Product Safety Assessment
Phenol

Select a Topic:

Names

- CAS No. 108-95-2
- Phenol
- Carbolic acid
- Phenylic acid
- Benzophenol
- Hydroxybenzene

Product Overview

- Phenol is a white, crystalline solid at room temperature. Phenol is present naturally in the environment and is also manufactured. Most manufactured (synthetic) phenol is melted to form a clear, colorless liquid that is used to produce chemical intermediates.[1] See Product Description.
- The primary sources of environmental phenol are automobile exhaust, benzene degradation, human metabolism, cigarette smoke and some combustion processes. Although ninety percent of the world's phenol is synthetic, environmental phenol is the primary source of potential consumer exposure.[2] Occupational exposure to phenol could occur at a phenol manufacturing site, or at a facility which uses phenol as a raw material or phenol-containing chemical intermediates. See Exposure Potential.
- Manufactured phenol is used to produce a wide variety of chemical intermediates, mainly bisphenol A which is used in the manufacture of epoxy resins and polycarbonate, and phenol-formaldehyde (PF) resins which are used to manufacture wood adhesives. Phenol is used in the production of many consumer goods such as: paints, varnishes, enamels, preservatives, lubricants, disinfectants, herbicides, and pharmaceuticals.[3] However, there is minimal residual phenol in these products. See Product Uses and Exposure Potential.
- Contact with pure phenol, even briefly, may cause severe burns to the eyes, mouth and throat. Harmful if inhaled.[4] See Health Information or Physical Hazard Information.
- Phenol is classified by OSHA as a "hazardous chemical." Phenol is corrosive and combustible. Phenol produces dense smoke when burned. Vapors are heavier than air and may accumulate in low-lying areas.[5] Physical Hazard Information.

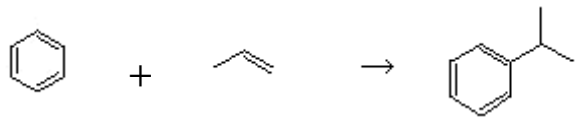
Back to top

Manufacture of Product[6]

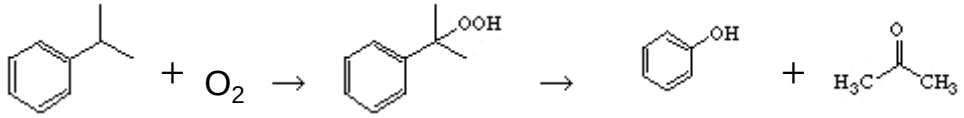
- **Capacity –** Global production of phenol in 2004 was nearly 17 billion pounds (7.7 million metric tons). Phenol is produced by Dow in the United States at the Freeport, Texas manufacturing facility. Dow's annual phenol production capacity as of June 2005 was 650 million pounds (295,000 metric tons).
- **Process –** Ninety percent of the world's phenol is produced using the cumene peroxidation method. This is a closed process which involves reacting benzene with propylene to form

cumene. Cumene is oxidized with air to form cumene hydroperoxide, which is then split into phenol and acetone by the addition a small amount of sulfuric acid. Prior to World War I, synthetic phenol was unavailable. "Natural" phenol was extracted from coal tar and petroleum.

The chemical synthesis of phenol is shown below:



Benzene Propylene Cumene



Cumene Oxygen Cumene Hydroperoxide Phenol Acetone

Back to top

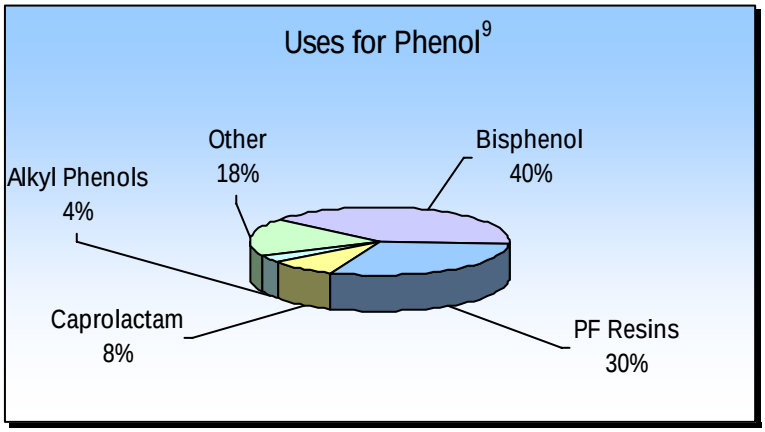
Product Description[7]

Phenol is a white crystalline solid at room temperature. Phenol is a liquid at temperatures above 106ºF (41ºC). Most phenol is consumed molten as a clear, colorless liquid. Ninety percent of the world's phenol is synthetic phenol.

Back to top

Product Uses[8,9]

Dow is a major producer of phenol. Phenol is used in the manufacture of the following chemical intermediates:



- Bisphenol A – used in the production of epoxy and polycarbonate resins
- Phenol-formaldehyde (PF) resins – used as molding powders, laminates, adhesives, and coating resins
- Caprolactam – used in nylon 6 production and resins
- Alkylphenols – including p-nonylphenol and p-dodecylphenol,two commercially significant alkyphenols
- Xylenols, adipic acid, and salicylic acid – used for rubber additives and aspirin

Products made using phenol can be found in a variety of applications:

- Phenolic resins in powder form are molded into products such as telephone housings and electrical outlets or plugs.
- High and low-pressure laminates made from phenolic resins are used in the manufacture of panel boards, table and counter tops, wall panels (paneling), chemically resistant containers, boat hulls, airplane parts, luggage, brake linings, and many other products.
- Caprolactam-based resins are used in automotive and truck parts including rear-end license panels, louvers, mirror housings, and wheel covers; nylon 6 fibers, also derived from caprolactam, are used to make carpet and rug yarns.
- Phenol-based adhesives are used in the manufacture of marine or exterior grades of plywood.

- Alkyl phenols are used as stabilizers or antioxidants in motor oil.
- Phenol is also used in the manufacture of preservatives and disinfectants, herbicides, insecticides, and pharmaceuticals.

Back to top

Exposure Potential

Phenol is present in the environment and is used in the production of industrial and consumer products. Based on the uses for phenol, the public could be exposed through:

- **Workplace exposure** – Phenol is manufactured in a closed process to minimize employee exposure potential. Occupational exposure could occur either in a phenol manufacturing facility, or in the various industrial or manufacturing facilities that use phenol or phenol-containing products. Those working with phenol in manufacturing operations could be exposed during maintenance, sampling, or other procedures. Each manufacturing facility should have a thorough training program, appropriate work processes, and safety equipment in place to limit unnecessary phenol exposure.[10] See Health Information.
- **Consumer exposure to products containing phenol** – Dow does not sell phenol for direct consumer use. The major sources of phenol found in the environment are: automobile exhaust, benzene degradation, human and animal metabolism, and some combustion processes. Cigarette smoke contains phenol. Phenol (from lignin in tree bark) is released into the atmosphere during forest fires. Phenol emissions from environmental sources are higher than industrial emissions. Very small amounts of residual phenol may be present in consumer products such as: floor wax or polishes, paints, disinfectants, cosmetics, and pharmaceuticals.[11] See Health Information.
- **Environmental releases**[12] – In the event of a spill, evacuate the area. Only trained and properly protected personnel must be involved in cleanup operations. Keep personnel out of low areas. Ventilate area. To clean up small spills: absorb with non-combustible material such as sand or dirt. Consult the relevant SDS for more information about protective equipment and procedures. See Environmental, Health and Physical Hazard Information.
- **Large release**[13] – Evacuate all personnel to upwind of spill. Only trained and properly protected personnel must be involved in cleanup operations. Phenol vapors are heavier than air and may travel long distances accumulating in low lying areas. Ventilate area and alert the public about downwind hazards if necessary. Eliminate all sources of ignition. Prevent phenol from entering into soil, ditches, waterways and groundwater. Remove spilled material with a shovel. Collect in suitable and properly labeled containers such as steel drums. Contact Dow for cleanup assistance. In case of fire, evacuate personnel upwind of spill. Dense smoke is produced when phenol burns. Wear positive-pressure self-contained breathing apparatus (SCBA) and protective clothing. Use of a direct water stream may spread fire. Water fog applied gently may be used as a blanket for fire extinguishment. Follow emergency procedures carefully. Consult the relevant SDS for more information.

Back to top

Health Information[14]

Accidental skin contact with phenol, even briefly, may cause severe burns. Phenol is absorbed readily through the skin and may be fatal. Phenol causes severe burns to the eye possibly resulting in corneal damage or blindness. It has local anesthetic properties, meaning numbness may occur following initial pain after contact. Skin or eyes should be flushed immediately and continuously with flowing water for at least 30 minutes. Obtain prompt medical attention.

Prolonged inhalation of vapors may cause irritation to the nose, throat, and lungs. Repeated excessive exposure to phenol could result in damage to the central nervous system. The lethal oral dose for humans is approximately 1 gram or ¼ teaspoon.

Phenol is not considered a carcinogen.

For more information about the health hazards of phenol and recommended protective equipment, view the SDS.

Back to top

Environmental Information[15]

Phenol is readily biodegradable. It has a low bioconcentration potential, meaning phenol does not accumulate in tissues of living organisms. Phenol is moderately toxic to aquatic organisms on an acute basis. Care should be taken to prevent spills from entering waterways.

For specific environmental information, review the SDS.

Back to top

Physical Hazard Information[16]

Phenol is a "hazardous" chemical as defined by OSHA. It is corrosive and combustible.

Phenol is stable under recommended storage conditions. To properly store and handle phenol:

- Keep it away from heat, sparks, and flame
- Avoid overheating storage container
- Avoid contact with the following metals: aluminum, magnesium, lead, zinc, iron, and copper
- Avoid contact with oxidizing materials such as calcium hypochlorite

Additional physical property information for phenol is available on the SDS.

Back to top

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of phenol. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant SDS or Contact Us.

Back to top

Additional Information

- Safety Data Sheet
- Contact Us
- *Dow Phenol: Properties, Usage, Storage, and Handling*, Dow Chemical Company, Form No. 115-00649-0300 http://www.dow.com/PublishedLiterature/dh_003a/09002f138003ab4e.pdf
- European Chemicals Bureau, European Union Risk Assessment Report: Phenol, Revised Edition, CAS No: 108-95-2, EINECS No: 203-632-7, Vol. 64, November, 2006

For more business information about phenol, visit Dow's epoxy web site.

Back to top

References

[1] "CEH Marketing Research Report: Phenol," *Chemical Economics Handbook*, SRI Consulting, June 2005, page 7.
[2] European Chemicals Bureau, European Union Risk Assessment Report: Phenol, Revised Edition, CAS No. 108-95-2, Vol.64, pages 11, 57 and 59.

[3] *Dow Phenol: Properties, Usage, Storage and Handling*, The Dow Chemical Company, Form No. 115-00649-0300, page 3.
[4] *Phenol Synthetic Material Safety Data Sheet*, The Dow Chemical Company, Form No. 000296, June 11, 2004, page 1.
[5] *Phenol Synthetic Material Safety Data Sheet*, The Dow Chemical Company, Form No. 000296, June 11, 2004, pages 1, 4 and 11.
[6] "CEH Marketing Research Report: Phenol," *Chemical Economics Handbook*, SRI Consulting, June, 2005, pages 4, 8 and 15.
[7] "CEH Marketing Research Report: Phenol," *Chemical Economics Handbook*, SRI Consulting, June, 2005, page 7.
[8] *Dow Phenol: Properties, Usage, Storage and Handling*, The Dow Chemical Company, Form No. 115-00649-0300, pages 7-8.
[9] "CEH Marketing Research Report: Phenol," *Chemical Economics Handbook*, SRI Consulting, June, 2005, pages 5, 14 and 25.
[10] European Chemicals Bureau, European Union Risk Assessment Report: Phenol, Revised Edition, CAS No. 108-95-2, Vol.64, pages 57, 59 and 69.
[11] European Chemicals Bureau, European Union Risk Assessment Report: Phenol, Revised Edition, CAS No. 108-95-2, Vol.64, pages 11, 33 and 73.
[12] *Phenol Synthetic Material Safety Data Sheet*, The Dow Chemical Company, Form No. 000296, June 11, 2004, page 5.
[13] *Phenol Synthetic Material Safety Data Sheet*, The Dow Chemical Company, Form No. 000296, June 11, 2004, page 5.
[14] *Phenol Synthetic Material Safety Data Sheet*, The Dow Chemical Company, Form No. 000296, June 11, 2004, pages 1, 2 and 7.
[15] *Phenol Synthetic Material Safety Data Sheet*, The Dow Chemical Company, Form No. 000296, June 11, 2004, pages 7 and 8.
[16] *Phenol Synthetic Material Safety Data Sheet*, The Dow Chemical Company, Form No. 000296, June 11, 2004, pages 4 and 5.

Back to top

NOTICE: Although the information and recommendations in this document or at a related Internet Web site (hereinafter "Information") are presented in good faith and believed to be correct, The Dow Chemical Company and its consolidated subsidiaries (“Dow”) make no representations or warranties as to the completeness or accuracy of Information.

Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Dow be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information or the product to which Information refers.

Nothing contained herein is to be construed as a recommendation to use any product, process, equipment or formulation in conflict with any patent, and Dow makes no representation or warranty, express or implied, that the use thereof will not infringe any patent.

NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

Dow makes no commitment to update or correct any information that appears on the Internet or on its World-Wide Web server.

The information contained in this document is supplemental to the Internet Disclaimer <http://www.dow.com/homepage/disclosure.html> and is not intended to be all-inclusive as it relates to use, handling, storage, disposal and all other described activities. Recipients must make their own determination of suitability and are responsible for compliance with all applicable governmental requirements. This information is offered solely for your consideration and verification and in no event will Dow be responsible for damages of any nature whatsoever resulting from the use or reliance upon this information or the product to which this information pertains.

Back to top

Form No. 233-00308-MM-0607