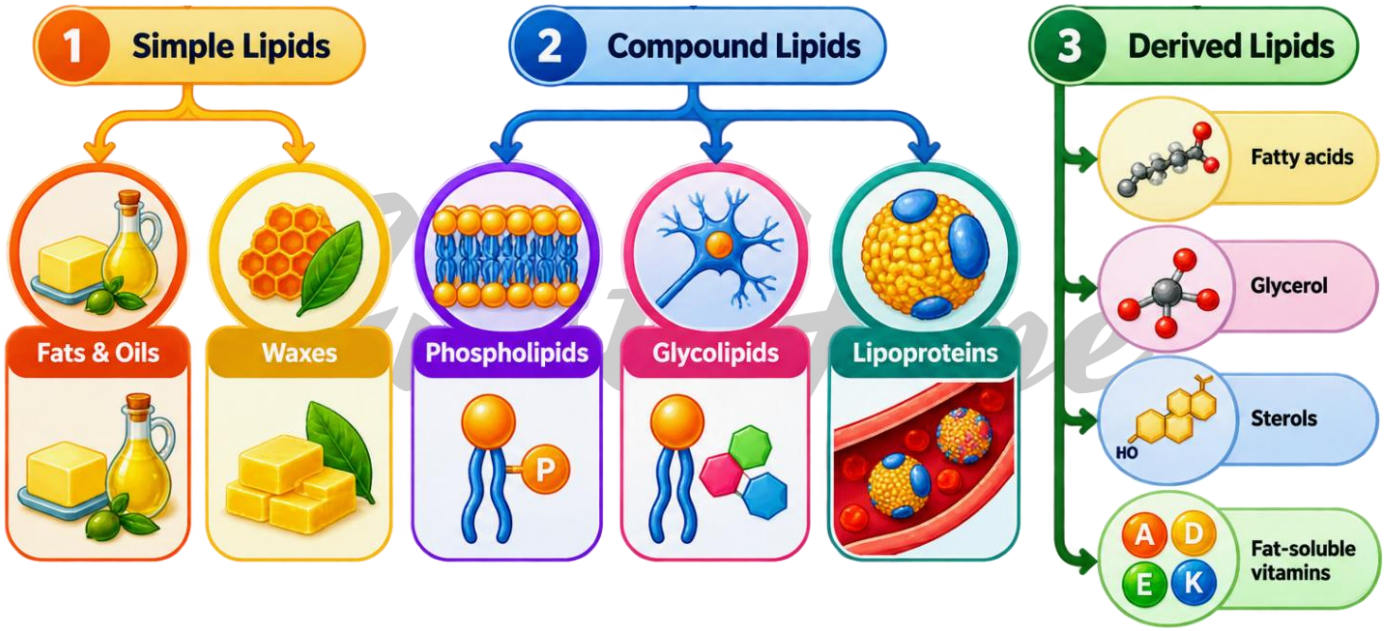
Lipids

Classification of Lipids

Basic Idea

- Lipids are a group of organic compounds that are insoluble in water but soluble in organic solvents such as ether, chloroform, and benzene.
- Lipids are important components of food and serve as concentrated sources of energy.
- Lipids provide approximately nine kilocalories of energy per gram.
- Lipids play important roles in energy storage, cell structure, insulation, and absorption of fat-soluble vitamins.

Classification of Lipids



1. Simple Lipids

➢ Simple lipids are esters of fatty acids with alcohols.

Types

A. Fats and Oils

- Fats are solid at room temperature because they contain a higher proportion of saturated fatty acids.
- Oils are liquid at room temperature because they contain a higher proportion of unsaturated fatty acids.

B. Waxes

- Waxes are esters of long-chain fatty acids and long-chain alcohols.
- Waxes provide protective coatings on fruits, leaves, and animal tissues.

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2. Compound Lipids

- Compound lipids contain fatty acids, alcohols, and additional chemical groups.

Types

A. Phospholipids

- Phospholipids contain phosphate groups and are important components of cell membranes.
- **Examples:**
  - Lecithin
  - Cephalin

B. Glycolipids

- Glycolipids contain carbohydrate groups and are found in nervous tissue and cell membranes.

C. Lipoproteins

- Lipoproteins are complexes of lipids and proteins that transport fats in the bloodstream.

3. Derived Lipids

- Derived lipids are substances obtained by the hydrolysis of simple and compound lipids.

Examples

- Fatty acids
- Glycerol
- Sterols
- Fat-soluble vitamins

Classification of Fatty Acids

1. Saturated Fatty Acids

- Saturated fatty acids contain no double bonds between carbon atoms.

Examples

- Palmitic acid
- Stearic acid

2. Unsaturated Fatty Acids

- Unsaturated fatty acids contain one or more double bonds.

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A. Monounsaturated Fatty Acids

- Monounsaturated fatty acids contain one double bond.
- **Example:** Oleic acid

B. Polyunsaturated Fatty Acids

- Polyunsaturated fatty acids contain two or more double bonds.
- **Examples:**
  - Linoleic acid
  - Linolenic acid

Functions of Lipids

- Lipids provide energy and serve as energy reserves.
- Lipids help absorb vitamins A, D, E, and K.
- Lipids contribute to the flavor and texture of foods.
- Lipids protect internal organs and provide thermal insulation.

General Methods of Analysis of Lipids

Basic Idea

- Lipid analysis is performed to determine the quantity, composition, and quality of fats and oils present in food.
- These methods help ensure food quality, safety, and compliance with standards.

Objectives

- To determine total fat content.
- To assess the quality and purity of fats and oils.
- To identify the fatty acid composition.
- To detect deterioration and adulteration.

Methods of Lipid Analysis

A. Solvent Extraction Methods

➢ Lipids are extracted from food samples using organic solvents.

Examples

- Soxhlet extraction method
- Goldfish extraction method
- Mojonnier extraction method

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B. Gravimetric Methods

- The extracted fat is weighed to determine total lipid content.
- The amount of lipid is expressed as a percentage of the food sample.

C. Chromatographic Methods

- Chromatographic techniques separate and identify individual fatty acids and lipid components.

Examples

  - Gas chromatography (GC)
  - High-performance liquid chromatography (HPLC)
  - Thin-layer chromatography (TLC)

D. Spectrophotometric Methods

- These methods measure changes in light absorption to determine lipid concentration or quality.

E. Nuclear Magnetic Resonance Methods

- Nuclear magnetic resonance techniques estimate fat content rapidly without extensive sample preparation.

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Common Quality Parameters



1. Iodine Value

- Iodine value measures the degree of unsaturation of fats and oils.

2. Saponification Value

- Saponification value indicates the average molecular weight of fatty acids present in fats.

3. Acid Value

- Acid value measures the amount of free fatty acids present in a fat or oil.

4. Peroxide Value

- Peroxide value indicates the extent of primary oxidation.

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Importance

- Lipid analysis helps maintain product quality.
- Lipid analysis supports nutritional labeling.
- Lipid analysis ensures compliance with food regulations.

Refining of Fats and Oils

Basic Idea

- Crude fats and oils contain impurities such as free fatty acids, pigments, phospholipids, moisture, and undesirable odors.

Steps in Refining of Fats and Oils



The main refining operations remove gums, free fatty acids, coloured impurities and unwanted odours.

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1. Degumming

- Degumming removes phospholipids, gums, and mucilaginous substances.
- Water, acids, or enzymes may be used during this process.

2. Neutralization

- Neutralization removes free fatty acids by treating the oil with an alkali solution.
- The free fatty acids form soap, which is separated from the oil.

3. Bleaching

- Bleaching removes pigments, trace metals, and oxidation products.
- Adsorbent materials such as activated clay or activated carbon are used.

4. Deodorization

- Deodorization removes unwanted odors and flavors by steam distillation under reduced pressure.

5. Winterization

- Winterization removes high-melting components that may cause cloudiness during storage.

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