Food Additives

FS 421 Food Preservation

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Definition of Food Additives:

A **chemical** added to a particular food for a during processing or storage that will change characteristics of the food, or become part of the food.

Additives….

This definition usually excludes food ingredients such as:

<u>salt, sugar, flavorings, spice, vitamins, minerals,</u>

Classes of Additives

- *Antimicrobial agents*
- *Antioxidants*
- *Artificial colors*
- *Artificial flavors and flavor enhancers*
- *Bleaching agents*
- *Chelating agents*
- *Thickening and stabilizing agents*

Introduction

- Food additives can be divided into two major groups

  - **Intentional additives**
    - Chemical substances that are added to food for specific purpose
    - Are regulated by strict governmental controls

  - **Incidental additives**
    - We have little control over incidental or unintentional additives

Introduction

- The law thus recognizes the following three classes of intentional additives
  - Additives generally recognized as safe (GRAS)
  - Additives with prior approval
  - Food additives (preservatives, colors, sweeteners, leavening agents, nutrients, etc)

"GRAS" is an acronym for …

Generally **R**ecognized **A**s **S**afe. Under sections 201(s) and 409 of the Federal Food, Drug, and Cosmetic Act (the Act)

GRAS List

http://www.accessdata.fda.gov/scripts/fdcc/?set=SCOGS

Intentional Additives

- The purpose of food additives
  - To improve or maintain nutritional value
  - To enhance quality
  - To reduce wastage
  - To enhance consumer acceptability
  - To improve keeping quality
  - To make the food more readily available
  - To facilitate preparation of the food

Intentional Additives

- In the following situations additives should *not* be used:
  - To disguise faulty or inferior processes
  - To conceal damage, spoilage, or other inferiority
  - To deceive the consumer
  - If use entail substantial reduction in important nutrients
  - If the desired effect can be obtained by economical, good manufacturing practices
  - In amount greater than the minimum necessary to achieve the desired effects

Preservatives

- Preservatives are additives that inhibit growth of bacteria, yeasts, and molds
- Preservatives or antimicrobial agents play an important role in today's supply of safe and stable foods
- Increasing demand for convenience foods and long shelf life of processed foods make the use of chemical food preservatives imperative

Preservatives

- The choice of antimicrobial agent has to be based on a knowledge of the
  - antimicrobial spectrum of the preservative
  - the chemical and physical properties of both food and preservative
  - the conditions of storage and handling,
  - the assurance of a high initial quality of the food to be preserved

Benzoic Acid

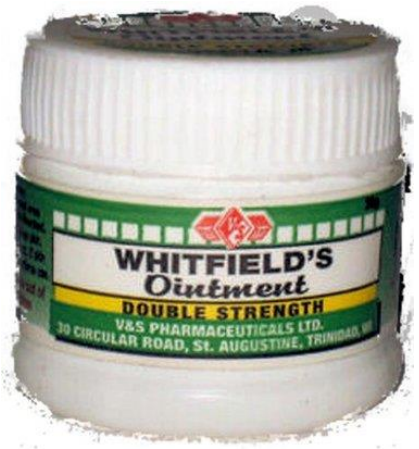
- Benzoic acid occurs naturally in many types of berries, plums, prunes, and some spices

- As an additive, it is used as benzoic acid or as benzoate

- The undissociated form on benzoic acid is the most effective antimicrobial agent
  - pK_a of 4.2; optimum pH range is from 2.5 to 4.0

Benzoic Acid

- This makes it an effective antimicrobial in high-acid foods, fruit drinks, cider, carbonated beverages, and pickles
- It is also used in margarines, salad dressings, soy sauce, and jams



Sorbic Acid

- As an acid, it has a low solubility in water at room temp
- The salts (sodium, or potassium) are more soluble in water

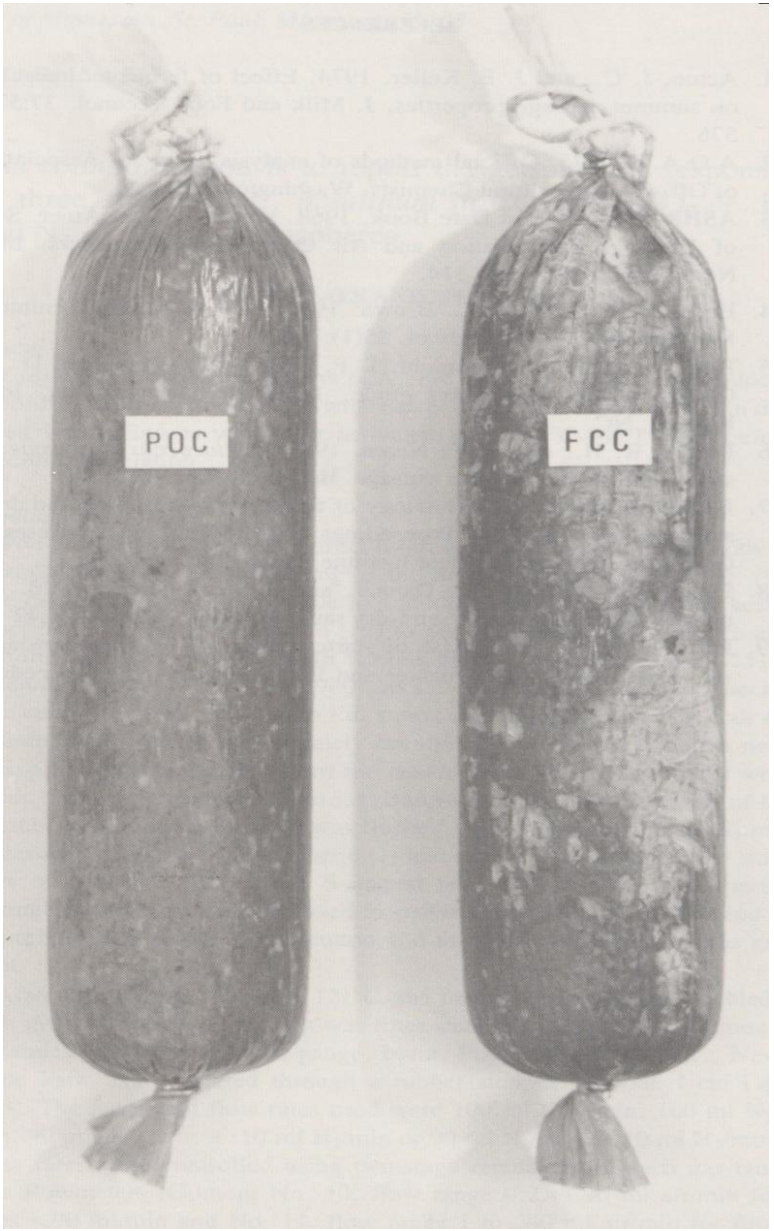
- Sorbates are stable in the dry form; the are unstable in aqueous solutions because they decompose through oxidation

- The rate of oxidation is increased at low pH, by increased temp, and by light exposure

Sorbic Acid

- Sorbic acid and other sorbates are effective against yeasts and molds
- Sorbate inhibit yeast growth in a variety of foods including wine, fruit juice, dried fruit, cottage cheese, meat, and fish products
- Sorbates are most effective in products of low pH including salad dressings, tomato products, carbonated beverages, and a variety of other foods
- The effective level of sorbates in foods is in the range of 0.05 to 0.30 percent

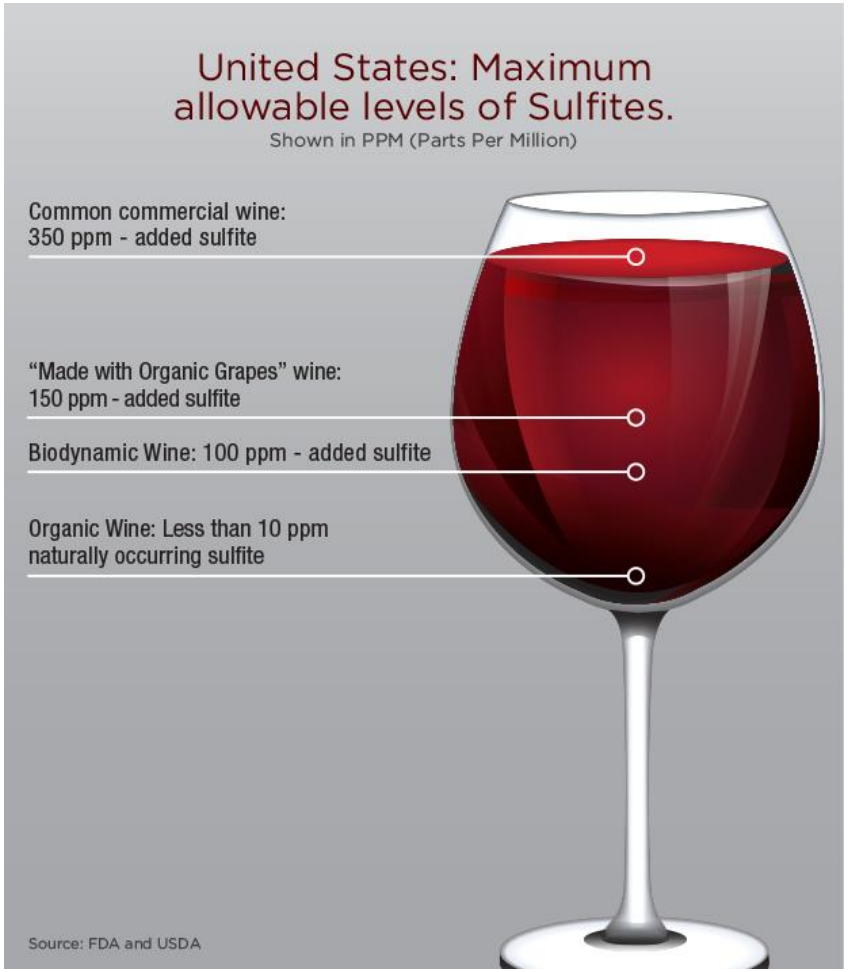
200 – 1000 ppm potassium sorbate



Sulfites

- Sulfur dioxide and sulfites have long been used as preservatives

- Serving both as antimicrobial substance and as antioxidant



Sulfites

- It is possible to classify bound SO_2 into three forms:
  - Aldehyde sulfurous acid
  - Glucose sulfurous acid
  - Rest sulfurous acid
    - Holds the SO_2 in a less tightly bound form
- Sulfites in wine serve a dual purpose
  - (1) antiseptic or bacteriostatic
  - (2) antioxidant

Sulfites

- The use of SO_2 is not permitted in foods that contain significant quantities of thiamine, because this vitamin is destroyed by SO_2
- SO_2 are used in
  - Wine
  - Dried fruits, dried vegetables

Hydrogen Peroxide

- Hydrogen peroxide is a strong oxidizing agent and is also useful as a bleaching agent

- The antimicrobial action of hydrogen peroxide is used for the preservation of milk (not in U.S.)

- Hydrogen peroxide decomposes slowly into water and oxygen

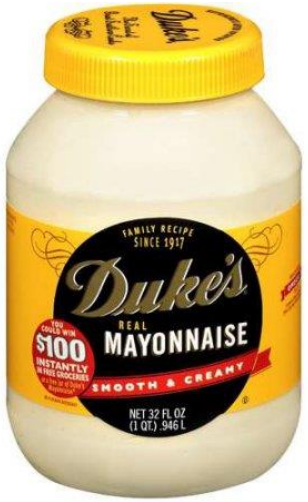
Hydrogen Peroxide

- When hydrogen peroxide is used for cheese making, the milk is treated with 0.02 percent hydrogen peroxide followed by catalase to remove hydrogen peroxide

- Hydrogen peroxide can be used for sterilizing food processing equipment and for sterilizing packaging material used in aseptic food packaging systems

Acids

- Acids serve a dual purpose
  - Acidulants
  - Preservatives
- Phosphoric acid is used in soft drinks to reduce the pH
- Acetic acid is used to provide tartness in mayonnaise and salad dressings
- Others: Citric acid, tartaric, malic, lactic



Antioxidants

- Food antioxidants in the broadest sense are all of the substances that have some effect on preventing or retarding oxidative deterioration in foods

- ***Primary antioxidants***

  Terminate free radical chains and function as electron donors

  They include …
  - butylated hydroxyanisole (BHA),
  - butylated hydroxytoluene (BHT)
  - tertiary butyl hydroquinone (TBHQ)
  - propylgallate (PG)
  - natural synthetic tocopherols

Antioxidants

Oxygen scavengers –

can remove oxygen in a closed system

Most widely used compounds are Vit C, and related substances, ascorbyl palmitate, and erythorbic acid

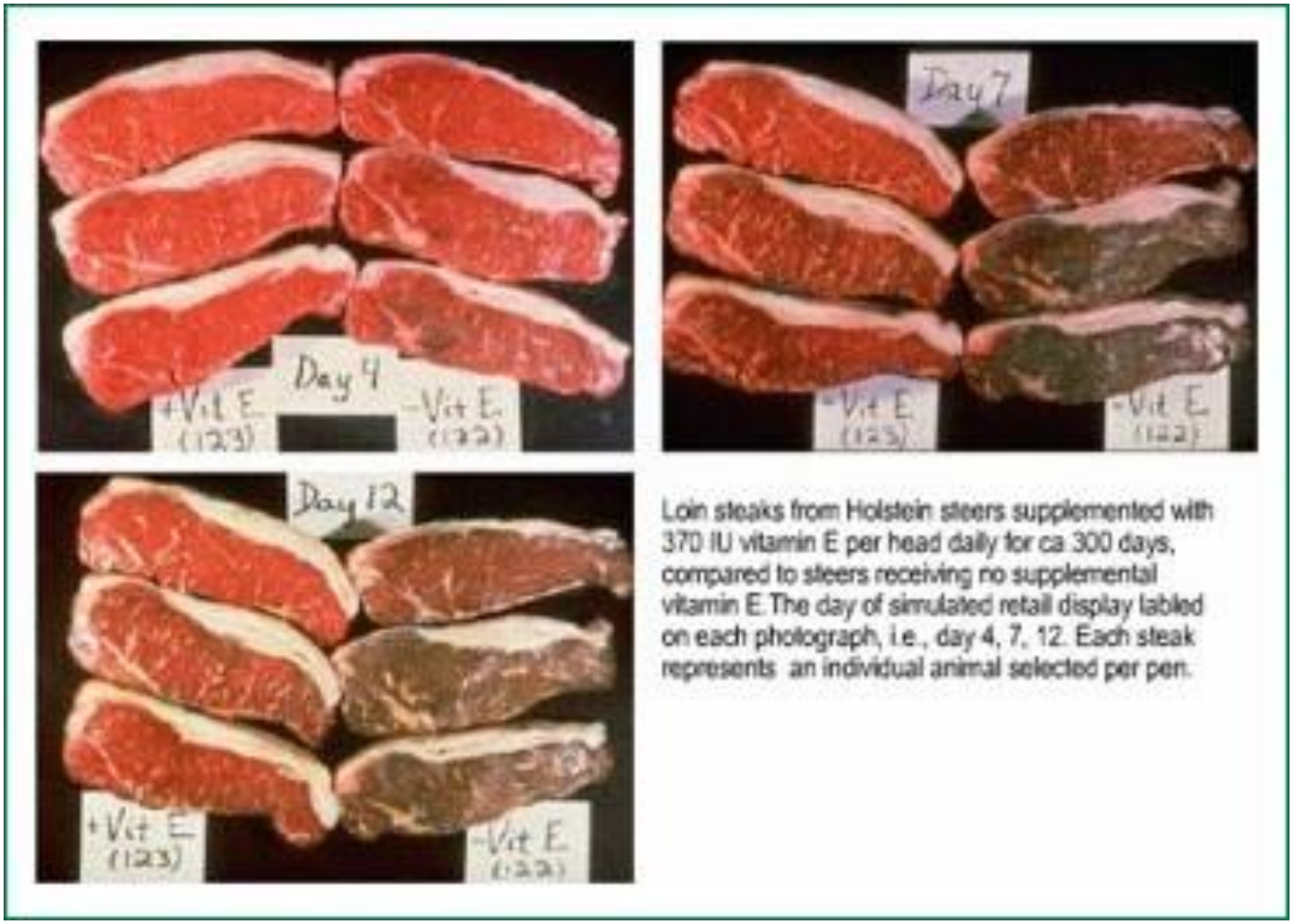
Chelating agents-

They remove metallic ions,

Cu & Fe

Citric acid is widely used for this purpose

Feeding Vitamin E to Ruminants



Loin steaks from Holstein steers supplemented with 370 IU vitamin E per head daily for ca 300 days, compared to steers receiving no supplemental vitamin E. The day of simulated retail display labled on each photograph, i.e., day 4, 7, 12. Each steak represents an individual animal selected per pen.

Antioxidants

- Enzymatic antioxidants
  - Can remove dissolved head space oxygen, such as glucose oxidase
  - Superoxide dismutase can be used to remove highly oxidative compounds from food systems
- Natural antioxidants
  - Present in many spices and herbs
  - Rosemary and sage are the most potent antioxidant spices

Color Additives

- Artificial – "certifiable colors" Certifiable color additives are man-made, derived primarily from petroleum and coal sources.

FD&C, D&C, or Ext. D&C

FD&C Yellow No. 5

Color Additives

- Natural - "exempt" from batch certification. These are obtained largely from plant, animal, or mineral sources.

Turmeric, caramel color, grape color extract

Bread Conditioners

- To speed up the aging process of wheat flour, bleaching and maturing agents are used
- Benzoyl peroxide is a bleaching agent that is frequently used

Bread Improvers

- Improvers used to ensure that dough will ferment uniformly and vigorously include
  - Oxidizing agents: Potassium bromate, potassium iodate, calcium peroxide
- There may be small amounts of other inorganic compounds in bread improvers
  - Including ammonium chloride, ammonium sulfate, calcium sulfate…
- Most of these bread improvers can only be used in small quantities, because excessive amounts reduce quality

Emulsifiers

- Most emulsifiers used in foods are synthetic synthetic emulsifiers are derivatives of fatty acids (polysorbate 80)

- Lecithin (natural) is the commercial name of a mixture of phospholipids obtained as a by-product of the refining of soybean oil