

BCH 445- Biochemistry of Nutrition [Practical]

Determination of sodium benzoate in fruit juice



Food additives

- **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

Table 1. 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

- 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**
 - **Sodium benzoate**
 - Potassium benzoate
 - Sorbic acid
 - Potassium sorbate
 - Propionic acid
 - Sodium propionate
 - Calcium propionate

Sodium benzoate

- **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**
- 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 %)**

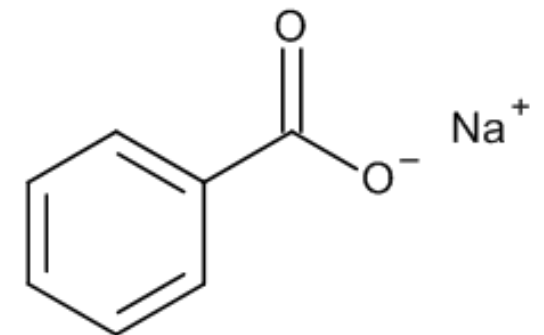


Figure 1. chemical structure of sodium benzoate

Practical Part

Objective:

- To estimate the concentration of benzoate in fruit juice.

Principle

- The **benzoate anion** is insoluble in non-polar solvents because of its negative charge
- However, in acid solution, **benzoate acid** is formed benzoic acid is neutral and quite nonpolar
- Moreover it is soluble in non-polar solvents, into which it may be extracted at acidic pH i.e well below the pKa of the carboxyl group, which is 4.20
- In this experiment, benzoic acid is separated from a known quantity of the sample by **a) saturating with NaCl and then b) acidifying with dilute HCl and c) extracting with chloroform**
- The chloroform layer is made mineral acid free and the solvent is removed by evaporation
- After dissolving the residue in 50% (v/v) neutralized ethanol and the **amount of benzoic acid is determined by titration against standard alkali (0.05 M NaOH)** using **phenolphthalein** as an indicator.

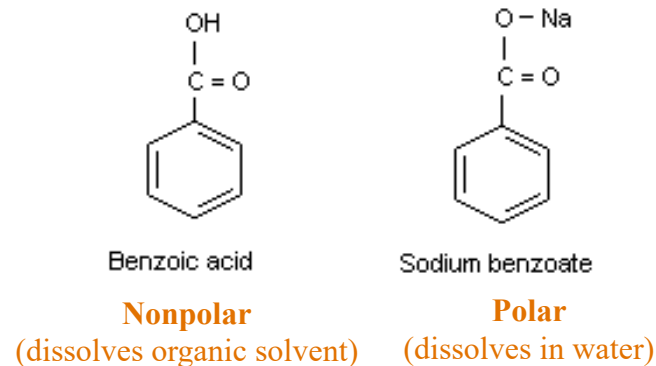


Figure 2. chemical structure of benzoic acid and sodium benzoate

When handling chloroform, **safety goggles**, **face mask** and **gloves** should be worn.

Method

1. Transfer 10 ml of juice sample into a beaker and add 1 ml of 10% NaOH solution and 12 g NaCl and mix the mixture
2. Add sufficient water to bring the vol. up to about 50 ml using volumetric flask and let it stand for 30 min. with frequent shaking
3. Add 1 drop of ph.ph (the color will change to pink), add drops of HCl until the color change (disappear), then add excess 3 ml HCl
4. Add 25 ml of chloroform and transfer into separator funnel
5. The separating funnel should be shaken vigorously for 15 min, while shaking open the cover from time to time to release any pressure within the funnel. *Be sure funnel is pointing away from you before opening*
6. The solutions then allowed to separate for 10 min at room temperature
7. Transfer 12.5 ml of the chloroform layer (lower layer) into a conical flask and evaporate of the chloroform on a hot plate
8. Add 50 ml of 50% ethanol solution
9. Add 2 drops of ph.ph as indicator and titrate with 0.05 M NaOH
10. Calculate the amount of sodium benzoate in the sample

Results and calculations

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) X 100

Normal range = not exceed 0.13 %