PRACTICAL MANUAL

Principles of Food Processing

B. Tech. (Food Technology)



Semester : I

Course No.: FPT - 111
Course Credit : 3 (2+1)

Dept. of Food Process Technology
College of Food Technology
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431402

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PRINCIPLES OF FOOD PROCESSING

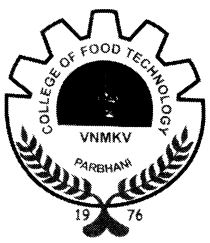
for

B. Tech. (Food Technology)

By

Syed Imran Hashmi

(Assistant Professor & Course Teacher)



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Certificate

This is to certify that Mr./Ms. _____

Reg. No. _____, *has completed the practical of Course No. FPT - 111 (Principles of Food Processing) as per the syllabus of B. Tech (Food Technology) First Semester as prescribed by MCAER, Pune.*

Date: _____ *(Course Teacher)*

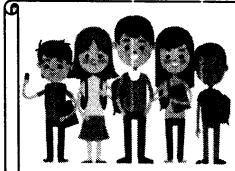
INDEX

Practical - 1

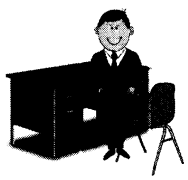
Demonstration of various Machineries used in Food Processing

INTRODUCTION

- Food Processing is the conversion of agricultural produce (with or without other ingredients) to food which have particular textural, sensory and nutritional properties using commercially feasible methods.
- Food Processing transforms raw ingredients into food, or of food into other forms.
- Food processing typically takes raw material and uses these to produce attractive, marketable and often long shelf-life food products.
- The ability of a food industry to provide a continuous supply of nutritious and safe food to the consumer depends on the processes and equipment used in all stages of handling, processing and distribution.
- There are wide range of equipments and machineries available to perform the food processing operations. (the details of which including working principle, operation, maintenance and specifications are to be learned by students during course elsewhere), however, the objective of this practical is to make the students acquaint with different food processing equipments available in the institute and their functions and uses.



At the end of practical, all students should get acquainted with the different food processing machineries available at institute with their functions.

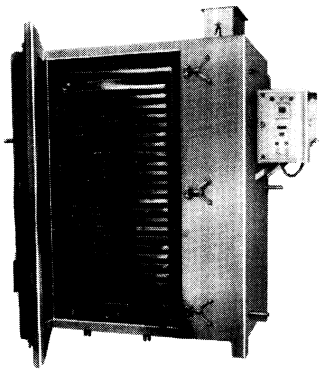


Course teacher should take the visit of students to different food processing units and laboratories available in the institute and highlight the function of different food processing machineries.

DRYING MACHINERIES

- Drying and Dehydration have been used widely for this purpose since ancient times.
- Drying is a method of food preservation in which water is removed from the food.
- Drying inhibits the growth of bacteria, yeasts, and mold through the removal of water.

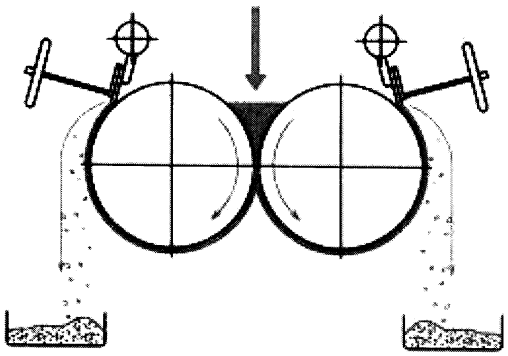
CABINET DRIER



(Draw Schematic diagram here)

- In cabinet dryers, the food is spread out, generally quite thinly, on trays in which the drying takes place.
- Heating may be by an air current sweeping across the trays, by conduction from heated trays or heated shelves on which the trays lie, or by radiation from heated surfaces.
- It also contains fans to enhance air flow and remove the humidified air out of chamber.

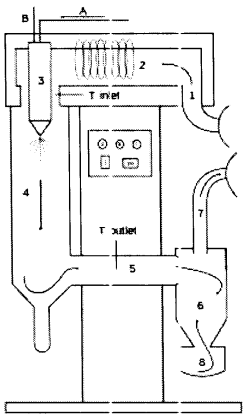
DRUM DRIER



(Draw Schematic diagrams here)

- In drum drier, the food is spread over the surface of a heated drum.
- Drum drying may be regarded as conduction drying.
- The drum rotates, with the food being applied to the drum at one part of the cycle.
- The food remains on the drum surface for the greater part of the rotation, during which time the drying takes place, and then dried material is scraped off.

SPRAY DRYERS



(Draw Schematic diagrams here)

- In a spray dryer, liquid or fine solid material in slurry is sprayed in the form of fine droplet dispersion into a current of heated air.
- Air and solids may move in parallel or counterflow.
- Drying occurs very rapidly, so that this process is very useful for materials that are damaged by exposure to heat for any appreciable length of time.
- The dryer body is large so that the particles can settle, as they dry, without touching the walls on which they might otherwise stick.
- Commercial dryers can be very large of the order of 10 m diameter and 20 m high.

ASSIGNMENT

Summarized all other major food processing machineries available (with their Drawing, Principle and Functions) at the institute with their major function which should include

- Baking Equipments (Baking oven, dough mixer, dough sheeter, moulds, bread slicer, etc)
- Canning Equipments (Report, Can Sealer, Seaming Machine, etc)
- Fruits and Vegetable Processing Equipments (Abrasion peeler, fruit pulper, Screw type juice extractor, steam jacketed kettles, etc)
- Other Equipments (Chapati maker, Ice cream maker, oil extract and All the Food Processing Machineries available in the Institute)

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Practical - 2

Demonstration of Effect of Blanching on Food Quality Characteristics

INTRODUCTION

- Blanching is a heat treatment given to fruits and vegetables for short period usually below 100°C for inactivation of enzymes.
- It is also known as scalding, parboiling or precooking.
- Fruits and vegetables are blanched prior to canning, freezing and dehydration. It is also called scalding.
- Fruits generally not blanched results in browning and other undesirable changes due to enzyme activity.
- Fruits are generally blanched by dipping into hot water of temperature 180 - 200°F, followed by immediate cooling of immersion in cold water.
- Vegetables are blanched by immersing in boiling water or steam for 2 to 5 minutes, followed by cooling.
- The enzymes that are usually used as an indication of sufficient blanching are catalase and peroxidase (depending on the vegetable).

REFERENCE VALUE FOR SOME VEGETABLES

Peas	85-90	2-7
Green beans	90-95	2-5
Cauliflower	Boiling	2
Carrots	90	3-5
Peppers	90	3

OBJECTIVES OF BLANCHING

i. The main objective of blanching is to inactive enzymes which cause toughness, discolouration (polyphenol oxidase), off-flavour (peroxidase), softening and loss of nutritive value.
ii. To helps in close filling of can due to removal of air from fruits tissues
iii. To remove tissue gases which reduce sulphides

iv. To reduce the area of leafy vegetables such as spinach by shrinkage or wilting, making their packing easier
v. To clean fruit and removal of microbes up to certain extent.

MATERIALS REQUIRED

FOR BLANCHING

Materials: Carrots/potatoes/apples/cabbage,

Utensils: Petri dishes, Wire baskets/muslin cloth, Knife and a chopping board,

Equipments: Water bath, thermometer (if required)

FOR TEST OF BLANCHING

Materials: Blanched samples

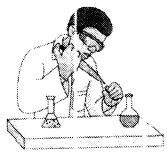
Chemicals: Guaiacol, ethanol, perhydrol (hydrogen peroxide), distilled water

Glasswares: Petri dishes, volumetric flasks, pipettes, beakers, test tubes

Utensils: Pestle and mortar

PREPARATION OF REAGENTS

1) **1% guaiacol in alcohol solution:** Dissolve 1g guaiacol 50 ml of 96% ethyl alcohol and then this preparation is brought to 100ml with the same solvent.
2) **0.3% Peroxide solution:** Dissolve 5ml of hydrogen peroxide in 150 ml of water.



- *Lab attendant should procure different fruits and vegetables samples.*
- *He should prepare reagent, check and calibrate water bath temperature.*
- *He should arrange all the glassware, reagents and equipments required to perform the practical.*

BLANCHING PROCEDURE

1) Take the fruit/vegetable sample, wash with tap water and clean it.
2) Cut the sample into different slices of 1 cm thickness.
3) Divide the slices (10g each) into 9 categories using petri dishes.
4) Fill water bath with water, switch it on and set the desired temperature (80°C). Calibrate the temperature readings using thermometer.
5) Take 3 samples separately in wire basket/ muslin cloth and dip into water bath for specified period (1, 2 and 3 minutes), followed by rapid cooling in cold water.
6) Repeat step (5) for other samples by setting temperature 90°C.
7) Repeat step (5) for other samples by setting temperature 100°C.
8) Then the peroxide test was carried out to find the minimum blanching temperature and time.

TEST FOR BLANCHING

- Blanching tests are of a paramount importance in order to determine the fruit/ vegetable blanching treatments (temperature and time); incomplete enzyme inactivation has a negative effect on finished product quality.
- The enzymes that are usually used as an indication of sufficient blanching are catalase and peroxidase (depending on the fruit/vegetable).
- For cabbage catalase inactivation by blanching is sufficient; blanching further to peroxidase inactivation would have negative effects on product quality and even complete browning.
- For all other vegetables and for potatoes, both tests MUST be negative, for catalase and for peroxidase.

1) Take this 1g of each sample, homogenized in a motar-pestle.
2) Filter through a muslin cloth and prepare the extract.
3) Do the tests for the presence of catalase and peroxidase enzyme.

Catalase Test

$$2H_2O_2 \longrightarrow 2H_2O + O_2 \uparrow$$

- Take 1ml of extract in test tube and add 1ml of H_2O_2 solution.
- Shake the content of test tube well.
- In the presence of Catalase, a strong oxygen generation (effervescence) is observed for 2-3 minutes.

Peroxidase test

- To the same tube to which H_2O_2 is added, add 0.5ml guaicol solution.
- Shake the content of test tube well.
- Keep the tube aside for sometime (approx. 5 min) for colour development.
- Appearance of pink/ red colour confirms the presence of Peroxidase.
- If there are no tissue colour modifications after 5 minutes, the reaction is negative and the enzymes have been inactivated.

OBSERVATIONS

Sample	Temperature (^oC)	Time (sec)	Catalase Test (+/-)	Peroxidase Test (+/-)

CONCLUSION

Practical - 3

Preservation by Application of Heat (Boiling of Milk)

INTRODUCTION

- Preservation by application of heat is most commonly used method of food preservation.
- The important conventional heat processing method includes blanching, pasteurization, sterilization, canning, aseptic processing, microwave, cooking, roasting, frying, boiling, baking, etc.

BOILING OF MILK

- Around 40 percent of the people in the world -- including a large number of children -- consume cow's milk.
- In those areas of the world where pasteurization of milk isn't routine, many consumers boil milk before using it.
- Boiling milk imparts a number of health benefits in terms of food safety and fat levels, but may decrease milk's nutritional content and does not alter its lactose properties.
- Boiling milk kills pathogens that cause illness in regions without access to pasteurized milk.
- Milk boils at a temperature at or above the boiling point of water, depending on the milk's fat and sugar content and the elevation at which the boiling occurs. This boiling temperature kills any bacteria and other microorganisms that may be in the milk.

MATERIALS REQUIRED

Materials: Milk
Equipment and Apparatus: Heating Mantle, beakers (500ml) 2 No., pH meter, etc.

PROCEDURE

1) Take 100 ml of fresh milk in 2 beakers.
2) Measure the pH of fresh milk.
3) Keep one beaker as control while boil the milk of another beaker at 100°C on heating Mantle.
4) Judge the End point of boiling by observing increasing in volume of milk.
5) Keep both milk at ambient temperature and observe the pH of all samples Every 6 hr for 2 days.
6) Reduction of pH of sample during storage period represents degradation of milk quality.

OBSERVATIONS

Effect of Boiling on pH of milk during storage

Sr. No.	Time of Incubation (hr)	pH (Raw milk)	pH (Boiled milk)
1	0		
2	4		
3	8		
4	12		
5	16		
6	20		

CONCLUSION

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Practical - 4

Preservation by Low Temperature (Effect of Refrigeration and Freezing on milk)

INTRODUCTION

- Although most bacteria, yeasts and moulds grow best between 16 - 38°C (60 - 100°F), there are some that will grow at 0°C (32°F) or even below.
- However, below 0°C (50°F) the growth of most microorganisms is slow and becomes slower as the temperature gets colder and colder.
- This is the reason why most foods stay in refrigerator for longer than they do at room temperatures without getting spoilt.
- This is also the reason why one can keep certain food items for months by freezing them. It is, however, important to realize that while cold temperatures slow down bacterial growth and activities and may kill some bacteria; cold including severe freezing cannot be depended upon to destroy all bacteria.
- Cold storage and freezing do not sterilize foods and when the frozen food is thawed the surviving organisms often start growing very rapidly. This is because the food structure may have been somewhat weakened by the cold or frozen storage.
- Thawing as you know refers to the process of bringing the frozen food to room temperature.

MATERIALS REQUIRED

Materials: Milk
Equipment and Apparatus: Refrigerator, Freezer, pH meter, beakers (500ml) 3 No., etc

PROCEDURE

7) Take 100 ml of fresh milk in 3 beakers.
8) Measure the pH of fresh milk
9) Store 3 beakers under different storage conditions (i.e. ambient temperature, refrigerator and freezer).
10) Observe the pH of all samples Every 6 hr for 2 days.
11) Reduction of pH of sample during storage period represents degradation of milk quality.

OBSERVATIONS

Effect of low temperature storage on pH

Sr. No.	Time of Incubation (hr)	Ambient Temp.	Refrigerated Temp.	Freezing Temp.
1	0			
2	6			
3	12			
4	18			
5	24			
6	30			

CONCLUSION

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Practical - 5

Preservation by High Concentration of Sugar (Jam)

INTRODUCTION

- Jam is a product made by boiling fruit pulp with sufficient quantity of sugar to a reasonably thick consistency, firm enough to hold the fruit tissues in position.
- Apple, sapota, papaya, plums, mango, grapes, jack, pineapple, banana, guava and pears are used for preparation of jam.

FSSAI specifications for Jam

Parameters	Specifications
Total Soluble Solids	Not less than 65.0%
Fruit Content (all fruits except strawberry or raspberry)	Not less than 45%
Fruit Content (for strawberry or raspberry)	Not Less than 25%

MATERIALS REQUIRED

Materials: Ripe papaya fruits, sugar, citric acid, paraffin wax, churner, muslin cloth, Glass bottles of packaging.

Utensils: Stainless steel pot, heating source, spatulas, Knife, etc.

Equipments: Refractometer, pH meter

PROCEDURE

1) Select ripe papaya fruits and after washing them thoroughly, cut the fruit into two halves and removes the seeds.
2) Squeeze out the pulp and pass it through churner to make a homogeneous mass.
3) For every 1 kg of the pulp take ¾ to 1 kg of sugar and 10 g of citric acid. Dissolve them in water and heat the mixture to nearly 60°C and strain in through muslin cloth and mix it thoroughly with the pulp.
4) The fruit and sugar mixture is then boiled to concentrate the soluble solids to about 65.0%.
5) Remove the scum during cooking. Occasional stirring of the mass is essential till the temperature reaches 104 to 109°C.
6) Soon after the end point is reached the jam is cooled in a cooling pan to about 200°F and filled into previously sterilized bottles and allow it to set over night.
7) Next day pour a layer of melted paraffin wax on the surface of the jam and glass bottles are sealed and stored in a cool dry place.

SHEET (OR) FLAKE TEST

- Flake or Sheet test is sometimes used to judge the end point of heating when refract meter is available.
- In order to perform that test, a small portion of jam is taken out during boiling in a spoon or wooden laddle and cooled slightly. It is then allowed to drop. If the product falls off in the form of a sheet (or) flakes instead of flowing in a continuous stream (or) syrup, it means that the end point has been reached and the product is ready. Otherwise boiling is continued till the sheet test is positive.

FLOW SHEET FOR PREPARATION OF JAM

Ripe firm fruits
↓
Washing
↓
Peeling
↓
Pulping (Remove seed and core)
↓
Addition of sugar and acid
↓
Boiling (with continuous stirring)
↓
Judging of end point by further cooking up to 105°C (or) 65% TSS (or) by sheet test
↓
Filling hot into sterilized bottles
↓
Cooling
↓
Sterilized bootles
↓
Cooling
↓
Waxing
↓
Capping
↓
Storage (at ambient temperature)

RECIPE FOR PREPARATION OF JAM USING DIFFERENT FRUIT PULPS

(Ingredients for 1 kg of pulp)

Fruit	Sugar (kg)	Citric acid (%)	Water (ml)	Fruit	Sugar (kg)	Citric acid (%)	Water (ml)
Aonla	0.75	-	150	Musk melon	0.75	2.5	50
Apple	0.75	2.0	100	Papaya	0.75	1.0	50
Apricot	0.60	1.0	100	Plum	0,80	-	150
Carrot	0.75	2,5	200	Peach	0.80	3.0	100
Grapes	0.70	1.0	50	Pear	0.75	1.5	100
Guava	0.75	2.5	150	Loquat	0.75	1.0	100
Karonda	0.80	-	100	Mango	0.75	1.5	50

OBSERVATIONS

RAW MATERIAL OBSERVATIONS

Characteristics	Result
Name of fruit	
Weight of whole fruit (g)	
Weight of obtained pulp (g)	
pH of pulp	
°Brix of fresh fruit (%)	
Amount of added Sugar (g)	
Amount of added citric acid (g)	

FINAL PRODUCT OBSERVATIONS

Characteristics	Result
°Brix of Jam (%)	
pH of Jam	
Weight of prepared Jam (g)	
% Yield of Jam (= weight of jam/ weight of whole fruit)	

CONCLUSION

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Practical - 6

Preservation by High Concentration of Sugar (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.
- Guava, sour apple, plum, karonda, wood apple, papaya and jack fruit are rich in pectin and generally used for preparation of jelly. Pineapple, strawberry grapes etc. can be used but only after addition of pectin powder, because these fruits have low pectin content.
- Preparation of jelly is similar to that of jam.
- Pectin, sugar, acid and water which are the four necessary constituents for jelly making, must be present approximately in the following proportions:

  Pectin: 1%
  Sugar: 60 to 65 %
  Fruit acid: 1%
  Water: 33 - 38%

MATERIALS REQUIRED

Materials: Ripe guava fruits, sugar, citric acid, paraffin wax, churner, muslin cloth, pectin, Glass bottles of packaging,
Utensils: Stainless steel pot, heating source, spatulas, Knife, etc.
Chemicals: Alcohol (for alcohol test)
Equipments: Refractometer, pH meter

PROCEDURE

1) Select just ripe, firm and sound fruits.
2) Wash the fruits thoroughly under cold running water and cut in to the slices with a stainless steel knife.
3) Cook the fruit with an equal weight of water containing 1 % citric acid, for 30 -35 minutes, unit it becomes tender and the pectin comes out in the water.

4) The juice should be extracted by hand press through a thick muslin cloth by putting the soft fruit piece and water in the cloth. The cleaner the juice the brighter the finished products.
5) The juice thus obtained should be finally tested for pectin content. This can be done by using Jel meter, or by Alcohol Test.
6) To every 1 kg of extract add ¾kg of sugar.
7) The mixture is boiled rapidly till the setting point is reached.
8) The scum which comes out on the surface during boiling should be removed and the boiling should be continued till the temperature reaches 221°F or when it gives a Sheeting Test.
9) The jelly then poured into previously sterilized glass bottles, allow it to cool and set.
10) Pour a thin layer of melted paraffin wax on the surface of the jelly and sealed the bottles air tight.
11) Label and store the bottles in a cool dry place.

FLOW SHEET FOR PREPARATION OF JELLY

Fruit (Firm, not over ripe)
↓
Washing
↓
Cutting into thin slices
↓
Boiling with water (1 ½ times the weight of fruits for about 20-30 min)
↓
Addition of citric acid during boiling (2 g per kg of fruit)
↓
Straining of extract
↓
Pectin test (for addition of sugar)
↓
Addition of sugar
↓
Boiling
↓
Judging of end point (sheet / drop / temp test)
↓
Removal of scum (or) foam (one teaspoonful of edible oil added for 45 kg sugar)
↓
Addition of colour and remaining citric acid
↓
Filling hot into clean sterilized bottles
↓
Waxing (paraffin wax)
↓
Capping
↓
Storage at ambient temperature

OBSERVATIONS

RAW MATERIAL OBSERVATIONS

Characteristics	Result
Name of fruit	
Weight of whole fruit (g)	
Weight of obtained Juice/ extract (g)	
°Brix of obtained Juice/ extract (%)	
Amount of added Sugar (g)	
Amount of added citric acid (g)	

FINAL PRODUCT OBSERVATIONS

Characteristics	Result
°Brix of Jelly (%)	
Weight of prepared Jelly (g)	
% Yield of Jelly (= weight of jelly / weight of whole fruit)	

CONCLUSION

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Practical - 7

Preservation by High Concentration of Sugar (Fruit Preserve)

INTRODUCTION

- A product in which the fruit retains its form and flavour with crispness when fully permeated with sugar syrup is termed as Fruit Preserves.
- A preserve is made from properly matured fruit, by cooking it whole or in large piece in a heavy syrup till it becomes tender and transparent.
- In its preparation not less than 450g of the fruit are used for every 550g of sugar, and cooking is continued till a concentration of at least 68 percent of soluble solids is achieved.
- Freshly made preserves are wholesome and attractive.
- Preserves made from frozen, fruits are generally superior in colour and flavour to those made from fresh fruits stored at room temperature.
- Fruits used for preserves are mango, apple, aonla, pears, peaches, apricot, cherries and vegetables used for preserves are ash gourd, carrot, bottle gourd.

MATERIALS REQUIRED

Materials: Matured Aonla fruits, sugar, Citric acid, Fork or Needle, Water, muslin cloth, Glass bottles of packaging, etc.
Utensils: Stainless steel pot, heating source, spatulas, Knife, etc.
Equipments: Refractometer

PROCEDURE

1) Select fully developed, firm and slightly underripe fruits. Unripe or fruits with loose pulp should be rejected.
2) Wash the fruits thoroughly and remove the damaged portions if any.
3) Peel the fruit and cut into large and good looking pieces. Take out the seeds or stones.
4) Keep the piece or slices in brine of water to prevent from browning.
5) Puncture the fruit or fruit slices uniformly so that sugar syrup may permeate properly.
6) The punctured materials are generally soaked in water, lime water, brine or alum solution before blanching and cooking. Soak the peeled slices for half an hour in lime water. The time to water ratio should be 1:3.
7) Wash the soaked slices thoroughly with water. Wrapped the wash slices in muslin cloth and dip it in boiling water for 5 to 10 minutes, till they become tender 2-3 percent alum solution may be used for boiling.

8) Sugar, equal to half the weight of fruit, is then put on the boiled piece in alternate layers, and the mass allowed to stand for 24 hours (36 to 38 0 Brix). The fruit gives out excess of water, and the sugar goes into solution giving a syrup of about 37-38 0 Brix.
9) More sugar is added to raise the strength of the syrup to about 60 0 Brix. A small quantity of citric acid or Tartaric acid (1.5 to 3 gm/kg weight of sugar) is also added to invert a portion of the cane sugar. The whole mass is then boiled for 4-5 minutes and left for 24 hours.
10) On the third day, , the strength of the sugar is raised to about 60 0 Brix and the mass boiled again for 4-5 minutes. The fruit is then left in the syrup for 3-4 days. Finally, the strength of the syrup is raised to 70 0 Brix.
11) Allow the piece to remain in syrup for 4-6 weeks in case of vegetables and 2-3 weeks in case of fruits.
12) The fruit is drained from the syrup and put into dry containers. Freshly prepared boiling syrup of 68°Brix is then poured into the containers which are exhausted for 8 -10 minutes at 212 °F and thereafter sealed air tight.

OBSERVATIONS

RAW MATERIAL OBSERVATIONS

Characteristics	Result
Name of fruit	
Weight of whole fruit (g)	
Amount of added Sugar (g)	
Amount of added citric acid (g)	

FINAL PRODUCT OBSERVATIONS

Characteristics	Result
°Brix of Preserve (%)	
Weight of prepared Preserve (g)	
% Yield of Preserve (= weight of preserve/ weight of whole fruit)	

CONCLUSION

Practical - 8

Preservation by using Salt (Pickling)

INTRODUCTION

- The preservation of food in common salt (or) in vinegar is known as pickling. It is one of the most ancient methods of preserving fruits and vegetables. Pickles are good appetizers and add to the palatability of a meal. They stimulate the flow of gastric juice and thus helps in digestion.
- Sodium chloride is an indispensable component of food. At lower concentrations it contributes significantly to the flavour. At higher concentrations it exhibits an important bacteriostatic action.
- **Pickling** is the result of fermentation by lactic acid forming bacterial which are generally present in large numbers on the surface of fresh vegetables and fruits. Theses bacteria can grow in acid medium and in the presence of 8-10% salt solution whereas the growth of a majority of undesirable organisms is inhibited. Some fruits like lime, mango, etc. are also preserved with salt.

MATERIALS REQUIRED

Materials: Lime, salt, red chilli powder, cinnamon, cumin, cardamom, black pepper, cloves, etc.
Utensils: Stainless steel pot, heating source, spatulas, Knife, etc.
Equipments: Refractometer

RECIPE

Lime - 1 kg, salt - 200 g red chilli powder -15 g, cinnamon, cumin, cardamom and black pepper (powdered) each - 10 g cloves - 5 Nos.

PROCEDURE

1) Select under □ripe full development variety of limes
2) Wash them in water.
3) Slice them longitudinally into 4 pieces and squeeze out juice from ½f slices.
4) Make spices mix as per recipe and mix it thoroughly with lime pieces and keep it in Glass jar
5) Tight it well to prevent movement of air.
6) Keeping in sun for 4-6 days (shaking jar at least twice a day).
7) Roast the fenugreek in dry form in a pan. Mix the other ingredients with the slices and smear them with a little mustard oil.

8) Pack the pickle in glass or glazed jar and covered with a thin layer of mustard oil. The pickle will be ready in 2-3 weeks.

FLOWSHEET FOR PREPARATION OF LIME PICKLE

Limes
↓
Washing
↓
Cutting into 4 pieces
↓
Squeezing out juice from ½ amount of fruit
↓
Mixing spices and salt with juice
↓
Mixing with lime pieces
↓
Filling in jars
↓
Covering with lid
↓
Keeping in sun for 4-6 days (shaking jar atleast twice a day)
↓
Storage at ambient temperature

OBSERVATIONS

Characteristics	Result
Weight of whole fruit (g)	
Weight of prepared pickle (g)	
% Yield (weight of pickle / weight of fruit)	

CONCLUSION

Practical - 9

Preservation by using chemical Preservatives (Sodium Benzoate)

INTRODUCTION

- Sodium benzoate is a substance which has the chemical formula $NaC_7H_5O_2$.
- Sodium benzoate is 180 times more soluble than benzoic acid.
- It is a widely used food preservative, with an E number of E211. It is the sodium salt of benzoic acid and exists in this form when dissolved in water.
- It is bacteriostatic and fungistatic under acidic conditions. It is most widely used in acidic foods such as salad dressings (vinegar), carbonated drinks (carbonic acid), jams and fruit juices (citric acid), pickles (vinegar), and condiments.
- Optimal pH for activity of sodium benzoate is 2.5 to 4.0.
- Benzoic acid, sodium benzoate, calcium benzoate, sorbic acid potassium sorbate, sodium sorbate and calcium sorbate.
- They are usually used in fruit juices and carbonated drinks as KMS (potassium metabisulphite cannot be used due to its color bleaching effect), however, the use of sodium benzoate with fruit juices rich in ascorbic acid should be prevented as with ascorbic acid (vitamin C) sodium benzoate leads to formation of benzene which is highly toxic.
- The level of sodium benzoate to be used in food varies depending upon the product. In general, their maximum allowable in a food product is regulated at 0.1%.

PRESERVATION OF MANGO RTS USING SODIUM BENZOATE

- RTS (Ready-to-Serve) beverage is prepared from fruit juice. It contains minimum of 10% fruit and 10% sugars. It not diluted before serving.
- Mango (*Mangifera indica* L.) is the most important and commercially cultivated fruit in India. The fresh mango juice has limited shelf life therefore it can be converted to value added product i.e. Mango RTS (Ready-to-Serve) beverage and preserved using Sodium Benzoate.

MATERIALS REQUIRED

Materials: Mango fruit (*Totapuri*) variety, water, citric acid, bottles for packaging, etc.

Utensils: Stainless steel pot, muslin cloth, pulper, spatulas, Knife, etc.

Equipments: Refractometer

PROCEDURE

1) Wash the fruit and cut into two halves. Separate the stone and remove the pulp.
2) Mix the pulp and stain using stainer or muslin cloth.
3) Add required quantity of pulp, grinded sugar and water.

4) Pulp to sugar ratio should be maintained to 10:10.
5) The pulp and sugar should be mixed thoroughly and heated up to 65°C to dissolve it properly.
6) Homogenize the mixture with mixer grinder and again stain with muslin cloth.
7) Add sodium benzoate @ 600 ppm.
8) Fill the RTS beverage in sterilized glass bottles (200ml capacity) and sealed with crown cork.

OBSERVATIONS

Characteristics	Result
Name of fruit	
Weight of whole fruit (g)	
Amount of Pulp (g)	
Amount of added sugar (g)	
% yield of RTS Beverage	

CONCLUSION

***

Practical - 10

Preservation by using chemical Preservatives (Calcium Propionate)

INTRODUCTION

- Calcium propanoate is used as a preservative in a wide variety of products, including but not limited to: bread, other baked goods, processed meat, whey, and other dairy products.
- It is listed as E number 282. It has the formula $Ca(C_2H_5COO)_2$. It is the calcium salt of propanoic acid.
- Propanoates prevent microbes from producing the energy they need, like benzoates do. However, unlike benzoates, propanoates do not require an acidic environment.
- Calcium propanoate is used in bakery products as a mold inhibitor, typically at 0.1-0.4%.
- Mold contamination is considered a serious problem amongst bakers, and conditions commonly found in baking present near-optimal conditions for mold growth.
- Bacillus mesentericus (rope) and molds are serious problem in bread which could be prevented by adding Calcium Propionate.
- Calcium propanoate can also be used as a fungicide on fruit.

MATERIALS REQUIRED

Materials: Flour, water, salt, yeast, sugar, shortening, skim milk powder
Chemicals: Calcium propionate
Utensils: steanless steel bowl, bread molds, dough divider, trough, etc.
Equipments: Weighing balance, dough kneader, , baking oven, etc.
RECIPE FOR BREAD

Flour	100%	Water	60%	Salt	2%
Yeast	1%	sugar	2%	shortening	1.5%
Skim milk powder	0.5%				

Note: The percentage used here is called baker□s percent in which quantity of flour is always taken as 100 percent.

PROCEDURE

- There are two general methods of bread preparation i.e. Straight Dough Process and Sponge Dough Process.

- Preparation of bread itself is a scientific process and involves various technical know-hows (which the students are expected to learn during subsequent courses).
- In this practical students are going to observe the effect of Calcium propionate on microbial quality of bread.

1) Preparation two different formulations as per recipe given above
2) Two bread loaves should be prepared; 1) control sample without addition of calcium propionate 2) treated sample with 0.1% of calcium propionate.
3) Preparation of bread should be carried out according to following flowsheet.

PREPARE THE BREAD FOLLOWING PROCEDURE GIVEN IN FLOWSHEET

Preparation of ingredients
↓
weighing
↓
Sifting and blending of flour
↓
Tempering of water
↓
Preliminary mixing of yeast, dried milk powder, etc
↓
Dough mixing
↓
Dough placed in trough
↓
Dough allowed to rise, turned and folded
↓
Dough sent to bench or divider
↓
Dividing and scaling
↓
Rounding
↓
Intermediate proofing
↓
Moulding
↓
Panning
↓
Pan proofing
↓
Baking
↓
Cooling
↓
Slicing
↓
Packaging
↓
Storage

4) Bread should be stored at ambient temperature.
5) Students should take observation for development of mold after 3rd day regularly up to 7 days.

OBSERVATIONS

SINCE 3RD DAY OF BREAD PREPARATION

Day and Date	Control Sample	Treated Sample
Day 3		
Day 4		
Day 5		
Day 6		
Day 7		

CONCLUSION

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Practical - 11

Drying and Dehydration of Fruit

INTRODUCTION

- Microorganisms need moisture to grow so when the concentration of water in the food is brought down below a certain level, they are unable to grow. Moisture can be removed by the application of heat as in sun-drying or by mechanical drying (dehydration).
- *Sun drying* is the most popular and oldest method of preservation. Drying is the process of removal of water without controlling the other parameters.
- *Food dehydration* refers to the nearly complete removal of water from the food under controlled conditions of temperature, relative humidity and air flow.
- Fruits are high in moisture content therefore cheap method of processing like drying and dehydration could be a possible measure to reduce the wastage during peak season.

MATERIALS REQUIRED

Materials: Apple or pineapple
Utensils: Knife, trays, kitchen board, muslin cloth, parchment paper
Chemical: Potassium metabisulphate (KMS)
Equipments: Cabinet drier, thermometer

PROCEDURE

Carry out the drying and dehydration of fruit as given in flowsheet.

PROCEDURE

Drying

Washing of fruit
↓
Removal of peel and seeds
↓
Cutting into thin slices
↓
Carry out blanching of slices
↓
Dipping in 1% KMS solution
↓
Arranging slices in parchment paper coated trays
↓
Sprinkling of seasonings at surface

Dehydration

Washing of fruit
↓
Removal of peel and seeds
↓
Cutting into thin slices
↓
Carry out blanching of slices
↓
Dipping in 1% KMS solution
↓
Arranging slices in parchment paper coated trays
↓
Sprinkle seasonings at surface

↓

Carry out drying under sun

↓

Turning of slices every two hours

↓

Take observations for reduction of weight

↓

Observe the quality of product

↓

Carry out drying in cabinet drier

↓

Turning of slices every two hours

↓

Cooling

↓

Take observation for reduction of weight

↓

Observe the quality

Note: Additional treatment may require depending upon the type of fruit

OBSERVATIONS

Name of Fruit : _____

OBSERVATIONS BEFORE AND AFTER DRYING & DEHYDRATION

Parameter	Drying	Dehydration
Quantity of fruit		
Quantity of Slices		
Edible Index		
Waste Index		

OBSERVATIONS DRUING AND AFTER DRYING & DEHYDRATION

Parameter	Drying	Dehydration
Loss in weight after		
Drying period		
Average time		
Average Temperature		
Weight of Dried Product		
% Yield of Dried Product		

CONCLUSION

Practical - 12

Drying and Dehydration of Vegetables

INTRODUCTION

- Vegetable is a part of one of the vegetative organs of the plant: roots, stems or leaves, or shoot systems.
- There are a few "vegetables which are difficult; broccoli and cauliflower are inflorescence buds, and artichokes are the entire inflorescence. Since flowers, the reproductive organ of the plant produce fruits and seeds, perhaps those vegetables which are inflorescences are more similar to fruits than they are vegetables.
- Fruits are high in moisture content therefore cheap method of processing like drying and dehydration could be a possible measure to reduce the wastage during peak season

MATERIALS REQUIRED

Materials: vegetable
Utensils: Knife, trays, kitchen board, muslin cloth, parchment paper
Chemical: Potassium metabisulphate (KMS)
Equipments: Cabinet drier, thermometer

PROCEDURE

Carry out the drying and dehydration of fruit as given in flowsheet.

PROCEDURE

Drying

Wash of vegetable
↓
Carry out Cleaning, trimming and cutting
↓
Carry out Blanching
↓
Dipping in 5% KMS solution
↓
Arranging pieces in parchment paper coated trays
↓
Measure the drying period (h) during day and keep the sample in packed container till next day

Dehydration

Washing of vegetable
↓
Removal of peel and seeds
↓
Cutting into thin slices
↓
Dipping in 5% KMS solution
↓
Arranging slices in parchment paper coated trays
↓
Sprinkling of seasonings at surface
↓
Drying in cabinet drier for

Turning of slices every two hours	Turning of slices every two hours
↓	↓
Repeat the above step for 2 days	Cooling
↓	↓
Take observations for reduction of weight	Take observation for reduction of weight
↓	↓
Observe the quality of product	Observe the quality

Note: Additional treatment may require depending upon the type of fruit

OBSERVATIONS

Name of Fruit : _____

OBSERVATION BEFORE AND AFTER DRYING & DEHYDRATION

Parameter	Drying	Dehydration
Quantity of vegetables		
Quantity of shreds		
Edible Index		
Waste Index		
Average Temperature		
Average Drying Time		
Weight of Dried Product		
% Yield of Dried Product		

CONCLUSION

_____

_____

_____

Practical - 13

Preservation of Coconut Shreds using Humectants

INTRODUCTION

Coconut shreds are used for bakery, confectionary and household purposes. Consumer acceptance of coconut products largely depends on whether the coconut is perceived as moist. Importantly, the percent water is not the only factor affecting the moisture perception. During the shredding and drying process to prepare for shipping, the coconut cellular structure is permanently damaged. As a result, simply adding water back to these coconut flakes, besides encouraging microbial growth, rehydrates the coconut in an undesirable manner. A product rehydrated in this manner has either matty or wet texture coupled with an undesirable off-flavor. To overcome these problems humectants to produce a perceptually moist coconut product could be used. In this practical, we will evaluate the suitability of humectant which can be used for preserving the quality of coconut shreds.

MATERIALS REQUIRED

Materials: Coconut, Sorbitol, Glycerine, Propylene glycol, Sugar, Commercial coconut shred samples.

Utensils or equipments: Shredder, Oven, Knife, Petri plates, Weighing balance

PROCEDURE

Coconut
↓
Separation of hairy structure
↓
Separation of Hard covering
↓
Peeling out the hard external cover using knife
↓
Shredding
↓
Different treatments with Humectants
↓

Drying up to optimum desired moisture content (20%)

↓

Packaging in LDPE bags

↓

Storage at ambient temperature

OBSERVATIONS

General Properties	Results
Weight of individual coconut	
Weight of fibrous waste	
Weight of hard covering	
Weight of peel	
Weight of edible coconut	

Changes in moisture content of coconut shreds with different humectants

General Properties	Fresh	2 days	4 days	8 days	10 days	1 month
Control sample						
Glycerine (2%)						
Glycerine (4%)						
Glycerine (8%)						
Sorbitol (2%)						
Sorbitol (4%)						
Sorbitol (8%)						
Propylene glycol (2%)						
Propylene glycol (4%)						
Propylene glycol (8%)						

CONCLUSION

Practical 14

Reconstitution Test for Dried Vegetable Samples

INTRODUCTION

This experiment was carried out to test the reconstitution of the dried vegetable sample. In reconstitution water is added to the product which is restored to a condition similar to that when it was fresh. This enables the food product to be cooked as if the person using fresh fruit or vegetables. It can be used as a measure of the quality of the product.

MATERIALS

Materials: Previously dried sample, Beaker, Cold water

PROCEDURE

5g of previously dried sample 5g of previously dried samplein beaker

↓

Addition of 50 ml of cold water

Cold water was added 10 times of the weight of the dried product.↓

Cover the container and boil the product under it get tender

↓

The container was covered and boiled and simmered gently until the product was tendered. The Cooking time was 30 minutes after the boiling point had been reached

↓

The sample was tested for palatability, toughness, flavour and presence or absence of bad flavour.

↓

Re-hydration ratio is evaluated

OBSERVATIONS

General Properties	Results
Weight of the dried sample	
Weight of the re-hydrated sample	
Rehydration Ratio	

CALCULATION

Re-hydration ratio= Wr/Wd

Wr = Weight of the sample after re-hydration

Wd = Weight of the dried sample

CONCLUSION

***

Practical - 15

Spray Drying of Milk

INTRODUCTION

- Spray drying is a method of producing a dry powder from a liquid or slurry by rapidly drying with a hot gas.
- The liquid food is generally preconcentrated by evaporation to economically reduce the water content.
- The concentrate is then introduced as a fine spray or mist into a tower or chamber with heated air.
- The advantages of spray drying include a low heat and short time combination which leads to a better quality product.

PRINCIPLE

The surface area of liquid is increased by passing through atomizer and droplet of less than 2 μm are exposed to heated air for very short time which flashes off moisture. The small particles formed are carried away by pressurized air and collected using cyclone separator.

COMPONENTS OF SPRAY DRIER

Principal components include:

- a high pressure pump for introducing liquid into the tower
- a device for atomizing the feed stream
- a heated air source with blower
- a secondary collection vessel for removing the dried food from the airstream
- means for exhausting the moist air

MATERIALS REQUIRED

Materials: Milk

Equipment and Apparatus: Spray drier, beaker, desiccator, weighing balance, petri dish, etc.

PROCEDURE

1. Collect the Milk is beaker and dip the feeder in milk.
2. Power on the Spray drier machine, air condenser.
3. Set the inlet temperature to 135°C.
4. After reaching to temperature, set the aspirator speed to 45 and start the feed pulp with 20 values (signifying 200ml of milk to pass through the system per hr).
5. Collect the Milk powder from the outlet beaker and cyclone separator in petri plate.
6. Immediately keep it in desiccator unless it reaches to ambient temperature.
7. Measure the quantity of milk powder obtained.

OBSERVATIONS

GENERAL OBSERVATIONS

Particulars	Results
Quantity of Milk	
Inlet Temperature	
Outlet Temperature	
Drying Time	
Quantity of obtained Powder	
% Yield	

CONCLUSION

***

Practical - 16

Preparation of Fermented Products (Sauerkraut)

INTRODUCTION

Sauerkraut (sour cabbage) is finely cut cabbage that has been fermented by various lactic acid bacteria, including Leuconostoc, Lactobacillus, and Pediococcus. It has a long shelf-life and a distinctive sour flavor, both of which result from the lactic acid that forms when the bacteria ferment the sugars in the cabbage.

CHEMICAL COMPOSITION OF CABBAGE

Cabbage contains 35 - 49% fermentable carbohydrate, 2.3 - 3.5 % protein nitrogen, 7 -9 % ash, 0.28 - 0.45% phosphorus, 0.27 - 0.49% inorganic sulfur and 5.3 - 7.1% solids.

MICROBES IN SAUERKRAUT FERMENTATION

Raw cabbage contains sufficient numbers of desirable lactic acid bacteria for spontaneous fermentation. In early stage of fermentation, most of the lactic acid bacteria are the heterofermentative (gas forming) species such as Leuconostoc mesenteroides. After 8 days of fermentation, most of the lactic acid bacteria are the homofermentative (nongas-forming) species such as lactobacillus plantarum.

FACTOR AFFECTING SAUERKRAUT FERMENTATION

It has been shown that growth and fermentation patterns are affected by:

i. *Variety of cabbage*: Indian cabbage variety *Hari rani* is recommended. It should be preferably organically grown.

ii. *Temperature*: temperature of shredded cabbage has a profound influence on the rate of fermentation. The rate of sauerkraut fermentation is rapid at 32C and 1.8 to 2% lactic acid can be produced 8 - 10 days.

iii. *Salt concentration*: A salt concentration of 2.25% favors the growth of desirable lactic acid bacteria in their natural sequence and results in a finished product with the proper balance of salt to acid.

PRINCIPLE

Sauerkraut is made by a process called lacto-fermentation. Addition of 2.5% salt causes water to lead out from cabbage shreds which facilitate the growth of Lactic acid bacteria (*Lactobacillus, Leuconostoc and Pediococcus, etc.*) present on cabbage surface causing fermentation of shreds and resulting into sourness and flavour development.

MATERIALS REQUIRED

Materials: Fresh, mature cabbage, Non-iodized salt

Utensils/equipments: Wooden spatula, Glass jar with lid, Glass plate and weight, Muslin cloth, Shredder, etc.

PROCEDURE

Select Fresh, mature cabbage
↓
Discard the upper leave
↓
Separate other leaves from the core
↓
Gently wash in tap water
↓
Shred the cabbage leave
↓
Put the cabbage shreds on glass or ceramic crock
↓
Sprinkle salt on the surface of shreds and apply thoroughly
↓
Mix the salt and let the cabbage stand for 1 hr.
↓
Compact the shreds using wooden spoon
↓
Add salted water (if required) to cover the shreds / or remove assess water if (observed)
↓
Weigh down the cabbage to keep it under the liquid using plate and some weight
↓
Cover the container with clean muslin cloth
↓
Keep in cool and dark place for fermentation
(4 - 6 weeks at the temperature of 10 - 15°C)
↓
Fill the fermented cabbage and late brine into retail package
↓
Sauerkraut

OBSERVATIONS

GENERAL OBSERVATIONS

Particulars	Quantity
Weight of Whole cabbage	
Weight of core and other waste	
Edible index	
Waste index	
Weight of shreds	
Quantity of salt used (2.5%)	
Quantity of salt solution used	
Amount of water leached after 1 hr	
Weight of sauerkraut	
Yield of sauerkraut	

CHANGES DURING FERMENTATION

Incubation Time	pH	Acidity	Quantity
Fresh			
1 week			
2 week			
3 week			
4 wheat			
5 weak			
6 weak			

- Titratable acidity should reach to 1.5% after fermentation

CONCLUSION