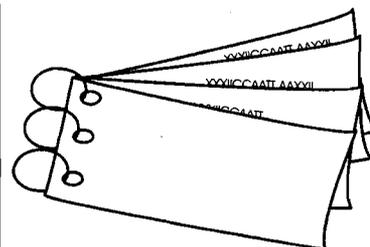


UNIT 8 FOOD ADDITIVES

Contents

- 8.1 Functions of Food Additives
- 8.2 Classification of Food Additives
- 8.3 Functional Role of Additives
- 8.4 Safety Issues



- A food additive may be defined as any substance or a mixture of substances other than the basic foodstuff which is present in food as a result of any aspect of production, processing, storage or packaging.
- Food additives are added intentionally to foods and are not naturally a part of the food.
- Additives perform a variety of useful functions ranging from keeping food wholesome and appealing, improving taste, texture, consistency or colour to adding nutrients to make up losses or for the purpose of fortification.
- Different countries have different laws pertaining to which food additives can be used and in which foods e.g. PFA Act and Rules in India. These laws specify the amounts and names of food additives which can be added to certain foods.

8.1 Functions of Food Additives

- Maintaining product consistency;
- Improving or maintaining nutritive value;
- Maintaining palatability and wholesomeness;
- Improving flavour or imparting desired colour;
- Providing leavening or controlling acidity / alkalinity.

8.2 Classification of Food Additives

Food additives are classified based on their function in food i.e. the purpose for which the additive has been added to the food.

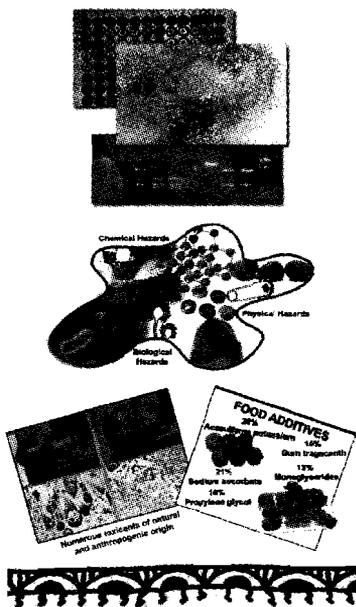
The various classes of food additives include:

- Antioxidants;
- Preservatives;
- Food colours;
- Food flavours;
- Emulsifiers and stabilizers;
- Artificial sweeteners;
- Miscellaneous: Anti-caking agents; sequestrants; acids, bases and buffers; anti-foaming agents, enzymes, leavening agents.

Broadly speaking, these food additives can be classified as:

- Direct food additives and
- Indirect food additives.

Direct food additives are added to a food for a specific purpose in that food e.g. synthetic colour. Indirect food additives become part of the food in trace amounts due to packaging, storage or other handling. Additives used in raw ingredients or any other material with which foods may come in contact may find their way into the finished food product. Antioxidants, for example, used in edible oil may be found in chips or any food item prepared with this oil. This is known as the "carry over" principle.



8.3 Functional Role of Additives

The following table summarizes the functional role of different additives.

Additives	Functional Role
1. Antioxidants	Chemical additive which when added to food retards or prevents oxidative deterioration of food e.g. lecithin, ascorbic acid, tocopherol. Butylated hydroxyanisole (BHA) can be added to ghee, butter, fat spread only.
2. Preservatives	Substances added to food to retard, inhibit or arrest the activity of microorganisms. Class I preservatives can be used without restriction e.g. salt, sugar, spices, vinegar. Class II preservative use is restricted to only certain foods and the amount of the preservative which can be added to these foods is also specified under PFA rules. The presence of a Class II preservative has to be declared on the packaging /label e.g. sulphites, nitrates and nitrites, benzoic acid, sorbic acid.

3. Food Colours	<p>Substances used to correct loss of colour due to food processing or to correct natural variations in food colour. Use of colours is restricted to only specific items of food. Caramel can be used without label declaration - other natural colours must be declared e.g. beta carotene, chlorophyll, riboflavin, annatto, saffron, curcumin or turmeric. Synthetic food colours permitted for use in India include: Ponceau 4R, Carmoisine, Erythrosine (red); Tartrazine, Sunset Yellow FCF (yellow); Indigo Carmine, Brilliant Blue FCF (blue); Fast Green FCF (green). Synthetic food colours are permitted only in certain foods such as icecream, biscuits, cakes, canned peas, fruit squash.</p>
4. Flavouring agents	<p>Add flavour or correct losses in flavour. Natural flavours are those exclusively obtained by physical processes from vegetable, sometimes, animal raw materials. Nature- identical flavouring substances are chemically isolated from raw materials or obtained synthetically. They are chemically identical to the substances present in natural products. Artificial flavouring substances are those which have not been identified in natural products and are chemically synthesized. Monosodium glutamate is permitted in restricted amounts and its addition needs to be declared on the label with a warning that the food is unsuitable for children below 12 months of age.</p> <p>Addition of any extraneous flavouring to a food has to be declared on the label.</p>
5. Emulsifying and stabilizing agents	<p>Substances capable of facilitating a uniform dispersion of oils and fats in aqueous media or vice versa and/or stabilizing such emulsions. No emulsifying or stabilizing agent can be used in any food except where use of emulsifying or stabilizing agent is specially permitted under PFA Rules. Commonly used emulsifying/stabilizing agents include agar, alginates, dextrin, sorbitol, pectin, cellulose, monoglycerides or diglycerides of fatty acids.</p> <p>Modified starches are being used the world over by the food processing industry as thickeners, binders and stabilizers. These starches make sauces thick, potato chips crisp, puddings smooth in texture. Edible gums are used as a thickening agent in jams, gravies and sauces; gelling agent in pudding desserts; encapsulating agent to stabilize flavours.</p>

(Table contd.)

6. Sweetening agents

Include calorie sweeteners, low-calorie sweeteners and non-calorie sweeteners (which contain little or no calories). Calorie sweeteners contribute 4 Kcal/gram and have been associated with dental problems like caries and gum disorders (e.g. cane sugar, glucose syrup, jaggery, honey, dextrose, invert sugar). Low-calorie sweeteners are relatively less sweet than sucrose (sugar) and provide energy between 1 and 3 Kcal per gram (e.g. sugar alcohols or polyols). They occur naturally but are often manufactured on a commercial scale. Use of polyols not only aids diet control by reducing calorie intake, they also do not cause dental caries. Non-calorie sweeteners may be natural or synthetic. Synthetic high intensity sweeteners are more popular----- they are very sweet, so needed in very small quantities e.g. saccharin, aspartame, acesulfame potassium. Acesulfame can be used in cooking. Phenylketonuria patients must not consume aspartame. Sucralose is derived from ordinary sugar, is not broken down by the body and is poorly absorbed. It is 600 times sweeter than sugar.

7. Anti-caking agents

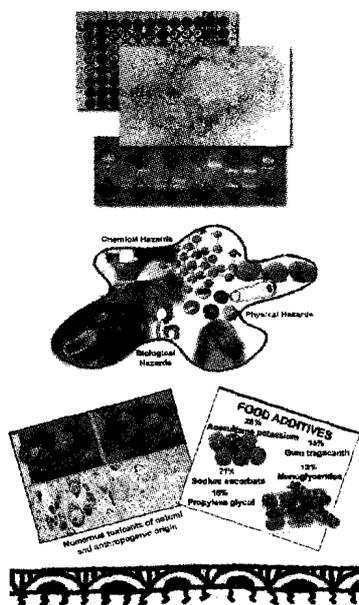
Anti-caking substance are anhydrous substances that can pick up moisture without themselves becoming wet and these are added to products such as table salt and dry mixes. "Free flowing" salt has anti-caking agents added to prevent formation of lumps. Anti-caking agents permitted in India include carbonates of calcium, magnesium, phosphates of calcium, magnesium; silicates, myristates, palmitates or stearates. In addition, calcium, potassium or sodium ferrocyanide may also be used as anti-caking agents in common salt, iodized salt and iron-fortified salt.

8. Sequestrants

Substances that form a complex with transition metal ions like copper, iron, cobalt and nickel. These metals are powerful catalysts in the auto-oxidation processes and their binding helps in eliminating / retarding the oxidative breakdown of foods which would otherwise result in decolourization, rancidity and production of an off taste. Examples are citric acid, phosphoric acid, tartaric acid, ethylene diamine tetra acetate (EDTA).

9. Buffering agents
(Acids, bases, salts)

Buffering agents are materials used to counter acidic and alkaline changes during storage or processing of food, thus improving flavour and increasing stability of foods. Examples are acetic acid, calcium oxide, ammonium phosphate monobasic, ammonium carbonate (bread improver in flour), citric acid, malic acid, DL lactic acid, L(+) tartaric acid (acidulants).

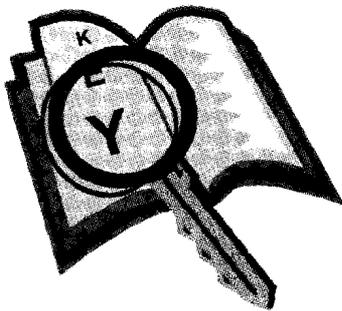


10. Anti-foaming agents	Reduce foaming on heating, slow down deteriorative changes e.g. dimethyl polysiloxane in edible oils and fats for deep-fat frying.
11. Enzymes	Mainly used in industry to split carbohydrates, proteins, lipids, used in cheese, bread production, tenderizing meat.
12. Leavening Agents	Introduction of gas in batter or dough leading to its expansion, improves appearance, texture and taste of foods. With yeast, the fermentation process was slightly difficult to control and at times could lead to undesirable flavours. Chemical leavening agents like baking soda (sodium bicarbonate) do not have this problem. The vast majority of chemical leavening systems are based on reaction of an acid with sodium bicarbonate to release carbon dioxide. There are a number of acids which might be used and they differ in the speed at which they release the leavening gas e.g. cream of tartar (rapid release), sodium aluminium phosphate or sulphate (slow release), anhydrous monocalcium phosphate (for an intermediate speed of release).

8.4 Safety Issues

- A large number of substances in use today as food additives are "generally recognized as safe" or GRAS substances. GRAS substances are those whose use is generally recognized by experts as safe, based on their extensive history of use in food or based on published scientific evidence. Salt, sugar, spices, vitamins are classified as GRAS substances.
- Although most food additives are considered to be without any potential adverse effects, there have been problems concerning the safety of some of these chemicals.
 - The safety of the antioxidant BHA has been questioned in the light of the fact that its consumption leads to cancer in rodents.
 - Sensitive asthmatics have been reported to develop allergic responses to the food colour tartrazine. Allergies have been reported to cause even fatal shock. Nitrites can form cancer-causing nitrosamines in foods in which they are added as preservatives.
 - MSG intake of 1.5 g or more can result in acute illness characterized by burning or tingling sensation on face, neck and head, tightness, stiffness or pressure in chest and facial muscles. This is the "Chinese Restaurant Syndrome" because these symptoms have been seen in people who had consumed Chinese food.
 - High levels of erythrosine intake have been associated with thyroid tumours.

- Ponceau 4R, Tartrazine and Sunset Yellow FCF have provoked allergic reactions in several individuals even at low levels of intake. The allergic responses vary from rashes to swelling and worsening of the condition of patients with asthma.
- One should choose foods that are free of additives or at least select those brands of processed foods which have a minimum number of additives. Foods with artificial or synthetic colours and Class II preservatives should specially be avoided. The label of the food product declares the presence of the additives used in the product. Hence only properly labelled foods should be selected.



Key Terms

Aqueous: Containing water

Anhydrous: Without water or moisture, dry

Anti-caking substances: Anhydrous substances that can pick up moisture without themselves becoming wet and these are added to products to prevent the particles from forming lumps

Anti-foaming agents: Added to retard deteriorative changes and foaming height during heating of edible oils and fats

Antioxidants: Substances which when added to foods retard or inhibit oxidation reactions

Buffering agents: Materials used to counter acidic and alkaline changes during storage or processing of the food, thus improving the flavour and increasing the stability of foods

Deterioration: Spoilage

Dispersion: To distribute uniformly in a medium

Emulsifying and Stabilizing agents: Substances which are capable of facilitating a uniform dispersion of oils and fats in aqueous media, or vice versa, and/ or stabilising such emulsions

Emulsion: A fine dispersion of one liquid in another

Encapsulating agent: Substance used to enclose something (e.g. flavour) as in a capsule

Fatal: Causing or ending in death

Food additive: Any substance or a mixture of substances, other than the basic foodstuff, which is present in food as a result of any aspect of production, processing, storage or packaging

Gelling agent: Substance which forms a gel

Leavening agent: Substance added to dough to make it ferment and rise

Preservatives : Substances which when added to food retard, inhibit or arrest the activity of microorganisms

Rancidity: Having a disagreeable smell or taste from partial decomposition, especially of a fatty substance

Sequestrants: Substances that bind with transition metal ions and thus help in eliminating/retarding the oxidative breakdown of foods

Toxin: A poison

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