

Test for Phenolic Group

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Phenol is a hydroxyl group (-OH) on an aromatic ring or simply the hydroxy derivatives of aromatic compounds are known as phenols. Phenols are weaker acids than [carboxylic acids](#). It undergoes substitution reaction easily. Phenol is one of the most versatile and important industrial organic chemicals.

Aim:

To identify the presence of phenolic functional group in a given organic compound.

Theory:

Any of the following test can be carried out to detect the phenolic functional group.

1. Litmus test
2. Ferric chloride test
3. Libermann's test
4. Bromine water test
5. Phthalein dye test

(a) Litmus Test:

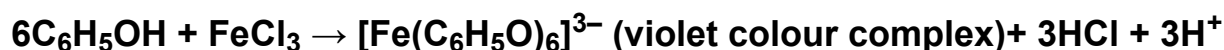
Scientists use litmus paper to test whether the given solution is acidic or basic. Red litmus paper turns blue while blue litmus paper remains unchanged in the presence of a base.

Phenol turns blue litmus paper red. This shows that phenol is acidic in nature. Carboxylic acid also give this test. Compare to carboxylic acid phenol is weakly acidic and it does not give an effervescence with aqueous [sodium carbonate](#).

(b) Ferric Chloride Test:

Aqueous solution of phenol reacts with freshly prepared ferric chloride solution gives coloured complex. Most phenols give dark coloured solution.

The chemical reaction is given below.

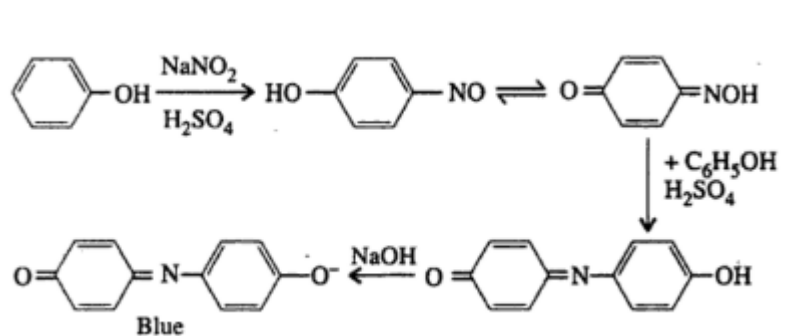


The colours produced by simple phenolic compounds with ferric chloride solution is listed below.

Phenol, resorcinol, Ortho cresol, Para cresol	Violet or blue colouration
Catechol	Green colouration
Hydroquinone	Violet or transient blue color
Pyrogallol	Blue rapidly changing to red

(c) Libermann's Test:

Phenol reacts with concentrated sulfuric acid and sodium nitrite forms a yellow colour quinone monoxime complex. With excess of phenol and sulfuric acid a deep blue indophenol complex is formed. On dilution a red colour indophenol is formed which turns to deep blue colour sodium salt solution of indophenol on treatment with sodium hydroxide.

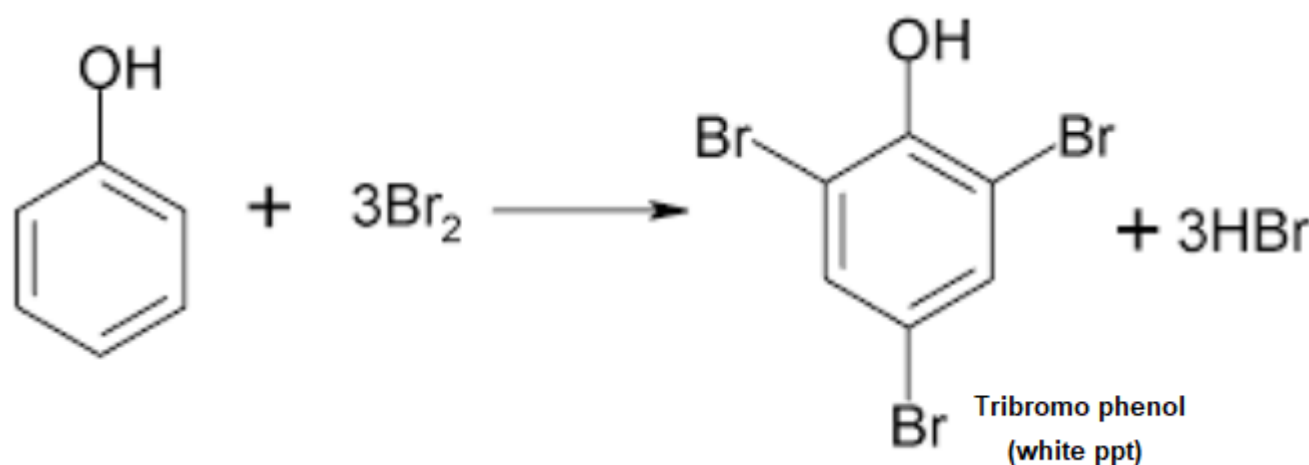


Note: This test is given by phenols which contain a free para position.

(d) Bromine Water Test:

Phenol undergoes electrophilic substitution reaction with bromine. When bromine water is added to aqueous solution of phenol the brown colour of bromine disappears and a white precipitate of tribromophenol is formed.

The chemical reaction is given below.

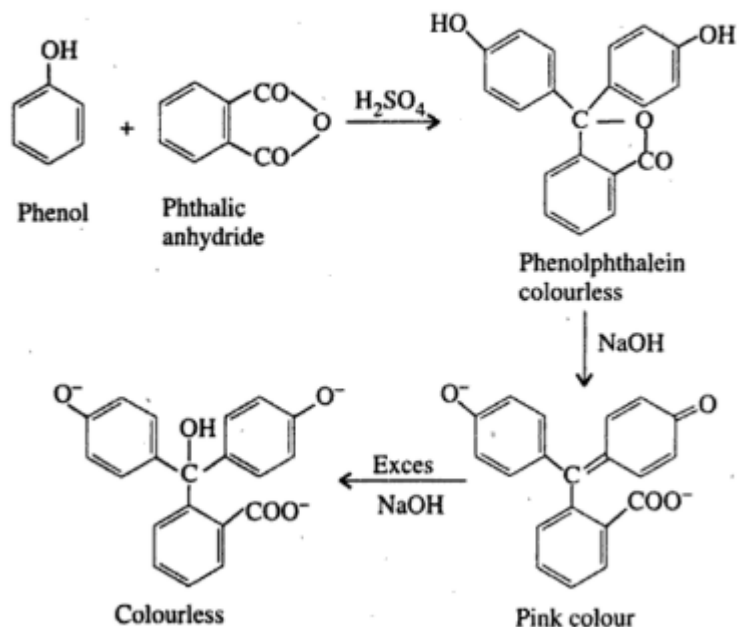


(e) Phthalein Dye Test:

Phenol on heating with phthalic anhydride in the presence of concentrated sulfuric acid forms a colourless condensation compound called phenolphthalein. On further reaction with dilute sodium hydroxide solution gives a pink colour fluorescent compound called fluorescein. Characteristic colours are produced by different phenolic compounds which can be viewed under white background.

The chemical reaction is given below.

Phthalein Dye Test



The colours produced by different phenolic compounds in phthalein dye test is listed below.

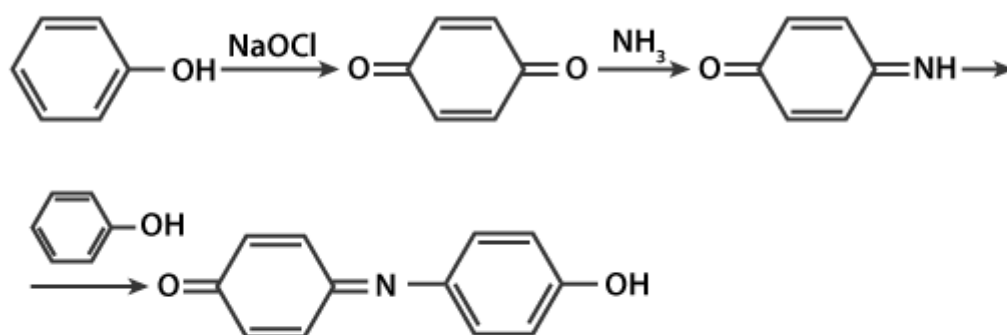
Phenol	Reddish pink
o-cresol	Red
m-cresol	blue or violet blue
1-naphthol	green
2-naphthol	faint green
Resorcinol	yellow-green fluorescence
Hydroquinone	deep purple

Materials Required:

1. Blue litmus paper
2. Ferric chloride solution
3. Sodium nitrite
4. Concentrated sulfuric acid
5. Sodium hydroxide
6. Bromine water
7. Phthalic anhydride
8. Organic compound to be tested
9. Test tubes
10. Test tube holder
11. Dropper
12. Beaker

Apparatus Setup:

Indophenol test (Blue colour)



Ferric chloride test (Violet colour)



Procedure:

Preparation of Reagents:

- Ferric chloride solution:** Neutral solution of ferric chloride is prepared by adding diluted solution of sodium hydroxide to ferric chloride solution drop by drop until a small but permanent brown precipitate appears. Filter the solution and use the clear filtrate for the test.
- Bromine Water:** Take 5ml of bromine add 100ml of distilled water and shake well. Decant off the clear liquid.

(a) Litmus Test:

- Place the drop of given organic solution or a small crystal on moist blue litmus paper.
- Observe the change in colour, if it changes to red then phenolic group may be present.

(b) Ferric Chloride Test:

- Dissolve the given organic compounds in water.
- Add neutral solution of ferric chloride slowly dropwise.
- Observe the change in colour.
- A red, blue, green or purple colouration indicates the presence of phenol.

(c) Libermann's Test:

- Place the crystals of sodium nitrite in a clean dry test tube.
- Add 1ml of phenol to sodium nitrite solution.

3. Heat the mixture gently and allow it to cool.
4. Add 1ml of concentrated sulfuric acid to it and shake the contents.
5. Observe the change in the colour of the solution.
6. Dilute the solution with water so that the given compound turns red if phenolic group is present.
7. Now add sodium hydroxide solution, the blue colour solution or green colour solution appears.

(d) Bromine Water Test:

1. Dissolve the given organic compound in glacial acetic acid.
2. Add bromine water solution to this dropwise.
3. If the colour of bromine disappears then it indicates the presence of phenol.

(e) Phthalein Dye Test:

1. Take the organic compound to be tested in a test tube.
2. Add 200mg of phthalic anhydride to it.
3. Add drops of concentrated sulfuric acid to the mixture.
4. Heat the solution for 2-3 minutes.
5. Cool the mixture and pour it into a beaker containing dilute sodium hydroxide solution.
6. Dilute the whole mixture with equal volume of water.
7. Observe the change in the colour in a white background.
8. If fluorescence colour exists the view it in a black background.

Observations:

Litmus test	Phenol turns blue litmus paper red.
Ferric chloride test	Violet or blue colouration shows presence of phenol.
Liebermann's test	Deep blue colour solution shows presence of phenol.
Bromine water test	Formation of white precipitate shows presence of phenol.
Phthalein dye test	Pink colour solution shows presence of phenol.

Results and Discussion:

The given organic compound is _____ .

Precautions:

1. The ferric chloride solution used should be freshly prepared should be neutral and very dilute.
2. Phenol should be handled with care because it is toxic and corrosive nature.
3. Bromine should not be inhaled because it causes irritation.
4. Concentrated acids should be handled with care.

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Frequently Asked Questions on Test for Phenolic Group

Name the intermediate compound formed in phthalein dye test?

The intermediate compound formed in phthalein dye test is phenolphthalein.

What type of reaction takes place when phenol is treated with bromine solution?

Aromatic electrophilic substitution reaction takes place when bromine is treated with phenol.

In the preparation of ferric chloride solution the brown precipitate formed is?

The brown precipitate formed during the preparation of ferric chloride solution is ferric hydroxide.

Which class of compounds are identified by using Libermann's test?

Phenols are identified by using Libermann's test.

Name the reagent used in Phthalein dye test.

In Phthalein dye test phthalic anhydride is used as a reagent. A pink colour dye is formed on adding excess of sodium hydroxide the colour will disappear.