

Food additives

Introduction

- Food additives are substances added to food to preserve flavour or improve its taste and appearance.
- Some additives have been used for centuries; for example, preserving food by pickling (with vinegar), salting, as with bacon, preserving sweets with sugar or using sulphur dioxide as in some wines.
- With the advent of processed foods in the second half of the 20th century, many more additives have been introduced, of both natural and artificial origin.

Types of food additives

- Emulsifiers
- Antimicrobial agents or Preservatives
- Sequestrant
- Flavor enhancers
- Sweetener
- Antioxidants
- Colour additives

Emulsifiers

- An emulsifier is a substance which stabilizes an emulsion by increasing their kinetic stability.
- [Emulsifiers](#) allow water and oils to remain mixed together in an emulsion. There are two types of emulsions.
 1. **Oil-in-water emulsion:** It contains small droplets of oil that are dispersed in water.
 2. **Water-in-oil emulsion:** It has small droplets of water that are dispersed in oil. Usually the water and oil will not mix and the emulsifier, or emulsifying agent, keeps the mixture stable and prevents the oil and water from separating into two layers.

- **Use:**

- Emulsifiers can help to make a food appealing.
- Emulsifiers have a big effect on the structure and texture of many foods.
- They are used to aid in the processing of foods and also to help maintain quality and freshness.
- In low fat spreads, emulsifiers can help to prevent the growth of moulds which would happen if the oil and fat separated.

Examples of food emulsifiers:

- Egg yolk (where the main emulsifying chemical is lecithin), honey, and mustard
- Soy lecithin is another emulsifier and thickener.

Antimicrobial agents or Preservatives

- Antimicrobial agents or preservatives prevent or inhibit spoilage of food due to [fungi](#), [bacteria](#) and other microorganism.
- Microbes will grow quickly when they are in the right conditions; warm, moist, correct pH and a supply of food to grow on.
- Preservation tries to alter the conditions to slow or stop the microbe growth.
- When this is not possible, or convenient, preservatives may be added to stop the food from going 'off'. Different microbes are sensitive to different types of preservatives and so a wide range of preservatives are in use today.

List of some important preservatives

- i) **Sorbic acid and its salts (E200-203):** Sorbic acid and its salts are naturally occurring substances and they are among the most important food preservatives. Sorbic acid gives no taste or flavour to products and it is effective over a wide range of foods and beverages. Sorbic acid is used in beverages, dairy products, fish and seafood, fat-based products, fruit and vegetable products, baked goods and confectionery products.
- ii) **Benzoic acid and its salts (E210-E213):** A widely used preservative. It is only used in acidic situations which include non-alcoholic beverages, products prone to spoilage by bacteria and fruit-based products.

iii) Sulfur dioxide and sulfites (E220-E228): These preservatives are multifunctional food ingredients which act as preservatives, antioxidants and colour stabilizers. They have a much more pronounced antibacterial effect than other preservatives and are therefore used when control of bacterial growth is essential. Sulfur dioxide is used in a wide range of products including packet soup, dried bananas and apricots, tinned crabmeat, sausage meat, beer, wine, quick frozen chips and jams

- iv) Potassium nitrite and sodium nitrite (E249 and E250):** They act as preservatives, stabilizers and flavours. Potassium and sodium nitrite are particularly important in the preservation of cured meat products.
- v) Propionic acid and its salts (E280-E283):** The propionates are also naturally occurring preservatives. They work better in the more alkaline conditions of bakery products and may be used, for example, to delay the green mould growth on bread

Sequestrant

- A sequestrant is a food additive whose role is to improve the quality and stability of the food products. Sequestrants form chelate complexes with polyvalent metal ions, especially copper, iron, and nickel, which serve as catalysts in the oxidation of the fats in the food. Sequestrants are a kind of preservative.

Common sequestrants

- Calcium disodium ethylene diamine tetra-acetate (E385)
Sodium and calcium salts of EDTA are commonly used in many foods and beverage
- Glucono delta- lactone (E575)
- Sodium gluconate (E576)
- Potassium gluconate (E577)
- Sodium tripolyphosphate
- Sodium hexametaphosphate (E452i)

Flavor enhancers

- **Flavor enhancers**
- Flavor enhancers enhance a food's existing flavors. They may be extracted from natural sources (through distillation, solvent extraction, among other methods) or created artificially.
- **i) Acidulants:** Acidulants are additives that give a sharp taste to foods. They also assist in the setting of gels and to act as preservatives. Many natural foods are acidic. For example, oranges, lemons, apples, tomatoes, cheese and yoghurt contain natural acids, such as citric acid, that give them their characteristically sharp taste. Some important acidulants are acetic acid, citric acid, fumaric acid, lactic acid, malic acid, phosphoric acid and tartaric acid
- **ii) Bases:** Bicarbonates, particularly bicarbonate of soda, are used as mild alkalis whilst phosphates are used for their [buffering](#) action as well as for their characteristic taste.

Sweetener

- **Natural sweetener:** Sugar is a most important natural sweetener. It gives the sensation of sweetness and provides a source of energy. Bulk sweeteners are indigestible and include sugar alcohols, such as [sorbitol](#), [mannitol](#), and [xylitol](#). Some are found in natural foods while others are manufactured.

Nutritive Sweeteners

- i. **Sugars.** Sugars (saccharides) are widespread in nature and are the building blocks of carbohydrates - monosaccharides, disaccharides and polysaccharides

- **Monosaccharide:** The monosaccharides, glucose, fructose, and galactose are composed of just one sugar molecule, and are known as the “simple sugars.” Glucose and fructose are abundant in fruits, honey, and processed foods. Galactose is found only in milk.

- **Disaccharide:** Disaccharides are formed from two simple sugar units that are chemically attached, and include sucrose, lactose and maltose.
- Sucrose comes from sugar beets or sugar cane, and is more commonly known as table sugar. Sucrose is composed of the two simple sugars, glucose and fructose. It is the most abundant sugar in nature, important for its palatability, availability, low cost, and simplicity of production. Additional products from the refinement process of sucrose are molasses, brown sugar, and confectioners' sugar.
- Lactose also is referred to as milk sugar. Lactose is made of the two simple sugars glucose and galactose.
- Maltose, two glucose units, is the result of the fermentation of the starch in grains by yeast or enzymes, as in bread-making or brewing.

- **Polysaccharide:** The polysaccharide family includes starch, cellulose, pectin, and glycogen. These complex carbohydrates are chains of glucose molecules. Starch, cellulose, and pectin are found in plants. Glycogen is the storage form of glucose for humans and animals.
- The simple sugars and many foods with large amounts of simple sugars provide energy (calories), but contain few other nutrients. They may replace other foods that are high in vitamins, minerals and other important nutrients in the diet. However, while fruits are sweet because of the sucrose and fructose they naturally contain, they are excellent sources of vitamins and fiber. Starch is abundant in nutrient-rich foods such as vegetables, grains, beans, and potatoes. Carbohydrates, regardless of the form, are important for providing energy to the body.

- **ii. Corn Syrup.** Corn syrup is a glucose derivative of corn starch, popular in the brewing, canning, and baking industries because it lends texture and body to these types of products.
- High-fructose corn syrup (HFCS) takes the processing of corn syrup one step further, by converting much or all of the glucose to fructose. The resulting product is sweeter than sucrose, allowing less of it to be used. HFCS is the main nutritive sweetener in the soft drink industry.

- **iii. Sugar Alcohols.** Sugar alcohols are sometimes used as a substitute for sucrose. Mannitol, sorbitol, and maltitol occur naturally in fruits. Xylitol is a normal intermediate product in the metabolism of carbohydrates in fruits and vegetables. Sugar alcohols add bulk and texture to food such as chewing gum and hard candies. Because they are metabolized by the body more slowly than sucrose, they are useful in foods for people following special diets, such as a diabetic diet.

Antioxidants

- Control of undesirable oxidation reactions in food is usually achieved by achieved by employing processing and packaging techniques that exclude oxygen or involve the addition of appropriate chemical agents called antioxidants.
- Ascorbic acid is employed to prevent enzymic browning of the cut surfaces of fruits and vegetables. Here it acts as a reducing agent by transferring hydrogen atoms back to quinines that are formed by enzymatic oxidation of phenolic compounds. In closed systems ascorbic acid readily react with oxygen and serve as oxygen scavenger.

- Sulfites are readily oxidized in food systems to sulfonates and sulfate and function as effective antioxidants in foods such as dried fruits. A number of synthetic compounds are used as antioxidants. E.g Butylated hydroxyl anisole(BHA), Butylated hydroxyl toluene(BHT), propyl gallate(PG)etc.

Colour additives in food

- Colour additives are added to food to replace colors lost during preparation, or to make food look more attractive. Colours that are allowed to be used in foods are strictly tested

Common food colour additives

Name	Description and color formed	Foods
Curcumin	Orange-yellow colour that is extracted from the roots of the turmeric plant	Curry, fats and oils, processed cheese.
Riboflavin	Riboflavin is also known as vitamin B2. It can be obtained by fermenting yeast or synthesised artificially. In foods, it is used as an orange-yellow colour.	Sauces, processed cheese and foods with added vitamins such as bread.
Tartrazine	Yellow coloured synthetic azo dye. This colouring sparks controversy as some groups suggest it causes behavioral problems in children	Is no longer widely used. Now rarely used in curries and some ready-meals

Beta-carotene	Orange-yellow colour found in plants such as carrots, tomatoes and oranges	Soft drinks, margarine, butter, yoghurt
Plain caramel	Dark brown to black colour. The most common colouring. 90% of all colouring used is caramel. Obtained by the heating of sugars	Cola drinks, confectionery, baked-foods, ice cream, chocolate, beers, vinegar and whisky
Amaranth	Dark purple coloured synthetic colour. Similar in colour to blackcurrants	Powdered soup, jam, ice cream, instant gravy