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Preservation by Chemicals



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Food Additives

- **A food additive is a substance or mixture of substances that is present in the food as a result of production, processing, packaging or storage**
- **Food additives that are specifically added to prevent the deterioration or decomposition of a food has been referred to as chemical preservatives**
- **Deterioration may be caused by microorganisms, enzymes, or by chemical reactions**
- **Preservatives inhibit microbes by interfering with cell membranes, enzyme activity, or their genetic mechanisms, or prevent oxidation of unsaturated fatty acids, neutralization of acids, stabilizers to prevent physical changes**



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Food Additives

- **Additives described as GRAS have been in use for several years**
- **The Food Safety and Standards Act (FSSA) classifies them as class 1 and class 11**
 - **Class I are salt, spices, vinegar, honey, vegetable oils**
 - **Class II are benzoic acid, sorbic acid, Na and K salts**



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Food Additives

Preservative	Significance
Nisin	Antibacterial in cheese
Sulphur dioxide	Inhibits fungal growth and non-enzymatic browning of dried and cut fruits from fermenting, and undesirable microbes in wine, reduces carotene and destruction losses
Nitrate and Nitrite	Colour stabilizer in the curing of meat and controls <i>Clostridium botulinum</i>
Sorbic Acid	Sodium and potassium salts inhibit the growth of yeasts and molds in bakery, cheese, wines
Diethyl pyrocarbonate	Antimicrobial in fruit juices, wines and carbonated beverages



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Food Additives

Preservative	Significance
Propionic Acid	Controls <i>Bacillus mesentericus</i> causing ropy bread, prevents molds and some bacteria
Benzoic Acid	Active against yeast, well used for preservation of acid foods such as carbonated beverages
Parabens	Very effective against yeasts and molds
Epoxides	Ethylene and propylene oxide to reduce microbes on spices
Acetic acid	Vinegar (4%) used to preserve pickled vegetables, acetates of Na, K, Ca used to prevent ropiness and growth of molds



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Colours

- **Colour additive is any dye, pigment or substance that can impact colour when applied to food**
- **Colour of foods may be due to natural pigments – carotenoids, chlorophylls, myoglobins, anthocyanins**
- **Natural colourants – anthocyanins impart blue, violet, and red colours to fruits and vegetables and are glycosidic derivatives of 2-phenylbenzophrylium structure**
 - **Carotenoids are β – carotene, canthaxanthin, natural carotenoid includes annatto from seeds of tropical plant**
 - **Xanthophylls consists of yellow carotenoid pigments having keto or hydroxy substituents**



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Colours

- **Betalines** – red beet root, *Beta vulgaris* contain red and yellow pigments, red-violet betacyanins and yellow betaxanthins
- **Caramel** – complex polysaccharide prepared by heating a food grade carbohydrate like glucose, sucrose, or starch in presence of a catalyst acetic sulfurous, or citric acid or bases such as ammonium, calcium, and sodium hydroxides
- **Curcumin** – turmeric is derived from rhizome of *Curcuma longa*
- **Sources of colourants:**
 - **Annatto** – yellow carotenoid used in dairy products and obtained from seeds of plant *Bixa orellana* (lipstick tree)



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Colours

<u>Colourant</u>	<u>Source</u>
Annotto	Bixin, Norbixin, gives yellow colour
Saffron	Crocetin (<i>Crocus sativus</i>), β carotene, Zeaxanthin
Cochineal	Carminic acid extracted from dried crushed bodies of female insects gives red colouring material
Kermesic acid	Kermes insect gives red colour
Alkannet	Red pigment extracted from <i>Alkanna tinctoria Tansch</i> used in icecream
Monascus	Yellow to red colour from Monascus species used in wine making
Red phycoerythrins Blue phycocyanins	Biliproteins from algae



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Natural Colourants

<u>Colourant</u>	<u>Source</u>
Capsanthin and capsorubin	Paprika extract
Xanthophyll	Leaves
Lycopene and lutein	Red palm oil
curcumin	Turmeric
canthaxanthin	Mushroom
α β carotene	Carrot



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Synthetic colourants

Colour	Common Name
Red	Ponceau 4R, carmosine, erythrosine
Yellow	Tartrazine, sunset yellow F.C.F
Blue	Indigo carmine, brilliant blue F.C.F
Green	Fast green F.C.F
Non-permitted colours	Rodamine, Orange G, Amaranth, Fast red, metanil yellow



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Synthetic Colourants

- **Synthetic colourants are permitted to be used only in certain foods with BIS (Bureau of Indian Standards) certification with declaration on the label and maximum quantity permitted is 200 mg/kg**
- **Congo red, malachite green, orange G, Sudan 111 and lead chromate are harmful**
- **Rhodamine B, Orange RN11, and Blue VRS are carcinogenic causing lesions on kidneys, spleen, and liver**
- **Metanil yellow causes degeneration of reproductive organs**



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Flavouring Agents and Sweeteners

- Flavours of most fruits and vegetables are produced by range of aldehydes and esters of organic alcohols and acids and essential oils with complex terpenoid structures
- Flavour enhancers monosodium glutamate is the sodium salt of glutamic acid made by fermentation process using starch, sugar beets, sugar cane or molasses
- Artificial sweeteners are used in food industry – polyols are white crystalline hygroscopic water soluble sugar alcohols synthesized from starch, sucrose, glucose, invert sugar, xylose and lactose
 - Acesulfame K, Aspartame, Saccharin, Sucralose
 - Stevia (*Stevia rebaudiana*) is a sweet herb



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Emulsifiers and Stabilizers

- **Surfactants are amphipathetic molecules which act at the interfaces of the two phases in food**
 - Commonly used are lecithin, mono and diglycerides
 - Soluble dietary fiber are water soluble gums – cellulose gum, carboxy methyl cellulose
 - Guar gum is plant polysaccharide obtained from shrub (*Cyamopsis tetragonoloba*) is used in breads, sauces, salad dressing
 - Papain from papaya is used as stabilizer in beer
 - Agar-agar (china grass) used as gel in place of gelatin
 - Gelatin – protein made by hydrolysing the animal bones and used in stabilising, thickening, and gel formation



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Emulsifiers and Stabilizers

- **Modified starches are carbohydrate polymers used as an emulsifying and stabilising agent in syrup, ice cream powder, salad dressing**
- **Chelating and sequestrants – compounds that form complexes with metal ions**
 - Metal ions released during degradative reactions participate in reactions leading to discolouration, oxidative rancidity, turbidity, flavour changes in foods
 - Citric acid, phosphates and salts of EDTA
- **Antioxidants retard rancidity and deterioration from exposure to oxygen (vitamin C, lecithin, tocopherol, gallic acid, butylated hydroxy anisole (BHA), BHT (BH toluene))**