine tea from the coarse.
      Fine tea- fermentation while coarse – 2nd rolling.

4. Fermentation:

    - ∗ The leaves are either sprrad on the cement concretibed / aluminium trays
    - ∗ Fermentation time varies from 1-3 hr (Rolling & entry in drier)

The major reactins include oxidation of catechin to quinines which inturn form/combine with one another to form thoflavins.

→ When theoflavins condense with oxidized catechins, theorebignis (polymeric) are formed
→ There oxidation reaction forms colour & taste of finished product.
→ Optimum fermentation is assessed by theoflaving content & time req for development of theoflavin
→ Balance b/w theoflavin (0.3-2% dry basis of black tea), theorebigins (2-90%) is essential (1;10 to 1: 12)
→ Max bristiness, quality & colour max be improved of fermentation time is 2 hr
→ Temparature should be controlled.

5. Firing/Drying:

→ Carried out in firing room where it undergoes firing at 90-95^{0}C & outlet temperature is 52^{0}C for 20 min
→ The main objective of drying is to arrest fermentation o& to remove m.c from 55 to 3.4%

Drying — conventional drying – Blast of air
Fidised bed drying

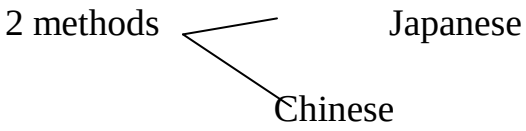
→If the inlet temperature if inlet / drying is <49C, the post frmentaitn process will continue for a considerable time & softens the liquor. This condition is referred to as 'stewing'
→If outlet temperature >57.2^{0}C → casehardened tea harsh liquor

6. Storage & packaging:

Storage temp: .0% M.C & HDPE is the ideal packaging material

GreenTea:

- Characteriated by proper preservation of active components.
- Tea leaves should be fresh, freshness is directly proportional relatrl to quality.
- Withering & fermentation stages are omitted in their processing



Japanese: Stewing of freshly cut leaves at 95^0C followed by cooling & drying.

Followed by rolling at $75 – 80^0$C

Chinese:
Fresh leaves are placed in a reaster heated by charcoal (smokeless) →rolling →sifting.

Grading: Based on descending particle size

1. Orange pekoye
2. Pekoye
3. Broken orange pekoye
4. Bop fanning
5. Fanning
6. Dust

Instant Tea

→Extraction of relatral tea leaf blend

- → 10 parts of water are combined with 1 part tea leaves by weight
- → Extraction temp b/w 60 & 100^0C for 10 min
- → Final extract 4% solids (85% of soluble solids)
- → Dearmolised by distillation
- → Can of dil extract in low temp evaporatral to b/w 25% & 58% soluble solids by drying.
- → Caffeine & tannins in hotwater 50% impart a slight haze/turbidity to brew called “clour”
- → It is by fitteration (on by contrifugati cloud) is removed.
- → Filteration is supplemental with distilled essence & dentrins are added to adjust 50% solids
- → Spray dried / low vacuum best dries
- → Aseptically packaged

→ Fommg (lost step)
→ Most important property of Green tea- powerful artioxidant action (EGCG)
→ Anti-oxidant present in Tea is soluble in waer & hence effective & Greentea also activates antioxidative Enzymes.
→ Present oxidative damage to all membrane
- Immune system
- Antiviral
- Anticholestrolemic
- Antidiabetic

→ Milk add $^{n}\downarrow$ flavanol absorption

Oolongtea: Intermediate b/w black & greentea which is charactrised by being partly fermental (50%) special flavour is due to reasting & high temperature relling.

Pouching /Yellow Tea:

→ 30% fermentation
→ On withering roasting & firing the portion of tannins undergoes oxidation & therefore a dried yellow tea is dacker than given tea.

Quality Atributes

Quality
Appearance
Colour (TF& TR)
Strength
Pungency
Flavour
Infusion

Lecture No: 11

CLOVE

Scientificname: Eugenia caryophylus
Family : Myrtaceae

→ The term "clove" is derived from frenchword "clov" on "clou" & English work "clove" both meaning same "Nail". The veason being that the unopened bud vesembles broad headed nail.
→ In world trade markets it is next to blackpepper
→ It is termed as most "ancientspice"

Uses:

- ❖ Aramatic and has mild flavour
- ❖ Essential oil can be produced by steamdistillation
- ❖ Used as aflavouring in bakery products & sweets, meat products pickles
- ❖ The oil is used for flavouring →confectionery all types of world cuisine
- ❖ Clove oil forms base for manufacture of ISO eugenol & highly quality syntheticuanillin from eugenol cone of the constituent of oil
- ❖ Oil is used in pharmaceuticals, dental formulation.
- ❖ Anticarcinogenic principles to exist in oil.

Composition:

→ Generally the fully grown unopened flower buds are picked green & dried in the sun till they become dark brown to form commercial clove.
→ Clove buds, stems & leaves on steam distillation yield 16-17%, 4.5 – 5% & 1.8 -2% essential oil.
→ The main constituent of bud & stem oil is eugenol & eugenolacutati.
→ Charactristic vesinois compounds — β-caryophylin, A-hunulene

Varies 7.3 – 12.4 % →β-c
1 – 14 % →α-h

- ∗ Tanzania supplies around 90% of total demand of clove
- ∗ Other chemical compounds →furfurals; pinines

Processing:

1) Harvesting: Optimum stage for picking clove bud is indicatul by change in colour from given to slightly pinkish brown.
   - Harvested manually & carefully
   - M.content ↑with maturity

- The yield is determined by no.of foctors such as age, number of flowerbuds for infloresance, number of inflorescence bearing branches & size of bud
- If bud is left unpicked, flower develops after fertilization into a fie shy purplish one seeded oval fruit known us "motherclove"
- Eugenol and is max at flowering stage

Curing process:

* Afer haivesting buds are detachul carefully endrying mats by helding the cluster in one hand & presessing it against the palm of other with a slight twistincy movement.
* Buds & stems are dried separately
* To avoid fermentation the buds should be dried immediately after detachment from clusters.
* The grun buds are spread out in a thin layer on drying floor (or) they may be racked in zinc trays form time for development of uniform colour & flavour.
* Sundrying$\rightarrow$4-5 days; In zinc trays on fix – 4 hours
* Fully dried cloves are brown & crisp.
* Impreperly dried ones will be very dark & wrinkled in appearance with inferior arema.
* Good quality of dried cloves is indicated by 12% M.C & 2.3% foreign matter (including defective cloves)
* Nearly 8,000 – 10,000 clove would make 1 kg & 8-10 cloves would weigh 1 gm only.
* Dried cloves generally loose 2/3rd of weight (Green)
* Finally step $\rightarrow$cleaning, sorting, grading.

Defective:

1. Khoskierclves: are those whichhare undergone fermentation due to improper drying $\rightarrow$ Generally characterized by their pale brown colour & mealy appearance.
2. Headless cloves: Cloves are devoid of ball shaped unopened flower bud at top.

3. Mother cloves: Mother cloves are fruits developed as ar result of fertilization of opened flowerbud. The fruits are ovoid, brown & surrounding by 4 sepals.
4. Entraneous matter: includes dirt, dust, stones, clay, clovestem & other pieces of wood. It should not exceed 2-3% of total wt of product.
5. Grading: Fully brown, plump crocon/bud, nowrinkle & rough to touch good quality yellow/wrinkled cloves are immature & yield less oil & poor eugenol content.

    - Good cloves should exude oil readiy when crushal with hand & finger nails since the consumer may be heaful by sedling hum exhausted buds.

Classification of whole cloves

Grades	Headless Cloves (%)	Mothercloves (%max)	%khoker cloves	%entraneous matter
Special (hand Pickle)	2	0.5	0.5	0.5
Grade II	5	4	3	1
Grade III	6	6	5	1

Processed products:

Oil : Volatile oil is entractral from dried clove bud (clove bud oil), stem (clove stem oil) & leaf (clove leaf oil) by steam distillation.

- Oil can also be obtained from roots & fruit
- Bud oil is of great importance as it contains a compound called " methyl amyl –n- ketone" which is used in various pharmacological formulations.

1. Clove bud Oil: From dried buds on steamdistillation
   - The bud oil is superior in odour & flavour than stem & leaf oil; yield- 16-17.

   Composition: Eugend (73.5 – 79.7) Eugenolacetate (17%) 99% caryophilline

   The fruity odour/aroma of bud oil is due to methyl amylketone

2. Clove stem oil:
   yield→5-7% Eugend content →76.4 – 84.8% is more compared to bud oil –eygebik acetate (1.5 – 8%) is very less.
   - Odour is flat & coarse due to less quality of trace, constituents (sesquiterpenes alcohol & naphthalene)
3. Clove leaf oil: leaves on steam distillation yield about 1.8-2%
   - Low% eugenol & e.actate than bud & stem oil.
4. Mother clove oil:
   On steam distillation yields about 6 – 7% oil with 83% phenols (of which 60% is Eugenol, a solid phenol having paraffin like adour)

5. Clove root oil : Oil yield (5-6%) on steamdistillation. Eugenol content vaules from 85 – 95% , fresh oil is bright yellow coloured & more an to bud oil in odour & quality.
6. Oleoresin: Oleoresin is obtained by cold /hot extracter of crushed spice. Using organic solvents like alcohol, acetone, dichloromethane benzene vol. essential oil→7-8% + Residual principles (or) fixed oil.

Adulteration process:

→ The common odulterants are headless cloves, clovestems, khoker cloves, mothercloves & entraneous matter like dirt, dust & stones.
→ Clove terpenes obtained as a byproduct during entraction of Eugenol.
→ Additional of small quality is difficult to be deteched by mixing large quantity can be detectral as it ↑es special grauity & refractive index of oil.
→ Synthetic terpenes like dibenzyl ether also used as adulterents of clove oil but its presence. Can be detictral by washing oil with saturatul salt solution.

→ A high saponi fication number water soluble matter is indicatie of presence of actins.

Packaging of cloves & clove Oil:

→ Usually packed in double jacketrel socks of 50-60 kg

For clove oil lacquer limd 2 kg capacity stainless steel drums on Pe containers for long term storage

→ The oleoresin is packaged in plastic parts of 25 kg capacity.

→ Opt storage conditions for storage of whole/ground cloves should be 65% M.C at 25-28^{0}C.

Typical Composition of cloves:

M.C →5.4%
Protein →18.1
CHO →57.7%
Crude fibre →11.1%
V.oil →13.2%
Ca →0.7%
P→0.11%
Na→0.25%
K→1.2%
Fe→0.01%
Vit.B→0.11mg/100mg
Niacin →1.5
Vit.B_2 →0.04
Vit c→80.9
Cal.value→430cal/100g
Vit A →75 Iu/100gm

Lecture No: 12

PEPPER

→(Blackgold/king of spices)

→ Max. foreign exchange earner in terms of international trade
→ Botanical name: Black pepper – Pipernigrum – fruit
Long pepper – piper longum – fruit, roots stem

Origin: Westrenghats of India

→ Imported to USA, U.K & middle east fruit of pepper is a single seeded sessile berry with a pulpy pericarp, usually globulardrupe

Uses:

1. culinary seasoning, pickling, sauces
2. Meat packers –canning
3. Pepper is widely used in Ayurvedic, Homeopathic, unani, African & Chinese systems.
4. It is used for its pharmacological activities exhibited by an unique alkaloid called "piperine"
(bite factor of pepper)
5. It is effective as CNS depressant, antipyretic & analgesic & anti inflammatory activities.
6. Pure piperine ↑es bioavailability of several nutrients.
7. Pepper is a good gastro – stimulant as piperine has very acid pungent taste.
8. Pepper is effective for dyspsia, malaria, delirium, haemorrhoids & cacminative in nature.
9. Piperine is used in cough syrups rubifacient
10. Pepper antihermithic, diabetics, piles, skin, diseases against gonorrhea etc.

Pungent principles:

→ Piperine, an alkatoid is Considend to be the major constituent responsible for bitter taste of black pepper & ranges from 3.3 – 5.6%
→ It is sparingly solude in water, readily soluble in alcohol & splits into piperidinc & piperic acid on hydrolysis.
→ Piperine has a vesinous isomers called, chavicin, isochavicin.

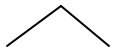
Oil & oleoresin:

→ Pepper oleoresin is a dark green, viscous heavy liquid with a strong aroma but on standing gets cry stallized due to piperine.
→ Pungency is determined by volatile oil content (15-20%) 4 piperine (5-55%) content.
→ 8 kg black pepper nearly can give 1 kg oleoresin which is equivatent ot 25 kg of spice in flavouring potential
→ Aroma of pepper is due to volatile Oil (Essential) while pungency lacrid nature is due to alkaloids- piperine

Entraction process:

Pepper →Cominuted →coarse powder →Extraction with suitable purified solvent (Acetone, ethanol (on both)

→ 25% of wt from outer skin
→ With outer skin (fibre content is (0-15%, starch 35-48%)
→ For white pepper (3.5%) starch (55-60%)
→ Volatile oil in black pepper →0.6 – 2.6%
→ Piperine is same in both (4-10%) resin Content – 18%
→ On storage of ground spice for long time leads to ↓se in pungency which can be attributed to photolytic transformations of pungent alkaloids
→ Fat content →2-9%



USFA SFA
51-83% 19-38%

Major acids predominantly

Palmitic – 16-23%
Oleic - 18-31%
Tinolenic – 25-35%
Linolenic – 5 – 19%

Processing:

1. Harvesting: Pepper vine comes fruit bearing state after 1yr of planting.

→ It veg 6-9 months for flower to get transformed to a fruit.
→ First harvest is taken in 3^{rd} year of planting but advisable commercial harvesting 6^{th}
→ Harvested when they fully mature but before full ripening.
→ Spikes are rubbed / scrubbed/ trampled to detach fruits. Average yield of drypepper is 18-20 g/ha

Processing:

Processing of pepper spikes

→ Beries are separatul from spikes & dried in shade for 7-10 days on under sun till it becomes crisp, black, shrinken & cossume characterstic wrinkled appearance of spice of commence.
→ Berries are turned over periodically
→ To improve colour & appearance & to ↓se drying time Green pepper is soaked in hot water for a min before drying
→ Microbial contamination is ↓ed.

Processed products:

1. Green pepper:

   → Obtained from unripe but fully developed pepper berries which are artificially dried (on) preserved in west form in brine, vinegae on citricacid.
   → Can should be taken to inactivate enzymes responsible for browning by blanching & So_2 trt & then beries are dehydrated.

   Berries →Blanching→So_2 trt →Enzymes get deactivatul
2. Bottled givenberries:

   Generally packed in pvc for better vetinction of gum colour bottled gumberies →20% brine sol^n + so_2 – 1 ppm + citricacid 2%.

   Blanching is not done (or) brine + 2% acelicacid on Acelic acid alene (2-4%)

3. Whitepepper:

Developed by CRTRI – stram boiling method

a. Steam boiling:

Ripenedbevies →Boiling for about 15 min→depulping→
Washed →blearched→drained in & dried →white pepper

White pepper is white inner corn obtained by removing outerskin (pericarp) of fully and berries wither before (or) after drying

Disadvantage : color is not appreciable due to gelatin zation.

Retting:

Spikes (50% or more →picked →packed in gumybags beries ripen)

Immersed in running →picked →skin removal by →water fermentationtanks drain H_2O rubbing / kneading (8-12 days)↓water is changed

Everyday to avoid foul smell

Skin is washed off →corns are sun →cuamy white dried for bleaching.

Disadvantage

1. Needs more water
2. If gun pepper (unripe) is present, it turns black cuemains intact) B.P<5% for good quality white corns

*Pitmethod: Ancient method – burring pepper inside the soil in underground pits.

Harvested spikes →packing in →buried in soil at a woven plastic sacs depth of 0-60 cm below soil surface.

→moisten soil once →skin becomes →15 days time for in 3 days for percolation smooth & softening of berries of moisture into product through block (fementation take place minute opening.

→ Berries are separated & →shade dried for skinremoveal by skin is removed easily removal of rubbing /kneading by rubbing .
→ White corns on kernels are separatul & dried

Advantages:

1. Less water
2. Low cost
3. Green beries →white pepper

4. Cured gunpepper:

→ No brine veg →packed in flexible packages
→ Fresh slightly→washed→shipped in saturated→enzymes inactivate
→ Brown discolouration →dried→packed is prevented.

5. Dehydrated gunpepper:

   → Light wt
   → Prepared using mechanical dehydrators
   → Universally liked in meat processing & sausages.

6. Fueze dried gum pepper:

   - Superior among all products in flavour, anoma, texture & colour but expensive.
   - Berries →cleaned →washed→blanching→water cooled→frozen (-40^{0}C)→vacuum sheet drying

7. Frozen green pepper:

   Clean, blanched →Frozenin 2%→vitamin c is added as
   cooled beries brine+0.25% an antioxidant
   citric acid

8. Pepper oil – stam distillation of powdered pepper
9. Pepper oleoresin – solvent entraction of ground pepper

   Grading : is based on strict AGMARK studied.

T- Tellicherry – fetches good price in market
G- Garbled
S- Special
E, B } Entra bold

Conposition:

M.C- 1401%
Starch – 49%
Crude fibre – 18%
Crude pipeline – 2.8 – 9%
Total ash – 5.7%

Lecture No: 13

CHILLIES

Bot Name : capsicum annum

Family: Solanaceae

- Annual plant
- Economical part is fruit
- Chilli producing states →A.P., Tamil Nadu, Maharastra, & Karnataka altogether produce 75% of National production but exports are only upto 2-3%

Uses:

1. Food flavourant/seasoning
2. Role in human physiology → it is a stimulant of ptyalin present in saliva which help in digestion.
   → Green chilles are rich in Vitamin c & vitamin A
   → Appetizer

3. Paprika (sweet pepper) – colourant & flavour
4. Green chilles are rich in α-asparginase which has antitumor element
5. Production of oleoresin has got various pharmacological uses eg: for pain relieving balms.
6. Chilly seed oil – an edible by products
7. Chilli seed cake – a protein content of 27-29% with neglible pungency can be used

Processing:

- Chilly is generally either consumed or preserved mostly by dehydration /drying
- Usually processing include tradition sundrying due to absence of efficient mechanical drying systems

Conventional processing:

- Indian chilly produce vary largely in size, shape, colour & pungency of fruits.
- Green chillies – used as vegetable
- Bell shape fruits – less pungent – used as vegetable

Steps:

1. Harvesting & curing:
   - Ripe fruits are plucked & harvested in door by heaping for 3-4 days for uniform ripening /colour development. If not cured like this, on drying white patches are developed.
2. Sun drying:
   - Chillies are spread on ground/concrete floor & sundried and the moisture is ↓sed from 70-80% to 10% for good storage life & also retain red colour & luster
   - Duration of drying – 3-15 days
   - Sometimes unfavourable conditions like cloudy weather also brings about discoloration
   - During this process there may be a seed loss of 10 kg/ton of dry chillies
   - Chillies are usually protected from color loss * loss & pungency by smearing the chillies with madhuca Latifolia.

Improved sundrying:

- This procedure process has been suggested by CFTRI
- This process uses a specific emulsion known as "DIPSOL" which reduces the drying time to one week.
- It takes 4-5 days for complete drying

Artificial/mechanical drying:

- It gives a quality consistent product
- The produce is first washed & then dried in trays as whole pods or sliced in 2.5cm/length
- Turnel driers & stainless steel continuous belt drier exposing the fruits to forced current of air at 50-60^{0}C (moisture content reduced to 7.8%)
- In case of c.annum species it has been observed that there were to losses in color & pungency at 60-75^{0}C even for >2 hrs.
- Optimum quality product was produced at 65^{0}C where whole fruits were dried at 8% Mc in 12 hrs & in 6hr when the chillies were subjected to slicing / slitting.
- Since slitting /slicing improved the rate of drying ↓sed drying time & improve colour &luster. IARI. Developed a punching machine.
- Punching machine has got 1024 needles arrange in 32 rows & Needle diameter (1mm). Each chillies is punched around 20 times evenly on the chilly surface.
- 10kg /hr is the capacity as compared 1 kg/lr traditionarly.

Chilly seed extractor : Developed by TNAU

- The dried chilly fruits are cut into small pieces & seed are separated in continuous seed extractor without cell rupture.
  Capacity →4 quintals of dried Fruit/day of 8 hr
- This method gives high yield of finished product more due to minimum breakage & loss of seeds

Preparation of emulsion:

- DIPSOL is a water based emulsion containing potassium carbonate (2.5%) refined groundnut oil (1%), Gum accasia (0.1%) Butyalated hydroxyl anisole (0.001%)

  Kco_3 – 2.5 g
  Refined G.N oil – 1 kg
  Gum accasia – 0.1 kg
  BHA – 0.001 kg

  5 lt Dipsol emulsion
  for 100 kg chillies

  KCO_3 & Gum accasia are dissoloved in water separately similarly BHA is dissolved in refined G.N. oil mix both water based & oil dissolved 30% slowly while stirring
- This mixture is passed through a homogenizer twice at 200 kg /cm^2 studies conducted under ICAR research at pant Nagar reported that concrete floor with tar coating is the best surface for sudrying only with 1% seed loss.
- When drying was carried by mechanical dehydrate on i.e using 50^0C & 52.5^0C with a air velocity of 1.5m/sec.for 12hr – 20hr
- Chillies with good quality were produced.

Drying:

Energy conservation and Reduction of drying time and clean product are the advantages.

- Carried out in a specific equipment developed by Regional research lab for drying chillies
- In this process plants with fruits still unplucked are harvested & spreadour on the ground for about a week for partial drying. There after fruits are hand plucked & spread on solar drier.

Processed products

1. Dried chillies:

   Dehydrated chillies contain 6% stalk 40% pericarp 54% seeds

- Important constituent colour and capsaicin are concentrated in pericarp.

- About 90% of the capsaicin in chillies have been notified in the placenta connecting seed with pericarp. Placenta which represents only <4% of total wt has a capsaicin content of 7%. Generally in the dry chillies Highly pungent
  Moderately
  Paprika-powdered
- All the three types can be used for extraction of oleoresin.
- Good quality dry chillies are generally characterized by bright red medium sized moderately thin pericarp, smooth glossy surface & firm stalk.
- Extent of wrinkling is more in chillies with thick pericarp
- Chillies with high pungency but colour not of importance for oleoresin extraction
- Harvesting, Drying & Handling procedures have a significant influence on quality characteristics

Fractionationation of Red Chillies

I. The CRTRI method has an opportunity to Fractionate red chillies into 3 products.
   a. Capsaicin rich powder →can act as substitute for whole chilly powder in oleoresin extraction
   b. skin→can be used for colour & loco pungent
   c. Seeds →oleoresin & seed as row material for seed oil extraction.

→ Chillies are dried to make them crisp & then ground in a suitable mill, where in all 3 fractions are separated.

→ The material is first sitted to separate inner sheet/ pungent part & then air clarified to separate seed & skin.

Flow diagram for Fractionatin (CFTRI)

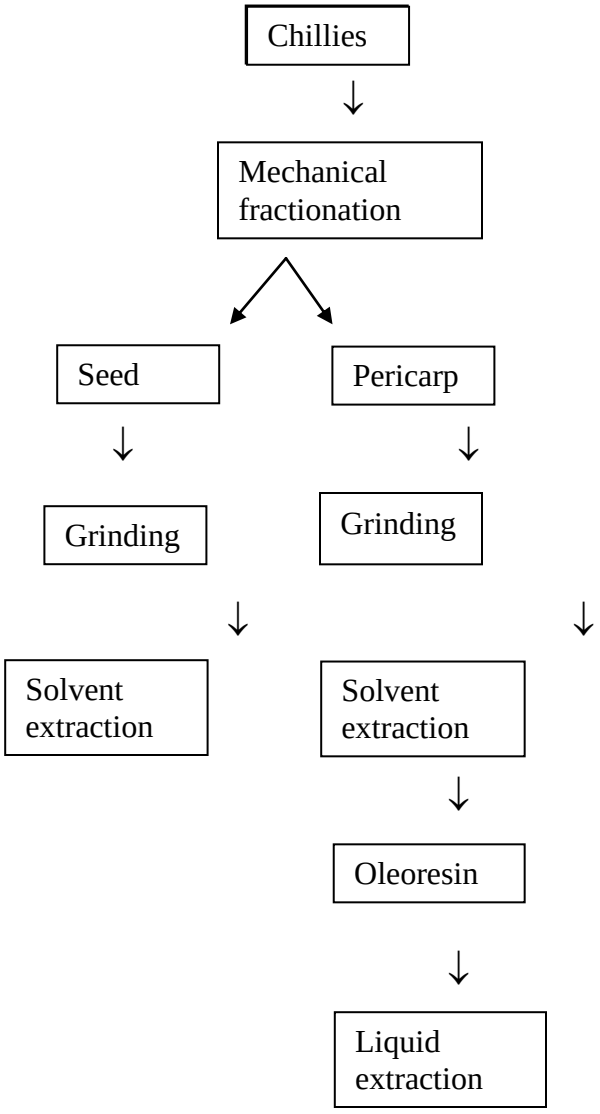
Red chillies →Drying →Grinding→Sifting→capsaicin rich factor I
↓
Over size
↓
Air clarification

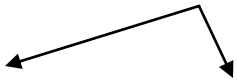
Heavy faraction seed III light fraction (skin) VI

NRDC Process:

(Aims at producing a highly pungent oleoresin fraction & a natural red colour free from pungency)

- Dry chillies with 8-10% MC is fed into pin mill & crushed & then fed into sieve / separator where chilly pericarp along with stalks are separated from seeds. Chillies seeds are generally separated by air clarification.





Chilli colour Highly pungent oleoresin

- The chilli pericarp is dried at controlled temp & then ground to required mesh in a disintegrator & packed in a battery of percolators where extraction of oleoresin is done by counter current extraction with solvent continuously fed form the top. A part of the extract conuing down is cooled up for desolventization. The remaining is fed crushed & then sent for process of solvent extraction. The oil obtained is freed of all solvent by distillation. The recovery of solvent from the extraction is accomplished by steam disticlation.

Types of oleoresin

3 types of oleoresin prepared from dried fruits of capsicum species.

1. Oleoresin capsicum (Bird chilly) – Capsicum Fruit – escens – African capsicum

   - Oleoresin is prepared form most pungent small fruit bird chillies
   - Very pungent oleoresin usually evaluated on its capsicum contents as percent st/oleoresin st (b/n 5 lacs & 18 lacs scoville units)
   - Colour is expressed on ASTA scale of 350 units
   - 1kg = 10kg of pepper

2. Oleoresin red pepper: (capsicum annum)
   - Obtained from larger, moderately pungent capsicums
   - Pungency rating is b/n 80,000 – 5 lac scoville units
   - Colour is expressed on ASTA scale of 20,000 units max.
   - 1 kg = 12-15 kg of red pepper
3. Oleoresin (paprika)
   - It is obtained from sweet peppers of paprika
   - It has intense colour but no pungency

- Commercial paprika oleoresins are available in colour strength ranging from 12000-1 lac units
- 1 kg paprika oleoresin replaces 12-15 kg of paprika powder in colour intensity.

4. Chilli oleoresin (5hr /50^0C)
   - It is extracted by solvent extraction for 5 hr at 50^0C for using ethyl acetate & acetone / ethyl alcohol.

Lecture No: 14

Turmeric

Scientific name: Curcuma longa

Family : Zingiberacere

Origin: India →leading producer & user (80%)

→ The term Turmeric is generally used for boiled, dried cleaned & polished rhizomes of curcumalonga.
→ Turmeric has got peppery, warm & bitter flavour
→ Rhizome is characterized by a tough brown skin with a deep orange flesh.
→ The crop mouches the stage of harvesting areved 9-10 months & undergoes processing (steaming – boiling-drying-polishing – marketing)
→ India is the largest producer & also exporter to M.E., USA, U.K, Japan.
→ Rhizome is generally branched (length 2.5-7cm, dia-2.5 cm)
→ Aroma & colour is generally enhanced by curing / processing
→ Turmeroness & Zingiberin M are responsible for typical arema of turmeric.
→ Major items of export : Raw & dry Rhizomes, powder & curcumin.

Uses:

- Anti-oxidant due to phenolic character of curcumin
- Generally used for flavouring & coloring food
- Principal ing in manufacture of curry powders
- Turmeric oleoresin is used instead of powder in pickles, gelatin, butter & cheese.
- Colourants are Entractral Eg: curcumins.
- E.oil of turmeric is antimicrobial, antiseptic & antibacterial (due to sodium salts of curcumin & curcuminoids)
- Used as blood purifiesr & antibiotics.

Varieties of Turmeric

Accepted levels of turmeric & curcumin as a food additive 2-5 mg Turmeric powder (or) of curcumin per kg body wt. (occording to FAO/WHO)

Important species generally cultivated:

- Curcuma dromatica (kochin Turmeric)
- Fingers are long, narrow & cylindrical with numerous secondaries.
- Rhizome is light yellow & has a distinct odour
- It has higher vol oil content & ranks low in colour intensity.
- Vol oil of 6% garnish brown oil with a flowery compohonaceous odour, can be entractral by steam distillation.

3. Curcumalonga: (Mango ginger): Characteristic flavour of raw mango & mild turmeric & ginger odours. Mostly used in pickles & salads.
4. Curcuma carsi: Rhixomes are bluish black & curcuma – (wild) abured, not desired, low value.

Types of pure Turmeric:

1. Allepay turmeric: (kerala) curcumin content high export value in unpolished form.
2. Madras Turmeric : Tamil Naud 3.5%, Curcumin, mustard yellow Rhizpmes
3. West Inidan Turmeric: (carva bean oroigin) Rhizpmes are small, reound, brown & dull yellowish in colour.

4. Indian type: Popular form in Inida. Rhizomes are harvested, peeled, boiled to destroy viability of tubers, ↑se flavour & ↓se drying time & gelatinize starch to give more uniform coloured products.

Various physical forms of Turmeric:

1. Fingers: lateral branches / secondary / daughter rhizomes generally detached from central rhizome befor curing (2.54 to 7.5 cm in length & 1 cm in dia)
2. Bulbs: Central, mother rhizomes which are ovati in shape & shorter length but great ida.
3. Splits: Bulbs which have been cut into halves on quarters before cduring/drying process.

Entraction methods:

1. Steamdistillation
2. Hydrocarbon
3. Chlorimatd solvent Entractin
4. Enzymatic treatment & fermentation
5. Supercritical fluid Co_2Entraction
   S – Co_2 at 500 bar & 35-60^{0}C
   C – no residual solvent
   F – Econendly
   E – Low batch time (2-4 hr)

- CFRI has standarised a technique for manufacture of oleoresin from ground turmeric using solvent extraction followed by vaccum concentratin.
- The semoliquid viscous oil contains both bol are matic principles & non-velatile acid/pungent fractions devoid of starch & fiber
- Rhixome oil is rich in sesquiterpene ketone compounds curcumins & Turmerones".

Processing of Turmeric

- Turmeric – rhizomes are chaned & fingers are separated from mother rhizome –used as seeding material
- For anema & odour development processing of Turmeric is required.

Processing steps include:

1. Sweating
2. Braning
3. Boiling & curing
4. Drying
5. Polishing
6. Colouring

1. Sweating : Leaves are cut off & Rhizomes are washed carefully in H_2O.
   - Lateral daughter rhizomes (fingers) are cut off from central bulb.
   - Fingers & bulbs are heaped separately, covered in leaves to sweat for a day.

2. Cleaning: Rhizomes aer thoroughly cleaned off from entraneous matrial adhering & subjected to curing.
3. Boiling & curing: Boiled / steamed to remove nawodour & ↓se drying time, gelatinize stach & produce uniform coloured product.
   Curing: Traditional method.

   - Cleaned fingers are placed in pans/ earthern plts forned with water and covered with leaves over which cowdung is layered.
   - Cowdung is used to makethe boiling meida alkaline due to pdn (or) liberatin of NH_3
   - Boiling of first lot req 45-60 min (soft) followed by less time for subsequent lots.
   - Then the fingers are artificially colorued with lead chromate/metanil yellow.
   - This method is not hygienic, can t be exported.

Presently in practice:

- Rhizones are placed in shallowpan in large iron vats
- Water is added to a level of 5-7 cm above rhizome
- $NaHCO_3$ (0.5-1%) added
- Rhizomes are boiled for 45 min
- Over cooking spoils colour & ↑ses brokens %
- Under cooking venders the dried product brittle.

Improved /advanced scientific method (TNAU)

1. Fingers & Rhizomes are boiled separately in pans
2. Cleaned rhizome are (50kg) taken in perforated trough (75 kg) of size with handles for immersing in pon.
3. These troughs are immersed in clean water present in outer tank.
4. The alkaline solution (0.1% of Na_2Co_3/$NaHCo_3$) is added to H_2O.
5. The whole system is boiled till fingers become soft
6. With the help of needle the extent of cooking can concluded.
7. Cooked rhizomes are taken out of pan by lifting trough & draining.
8. Alkalinity of boiling water helps in impanting tinge to core of turmeric.
9. Sailent features: 200kg/ batch Rs. 6000/ batch expenditure
    - 25-30 kg Agricultural waste for fuel
    - 2 labours are required
    - Proper utilization of water.

4. Drying:
    - Dried in sun by sprading them in a thin layer 5-7 cm on bamboo mat /dry floor
    - Artificial drying –during night the material is heaped on covered.
    - Duratin of this step/stage to attain hard & should produce metallic sound when broken.

5. Polishing : In order to smoothen rough & hand outer surface of boiled dried turmeric & also to improve its colour it is subjectral to polishing.

   Boiling step – pregelatrizatin of starch in rhizome $\rightarrow$good solution.

   2 types Hard polishing
   Machine polishing

6. Colouring: Half polished rhizomes are taken in bamboo baskets & shaken with turmeric (1:2 i.e, 100 kg of finger reg 200 kg of turmeric. Trureric is suspended in wsaer & mixed for sprinking inside the opolishing basket (effective method than dry)

   If it is going to be used in emulsion composition.

Alum – 40g
Turmeric powder – 2 kg
Castor send oil – 140 ml
Sod bisulfate – 30 gm
Con Hcl – 3ml

Specification for exporting turmeric (uslow)

Lecture No: 15

COFFEE

Brazil is largest producer of coffee in world
Nearly 70 species are present

Scientific name: Coffee anabica (75% world productin)
Coffee robusta (canephora (25%)
Coffee liberica (1%)
Tresize is mas in all the 3 spices)

Family: Rubeaual

- Coffee is generally preferd for its refreshing & neugro stimulating effects.
- Coffee is generally prepared from endocarp/beans of crimos fruits surrounding pulp (mesocarp) 7 outerskin. (endocarp) are removed.

Structure of coffeebean / cherry:

1. Coffee beans are covered by a thin parchment like hust which is further surrounded yb pulp.
2. Both the hull / parchment & pulp are removed before coffee beans are paichment roasted.
3. The mature red fruit is depurded, fermented washed & dried to give paichment (or) plantation coffee (wet processing)
4. The mature fruit may be dried & dehusted mechanically to give cherry coffee / green coffee (dry method)

Composition : Mostly depends on variety, origin, Processing & climate

Main composents in Arabica Coffee are Caffeoyl quinic acid (3 – 5)

- In rebusta Coffee caffeoul quinicacid (44 – 66%)

Other Components are protein – 89%
Sugar – 41%
Ash – 7%
Pectic substances – 0.91%

Coffee processing Berries to Bean
Beans to Brewing

Coffee processing is carried out in two ways

a. Wet processing by which plantation (on parchment coffee is prepared.
b. Dry method: by which cherry coffee/green coffee is prepared.
   Wet processed coffee is superior to dry processed coffee in quality.

- Wet processed coffee is superior to dry processed coffee in quality.
- Arabica coffee – 75% is wet processed except in brazil – robusta coffee – puedominantly dry processed except in Indonesia.
- Wet processed generally demands more revenuel premium price from than dry form.

Dryprocess:

- Harvesting
- Drying: The harvested cherries containing 65% M.C are subjectral to sudrying by spreading to a thickness of 4-8cm with periodical atleast 4-5 times a day initially drying followed by hourly intervals for even drying drying takes nearly 12-15 days depeding on thickness of layers & availability of sunshine.
- The outerskin dries off to form husk which is then removed mechanically during hulling process
- This process of drying is accomplished fixed, movable raised. Trays, cementral f 100 r on plastic sheet which is beneficial comp and to traditional method where coffee beans were lay end on bare greound on cowdung smeand (with) earth. The reason being that traditional method always produced faintred product & also develops earthy smell.
- Drying is Completed when M.C is reduced 12% (beans tend to rattle when shaken)

- The dry processed coffee will have strong body strong anoma & low acidity.
- Dried cherries are stored for several weeks.
  Storage
- Thrashing- step carried out prior to Enporting
  Silver screen is removed to improve appearance of grin coffee & gives a by-product called "chaff"

Wet process:

i. Harvest quality: Right type of fruit at right stage is very much essential for production of quality coffee ripen fruits are generally plucked. Time for inihiation of ripening is Arabica – 135

Robusta – 4-45 wks

ii. Cherry sorting: Intended to remove immature pest infestal dry berries and other entraneous matter only fully ripen & material berries which have adsequate mucilage and natural pectionolytic enzymes are to be taken for wet precessing.

iii. Pulping: Pulping refers to mechanical removal of red outerskin from fruit to obtain parchment coffee/pulping eqp and water (chen) supply is must

- Pulping depends on lubricatin from mucilaginous layer b/w pulp & parchment.
- Pulping should be carried out on same day to avoid fermentation
- Pulping called vertical type pulper/penagos is used
- "penagos" req 1.5 H.p power & can pulp about 850-2,200 kg/hr with a water req of lit/kg where as conventional pulp req 6 lit/kg.
- Any pulper will have smooth slothed base/member over which is mounted or rough suffaced violating drum/cylinder/disc.
- The distance b/w moving member & stationary member is carefully adjusted so that space narrows s the fruit is carried through. This kind of provision is to bring about squeezing action. The seeds are separatral from skin.
- Then seeds are separated from skin by means of plates with sharp edge.
- Demucilaging: The mucilage is wet, slippery outerlayer of bean. This layer is removed yb friction as beans nove against each other. This process is called demucilaging.

- Removal of mucilage mechanically allow fermentation step to be shortened.
  Fermentation: Mucilage is removed by

  * Biological /natural fermentation
  * Enzymatic method
  * Chemical method
  * Removal by attrition

- The enzymes of fermentation bacteria converts mucilage made up of sugars & pectins into acids.
- Fermentation time varies form 16-36hr depending on acidity, temp & O_2 levels.

I. Natural fermentation: Pectin hydrolyzing enzymes native to mucilage & bacteria bring about hydrolysis

- Over fermentation induces toxybeans/onion flavour defective quality
- Under fermentation leads to absorption of moisture by beans & thus results in mustiness in final produce.

II. Enzymatic method: For mucilage degradation pectinolytic enzymes are to be used to hasten the fermentation process.
- The recommended dose of coffenzyme is 350-750 gm/ton of Arabica fruits for a contact time of 12 hr at 20^0C with occasional ogitation.

III. Chemical method/alkalitrt: A sol^n of 1olit of NaoH (1 kg of NaoH in 1olit of H_2o) for 1200 kg of pulped beans. A contact time of 30 min and 60 min is req for hydrolysis.

IV. Removal of mucilage by attrition: In this the pulped parchment is directly fed to mechanical device called "Aquawasher" in which the mucilage is removed by mechanical scrubbling/friction & washed by a jet of water.
- Brusing of beans can be avoided carefully by adjusting flow rate (24% brushing is encountered)

V. Post fermentation soaking:

- Soaking refers to complete immusino of wsashed parchment under clean water for a period of 8-12hr for anabica & 12-24 hr for rebusta.
- Soaking improves adour but more than 24 hrs can give a defective process
- Water should be un polluted free from metallic contaminants & microbial contaminant as they impart metallic & foul flavour.

VI. Drying: Proper contributes to healthy colour to beans.

- Under drying – rapid deterioration turns mouldy & also gets bleached.
- Wet parchment Coffee M.C is 50-55% & has to be brought down to 10-12%
- When bitter the bean should be split into two once process is complete.
- Rapid drying of surface moisture on a wire mesh trays for first two days of drying.
- Followed by slow drying for nent 2 days to allow slow moisture loss with out breaking parchment.
- Slow drying of result an parchment at M.C of 10-12% under strong solar radiation is carried out from 5^{th} day on wards.

Threshing:

Decaffeination: 3 methods

The process during which caffeine is removed from coffee beans. Coffee with atleast 97% caffeine removed is labeled "Decaffeinated"

3 methods : "Decaffeinatral"

1. Waer decaffeination method:
   - Simply uses H_2O t extract caffeine from Coffee
   - Green beans are rinsd in water for a long period during which caffeine dissolves in water.
   - H_2O + dissolved caffeine is pumped through an active
   - Carbon filter which absorbs Caffeine.
   - Decaffeinatul beans are dried using warm air & then cooled with cold air.
   - Then they are roasted, ground & packed. The water is reused for decaffeiration.

2. Super critical Co_2 Entraction: uses Co_2 to remove caffeine
    - Removal of 97-99% of caffeine is possible by this method.

3. Solvent method: Ethylactate, dichloromethane with expore time (30 min)

Roasting:

100 – 200 – 500^{0}C temp can be used for reasting to bring out delightful anema.

Processphases:

Drying – development – decomposition – full roasting.

1. Initial chanes occurs at on above 50^{0}C when protein in tissuelcells denature & water evaporates
2. Browning occurs above 100^{0}C due to pyrolysis of organic compounds accompanied by swelling & an initial dry distrillation at about 150^{0}C these a release of volatile (H_2o,Co_2,Co) which results in an ↑ in bean volume
3. Decompositionphase, which begins at 180-200^{0}C is recognized by beans forced to pop & burst along groove. This phase is also characterized by bluish smoke & release of coffee arema.
4. Fully roasting- carwmelizatin (M.C- to 5-3.5%) over reasting/ scorching should be avoided.

Methods:

- Contact roasting (walw of reasting apparatus
- Heat transfer is uneven
- Roasting time 20-40 min
- Hot aik conveation/gas (combuslible) 5-18 min.
- Centrifugal masters/fludized bed reasters are must commonly used.

Changes in roasting:

1. ↑se in volume (50-80%)
2. Green colour – Brown
3. Water loss leading to st loss by 12-25%

4. ↓se ub caffeube cibtebt
5. Chlorogenicaacid →caffeicacid & quinic acid
6. Beans become brittle
7. Pressure develops inside due to gas accumulatin leading bursting process
8. Co_2 is produced
9. CHO decompose, carametize& Contribute ot flavour
10. Protein decomposition products ↑es
11. Roasting bring about ↑se in nicoticacid content from 16-55 mg/gm t 95-263 mg/gm.

Roasting — Light on blande roasting Scandinavia mild flavour
Medium roasting strong – USA & Asia.
Dark roasting very strong Europe an

Grinding: It is carried out in Rollingmills

- Rolling mill consists of several groups of cylinders which turn in opposite directions.
- The clenance of cylinder is according to req fineness

Brewing: Entraction of soluble solids of coffee waer is used as solvent.

There different methods used

1. Percolation system
2. Counter current type

Instant:

Prestripping →done by passing steam through a Bed of ground & roasted coffee

↓

Entraction of soluble solids

↓

Vacuum Concentration

↓

Drying — Freeze drying / Spray drying

↓

Packing

From Bean to Brewing:

Regular	Decaffeinated	Instant
↓	↓	↓
Roasting	Decaffeination	Roasting
↓	↓	↓
Grinding	Roasting	Grinding
↓	↓	↓
Brewing	Grinding	Brewing
↓	↓	↓
Cupping/serving	Brewing	Concentration
	↓	↓
	Cupping	Freezedrying
		↓
		Cupping

Lecture No: 16

Areca nut
S. Name : Areca Catechu
Family : Palmae

Ø Source of the common masti catory nut
Ø Common name: betel nut or supari
Ø An essential requisite for several religious and social ceremonies
Ø In India: Kerala, Karnataka, Meghalaya, Tamilnadu, and West Bengal
Ø It is native of Cochin, China, Malay peninsula and neighbouring islands.

Botanical view:
Ø Fruit is ovoid or oblong, supported by persistent perianth;
Meso carp – fibrous
Seeds
Truncate base
Opaque and a-endosperm – deeply ruminate
White and astringent embryo – basilar.
Ø Stem will be visible after 3 years of planting
inflorescence – spadix
Ø Fruit – mono –locular, one seeded berry
When ripe – orange red to scarlet

- thick fibrous outer layer
- seed enclosed with husk

Ø Mature fruits – 3 zones- Exo carp, Meso, Endo

Ø Time taken from full bloom to maturity of fruit ranges from 35 – 47 weeks

Propagation: Seed.

Processing: either raw or processed – use

Ø Depending on the nature of the end product the fruit is harvested at different stages.

Ø Major constituents are

Polyphenols
Fat
Polysaccharides
Fibre and protein
Allcaloid (Significant)
Minerals : Ca (0.05%), P (0.13%), Fe (1.5mg/100g)

Harvesting

i). 2 months old tender areca nuts – no resistance while cutting

ii). 4-5 months – outer skin is dark green

viii) inside it is translucent and jelly like, with the pale coloured streaks.

iii). 6-7 months - green nut, which is hard, but can be cut easily. It has less/ more white core and light brown veins from periphery to core.

iv). 9 months of maturity – ripe fruit has a yellow – orange red colour, the enclosed hard nut has distinct brown polyphenol – veins embedding white fat, P.S and white core.

Chemical composition includes mainly

Ø High amount of polyphenols, N2 and ash

-Tender stage

Ø P.S, fiber, fat and alkaloids are formed rapidly in the middle stage.

ix) middle stage

Ø Drop in M.C results in hardening of nuts and formation of P.S's

Ø Lignification and a high degree of polymerization of polyphenols.

x) matured stage

Processing

Kerala: fresh fruits

Steeping in water

Inner core is well preserved

These H2O preserved nuts – neetadaka

Ø Discolouration of outer husk and foul smell result due to bacterial attack.
Ø It is a favourite for chewers even it is having mild off flavour.
Ø Preserved nuts are more prominent in the market for the preparation of pan & Neetadaka.
Ø A new technique to preserve fully ripe nuts

Freshly harvested Areca nuts

Washing (100 ppm chlorinated H2O)

Blanching (0.2% CaCl2 solution)

Steeping

Can be stored upto 10-12 months

Dried ripe nuts
Dried , whole nut – ‘chali’ or ‘rattapak’

Ripe nuts

Sundrying (30-40 days)

Husking

Whole nuts

Marketing

Grades/ sizes : Moti, Srivardhan, Jam nagar, Jini

Main areas: Kerala, Karnataka, Assam, Maharastra

Characters of 'Chali'

Ø Free from immature nuts, surface crackling, husk sticking, fungus and insect attack.

Ø To facilitate drying, fruit are cut longitudinally into two halves and sundried about 10 days.

Ø The kernels are scooped out and given a final drying- pareha (Kerala, Karnataka)

Kalipak:

Ø Improved form of processed areca nut .

Ø Main processing centers are Kerala, and Karnataka.

Ø 6-7 months old nuts are selected.

Ø This processing consists of dehusking, cutting the soft nuts into pieces, boiling, 'Kali' coating and drying.

Ø In case of boiling process, usually the same batch of water is used for boiling 3-4 batches of cut areca nuts.

Ø The extract so obtained is concentrated to a thick 'kali' (major const. Polyphenols)

Ø The kali coating is repeated to get a good glossy appearance.

Ø Defects / problems in this process

Ø Fungus growth and thickening of the top layer – during storage of kali.

Solution: stored in closed containers

Ø Both sundrying and oven drying are adopted

Ø During monsoon – artificial drying over an open fire is beneficial.

Over drying- smoky off flavour

Ø End product is well dried product with a dark brown colour, glossy appearance crisp chewing peel, well toned astringency and absence of over mature nuts.

Scented supari:

Dried areca nuts

Broken into bits

Blended with flavour

Packed

- Ø Usually bits are roasted in ghee or oil, but it develops rancidity, so it's not followed.
- Ø The flavouring of supari varied with region.

In south India – made from Kalipak spices and synthetic flavour added

- Ø Rose essence + menthol -> very common

Coconut gradings are not added -> to check M/l growth.

- Ø Chali and ripe areca nuts -> have large fibrous residue used alone with Betel leaf + lime (flaked)
- Ø ' colour " development upon chewing along with stimulation and pleasant taste, it develops bright red colour of mouth.
- Ø B'loz – Catechin turns reddish brown on standing for more than 2 hrs..
- Ø Due to formation of O-quinone from H2O soluble polyphenols like leuco cyanides under alkaline pH and subsequent 20y reactions.
- Ø Betel leaf has no contribution for colour (red) but added for – freshness of flavour due to the phenotic essential oil present in it.

Uses:

1. Masticatory and socio – religious uses: It is takes in the form of " tambula", combination of betel leaves of pan + lime + tobacco + camphor or spice.

- Ø Chewing -> to -se the production of saliva and gastric juices then aid in digestion.
- Ø It strengthen the gums and the teeth and cleanses and deodourize the mouth.
- Ø An appetizer and a stimulant.
- Ø Offerings of betel nut, flower, few leaves of pan, during worship/ pujas.
- Ø Offered a few pieces of nuts and betel leaves as a sign of honour to the people and welcome.
- Ø Exchange of betel leaves and areca nut is important part of betnothel ceremonies (marriages).

xi) Medicinal uses:

Areca nut used against leued derma, lepracy, cough, fits, worms, aracmia and obesity as a purgative + as a stimulant and appetizer.

xii) Leaf sheath:

For making paper boards Areca leaf sheaths: imaginative novelties (sheath surface given a French polish).

xiii) Husk:

- produces fiber
- for the preparation of ‘ kraft paper’ but not in use due to cost of process.

Lecture No: 17

Aniseed

Sc. Name:

Family : Umbelliferae

- Native of the East Mediterranean region.
- Aniseed is an annual herbaceous plant
- Aniseed is available in India under the name of ‘ lucknow sauni” or Indian Aniseed.
- It is grown on a small scale in Rajasthan, Punjab, U.P and Orissa.
- Aniseed bears fruits which contain volatile oil similar to that of staranise.
- View: Aniseed is ground-grey to grayish –brown in colour, 3.0 to 5.0 mm in legth, avail in shape, and with a short stalk (pedicel) attached . five longitudinal ridger are visible on each pericarp.

Composition:

Moisture:	9-13%
Protein:	18%
Fatty oil:	8-23%
Sugars:	3-5%
Starch:	5%
Crude fiber:	12-25%
Ash:	6-10%
Essential oil:	2-7%

Adultration: With fine earth, and other small seeds ground form adultrated with female (ground). Aniseed oil is adultrated with lowgrade star-anise oil.

- Adultration with synthetic 'anethole' made from pine oil is also reported.
- Harvesting of fruits and drying followed by threshing.
- Marketed form : I) Seeds

ii) Ground form

iii) Essential oil

- Packaging: packed in clean, sound and dry containers.
- Storage & Transport: Well protected from the sun, rain and excessive heat.
- Essential Oil: Steam distilled oil, also called as "oil of Anise", yield oil: 1.9-3.1%
- The chief constituent of anise oil is "ancthole' constitute 80-90% and responsible for the characteristic flavour of seed.
- Also containe charcol, p-methony, phenyl acetone and small smounts of tarpence and sulphur containing compounds of disagreeable odour.

Uses:

- As it emits sweet aromatic taste rohen crushed, used for flavouring food, confectionery, bakery product, beverages and other liquors.
- A beverage flavoured with Aniseed is called as 'anisette'.
- Essential oil is used as an insecticidal agent against small insects such as head-lice, mites and vervin. (has fungicidal activity)
- Residue after extraction of oil is used as high grade cattle feed. (17-19% protein, 16-22% fat)
- Oil used in soap-making, substitute for Cocoa butter in confectioneries.

Lecture No: 18

Celery seed

Sc.Name: Apium graceotlens

Family : Umbelliferae

- Celery is an aromatic herb grown for its leaves, seeds, oleoresin and essential oil.
- Celery of commerce: dried ripe fruit
- Fruit is small, ovoid, 1.1 to 1.5 mm long and 1-2mm in diameter, contains a small brown seed, bitter in taste.

- Native – Sweden
- In India, it is commercially important more for its seeds, which have a good aroma and find a ready export market.

Harvesting and threshing:

- Ripe fruits are harvested (over ripe fruits not suitable).
- Harvesting should be done at night time to avoid shedding of seeds.
- Threshing carried out with sticks followed by sieving.

Post Harvest Technology:
Threshing -> Cleaning -> Drying -> Sieving -> Packing -> Marketing

Composition:

Moisture	: 5.1%	Ca	: 1.8%
Protein	:18.1%	P	:0.55%
Fat	: 22.8%	Fe	: 0.45%
Crude fiber	: 2.9%	Na	: 0.17%
CHO's	: 40.9%	K	: 1.4%
Total ash	: 10.2%		

Adultration:

Mostly with exhausted or spent seeds, excess stems, chaff and earth or dust.

Cpage 486 -> Cumin seed

ASTA tolerence Limits for
Dill seed
Celery seed
Fennel seed

Processed products:

i) Celery seed oil: Warm, spicy, slightly fatty, fruity, penetrating & very persistent very bitter taste with burning sensation 2-3% vol.oil -> pale yellow.

ii) Celery Herb (leaf) oil: Not attained commercial impt'e.

iii) Celery chaff oil : has a harsher and coarser odour and flavour than that of celery seed oil.

iv) Celery seed oleoresin: it is a green liquid having a volatile oil content of 9ml/100g.

2 types of oleoresin: French: sweet, herbal. Slight citrus undertone
Indian: more herbal with slight lemon like aroma

v) Celery salt: Prepared by mixing finely ground table salt with ground Celery seed or Celery seed oleoresin or ground dried Celery stems.

vi) Celery pepper: It substitutes ground black pepper for celery salt but should contain not more than 70% of pepper.

vii) Other than seed, celery is processed and forms of celery herb used / marketed are dehydrated celery, celery juice blends, freeze-dried celery.

Uses:

i). Food flavourant:

- Seeds used as 'bird feed'.
- Dried ripe fruits are used as spice.
- Leaves and stalks are used as salads and in soups as appetizer.
- Seeds used to flavour soups, salads, tomato juice and sauces.
- The principal constituents of celery seed oil are d-limonene 60%, d-selinene 10%, sedanomic acid anhydride 0.5% and scdanolide 2.5 – 3%.
- Sedanonic acid anhydride + sedonolide is responsible for the aroma of the oil.

ii). Medicine:

- Seeds are stimulant and tonic
- Used to cure asthma and for liver diseases.
- Used as a nervive sedative and tonic.
- Rlieves rheumatism

iii). Perfume:

- Important ingredient in navel perfumes
- Fatty oil- 7%
- Used as anti – spasmodic and nervestimulant
- Used as intestinal antiseptic
- Employed in rheumatoid arthritis

Lecture No: 19

Caraway

Sc. Name: Carum carvi

Family:

Two types - Caraway (carum-carvi)

- Black caraway (carum bulbo castanum)

- Roman soldiers dispersed caraway seed from its home in Asia.

- The dried fruit or seed is brown in colour, has pleasant odour, aromatic flavour, is warm with some what sharp taste (caravone).

View

- Seeds are hard and sharp to touch
- They are free from stalk ends
- Yield of aromatic essential oil 4 – 6%

Black caraway: also called "Kala zira'

Harvesting and threshing

- Harvesting time: When the seeds turn light brown (for commercial grade)

: dark brown for seed purpose.

- Threshing : done with sticks
- Well ripened fruits – low quality
- Fruits collected before ripening

Post Harvest Technology

i) Packing

ii) Storage

Picking (Threshing)

Drying ® (cleaning)

Packing (small bags)

Storage

- Caraway mostly sold as whole form

Composition

Moisture	: 4.5%	Ca	: 1.0%
Protein	:7.6%	P	:0.11%
Fat	: 8.8%	Na	: 0.02%
Fiber	: 25.2%	K	: 1.9%
CHO's	: 50.2%		
Ash	: 3.7%		

Adulteration:

Adulterated with cumin seeds, gravel and earth.

Processed products: I) Volatile oil

xiv) Carvone (isolated form)

Volatile Oil- obtained from fresh seeds up on steam distillation yields a colourless or pale yellow oil.

- A terpene, formerly called carvone, recognized to be di-limonene and traces of carvancol are found.
- The official standard require that the oil should contain not less than 53% & not more than 63% carvone.

Decarvonized Oil: It consist of limonene with trace of carvone, used to scent cheap soaps.

Caraway Chaff oil: Oil –steam distilled from the husks and stalks that remain after threshing. Contains 20-23.5% crude protein & 14-16% fat. It can be used as cattle feed.

Uses:

xv) Food flavorent:

- Culinary purposes
- For flavouring rye-bread, biscuits, cakes and cheese.
- Used in manufacturing of ‘ Kummel” cordial and also become an ingredient for seasoning sausage and pickling spice, soups and meat stews.

xvi) Medicinal uses:

- It is a mild stomachic and carminative
- Occasionally used in flatulent colic.
- Carvone (isolated form) is used as anthelmintic in Hookwarm disease,
- Caraway seed oil is used in oral preparations for overcoming unpleasant odor.
- It is also used for sending soaps.

Oil palm

Sc. Name: Elacis guineensis

Family : Palmae

- Africa origin
- Elaton=oil
- Among the oil bearing trees, highest yielding

- Economic part: Kernel and flesh

Palm kernel oil, crude palm oil

- Mostly found in Africa, South East Asia and America
- In India : Kerala, Maharastra, Karnataka, Tamilnadu and Andhra Pradesh
- Botanical view: The fruit is a sessile drupe with spherical to avoid or elongated and bulging at the top in shape.

The pericarp of the fruit consists of the outer exocarp (skin), the mesocarp or pulp and the endocarp or shell.

the endocarp and the kernel – seed

- Varieties:

	Durga	Tencra	Pisifera
Mesocarp :	35 – 55%	60-96%	Shell absent

Upto 60% in Delidura

- Propagation: I) Seeds

xvii) Tissue culture: Shoot tip culture

: Embryo culture

Yield factors for oil palm include:

i) Yield of bunches
ii) % fruits / bunch
iii) % oil in the mesocarp
iv) mean weight per bunch
v) mean annual no. of bunches
vi) % mesocarp in fruit
vii) % shell
viii) % kernel

Harvesting and Yield:

- First harvest: 3 ½ to 4 years after planting
- Sign of harvest: when a few fruits are loose / fall away then it is ready.
- Ripeness: the no. of fruits detached per bunch.
- Minimum ripeness: 5-10 detached fruits/bunch
- Harvesting intervals : 5-14 days harvesting intervals kept as low as possible.
- The rate of rise of oil in mesocarp, rised ripen
- A chisel is used for harvesting bunches from young palms
- Taller trees-> Harvesting hook
- Average yield 12 tonnes of FFB/ year

Tenera fruit

Palm oil	: 35%
Pulp residue	: 35%
Kernel	: 7%
Shell	: 23%

- Average yield : 2.5 t/ha – 6t/ha
- Palm oil / bunch : 20%

Processing:

Perishable : so to be processed with in 24 hrs otherwise develops FFA-> poor quality oil

Factors enhance FFA development:

i) bruising
ii) bad handling
iii) over ripening
iv) delay in processing

Processing: 3 distinct stages

1. Extraction of crude palm oil
2. RBD (Refining, bleaching, deodouring) of palm oil.
3. Fractionation of palm oil: palmolin (liquid free)

Wet extraction method:

(Multi unit operation)

Harvesting (loosening of fruit from the top of the bunch)

–

FFB – steam- 1200C , 3 kg/cm3 Sterilization – 1 hr to inactivate lipase into lipoxidase to loosen the fruit from bunch

–

A bunch stipper 20 rpm inclined Stripping for seperation of sterilized fruit & calyx at an angle to Horizontal from bunch

–

Mechanical igitation 950C/ 30 min Digestion (to loosen the pericarp to break up the fruit pulp 20-30% of the oil are released o/w ----)

–

Hydraulic – small scale press Pressing

Screw press – large scale

–

Clarification

Clarifier Oil water mixture – dilution with H2O- 950C Oil at the top- residue at bottom

–

Purification

–

Purified for the removal of dirt & moisture

High speed centrifuge

–

Degumming Edible oil

–

Neutrilization

–

Bleaching

–

Deodorizing

–

Frutioniligation Liquid palmolin

Extraction of kernel oil

- Nuts –shelled – rotary cracker
- Separation of shells from kernel – Hydro cyclone
- Kernels – drying silo
- Expellers – to extract oil
- Light fraction of kernel / shell - ----

Nutritional value

Raw palm oil: High in carotenoids

Refining : Total destrution of carotenoid

Under hygienic conditions with low FFA, it can be directly consumed & is economical (African countries – raw oil)

Present scenario

- Oil palm processing unit at OPIL, Quilon has the capacity to process 0.75 tonnes FFB/hr later 3 tonnes/hr
- OPIL – Oil extracted is sold for industrial purposes.
- RRL, Trivandrum – developed a technique for production of unrefined oil under Hygenic conditions.

Lecture No: 20

Vanilla

Sc. Name: Vanilla plemifolia Andrews

Family: Orchidacae

Introduction:

- Native to Atlantic coast from Mexico, Brazil
- In India it grows in Kerala, Karnataka, Tamilnadu, Assam, Andaman &Nicobar islands.
- Vanilla is an orchid cultivated for its pleasant flavour.
- Out of 50 spices only 3 considered as important sources.

1. Vanilla planifolia: Andrews – Vanilla fragrans
2. Vanilla pompona
3. Vanilla tahitensis

Botanical view:

- Climbing orchid, having acrial roots at nodes.
- Flowers are large & yellow (inflore- 15-20 flowers)

Cultivation:

- Plant grows at warm and moist conditions

Propagation:

- Propagated by stem cutting of 60-120cm long

Plantation:

- Vanilla is a climbing tree, needs support for growth.
- If the support is a legume it will be able to enrich the soil.

Harvesting:

- Immature Vanilla been is dark green in colour.
- Ripe yellowish commences from its distal and this is the optimum time for harvesting.
- If left on vine, the beans turn yellow on the remaining portion and start splitting. The beans at this stage do not have aroma as vanillin is not present in them.
- Vanilla is developed as a result of enzyme action on the glucosides contained in the beans during the process of curing.

Different stages of curing

1. Killing the vegetative life of the beans to allow the onset of enzymatic reaction.
2. Raising temperature to promote this action and to achieve rapid drying to prevent harmful fermentation.
3. Slower drying for the development of different fragment substances.
4. Conditioning the produce by storing for a few months.

Curing & Drying

- The commercial value of vanilla depends mainly on the care bestowed on curing.
- The pods nearly take a month for completion of ripening.
- Eventually they become dry, brittle and finally become scentless.
- Therefore different artificial methods are employed to cure vanilla.

i) Peruvian process
ii) Guiana process
iii) Mexican process

Peruvian process: (wet process)

- Curing is done by hot water.

Pods are dipped in boiling water
–
ends are tied & hang in the open
–
dry for 20 days
–
coated with castor oil
–
tied up in bundle

Guiana process: (dry process)

Pods are collected and dried in the sun till they shrived
–
wiped and rubbed with olive oil
–
ends are tied up to prevent splitting
–
bundled

Mexican process:

Harvested pods are kept under shade till they shrivel
–
subjected to sweating (for 2 days)
warm weather: spread over blanket and exposed to the sun, during midday, blanket covered over and bundled and left in the open for rest of the day
–
they are wrapped in blankets in the night to maintain continuous fermentation and sweating (pods should wrapped when they are hot to touch). This process

is repeated for 7-12 days till they become dark brown in colour, soft & flexible.

packed in tins and sealed.
Yield 4.15-4.40% vanillin content

Vanillin or Vanilla essence is the extract made by macerating the beans in alcohol.

Cloudy weather: pods are bundled in bales and wrapped with woolen cloth covered with banana leaves.

subjected to heat by air- oven at 1400F for 24 hrs

dried to change colour

packed and sent for market

If Vanilla ripe:-

- It is devoid of characteristic scent, which develop only at the time of fermin during curing.
- The scent is developed from the avid pulp on the outer skin of the pods in the form of citron coloured oil.
- If the pods are unharvested and may delay in the maturity of the pods turning yellow, they emit an odour similar to that of bitter almond.
- The pods upon ripening and splitting gives a small quantity of oil reddish brown in colour.
- Produced in large quantity is called Baksam of vanilla.

Enzymatic generation of vanillin:

- During the curing process, vanilla pods get the flavour as the result of the naturally induced enzymatic actionof glucosidase on the precursor glucovaanillin factors, affecting the formation of vanillin and sugar.

glucosidase
Gluco vanillin ----------à vanillin + sugars
High temp+ high humidity

Factors effecting vanillin formation/ content & Quality

i) Climatic conditions
ii) Timing of harvest

iii) Extent of sweating of the pods during curing

Bourbon vanilla:
Pods placed in hot water (700C) for 15-20 sec
–

followed sweating and sundrying like Mexican process

Bourbon vanilla is said to yield a some what stronger and harsher flavour than that obtained by the Mexican process

Classification –6 grades

Prime:	Thirds:
Firsts:	Fourth:
Seconds:	Splits:

Prime: perfect beans, fully mature, smooth, broad & very oily, rich in chocolate flavour with m.c of 37%.
First cuts: lower in appearance.
Second cuts: sweet flavoured, inclined to hardness, m.c =25.5%
Thirds : have a good flavour but surface is blemished , m.c=13%
Fourths: smaller than thirds, lighter colour and rich in resin content but low in vanillion.
Splits: reddish brown, shriveled and dry. High in vanillin & low in resin. M.C is 16%.
Packaging: Beans stored at a temperature of 100C and low humidity
- M.C of 25 and 30% preferred for extraction & storage temperature rise to 15-210C.

Composition:

Moisture	: 25.85-30.93%	Vanillin=1.48-2.9%	
Protein	:2.56-4.87%	resins=1.5-2.6%	
Fatty oil	: 4.68-6.74%	Ca	: 19.7µg
Oil	:0.0-0.64%	K	: 16.2 µg
Fiber	: 15.27-19.6%	Na	: 6.7 µg
CHO’s	: 7.1-9.1%	P	:9.5 µg
Ash	: 4.5-4.7%	Fe	:0.3 µg

Processed products:

i) Vanilla extracts/ essences: Dark coloured extracts with alcohol is obtained from dry beans and the presence of glycerin deepens the colour of extract.

- Stored in SS , Al or glass containers.
- Ageing for 25-30days improves the aroma due to formation of esters from acids in the presence of 42-45% alcohol.

ii) Vanilla sugar: Vanilla extract mixed with sugar is called 'powdered vanilla' or vanilla sugar.

iii) Vanilla oleoresin: S.E of finely cut vanilla

iv) Vanilla powder, vanilla absolute + vanilla tincture is used in perfume preparation.

Uses:

Food flavourant:-numerous sweetened foods

Vanilla sugar- preparation of / manufacture of chocolate

Vanilla flavouring – liquor, brandy, whisky

Pure flavour – ice creams, soft drinks, chocolate confectionery, candy, tobacco, baked foods, puddings, cakes, cookies, liquors

- no medicinal use.

Lecture No: 21

Coconut

S.Name: Cocos nucifera

Family : Palmae

- One of the most beautiful & useful tree in the world.
- Grown in more than 80 tropical countries important among all cultivated palms.
- Not only supply food, drink and shelter, but also provide raw materials for a number of industries – connected with domestic as well as economic life.
- All the parts of this 'wonder palm' as useful to mankind – 'kalpa vriksha' (tree of heaven).
- India figures third after phillipines and Indonesia in area.
- Kerala is the major producer in the country (65% area).

Botanical view:

It occupies a conspicuous position in the vegetative kingdom, owing certain characteristic features of palm: slow growth, unusual thickening at base of the trunk, unbrached, erect, cylindrical, pillar like stem.

- Stem is covered with heavy scars of old leaf bases, a compact magnificient crown of gigantic, feathery, glossy thick-cuticled leave.

- Sheathed at base providing firm attachment to the stem oriented at the top of the truck rendering in a sheath – spadix.
- The absence of top root and the continually growing terminal and commonly known as the 'cabbage'.

Fruit: drupe, one seeded

1) Outer layer of the pericarp: thick & fibrous
2) Inner layer of the fruit: endocarp/ shell very hard, horny/strong with 3 basal poses (one lies embryo)
3) The thin testa cohering to the endocarp is lined with white albuminous endosperm (meat)
4) A large cavity – filled with sweet fluid

Propagation: Seed

Harvesting: for fully matured (for copra & oil) : shaking the nut (with small amount of H2O).

- A large number of coconuts are harvested at immature stage.
- 12 inflorescence in one year.
- In Kerala, harvesting is done at 45 days interval- during summer
  60 days interval- during rainy season
  other places of India harvesting twice/year
  Phillipines & Srilanka- 6 times/year
- Harvesting done by climbing tree, often uses a small ladder.- rope ring around the feet for climbing rest of the tree.
- Then climber examines the stage of maturity of the nuts and cut down bunches.
- Removes dry leaves, sheaths and spathes and cleans the crown at the time of harvesting.
- Other method: knife attached to bamboo pole
- Malaysia & Thailand: Trained monkeys, experienced climbers
- Yield : 60-80 / year

Storage:

- After harvest, stored in heaps under shade for a few days. It is necessaryof loz.

i) Husking becomes easier
ii) The M.C of the meat decreases and its thickness increases the yield of copra and oil also increases.
iii) The quality of copra also improves

- Storage of harvested nuts is beneficial, if the nuts are fully ripe.
- Immature nuts – spoiled on storage

Composition: C.V : 17.4 / 100g

1. Coconut water

Water	:	95.5%
Protein	:	0.1%
Fat	:	0.1%
Mineral matter:		0.4%
CHO	:	4%
Ca	:	0.02%
P	:	0.01%
Fe	:	5 mg/100g

- Because of this composition of tender, coconut water is used widely.

Liquid endosperm – tender coconut:

Ø Refreshing drink
Ø Suitable for saline glucose in intravenal infusions.
Ø Adopted in serious cases of Diarrhea, vomiting, against dehydration.
Ø It increases blood circulation in the kidneys & causes profuse dicrisis.
Ø Urinary antiseptic –eliminates poison through the kidneys in cases of mineral poisoning.

2. Wet meat / Kernel: culinary purpose

fresh: moisture	:	45%
Protein	:	4%
Fat	:	37%
Minerals	:	4%
CHO's	:	10%

3. Coconut flour: partially defatted coconut gratings -> bakery and confectionery nutrition feeding programmes –schools.

4. Edible copra:

dried kernel – Ball copra (whole)
- Cup copra (split half)

It fetches a higher price than the milled.

5. Coconut oil &oil cake:

60-67% oil: illuminant or lubricant, edible purpose, soap making, toilet & toilet preparations.

33-40% oil cake: largely used to feed cattle & poultry as food by the poor people.

6. Coir/ coconut fiber: Commercial product husk of the coconut
- dried, spun into yarn
- make into ropes, mats, mattings, nets and bags etc.,

7. Coconut leaves:
That ching houses, fencing & shading
Coconut trunk: House construction, furniture making.

Lecture No: 22

Cardamom
SC. Name: Elettaria Cardamom muton
Family : Zingiberaccac
- Popularly known as the 'Queen of spice'.
- The total area under cardamom in India is estimated to 73,650 ha. It is mainly cultivated in the three Southern states Kerala (59%), Karnataka (34%) and Tamilnadu (7%).
- Cardamom is used for flavouring various preparations of food, confectionery, beverages and liquore.
- Used for medicinal purposes both in Allopathy and in Ayurveda.
- In the middle East countries, cardamom is used mainly for preparation of 'Gahwa' or 'Arab coffee' (cardamom flavoured coffee).

Botany
- Real stem = underground rhizome
- Areal pseudo stem = leaf sheaths
- Inflorescences or the long panicles with raccmose clusters arise from the underground rhizome but come up above the soil.
- Seeds are black when they fully ripe in a capsule and embedded or covered with their white mucilaginous coat, seeds are 15-20 per capsule with a hard seed coat. (Trilocular capsule-Fruit)

Varieties:
Three cultivars are generally recognized viz, Malabar, Mysore and Vazhukka. They are mainly identifiable by nature of their panicle, shape and size of fruit and other growth features.

1) Malabar cardamom: Fruits are roundish or egg shaped. This type better suited at 600 – 900 meters elevation; and commonly cultivated in Kerala, Tamilnadu and Karnataka at lower elevation.
2) Mysore cardamom: Capsules are bold and long. They are better adopted to an altitude ranging from 900-1200 meters above MSL, and thrive

well under assured and well distributed rain fall condition. This type is cultivated mostly in Kerala.

3) Vazhukka : It is a natural hybrid of Malabar and Mysore type and consequently the plants exhibit various characteristics which are intermediatary between the two types. This type is cultivated extensively in Kerala on elevations ranging from 900-1200m above MSL.

Propagation: by two methods

1. by rhizomes
2. by seeds

Cropping:

- cardamom plant starts bearing from the 2nd year of planting, which may be the 4th or 5th year after sowing.
- Initial flowering is during Jan – and the peak flowering period is from May-June which continuous for about 3-4 months.
- The fruiting period: From the opening of the flower to the ripening of the fruit is nearly 3-4 months.

Harvesting:

- Cardamom yields from the 3rd year onwards, but good yields are expected from the 5th year.
- The peak harvesting period is Oct-Nov.
- Harvesting is continued at intervals of 30-40 days and completed in 5-6 months.
- Considerable skill and experience are required for efficient picking.
- At the time harvest, capsules are at different stages of maturity and distinguished as i) Bud stage

ii) Tender stage–gathered for making pickles

iii) Brown seed stage-shink on drying giving a shiveled appearance.

iv) Dark seed stage-right stage for curing

v) Capsules with stack end intact and the fully ripe stage picked for seed purpose.

Problems associated with harvesting”

- If fruits are left to ripen further, the fruits split during drying.
- If picked under ripe, the fruits will shrink while drying.
- Fruits should be harvested with peduncles as and when they are ready. They should not be stipped.
- After 15 years, the yields of cardamom decreases, although there are some plantations giving record yields even after 25 years.

- After the harvest of cardamoms, they are cured by sun drying or drying by artificial heat.

Curing

- Capsules of cardamom when picked are almost juicy. Therefore curing is necessary before they are stored and marketed.
- Sulphuring is done to remove moisture and it bleaches them out. Due to this practice the natural colour get lost and fetches less price in the market.

i) Sulphuring process: In this method of curing, cardamoms are spread in Bamboo trays one over the other and the sulphur is burnt underneath in special chambers.

Sun drying:

- it takes about 3-4 days and the capsule get dried and bleached.
- Immediately after drying, they should be stored as otherwise they reabsorb moisture.
- General complaint: The sundried capsules can not be stored successfully due to the fact that perfect drying is not possible; as a result of which seeds remain still wet.

Artificial curing:

i) Mud-platform curing: 'crude' method of curing.

- Curing is done in a device of heating mud platform through woodfire.
- In the device there is a shallow platform about 60cm wide and 180-240cm long running along one side of a room and the hallow space underneath running from one side of the wall to the other opening at both the outside ends.
- On one side wood fire is lighted and the hot flames and smoke pass through the hallow platform.
- The green cardamoms are spread on the smoothly plastered platform and dried.

ii) Flue curing:

- The desired temperature is obtained by burning wood fuel in a hearth or chamber.
- The hot air passed through pipes or coils.
- The smoke is allowed to escape through chimneys.
- The room is fitted with rafts and wire meshes which are heated by the above pipes.

Cardamom

treating with 2% washing soda (NaOH) solution for 10min

spreading treated capsules on the rafts & racks

racks arranged in tiers at interval of ------

- Harvested fresh green cardamom have to be soaked in 2% sodium carbonate solution for 10min (2kg NaCO3 in 100Hz per 100kg capsules).
- The capsules are tied in a piece of cloth or in wire basket dripped in the solution for 10 min.
- After draining they are spread for drying.
- The temperature is kept at 550C /3hrs after closing the ventilators.
- Then the room is cooled by opening the ventilation to facilitate the vapour to escape.
- Again temperature is raised to 450C and maintained for 20hrs.
- Further temperature raised to 540C and maintained for 3hrs
- At the end of curing, pods are taken out of the chamber, cleaned by rubbing for the removal of the adhering and lower bracts & stalks.
- The natural colour of the cardamom is thus retained.

White or Bleached cardamom

Cardamom capsules having non-uniform colour fetch poor value in the market, hence these are processed to bleach them to attain a uniform colour. It gives a clear and white appearance. It losses its flavour and in general is not as good as unbleached cardamoms in chemical characteristics.

- The pods are hand picked and are generally sticky to touch.
- World's third most expensive spice after saffron & vanilla.
- Cardamom comes from the Greek word, Kardamom,

1) True or lesser -> Elettaria cardamom

Native to India and Srilanka

2) False or greater -> Amomum or Afromomum subulatum

- Grains of paradise have a pungent and peppery flavour that is in between the flavour ranges of black pepper and dried white pepper.

Chemical composition:

True cardamom 2-10% volatile oil
Essential oil 1, 8 – cineole = 25-45%
a- tepineol acetate =28-34%
linayl acetate = 1-8%
sabinene = 2%

limonene =2-12%
linalool= 1-4%

oil is spicy, sweet, citrus and musty, while the oleoresin is dark green, pungent, cool and burning.

False cardamom: >70% of 1.8-cineole, its camphor taste is due to 'bornyl acetate' minerals present in both= Ca, Mg, K, Mn.

Uses of cardamom:

- Grains of paradisse are used in the spice mixtures raset hanout and other savory dishes of North and West Africa.
- Green cardamom is an essential ingredient in Indian sweets, puddings, yogurt and ice creams.
- Whole form important in chai masala, a special hot tea beverage.
- Aid in digestion, prevents nausea and vomiting.
- Soother coliky babies, induces sweating and cools the body during summer months.
- In Europe: Danish pastries, cookies, cakes, breads glogg (hot special wine punch), apple pie and meat balls.

Lecture No: 23

Palm oil Processing

Palm oil derived from the meso carp of the oil palm fruit

Major steps in the extraction of palm oil are Harvesting, sterilization, stripping, digestion, pressing, clarification and purification.

Harvesting:

- Oil palm fruits mature in about 180 days after pollination.
- Loosening of fruits from the top of bunch
- An indication for havesting

Sterilization:

- FFB (fresh fruit bunches) are steam sterilized at a temperature of 1200C and a pressure 3 kg/cm3 for 1hr in a sterilizer.
- To inactivate lipose enzyme into lipoxidase and to loosens fruit from the bunch.

Stripping:

- Using bunch stripper, which is cylindrical cage rotating at a speed of 20rpm and inclined at an angle to the horizontal is used.
- To separate sterilized fruit and calyx from the bunch

Digestion:

- Mechanical agitation at a temperature of 950C for 30 min to digest the fruit.
- To loosen the pericarp and to breakup the fruit pulp physically.
- In this process 20-30% of the oil is released in the form of oil/water mixture.

Pressing

- Either by hydraulic press for small scale operation or by screw press for large scale extraction.
- In screw press, a continuous processing is envisaged.
- In hydraulic pressing system, the digested pulp is filled in perforated cages and subjected to pressure of 75 kg/cm3.
- The oil-water mixture containing fibre debris and other SS is thus extracted.
- The left over press cake contains nuts, fibre and SS residues.

Nut -> Extraction of palm kernel oil

Fibre and shell-> fuel for boiler

Clarification:

- The oil-water mixture after dilution with water is heated in the clarifer to 950C.
- The oil separates at the top and water containing fibrous residues settles at the bottom, with an inter phase containing proteinaceous matter with occluded oil in the middle as sludge.
- Oil layer is decanted and the sludge is removed from the bottom of the settling tanks.
- Centrifuging is adopted for rapid separation of oil from the sludge.
- The extracted oil should contain less than 2% FFA

Purification:

- Clarified oil is centrifuged to remove dirt and moisture in a high speed centrifuge.
- Further refined for making edible oil, it is subjected to degumming.

Neutralization ®(Refining replaced with this step)

Bleaching and deodourization

Fermentation

Lecture No: 24

Bay Leaf / Laurel Leaf

Sc.Name: Laurus nobilis

Family : Lauraoeac

- Greek name for bay leaf is 'daphnec', which means medicine and poetry.
- The world bay is derived from the Latin baca meaning 'berry'.
- Bay leaf is native to the Mediterranean and Asia.

Botanical view

Bay leaf is a thick, leatery, aromatic leaf with a bright green, glossy upper surface and a pale green colour beneath.

Post Harvest Technology:-

Drying: leaves are dried in shade to the desired moisture level.

Composition: According to ASTA, dried bay leaves contain

Moisture	: 4.5%	Ca	: 1.0%
Protein	:7.6%	P	:0.11%
Fat	: 8.8%	Na	: 0.02%
Fiber	: 25.2%	K	: 0.6%
CHO's	: 50.2%	Fe	: 0.53%
Ash	: 3.7%		

Processing:

I) Essential oil recovery:

- Yield = 1-3% with a characteristic sweet and spicy odour, reminiscent of cajuput.
- Fresh leaves and terminal branches yield = 0.5% oil while dried leaves yield about 0.8%.

Uses:

1) For flavouring:-

- Bay leaves are among the oldest herbs of the world.
- Laurel leaves are used principally in vinegar pickle when packing pig's feet and lamb and pork tongue.
- Flavouring soups, stews, meat and game dishes, fish and sauces, pickling spice and in confectionery also.

2) Medicinal

- Both leaves and fruits, possessing aromatic, stimulant and narcotic properties, were formerly employed for hysteria, amenorrhoea and flatulent collie.

- Principal use in veterinary medicine.

Processed products

II. Fat from Bay or Laurel Berries

Extraction : The berry (pericarp 30%, seed 70%)

↓

pressing / berling with H_2O

↓

skimming off

↓

Fat (yield 20-34%)

Composition:

Unsaponifiable matter : 1-6%
Mixed fatty acids contain lauricanial : 30.35%
Palmitic acid : 10-11%
Oleic acid : 33-40%
Linoleic acid : 18-32%

Uses: Berries are used in diarrheah and dropsy.

Dried fruits mostly contain 1,8 cineol, a-terpineol,a-b pinene, cinnamic acid and methyl ester.

III. Laurel wood:

Use: Laurel wood resembles walnut in grain and colour and is suitable for decorative cabinet work.

Chemical composition of Bay leaf

Essential oil : 0.8-3%
1,8 cineole : 35%
methyl Eugenol: 4%
a- pinene : 12%
b pinene : 6%
linalool:11%
a-terpineol : 6%
limonene : 4%
a-terpinyl acetate: 10%
sabinene : 5%
engenol : 2%

- Bay leaf helps relieve pain in joints, chest, womb and stomach.
- It also eases cramps and ear aches.
- Aids digestion by stimulating gastric functions.

Lecture No: 25

Annatto

Sc.Name : Bixa orellana
Family : Bixaceac

- Annatto is called urucual by the Tupi-Gurani Indiane of the Amazon region.
- 'Achiote' by Aztects in Mexico
- 'Annatto' by Caribs
- 'Achuete' by Philipinos.
- The caribs, mayans and other native Americans dyed their bodies with annatto oil to protect against the sun, thus giving rise to the term 'red skin' by early European settlers in the America.
- Aztecs used annatto seeds to intensify the colour of their chocolate drink.
- Annatto seeds are an important colouring and flavouring spice.
- It is often called 'saffron' by Puerto ricane, this spice was introduced to India by the Portuguese.
- Annatto is indegenious to the Caribbean, Mexico, Central America and South America. It is now cultivated in Brazil, Peru, Guatemala, India and Western Africa.

Botanical view: Annatto is a small dark red skinned seed in a prickly, heart shaped fruit. It is sold as a paste, as oil (extracted from seeds) or ground (from whole seed).

Properties: Annatto is deep golden yellow or orange red in colour. It has a delicate, mild peppery flavour with flowery and early under tones.

Chemical composition:

'Bixin', an oil-soluble apocarotenoid, is the main coloring pigment, with 'norbixin', other carotenoids and apocarotenoids making up 7% of the dry seed.

Uses:

- Annatto combines well with cumin, garlic, oregano and corander.
- The seeds are fried in oil or lard that become a golden orange in colour.
- Then the seeds are discarded and this colored oil is used to fry vegetables, rice, chicken or meats.

- The whole annatto seed is ground into a paste or /and is used with other spices as a rup and to provide a deeper flavour to barbecued pork, poultry and fish dishes.
- Annatta is used in relishes, shades, beverages, gravies, seasonings, baked goods and margarine.

Other uses:

- The ancient mayans and carribs used annatto to paint their faces and bodies in religious ceremonies and in preparation for wars.

Lecture No: 26

Asafoetida / Asafetida

Sc.Name : Ferula asa-foetida

Family : Umbelliferac/ Apiaceae

- Asafoetida was known to early persians as 'the food of the gods'
- In ancient India and Iran, Asafoetida was used as a condiment and as a medicine.
- Asafoetida or Asafoetid is the dried latex or oleo-gum or gum oleoresin, excluded as a very thick and sticky and pasty sap or latex from the living underground rhizome or root stock or tap root.
- Its main growing areas are the eastern parts of Iran and the western part of Afghanistan. In no other part of the world, it is grown commercially.

Botanical view: It is a congealed, dark brown to black resin like gum obtained from the juice of the rhizome of the ferula or giant fennel plant. After drying, it becomes a darker brown, resin like mass. It is sold as different grades of resin, dried granules, chunks or powders.

C.T.C- Cutting, Tearing and Curing

- It is a short process for tea making
- The leaves are fed into a cutting tearing and curling machine.
- This has got two rollers meshing closely against each other.
- The rollers have got about 8-12 teeths / 3 cm.
- Rollers are placed in each away that the teeth of the first roller fits into the grooves of the 2nd roller.
- The rollers crush the leaf, the teeth tear of the leaf and finally they are dried going out.
- The first roller rotates faster than the 2nd one normally in the ratio of 10:1, the size of the bits that come out are about 1 to 1.25 cm.

Grades:

After processing tea (which is dried) leaves are passed on to sorting room to sort them into different grades.

- There is a strong trade objection of the presence of stalks in the teas and it is considered as an impurity. Stalky teas generally are due to coarse plucking resulting in poor liquor quality.
- A machine known as Andrew's breaker is used to break up the dried teas. During this process of breaking, these stalky parts are left intack and can be removed easily by suitable sifting.

Blending: Tea has to be blended before it reaches the consumers. Blending is done to produce a product with uniform character so that the consumer may get a similar product in each packet.

Types of Tea

Green Tea: Preference given to green tea in China and Japan. The leaves for green tea are heated as quickly as possible after harvest to a temperature, which inactivates the oxidizing enzymes. It is then cooled and rolled and by further heating and rolling, it is dried eventually to about 4% M.C.

- Green tea retains more of its cutechin than black tea. (as it is less modified form)
- Green tea is apt to be a little bitter than black tea.
- Good quality leaf with small shoots should be plucked for green tea.
- Green tea liquors have an olive or pale yellow colour but not reddish/ brownish.
- Very strong and pungent.

Oolong tea:

- It has good demand in USA.
- Manufacturing of Oolong tea may be described as an intermediate between that of green and black tea.
- The leaf is lightly withered before manipulation and a light fermentation is allowed to develop before the tea is dried.
- Some oxidation is permitted before the leaf is heated to inactivate the enzyme but not as much as in making black tea.

Brick tea: has good demand in Tibet and China.

- Teas are made into solid cakes or bricks known as brick tea.
- Long and tough leaves are a speciality for the manufacturer of brick teas.
- The coarse leaves are heaped on a cement floor to generate heat.
- A black fungus grows in it that is responsible for importing a peculiar taste of brick tea liked by the drinkers. It also causes the peculiar black colour of the infused leaves.

Analytical study of the Tea

1. Development of flavour and aroma and the formation of certain compounds.
2. Solubility of tamin compounds in tea infusion and give characteristic colour.

- Aroma and flavour are qualities associated with the essential oil of tea.
- During manufacture of green tea, no soluble colour tamin bodies are found. Most of the tamin remain soluble. No essential oil formation during tea manufacturing.
- A green tea infusion consists mainly of tamin, caffeine, gunny substances, CHO's and small quantities of pigments.
- The tea tamin is regarded as the 2nd valuable constituent of tea; the % of caffeine and tamin varies. (Caffeine 2.5-5%; Tanmin 7-14%)
- A typical black tea infusion consists chiefly of tamin and tamin products, caffeine, CHO's and small quantities of nitrogenous substances; a trace of essential oil is also present and small quantities of pigments.

Tamin-> Golden & Red colour, creaming
Caffeine -> A stimulant.

Judging tea quality – 3 factors

1. The appearance, twist and smell of the dry leaf are judged by sight and smell.
2. The colour, brightness and order of the infusion are judged by sight and smell.
3. The colour, thickness, strength, pungency and the flavour of the liquor is judged by sight and taste.

Lecture No: 27

Rosemary

Sc. Name : Rosmarinus officinalie
Family : Labiacae

- The name 'Rosemary' joins 2 latin words meaning 'Dew of the Sea', because it thrives best where fog rolls in from the sea.
- In India it is cultivated in temperature Himalayas and Nilgiri Hills with dry to moist climates.
- Rosemary of commerce: dried leaves.

Botany: It is an evergreen shrub grows upto 2m high, cultivated in Indian gardens, the leaves are narrow, about 2.5 cm long, and resemble curved pine needles.

- The shrub bears a few bluish, white or violet flowers.

Physical appearance:

The colour of the dried herb is brownish green and have a tea-like fragrance.

Flavour: It has an agrecable and fragrant, spicy aroma with a camphoraceous note.

- The taste has fragrant, spicy, pungent, bitter and camphoraceous notes.
- Marketed form: whole form

Harvesting: Commences from the 2nd year to any time upto August, after the full flowering.

Post Harvest Technology: Drying and packing . as the leaves are spicy and thin, they cut into small pieces and are dried under shade, later crushed or powdered and packed in consumer packs.

Composition of Rosemary dried leaves:

Moisture	: 5.7%	Ca	: 1.5%
Protein	:4.5%	P	:0.70%
Fat	: 17.4%	Na	: 0.004%
Crude fiber	: 19%	K	: 1.0%
CHO's	: 47.4%	Fe	: 0.03%
Ash	: 6.0%		

Volatile oil : 1-2% (upon steam distillation)

- In addition leaves contain saponin, tamin, ursolic acid, carnosic scid, amyrins, betulin and rosmariaic acids (phenolic fraction -> Anti oxidant, property).

Processed products:

Volatile oil: Obtained from leaves, flowering tops and twigs (by steam distillation).

- The oil is pale yellow or colourless liquid with characteristic odour of the leaves and a warm camphonaceous taste.
- The chief constituents of the oil are pinche, camphene, cineol, camphor, borneol and bornyl acetate.

Adultration: with eucalyptus, sage and turpentine oils.

Uses:

i. Food flavourant: Fresh tender leaves used for garnishing and for flavouring cold drinks, pickles, soups and other foods.

- Leaves are employed as condiment.

- Dried and powdered form used for cooked meats, fish, poultry soups, stews, sauce, dressings, preserves and jams.

ii. Perfumery & cosmetics:

- Main ingredient in cheap perfumery, scenting of soaps, hair lotions and denaturing of alcohols.
- Also employed in room-sprays and inhalauts.

iii. Medicine:

- The oil is useful in headache and in tardy menstruation.
- An emulsion prepared from the oil is used as a gargle for sore-throat.
- The oil exhibites antibacterial activity.

(against staphylococe aureus, E-coli and Bacillus subtilis).

- Flowers are an excellent source of honey and they impart their characteristic flavour to the honey.

Lecture No: 28

Origanum

Sc. Name: Origanum vulgare

- Also called origanum, oregane, Mexican origanum famous name 'pizza herb'.
- Popular herb of Mediterranean cooking.
- A perennial herb, 30-90 cm high, found in the temperature. Himalayas from Kashmir to Sikkim.
- It has branched leaves which has aromatic property.
- Origanum of commerce: dried leaves
- It grows in Mexico, so called 'Mexican sage'
- In India it grows in Shimla hills and in Kashmir valley.

Harvesting: The leaves and tops are cut prior to blooming.

- Dried in shade and are used to flavour foods in same way.

Post Harvest Technology:

- Oregano should be dried when in flowering in order to allow full development of its aroma or flavour.
- Stalks also picked as they blossom and hang up in small bunches in shade for drying.
- Dried leaves are rubbed at the time of use for garnishing of foods.
- Dried leaf is about 1.5cm long and is in light green colour.
- Its quality is measured by its volatile oil, moisture, total and acid insoluble ash.
- The aroma of dried herb is light green.

- The aroma of the herb is strong camphoraceous and resembles to that of marjoram.
- The herb is traded both as 'whole' dried leaves and in 'ground' form.

Composition of green herb:

Moisture	: 80.0%	Ca	: 1.7%
Protein	:11.7%	P	:0.20%
Fat	: 6.4%	Na	: 0.02%
Crude fiber	: 11%	K	: 1.7%
CHO's	: 53.9%	Fe	: 0.05%
Total Ash	: 9.0%		

Volatile oil content: 0.15-0.40%

Bitter principle = tanmin =0.8%

Thynol =7%

Carvacol= 13%

(free alcohols)

easters as geranyl acetate =2-3%

bicyclic sesquiterpene = 12.5%

- Volatile oil is pale yellow in colour

Phenol content : Nil

- Volatile oil contains 1-pinene, dipentene, lina lool, bi and tri-cyclic sesquiterpenes and palmatic acid.

Uses:

i. As feed flavourant:

- Pizza spice
- is used for flavouring, soups, meat-dishes, pork, fish, egg-dishes and salads.
- The plant is used in Punjab as a pot herb.
- It were formerly employed to flavour ale and beer before hope were introduced in the browing industry.

ii. Medicine

- It is applied in chronic rheumatism, tooth-ache and ear-ache.
- It is used as an external application in healing –lotions for wounds (in combination)
- It is used in gargle and bath.
- It stimulates growth of hair, so oil is used in cosmetics and soap industries.

Lecture No: 29

All spice / Pimenta
Sc. Name : Pimenta dioica
Family : Myrtaieac

- All spice is a native of West Indies and South America.
- It combines in itself the odour and flavour of 'all spices'- Nutmeg, clove, cinnamons, pepper.
- Bears berries which resembles of pepper then hence it is called as pimenta.
- Spice of commerce: Dry unripe fruit.
- Largely grown in Jamaica- jamican pepper
- In India – grows in Kerala, Tamilnadu

Uses:

- It is used for flavouring of food products such as meats, sauces, canned foods, pickles and confectionery.
- Volatile oil extracted by steam distillation contains chiefly engenol.
- Walking sticks and umbrellas are made out of allspice shoots.
- Leaves-> 2% E.oil

2.5 – 4% - Jamaican pimento leaves
2.5% Mexican and Gautemalan pimento
2% Honduran pimento

- In Scandinavian, during voyage, the berries are used to preserve fish in barrel enroute from the outlaying areas to the coastal market.

Botanical view

- All spice is an evergreen tree growing to a height of 12-13 metres.
- Oil grands present on lower surface of leaf.
- Fruit purple, one seeded berry, dark reddish brown hard with a rough surface caused by numerous protuberant oil cavities underlying the exocarp, had two locules separated by a thin partition.

Propagation: by seeds selected from ripe berries germinates with in 15days.

After 6 months seedlings ready for transplanting.

- Starts flowering from 7th – 10th year but peak harvest obtain between 15-20 years.
- When berries are fully developed (july-august) they appear greenish and become glossy and dark later.
- The taste changes from spicy to sweet.
- So to preserve the spicy conditions, berries are harvested before they change to the dark and glossy appearance.

Curing:

- The harvested fruits are sun dried and are frequently turned down with ladles.
- Process of curing lasts 3-12 days till the berries are completely dried.
- Curing is complete when the berries crisp and produce metallic sound when shaken.

Form: Seed of the pimento picked green/ unripe and then dried until it turns to dark reddish brown in colour. It is globular and has a rough textural surface.

- It is slightly larger than black pepper corn

Mexican – larger – less sweet and more mellow
Jamican – smaller – most aromatic
Honduran – larger like – E-oil=2.35%

- Aromatic leaves & barks – to smoked meats and beverages.

Properties: has a warm, pungent taste and the aroma of cloves with sweeter, floral back ground notes.

- Its flavour has a lint of cinnamon, mace and nutmeg with peppery overtones.
- Loose its aroma upon ripening.

Chemical composition:

- E. Oil- 1.5 –5% -> reddish yellow colour

Jamaican pimento

Essential oil : 5% F.Oil :6%
Guatamalan :3%
Phenols :65%
i. engenol : 2%
ii. methyl Eugenol: 2.9 -13%
iii. 1,8 cineole
iv. a- phellandrene
humulene
terpinolene
caryo phyllene

- Astringency of all spice is due to ‘querit anmic acid (8%)’
- All spice has bactericidal, fungicidal and antioxidant properties.

Uses:

- Aztecs & Mayans flavered chocolate drink with allspice seeds.
- Caribs and Indigeneus American – preserving fish and meat.
- During 17th century, pirates in the carribbean smoked and barbeened meat with Allspice which they called “Boucan”.
- Used for picking and marinating fish-spiceblend

- In sauces and sausages-> extracted oil.
- In ketchup, jams, pumpkin pies, gravio, roast and ham.
- Well with smoked pork, beef and fish.
- All spice leaf is used in baked goods, chewing gum, candy, icecream, fruit soup, teas and liquors.
- All spice rubbed over pork, chicken or fish that are then cooked over a fire.
- It gives a smoky and spicy flavour to the barbecued product.
- Middle eastern use flavour stews, kibbch (ground lamb with cracked wheat) and pilafs with ground all spice.
- The erapeutic uses:Aztecs and Mayan-> embalm bodies
- Promote digestion and remove gases from the upper intestinal tract.
- Mild anaasthetic for aching gums and teeth
- Mild pain reliever for muscles and joints.

Composition of All spice (dried b---)

Moisture	: 8.8%	Ca	: 0.8%
Protein	:6.0%	P	:0.1%
Fat (etha --)	: 6.6%	Na	: 0.08%
Fiber	: 21.6%	K	: 1.1%
CHO's	: 52.8%	Fe	: 7.5%
Total Ash	: 4.2%		

Vit.C = 39.2 mg/ 100gm

Niacin = 2.9 mg

Characteristic odour is due to 3.3 – 4.5% E.Oil (mainly in pericarp)

Quercitannic acid =8%

Soft resin with burning taste

Fixed oil = 5.8% Crude starch =20%

Ash = 5.8% Trace of alkaloid

- Package: packed like black pepper in gunny bags, internally lined P.E.

Processed products:

i) Pimenta Berry oil:- Steam distilled crushed dried (10hr) berries

Engenol = 65 –89% ->3.3 – 4.5% oil

ii) Pimenta leaf oil :- Steam distilled dried leaves

0.7 – 2.9% oil but has inferior odour and flavour that of berry oil.

Engenol= 65 – 95%

iii) Pimenta oleoresin and oil:- only small scale

Lecture No: 30

Thyme

Sc. Name: Thymus vulgaris

Family : Labiate / Lamiaccac

- Thyme is native to the Mediteerranean regions
- The name 'thyme' comes from the Greek word, 'thymon', meaning 'courage'.
- There are numerous varieties of thyme, each different in flavour: garden thyme, wild thyme, lemon thyme, orange thyme, avise thyme, caraway thyme and moroccon thyme etc.,
- Form / economic part: Fresh / dried leaves
- The fresh leaves are green, pointed, oval, slightly rolled and covered in fine hairs.
- Thyme has a piney, phenolic taste with herbaceous and slightly floral aroma. It turns black in an acidic medium (Aoneato sauce) and loses its aroma quickly with heat. Its flavour is retained in the dried herb.
- The essential oil content ranges from 1.5% to 5%. It is colourless to pale yellowish red and predominantly contains thymol.

Composition of E. oil is

Thymol : 12-61%

Carvalol : 0.4 – 20.6%

1,8 cineole : 0.2 – 14.2%

r - cymene : 9.1 – 22.2%

linalool:2.2 – 4.8%

borncol: 0.6 – 7.5%

a- pinene : 0.9 – 6.6%

camphor : 0.7 – 3%

- Its oleoresin is green to brownish green and is viscous.
- Thyme contains vitamin A, niacin, Ca, sodium, potassium, magnesium and phosphorus and soda.

Uses:

- Thyme is European cooking added during cooking or toward the end of cooking or even sprinkled over the dish at the serving table. It pairs wellwith fatty foods, such as mutton, goose, duck, pork, tomato-sauce, stuffings, roasts, fish and wine.
- It is used to flavour pickled olives and the liquor Benedictine, and it is combined with marjoram in many dishes.

- Cajun and Creole cooking use thyme as part of a creating mix for fish or meat before they are blackened. The blackening spices become dark brown but not cherred, so their flavour is retained.

Therapeutic uses:

- Thyme was used by the ancient greeks to purify temples and by romans to infuse bath water.
- Used to treat infections, digestive complaints, and respiratory ailments, such as bronchilis, and whooping cough.
- It relieve muscle pains.

Lecture No: 31

Savory

Sc.Name: Satureia hortensis

Family : Labiatac

Savory of commerce: dried leaves & flowering tops (winter savory)

Best quality -> dried leaves (summer savory)

- It grows in Southern France, Germany, Spain, Europe, England, Canada and USA.

Botanical view: Savory is an erect pube scent annual herb, grows upto a ht. of 25-35cm with pinkish branches.

- In India it grows in Kashmir.

Post Harvest Technology: drying under shade

Marketed as 'whole' and ground form.

Processed products:

Essential Oil: 0.1 – 0.2% of vol. oil from leaves and flowering tops.

Composition of dried herb and fresh herb.

Fresh herb	Dried herb		
Moisture	: 71.88%	9.1%	Ca :2.2%
Protein	: 4.15%	7.1%	P :0.14%
Fat	: 1.65%	5.2%	Fe :0.04%
Sugar	:2.45%	54.6%	Na : 0.02%
Fiber	: 8.6%	15.3%	K : 1.1%
Ash	: 2.11%	8.7%	

Uses:

- Savory is used in flavouring soups and sauces, egg, salad dishes, canned meats and poultry dressing.
- Used in pork sausage and in vegetables.

- The antioxidant property of the savoury herb is due to the presence of 'labiatic acid'.

Lecture No: 32

Sage

Sc. Name : Salvia officinalis

Family : Labiatae

Introduction:

- Native of the Mediterranean area.

Botanical view: Stems are shrubby, white woolly, 30-60cm tall, and the leaves are grayish green, aromatic, entire, petiolate, oblong, 7-8 cm long, base narrowed or spear shaped or round.

- Drying gives silvery gray colour & soft velvety texture to the leaves.
- In India it is cultivated in Jammu for volatile oil.
- The odour is strong, fragment and aromatic/ and the taste is aromatic, warm some what astringent and a little bitter.

Different forms of sage:

Sage leaf is available in the market in following forms.

i) whole ii) cut iii) rubbed iv) ground

Whole leaf sage: Cleaned and dried whole leaves .

Cut sage:- also called as cracked, sliced, chopped, and butchers chop etc. it refers to leaves that have been cut into smaller pieces. Particle size ranges from 0.3-0.6cm.

Rubbed sage: sage which has under gone minimum grinding and a coarse sieve.

- Rubbed sage is a fluffy, almost cotton like product, unique among ground herbs. Many sausage makers prefer this as they believe that it preserves flavour longer and blends into the product very easily.

Ground sage: ground form of sage leaves.

Post Harvest Technology: Drying is an important operation.

- Cleaned in cold water to remove dirt.
- Dried under shade to retain natural colour and flavour.
- Spread on screens and dried in a well-ventilated warm room.

Composition:

Moisture	: 5.7%	Ca	:1.8%
Protein	: 10.2%	P	:0.09%
Fat	: 14.1%	Fe	:0.03%
Crude Fiber	:16.0%	Na	: 0.01%
CHO's	:46.3%	K	: 1.0%

Total Ash : 7.7%

- Adultrated with Spanish sage or Greek sage.

Storage: stored under cool, dry conditions.

- Excessive heat will make it to loose flavour
- Danymell will tend to cake the powdered pdts.
- Packed in air tight containers and stored at room temperature (upto 12 months)

Processed products:

i) Volatile oil:- 1.3 – 2.6%

- Steam distillation of dry sage leaves.

Volatile oil composition: (sage)

a- pinene : 1.8%

cineole, linalyl acetate : 10.1%

Thujone :44.45%

Traces of borneol, borny/ acetate, farnesol and camphor.

Uses:

In foods: the aroma is strong, fragrant and spicy also taste is fragrant, spicy, warm, astringent and a little bitter. So it is used to flavour meat and fish dishes.

- Used largely in poultry dressings, sausage, and hamburger seasoning in the western countries.
- In food industries ->standard spice in making stuffing for food, meats and sausage.
- Fresh leaves – in salads and sandwiches
- Young leaves – in tea making
- Dried leaves – cheese dishes, cooked meat, vegetables.

Medicine: mild tonic, astringent and carminative.

- Treatment of sore throat
- Cure female disorders
- Used in tooth and mouth washes, gargles, poultries, tooth powders, hair tonics and hair dressings.

Perfuming: used in perfumes as a deodorant and used in insecticidal preparations

Anti-oxidant: Poly-hydric phenol.

By-products: residue after steam distillation used with oil for flavouring foods.

Seeds =18% protein used as a bonding agent

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