



FOOD CHEMISTRY

Course No.-DTC-321, Credit Hours – 3 (2+1)



FOOD ADDITIVES

Vitamins, Amino Acids, Minerals

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- ❖ **food additive** is a substance (or a mixture of substances)
 - ➔ added to food and ➔ involved in
- ❖ processing,
- ❖ production,
- ❖ packaging and/or
- ❖ storage of foods
- ❖ without being a **major ingredient**.

- ❖ Additives or their degradation products ➔ **remain** in food,
- ❖ but in some cases they may be **removed** during processing.

- ❖ Food additives may be **defined** as chemical substances deliberately added → foods,
- ❖ in known and regulated quantities,
- ❖ for the purpose of assisting in the
- ❖ processing of foods,
- ❖ preservation of foods ,
- ❖ improving the flavor ,
- ❖ texture or
- ❖ appearance of foods.

As per **PFA Act** food additive is defined as any substance **not normally used as a typical ingredient** of foods whether or not it has **nutritional value**;
the **intentional addition** of which to food for **technological** reasons Including organoleptic purpose in the **manufacturing, processing, preparation, treatment, packing, packaging, transport or holding** of food results in it or its ingredients **becoming a component** or otherwise **affecting characteristics** of such foods.

FUNCTIONS OF FOOD ADDITIVES :

- 1.Improves **aroma and taste** of food.
- 2.Improves **body and texture** of food.
- 3.Improves **colour and appearance** of food.
- 4.Improves and maintains **nutritive value** of food.
- 5.Facilitates the **processing / preparation** of food.
- 6.Enhances the **shelf life** of food.
- 7.Reduces the **wastage** and improves **yield** of the product.
- 8.Enhance the **consumer's acceptability** of the food.

CLASSIFICATION OF FOOD ADDITIVES :

(A) Intentional Food Additives

- added intentionally to improve quality and sensory properties
- selectively in carefully controlled conditions during processing and
- in small permissible amounts necessary to achieve the desired effects e.g.,
 - Antioxidants – Vit C & E , Se, Carotenoids
 - Colourants – Carotenoids, anthocyanin, chlorophyll
 - emulsifying agents - Agar, albumin, alginates, lecithin
 - Flavorings – Alcohol(bitter), ester(fruity), ketones(caramel)
 - nutrient supplements – Vit B₁₂, D, Ca, Fe
 - Preservatives – Benzoates, Nitrites, Sulphites, Sorbates
 - Stabilizers –Gelatin, guar gum, carrageen, gum Arabic(degradation)

(B) Unintentional Food Additives – contaminants

find their way in food accidentally.

not deliberately added to foods but gain entry as a result of operations

inherent to

- processing ,
- production,
- storage or
- marketing.
- **Some of the incidental additives are**
- anti nutrients – PA,OA,TI, Saponins, Flavonoids
- heavy metals – Hg, Cd, Ni, Pb, Cr
- Pesticides – DDT, Carbamates, Atrazine,
- toxic metals - Hg, Cd, Ni, Ba, Cr,Li
- It may cause **health hazard** and may also **spoil** the food.

FOOD ADDITIVES ARE FURTHER CLASSIFIED BASED ON SOURCE

Natural:

derived from **natural sources** like animals, plants, micro-organisms etc.

Synthetic:

chemically synthesized in laboratory

Nature Identical:

chemically identical to those obtained from natural sources but **synthesized artificially**.

VARIOUS CATEGORIES OF FOOD ADDITIVES (24)

- ❖ Antioxidants- Vit C & E , Se, Carotenoids
- ❖ Appearance control agents – ester gum, waxes, polishes etc
- ❖ Coloring agents - Carotenoids, anthocyanin, chlorophyll
- ❖ Emulsifiers and Stabilizers (Thickening agents) - Agar, albumin, alginates, lecithin
- ❖ Flavour enhancers - Alcohol(bitter), ester(fruity), ketones(caramel)
- ❖ Humectants – moisture control agents – Propylene glycol , hexylene glycol
- ❖ Preservatives - Benzoates, Nitrites, Sulphites, Sorbates
- ❖ Sugar substitutes and artificial agents – Saccharine, Sucralose, Aspartame

- ❖ Buffers – pH control agents – acids, alkalis and salts
- ❖ Firming agents - ppt residual pectin (CaCO_3)
- ❖ Leavening agents – yeast and chemicals
- ❖ Masticating substances – increase salivation – gums -
- ❖ Nutrients supplement (vitamins, amino acids, minerals,
- ❖ Oxidizing and reducing agents – pot. Nitrate, nitric acid
- ❖ Propellants and gases – nitrous oxide
- ❖ Sequestering agents and chelating agents - EDTA

- ❖ Acidulants – citric acid
- ❖ Anti-freeze agents- Ethylene glycol, methanol
- ❖ Anti-stick (release) and Anti-caking (free- flowing) agents – icing sugar, baking pd
- ❖ Bleaching & maturing agents – change baking properties
benzoyl peroxide
- ❖ Bulking agents –guargum, glucan,maltitol
- ❖ Clarifying agents - chitosan, gelatin, guar gum
- ❖ Foaming (aerating) and Antifoaming agents – oleic acid, amide waxes-
- ❖ Tracers- prevent pd from forming clumps-sod. Nitrates, sulfites

Some **guidelines** before use of any additives:

1. must be **real need** for their use.
2. sd not **reduce** the **nutritive value** of food.
3. sd **confirm** the **agreed specifications**.
4. sd not **cause** any **adverse physiological** and **harmful effects** even upon **regular** consumption → **prolong period**
5. Legislation should define **permissible max quantities** → given additive
6. sd be used at **minimum level** necessary → **desired effect**
7. Additives or their degradation products **remain** in food but in some cases they may be **removed during processing**.

limit for addition of food additives :

1. An adequate **margin of safety** to reduce to a minimum for any hazard in all groups of consumers.
2. **Minimum level** which in animal studies produce deviation from the normal physiological behaviour.
3. The estimated **level of the consumption** of food for which an additive is proposed.

GOOD MANUFACTURING PRACTICES FOR FOOD ADDITIVES :

A/C Codex General Standard ,

The quantity of F A added to food shall be limited to **lowest level** necessary for desired effect

The quantity of F A → becomes a **component** of food as a result of its use → no technical effect in food → is **reduced to minimum** and

F A is prepared and handled in **same way** as a food ingredient.

SAFETY ASPECTS OF FOOD ADDITIVES

necessary to know → **how safe** the food additive is before permitting its use in food products.

ADI of Food Additives:

ADI (**Acceptable Daily Intake**):

is the **amount** that can be consumed on a **daily basis** for a **life time** without appreciable risk. Its unit is **mg/kg body weight / day**.

GRAS substances:

GRAS (**Generally Recognized as Safe**)

is a device which US FDA has adopted to **give endorsement** to those substances which have had **many years of use** and for which there is **no evidence of any harmful effects**.

VITAMINS

food products → enriched or fortified with vitamins → adjust for processing losses or to increase the nutritive value.

Such enrichment is important for :

- fruit juices,
- canned vegetables,
- flour and bread,
- milk, margarine and
- infant food formulations.

Several vitamins have some desirable additional effects :

- **Ascorbic acid** → dough improver and antioxidant.
- **Carotenoids** and **riboflavin** → coloring pigments.
- **Niacin** → improves color stability of fresh and cured and pickled meat.

EXAMPLES OF VITAMIN FORTIFICATION OF FOOD PRODUCTS

Vitamin	Food products
B1	Cocoa powder and its products, beverages and concentrates, confectionary and other baked products
B2	Baked products, beverages
B6	Baked and pasta products
B12	Beverages, etc.
Pantothenic acid	Baked products
Folic acid	Cereals
C	Fruit drinks, desserts, dairy products, flour
A	Skim milk powder, breakfast cereals (flakes), beverage concentrates, margarine, baked products, etc.
D	Milk, milk powder, etc.
E	Various food products, e. g. Margarine

AMINO ACIDS

- **Biological value** of a protein (g protein formed in the body/100 g food protein) → **essential amino acids** and by **factors** → **digestibility and availability**.
- **Addition of essential amino acids** → **foods** → is gaining importance → **increasing its biological value**.
- Best **examples** of **use of amino acid** → **as additive** :
- fortification of **rice** with **L-lysine** and **L-threonine**,
- supplementation of **bread** with **L-lysine** and
- fortification of **soya** and **peanut** protein with **methionine**.
- **Synthetic amino acids** are used also for **chemically defined diets** → completely absorbed and utilized for nutritional purposes in **space travel**,
- in **pre-and post-operative states**, and
- during therapy for **maldigestion and malabsorption syndromes**.

MINERALS

- ❖ Food → abundant source of minerals.
- ❖ Fortification is considered for iron, calcium, magnesium, copper and zinc.

- ❖ Iodization of salt → iodine deficient areas.
- ❖ preventive measure against goiter.
- ❖ It contains 45 micrograms / gram of salt. RDI-150 microgram

- ❖ Nitrite salts → for pickling and dry curing of meat.
- ❖ consist of common salt and sodium nitrite (0.4–0.5%), with or without additional potassium nitrate.

- ❖ **Fortification** is the practice of deliberately increasing → the content of an essential micronutrient :
- ❖ **Vitamins** and
- ❖ **Minerals** (including trace elements) in a food →
- ❖ improve the nutritional quality of the food and
- ❖ provide a public health benefit with minimal risk to health.

CONCLUSION :

- ❖ Additives are inevitable part of processing food industries**
- ❖ Potential health hazards (synthetic food additives) are matter of great concern**
- ❖ Need for production of safer food additives and upgraded analytical techniques to ascertain use of food additives under permissible limits.**

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THANKS