

1.1 BASIC PROPERTIES AND THERMAL PROCESSING OF FOODS MATERIALS

Constituents of food and their energy values, rheological properties of food materials, texture of food materials, viscometry, Concentrations of foods, freeze concentration, membrane concentration

Constituents of Food and Their Energy Values:

Carbohydrates: 4 calories per gram

Proteins: 4 calories per gram

Fats: 9 calories per gram

Alcohol: 7 calories per gram

Water: Contains no calories

Vitamins and Minerals: Essential for various bodily functions but do not provide energy.

Rheological Properties of Food Materials:

Rheology is the study of the flow and deformation of materials.

Food materials exhibit various rheological behaviors, including elasticity, viscosity, and plasticity.

The rheological properties of food influence its texture and mouthfeel.

Rheological Properties of Food Materials:

Elasticity:

Refers to the ability of a material to return to its original shape after deformation.

In food, elasticity is crucial for products like bread, where dough needs to rise and then hold its shape during baking.

Texture of Food Materials:

Texture is a crucial aspect of food quality, influencing consumer preference.

It involves characteristics like hardness, chewiness, crispiness, and tenderness.

Texture can be influenced by factors like ingredients, processing methods, and storage conditions.

Hardness:

Measure of how easily a food item can be crushed or chewed.

Often assessed using instruments that measure force, providing a hardness value.

Chewiness:

Describes the resistance a food item offers to being chewed.

Influenced by factors like protein content and gelatinization of starch.

Crispiness:

Refers to the brittleness or crunchiness of a food item.

Potato chips exemplify a crispy texture.

Viscometry:

Viscometry is the measurement of viscosity, which is the resistance of a fluid to deformation.

In food science, viscometry is used to assess the thickness or flow properties of liquids or semi-liquids like sauces, dressings, or batters.

Viscosity:

Describes a fluid's resistance to flow.

High viscosity is evident in substances like honey, while low viscosity is seen in water.

Viscosity affects the ease of pouring, spreading, and other flow-related characteristics in food.

Concentrations of Foods:

Concentration refers to the ratio of solute to solvent in a solution.

In food, concentration is important in processes like cooking, baking, and preserving.

Solubility:

The ability of a substance (solute) to dissolve in another substance (solvent).

Important in processes like making solutions, syrups, and beverages.

Evaporation:

Concentration can be achieved through the removal of water by evaporation.

Commonly used in the production of concentrated fruit juices.

Freeze Concentration:

Freeze concentration is a method used to concentrate a liquid by freezing part of the water content.

Ice is separated from the concentrated liquid, resulting in a higher concentration of solutes in the remaining liquid.

Freezing Point Depression:

A principle behind freeze concentration where lowering the temperature of a solution causes the solvent to freeze, leaving behind a more concentrated solution.

Ice Separation:

In freeze concentration, ice crystals are separated from the concentrated liquid, typically through methods like filtration or centrifugation.

Membrane Concentration:

Membrane concentration involves the use of semipermeable membranes to separate water and solutes in a solution.

This method is employed in the food industry for concentrating juices, proteins, and other liquid products.

Understanding these concepts is essential for various aspects of food science, including product development, quality control, and the optimization of food processing techniques.

Reverse Osmosis:

A membrane separation process where water is forced through a semipermeable membrane, leaving behind concentrated solutes.

Ultrafiltration:

Utilizes membranes with specific pore sizes to separate components based on molecular size.

Commonly applied in concentrating proteins or removing impurities from liquids.

These concepts are integral to understanding the physical and chemical properties of foods, contributing to the development and improvement of various food products and processes.

Advanced Concepts in Food Science:**Food Emulsions:**

Emulsions involve the dispersion of one liquid in another, often oil in water or vice versa.

Stability of emulsions is crucial in products like salad dressings, mayonnaise, and certain sauces.

Maillard Reaction:

A complex chemical reaction between amino acids and reducing sugars, leading to the browning of food during cooking.

This reaction contributes to the flavor, aroma, and color of various foods, including baked goods and roasted coffee.

Food Extrusion:

The process of forcing a food mixture through a shaped opening, resulting in a specific form.

Widely used in the production of snacks, cereals, and certain pasta shapes.

Sensory Analysis:

Involves evaluating food products through sensory perceptions, including taste, aroma, texture, and appearance.

Professionals use trained panels or consumer tests to assess and improve the sensory qualities of foods.

Food Preservation Techniques:

Various methods such as canning, dehydration, and irradiation are employed to extend the shelf life of food by inhibiting the growth of microorganisms, enzymes, and oxidation.

Nutraceuticals:

Bioactive compounds found in food that have health benefits beyond basic nutrition.

Examples include antioxidants in fruits and vegetables or omega-3 fatty acids in fish.

Smart Packaging:

Incorporating technology into packaging materials to monitor and enhance food quality and safety.

Intelligent packaging can include sensors to detect freshness, temperature indicators, or antimicrobial coatings.

Understanding these advanced concepts in food science is vital for addressing contemporary challenges in the industry, including improving nutritional profiles, developing innovative products, and ensuring the safety and quality of the food supply.