Product Safety Assessment

DOW™ Caustic Soda


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Names
- CAS No. 1310-73-2
- Caustic soda
- DOW™ caustic soda
- Sodium hydroxide (NaOH)
- Caustic
- Lye

Product Overview
- Most DOW™ caustic soda (sodium hydroxide) is produced as a 50% solution in water. It is available in industrial, commercial, and low-salt grades. For further details, see Product Description.
- Caustic soda is an essential ingredient in a variety of industrial applications. In addition, consumers use caustic soda when using heavy-duty cleaners, such as oven and drain cleaners. For further details, see Product Uses.
- Good industrial hygiene practices minimize the risk of exposure in the occupational setting. Consumer exposure is dependent upon the conditions under which caustic soda is used. For further details, see Exposure Potential.
- Eye contact with solution or mist may cause burns and severe irritation with corneal injury that can result in permanent vision impairment, even blindness. Even brief skin contact can cause severe burns and tissue damage. Inhalation of mist may cause severe irritation of the upper respiratory tract, while ingestion may result in chemical burns to the mouth, throat, and gastrointestinal tract. For further details, see Health Information.
- Although caustic soda is only slightly to moderately toxic to aquatic organisms, a large discharge can change the pH of the aquatic system, which may be harmful to aquatic organisms. For further details, see Environmental Information.
- Caustic soda is chemically stable, but will absorb carbon dioxide from the air. It reacts with aluminum, magnesium, zinc, tin, chromium, bronze, brass, copper, tantalum, and galvanized (zinc-coated) materials. Flammable hydrogen may be generated from contact with these metals. It can also react with various reducing sugars to form carbon monoxide, a toxic gas. Avoid contact with acids, glycols, halogenated organics, and organic nitro compounds. For further details, see Physical Hazard Information.

References

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Created: April 8, 2013

The Dow Chemical Company
Manufacture of Product

- **Capacity**: The Dow Chemical Company is the largest producer of caustic soda in the world. Dow has production sites in the U.S., Brazil, Canada, and Germany, with total annual caustic production exceeding 6.8 million metric tonnes (15 billion dry pounds).

- **Process**: The chlor-alkali process uses naturally occurring salt (in the form of brine) to produce two major products: caustic soda and elemental chlorine, plus hydrogen. The sodium chloride brine is electrolyzed to produce chlorine at the positive electrode (anode) and sodium hydroxide and hydrogen at the negative electrode (cathode). The electrolysis reaction is shown below.

  \[ 2 \text{NaCl (aq)} + 2 \text{H}_2\text{O} \rightarrow \text{Anode} \quad \text{C}l_2(\text{gas}) \quad \text{Cathode} \quad \text{H}_2(\text{gas}) + 2\text{NaOH (aq)} \]

  Dow uses two electrolytic processes to produce caustic soda and chlorine.
- Diaphragm cell
- Membrane cell

The anode and cathode chambers are separated by a barrier to prevent the sodium hydroxide and hydrogen from reacting with the chlorine. This barrier is either an ion-selective membrane or porous diaphragm. The membrane is selective, meaning that sodium chloride (NaCl) cannot readily pass through the membrane, resulting in lower salt in the final caustic.

**Product Description**

DOW™ caustic soda is an odorless and colorless liquid. It is available in industrial, commercial, and low-salt grades. Although usually produced as a 50% solution in water, some grades are also available in 25% or 30% solutions. Varying amounts of sodium chloride, sodium carbonate, and sodium sulfate are impurities in most grades of caustic soda.

**Product Uses**

DOW™ caustic soda is used in the following industries and applications:
- **Pulp and paper** – used in deinking of waste paper, water treatment, and as a raw material in the pulping and bleaching process.
- **Textiles** – used to process cotton and synthetic fibers, such as nylon and polyester.
- **Soap and detergents** – used to convert fat, tallow, and vegetable oils into soap. Caustic soda is used to manufacture anionic surfactants, a crucial component in most detergents and cleaning products.
- **Bleach** – used to make bleach, which has industrial and consumer applications such as mold and mildew control around the home or control of microbial levels in swimming pools and hot tubs.
- **Petroleum products** – used to explore, produce, and process petroleum and natural gas. Caustic soda removes objectionable smells from these materials that result from the presence of hydrogen sulfide and mercaptans.
- **Aluminum production** – used to dissolve bauxite, the ore for aluminum production.
- **Chemical processing** – used as a basic feedstock for a wide range of downstream products, including solvents, plastics, fabrics, adhesives, coatings, herbicides, dyes, inks, pharmaceuticals, etc.
- **Other** – Small applications for caustic soda include water treatment, cleaners for beverage bottles, cleaning products such as drain and pipe cleaners, oven cleaner, and other household cleaning products, and home soap making.
Exposure Potential

DOW™ caustic soda is used in the production of industrial and consumer products. Based on the uses for this material, the public could be exposed through:

- **Workplace exposure** – Exposure can occur either in a facility that manufactures DOW caustic soda or in the various industrial or manufacturing facilities that use it. It is produced, distributed, stored, and consumed in closed systems. Those working with this product in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Good industrial hygiene practices minimize the risk of exposure. When exposures occur, they are most frequently to the skin and eyes, although oral exposure and ingestion are possible. Each manufacturing facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit exposure. See Health Information.

- **Consumer exposure to products containing DOW caustic soda** – Although Dow does not sell caustic soda through retail stores, caustic soda may be an ingredient in some consumer products. For example, drain cleaners and oven cleaners can contain high concentrations of caustic soda. It is important to read and follow the use instructions on the container to prevent injury. It is also important to keep all chemical products out of the reach of children. See Health Information.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil and surface or ground water. For small spills, caustic soda should be diluted with water and neutralized with acetic acid (vinegar). Caustic soda is considered slightly to moderately toxic to aquatic organisms on an acute basis, but large spills can increase the pH (decrease the acidity) of the aquatic or terrestrial environment and result in environmental damage. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, the material should be captured, collected, and reprocessed or disposed of according to applicable governmental requirements. Positive-pressure, self-contained breathing apparatus (SCBA) with an approved full-face mask is recommended for emergency work. Small, residual amounts can be neutralized with dilute acetic acid (vinegar). Emergency personnel should wear proper protective equipment and follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – Deny any unnecessary entry into the area. Caustic soda does not burn. Use firefighting methods appropriate for surrounding materials. Avoid the use of large amounts of water since rapid dilution with water generates heat, often violently. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. If contact is likely, wear positive-pressure, self-contained breathing apparatus and change to full chemical-resistant firefighting clothing. Fight the fire from a remote location. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, request the Safety Data Sheet from the Dow Customer Information Group.
Environmental Information

Because of its high water solubility, caustic soda tends to stay in water if it is released into soil or water. Caustic soda in surface water absorbs carbon dioxide slowly from the air and is converted to sodium carbonate. Caustic soda has a high potential for mobility in soil. Caustic soda does not bioaccumulate and is considered slightly to moderately toxic to aquatic organisms (EC\textsubscript{50} between 10 and 100 mg/L) on an acute basis. However, a large quantity of caustic soda released may shift the pH of the surrounding soil or water to highly alkaline conditions. Such a change may be harmful to aquatic organisms.

The OECD SIDS Initial Assessment Profile for sodium hydroxide concluded that the chemical is currently of low priority for further work.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Physical Hazard Information

Although caustic soda is chemically stable under typical storage and use conditions, it can absorb carbon dioxide (CO\textsubscript{2}) from the air to form sodium carbonate (Na\textsubscript{2}CO\textsubscript{3}). Caustic soda reacts with metals such as aluminum, magnesium, zinc, tin, chromium, bronze, brass, copper, tantalum, and galvanized (zinc-coated) materials. In some cases flammable hydrogen may be generated from contact with these metals. It can also react with various reducing sugars to form carbon monoxide, a toxic gas. Avoid contact with acids, glycols, halogenated organics, and organic nitro compounds.

When diluting solutions of caustic soda, always wear proper personal protective equipment and always add caustic soda slowly to water with constant agitation to minimize rapid temperature increase and the potential for the solution to boil, splatter, or violently erupt.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of DOW™ caustic soda. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us. Dow has filed a REACH dossier for this material and the public can access relevant information on the European Safety Data Sheet.

Additional Information

- Safety Data Sheet (request from the Dow Customer Information Group at www.dow.com/assistance/dowcig.htm)
- Dow has filed a REACH dossier for this material and the public can access relevant information on the European Safety Data Sheet.
- Contact Us (www.dow.com/causticsoda/contact/)
- DOW™ Caustic Soda web site (www.dow.com/causticsoda/)
- The Chlorine Institute web site (http://www.chlorineinstitute.org/)

For more business information about DOW caustic soda, visit the Dow Caustic Soda web site at www.dow.com/causticsoda/.
References

5 Caustic Soda Solution 50%, Commercial Grade, Material Safety Data Sheet, The Dow Chemical Company, June 28, 2010, Hazards Identification, Toxicological Information.
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NOTICES

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