

Antimicrobial Agents

- The main objective of anti-microbial agents is to keep the food acceptable for longer time by destroying micro-organisms and by preventing their growth and development.
- The most common food related spoilage agents are moulds, yeasts and bacteria.
- Preservation in food chain is achieved by the addition of preservatives. Generally, they serve as either antimicrobial or antioxidant or both.

Factors affecting the selection of antimicrobial agents

1. Antimicrobial activity / spectrum
2. Physical and chemical properties of antimicrobial agents and food products
3. pH of the food product
4. Processing and storage conditions
5. Solubility
6. Flavor
7. Cost Marketing impact

Inappropriate uses of antimicrobial agents

- ❖ Addition of frozen products
- ❖ Addition to dried products
- ❖ Addition to heat sterilized products
- ❖ Addition to cover up poor sanitation
- ❖ Addition to food with the wrong pH

Benzoic acid & Benzoate



- Benzoic acid usually used in the form of sodium salt.
- Benzoic acid occurs naturally in some fruits and spices such as prunes, plums, cinnamon and cloves.
- Maximum permissible concentration is 0.15-0.25%.
- Primarily antimycotic agent.
- Benzoates are most effective at pH 2.5-4.0 and least effective above pH 4.5.
- Regarding the mechanism of antimicrobial action, it is believed that benzoic acid inhibits amino acid uptake in mold and bacteria.
- Benzoic acids have very low toxicity.
- Sodium benzoate is used as an antimicrobial in carbonated and still beverages (0.03-0.05%), jams, jellies, pickles, syrups (0.1%) etc.

Parabens



- Alkyl (methyl, ethyl, propyl, butyl and heptyl) esters of hydroxybenzoic acid are collectively known as parabens.
- Their antimicrobial activity is directly proportional to the chain length.
- Parabens are more active against molds and yeasts than bacteria.
- The mechanism by which the parabens inhibit microorganisms is most likely related to their effect on the microbe cytoplasmic membrane.
- The US FDA consider methyl and propyl paraben as GRAS, with a total addition limit of 0.1%.

Sorbic acid and sorbates

- Sorbic acid and its potassium, sodium and calcium salts are collectively known as sorbates.
- These are effective preservatives at low concentration for the control of mold and yeast.
- Used in cheese products, baked goods, fruit juices, pickles and certain meat and fish products.
- Sorbic acid and its salts are naturally occurring substances.
- It imparts no taste or flavor to products
- The maximum allowed concentration of sorbic acid is 0.2%.
- Highest anti-microbial activity is at pH 4.75.



- Food related yeast which are inhibited by sorbates include species of:
 - Brettanomyces
 - Candida
 - Debaromyces
 - Cryptococcus
- Food related mold species inhibited by sorbates include genera of:
 - Alternaria
 - Aspergillus
 - Cephalosporium
 - Fusarium
- Sorbates inhibit the growth of *Salmonella*, *Clostridium botulinum* and *Staphylococcus aureus* in meat products.

Short chain organic acids

Acetic acid and acetates

- Effective at pH 3.5
- Against the bread mold & rope forming bacteria
- Used in baked goods

Lactic acid

- Used in many fermented products
- Mainly for pH control and flavoring

Propionic acid and its salts

- It inhibits spore forming organism *Bacillus subtilis* which cause ropiness in bread

Fumaric acid

- Inhibit mold growth in bread

Nitrites and nitrates

- Nitrite salts (Na and K) act as preservatives, stabilizer (color in meat) and flavor enhancer
- Inhibit growth of *Clostridium botulinum* in meat
- Prolonged ingestion may cause methmyoglobinemia, which is characterized by excess production of abnormal hemoglobin



Sulfites

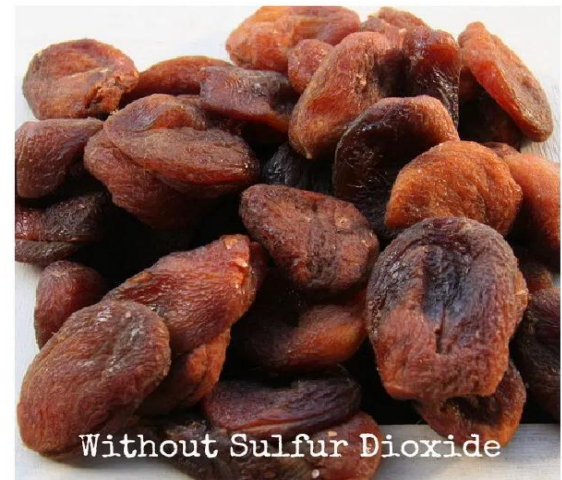
- Sulphur dioxide act as preservative, antioxidant and color stabilizers
- Used extensively as an antimicrobial agent and to prevent enzymatic and non-enzymatic discoloration in variety of foods.
- Yeast and mold are less sensitive to SO_2 than bacteria
- Primarily used in fruits and vegetable products

Hydrogen peroxide

- Used in milk, egg



With Sulfur Dioxide



Without Sulfur Dioxide

Biologically derived antimicrobial agents

Nisin

- It is a polypeptide produced by *Lactococcus lactis*.
- Nisin has a narrow antimicrobial spectrum limited to gram-positive bacteria such as lactic acid bacteria.
- US FDA approved it to use in pasteurized cheese spread to inhibit the growth of *Clostridium botulinum*

Natamycin

- Produced by *Streptomyces natalensis*
- Also peptide
- Effective against yeast and mold
- Used in surface treatment of food (Cheese, Sausages)

