



# Introduction to Food Additives

**An-Najah National university**

M.Sc. Mohammed Sabah

**2015**

- ***"All things are poisons; nothing is without poison; only the dose determines whether there is a harmful effect".***



# I. INTRODUCTION

- According to the Food Protection Committee of the Food and Nutrition Board, **food additives may be defined as follows:**

**FOOD ADDITIVES:** a substance or mixture of substances, other than a basic foodstuff, which is present in a food as a result of any aspect of production, processing, storage, or packaging.

- Since prehistoric times, chemicals have been added to foods to perform special functions.
- Although basic foods contain no additives,
- As foods are processed for conversion into a variety of products, an increasing number of additives are generally used.

- Technological advances in food processing have increased the variety and use of these additives.
- Today, more than **2500** different additives are intentionally added to foods to produce a desired effect.
- The use of these additives is a well-accepted practice but is not without controversy

## II. TYPES OF ADDITIVES

- Additives can be divided into **six** major categories:
  1. preservatives,
  2. nutritional additives,
  3. flavoring agents,
  4. coloring agents,
  5. texturizing agents,
  6. and miscellaneous additives.

- Several lists of these additives are available.
- Several additives commonly serve more than one function in foods.
- In Europe and other parts of the world, the **E system**, developed by the **European Union** (formally the **European Economic Community**), provides a listing of several commonly used additives.

- The European Union **adopted directives** which set the criteria by which additives are assessed.
- The **European Scientific Committee for Food (SCF)** oversees additive safety against the established criteria.
- Specific directives have been established for sweeteners, colors, and other food additives.

- **The Codex Alimentarius Commission Committee on Food Additives and Contaminants** has developed an **international numbering system(INS)** for food additives based on the E system.
- The **INS** systems **broader** than the **E** system and is intended as an identification system for food additives approved for use in one or more countries.

- **The INS numbers are largely the same numbers used in the E system without the E.**
- The INS system also includes a listing of the **technical function** for each additive based on **23 functional classes.**

- **The E numbers are categorized as follows:**
  - E100–E199 (colors)
  - E200–E299 (preservatives)
  - E300–E399 (antioxidants, acidity regulators)
  - E400–E499 (thickeners, stabilizers, emulsifiers)
  - E500–E599 (acidity regulators, anti-caking agents)
  - E600–E699 (flavor enhancers)
  - E900–E999 (surface coating agents, gases, sweeteners )
  - E1000–E1999 (additional chemicals)

# A. Preservatives

- There are **basically three** types of preservatives used in foods:
  1. antimicrobials,
  2. antioxidants,
  3. and antibrowning agents.
- These additives are grouped under the category of preservatives in the INS system.
- The antimicrobials, with E and INS numbers ranging from **200 to 290**, are used to check or **prevent** the growth of microorganisms.

- **Antimicrobials** play a major role in **extending the shelf-life** of numerous snack and convenience (useful) foods and have come into even greater use in recent years as microbial food safety concerns have increased.

- **The antioxidants (INS 300–326 and E300–E326)**, are used to prevent lipid and/or vitamin oxidation in food products.
- They are used primarily to **prevent autoxidation** and subsequent development of rancidity and off-flavor.

### ➤ **autoxidation**

The unsaturated fatty acids present in the lipids of many foods are at risk to chemical breakdown when exposed to oxygen. The oxidation of unsaturated fatty acids it proceeds (income) by a free-radical chain reaction.

- The antioxidants vary from **natural** substances such as: **vitamins C** and **E** to **synthetic** chemicals such as butylated hydroxy anisole (BHA) and butylated hydroxy toluene (BHT).
- The **antioxidants** are especially useful in **preserving** dry and frozen foods for an extended period of time.

- **Antibrowning agents** are chemicals used to **prevent** both **enzymatic** and **nonenzymatic** browning in food products, **especially** dried fruits or vegetables.
- **Enzymatic browning** is a chemical process which occurs in fruits and vegetables by the enzyme **poly phenol oxidase**, which results in **brown pigments**.
- **Non enzymatic browning**: It results from a **chemical reaction** between an **amino acid** and a **sugar**, usually requiring **heat**

- The **most commonly used** additives in this category (**antibrowning**) are:
  1. Vitamin C (E300),
  2. citric acid (E330),
  3. and sodium sulfite (E221)
- These additives are classified as either **antioxidants** or **preservatives** in the INS system, but retain the **same** numbers as in **the E system without the E.**

# B. Nutritional Additives

- Nutritional additives **have increased** in use in recent years as consumers have become more concerned about and interested in nutrition.
- **Vitamins**, which as indicated before are also used in some cases as **preservatives**, are commonly added to **cereals and cereal products to:**
  1. **restore** nutrients lost in processing
  2. or to **enhance** the overall nutritive value of the food.

- The addition of **vitamin D to milk** and of **B vitamins to bread** has been associated with the **prevention** of major nutritional **deficiencies** in the United States.
- Minerals such as **iron** and **iodine** have also been of extreme value in preventing nutritional deficiencies.

Like vitamins, the primary use of **minerals** is in **cereal products**.

- **Amino acids** are **not commonly** used in foods.
- However, **lysine** is sometimes added to cereals to **enhance** protein quality.
- **Proteins** or **proteinaceous** materials such as **soya** protein are also sometimes used as **nutritional additives**.

- **Fiber** additives have seen increased popularity in recent years with the increase in consumer interest in dietary fiber.
- Various **cellulose**, **pectin** and **starch** derivatives have been used for this purpose.
- Recently, **naturally derived** fiber from **apples** and other **fruits** as well as **sugar beets** has been introduced as a fiber additive.



- **Fiber additives** are not well defined and in reality have **little or no direct nutritional value**, although they do have **indirect nutritional benefits**.
- In some cases, fiber additives also **provide improved texture** to food products and are categorized in the INS and E system as **bulking agents, thickeners, or stabilizers**.

# C. Coloring Agents

- Most coloring agents are **used** to **improve** the overall **attractiveness** of the food.
- A number of **natural** and **synthetic** additives are used to color foods.
- In addition, **sodium nitrite** is used not only as an **antimicrobial**, but also **to fix the color of meat** by interaction with meat pigments.
- The colors are included in the **E** system as **E100–E180** and in the **INS** as **100–182**.

# D. Flavoring Agents

- Flavoring agents comprise the **greatest number** of additives used in foods.
- There are **three** major types of flavoring additives:
  1. sweeteners,
  2. natural and synthetic flavors,
  3. and flavor enhancers.

- The most commonly used sweeteners are:
  1. sucrose,
  2. glucose,
  3. fructose,
  4. and lactose,
- with **sucrose** being the most popular.

These substances, however, **are commonly classified as foods rather than as additives**

- The most common additives used as sweeteners are **lowcalorie** or **noncaloric** sweeteners

such as **saccharin** and **aspartame**.

- there are more than **1700 natural and synthetic** substances used to **flavor** foods.
- These additives are, in most cases, **mixtures** of several chemicals and are used to **substitute** for **natural flavors**.

- Flavor enhancers (INS 620–642 and E620–E640) **magnify or modify** the flavor of foods and do not contribute any flavor of their own.
- Flavor enhancers, which include chemicals such as **monosodium glutamate (E621)** and others are often used in Asian foods or in soups to enhance the perception of other tastes.

# Assignment No. 1

26/1/2015 – 2/2/2015

➤ **Please explain the following? And give 3 examples of food additives that used in each one?**

- **1- bulking agents:**
- **2- thickeners:**
- **3- stabilizers:**
- **4- Gelling agents:**
- **5- Emulsifiers:**

# E. Texturizing Agents

- Although flavoring agents comprise the **greatest number** of chemicals, **texturizing agents** are used in the **greatest total quantity**.
- These agents are **used to add to or modify** the overall texture or mouthfeel of food products.

- the primary additives in this category are:
  - 1. Emulsifiers**
  - 2. Stabilizers**
  - 3. Phosphate**
  - 4. dough conditioners**

- **Emulsifiers** (INS 429–496 and, E431 and E495) include:
  1. **natural** substances such as **lecithin (INS 322 and E322)** and **mono and diglycerides**
  2. as well as several **synthetic** derivatives.
- The primary role of these agents is **to allow flavors and oils to be dispersed throughout a food product.**

- **Stabilizers** include several natural gums such as **carrageenan** as well as **natural and modified starches**.
- **Stabilizers used:**
  1. to provide the **desired texture** in products such as **ice cream**.
  2. They also are used to **prevent evaporation** of volatile flavor oil.

- **Phosphates** (E338–E343) are often used to modify the texture of foods **containing protein or starch**.
- These chemicals are especially useful in stabilizing various dairy and meat products.
- The phosphates apparently react with protein and/or starch and modify the water-holding capacity of these natural food components.

- **Dough conditioners**

such as

1. steroyl-2-lactylate E481
2. and sodium silico aluminate E554

they are also used as texturizing agents.

# F. Thickeners

- Thickeners are substances which, when added to the mixture, to increase its viscosity
- Types of thickeners
  - i. Binder
  - ii. Bodying agent
  - iii. Texturizing agent
  - iv. Thickener



Showing classification of food additives

# III. BENEFITS OF ADDITIVES

- There are clearly **many** recognized **benefits** to be derived from additives.
- Some of the major benefits **are**:
  - A. a **safer** and more nutritious food supply,
  - B. a **greater choice** of food products,
  - C. and a **lower-priced** food supply.

# A. Safer and More Nutritious Foods

- There is no question that the **preservative** and **nutritional additives** used in foods increase the **safety** and **overall value** of many food products.
- The use of several **antimicrobials** is known to **prevent** food poisoning from various bacteria and molds.

- **Antioxidants**, used to **prevent** the development of **off-flavors**, also **prevent** the formation of potentially toxic **autoxidation** products and **maintain** the nutritional value of vitamins and lipids.
- the use of various nutritional additives such as **vitamins** is also of proven value in **preventing nutritional deficiencies**.

## B. Greater Choice of Foods

- Most major supermarkets today carry more than **20,000 food items**, providing the consumer a **wide choice** of food products.
- The **availability of additives** has allowed the production of numerous **out-of-season foods** and a **variety** of new food products.
- Additives have increased the **development of**: convenience foods, snack foods, low-calorie and health promoting (functional) foods and exotic (foreign) foods.

- Additives allow these foods to be **pre-prepared** and **still** maintain acceptable flavor, texture, and nutritional value.
- It is estimated that the **shelf life of cereal** products can be increased over **200%** by the use of **antioxidants**.
- The **snack food industry** has continued to be **successful** because the use of **coloring** and **flavoring** additives make available a wide array of snack items.

- The **greatest increase** in food additive use in the next several years is likely to be in the **functional food**
- **A functional food: can be defined as** a food or beverage that imparts a physiological benefit that enhances overall health, helps prevent or treat a disease/condition, or improves physical or mental performance via an added functional ingredient, processing modification, or biotechnology.

# IV. Dangers of food additives and preservatives

- Although additives and preservatives are essential for food storage, they can give rise to certain health problems.
- They can cause different allergies and conditions such as hyperactivity and Attention Deficit Disorder in the some people who are sensitive to specific chemicals.
- The foods containing additives can cause asthma, hay fever and certain reactions such as rashes, vomiting, headache, tight chest, hives and worsening of eczema.

- **Toxicological problems** resulting from the long-term consumption of additives **are not well documented.**
- **But the long-term consumption of additives is related to:**
  - 1. Cancer**
  - 2. and reproductive problems**

*although there is no direct evidence linking additive consumption with their occurrence in humans.*

- There are, however, **animal studies** that have indicated potential problems with some additives.
- Although most of these additives have been banned, some continue to be used, the most notable being **saccharin**

# Colour additives to avoid

Colour additives to avoid	
Erythrosine 127	E123
Tartrazine E102	E132*
Quinoline yellow E104	E133
Sunser yellow E110	
Carmosine E122	
Allura red E129	
Ponceau 4R E124	

<b>Food preservatives to avoid:</b>	<b>Flavourings &amp; sweeteners to avoid:</b>
<b>E211*</b>	<b>E621</b>
<b>E249</b>	<b>E951</b>
<b>E220</b>	<b>E954</b>
<b>E213</b>	<b>High Fructose Corn Syrup (HFCS)</b>
<b>E226</b>	

## E-Numbers and Additives

home

food and diet

additives

safety

E-numbers

food issues

for teachers

glossary

### E100 - E199

#### Colours

Colours are sometimes added to food to improve their general appearance and make them more appetising.

- E101
- Scroll and click
- E100
- E101
- E102
- E104
- E110
- E120
- E122
- E123
- E124
- E127
- E129
- E131
- E132
- E133
- E140
- E141
- E142
- E150a
- E150b

E-number	E101
Name	Riboflavin
Function	Colour
Foods	Sauces, processed cheese and foods with added vitamins such as bread.
Description	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.