AmbujaNeotia

THE NEOTIA UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

Post-harvest Management and Value Addition of Fruits and Vegetables

PRACTICAL MANUAL

COURSE CODE: CC-AGP 647 CREDIT : 2 (1+1)

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CONTENT

Exp 1: Applications of different types of packaging, containers for shelf life extension of Fruits and Vegetables.

1. Introduction

Packaging fresh fruits and vegetables is one of the more important steps in the long and complicated journey from grower to consumer. Bags, crates, hampers, baskets, cartons, bulk bins, and palletized containers are convenient containers for handling, transporting, and marketing fresh produce.

2. Objective

To understand

i) Different types of packaging for fresh fruits and vegetables.

ii) Selection of appropriate packaging for specific product to minimize transition injury and prolong shelf life.

3. Materials required

i) Baskets made from bamboo, cane, straw, palm leaves.
ii) Straw or hay.
iii) Wooden crate of approx. dimension 1.5 ft x 1ft x 1ft.
iv) Corrugated fiber box of approx. dimension 1.5 ft x 1ft x 1ft.
v) Pulp containers made from recycled paper pulp and a starch binder are taken of specific shape.
vi) Plastic mesh bags and paper bags.
vii) Transparent plastic packets with perforations and zippers or sticker flap.
viii) Transparent stretchable plastic film of width min 1 ft and considerable length.
ix) Thermocol tray.
x) Transparent rigid,transparent, plastic boxes with perforations and lock mechanism.
xi) Rigid coloured plastic boxes having slits at the sides.
xii) Vegetables like tomato,leafy vegetables, okra, potato, onion, bell pepper.
xiii) Fruits like grapes, apple, mango, guava.

4 . Procedure

i) Fruits or vegetables are cleaned and stacked inside the basket, crates, mesh bags, corrugated fibre box or plastic box.
ii) The fruits or vegetables are placed in respective pockets designed in the pulp containers, rigid, transparent plastic boxes.
iii) Leafy vegetables are packed inside perforated zipper pouches.
iv)Some firm vegetables like bell peppers, tomato are organized in thermcol tray and tightly wrapped with shrink wrap.

v) All packages are covered with their respective sealing mechanisms.

5. Conclusion

Basket made from bamboo, cane and wooden boxes are eco-friendly. But they are difficult to clean and cause pressure damage when tightly filled whereas wooden boxesare difficult to handle as because they have a marked weight of themselves.While, corrugated fibre boxes significantly reduce contamination from pathogenic and spoilage microorganisms andincreases the shelf life of fruit and vegetables. As for pulp containers, they can absorb surface moisture from the product and are also biodegradable and recyclable.Mesh bags has the advantage of uninhibited air flow, but do not offer protection from rough handling or contaminants.Plastic Film bags are clear, allowing for easy inspection of the contents, and readily accept high quality graphics; hence, good for retail packaging.Shrink wrap can reduce mechanical damage and provide a good surface for stick-on labels, besides reducing shrinkage and protecting the produce from disease.The transparent rigid plastic boxes are ideal for retail packaging as it provides mechanical protection to the products inside and the perforation at top and bottom lets easy passage of air inflow and thus increases shelf life. Coloured plastic crates are durable as slits lets air passage inside and keeps the products fresh for a longer time.



Packaging materials from natural source

Wooden crate packaging

Corrugated Fibre box packaging

Pulp containers packaging

Paper bag and mesh bag packaging

Plastic film packaging

Plastic field boxes

Shrink wrap packaging

Rigid plastic box packaging

VIDEO LINKS:

Packing fruit & vegetables https://youtu.be/BfehumdLZ08
Onion Potato Garlic Orange Mesh Bag Clipping Machine https://youtu.be/X9z0tmw2_Lk
Fresh Cut Fruit https://youtu.be/o8K12YeTVjM

Note Reference:

ICAR Science & Technology Newsletter
https://icar.org.in/files/newsletters/icar-news/ICAR-News-July-Sept-09.pdf

NC State Extension Publications/ NC State Extension Publications
https://content.ces.ncsu.edu/packaging-requirements-for-fresh-fruits-and-vegetables

Exp 2: Effect of temperature on shelf life and quality of produce.

1. Introduction:

The shelf life of fresh fruit and vegetables can be controlled through postharvest management of the two most important determinants of storage life and quality — respiration and transpiration. Proper control of temperature and relative humidity is the key to maximising storage life and marketable quality.

2. Principle:

Temperature

By lowering produce temperature as soon as possible after harvest — generally within four hours — the following effects are achieved:

- Respiration rate is decreased.
- Water loss is reduced.
- Ethylene production is suppressed.
- Sensitivity to ethylene is reduced.
- Microbial development is slowed.

Relative Humidity

High humidity should be used with low temperature storage because humidity and warmth combined favour the growth of fungi and bacteria.
Each product handled has its own particular temperature requirements. (Table 1).

3. Objective

i) Understanding precooling and ZECC technology for extending the shelf life of fresh fruits and vegetables post harvest.

ii) Maintaining the keeping quality of the fruits and vegetables as intact as possible through manipulation of temperature and relative humidity.

4. Materials required

- Vegetables like carrot, cabbage, okra, cucumber.
- Clean water
- Crushed ice
- Large utensils
- Boxes with plastic sheets for covering inner surface

Table 1: **Recommended temperature and relative humidity for some fruits and vegetables and the approximate storage life under these conditions (Source: FAO)**

CROP	TEMPERATURE (°C)	RELATIVE HUMIDITY (%)	STORAGE LIFE (days)
Apple	-1-4	90-95	30-180
Banana - Plantain	13-15	90-95	7-28
Cabbage	0	98-100	150-180
Carrot	0	98-100	210-270
Cucumber	10-13	95	10-14
Eggplant	8-12	90-95	7
Ginger	13	65	180
Guava	5-10	90	14-21
Lemon	10-13	85-90	30-180
Mango	13	90-95	14-21
Okra	7-10	90-95	7-10
Onions	0	65-70	30-240
Peas	0	95-98	7-14
Potato	4.5-13	90-95	150-300
Tomato (red)	8-10	90-95	8-10

5. Procedure

I. Refrigeration

The fresh fruits and vegetables are stored at appropriate low temperature along with necessary relative humidity post harvesting. But a treatment of precooling just after harvest prior to refrigeration enhances the shelf life of the produce.

i) Precooling

As deterioration is proportional to the time produce is exposed to high temperatures, precooling is beneficial as it rapidly reduces the temperature of the produce.

Method of Precooling

Precooling can be done in following ways:-

a. Cold water:	Hydrocooling	Fresh vegetables are cooled by immersing in water.

b. Contact with ice:	Crushed ice	Crushed ice is laid down in between the layers of the fruits or vegetables kept in plastic boxes.

ii) After precooling, the vegetables are lightly dried in air and stored at appropriate temperature (as listed in table 1) in refrigerator.

Hydro cooling

Ice cooling

II. Zero Energy Cool Chamber (ZECC)

It is alow cost cooling technology that does not require any electricity or power to operate and all the materials required to make the cool chamber are available locally, easily andcheaply. The cool chamber can reduce the temperature by 10-18°C of ambient temperature and maintain high relative humidity of above 90%throughout the year that can increase the shelf life and retain the quality of fresh horticultural produce.

Requirements

•Construction materials: bricks, sand, bamboo etc.
•Top cover: khaskhas fixed in a bamboo-frame.
•Watering of the chambers: watering can or bucket and mug, water tank, drip system etc.
•Plastic crates for storage and plastic sheet for cover.
•Hand sprayer (small) for spraying of insecticides/fungicides.

Procedure

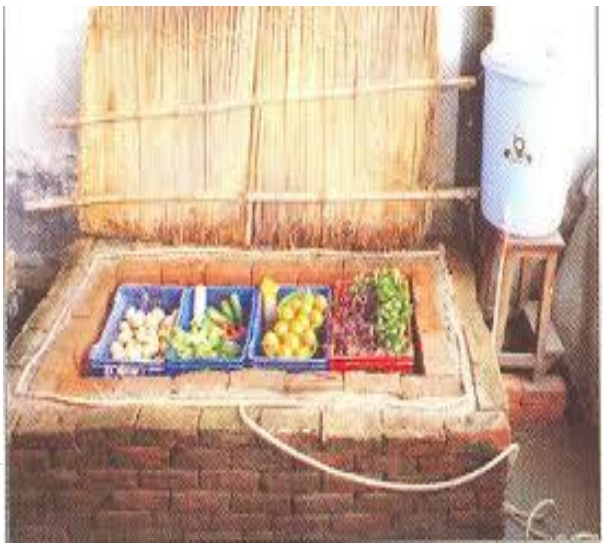
For construction of zero energy cool chamber select an-upland having a nearby source of water supply.

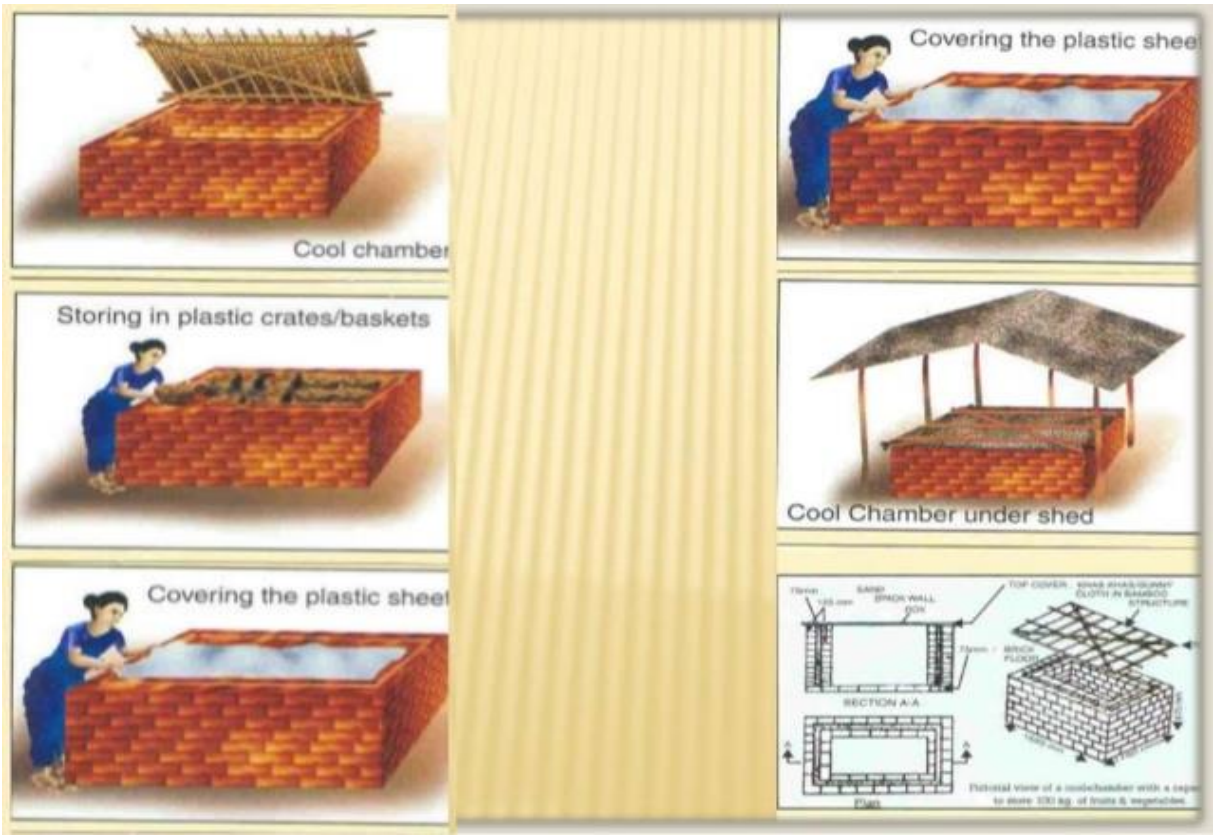
•Make floor of the chamber with the help of bricks size 165 cm × 115 cm.
•Erect the double bricks wall on the above floor to a height of 67.5 cm leaving a cavity of 7.5 cm.
•Drench the chamber with water and soak the fine riverbed sand with water. Fill the cavity between the double brick wall with this wet sand.
•Make a frame of top cover with bamboo (165 cm × 115 cm) frame and straw or dry grass.
•Make a thatch/tin/asbestos shed over the chamber in order to protect it from direct sun or rain.
•After construction, keep the sand, bricks and top cover of the chamber wet with water regularly.
•In order to achieve desired temperature and relative humidity, water twice daily (morning and evening). Alternatively, fix a drip system for watering with plastic pipes and micro tubes connected to an overhead water source.
•Store the fruits and vegetables in this chamber by keeping in perforated plastic crates. Cover these crates with a thin polyethylene sheet.
•The cool chamber should be reinstalled once in 3 years with new bricks utilizing the old bricks for other purposes.

Precautions

•The site should be selected where breezes blow and should be built in an elevated place to avoid water logging.
•Only clean, unbroken bricks with good porosity must be used sand should be clean and free from organic matters, clay etc.
•The bricks and sand should be kept saturated with water. The chambershould not be exposed to sun, rain.
•Only plastic crates should be used for storage and avoid bamboo baskets, wooden/fibre board / boxes, gunny bags.
•Efforts should be made to prevent water drops coming in contact withstored material.
•The chamber should be kept clean and disinfect the chamber periodically with permitted insecticide/ fungicide/ chemical, to protect from fungus, insect / pests, reptiles, etc.

Zero Energy Cooling Chambers (ZECC)





Different stages in construction of ZECC

VIDEO LINKS:

Cooling Methods https://youtu.be/AmTeTHj1tpk

Storage structures for fruits and vegetable https://youtu.be/8dSCdSV1v04

Build your own Zero Energy Cooling Chamber (ZECC) https://youtu.be/enOjVc-kN7Q

Note Reference

http://www.fao.org/3/y4893e/y4893e06.htm

Govt of Western Australia- Manual for Storage of fresh fruit and vegetables
https://www.agric.wa.gov.au/fruit/storage-fresh-fruit-and-vegetables

CBSE practical manual- Basic Horticulture
http://www.cbseacademic.nic.in/web_material/publication/cbse/36BasicHorticulture-I-XI.pdf

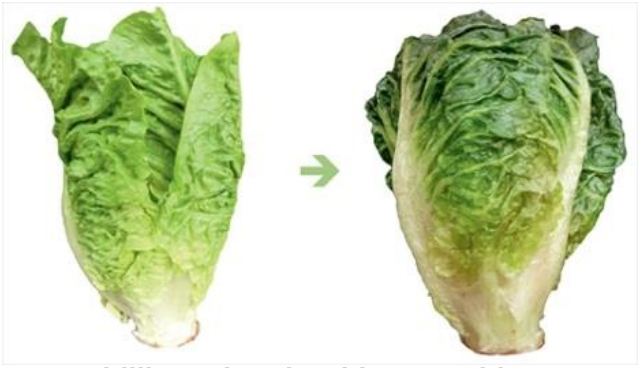
IARI- low cost storage technologies for preservation of fruits and vegetables.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwia9a7XgPjtAhUlheYKHdt5CqwQFjAPegQIGxAC&url=https%3A%2F%2Fwww.iari.res.in%2Fdownload%2Fpdf%2Fstory4_eng.pdf&usg=AOvVaw0DHvx_XwZYeNWMeQ3JOP9R

Exp 3: Demonstration of chilling and freezing injury invegetables and fruits.

Introduction:

Refrigeration is the most widely used method for extending the postharvest life of fruits and vegetables. However, low temperatures may produce injuries to plant tissues. Freezing (prolonged exposure to temperatures lower than 0 °C); forms ice crystals inside tissues. This causes damage.

Most chilling sensitive crops are of tropical or subtropical origin. For example, tomatoes, peppers, eggplants, banana etc. Some temperate crops may also be sensitive. For example, asparagus, potato, some apple varieties, etc. Critical temperatures for these crops range from 0-5 °C, while those of tropical origin are from 7-15 °C.



Chilling Injury in Chinese Cabbage

Objectives

Identify the various symptoms of chilling injury and finding out the optimum temperature for storage of fruit (banana).

A. Symptoms of Chilling Injury:

- *Skin pitting* - is a common chilling injury symptom that is due to collapse of cells beneath the surface. The pits are often discoloured. High rates of water loss from damaged areas may occur, which accentuates the extent of pitting. (e.g. eggplant)
- *Water-soaking* - in leafy vegetables and some fruits (e.g. papaya)
- Fruit that has been picked immature may fail to ripen or ripen unevenly or slowly after chilling (e.g. tomato).
- Rotting - Leakage of metabolites and ions during chilling injury, together with degradation of cell membranes, provides substrates for growth of pathogenic organisms, especially fungi. Such pathogens causes rotting.

Produce	Lowest safe storage temperature (°C)	Symptoms
Banana	12	Brown streaking on skin
Cucumber	7	Dark-coloured, water-soaked areas
Eggplant	7	Surface scald
Mango	12-13	Dull skin, brown areas
Papaya	7-15	Pitting, water-soaked areas
Tomato	10-12	Pitting, Alternaria rots

B. Experiment to demonstrate Chilling injury in banana in cold storage

Introduction

Cavendishtype banana (Musa acuminatacv. Cavendish L.)is one of the major horticultural products of the world providing an enormous amount of produce throughout the world yearly. Due to its physiologyand origin,among improper cold storage conditionsmature green banana fruits easily suffer a chilling injury (CI) called physiological damage with its unique visible symptoms.

Objective

The aim is to observe and monitor the low but not freezing temperatures induced chilling injury phenomena of green-ripe banana.

Materials and methods

1. Mature, green and fresh Cavendish type bananas were obtained frommarket in uniform maturity.
2. Bananas were stored in temperature controlled refrigerators at temperatures of 2.5±0.5 °C, 5±0.5 °C and 10±0.5 °C.
3. Control samples were cold stored additionally at slightly above optimum, at 15±0.5 °C.
4. Samples were cold stored for 8 days and subsequently for 8 days of shelf-life at 20-22 °C wrapped in LDPE bags.
5. Six measuring points on thetwo opposite sides were equally distributed along the banana length:one near the stem-end, one at the middle part and one close to the tip (3 for concave side and 3 for convex side).
6. They were selected for surface color measurements- green to brown.
7. Mass loss (% of fresh weight) was calculated based upon the measured weight data of each sample on every measuring day.

Results and discussion

- Concerning the mass loss change of the different treatments, no significant difference was found between the chilling injury inducing temperatures(2.5,5 and 10 °C).
- After the 3rd–4thday,a significant difference was found between at15 °C stored samples and the samples stored at and below 10 °C, followed by a steep and significant increase after the removal to shelf-life (after 8days) conditions with room temperature.

Conclusion

Chilling injury related physiological responses of mature green banana stored at different chilling injury inducing temperatures (2.5, 5 and 10 °C) and near optimal (15°C) cold storage temperaturewere investigated. Mass loss change clearly showed the storage temperature dependency with a significant difference between the optimal and chilling inducing temperaturesbeing more pronounced during cold storage. After removal to shelf-life, at 2.5, 5 and 10 °C stored samples' mass loss increase showed the same intensity change but with a one day long delaycompared to data of 15 °C.

Reference

Zsom,Strohmayer,Lien Nguyen, Hitka,Zsom-Muha. Chilling Injury Investigation by Non-Destructive Measuring Methods during Banana Cold Storage.Progress in Agricultural Engineering Sciences 14(2018) S1; 147–158. DOI: 10.1556/446.14.2018.S1.14

e-krishishiksha- IASRI http://ecoursesonline.iasri.res.in/mod/page/view.php?id=17073

Exp 4:Extraction and preservation of pulps and juices.

Introduction

Fruit juice is the natural liquid expressed by pressure or other mechanical means from the edible portion of the fruit. They are generally extracted from fruits in a number of ways, depending on their structure and composition. The composition of juice is unaltered during preparation and preservation.

Objective

i) Learn different methods and equipment to be used for extraction of juices and pulp that depends upon the structure of fruit, location and character of the tissues in which the juice is located.
ii) Learn different methods of preservation of the extracted juices.

Materials required

Requirements for extraction and preservation of pulps and juices are as follows:

Extraction

• Fruits- lemon, mosambi, pomegranate, pineapple, water melon, mango
•Pulpers
•Manual juice extractor
•Lemon squeezer
•Fruit grater
• Knife, peeler
•Aluminum pan
•Stain less steel pans
•Wooden laddle

Preservation

• Extracted fruit juice/pulp
•Gas burner/heating arrangement
•Sodium benzoate
• Potassium metabisulfite (KMS)
•Cooling tank
•Stain less steel pans
•Thermometer
• Funnel
• Beer bottles, Jerry cans, Glass containers and closures

Method for preparation of fruit juice:

1. SELECTION OF FRUITS:

Only fully ripe fruits are selected. Over ripe and unripe fruits adversely affects the quality of the juice.

2. SORTING AND WASHING:

Diseased, damaged or decayed fruits are rejected or trimmed off. Dirt and spray residues of arsenic, lead etc are removed by washing with water.

3. JUICE EXTRACTION:

Mango, water melon, etc.

•These are all pulpy fruits therefore a pulper can extract the juice/pulp easily.
•Peel and cut the fruits in general before placing in the pulper.
•These are then crushed and pressed by the paddles against the cylindrical sieve.
•The juice/pulp flows out through the sieve into jacket and collect the juice/pulp by placing in a container below the pulper.
•The coarse residue, stone etc, passes out at the lower end of the sieve.

Mosambi, lemon

•Cut the citrus fruits in to two halves.
•Hold or press the cut half against lime squeezer..
•Collect the reamed juice in a container placed below.

Pomegranate, pineapple,
•In order to extract the juice from the above-mentioned fruits you have to grate or crush them in a grater or crusher.
•Then place the grated or crushed mass in a filter cloth tie it properly but loosely.
•Carefully put the filter cloth containing grated or crushed mass inside the basket.
•Put the load/wooden disc on the filter cloth containing grated or crushed mass and press the juice out by hand operated or hydraulic type press.

Hydraulic Press Juice Extractor

Screw type Juice Extractor

Manual Juice Extractor

Fruit Pulper

Lime squeezer

Lemon Squeezer

Method of p

Either of the following two methods of preservation can b

a) HEAT PROCESSING

•Heat the juice or pulp to about 100°C for sufficient time to kill the microorganisms causing spoilage.
•Fill the almost boiling hot juice in preheated glass bottles without giving any head space and cap it immediately.
•Keep the bottles in a horizontal position and cool them in air.

b) CHEMICAL PRESERVATIVES

•The two permitted preservatives are viz. i) sodium benzoate and ii) Potassium metabisulphite (KMS).
•Addition of 0.06 to 0.1 % sodium benzoate is sufficient in juice having a pH of 3.5 to 4.0.
•Addition of 0.15–0.2 % potassium metabisulphite is sufficient in juice/pulp having a pH of 3.5 to 4.0.
•Weigh exact amount of preservative and dissolve in small quantity of freshly boiled and cooled water before adding to heated and cooled pulp/juice.
•Fill in the container (glass jar, jerry can etc) and close it securely.

Precautions for preservation
•The KMS should not be used in naturally colored juices like phalsa, Jamun, pomegranate and strawberry juices, on account of its bleaching action.
•It should alsonot be used in those juices, which are to be packed into tin containers, because it may act on the tin of the containers causing pinholes, forms hydrogen sulphide and black compounds.
•KMS should be first dissolved in a small quantity of water and then added to the juice to be preserved.

Conclusion
The extracted juice/pulp can be preserved for nearly 1 month if the bottles are kept in cool and dry place.

GENERAL PRECAUTIONS
•Avoid overripe and microbiologically spoiled fruits for making juice and pulp.
•Wash the extractors and other equipment with hot water to reduce thechance of infection.
•Preserve the juice and pulp immediately after extraction in order to avoid quality deterioration and incidence soilage.
•Dry the pomace immediately in order to avoid spoilage and use it for the production of value added product.

VIDEO LINKS:

Fruit pulp and fruit juice machine, vegetable pulpermachine,pulper machine, jam mixer machine https://youtu.be/OldeL5uizds

PR 100 Commercial Hydraulic Juice Press Demo https://youtu.be/CQP_M21yVVI

Note Reference:

- e-krishishiksha- IASRI http://ecoursesonline.iasri.res.in/mod/page/view.php?id=17073
- Acharya Ng Ranga Agricultural University/department Of Food Science And Technology(Study Materialhttp://www.rvskvv.net/images/Fruits_Vegetable_Processing_16.04.2020.pdf

Exp 5:Preparation of jam.

Introduction

Jam is a product made by boiling fruit pulp with sufficient amount of sugar to a reasonably thick consistency, firm enough to hold the fruit tissues in position. Apple, pear, sapota (chiku), peach, papaya, plum, straw-berry, mango and pineapple are used for preparation of jams. It can be prepared from one kind of fruit or from two or more kinds.Jamcontains0.5-0.6percentacidandinertsugarsuchas glucosewithnotmorethan40 percent.As perfruitproductorder(FPO),Fruitjamshouldhaveminimum68 percentsugar(TSS)andminimum45 percentof fruitpulp.

Fruit Jam

Objective

- Knowing the methods of preparation and preservation of jam along with recipe with Apple/Mango/Pineapple.
- Knowing the difficulties, precautions to be taken and technical know-how of the final product quality.

Materials required

•Apple/Mango/Pineapple
•Peelingandcuttingknives;
•Strainer/muslin cloth;
•Grateror pulper
•stainlesssteelutensils;
•Glassjar;
•Refractometer;
•Cooking Thermometer;
• Ladle.

Procedure

•Selectgoodqualityripebutfirmfruits.
•Washthefruitsandpeelthem.
•Extractthepulpfromfruitsanddiscardpeelandstone/seed.
•Crushthepulpto makeit uniform;
•Addrequiredquantityof sugarandcitricacidas mentioned in Table 1. ;
•Boilthepulpalongwithsugarandcitricacid.Addlittlewaterto makethe pulp softandto dissolvethesugar;
•Concentrateit tillthetotalsolublesolids(sugar)reaches68percentortemperatureup to 105 °C;
•Fillthe jamin sterilizedwidemouthbottlesup to theneckandsealit withcap;
•Invertthebottletillit cooldown.It willhelpto blocktheair passagefromthe cap;
•Storethebottlesin coolanddryplace.

Table 1.:Recipe for Preparation of Fruit Jam

Product	Pulp (kg)	Sugar (kg)	CitricAcid(g)	Water(ml)
Applejam	1.0	0.75 -1.00	2.5	200
Mango jam	1.0	0.75 -1.00	3.0	100
Pine apple Jam	1.0	0.75 -1.00	1.5	50

Precautions

•Firmripefruitsshouldbe used.
•It is necessaryto haveacidandsugarpresentin correctproportiontogetwellset jam.
•Jamshouldbe boiledrapidlyuntilendpoint (68 percent) is reached.
•Usesterilizedbottleandcapforpackingjam.

Conclusion

The jam prepared is stored in cool-dry place. They are consumed with various deserts or bread.

FLOWCHART FOR PROCESSING OF JAM

Ripe firm fruits

↓

Washing

↓

Peeling

↓

Pulping

(remove seed and core)

↓

Addition of sugar (add water if necessary)

↓

Boiling

(with continuous stirring)

↓

Addition of citric acid

↓

Judging of end-point

↓

By further cooking

Up to 105°C or 68-70% TSS or

By sheet test

↓

Filling hot into sterilized bottles

↓

Cooking

↓

Waxing

↓

Capping

↓

Storage

(at ambient temperature)

VIDEO LINKS:

3 Ingredients Mango Jam Recipe with Storage Instructions ~ Mango Delight S1 E6
https://youtu.be/8wWBaQe2MKQ

BBC Work Experience Project - Jam Production sequence https://youtu.be/hUPsumcpwMU

Note reference:

- TNAU Agritech portal/ post harvest technology/ preparation of squash https://agritech.tnau.ac.in/postharvest/pht_fruits_intro.html
- FAO Fruit and vegetable processing manual http://www.fao.org/3/v5030E/V5030E0m.htm

Exp 6:Preparation of jelly

Introduction

A jelly is a semi-solid product prepared by boiling a clear, strained solution of pectin-containing fruit extract, free from pulp, after the addition of sugar and acid. A perfect jelly should be transparent, well-set, but not too stiff, and should have the original flavour of the fruit. It should be of attractive colour and keep its shape when removed from the mould. It should be firm enough to retain a sharp edge but tender enough to quiver when pressed.

Objective

- Knowing the methods of preparation and preservation of jelly along with recipe of Guava/Karonda.
- Knowing the difficulties, precautions to be taken and technical know-how of the final product quality.

Materials required

•Guavas/Karonda
•Knives;
•Grater;
• Masher
•Jellythermometer/refractometer;
•Jelmeter;
•Utensils;
•Glassjars;
•Caps, etc.
• Muslin cloth
•Heating arrangement

JELLY

Procedure

•Selectripeandfirmfruits;
•Washthefruits,peelandmakeslices;
•Boilthesliceswithequalquantityof water;
•Addcitricacid(g)whileboiling;
•After 3 minboiling,straintheextractthrougha muslincloth;
•Performpectintestusingjelmeter.Fillthejelmeterwithextractandallowto droptheextractforoneminute.Notethelevelof extract.It willindicatetheamountof sugarto be added;
•Addabout750.g sugarfor1 litreof guavafruitextract;
•Boilthemixturetilltheconsistencyreachedabove65 percent(TSS).Itis checkedby refractometeror whentemperaturereaches 105°Cinjellythermometer;
•Removethescumandpourthejelly in bottles;
• Let the jellycoolandcoverit witha tightcap.

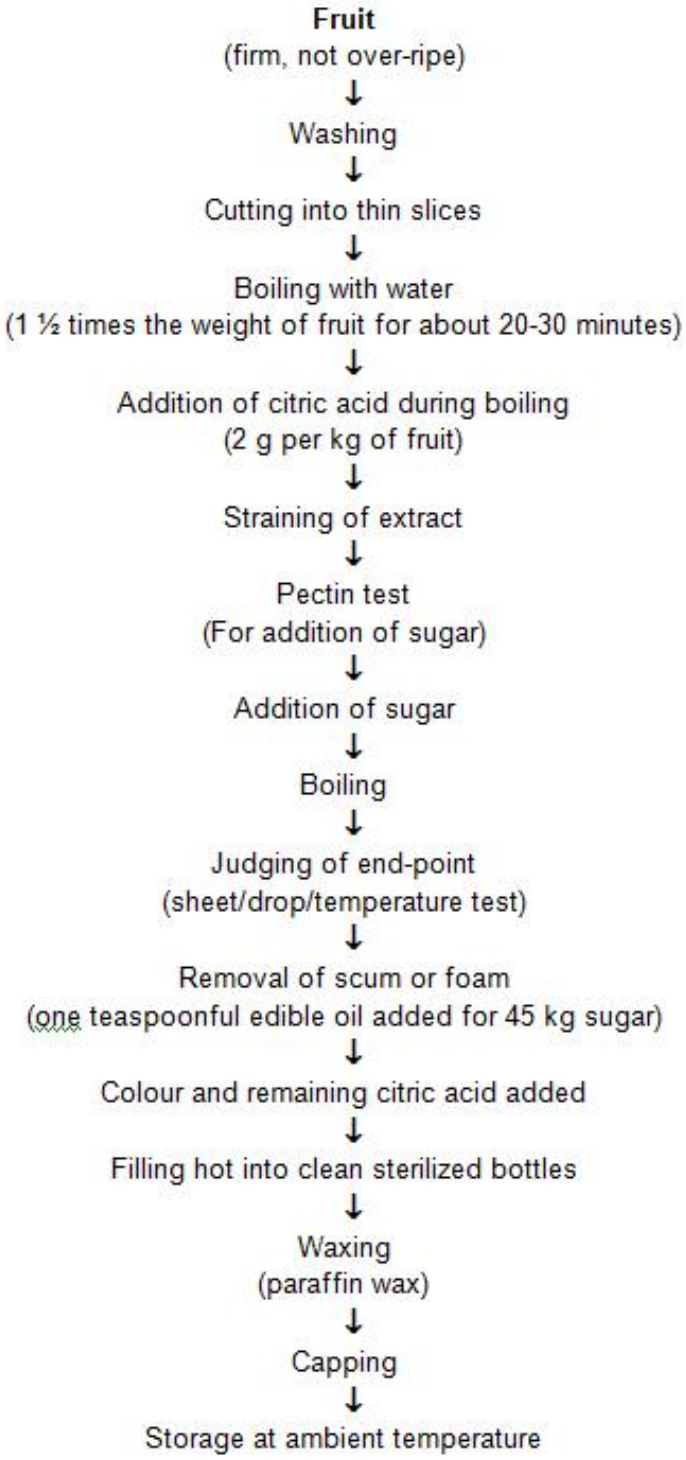
Precautions

•Thefruitslicesshouldsimmergentlyandbe thoroughlybrokenup beforeit isstrained.
•Thepulpshouldbe allowedto strainwithoutsqueezingif a clearjellyis required.
•Thesugarshouldbe addedonlywhenthestrainedjuicehassufficientlyboiled

Conclusion

The jelly looks like crystal and soft to touch. It is stored in jar and consumed directly or with bread.

FLOWCHART FOR PROCESSING OF JELLY



VIDEO LINKS:

Homemade Guava Jelly **https://youtu.be/hDtIOOkjUxI**

Note reference:

- TNAU Agritech portal/ post harvest technology/ preparation of squash https://agritech.tnau.ac.in/postharvest/pht_fruits_intro.html
- FAO Fruit and vegetable processing manual http://www.fao.org/3/v5030E/V5030E0m.htm

Exp 7: PREPARATION OF READY-TO-SERVE (RTS)& NECTAR

7A. Preparation Of Ready-To-Serve (RTS)

Introduction

This is a type of fruit beverage which contains at least 10 per cent fruit juice and 10 per cent total soluble solids besides about 0.3 per cent acid. It is not diluted before serving, hence it is known as ready-to-serve (RTS).

Objective

Learn the process of preparing Ready to serve Mango/Orange beverage as means of preservation.

RTS MANGOBEVERAGE

Materials required

- Mango/orange
- Pulp extractor/squeezer
- Boiling pan
- Sugar
- Citric acid
- Potable water
- Bottles for filling.
- Refractometer
- Weighing machine

Method of preparation

For the preparation of 5lts.of RTS beverage, follow the procedure given below:

•Calculate the amount of juice required as per commercial specification (say 10%)

Required juice = (10/100) × 5 = 0.5 ltr.

• Extract the required amount of pulp/juice into a pan.

•Measure the TSS of the juice/pulp using a refractometer (say the TSS is 30%)

Calculate the total solids content of the juice i.e. 0.3 × 0.5 = 0.15 kg

•The final required TSS content in the product is to be say 10%.

The TSS required to be added to obtain the final product is {(0.1×5)–0.15}kg = 0.35 kg

•The amount of soluble solids in the form of citric acid and KMS is Citric acid @ 0.3%, which is 30 g i.e. 0.03 kg.

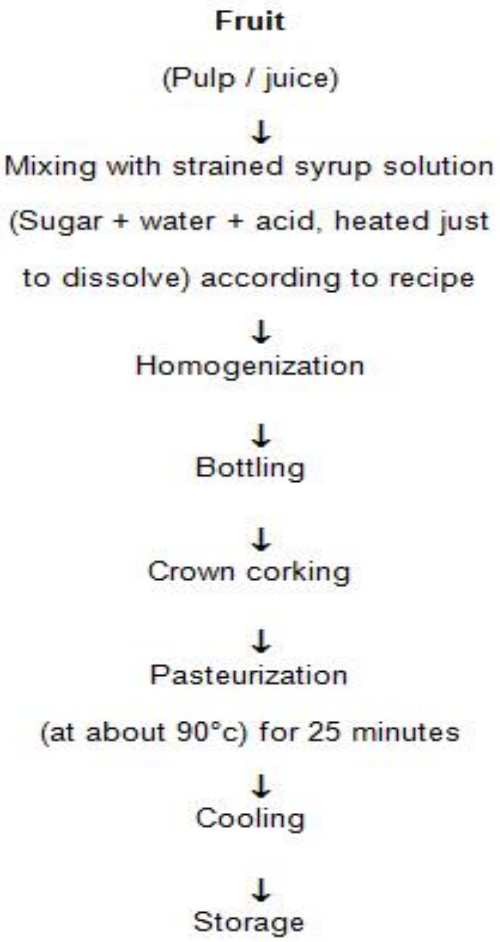
•Amount of solids to be added in the form of sugar is 0.35–0.03=0.32kg.

•Add calculated amount of sugar to about 1 ltr of water and heat it till it dissolves completely.

•Add citric acid and juice to the sugar syrup and makeup the volume to 5 ltr with water. Mix it well.

•Heat up to 90°C, fill hot in clean pre-sterilized glass bottles up to brim, seal and cool in the air or fill in bottle, seal and heat process (90°C for 25 min.).

FLOW-SHEET FOR PROCESSING OF RTS BEVERAGES



Conclusion

The bottled Ready-to-serve beverage is stored in cool, dry place. They can be served directly with ice.

VIDEO LINKS:

Ready to serve Mango Beverage https://youtu.be/hltvRZ7wEZE
Ready to serve (RTS) ,mango RTS(juice) homemade https://youtu.be/lvKv12t1Va8

7 B. Preparation of Nectar

Introduction

This is a type of fruit beverage containing at least 20% fruit juice/pulp and 15% total soluble solids besides about 0.3% acid. It is also not diluted before serving.

Objective

Understand the process of preparation of fruit nectar (Mango/Papaya).

Requirements

- Mango/papaya
- Pulp extractor/squeezer
- Boiling pan
- Sugar
- Citric acid
- Potable water
- Bottles for filling.
- Refractometer
- Weighing machine

Method of preparation

For the preparation of 2 ltr.of fruit nectar, follow the procedure given below:

• Calculate the amount of juice required as per commercial specification

Required juice = (20/100) × 2 = 0.4 ltr.

• Extract the required amount of pulp/juice into a pan.

• Measure the TSS using a refractometer (say the TSS is 30%)

Calculate the total solids content of the juice i.e. 0.3 × 0.4 = 0.12 kg.

The final required TSS content in the product is to be 15%.

The TSS required to be added to obtain the final product is {(0.15×2)–0.12} kg = 0.18 kg

•The amount of soluble solids in the form of citric acid and KMS is Citric acid @ 0.3%, which is 30 g i.e. 0.03 kg.

•Amount of solids to be added in the form of sugar is 0.18–0.03=0.15kg.

•Add calculated amount of sugar to about 1 ltr of water and heat it till it dissolves completely.

•Add citric acid and juice to the sugar syrup and makeup the volume to 2 ltr with water. Mix it well.

•Thus, for preparing the above beverages, the total soluble solids and total acid present in the pulp/juice are first determined and then the requisite amounts of sugar and citric acid dissolved in water are added for adjustment of TSS and acidity.

Conclusion

The fruit nectar is stored in bottles. It is consumed by diluting with water since it is bit sweet if consumed directly.

VIDEO LINKS:

Juices vs Nectars https://youtu.be/bUnVSU9j21E

Notes Reference:

TNAU Agritech portal/ post harvest technology/ preparation of squash
https://agritech.tnau.ac.in/postharvest/pht_fruits_intro.html

Exp 8: PREPARATION OF OSMOTICALLY DRIED PRODUCTS

Introduction

Dehydration or drying means the process of removal of moisture by the application of artificial heat under controlled conditions of temperature, humidity and air low. In osmotic dehydration the prepared fresh material is soaked in a heavy (thick liquid sugar solution) and / or a strong salt solution or blanched and then the material is sun or solar dried.

Objective

i) Understand the importance of the techniques of pre-drying treatments required for fruits and vegetables to produce a quality-dried products.

ii) Know the process of osmotically drying fruits and vegetables.

Osmotically dried fruits

Regularly dried fruits

Principle

Microbes cannot grow and multiply in absence of sufficient water in the environment. Many of the enzymatic reactions are hydrolytic in nature and require water as one of thereactants. Therefore, by removing water from the fruits and vegetables, it should be possible to preserve them by checking the spoilage causing agents. Employing blanching, sulphuring or sulphitation can improve the quality of sun-dried fruit and vegetable products.

Materials required

• Tomatoes/Kasurimethisaag/ apples.

•Preparation table having stainless steel sheet or aluminum top

•Stainless steel peeling, coring and pitting knives

•Blanching tank/aluminum vessel

•Gas burner/heating arrangement
•Cooling tank
•Aluminum pan for sulphitation
•Perforated aluminum trays
•Solar drier/facility for sun drying
•Black polyethylene sheet
• Polythene zipper pouches.

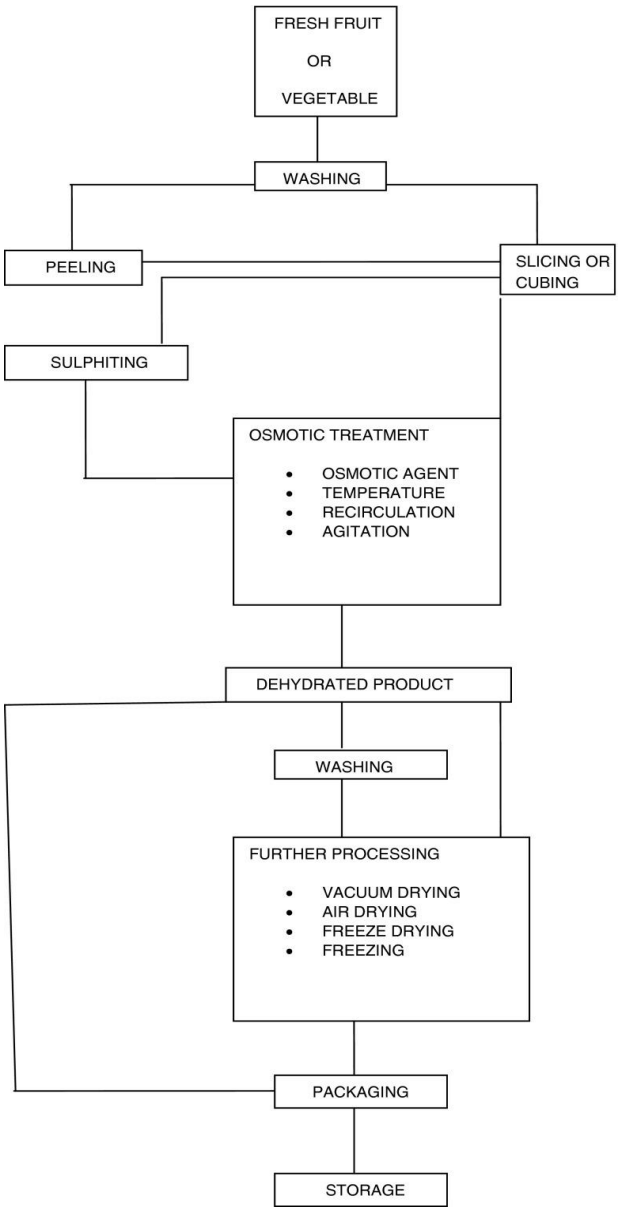
Procedure

•Select vegetables very carefully for drying.
•Wash the vegetables thoroughly to remove any dirt and other extraneous matter.
•Prepare the vegetables by peeling and cutting into suitable sizes on the day of harvest itself. Thinner the slicer, better the drying.
•Blanching is used as pretreatment for vegetables, this is done by rapidly boiling the vegetables in water for known time to inactivate the enzymes and partially killing the microorganism.
•Immediately after blanching the vegetables are dipped in cold water to avoid over cooking.
•The blanched vegetables are sulphited by placing them in 0.5% solution of potassium metabisulphite for 2-3 mins.
•The fruits and vegetables are then spread on perforated tray, dried in direct sun or in shade preferably in a well - ventilated room away from direct sunlight. Provision of a ceiling fan in the room will hasten the process of drying.
•Solar drying can be improved considerably by using black polyethylene structure.
•It should be made in such a way that it could hold trays containing fruits and vegetables for drying with the provision of entry of dry air from the bottom and exit of moist air from the top of the structure.
•The samples should be turned every 4-6 hours for uniform drying.
•Dried vegetables are highly susceptible to contamination andtherefore, should be packed in polyethylene (plastic) bags/pouches as soon as they are cooled after drying is over.
•In order to prevent rodent attack, the plastic bags are placed in metal containers and closing the lid firmly.

Precautions

•For the purpose of drying select fruits and vegetables in prime condition of eating and cooking.
•Recommended pre-treatments and drying process should be strictly followed.
•Care must be taken to see that the dried products are packed at the right time and do not pick up moisture
•Rodent attack on the plastic pouches must be prevented.

FLOWCHART FOR OSMOTICALLY DRYING OF VEGETABLES



Conclusion

The packed dried vegetables are stored in cool, dry place. They are used in adequate amount in various cooking directly.

VIDEO LINKS:

How to Dehydrate and Preserve Organic Fruit https://youtu.be/f141C9Kw3jo

Dried Mango https://youtu.be/GTn7-U5CtwQ

Note reference:

- FAO Fruit and vegetable processing manual http://www.fao.org/3/v5030E/V5030E0m.htm
- FME-SKILL TRAININGDrying and Dehydration of Fruits And Vegetableshttp://iifpt.edu.in/curmetmg.pdf

Exp 9: PREPARATION OF SQUASH

Introduction

This is a type of fruit beverage containing at least 25 per cent fruit juice or pulp and 40 to 50 per cent total soluble solids, commercially. It also contains about 1.0per cent acid and 350 ppm sulphur dioxide or 600 ppm sodium benzoate. It is diluted before serving.

Mango, orange and pineapple are used for making squash commercially. It can also be prepared from lemon, bael, papaya, etc. using potassium metabisulphite (KMS) as preservative or from jamun, passion-fruit, peach, plum, raspberry, strawberry, grapefruit, etc. with sodium benzoate as preservative.

Objective

- Knowing the methods of preparation and preservation of fruit squash along with recipe for lemon/orange.
- Knowing the difficulties, precautions to be taken and technical know-how of the final product quality.

Materials required

•Ripefruits (lemon/ orange),Juiceextractor:
•Pulper;
•Knives;
•Bottles;
• Utensil- boiling pots
• Strainer/ muslin cloth
• KMS and citric acid

Procedure

•Selectgoodqualityfullyripefruits;
•Washandpeelthefruitandextractjuiceasin orange,juicecanberecoveredandin mango,pulpcanbe extracted;
•Mixthepulpwellto makeit a smoothpaste;
•Takesugar,waterandcitricacid(for orange) as mentionedin Table 1;
•Mixtheingredientsandgiveoneor twoboilsto dissolvethe sugar;
•Coolthesugarsyrup,and add thefruit pulp;
•Mixthepulpandsugarthoroughlyandpast througha muslin cloth;
•Addapprovedcolourandflavour(essence);
•Addpreservativei.e.potassium/sodiummetabisulphite(KMS/SMS)@ 0.7g/litreor sodiumbenzoate(SB)@1.0g/litreof finishedproduct;
•Fillthesquashin sterilizedbottlesandsealit andstorein cooldryplace.

Table 1:RecipeforPreparation

Product	Quantity of juice/ pulp	Sugar (kg)	Water (ml)	Citric Acid (g)	Preservative to be added
Orange Squash	1.0	1.5	0.75	25-28	KMS/ SMS
Lime/ lemon squash	1.0	2.0	0.50	-	KMS/ SMS

Precautions

•Donotheatthejuice.
•Donotmixhotsugarsyrupin juice'orpulp.
•Donotusesodiumor potassiummetabisulphiteforcolouredsquashes.
•Alwaysusestainlesssteelutensils,knives, etc.

Conclusion

The squash is ready for preservation in bottles. They are stored in cool, dry place. They are taken in adequate amount and mixed with chilled water and served.

FLOWCHART FOR PROCESSING OF SQUASH

Fruits

↓

Washing

↓

Trimming

↓

Cutting or grating

↓

Juice extraction

↓

Straining

↓

Juice measuring

↓

Preparation of syrup

(Sugar + water + acid, heating just

to dissolve)

↓

Straining

↓

Mixing with juice

↓

Addition of preservative

(0.6 g KMS or 1.0 g sodium

Benzoate / litre squash)

↓

Bottling

↓

Capping

↓

Storage

VIDEO LINKS: https://youtu.be/fQ6UsZ755s0

Note reference:

TNAU Agritech portal/ post harvest technology/ preparation of squash
https://agritech.tnau.ac.in/postharvest/pht_fruits_intro.html

Exp 10: PREPARATION OF FRUIT BAR

Introduction

Fruit bar is the product prepared by blending fruit purees or pulp extracted from ripe pulpy fruit, sugar or other nutritive sweeteners and other ingredients and additives desired for product and dehydrated to form sheet which can be cut to desired shape and size.

Objective

- Knowing the methods of preparation and preservation of fruit bar along with recipe of banana/mango.
- Knowing the difficulties, precautions to be taken and technical know-how of the final product quality.

Materials required

To prepare approximately 1 kg of fruit bars, materials required are as follows:

Type of fruit	Fruit required in kg	Pulp obtained in kg	Sugar required in gm	Yield (% of fresh fruit) approx.
Mango	7.2	3.6	33	14
Banana	6.0	3.6	30	17

- Mango/banana
- Sharp steel knife
- Masher
- Citric acid
- Refractometer
- Stove or heater
- KMS powder
- Glycerine
- Stainless steel tray
- Dryer
- Cellophane paper

Method of Mango fruit bar preparation

- Fully ripe mangoes are selected and washed in water at room temperature.

- The peeled fruit is cut into slices and pulp extracted.
- The required amount of sugar to adjust the Brix (the unit measure for total solids in fruits) of the mixed pulp to 25 degrees Brix is then added.
- Two grams of citric acid per kilogram of pulp (or 20 ml of lime or lemon juice) are added to inhibit possible growth of micro-organisms during drying.
- The mixture is then heated for two minutes at 80° C and partially cooled; the heat treatment serves to inactivate the enzymes and destroy the micro-organisms.
- Potassium or sodium metabisulphite is added (two grams per kg of prepared mixture), so that the concentration of SO_2 is 1000 ppm.
- The mixture is then transferred to stainless steel trays which have been previously smeared with glycerine (40 ml/m).
- Drying could be carried out by a dual-powered dryer for a total of 26 hours.

a) 10 hours by solar energy at about 55° C and
b) 16 hours by electric or steam power at 70° C.

- At the end of the drying operation, when moisture content is between 15 and 20%, the pieces of suitable shape and size are wrapped in cellophane paper, packed in cartons and stored at ambient air temperature.

Method of Banana fruit bar preparation

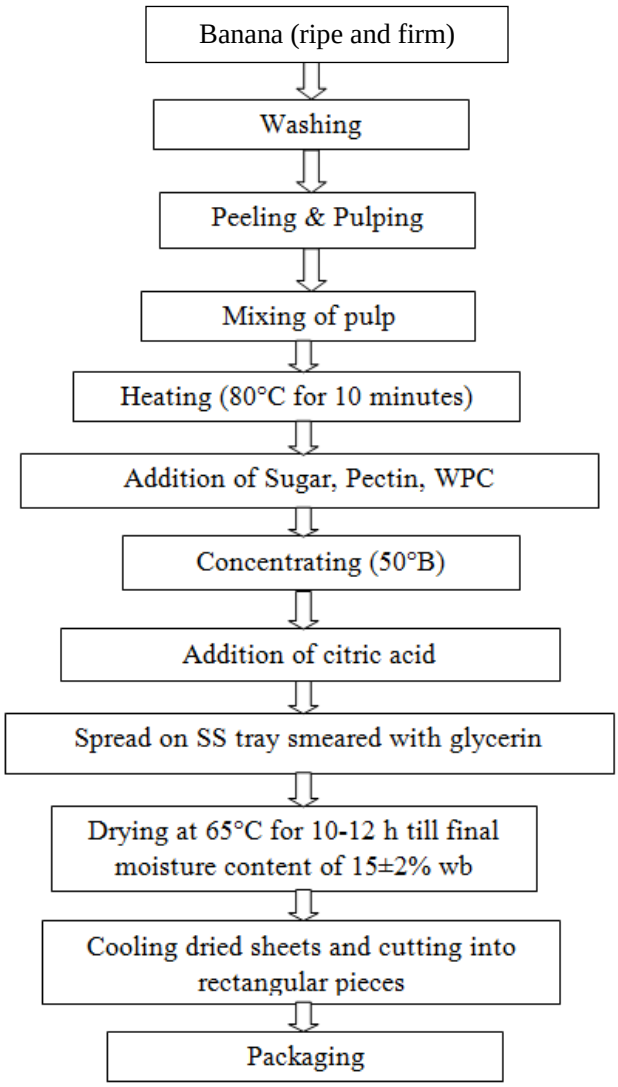
- Banana varieties which give smooth pulp without serum separation must be used for this purpose.
- Ripe, suitable fruit is selected. The hand-peeled fruits are soaked in 0.3 per cent citric acid solution for about 10 minutes (lime or lemon juice can replace citric acid).
- The drained fruit are pulped to obtain smooth pulp.
- The rest of the procedure is the same as in the case of the mango bar.

Packing and storage.

- The dried pulp is removed from the dryer and cut into square pieces of 5 x 5 cm at a thickness of about 0.3 cm.
- Each block is separately wrapped in cellophane and the unit pack is filled in a printed cellophane bag of size 15 x 8 cm.
- Shelf-life is about one year at room temperature.

MANGO FRUIT BAR

FLOWCHART FOR PROCESSING OF BANANA FRUIT BAR



VIDEO LINKS:

Fruit bar recipe - Apple fruit energy bar recipe - Naturo fruit bar - Homemade fruit rollhttps://youtu.be/uHGgvDXBJ3w

Note Reference:

C.K.Narayana, M.M. Mustaffa and S. Sathiamoorthy.Standardization of process for preparation of banana fruit bar.Indian J. Hort. 64(3), September 2007: 349-350

Exp 11: PREPARATION OF CANDY

Introduction

A whole fruit / vegetable or its pieces impregnated with cane sugar or glucose syrup, and subsequently drained free of syrup and dried, is known as candied fruit / vegetable. The most suitable fruits for candying are aonla, karonda, pineapple, cherry, papaya, apple, peach, and peels of orange, lemon, grapefruit and citron, ginger, etc.

Objective

- Knowing the methods of preparation and preservation of fruit candy along with recipe of aonla.
- Knowing the difficulties, precautions to be taken and technical know-how of the final product quality.

Materials required

Ingredients

Aonla	1 kg
Sugar	1.120 kg
Water	500 ml
Citric acid	6.4 g
KMS	1.2 g

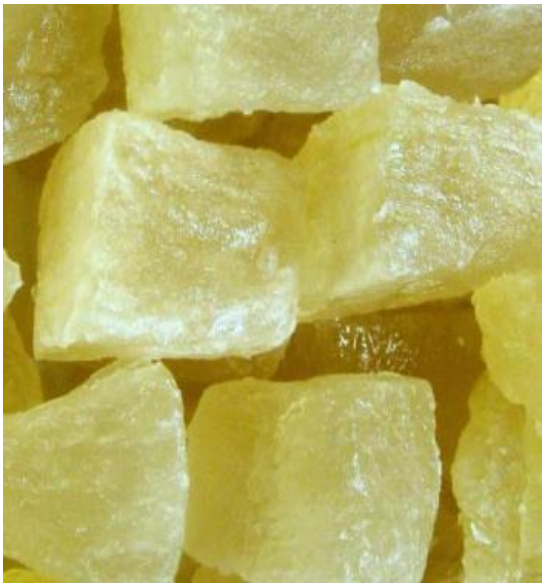
- Sharp steel knife
- Citric acid
- Refractometer
- Stove or heater
- KMS powder
- Stainless steel tray
- Dryer
- Glass jar

Method

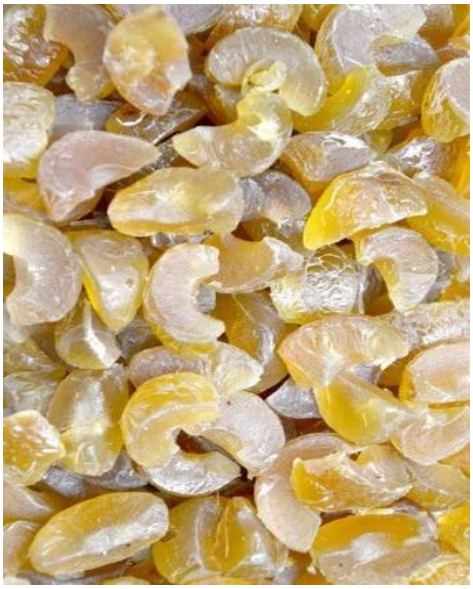
- Preparethe sugar syrup (Mix 765g of sugar in 500ml of water).
- citric acid and KMS.
- Soak fruits for 24hr.
- Boil the sugar syrup to 60° Brix.
- Add the remaining sugar
- Add Aonla pieces and sugar (1:1.5)
- Pack the aonla preserve in glass jar.
- Allow to dry in shade.

Conclusion

Candies are stored in a container in dry and cool conditions.

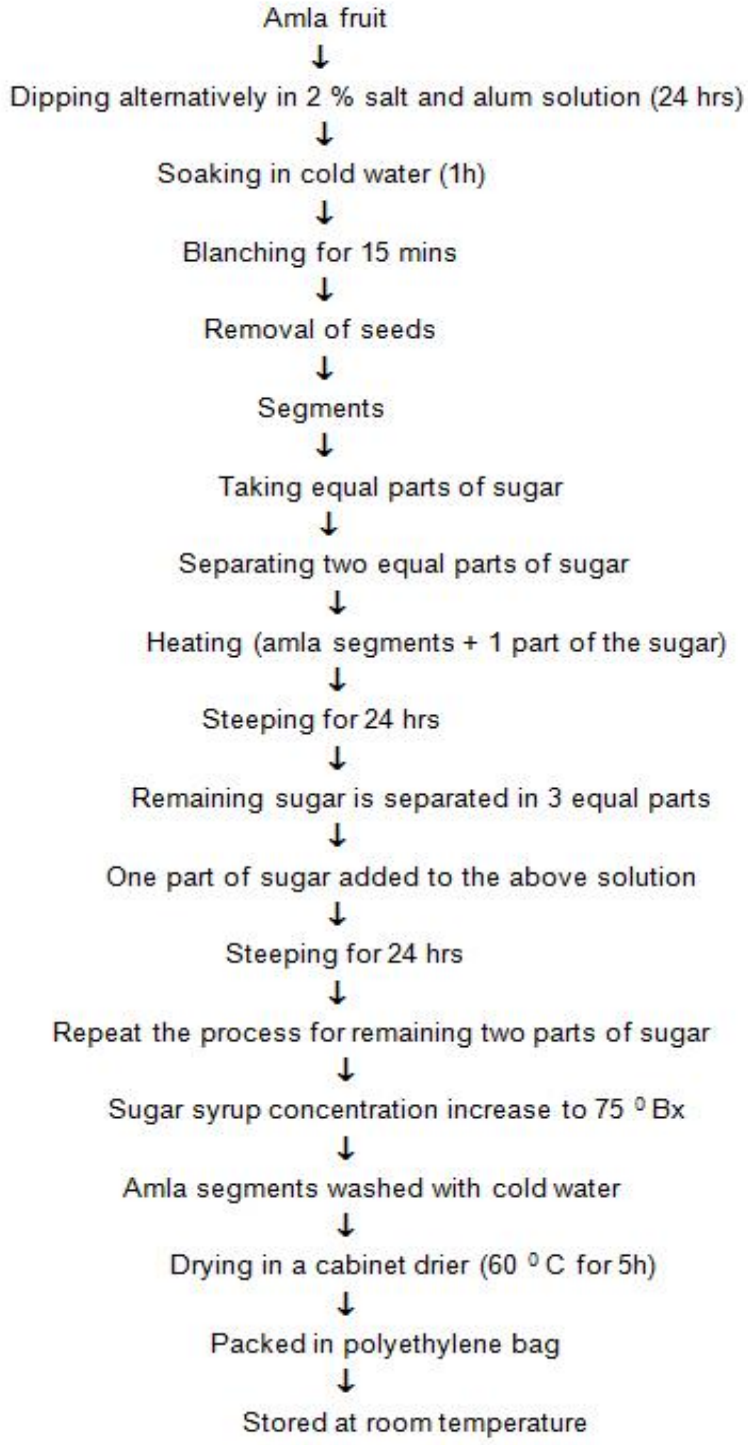


FRUIT CANDY (Bottle gourd)



FRUIT CANDY (Aonla)

FLOWCHART FOR PREPARATION OF SWEET AONLA CANDY



VIDEO LINKS:

Amla Candy Recipe - How to make amla candy.https://youtu.be/_9aEz61FsrM

Note Reference: TNAU Agritech portal/Post Harvest Technology

https://agritech.tnau.ac.in/postharvest/pht_medicinalplants_amla.html

Exp 12: PREPARATION OF TOMATO PRODUCTS

Introduction

Tomatoes can be preserved by converting into delicious products like paste, puree, juice, ketchup and sauce.

High quality tomato products can be prepared only by: (i) using plant-ripened uni-formly red tomatoes as the yellow and greenish portions not only mask the red colour but also cause browning due to oxidation; (ii) avoiding prolonged heating, and cooling the product quickly after preparation; and (iii) not using iron and copper equipment at any stage of processing.

Objective

- Knowing the methods of preparation and tomato ketchup along with recipe.
- Knowing the difficulties, precautions to be taken and technical know-how of the final product quality.

Principle

Tomato products are prepared from ripe tomatoes and preserved by chemical preservatives or by heat application.

Materials required

Raw materials, equipment and apparatus

1.Tomato, spices, etc.
2.Pulper
3.Filter cloth / sieve
4.Pans of suitable size
5.Heaters
6.CookingThermometer
7.Volumetric flask
8.Measuring cylinder
9.Weighing balance
10.Potable water
11. Muslin spice bag.

Chemicals and reagents

1.Salt
2.Sugar
3.Citric acid/Vinegar

4.Spices
5. Sodium benzoate

Recipe:

Tomato pulp 1 kg, sugar 75g, salt 10g, onion (chopped) 50g, ginger (chopped) 10g, garlic (chopped) 5g, red chilli powder 5g, cinnamon, cardamom (large), aniseed, cumin, black pepper (powdered) 10g each, clove (headless) 5 numbers, vinegar 25 ml or glacial acetic acid 5 ml and sodium benzoate 0.25g per kg final product.

Procedure

Tomato Sauce/Ketchup preparation

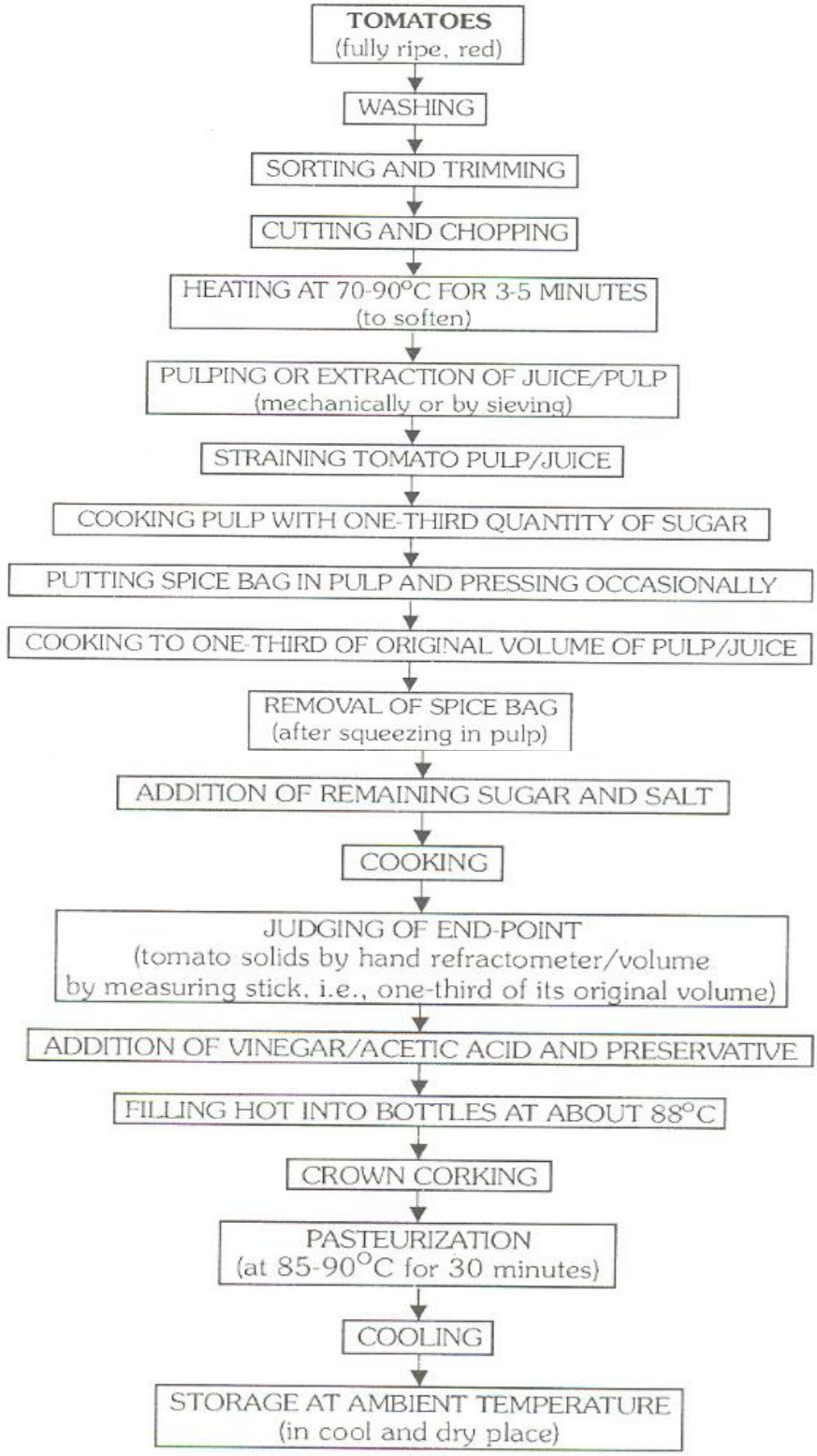
1. Wash ripe tomatoes throroughly.
2. Dice the tomatoes in small pieces.
3. Heat the tomatoes with little water at temp. 70°C till they soften.
4. Extract the pulp using a strainer or sieve.
5. Cook the pulp with one third amount of sugar taken.
6. Put the spices inside a spice bag and put in the cooking pulp. Press occasionally.
7. Continue cooking till the pulp reduces to one third of the original volume.
8. Take out the spice bag and add remaining sugar and salt.
9. Continue to cook till end point is reached which is judged by measuring stick (1/3 rd of original volume.)
10. Add vinegar and sodium benzoate.
11. Fill the bottles at 88°C and the pasteurize at 90°C for 30 mins
12. Cool the bottles and store.

General considerations:

- About one-third of the sugar required is added at the time of commencement of boiling to intensify and fix the red tomato colour.
- If the whole quantity of sugar is added initially, the cooking time will be longer and the quality of pulp will be adversely affected.
- Generally,the sugar content in ketchups/sauces varies from 10-26%. On the other hand, salt bleaches the colour of the tomato product. It is, therefore, desirable to add it towards the end of the cooking process.
- Good quality vinegar is essential for the preparation of high quality sauce/ketchup. It should contain 5.0-5.5% acetic acid and should be added when the product has thickened sufficiently, so that the acid is not lost by volatilization.
- The ketchup should be filled hot (about 88°C) to prevent browning and loss of vitamins during subsequent storage.

- It is advisable to add 0.025% sodium benzoate to the product before bottling and then pasteurize the bottles as a precaution against spoilage during the 3 to 4 weeks that the ketchup remains in the opened bottle before it is used up.

PROCESSING FLOW-SHEET FOR TOMATO SAUCE/KETCHUP



Tomato Ketchup

Conclusion

The tomato sauce is ready for preservation or future usage in the bottles. They are stored in cool, dry place.

VIDEO LINKS:

Scientific Method for making Tomato Ketchup https://youtu.be/nKab_q2Dac8

Note Reference:

IGNOU Food processing manual- preparation of tomato products.
IIFPT FME-Training Manual on Processing of Tomato Products.

Exp 13: PREPARATION OF CANNED PRODUCTS

Introduction

Canning is a method of preservation of food in which the food is processed and hermetically sealed in containers (of metal, glass, thermo stable plastic, or a multi- layered flexible pouch) through agency of heat.
Canning provides a shelf life typically ranging from one to five years, although under specific circumstances it can be much longer.
Heating is the principle factor to destroy the microorganisms and the permanent sealing is to prevent re-infection.

Objective

- Knowing the methods of preparation and preservation of canned products like tomato/peas/carrot.
- Knowing the difficulties, precautions to be taken and technical know-how of the final product quality.

Materials required

- Tomatoes/Peas/Carrots
- Knife
- Peeler
- Water (hot and cold)
- Salt
- Plastic knife
- Boiling pot
- Wide-mouthed glass jars/ bottles with rubber ring in cap.
- Cooking Thermometer
- Canning jar tongs

Procedure

1. Selection of vegetables
(i) Vegetables should be absolutely fresh.
(ii) It should be ripe, but firm, and uniformly mature. Over-matured vegetables should be rejected because they are infected with microorganisms and give a poor quality product. Immature vegetables should be rejected because they generally shrivel and toughen on canning.
(iii)Tomatoes should be firm, fully ripe and of deep red colour / vegetables should be of good colour.

(iv) They should be free from dirt.
(v) They should be free from blemishes, insect damage or mechanical injury.

2. Grading

- The selected vegetables are graded according to size and colour to obtain uniform quality.
- This is done by hand.
- Tomatoes/ carrots are generally graded after cutting into pieces or slices/ Peas are graded whole.

3. Washing

- It is important to remove pesticide spray residue and dust vegetables.
- Vegetables can be washed in water thoroughly.

4. Peeling (In case of carrots)

The objective of peeling is to remove the outer layer. Peeling may be done by hand peeling.

5. Cutting (In case of tomato and carrot)

Pieces of the size required for canning are cut – preferably circular cut or diced.

6. Blanching

-Blanching is done in case of vegetables by exposing them to boiling water or steam for 2 to 5 minutes, followed by cooling.
-This inactivates most of the plant enzymes which cause toughness, discoloration (polyphenol oxidase). mustiness, off-flavour (peroxidase), softening and loss of nutritive value.
-Reduces the number of microorganisms by as much as 99%.

7. Cooling

After blanching, the vegetables are dipped in cold water for better handling and keeping them in good condition.

8. Filling

Before filling, bottles are washed with hot water and sterilized.

- Choice grades of vegetables are normally filled by hand to prevent bruising in India. Hand filling is the common practice.
- After filling, covering with 2% hot brine water (20 gmsalt dissolved in 1 ltrwater) is done and this process is called brining. Headspace left inside ranges from 0.32 cm to 0.47 cm.

9. Exhausting

- Slide a small nonmetallic spatula or plastic knife around in the hot mixture to remove any air bubbles.
- After filling and lidding, this is done and this is known as exhausting.

10. Sealing

- In case of glass jars a rubber ring should be placed between the mouth of the jar and the lid, so that it can be sealed airtight.
- During sealing the temperature should not fall below 74°C.

11. Processing

- Heating of foods for preserving is known as processing. The bottles/jars are processed (heat treated) immediately after closing (hermetic sealed) at suitable time and temperature by putting the jars in boiling water.

12. Cooling

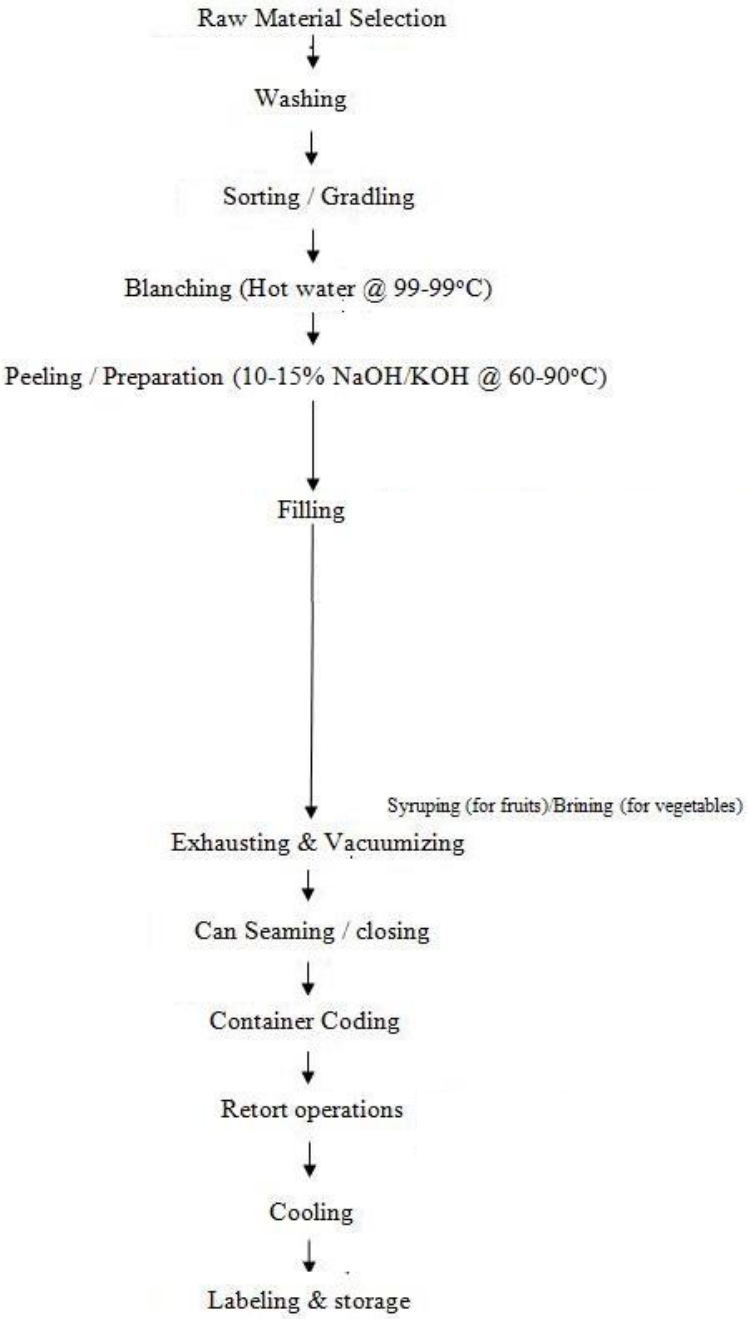
- Immediately after processing, the bottles/jars are cooled in water to a temperature of 36°C to 42°C to avoid thermophilic spoilage.
- If the bottles/jars are cased at temperatures much over 42°C, thermophilic spoilage may occur.

Conclusion

The vegetables are ready for preservation in the form of canned/ bottled products. They are stored in cool, dry place.

CANNED PRODUCTS

FLOW CHART FOR PREPARATION OF CANNED PRODUCTS



VIDEO LINKS:

Fruits and Vegetables Canning Technician https://youtu.be/2feH-pLw8f0

CANNED TOMATOES | How It's Madehttps://youtu.be/jr5Nq7W1KT4

Note Reference:

http://courseware.cutm.ac.in/wp-content/uploads/2020/05/Canning-of-fruits-and-vegetables.pdf

https://www.britannica.com/topic/canning-food-processing

http://ecoursesonline.iasri.res.in/mod/page/view.php?id=17069

Exp 14: Quality evaluation of products - physico-chemical and sensory.

Experiment: Physico-chemical and Sensory evaluation of Tomato sauce Quality.

I. Introduction

Quality is the ultimate criterion for desirability of any product. Food quality can be evaluated by

1. Sensory analysis (or) sensory evaluation. The quality of food product is assessed by means of human sensory organs. Eg: Appearance,flavour,colour,viscosity, texture. It is also called Subjective or Organoleptic test.
2. Physico-chemicalEvaluation. Methods of evaluating food quality depend on some measure other than human senses. Eg: characters like TSS, pH, Ascorbic Acid content, Acidity, etc.

II. Objective

To evaluate the quality of processed product (tomato ketchup) in terms of physico chemical characters and sensory parameters; branded ketchup vis-à-vis unbranded ketchup.

III. Materials and Methods

A. Physico chemical evaluation:

1. **Total Soluble Solids (TSS):**TSS of tomato ketchup can be measured by hand refractometer of range of 0-32°Brix .
2. **pH**: pH is the measurement of the logarithm of inverse of hydrogen ion concentration in the solution or pH is the measurement of H+ activity. The pH values can be determined using the digital pH meter.
3. **Acidity**: Acidity may be referred as the percent total acid in any food substance. The organic acid is responsible for the sourness of fruit. Acidities of final products can be determinedby titration.

Sample

A bottle of branded tomato ketchup and unbranded tomato ketchup.

Apparatus

- A Hand refractometer
- Digital pH meter
- Conical Flask
- White porcelain Basins – hemispherical 60ml Capacity.
- Pipette – 10ml

- Burette with soda lime guard tube
- Measuring cylinder – 25ml
- Starring glass road flattened at one end

Reagents

- Buffer Solutions - of known pH values of 4.0, 7.0 and 10.0.
- Standard sodium hydroxide solution 0.1N prepare a concentrated stock solutionof sodium hydroxide by dissolving equal part of NaOH in equal volume of distilledwater in a flask Tightly stopper the flask and keep the solution for 3 – 4 days tosettle any insoluble sodium carbonate. Use the clear solution to prepare 0.1normal solution standardize the solution against 0.1 normal oxalic acid solution.
- Phenolphthalein indicator solution – Dissolve 1gm of the indicator in 100ml of96% ethyl alcohol. Add 0.1N NaOH drop wise till the colour is faint pinkto make the indicator neutral.
- Rosanilin Acetate solution (bench solution). Dissolve 0.12gm of rosanilineacetate in 50ml distilled water containing 0.5ml of glacial acetic acid. 1ml ofthis solution is diluted to 500ml with a mixture of rectified alcohol and distilledwater to prepare bench solution. These solutions must be stored in ambercoloured bottles.

B. Sensory evaluation:

Thesensory analysis can be carried out in a standard sensory laboratory provided with 6 testing booths (ISO 8589: 2007). The samples were served on white porcelain dishes. The service size is to be 25 ml ketchup in 50 ml glass beakers. The flavour acceptance can be determined by testing 10 g ketchup on 50 g French fries. The list of descriptors is given in Table 1.

Table 1: Descriptors and the limits of unstructured graphical scale

Sensory Attributes	***Grading***
Colour hue	pale red/ chilli red/ dark red
Resistance, to taking and stirring and ladling with a spoon	Very Easy/ Easy/ difficult
Resistance, to pouring from the spoon	Smooth/ difficult/ very difficult
Viscosity observed at ingesting the sample	Very small/ thick/ very thick
Viscosity observed on pressing the sample against the palate	Very small/ thick/ very thick
Sensory texture acceptability	Bad/ good/ excellent

Intensity of spicing	Weak/strong/very strong
Overall flavour acceptability	Bad/ good/ excellent
Hot taste after swallowing	Weak/strong/very strong
Taste on French fries	Bad/ good/ excellent

IV. Methodology

i) TSS Measurement

- Place few drops of the sample in between the prisms of hand refractometer and note the reading at the demarcation line.
- Apply temperature correction for readings taken at temperatures other than 20°C using the following table available with refracrometer user manual.
- Place a few drops of the sample in between the prisms and allow the temperature to equilibrate and note the Brix reading, which gives per cent of sucrose sugar or TSS.
- If sample is thick, squeeze it through cotton and place the drop in between the prisms.

ii) pH Measurement

- Place 10 g of the test sample in a dry conical flask and add 100 ml of cool, recentlyboiled distilled water.
- Agitate the flask until an even suspension, free from lumps, isobtained.
- Allow suspension to stand at 25°C for 30minutes, agitating continuously orintermittently in such a manner as to keep the starch particles in suspension. Let it standfor 10 more minutes.
- Decant the supernatant liquid into the electrode vessel andimmediately determine pH using a potentiometer and electrodes which have beencalibrated against known buffer solutions.

iii) Measurement of Titrable Acidity

- Take accurately 10ml well mixed sample in two Porcelain basins.
- Add an equal volume of freshly boiled and cooled distilled water. If it isa solid product, then a dispersion of known weight of the sample may be madein distilled water.
- Add 1ml of the phenolphthalein indicator to one basin and toanother add 1ml bench solution of rosaniline acetate.

- Titrate the content of thebasin to which phenolphthalein has been added, against standard sodium hydroxidesolution added drop by drop from the burette till the appearance of a pink colour.
- By comparison the colour matches the pink colour of the solution in the basincontaining the rosaniline acetate solution.
- Stir vigorously throughout.
- The timetaken to complete the titration shall not exceed 20 seconds. The titration must becarried out in illumination from daylight lamp**.**

Calculation

Titrable acidity as % citric acid per 100 ml of tomato ketchup or per 100 g products
= (0.9 x V1 x N1) / V2
Where,
V1 =Volume in ml of standard NaOH solution used for titration
N = Normality of standard NaOH solution
V2 = Volume in ml of or weight in gram of ketchup taken for thetitration

V. Inference:

Comparison in terms of sweetness (TSS), acidity (pH and titrable acidity) and sensory parameters were done in between the branded and unbranded tomato ketchup and the result found was……..

Reference:

Se-Han Kim, Suk-Gil Kong, Dae-Soon Par. Quality Characteristics and Sensory Evaluation of Tomato Sauce with Added Perilla Leaf.2013.The Korean Journal of Food And Nutrition 26(4); DOI: 10.9799/ksfan.2013.26.4.766

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