

Chapter: 03

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AIM: TO PERFORM SYSTEMATIC QUALITATIVE ANALYSIS OF ESTERS

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Requirements

Chemicals

1. Methanol
2. Hydroxylamine hydrochloride
3. Dil. HCl
4. KOH
5. FeCl₃
6. NaOH
7. Phenolphthalein

Glass wares

1. Test-tube
2. Stands
3. Brush
4. Holder
5. Glass rod
6. Beakers

Theory: Esters are types of chemical compounds that are formed when carbonyl groups are linked to ethers. The reaction of an acid with an alcohol or phenol that already has a hydroxyl group in it results in the formation of these compounds. The combination of carboxylic acids with alcohols is the typical starting point for the synthesis of esters. Therefore, esters are created when an acid and an alcohol are condensed into one another.

Functional Group Test for Esters

S. No.	Identification Test	Observation	Inference
1	<p>Hydroxamine acid test: In one ml of methanolic solution of hydroxylamine hydrochloride, combine one drop of the chemical with the solution. Then, add a few drops of methanolic KOH solution, and bring the mixture to a boil. Once it has reached room temperature, add 2 mL of 1M hydrochloric acid while exercising extreme caution. Observe the colour after adding one drop of a ferric chloride solution containing 5%.</p> $ \begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{OR}_1 + \text{NH}_2\text{OH} \longrightarrow \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NHOH} + \text{R}'\text{OH} \\ \text{Ester} \qquad \qquad \text{Hydroxylamine} \qquad \qquad \text{Hydroxamic acid} \end{array} $ $ \begin{array}{c} \text{O} \\ \parallel \\ 3 \text{R}-\text{C}-\text{NHOH} + \text{FeCl}_3 \longrightarrow (\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NHO})_3\text{Fe} + 3\text{HCl} \\ \text{Hydroxamic acid} \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \text{(Reddish blue)} \\ \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \text{(Magenta)} \end{array} $	Deep red or violet colour	Ester is confirmed
2	<p>Hydrolysis test (Phenolphthalein test): Dissolve a small amount of the sample in 2 ml of CH₃OH. To this, add a few drops of diluted sodium hydroxide and one drop of phenolphthalein. The test tube produces a pink colour after being heated carefully in a water bath; notice the colour after doing so. The colour gradually becomes less vivid</p>	Pink colour	Ester is confirmed

	until it vanishes altogether. $\text{R-COO-R}' \longrightarrow \text{R-COONa} + \text{R}'\text{-OH}$		
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Result: The results of the systemic qualitative tests performed and esters were found and reported.