

भारतीय ज्ञान परंपरा में शिक्षा के समाजशास्त्रीय आधार

सम्पादक :
डॉ. दिनेश चन्द्र शर्मा

भारतीय ज्ञान परम्परा में शिक्षा के समाजशास्त्रीय आधार

सम्पादक :

डॉ. दिनेश चन्द्र शर्मा

Ph.D., D.Lit. (Sub.)

निदेशक, कॉम्पिटिशन प्लस ग्रुप ऑफ इन्स्टीट्यूशन,
अजमेर

छवि पब्लिकेशन्स

अजमेर-305001

प्रकाशक :

छवि पब्लिकेशन्स

अजमेर-305001

मो. 9660111549

संस्करण :

प्रथम 2024

ISBN : 978 - 81 - 89435 - 66 - 0

मूल्य - 300/-

रचना - भारतीय ज्ञान परम्परा में शिक्षा के समाजशास्त्रीय आधार

सम्पादक - डॉ. दिनेश चन्द्र शर्मा

मुद्रक - श्रीनिवास प्रिन्टोग्राफिक्स, अजमेर

Phenol and Its Reaction

Dr. Nidhi Sharma

HOD (Deptt. of Science and Technology)

Hukumchand Noble Institute of Science and Technology, Ajmer

Phenol is an important organic compound with the molecular formula C_6H_5OH . It consists of a hydroxyl group (-OH) bonded directly to an aromatic benzene ring, making it the simplest member of the aryl alcohols, though it behaves quite differently from typical alcohols due to the influence of the aromatic ring. Phenols are important organic compounds having wide range of applications in a daily life. Due to their unique chemical properties, they are used in the synthesis of some essential products, including antibiotics, antiseptics, and analgesics. Here, we are going to learn about the applications of Phenol in daily life.

Phenols are a group of aromatic organic compounds having a six-membered benzene ring connected with a hydroxy group (-OH) that is volatile in nature. They are also known as carbolic acids. The molecular formula of phenols is C_6H_5OH , also known as benzenol.

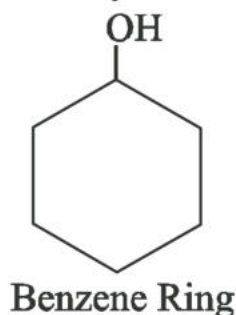
Basic Information

- * IUPAC name: Phenol
- * Molecular formula: C_6H_6O or C_6H_5OH
- * Molar mass: 94.11 g/mol
- * Appearance: White to light pink crystalline solid
- * Melting point: $\sim 40-43^\circ C$
- * Boiling point: $\sim 181.7^\circ C$
- * Solubility in water: Moderately soluble; forms a weakly acidic solution

Structure of Phenol

Phenol has a planar structure, and the lone pair of electrons on the oxygen of the hydroxyl group interacts with the π electrons of the

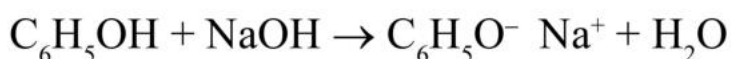
benzene ring through resonance, increasing the stability of the molecule. This delocalization is key to many of its chemical properties.



Acidity

Phenol is more acidic than alcohols (like ethanol), but less acidic than carboxylic acids. This is due to the resonance stabilization of the phenoxide ion ($\text{C}_6\text{H}_5\text{O}^-$) formed after losing a proton (H^+).

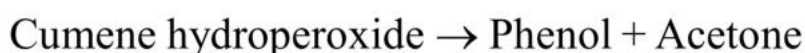
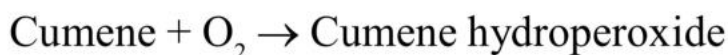
Reaction with base:



Preparation Methods

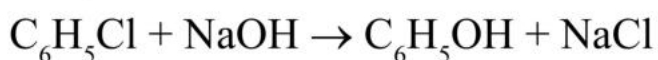
1. From Benzene (Industrial):

* **Cumene process:** The most common method



2. From Chlorobenzene:

" By reaction with NaOH at high temperature and pressure:



Chemical Properties

1. Electrophilic Aromatic Substitution:

- * The -OH group is activating and ortho/para directing.
- * Reactions include nitration, halogenation, sulfonation.

2. Reactivity with Metals:

- * Reacts with sodium to form phenoxide and hydrogen gas.

3. Oxidation:

- * Phenol can be oxidized to quinones, such as benzoquinone.

Uses of Phenol

- * Precursor to plastics, especially Bakelite
- * Manufacture of resins, such as phenol-formaldehyde resins
- * Disinfectants and antiseptics (historically used as the first surgical antiseptic)
- * Pharmaceuticals: Intermediate in drugs like aspirin
- * Dyes, explosives, and herbicides

Toxicity and Safety

Phenol is toxic and corrosive, especially in concentrated forms. It can be absorbed through the skin and cause chemical burns, and prolonged exposure can affect the central nervous system.

Safety Measures:

- * Use gloves and goggles
- * Work in a well-ventilated area or fume hood
- * Proper storage and disposal

Properties of Phenol

Here are a few properties of phenols:

- * Phenols often smell strong and are slightly acidic.
- * They can dissolve in water, but not too much.
- * Phenols turn a bit purple when you add iron(III) chloride to them.
- * They're found in things like plants and disinfectants.
- * Phenols can kill germs and are used in some medicines.

APPLICATIONS OF PHENOL IN DAILY LIFE

Due to its versatility, phenols have a several applications in daily life. Phenol plays a significant role in various aspects of modern living. Furthermore, phenol serves as a building block in the synthesis of plastics like Bakelite, contributing to the manufacturing range of products such as kitchenware, pharmaceuticals etc. Let's learn about some applications of phenols in detail.

Used in Cosmetic Industry

- * Phenol is majorly used in the manufacturing of the cosmetic

items like sunscreens, skin lightening creams and hair coloring and dyes.

- * Phenol is used in the cosmetics and skincare products manufacturing industries for the production of various skincare and cosmetics products such as skin lightening creams and lotions, sunscreens, and hair colors and dyes' solutions.

- * Phenol derivatives have the antimicrobial properties. It can be used as facial cleansers, acne treatments, and anti-aging creams. Mostly hydroquinone can be used to lighten hyperpigmentation in the skin.

Used in Manufacturing Industries

- * Used in plastic manufacturing industries. We cannot imagine our lives without plastic. Most of the things around us are either made from plastics or have plastic components in them.

- * The condensation reaction of phenol with acetone produces bisphenol A which is extensively used in polymer industries to synthesis various epoxide resins and polycarbonates.

- * Phenol can be used as a precursor in the synthesis of picric acid, also known as trinitrophenol. Picric acid is primarily used as an explosive and as a yellow dye.

As a Preservative

- * Phenol and its derivatives are used as preservatives in some pharmaceuticals and personal care products to extend their shelf life by inhibiting the growth of bacteria, fungi, and other microorganisms.

- * Phenol or are added in a minor quantity in products to extend their shelf life by inhibiting the growth of bacteria, fungi, and other microorganisms.

- * Mixtures of phenols (cresols) are used as components in wood preservatives such as creosote.

As a Cleansing agent

- * The most commonly used disinfectant since ancient times is Phenol. It has got amazing antiseptic properties too. It was one of the most common chemicals used to clean household materials, especially washrooms and floor tiles.

* Phenol is an effective disinfectant and is used in various household cleaning products, such as disinfectant sprays and wipes, to kill germs on surfaces.

* Products such as Lysol and Dettol contain phenol derivatives like cresols or chloroxylenol.

In Pharmaceuticals Industry

* Phenol is commonly used as an oral analgesic and mild anaesthetic. This is because of the numbing sensation it provides due to its astringent properties since it is an alcohol.

* Some precautions should be taken while using it orally because the concentrated solution of phenol can be toxic to human skin.

* Aspirin is most commonly used phenol derivatives as Analgesic medicines.

In Mouthwashes

* Phenol, although in very minor quantity, is also used in the manufacturing of mouthwashes for effective cleansing of the mouth and removal of mouth bacteria.

* Although due to toxicity of Phenol, it was replaced by the chlorhexidine and essential oils like menthol and eucalyptol, which offer antibacterial properties with fewer adverse effects on the human health.

* Phenol also provide pain relief and anaesthetic effects, which can help alleviate pain and discomfort associated with minor mouth irritations and mouth ulcers.

In Utensils

* Bakelite is extensively used in electrical switches and automobiles due to its property of holding extreme conditions of heat and resistance to electricity and other chemicals.

* The intermediate produced during the polymerization reaction is called novolac, this is a resin and is used as a binding agent or adhesive in many industries. Novolac is also used for protective coating purposes.

* Bakelite is widely used for making non-stick kitchen utensils.