

Chapter: 10

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AIM: TO CARRY OUT THE QUALITATIVE TEST OF AROMATIC HYDROCARBON (BENZENE, TOLUENE AND NAPHTHALENE)

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Requirements

Chemicals

1. Conc. H_2SO_4
2. Conc. HNO_3
3. CH_3OH
4. $\text{C}_2\text{H}_5\text{OH}$
5. CHCl_3
6. Formaldehyde
7. AlCl_3

Glass wares

1. Test tubes
2. Beaker
3. Bunsen burner
4. Stirring rod
5. Thermometer
6. Porcelain dish

Theory: Aromatic Hydrocarbons are organic molecules having a circular shape that contain sigma bonds and delocalized pi electrons. These chemical substances are also referred to as arenes and aryl hydrocarbons. Aromatic hydrocarbons are "unsaturated hydrocarbons with hydrogen atoms connected to one or more planar six-carbon rings termed benzene rings." Numerous aromatic hydrocarbons include benzene rings (also referred to as an aromatic ring). Resonance stabilises the benzene ring and delocalizes the pi electrons inside the ring structure.

Preliminary test

Nature.....(solid/liquid/gas)

Colour.....(colour/colourless)

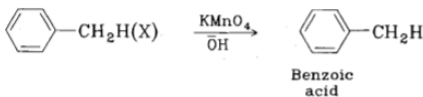
Odour.....(odour/odourless)

Flame test.....(Sooty flame)

Solubility test: Solubility in water, Conc. H_2SO_4 , dil. HCl

S. No.	Test Procedure	Observation	Inference
1.	Sulphuric acid test: Take the given sample in a properly cleaned and dry test tube. Add conc. H_2SO_4 . Then, boil the solution until it is clear. Then, chill and add H_2O to a beaker.	Clear solution	Aromatic compound may be present
2.	Nitration: Add 0.4 mL of concentrated H_2SO_4 to 100 mg of the aromatic compound while stirring. While cooling the reaction mixture in water, add 0.4 mL of concentrated HNO_3 while stirring and shaking. The reaction mixture is then heated and shaken in a H_2O bath at about 50°C for 15 minutes, poured into 2 mL of cold H_2O , and collected by filtration. From methanol, recrystallize to a constant melting point. Use fuming nitric acid instead of concentrated nitric acid for nitrating unreactive	Greenish-yellow crystals	Aromatic compound is confirmed

	<p>substances.</p> <p>A pale yellow, insoluble oil with an almond-like odour. It freezes to produce yellow-green crystals.</p>		
3.	<p>Formalin test (Le Rosen test for aromatic compounds): Take 0.6 g of material in CHCl_3 and 4-5 drops of formaldehyde-H_2SO_4 reagent and place them on a porcelain plate. [Reagent: 5-6 drops of 37% HCHO + 5 ml of Conc. H_2SO_4. It should be prepared freshly.</p>	Red or Green colours	Aromatic compound is confirmed
4.	<p>Chloroform-aluminium Test: Heat 0.2 g of AlCl_3 in a test tube until it sublimates and adheres to the test tube's walls. Run 2 ml of Substance in CHCl_3 down the test tube's sides. Note the colour created by interaction with AlCl_3 solution. Due to the synthesis of triphenylmethane dyes, a red, orange, blue, or green hue may be observed.</p>	Red, orange, blue or green colour	Aromatic compound is confirmed
5.	<p>Permanganate method: In a flask with a round bottom, combine 1g of the unknown substance, 4g of potassium permanganate, 1g of sodium carbonate, and 100ml of water. Flux the mixture until the permanganate's colour is expelled.</p>	Benzoic acid	Aromatic compound is confirmed

	<p>Acidify with diluted HCl and then add a 25 percent sodium sulphite solution while vigorously shaking until the brown manganese dioxide precipitate has disintegrated. On cooling, a solid product separates from water or aqueous ethanol, which is then recrystallized.</p>		
			

Functional Group Test for Benzene or Toluene

S. No.	Test Procedure	Observation	Inference
1.	<p>Nitration: To 5 ml of an equal volume mixture of conc. HNO₃ and conc. H₂SO₄, add progressively 1 ml of benzene or toluene while shaking. Cool if the reaction begins to become too vigorous. After vigorously shaking the mixture for approximately 2 minutes, pour it into cold water. Yellow oil or solid will separate from the nitro-compound. Product is separate and washes with water, and then reduces it</p>	Yellow oil or solid	Benzene/toluene is confirmed

Aim: to carry out the qualitative test of aromatic hydrocarbon (benzene, toluene.....

	with tin and concentrated HCl to demonstrate the existence of the nitro-group.		
2.	Sulphonation: Take 1 ml benzene or toluene and carefully add 1 ml of fuming 20 percent H ₂ SO ₄ . Shake thoroughly and see the resulting homogenous solution. Now, gently add the reaction mixture into roughly 20 ml of cold H ₂ O while stirring; a clear solution of sulphonic acid is produced. However, a little quantity of the equivalent sulphone, R ₂ SO ₂ , typically separates as fine, colourless crystals.	Clear solution	Benzene/toluene is confirmed

Functional Group Test for Naphthalene

S. No.	Test Procedure	Observation	Inference
1.	Nitration: A transparent yellow solution is prepared by dissolving 1 g in 5 ml of glacial acetic acid using mild heating, cooling, adding 1 ml of	Yellow 1-nitro-compound	Naphthalene is confirmed

	<p>cone HNO_3, and heating to about $80\text{ }^\circ\text{C}$ for 1 minute. Inject into water. The yellow 1-nitro compound solidifies at $61\text{ }^\circ\text{C}$. A transparent yellow solution is produced. The 1-nitro compound becomes solid.</p>		
2.	<p>Picrates: After you have prepared a conc. picric acid solution in cold acetone, mix approximately 2 millilitres of this solution with approximately 2 millilitres of a cold conc. Naphthalene solution in acetone. Shake well. After approximately one minute of standing, yellow needles of naphthalene picrate crystallise out. The melting point of picrate after recrystallization from ethanol is $152\text{ }^\circ\text{C}$. Long, yellow crystals</p>	Long yellow needles crystal	Naphthalene is confirmed

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	of naphthalene picrate emerge.		
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Result: The results of the systemic qualitative tests performed and benzene/ toluene/ naphthalene were found and reported.