



Product Stewardship Summary

Sodium Hydroxide

Summary

Sodium hydroxide serves a wide range of end use markets. The largest users of sodium hydroxide are the pulp and paper, detergent, and chemical industries.

OxyChem markets sodium hydroxide in solution. The solutions are colorless. The chemical formula of sodium hydroxide is NaOH. Sodium hydroxide is a corrosive liquid, and it must be stored and handled with this hazard in mind.

1. Chemical Identity

Name: Sodium hydroxide

Synonyms: Caustic soda or caustic

Chemical Abstracts Service (CAS) number: 1310-73-2

Chemical Formula: NaOH

Molecular Weight: 40.00

2. Production

OxyChem manufactures sodium hydroxide by the electrolysis of sodium chloride brine in either a membrane or diaphragm electrolytic cell. The co-products are chlorine gas and hydrogen gas. The reaction is:



In the membrane process, a solution approximately 30% in strength is formed. The solution is then sent to evaporators, which concentrate it by removing the water. The resulting sodium hydroxide solution is stored in tanks prior to shipment.

The diaphragm process is very similar to the membrane process except that a solution of only 10 to 12% is formed in the cell. Therefore, additional evaporation is required.

OxyChem has played a leading role in providing sodium hydroxide to meet the increasing demands of industry. OxyChem plants are strategically located to conveniently and economically serve industry. Warehouse stocks of our sodium hydroxide and other products are maintained in many principal cities. Distributor stocks are also available in these and many other cities and form a network of supply for the end user's convenience.

3. Uses

The largest users of sodium hydroxide are the pulp and paper, detergent and chemical industries. Sodium hydroxide is also used in the alumina, oil and gas and textile industries. Some principal products or processes in which sodium hydroxide is used are:

- Acid Neutralization
- Agricultural Chemicals
- Aluminum Industry
- Boiler Compounds
- Cellulose Film
- Chemicals:
 - Ammonia
 - Amyl Amines
 - Cresol
 - Ethylene Amines
 - Formic Acid
 - Glycerine
 - Maleic Anhydride
 - Pentaerythritol
 - Phenol
 - Propylene Oxide
 - Polycarbonates
 - Salicylic Acid
 - Sodium Aluminate
 - Sodium Hydrosulfide
 - Sodium Hypochlorite
 - Sodium Phosphates
 - Styrene
 - Vinyl Chloride Monomer
- Detergents
- Drain Cleaners
- Drilling Muds
- Dyestuffs
- Food Processing
- Fruit & Vegetable Peeling
- Glass-Batch Wetting
- Ion-Exchange Resin Regeneration
- Ore Flotation and Processing
- Paint Removers
- Petroleum Refining
- pH Adjustment
- Pharmaceuticals
- Pigments
- Pulp & Paper
- Rayon
- Soap
- Surfactants
- Textile Bleaching, Dyeing, and Mercerizing
- Vegetable Oil Processing
- Water Treatment

4. Physical and Chemical Properties

Corrosivity

Sodium hydroxide in liquid form has a markedly corrosive action on all body tissue. Even dilute solutions may have a destructive effect on tissue after prolonged contact. Inhalation of concentrated mists can cause damage to the upper respiratory tract, while ingestion of liquid sodium hydroxide can cause severe damage to the mucous membranes or other tissues where contact is made.

Reactivity

Sodium hydroxide is a corrosive chemical which is normally handled in either steel, nickel, nickel alloys or certain types of plastic equipment. The most common construction materials for handling and storing sodium hydroxide solutions are black iron and mild steel. However, liquid sodium hydroxide will attack these metals at elevated temperatures. Aluminum, copper, zinc, lead and their alloys (e.g., brass and bronze) are NOT suitable. Sodium hydroxide readily attacks these materials.

In addition, considerable heat is generated when liquid sodium hydroxide is mixed with water, which can result in boiling or splattering and may cause a violent eruption. When diluting, always add sodium hydroxide to water. Never add water to sodium hydroxide.

5. Health Effects

Sodium hydroxide solutions are alkaline solutions, meaning they have high pH. The pH can be greater than 13. This property means sodium hydroxide is a severe eye, skin, and respiratory tract irritant, and it can burn any tissue with which it comes in contact.

- Eye splashes are especially serious hazards. Contact with the eyes can cause severe irritation, pain, and corneal burns, possibly leading to blindness.
- Direct contact with the skin may cause severe burns if the material is not quickly rinsed away with large amounts of water.
- Inhaling mists of sodium hydroxide may result in irritation of the nose and throat with symptoms such as burning, coughing, choking and pain. Inhaling concentrated mist may result in pulmonary edema and shock.
- Ingesting sodium hydroxide may cause pain and burns of the esophagus and gastrointestinal tract. Ingestion can lead to corrosion of the mucous membranes of the upper part of the digestive tract. Death may result from shock, perforation of the esophagus, aspiration from the esophagus into the trachea (asphyxia), or infection from the corroded tissues.

Sodium hydroxide is not classified as a carcinogen by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or the Occupational Safety and Health Administration (OSHA).

6. Environmental Effects

Sodium hydroxide is moderately toxic to aquatic organisms. It dissociates in water and can elevate the pH of systems that are not well buffered. Since it contains no degradable functional groups, it exerts no biological oxygen demand.

7. Exposure

Sodium hydroxide is corrosive to the skin and eyes. The most likely ways exposures could occur are:

- Worker exposure – Exposure could occur in the manufacturing facility or in industrial facilities that use sodium hydroxide. When exposures occur, they are typically skin or eye exposures. Good industrial hygiene practices and personal protective equipment minimize the risk of exposure.
- Consumer exposure – OxyChem does not sell sodium hydroxide in retail stores, although it may be an ingredient in some consumer products.
- Releases – If a spill occurs, emergency personnel should wear protective equipment to minimize exposures.

8. Recommended Risk Management Measures

Sodium hydroxide is non-flammable, non-explosive, and non-toxic. It is, however, an alkaline material and poses hazards to the skin and eyes. Sodium hydroxide can react with certain materials of construction. Prior to using sodium hydroxide, carefully read and comprehend the Material Safety Data Sheet. The following are some risk management measures that are effective against these hazards:

- Provide eyewash fountains and safety showers in areas where sodium hydroxide is used or handled. Any sodium hydroxide burn may be serious. Flush areas that have come in contact with sodium hydroxide with large amounts of water, and then seek medical attention. DO NOT use any kind of neutralizing solution, particularly in the eyes, without direction by a physician.
- To prevent eye contact, protective eye wear (such as splash goggles, a full face shield, or safety glasses with side shields) must be worn.
- Work areas where sodium hydroxide is used should be well ventilated to maintain concentrations below exposure limits. If exposures exceed accepted limits or if respiratory discomfort is experienced, use a NIOSH approved air purifying respirator with high efficiency dust and mist filters
- Wear chemical resistant clothing to prevent contact with the body. Suitable materials include natural rubber, neoprene and nitrile.
- Wear rubber gloves to protect the hands while handling sodium hydroxide. Gloves should be long enough to come well above the wrist, and sleeves should be positioned securely over the glove wrists.
- Sodium hydroxide causes leather to disintegrate rapidly. For this reason, wear rubber boots. Wear the bottoms of trouser legs outside the boots. DO NOT tuck in.
- Residues that dry on equipment can cause irritation. Keep equipment clean by promptly washing off any accumulation.
- Proper labeling, handling and storage of sodium hydroxide will reduce the likelihood of accidental ingestion.
- Equipment used for sodium hydroxide storage or processing should be constructed of the proper materials. For example, bulk storage containers should be constructed of mild, carbon, or stainless steel. Do not use aluminum as a material of construction. For more detailed information regarding materials of construction, refer to the OxyChem Handbook.
- The packing glands of pumps used in sodium hydroxide service should be shielded to prevent spraying in the event of a leak.
- A safety shield of wrap-around polypropylene is recommended for all flanged joints. This will protect personnel against spraying in case a gasket leaks.
- When making solutions, always add the sodium hydroxide slowly to the surface of the water with constant agitation. Never add the water to the sodium hydroxide. Always start with lukewarm water (80 -100°F). Never start with hot or cold water. Dangerous boiling or splattering can occur if sodium hydroxide is added too rapidly, allowed to concentrate in one area or added to hot or cold liquids. Care must be taken to avoid these situations.
- Personnel involved with sodium hydroxide handling operations should be properly trained. For detailed recommendations regarding personnel involved in unloading sodium hydroxide, refer to the OxyChem Handbook.

9. Product Stewardship Programs

An OxyChem product handbook is available for sodium hydroxide. The handbook includes extensive physical property and technical data regarding the product as well as more detailed information about the manufacturing process and product uses. In addition, specific information for storing, unloading, preparing and using sodium hydroxide safely is provided, including data on materials of construction and equipment recommendations.

10. Regulatory Compliance Information

The following is a summary of regulations and guidelines that may pertain to sodium hydroxide (additional regulations and guidelines may apply):

- Sodium hydroxide is designated as a hazardous substance under Section 311(b) (2) of the Clean Water Act. See 40 CFR 116.4.
- A release of sodium hydroxide in an amount greater than the Reportable Quantity (RQ) is subject to reporting under Comprehensive Environmental Response, Compensation and Liability Act, Section 103. The RQ for Sodium hydroxide is 1000 pounds. See 40 CFR 302.4.
- Possible Resource Conservation and Recovery Act (hazardous waste) Codes: D002
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) - Residues of sodium hydroxide are exempt from the requirement of a tolerance when used as a neutralizer in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest. See 40 CFR 180.910.
- FIFRA - Sodium hydroxide is exempt from the requirement of a tolerance when used as a neutralizer in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to animals. See 40 CFR 180.930.
- Food and Drug Administration (FDA) – Sodium hydroxide used as a general purpose food additive in animal drugs, feeds, and related products is generally recognized as safe when used in accordance with good manufacturing or feeding practice. See 21 CFR 582.1763.
- FDA - Sodium hydroxide added directly to human food is affirmed as generally recognized as safe when used in food at levels not to exceed current good manufacturing practice. See 21 CFR 184.1763.
- FDA – Sodium hydroxide (not to exceed 1%) is a food additive permitted for direct addition to food for human consumption, as long as 1) the quantity of the substance added to food does not exceed the amount reasonably required to accomplish its intended physical, nutritive, or other technical effect in food, and 2) any substance intended for use in or on food is of appropriate food grade and is prepared and handled as a food ingredient. See 21 CFR 172.892.
- Sodium hydroxide, liquid, is regulated by the U.S. Department of Transportation (DOT) and is classified as a corrosive material. The DOT identification number is UN 1824.
- The Occupational Safety and Health Administration has established a Permissible Exposure Limit for sodium hydroxide. The limit is 2 mg/m³ averaged over an 8-hour period.
- The American Conference of Governmental Industrial Hygienists has established a Threshold Limit Value for sodium hydroxide. The guideline is 2 mg/m³ as a ceiling limit.
- The National Institute for Occupational Safety and Health has established an Immediately Dangerous to Life and Health concentration for sodium hydroxide. The concentration is 10 mg/m³.

11. Sources for Additional Information

American Conference of Governmental Industrial Hygienists (ACGIH), Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th ed., 1 (1991), Sodium hydroxide and corresponding entry in "Pocket Guide" 1997-1998.

Canadian Centre for Occupational Health and Safety (CCOHS), Chemical Profile, Health Effects of Sodium Hydroxide, January 1998.

Clayton, G.D. and Clayton, F.E., Patty's Industrial Hygiene and Toxicology, 4th ed., John Wiley & Sons, Inc, pp. 766+, 1994.

Grant, W. Morton (1986). Toxicology of the Eye, Clarence C. Thomas, Pub.

Hazardous Substances Data Bank (HSDB), HSDB Number 229, Last revision date: June 24, 2005.

OxyChem Product Handbook web site:

<http://www.oxy.com/OurBusinesses/Chemicals/Products/Pages/AlkaliProducts.aspx>

OxyChem Material Safety Data Sheet web site: <http://msds.oxy.com/>

Registry of Toxic Effects of Chemical Substances (RTECS), RTECS Number WB4900000, Review Date: February 2008.

12. Contact Information: For additional information, call 1-800-752-5151 or 1-972-404-3700.

13. Preparation Date: 12/12/2008 **Revised:** 02/13/2013

This Product Stewardship Summary is intended to give general information about the product discussed above. It is not intended to provide an in-depth discussion of all health and safety information about the product or to replace any required regulatory communications.

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