Part 6:
Preparation of Organic Compounds

CHAPTER-15

PREPARATION OF BENZOIC ACID FROM BENZAMIDE

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Aim:

To synthesize Benzoic acid from benzamide and to find out its % practical yield and melting point.

Requirements:

A. Glassware & Instruments:

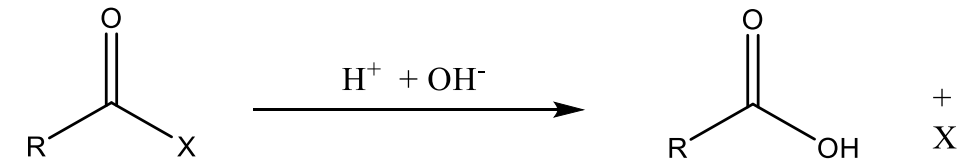
1. Round bottom flask (250 ml)
2. Beaker
3. Reflux condenser
4. Buchner's flask
5. Vacuum pump, 25 ml
6. Measuring cylinder

B. Chemicals & Reagents:

1. Benzamide
2. HCl
3. NaOH (10%) solution

Theory:

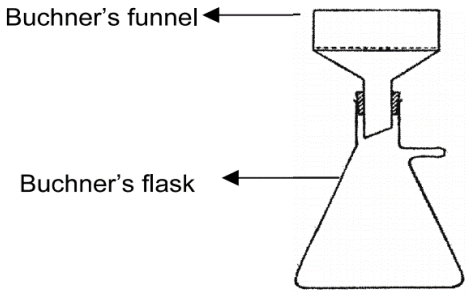
- **Hydrolysis:** Hydrolysis is the process of bond dissolution through the addition of a water molecule. Functional derivatives of carboxylic acid, such as amides or esters, can be hydrolyzed in acidic or alkaline media to produce the carboxylic acid (as a salt) and ammonia/amine or alcohol/phenol. Hydrolysis of a functional carboxylic acid derivative is an illustration of a nucleophilic substitution reaction.



Ester if X = R'O-
Amide if X = NH_2-

Carboxylic acid

- **Synthesis:** It is a chemical reaction that produces a new substance with a distinct structural formula, molecular weight, and melting point.
- **Purification:** Purification is the removal of contaminants from a product. Recrystallization, washing, and drying the product in an oven at a specific temperature and for a specified amount of time are included in the purification of the product. Buchner's funnel and flask assembly:



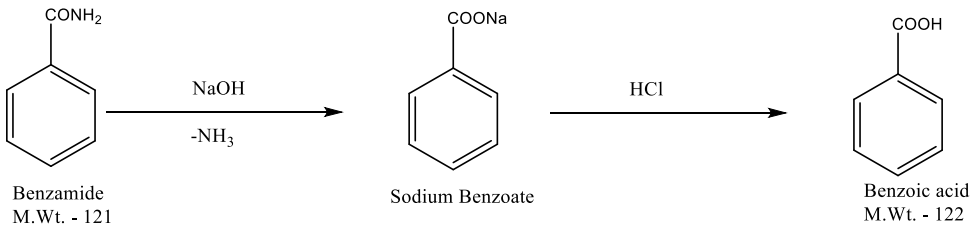
- **Recrystallization:** Recrystallization is the process by which a compound is dissolved in a solvent of choice through heating, and then slowly cooled to form a saturated solution from which pure compound crystallises.
- **Yield:** It refers to the amount of product obtained from a synthesis. They include the theoretic yield, the practical yield, and the percentage yield.
- **Theoretical Yield** is the weight of the product one should obtain based on the stochiometric quantities of the reagents, assuming that the reaction is carried out to 100 percent efficiency.
- **Practical Yield** is the actual amount of product obtained after product purification.
- **Percentage yield** is calculated from the formula given below:

$$\% \text{ Yield} = \frac{Practical\ yield * 100}{Theoretical\ Yield}$$

Procedure:

1. In a 250 ml round-bottom flask fitted with a reflux condenser, combine 5 g of Benzamide and 75 ml of NaOH solution.
2. Add a few unglazed porcelain fragments to the reaction mixture.
3. Gently boil the mixture for 30 minutes.
4. The solution is cooled in a mixture of ice water and concentrated HCl, which is added slowly until the mixture is highly acidic. A white product immediately separates.
5. Dissolve the product in a minimum amount of boiling water, and if necessary, filter the hot solution.
6. Bring the temperature to room temperature. Obtain practically colourless crystals of benzoic acid.
7. Collect and dry the product at the pump.
8. Accurately weigh the yield obtained and determine its melting point.

Reaction:



Observations:

- Amount of Benzamide taken for synthesis = 5 g
- Practical yield of the recrystallised product=
- Melting point of the product =

Calculations:

Theoretical Yield of the product.

From the reaction,

121 g of benzamide gives 122 g of benzoic acid

5 g of benzamide will give 5.04 g of benzoic acid

Percentage Practical Yield

% Yield $= \frac{Practical\ yield * 100}{Theoretical\ Yield} =$ ……%

Result:

Percentage yield of Benzoic acid = ……%

Melting point of Benzoic acid is = ……..°C

Viva questions:

- What is Hydrolysis?
- Define the terms listed below. 1. theoretical yield, 2. practical yield, and 3. practical yield percentage.
- What is the function of a reflux condenser?
- Describe the method used to purify benzoic acid.
- Identify the organic reaction required for the production of benzoic acid. What is the chemistry involved?
- List the official formulations of benzoic acid.
- What purposes does benzoic acid serve?
- What is the function of sodium benzoate, the sodium salt of benzoic acid?
- Explain why unglazed porcelain was added to the reaction mixture.