PRACTICAL ORGANIC CHEMISTRY

(III)

SECOND LEVEL

SECOND SEMESTER

1443 - 1444

2022 - 2023

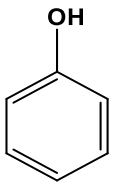
LECTURER: RAWNAQ THAMER KADEEM

EXPERIMENT 4

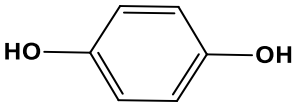
IDENTIFICATION OF PHENOLS

What is phenols?

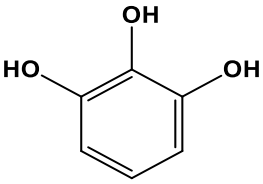
Phenols are hydroxyl aromatic compounds which dissolved in alkali forming phenolates, it was dissolve in water too. They have the general formula Ar-OH. Examples of them include phenol, hydroquinol, Pyrogallol, 1-naphthol, Catechol, resorcinol, curcumene.



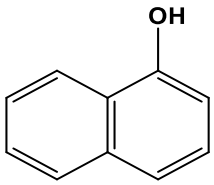
phenol



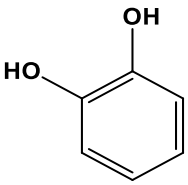
Hydroquinol



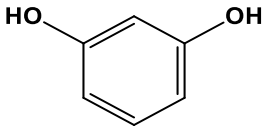
Pyrogallol



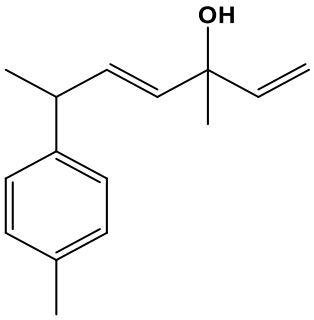
1-naphthol



Catechol



Resorcinol



(*E*)-3-methyl-6-(*p*-tolyl)hepta-1,4-dien-3-ol

"Curcumen"

Chemical reactions:

Phenols can undergo many types of reactions as both the electron-rich benzene ring and the polar -OH group can participate in chemical reactions.

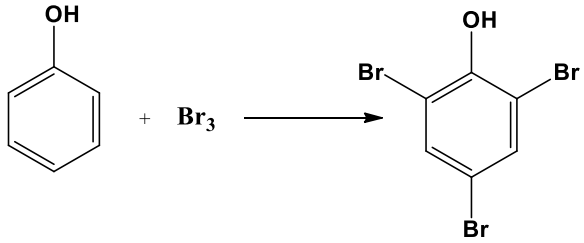
- **The -OH group in phenols has a slightly acidic character. It can therefore act as an acid and take part in acid-base reactions.**
- **Phenols are weak acids and undergo acid-base reactions in alkaline solutions.**
- **Azo compounds are formed from the reaction of phenols with diazonium ions.**
- **A hydrogen atom in the benzene ring is substituted by a nitro (-NO2) group, this is also known as the nitration of phenol.**

❖ **Phenols also undergo electrophilic substitution reactions when reacted with bromine water at room temperature, Bromination.**

Tests for identification for phenols:

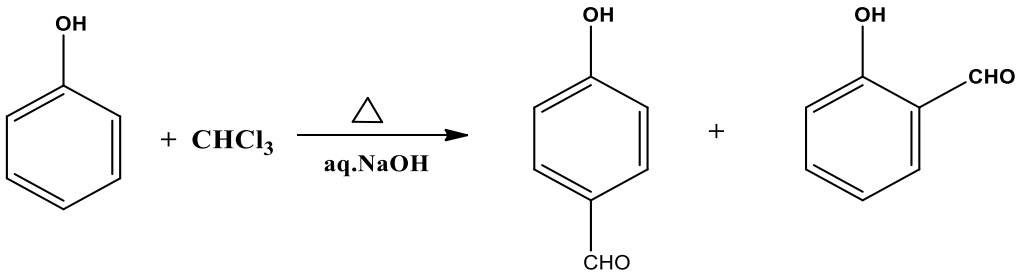
1) Bromine water test:

Phenols are generally highly reactive towards electrophilic reagents and are readily brominated by bromine water. e.g.



2) Riemer - Tiemann reaction:

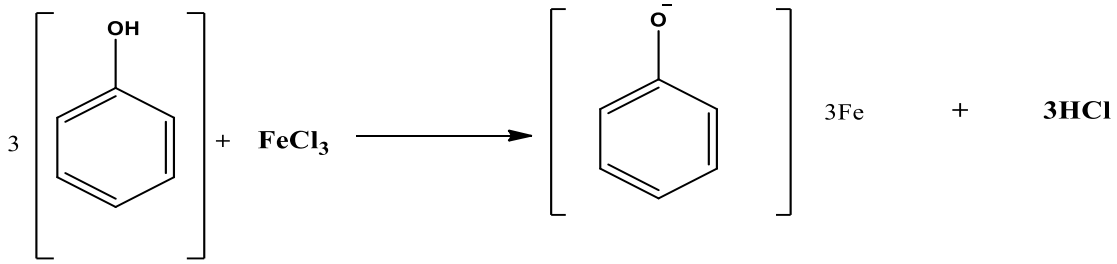
Treatment of phenol with chloroform and aqueous sodium hydroxide solution introduces an aldehyde group (-CHO) into the aromatic ring at the ortho- or para- positions.



4-hydroxybenzaldehyde **2-hydroxybenzaldehyde**

3) Ferric chloride test:

Phenols react with ferric chloride to give colored compounds due to the presence of [-C=C-OH] (enol) group. Indeed this reaction is considered as a test for any compound with enol group.



colord complex

Procedur:

Dissolve or suspend about 0.05 g of the compound in 2 mL of dilute hydrochloric acid and add bromine water drop wise until the bromine color remains. A white precipitate of the bromophenol may form. Solid bromophenol derivatives can be used for the confirmation of the structure of a phenol To a very dilute aqueous solution of phenol or to a few crystals of the solid phenol (0.1 gm) dissolved in water add 1 drop of ferric chloride solution and observe the resulting color.

Phenols	Colors
Phenol, m-cresorciol	Violet or blue
o- and p-cresol	Greenish blue
Hydroquinone	Deep green
2-naphthol	No special color

In the reaction of hydroquinone with ferric chloride as crystals may separate, and on further addition of ferric chloride solution a yellow solution of p-benzoquinone is produced

ADVANTAGE:

- **The advantage of using phenols and related compounds is that, they are stable to heating and drying.**
- **They can stop the reaction of free radicals with other molecules in your body, act as antioxidants.**

DISADVANTAGES:

- **When phenols used in its pure form, phenol is harmful to tissues , It also has a disagreeable odour.**
- **Phenol is considered to be quite toxic to humans via oral exposure.**

Some Pharmaceutical applications and uses:

- **Some simple medicines that contain phenol have healing, antiseptic and anti-inflammatory properties for urinary problems.**
- **Several compounds in this series have antibacterial and antifungal properties, particularly against allergic pathogens.**