

**BCH 445- Biochemistry of Nutrition [Practical]**  
**Determination of sodium benzoate in  
fruit juice**



# Food additives

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- **Food additives are** substances added to products to perform specific technological functions.

These functions include;

1. Preserving and increasing shelf-life.
2. Restoring nutrients lost or degraded during production.
3. Adding coloring and flavoring to food.

- The U.S. Food and Drug Administration (FDA) has a list of food additives that are thought to be safe. Many have not been tested, but most scientists consider them to be safe.
- These substances are put on the "**generally recognized as safe (GRAS)**" list. This list contains about 700 items.



# Types of food additives

Type	Function	Examples of Uses
Sweeteners	Add sweetness with or without the extra calories .	Beverages and baked goods.
Color Additives	Offset color loss and enhance colors that occur naturally.	Candies, snack foods, margarine, cheese and soft drinks.
Emulsifiers	Allow smooth mixing of ingredients and prevent separation.	Salad dressings, peanut butter and chocolate.
Flavor Enhancers	Enhance flavors already present in foods.	Many processed foods.
Preservatives	Prevent food spoilage from bacteria, molds, fungi, or yeast (antimicrobials); slow or prevent changes in color, flavor, or texture and maintain freshness.	Beverages and baked goods.
Others ...		

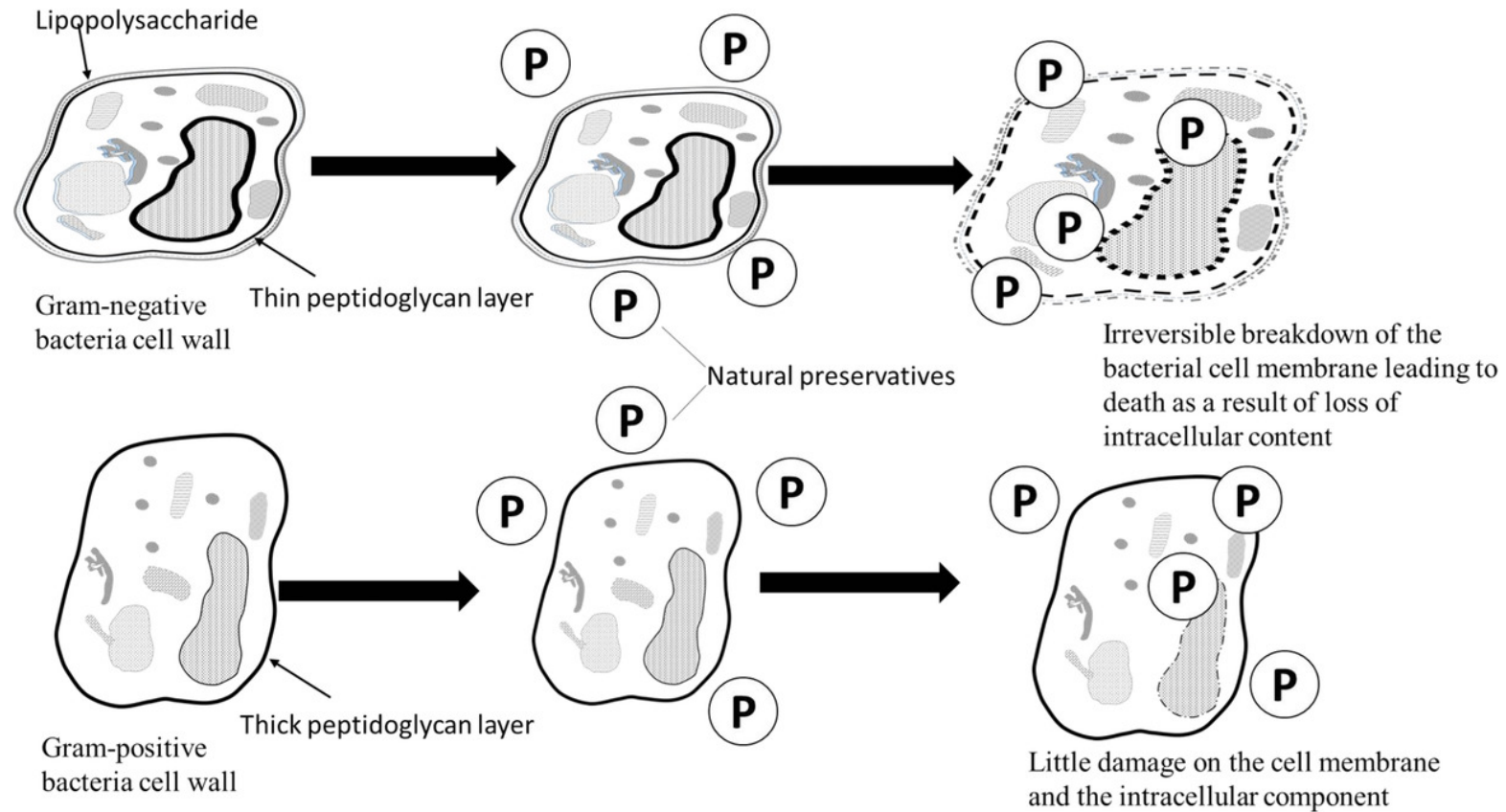
# Preservatives

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- The **main** purpose of preservatives is to maintain the safety of food for human consumption, retain its nutritional value and its overall quality.
- A substance which when added to food is capable **of inhibiting, retarding or arresting** the process of fermentation, acidification or other decomposition of food.
- Used to prevent and retard the microbial food spoilage.
- Examples of Preservatives:
  - Benzoic acid .
  - Sodiumbenzoate.
  - Potassiumbenzoate.
  - Sorbicacid.
  - Potassiumsorbate.
  - Propionicacid.
  - Sodiumpropionate.
  - Calciumpropionate.

# Preservatives mechanism of action

The **inhibitory action** of preservatives is due to their interfering with the mechanism of cell division, permeability of cell membrane and activity of enzymes.



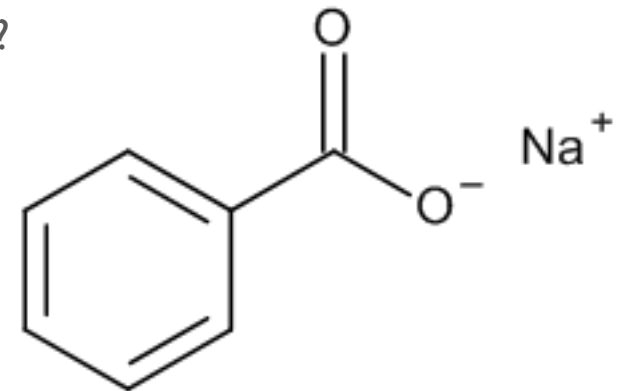
**Figure.2.** Response of Gram-positive and Gram-negative bacteria to preservatives.

# Sodium benzoate

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- **Sodium benzoate** (MW = 144) is a preservative.
- As a food additive, sodium benzoate has the **E number E211**.
- It is bacteriostatic and fungistatic.
- It is most widely used in **acidic food** such as salad dressings (vinegar), carbonated drinks (carbonic acid), jams and fruit juices and pickles (vinegar).
- It is also used as a preservative in **medicines**.

💡 **Pause and Think** Can we use sodium benzoate with in yeast-leavened products?



## Sodium benzoate

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- When added in **high concentration** it affects the taste of juice.
- Sodium benzoate is usually permitted at a concentration of up to 1.3g/l of juice.  
(not exceed 0.13 %)

## Practical Part

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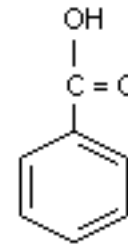
### Objective:

- To estimate the concentration of benzoate in fruit juice.



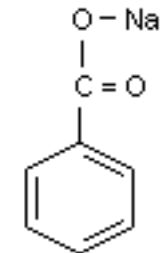
# Principle

- The benzoate anion is **not soluble** in non-polar solvents because of its negative charge.
- However, in **acid solution**, **benzoic acid is formed**, this is neutral & quite non-polar is soluble in non-polar solvents.
- Benzoate is separated from a known quantity of the sample by saturating with **NaCl** and then **acidifying with dilute HCl** and extracting with chloroform.
- The chloroform layer is made mineral acid (inorganic acid) free and the solvent is removed by evaporation.
- The residue is dissolved in neutral alcohol and the **amount of benzoic acid is determined by titration against standard alkali (0.05 M NaOH)** using phenolphthalein as an indicator.



Benzoic acid

Nonpolar  
(dissolves  
organic solvent)



Sodium benzoate

Polar  
(dissolves in water)

## Method

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1. Weight 10 g of sample into a beaker and add 1 ml of 10% NaOH solution and 12 g NaCl.
2. Add sufficient water to bring the vol. up to about 50 ml and let it stand for 30 min. with frequent shaking.
3. Add 1 drop of Phenolphthalein -ph.ph- (the color will change), add drops of HCl until the color change (disappear), then add excess 3 ml of HCl.
4. Add 25 ml of chloroform.
5. Transfer into separator funnel.
6. Let it stand for 20 min with frequent shaking.
7. Transfer 12.5 ml of the chloroform layer (lower layer) into a conical flask and evaporate of the chloroform on a steam bath.
8. Add 50 ml of 50% ethanol solution.
9. Titrate with 0.05 M NaOH add 1 drops of ph.ph as indicator.
10. Calculate the amount of sodium benzoate in the sample.

## Results and calculations

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1 ml of 0.05M NaOH → 0.0072g of sodium benzoate

..... ml of NaOH → ? gm of sodium benzoate

**Percentage of sodium benzoate** = (wt. of sodium benzoate / wt. of sample) × 100

**Normal range** = not exceed 0.13 %