Chapter 2

Principles of Preservation & of Horticultural Pr

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This booklet covers Chapter 2 only. All content is in simple British English so it is easy to understand. Great for CBSE Board exams, NEET, and competitive exams.

📖 EASY STUDY NOTES — CHAPTER 2

Why is Preservation Important?

In India, about 30–40% of horticultural produce (fruits, vegetables, flowers) is wasted after harvesting because of improper handling and storage. If this produce is preserved and converted into value-added products such as jams, juices, pickles, and dried goods, farmers earn more money, food is available even in the off-season, and more jobs are created.

Benefits of Processing & Preservation:

- Raw food is converted into a safe, tasty, and usable form.
- Seasonal food becomes available throughout the year.
- Post-harvest losses are greatly reduced.
- Export opportunities increase.
- Employment is created in packing, grading, storage, and marketing.

3 Main Principles of Preservation

Principle	What it Means	How We Do It
1. Stop Microbial Decomposition	Prevent bacteria, fungi, and yeast from spoiling food	Acidity, filtration, low temperature, drying, chemicals, he
2. Stop Self-Decomposition	Food breaks down by its own enzymes and chemical reactions	Blanching (destroys enzymes), antioxidants (stop oxidati
3. Stop Physical Damage	Insects, rodents, and rough handling damage food	Proper packaging and safe storage

Physical Methods of Preservation

A) Thermal Processing (Using Heat)

Method	Temperature	What Happens	Example Use
Blanching	At or below 100°C (boiling water)	Destroys enzymes; reduces surface microbes	Before freezing vegetables
Pasteurisation	Below 100°C LTH: 63°C / 30 min HTST: 71.7°C / 15 sec	Kills harmful (pathogenic) microorganisms	Milk, fruit juices
Sterilisation	121°C or higher UHT: 140°C / 2–4 sec	Kills ALL microorganisms; shelf life = 6+ months	Canned food, UHT milk

🔑 Key Difference Blanching ≤ 100°C → Pasteurisation < 100°C → Sterilisation > 100°C. Pasteurisation kills only harmful microorganisms; Sterilisation kills all microorganisms.

B) Drying / Dehydration

Drying is perhaps the oldest method of food preservation. When food is dried, its weight reduces to 1/4th to 1/8th of the original weight. Without moisture, microorganisms cannot grow. Types of drying include:

- Solar Drying — drying under sunlight (cheapest method)
- Atmospheric Drying — using machines (cabinet dryers, spray dryers, drum dryers)
- Osmotic Dehydration — placing food in concentrated sugar or salt solution
- Freeze Drying — most advanced method; best quality product

Chemical Methods of Preservation

High Sugar: Water activity drops below 0.70 — microbes cannot survive. Used in Jam, Jelly, Murabbah.

Salt / Vinegar (Pickling): Common salt or vinegar creates a hostile environment for microbes. Used in Pickles, Sauces.

Chemical Additives: FDA-approved preservatives such as Sodium Benzoate and Potassium Metabisulphite are used in small quantities (up to 0.2%) without affecting taste.

Biological Preservation — Fermentation

Fermentation uses selected desirable microorganisms (such as lactic acid bacteria or yeast) to preserve food. Alcoholic fermentation produces wine and beer; lactic acid fermentation produces pickles and kanji. Fermentation reduces harmful microbes while producing flavour.

Hurdle Technology	Hurdle Technology means combining two or more preservation methods together. For example: mild heat + reduced pH + lowered water activity + chemical additives. Each "hurdle" adds an extra barrier against microbial growth, resulting in a safer product.

VALUE ADDED PRODUCTS — QUICK REFERENCE

Product	Key Feature / Specification
Jam	Made from fruit pulp + sugar; TSS ≥ 68.5%; cloudy appearance
Jelly	Made from fruit extract + pectin + sugar + acid; clear & transparent
Marmalade	Citrus fruit jelly with fruit slices or shredded peel suspended in it
Murabbah (Preserves)	Whole fruits/vegetables in sugar syrup; TSS ≈ 70%; hermetically sealed
Chutney & Sauce	Fruit/vegetable + spices, salt, sugar, vinegar; preserved with Sodium Benzoate
Squash	Min. 25% fruit juice, 40% TSS
RTS (Ready to Serve)	Min. 10% TSS, 10% fruit juice
Cordial	30% TSS, 25% fruit juice
Fruit Syrup	65% TSS, 25% fruit juice
Pickles — Unfermented	Preserved with spices and oil

Pickles — Fermented	Preserved by lactic acid fermentation
Raisins	Dried grapes
Amchur	Dried raw mango powder
Gulkand	Dried rose petals + sugar in ratio 1:2; sun-dried
Dry Flowers / Pot Pourri	Sand drying or air drying; fixatives like salt or gum benzoin added
Essential Oils & Fragrances	Extracted from flowers; supercritical CO_2 extraction gives high purity

PART A | Multiple Choice Questions (MCQs) — 20 Questions

Instructions: Choose the correct option (a, b, c or d) for each question. Answers are given at the end of this section.

Q1. In India, approximately what percentage of horticultural produce is wasted after harvesting?

(a) 10–15%
(b) 20–25%
(c) 30–40%
(d) 50–60%

Q2. Which of the following is NOT one of the three main principles of food preservation?

(a) Prevention of microbial decomposition
(b) Prevention of self-decomposition
(c) Prevention of over-ripening
(d) Prevention of physical damage

Q3. Blanching is carried out at a temperature of:

(a) Below 50°C
(b) At or below 100°C
(c) Exactly 121°C
(d) Above 150°C

Q4. The main purpose of blanching in food processing is to:

(a) Kill all microorganisms
(b) Destroy enzymes
(c) Add flavour
(d) Increase shelf life to 6 months

Q5. Which pasteurisation method uses a temperature of 71.7°C for 15 seconds?

(a) LTH (Low Temperature Holding)
(b) UHT processing
(c) HTST (High Temperature Short Time)
(d) Sterilisation

Q6. Sterilisation of canned food is typically carried out at:

(a) 63°C
(b) 100°C
(c) 121°C
(d) 140°C

Q7. After drying/dehydration, the weight of food is reduced to what fraction of the original?

(a) 1/2 to 1/3
(b) 1/4 to 1/8
(c) 1/10 to 1/12

(d) 1/16 to 1/20

Q8. Which of the following is the oldest method of food preservation?

(a) Canning
(b) Chemical preservation
(c) Drying/Dehydration
(d) Fermentation

Q9. Jam is different from jelly because jam has a:

(a) Transparent appearance
(b) Cloudy appearance
(c) Lower sugar content
(d) Higher water activity

Q10. The minimum TSS (Total Soluble Solids) required in Jam is:

(a) 40%
(b) 55%
(c) 65%
(d) 68.5%

Q11. Which product is made from citrus fruit jelly with fruit slices or shredded peel suspended in it?

(a) Jam
(b) Preserve (Murabbah)
(c) Marmalade
(d) Cordial

Q12. According to FPO specifications, RTS (Ready to Serve) beverages must contain a minimum of:

(a) 5% fruit juice and 5% TSS
(b) 10% fruit juice and 10% TSS
(c) 25% fruit juice and 40% TSS
(d) 30% fruit juice and 65% TSS

Q13. Potassium Metabisulphite is used in food preservation as a:

(a) Flavouring agent
(b) Colouring agent
(c) Chemical preservative
(d) Thickening agent

Q14. Which gas is added to beverages to make them carbonated?

(a) Oxygen (O_2)
(b) Nitrogen (N_2)
(c) Carbon Dioxide (CO_2)
(d) Hydrogen (H_2)

Q15. Hurdle Technology in food preservation means:

(a) Using only one preservation method
(b) Combining two or more preservation methods
(c) Using very high temperatures only
(d) Removing all nutrients from food

Q16. Which method of drying is considered the most advanced and gives the best quality product?

(a) Solar drying
(b) Cabinet drying
(c) Spray drying
(d) Freeze drying

Q17. Gulkand is prepared from:

(a) Jasmine flowers
(b) Dried rose petals and sugar
(c) Mango pulp and spices
(d) Citrus peel and jaggery

Q18. In fermentation-based preservation, which type of bacteria is considered highly desirable?

(a) Pathogenic bacteria
(b) Lactic acid bacteria
(c) Coliform bacteria
(d) Aerobic bacteria

Q19. Squash (according to FPO standards) must contain a minimum of:

(a) 10% fruit juice
(b) 15% fruit juice
(c) 25% fruit juice
(d) 30% fruit juice

Q20. Nicolas Appert is known as the:

(a) Father of Horticulture
(b) Father of Canning
(c) Father of Fermentation
(d) Father of Botany

MCQ Answer Key:

Q1: (c) | Q2: (c) | Q3: (b) | Q4: (b) | Q5: (c)
Q6: (c) | Q7: (b) | Q8: (c) | Q9: (b) | Q10: (d)
Q11: (c) | Q12: (b) | Q13: (c) | Q14: (c) | Q15: (b)
Q16: (d) | Q17: (b) | Q18: (b) | Q19: (c) | Q20: (b)

PART B | Fill in the Blanks — 10 Questions

Instructions: Fill in each blank with the correct word or phrase. Answers are given at the end.

1. In India, approximately _____ of horticultural produce is lost after harvesting due to improper handling.

2. Blanching is done to inactivate _____ in vegetables and fruits.

3. Sterilisation of food is carried out at approximately _____ to kill all microorganisms.

4. Jam has a _____ appearance, while Jelly has a transparent appearance.

5. Jam contains a minimum of _____ TSS (Total Soluble Solids).

6. The process of preserving food in salt or vinegar is called _____.

7. RTS beverages should have a minimum of _____ fruit pulp/juice.

8. In drying/dehydration, the weight of the product is reduced to _____ of the original weight.

9. For preparing carbonated drinks, _____ gas is dissolved in the beverage.

10. Gulkand is made from dried _____ petals mixed with sugar in a ratio of 1:2.

Fill in the Blanks — Answers:

1. 30–40%
2. enzymes
3. 121°C
4. cloudy
5. 68.5%
6. Pickling
7. 10%
8. 1/4th to 1/8th
9. CO_2 (Carbon Dioxide)
10. rose

PART C | Book Exercise FAQ — 10 Questions & Answers

These are important questions taken directly from or closely based on the NCERT / textbook exercises.

Q1. What is thermal processing? Describe its different methods.

Answer: Thermal processing is the technique of using heat to destroy or inactivate microorganisms in food. There are three main methods: (i) Blanching — food is exposed to boiling water or steam at approximately 100°C to destroy enzymes and reduce surface microbes; (ii) Pasteurisation — mild heat below 100°C is applied to kill pathogenic (harmful) microorganisms. Two methods are used: LTH (63°C for 30 minutes) and HTST (71.7°C for 15 seconds); (iii) Sterilisation — very high temperature (121°C) kills ALL microorganisms. Shelf life extends to 6 months or more. UHT processing (140°C for 2–4 seconds) is an advanced form of sterilisation.

Q2. Describe briefly different methods of preservation of fruit juices and beverages.

Answer: (i) Pasteurisation — Holding method (85°C for 25–30 minutes) or Flash pasteurisation. (ii) Carbonation — CO_2 gas is dissolved in the beverage; it inhibits microbial growth and gives a refreshing taste. (iii) Chemical Preservation — 700 ppm Potassium Metabisulphite or 700 ppm Sodium Benzoate is added. (iv) Fermentation — alcoholic, lactic acid, or acetic acid fermentation is used to naturally preserve and flavour beverages.

Q3. List the value-added products that can be made from fruits.

Answer: Value-added products from fruits include: Jam, Jelly, Marmalade, Preserves (Murabbah), Chutney, Sauce, Fruit Juice, Squash, Syrup, Nectar, RTS beverages, Cordial, Fruit Juice Concentrate, Pickles, Dried products (Raisins from grapes, Amchur from raw mangoes), and Fermented beverages (Wine, Beer, Cider).

Q4. Briefly discuss the principles involved in preservation of fruits and vegetables.

Answer: There are three main principles: (i) Prevention/delay of microbial decomposition — achieved by asepsis, filtration, low temperature storage, drying, chemical preservatives, heat, or radiation. (ii) Prevention/delay of self-decomposition — enzymes are destroyed by blanching; antioxidants are added to prevent oxidation. (iii) Prevention of damage by insects, rodents, and mechanical handling — achieved through proper packaging and safe storage conditions.

Q5. What is the difference between pasteurisation and sterilisation?

Answer: Pasteurisation uses a temperature below 100°C (e.g., 63°C/30 min or 71.7°C/15 sec). It kills only harmful (pathogenic) microorganisms and gives a shorter shelf life. Sterilisation uses a temperature above 100°C (typically 121°C). It kills all microorganisms and gives a shelf life of 6 months or more. Pasteurisation is used for milk and juices; sterilisation is used for canned foods.

Q6. What is Hurdle Technology? Why is it used?

Answer: Hurdle Technology is a food preservation approach that combines two or more preservation methods simultaneously. Each method acts as a 'hurdle' that microorganisms must overcome. Examples include combining mild heat treatment with a slight reduction in pH, lowered water activity, and the addition of antimicrobial chemicals. This approach achieves a safer and longer-lasting product with less processing damage to the food's taste and nutritional value.

Q7. Describe the FPO specifications for Squash, RTS, Cordial, and Fruit Syrup.

Answer: According to FPO (Fruit Products Order) standards: Squash — minimum 25% fruit juice and 40% TSS. RTS (Ready to Serve) — minimum 10% fruit juice and 10% TSS. Cordial — minimum 25% fruit juice and 30% TSS. Fruit Syrup — minimum 25% fruit juice and 65% TSS.

Q8. What are the value-added products made from floricultural crops?

Answer: Floricultural crops can be used to produce: (i) Dry flowers and Pot Pourri — using sand drying or air drying with fixatives like salt and gum benzoin; (ii) Essential oils, flavours, and fragrances — extracted using supercritical CO_2 for high-purity products; (iii) Pharmaceutical and nutraceutical products — pigments, oils, and alkaloids from medicinal flowers; (iv) Natural dyes and pigments — anthocyanins, flavonoids, carotenoids; (v) Gulkand and Rose Water — from rose petals; (vi) Insecticidal compounds — natural plant metabolites that repel insects and mosquitoes.

Q9. What is fermentation and how does it help in food preservation?

Answer: Fermentation is a biological preservation method that uses selected desirable microorganisms to convert sugars into alcohol, acids, or gases. In alcoholic fermentation, yeast converts sugar into ethanol and CO_2, producing wine, beer, and cider. In lactic acid fermentation, lactic acid bacteria produce lactic acid, which preserves pickles and kanji. Fermentation reduces harmful microorganisms while encouraging beneficial ones, improving both safety and flavour.

Q10. Why is the processing of horticultural produce important for farmers and the nation?

Answer: Processing is important because: (i) India wastes 30–40% of its horticultural produce after harvesting due to poor storage and handling; (ii) Processing converts this perishable produce into long-lasting value-added products such as jams, juices, and pickles, thereby reducing waste; (iii) Farmers earn higher and more stable income from processed goods; (iv) Processed products can be sold in off-seasons when fresh produce is not available; (v) India's export potential increases; (vi) Processing units create employment in grading, packing, storage, and marketing.

PART D | Short Questions & Answers — 10 Questions

These questions require answers of 2–4 sentences. Ideal for board exam short-answer questions.

Q1. What is blanching?

Ans: Blanching is a thermal processing method in which food (mainly vegetables) is briefly exposed to boiling water or steam at approximately 100°C. Its main purpose is to destroy or inactivate enzymes that would otherwise cause the food to deteriorate in colour, texture, and flavour. Blanching also reduces surface microorganisms before the food is frozen or processed further.

Q2. What is the difference between Jam and Jelly?

Ans: Jam is made from fruit pulp or crushed fruit boiled with sugar until the TSS reaches at least 68.5%. It has a cloudy appearance. Jelly, on the other hand, is made from clear fruit extract (juice) combined with pectin, sugar, and acid. It is transparent and clear in appearance with a firm but tender texture.

Q3. What is Hurdle Technology?

Ans: Hurdle Technology is the use of two or more preservation methods combined together to preserve food effectively. Each method acts as a 'hurdle' for microorganisms. For example, mild heat combined with reduced water activity and added preservatives creates a very safe and shelf-stable product without needing extreme individual treatments.

Q4. What is Gulkand and how is it made?

Ans: Gulkand is a value-added product made from dried rose petals. It is prepared by mixing rose petals and sugar in a ratio of 1:2 and leaving the mixture to sun-dry. The resulting product is used as a sharbat (cool drink) and is known for its cooling and medicinal properties.

Q5. Define water activity and explain its role in food preservation.

Ans: Water activity (aw) refers to the availability of free water in food that can support microbial growth. When water activity is reduced below 0.70 (for example, by adding large amounts of sugar or salt, or by drying), microorganisms are unable to grow and the food is preserved. High-sugar products like jam and low-moisture dried products use this principle.

Q6. What is asepsis in the context of food preservation?

Ans: Asepsis means keeping microorganisms away from food so that they cannot contaminate it in the first place. This is done through hygienic handling, sterilised equipment, and clean processing environments. Asepsis is part of the first principle of preservation — preventing microbial decomposition.

Q7. Why is carbonation used in beverages?

Ans: Carbonation is the process of dissolving carbon dioxide (CO_2) gas into a beverage under pressure. It serves two purposes: it gives the drink a refreshing, distinctive taste and a pleasant fizz, and it also inhibits the growth of undesirable microorganisms, thereby acting as a mild preservation method.

Q8. What is Marmalade? How is it different from Jam?

Ans: Marmalade is a type of fruit jelly made specifically from citrus fruits (such as oranges, lemons, or grapefruits) in which pieces of fruit peel or slices are suspended. It differs from ordinary jam in two ways: it uses citrus fruits only, and it has a jelly-like (transparent) base rather than a cloudy pulp-based texture.

Q9. What are the advantages of freeze drying?

Ans: Freeze drying (sub-atmospheric dehydration) is the most advanced drying method available. It preserves the original colour, flavour, aroma, and nutritional content of food far better than other drying methods because the water is removed as vapour at very low temperatures (without heating). The resulting product is lightweight, easy to store, and quickly rehydrated.

Q10. Name four chemical preservatives and their uses in food.

Ans: (i) Sodium Benzoate — used in fruit juices, squashes, and sauces (up to 750 ppm); (ii) Potassium Metabisulphite (KMS) — used in fruit juices and dried fruits to prevent browning and microbial growth; (iii) Common salt (NaCl) — used in pickling to create an unfavourable environment for microbes; (iv) Vinegar (Acetic acid) — used in pickles and sauces to reduce pH and inhibit microbial growth.

PART E | Book Exercise Long Questions & Answers — 10 Questions

These are detailed long-answer questions for board exams. Each answer is thorough and easy to understand.

Q1. Explain in detail the three principles of food preservation with suitable examples.

Answer:

Food preservation is based on three fundamental principles:

1. Prevention or Delay of Microbial Decomposition: Microorganisms such as bacteria, fungi, and yeast are the primary cause of food spoilage. To prevent this, we use: (i) Asepsis — maintaining hygienic conditions so microorganisms do not enter the food; (ii) Filtration — physically removing microbes; (iii) Low temperature storage — slowing or stopping microbial growth in refrigerators and freezers; (iv) Drying — removing moisture so microbes cannot grow; (v) Chemical preservatives — substances like Sodium Benzoate that inhibit microbial activity; (vi) Heat treatment (pasteurisation, sterilisation) or radiation to kill microorganisms.

2. Prevention or Delay of Self-Decomposition: Food also deteriorates through its own enzymatic reactions and oxidation — even without the presence of microorganisms. Blanching destroys enzymes in vegetables before freezing or canning. Antioxidants (such as Vitamin C or citric acid) are added to prevent oxidative browning in cut fruits and juices.

3. Prevention of Damage by Insects, Rodents, and Mechanical Injury: Physical damage can accelerate spoilage by creating entry points for microbes or damaging protective skins. Proper packaging using airtight containers, rat-proof storage facilities, and careful handling during transport prevent this type of damage.

All three principles work together to extend the shelf life and maintain the quality of horticultural produce.

Q2. Give a detailed account of thermal processing methods used in food preservation.

Answer:

Thermal processing uses heat to destroy or inactivate microorganisms in food. There are three main methods:

1. Blanching: Food is exposed to boiling water or steam at temperatures at or below 100°C for a short time (usually 2–5 minutes). The main purpose is to destroy enzymes that cause loss of colour, texture, and flavour. Blanching also reduces the number of surface microorganisms. It is commonly applied to vegetables before freezing or canning.

2. Pasteurisation: A mild heat treatment below 100°C that kills pathogenic (disease-causing) microorganisms without affecting taste and nutritional value significantly. Two methods: LTH (Low Temperature Holding) — 63°C for 30 minutes, suitable for batch processing; HTST (High Temperature Short Time) — 71.7°C for 15 seconds, used for continuous flow processing of milk and juices. Pasteurised food has a limited shelf life and must be refrigerated.

3. Sterilisation: Very high temperature (121°C) is applied to kill ALL microorganisms including spores. The shelf life of sterilised food is 6 months or more without refrigeration. UHT (Ultra High Temperature)

processing (140°C for 2–4 seconds) is the most advanced form and is used for long-life milk and juices.

Key comparison: Blanching ≤ 100°C (enzyme destruction); Pasteurisation < 100°C (kills harmful microbes only); Sterilisation > 100°C (kills all microbes).

Q3. Describe in detail the various value-added products made from fruits and vegetables.

Answer:

A wide range of value-added products can be prepared from fruits and vegetables:

Jam: Made by boiling fruit pulp with sugar until TSS reaches 68.5% or more. Has a cloudy, spreadable texture. Can be made from a single fruit or a mixture of fruits.

Jelly: Prepared from clear fruit extract (juice) combined with pectin, sugar, and acid. The product is transparent and clear with a firm but tender texture.

Marmalade: A special type of citrus fruit jelly in which shredded fruit peel or slices are suspended throughout the product.

Preserves (Murabbah): Whole or large pieces of fruits or vegetables preserved in thick sugar syrup. TSS is approximately 70%. Hermetic (airtight) sealing is essential.

Chutney and Sauce: Made from fruits or vegetables cooked with spices, salt, vinegar, and sugar. Common types include tomato, mango, and amla chutney. Chemical preservatives (Sodium Benzoate, Potassium Metabisulphite) are added for long-term storage.

Pickles: Vegetables or fruits preserved in salt brine or vinegar. Unfermented pickles use spices and oil; fermented pickles rely on lactic acid produced by natural fermentation.

Dried Products: Raisins (dried grapes), amchur (dried raw mango powder), and citrus peel powder are important dried products.

Fruit Beverages: Squash (25% juice, 40% TSS), RTS (10% juice, 10% TSS), Cordial (25% juice, 30% TSS), and Fruit Syrup (25% juice, 65% TSS) are all regulated by FPO standards.

Q4. Describe the various types of drying methods used in food preservation.

Answer:

Drying is one of the oldest and most widely used methods of food preservation. When food is dried, moisture is removed so that microorganisms cannot grow. The weight of food is reduced to 1/4th to 1/8th of its original weight, making it lighter and easier to store and transport.

1. Solar Drying: Food is spread out under direct sunlight. This is the cheapest and most traditional method. However, it depends on weather and takes longer. Commonly used for spices, grains, and fruits like grapes (to make raisins).

2. Atmospheric Drying: Uses heated air to remove moisture. Types include: Batch drying (cabinet or mechanical dryers — food is loaded in batches); Continuous drying (food moves through a dryer on a conveyor belt — types include fluidised bed dryers, spray dryers for liquids like fruit juice, and drum dryers).

3. Osmotic Dehydration: Food is placed in a concentrated solution of sugar or salt. Water moves out of the food by osmosis, partially dehydrating it. This is a gentle pre-treatment before further drying.

4. Freeze Drying (Sub-atmospheric Dehydration): The most advanced and expensive method. Food is first frozen, then placed in a vacuum chamber where the ice is converted directly into water vapour (sublimation) without passing through a liquid stage. This preserves the original colour, flavour, aroma, and nutritional value exceptionally well. The product is lightweight and quickly rehydrated.

Q5. Explain chemical methods of food preservation with relevant examples.

Answer:

Chemical preservation uses substances that inhibit the growth of microorganisms or slow down chemical reactions that cause food spoilage. The main chemical methods are:

1. High Sugar Preservation: Adding large quantities of sugar reduces the water activity (aw) of food to below 0.70. At this level, microorganisms cannot grow because they cannot access free water. Products preserved by this method include Jam (TSS ≥ 68.5%), Jelly, Preserves (Murabbah) (TSS ≈ 70%), and candied fruits.

2. Salt Preservation (Pickling with Salt): Common salt (NaCl) is added to food either as dry salt or in a brine (salt solution). Salt draws water out of the food by osmosis, reduces water activity, and creates a high-osmotic-pressure environment that prevents most microbes from surviving. Used in pickles and cured meats.

3. Acid Preservation (Pickling with Vinegar): Vinegar (acetic acid) reduces the pH of food, creating an acidic environment in which most pathogenic microorganisms cannot survive. Used in pickles, sauces, and chutneys.

4. Chemical Additives (Permitted Preservatives): Substances approved by regulatory bodies (such as FSSAI in India and FDA in the USA) are added in small, safe quantities. Examples include: Sodium Benzoate (up to 750 ppm) — used in fruit juices and squashes; Potassium Metabisulphite / KMS (up to 700 ppm) — used in fruit juices and dried products to prevent browning and microbial growth. These additives do not alter the colour, taste, or aroma of the food at the permitted levels.

5. Spices and Edible Oils: Certain spices (such as mustard, turmeric, and chilli) and edible oils (like mustard oil) have natural antimicrobial properties and are traditionally used in Indian pickles and preserves.

Q6. Write a detailed note on fermentation as a method of food preservation.

Answer:

Fermentation is a biological preservation method in which microorganisms (such as yeast, lactic acid bacteria, or acetic acid bacteria) convert carbohydrates (sugars) into alcohol, organic acids, or gases. This process naturally preserves food while also developing new flavours and textures.

Types of Fermentation:

1. Alcoholic Fermentation: Yeast (Saccharomyces cerevisiae) converts sugar into ethanol (alcohol) and CO_2. Alcohol is a natural preservative. Products: Wine (from grapes), Beer (from barley), Cider (from apples), Kanji (from black carrots).

2. Lactic Acid Fermentation: Lactic acid bacteria (LAB) convert sugars into lactic acid. The acidic environment (lowered pH) prevents the growth of harmful microorganisms. Products: Fermented pickles, yoghurt, and traditional Indian fermented foods. LAB are considered highly desirable microorganisms and are beneficial for gut health.

3. Acetic Acid Fermentation: Acetobacter bacteria convert ethanol into acetic acid (vinegar). Vinegar itself is then used as a preservative in other products.

Advantages of Fermentation: (i) A natural, chemical-free method of preservation; (ii) Improves flavour and develops unique tastes; (iii) Some fermented products have probiotic health benefits; (iv) Low cost and accessible technology.

Note: Fermentation reduces overall microbial counts but encourages desirable beneficial bacteria. It is often combined with other preservation methods for best results.

Q7. What are the value-added products from floricultural crops? Explain each briefly.

Answer:

Floricultural crops (flowers) are not just grown for their beauty — they are the raw material for a wide range of valuable industrial and consumer products:

1. Dry Flowers and Pot Pourri: Flowers are preserved by sand drying or air drying. Fixatives such as salt and gum benzoin are added to retain fragrance. These are used in home decoration, greeting cards, photo frames, and paper weights.

2. Essential Oils, Flavours, and Fragrances: Floral extracts are obtained through steam distillation or, more recently, supercritical CO_2 (carbon dioxide) extraction, which gives extremely high-purity products. Rose, lavender, and jasmine oils are widely used in perfumery, cosmetics, and food flavouring. There is strong demand in both domestic and international markets.

3. Pharmaceutical and Nutraceutical Products: Many flowers produce pharmacologically valuable compounds, including pigments, essential oils, and alkaloids. These are used in medicines and health supplements.

4. Natural Pigments and Dyes: Anthocyanins (red/purple), flavonoids (yellow), and carotenoids (orange) extracted from flowers are used as natural food colours and dyes in the pharmaceutical and textile industries.

5. Gulkand and Rose Water: Gulkand is prepared from dried rose petals mixed with sugar (1:2 ratio) and sun-dried. It is used as a cooling health tonic and sharbat ingredient. Rose water is used in food, cosmetics, and religious ceremonies.

6. Insecticidal and Nematicidal Compounds: Certain flowers produce natural metabolites that repel or kill insects, aphids, mosquitoes, and nematodes. These are used as bio-pesticides, offering an eco-friendly alternative to chemical pesticides.

Q8. Explain the importance of post-harvest management and value addition for farmers in India.

Answer:

Post-harvest management refers to all the activities that take place after a crop is harvested — including handling, storage, processing, packaging, and marketing.

The Problem: India is one of the world's largest producers of fruits and vegetables. However, approximately 30–40% of this produce is wasted after harvesting due to poor storage facilities, lack of cold chains, improper packaging, and limited processing infrastructure. This results in huge economic losses for farmers.

The Solution — Value Addition: Value addition means converting raw produce into products with a longer shelf life and higher economic value. For example: fresh tomatoes → tomato sauce or ketchup; raw mangoes → pickle, squash, or amchur; grapes → raisins or wine; rose petals → gulkand or rose water.

Benefits for Farmers: (i) Higher and more stable income from processed goods compared to perishable fresh produce; (ii) Ability to sell produce even in the off-season; (iii) Reduced losses from spoilage; (iv) Access to export markets.

National Benefits: (i) Reduced food waste; (ii) Increased food security — processed food is available year-round; (iii) Employment in processing units (grading, packing, loading, storage, marketing); (iv)

Growth of agro-industrial sector; (v) Increased foreign exchange through exports.

Investment in food processing infrastructure, cold storage, and skill development for farmers is therefore a national priority in India.

Q9. Describe the preparation of Jam, Jelly, and Marmalade with their key specifications.

Answer:

Jam: Jam is prepared by boiling fruit pulp or crushed fruit with sugar until the mixture reaches the required concentration. The TSS (Total Soluble Solids) must be at least 68.5% as measured by a refractometer. Jam has a soft, spreadable consistency with a cloudy appearance because the fruit pulp is included. It can be made from a single fruit or a mixture of fruits. Common examples include mango jam, mixed fruit jam, and strawberry jam.

Jelly: Jelly is made from clear fruit juice (not pulp) combined with pectin, sugar, and citric acid. The mixture is boiled until it sets into a firm, transparent gel. Jelly must have a clear, transparent appearance that allows light to pass through it. It has a firm but tender texture. Examples include guava jelly and grape jelly. Pectin (a natural gelling agent found in fruit skins and cores) is essential for setting.

Marmalade: Marmalade is a specialised form of jelly made exclusively from citrus fruits such as oranges, lemons, grapefruits, or limes. What distinguishes marmalade is that it contains shredded peel or slices of the citrus fruit suspended in the jelly base. This gives it a characteristic slightly bitter taste from the citrus peel. Common examples include orange marmalade and lemon marmalade.

Key comparison: Jam = pulp-based, cloudy; Jelly = juice-based, transparent; Marmalade = citrus-based jelly with suspended peel.

Q10. Write a detailed note on types of pickles and their preparation.

Answer:

Pickles are preserved products made from fruits, vegetables, or both, using salt, vinegar, spices, and/or edible oils. They are one of the oldest and most popular preserved foods in India.

Classification of Pickles:

1. Unfermented Pickles: These pickles are preserved directly using salt, spices, and edible oil (usually mustard oil) without any fermentation process. The salt draws water out of the vegetable, spices add flavour and possess natural antimicrobial properties, and the oil creates a physical barrier against microorganisms. Examples include mixed vegetable pickle, mango pickle (achar), and lime pickle as commonly prepared in Indian homes.

2. Fermented Pickles: These are prepared using a salt brine (water + salt solution) in which lactic acid bacteria naturally present on the vegetable surface ferment the sugars in the food to produce lactic acid. The lactic acid lowers the pH, creating an acidic environment that preserves the pickle naturally. The process is called lactic acid fermentation. Examples include fermented cucumber pickles, kanji (black carrot pickle), and sauerkraut (fermented cabbage).

Preservation in Pickles: Common salt (NaCl) inhibits microbial growth by reducing water activity. Vinegar (acetic acid) lowers pH below the growth range of most microorganisms. Chemical preservatives such as Sodium Benzoate and Potassium Metabisulphite are added for long-term commercial storage.

Importance: Pickles extend the availability of seasonal vegetables and fruits throughout the year. They are a significant cottage industry in India, especially in rural areas, and an important category of export food products.