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Food Preservation has become an integral part of the food processing industry. There are various methods of food preservation; drying, canning, freezing, food processing etc. Food processing is one the method of food preservation which is the set of methods and techniques used to transform raw ingredients into food or to transform food into other forms for consumption by humans or animals either in the home or by the food processing industry. Canning is one of the various methods of food preservation in which the food is processed and then sealed in an airtight container. This process prevents microorganisms from entering and proliferating inside. Dehydration is the process of removing water or moisture from a food product. Food dehydration is safe because water is removed from the food. Freezing is also one of the most commonly used processes commercially and domestically for preserving a very wide range of food including prepared food stuffs which would not have required freezing in their unprepared state. Benefits of food processing include toxin removal, preservation, easing marketing and distribution tasks, and increasing food consistency. In addition, it increases seasonal availability of many foods, enables transportation of delicate perishable foods across long distances and makes many kinds of foods safe to eat by deactivating spoilage and pathogenic microorganisms. Nanotechnology exhibits great potential for the food industry. New methods for processing nanostructures are being developed having novel properties that were not previously possible. As such, due to the recent upgradation of preservation techniques, the preservation industry is also growing almost at the same rate as the food industry which is about 10 to 12% per year.

The purpose of this book is to present the elements of the technology of food preservation. It deals with the products prepared from various fruits and vegetables commercially. Relevant information on enzymes, colours, additives, flavours, adulteration, etc., has been given. This book also contains photographs of equipments and machineries used in food preservation.

This book will be very useful for new entrepreneurs, food technologists, industrialists, libraries etc.

Content:
1. Introduction of Food Technology
   Source of Man's Food
   Impact of Science and Technology

2. Acceptable Food to Eat
   Nature's Seal of Quality
   Food Flavors
   Food Colors
   Our Senses Can Fail Us
   Excessive Heating Impairs Foods,
   Moderate Heating May Improve Foods
   Food Spoilage
   Must Deter Natural Processes
   Safe Food for Man
   Food Poisoning
   Food Intoxications
   Food Infections
   Sanitation and Health

3. The Refrigerated Storage of Perishable
   Commodities
   Temperature of Objects
   Temperature Measurements
   Metabolism a Function of Temperature
   Energy Deficit of Ice
   Creating Energy Deficits Mechanically
   Keeping Fresh Foods Edible
   Animals Foods
   Plant Food
   Temperature of Cold Storage Rooms
   Humidity of Storage Chamber
   Heat Evolved by Living Tissues
   Specific Heat of Foods
   Calculation of Refrigeration Load
   Cold Injury of Fruits and Vegetables
   Ammonia Injury to Refrigerated Fruits and Vegetables
   Waxing Foods to Prevent Shrinkage
   Effect of Cold Storage on Quality
   Preserving Foods in a Micro-Environment
   Packaging Materials Tests Which May Be Performed
   Formed Container Tests
   Disorders of Stored Foods

4. Principles of Food freezing
   Development of a Frozen Food Industry
The Freezing Point of Foods
Per Cent Water Frozen vs. Temperature of Food and Its Quality
Size of Ice Crystals Formed
Volume Changes During Freezing
Refrigeration Requirements in Freezing Foods
Establishing the Refrigeration Requirements to Freeze Food
Freezing in Air
Freezing by Indirect Contact with Refrigerants
Direct Immersion Freezing
Freezerburn
Packaging requirements for Frozen Foods
Influence of Freezing on Micro-organisms
Influence of Freezing on Proteins
Influence of Freezing on Enzymes
Influence of Freezing on Fats
Influence of Freezing on Vitamins
Influence of Freezing on Parasites
Thawing Damage to Frozen Foods

5. Principles of Food Preservation by drying
Drying a Natural Process
Dehydration-Artificial Drying
Dehydration vs. Sun Drying
Why Dried Foods
Dehydration Permits Food Preservation
Humidity-Water Vapor Content of Air
Air-The Drying Medium
Adiabatic Driers
Heat Transfer Through a Solid Surface
Criteria of Success in Dehydrated Foods
Freeze-Dehydration (Freeze Drying)
Triple Point of Water
Temperature Changes in Meat Freeze-Dehydration
Influence of Dehydration on Nutritive Value of Food
Influence of Drying on Micro-organisms
Influence of Drying on Enzyme Activity
Influence of Drying on Pigments in Foods
Dehydration of Fruits
Dehydration of Vegetables
Dehydration of Meat
Dehydration of Fish
Dehydration of Milk
Dehydration of Eggs
Packing of Dehydrated Foods
6. Principles of Food Preservation by Canning

The Art of "Appertizing"
Temperature vs. Pressure of Boiling Water
Spoilage of Food Caused by Micro-organisms
Evolution of Containers for Canning
Important Food Groups
Micro-organisms Associated with the Food Groups
Sources of Spoilage Organisms
Heat Resistance of Micro-organisms
Important in Canning
Factors Influencing the Heat Resistance of Spores
Influence of Food Ingredients on Heat Resistance of Spores
Heat Resistance of Enzymes in Food
Heat Penetration into Food Containers and Contents
General Method for Calculating the Process Time
for Canned Foods
Inoculated Pack Studies
Adequacy of Heat Processes
Spoilage of Canned Foods
Microbial Spoilage
Failure of Glass Containers
Surface Markings on Broken Glass
Vacuum-pressure Relations in Canning Process
Storage of Canned Foods
External Corrosion of Cans
Coding the Pack
Influence of Canning on the Quality of Food
Colour
Flavor and Texture
Protein
Fat and Oil
Carbohydrates
Vitamins
Misconceptions Relating to Canned Foods
Improvements in Canning Technology

7. Principles of Food Preservation by Fermentation and Pickling

Life with Micro-organisms
Fermentation of Carbohydrates
Industrially Important Organisms in Food
Preservation
Order of Fermentation
Types of Fermentations of Sugar
Fermentation Controls
Sources of Salt
Wine and Beer
Salted-Fermented Foods
Deterioration of Fermented and Pickled Products
Nutritional Value of Pickled Products
Future Trends

8. Preservation of Food as Sugar Concentrates
Concentrated but moist
High solids high acid foods
Jelly
Jam
Fruit Butter
Marmalade
Pectin and gel formation
Invert Sugar
Jelly Making
Other Fruit Preserves
Candied and Glacéd Fruits
Maraschino Cherries
Sweetened Condensed Milk
Future Trends

9. Preservation of Foods with Chemical Additives
Introduction
Definition of Chemical Additive
Importance of Chemical Additives
Legitimate Uses in Food Processing
Undesirable Uses of Additives
Safety of a Food Additive
Functional Chemical Additive Applications
Historical Significance
Specific Uses of Chemical Additives
Additives Permitted and Prohibited in the United States
Chemical and Use
Food Regulation and Compliance
Miller Pesticide Amendment of 1954
1958 Food Additives Amendment
1960 Color Additives Amendment
Chemical Preservatives
Preservatives (Antimycotics)
Specified Uses and Amounts
Preservatives (general)
Specified Use
Microbial Antagonists
10. Preservation of Food with Ionizing Radiations

A Place for Radiation Stabilized Foods

Discovery of Radioactivity

Alpha, Beta and Gamma Radiations

Dosimetry

Dose Distribution

Induced Radio-Activity in Treated Food

Mode of Action of Ionizing Radiations

Radiation Effects on Micro-organisms

Radiation Effects on Proteins

Radiation Effects on Enzyme Systems

Effects of Radiation on Amino Acids

Effects of Radiation on Vitamins

Radiation Effects on Carbohydrates

Radiation Effects on Lipids

Radiation Effect on Pigments

Radiation Effect on Parasites and Insects

Packaging of Radiation Stabilized Foods

General Methods for establishing Radiation Stabilization Process for Foods

The Food Product-Micro-organism Destruction

Dose Requirements for the Radiation Sterilization of Foods

Technological aspects of the Radiation Pasteurization of Foods

Radiation Resistant Organisms

Factors Influencing the Survival of Micro-organisms from a Radiation Process

The Influence of the Type of Radiation on the Inactivation of Micro-organisms

The Influence of Dose Rate on the Inactivation of Micro-organisms

The Influence of Environmental Conditions on the Survival of Micro-organisms from a Radiation Process

Combination Processes

Conditions after Irradiation Affecting Survival and Recovery of Micro-Organisms
11. Preservation of Semi-moist Foods

Introduction
Canned white bread
Storage stability
Sponge and Dough
Filling and Proofing
Processing
Finished Product
Fungistatic and fungicidal agents
Sorbic acid
Polyethylene
Semi-moist Pet Foods
Process for Semi-moist Pet Foods
Marbled, Textured Product
Water Activity
Production of Semi-moist Products Growing
Semi-moist Human Foods
Coarse Ground Beef and Beef Cubes
Other Products being developed

12. Principles and Preservation of Bakery Products

Introduction
13. Storage Stability of Preserved Foods
   Introduction
   Relationships of Product Qualities and Storage conditions
   Objective Tests of Quality of Stored Foods
   Objective Odor Measurements
   Mechanical Texturemeter
   Long-term Storage of Preserved Foods
   Temperature of Storage
   Nutrients
   Containers for Long-Term Storage
   Storage Costs
   Storage Stability of Selected Frozen Foods
   Result
   The Future

14. Food Preservation Using Ozone
   Introduction
   Physicochemical Properties of Ozone
   Use of Ozone in Storage and Packing Facilities
   Extension of Storage Life with Ozone
   Ozonation to Sanitize packing Line Process Water
   The Commercial Production of Ozone
   Importance of Ozone in Fishing Industry
   Future Perspectives

15. Food Preservation by Smoking Process
   Introduction
   Types of Smoking
   The Difference between Curing and Smoking
   Meat Curing and Smoking
   Types of Smokers

16. Thermal Food Preservation
   Introduction
   Effect of Preservation Temperatures
   Effect of Processing on Nutrients in Foods
   Thermal Preservation Methods

17. Machinery & Equipments (Photographs)

Directory Section

Sample Chapter:
PRINCIPLES OF FOOD FREEZING
Development of a Frozen Food Industry
Freezing temperatures, once feared by mankind, have been turned to his great advantage by his inquiry into the phenomena. While ice-salt systems were used to freeze foods in the mid 1800's, and patents for freezing fish, for example, were granted in 1861 to Enoch Piper in Maine, and even earlier to H. Benjamin in England in 1842 the invention of mechanical refrigeration in the late 1800's provided the base for subsequent commercial exploitation of the process. Frozen foods have become important items of commerce (90 per cent of Iceland's export trade is frozen fish) and important in food preparation for dinner tables (Figs. 4.1 8s 4.2).
Clarence Birdseye fathered this revolution as a technologist by developing quick freezing processes and equipment, and successfully promoting consumer units of frozen foods. He overcame tremendous obstacles. In the 1920's there "were few mechanical refrigerators in homes in the United States. In the 1930's, as facilities for food freezing and retail distribution developed across the United States, frozen foods began to find their place in commerce. Yet, it was not until 1940 that they became important competitors of other consumer-type preserved foods. While Clarence Birdseye was a prime mover industrially, the frozen food industry had support in the scientific aspects of the development by men such as Dr. Donald K. Tressler, at Cornell, and Dr. C.R. Fellers at the then Massachusetts State College.
The present day finds competition between all methods of food preservation, and the competition is being resolved by consumers (Fig. 4.2). Those foods best preserved by freezing are largely frozen. Those foods highly acceptable as canned products continue as highly successful consumer goods. The economic struggle for survival between fresh commodities, canned foods, and frozen foods in a free market evidences itself in better foods at lower prices for consumers.

The Freezing Point of Foods

Living cells contain much water, often two-thirds or more of their weight. In this medium there are organic and inorganic substances, including salts and sugars and acids in aqueous solutions, and more complex organic molecules such as proteins which are colloidal suspension. To some extent gases are also dissolved in the watery solution.

The physical, chemical, and biological changes occurring during the freezing and subsequent thawing of foods are complex and not completely understood. Nevertheless it is useful to study the nature of these changes which have been recognized in order to design a successful freezing process for a food.

The freezing point of a liquid is that temperature at which the liquid is in equilibrium with the solid. A solution with a vapour pressure lower than that of a pure solvent will not be in equilibrium with the solid solvent is at normal freezing point. The system must be cooled to that temperature at which the solution and the solid solvent have the same vapour pressure. The freezing point of a solution is lower than that of a pure solvent. The freezing point of food is lower than that of pure water.

When a liquid evaporates the escaping molecules exert a pressure known as the vapour pressure. The total pressure of a system will be equal to the sum of the partial pressures of the system. The addition of a non-volatile solute (sugar) to water lowers the vapour pressure of the water solution of sugar, and the freezing point of the water solution will be lower than that of pure water (Table 4.1).

Because of the high content of water in most foods, most of them freeze solidly at temperatures between 32°F and 25°F (Fig. 4.3). The temperature of the food undergoing freezing remains relatively constant until the food is mostly frozen, after which time the temperature approaches that of the freezing medium.
Quick freezing has been defined, by those who adhere to rapid crystallization theory, as that process where the temperature of the food passes through the zone of maximum ice crystal formation (32°F to 25°F) in 30 minutes or less. The basic principle of all rapid freezing methods is the speedy removal of heat from food. These methods include freezing in cold air blasts, by direct immersion of the food in a cooling medium, by contact with refrigerated plates in a freezing chamber, and by freezing with liquid air, nitrogen, or carbon dioxide. Freezing in still air is the poorest method of all. By circulating cold air, the freezing rate is greatly accelerated, as will be explained.
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