

Bromine

Bromine is a unique chemical with a wide variety of uses in the manufacture of everyday products. More than 1,600 derivatives of bromine occur naturally in ocean water, plants and animals, including people. Bromine is commonly used by industry as a “building block” chemical, meaning it is reacted with other chemicals in highly controlled environments to create new molecules.

Unless you are a chemist in a lab or work in an industrial setting, it is unlikely that you will ever come into contact with bromine in its elemental form. However, people benefit from the many products that bromine helps to create such as car tires, electronic products, building materials, pharmaceuticals, foodstuffs and more.

Because bromine is a chemical with significant known hazards, specific regulations apply to its transport, sale and use. Due to the hazards of bromine, numerous safeguards are in place to ensure it is supplied only to those with the appropriate knowledge and handling capability. Elemental bromine is not found in consumer products.

Identification

- Bromine
- Diatomic bromine
- Elemental bromine
- Br₂
- CAS no. 7726-95-6
- EINECS no. 231-778-1

LANXESS Solutions US Inc. does not sell bromine under trade names.

Description

Production:

Natural bromide salts are present in ocean water, as brine in natural underground rock formations, and in surface waters throughout the world. Bromine is extracted from these naturally occurring brine deposits primarily at a few manufacturing plant locations in the United States (Arkansas), Israel and Jordan. India, China and the Ukraine also produce small amounts of bromine. Bromine is extracted from brine in specially-constructed manufacturing plants designed for this purpose.

Uses:

As a chemical, bromine has many unique and beneficial properties that cannot be readily duplicated by other elements or chemicals. Because of these unique properties, it is useful as a production intermediate or reactive material to make a wide variety of high performance products. Examples of the numerous products that bromine and its derivatives (other chemicals or materials made from bromine) are used to make include agricultural chemicals, dyes and inks, flame retardants, food additives, oil field fluids, pharmaceuticals, specialty rubber, and water treatment chemicals.

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| Properties: | Boiling Point: | 58.8 °C |
| | Freezing Point: | -7.2 °C |
| | Water Solubility: | 3.38 g/100 ml at 20 °C |

Potential Human Health Effects

Health Effects:

Bromine is a highly-reactive material, which is one of the reasons it is used in such a wide variety of applications. However, bromine's reactivity can also make it hazardous to humans, animals and the environment. Bromine has recognizable odor warning properties, allowing people to readily notice a "swimming pool"-type smell if bromine is in the air, even at very low concentrations. Liquid bromine is very corrosive to human tissues and can cause severe chemical burns. The mucous membranes of the eyes, nose,

Product Safety Assessment: Bromine

mouth and respiratory tract are especially irritated by bromine vapors. In sufficient concentrations and with time, bromine vapors will chemically “burn” the respiratory tract and lungs. Consequently, exposure to bromine, whether through direct contact or through exposure to vapors, can cause significant injury or even death.

Industrial Use:

Bromine is used to manufacture a diverse range of products, and LANXESS Solutions US Inc. only sells it for use in highly controlled settings by people trained in dealing with the hazards of chemicals. Bromine used in a manufacturing setting should be handled using best practice techniques developed to minimize any potential risk of exposure. Industry typically seeks to use engineered systems to minimize the potential for exposure to chemicals with high hazard levels. Employees working with bromine are expected to be trained and are required to wear personal protective equipment/clothing for additional protection.

Laboratory Use:

Because it is a building block chemical and its chemical characteristics are well understood, bromine is regularly used in research laboratories in small quantities to develop new molecules. Similar to industry, scientists use engineered systems, chemical training, and specialized protective clothing when working with bromine.

Consumer Use:

Consumers are not expected to be exposed to bromine, because it is not sold directly to them. Because of the hazards of bromine, special sturdy containers are used for transport. Additional precautions are taken throughout transport to ensure the vessel movements are well controlled and the risk to the public is minimized.

Environmental Release:

Typically, bromine is handled or transferred using engineered systems that minimize the potential for emissions to the environment. Due to its recognizable odor and visible vapor, releases during transfer are readily observable and can be quickly corrected. Regulations typically mandate that bromine quantities released to the environment in excess to predefined threshold levels must be reported to the appropriate government agencies.

Physical Hazards

Bromine is the only non-metallic element that is liquid at ordinary temperatures and pressures. In its elemental form, it has a dark, amber-red color and an intensely irritating odor. The name is derived from the Greek *bromos*, meaning “stench”, which gives a good indicator of the noxious fumes it emits. Bromine does not burn, but it could initiate fires if it comes into contact with paper or other materials that ignite easily. Bromine can be very corrosive to many materials and very reactive towards some common metals, such as aluminum.

Though the vapor pressure does fluctuate during typical daytime temperature cycles, the pressure in bromine transport containers is typically very low. As a comparison, the pressure found in a bromine transport container is roughly 5-10 times lower than that found in a typical can of soda. Bromine will boil at a temperature significantly lower than the temperature at which water will boil, and on hot days bromine will fume more so than on cold days. Bromine is more than three times heavier than water, making it a deceptively heavy liquid. Similar to water, bromine can freeze when it gets too cold; freezing point is -7.25°C . Bromine vapors are heavy, and the reddish brown vapors that are released into the air will have a tendency to stay near the ground, especially on a calm day.

Potential Environmental Impact

In the unlikely event that significant amounts of liquid bromine are released into the environment, it will immediately generate its characteristic reddish-brown vapors and soak into permeable sources such as soil or gravel. Until it is sufficiently diluted or removed, bromine is very toxic to aquatic organisms and would also be expected to kill surrounding vegetation and be a hazard to animals or people in the vicinity. In the event of a release, only specially-trained emergency responders should clean up the spill, remediate the soil, and ensure the natural environment is returned to its original state.

Product Stewardship

Manufacturing locations:

LANXESS Solutions US Inc. provides safe handling guidance to all bromine customers. Highly engineered systems are used to manage the hazards of bromine. Engineered controls include capabilities to prevent unintentional releases and safety equipment to protect employees. In addition to engineering controls, protective clothing is made available to all employees that handle bromine. In an industrial setting, site

Product Safety Assessment: Bromine

leadership will typically perform a risk analysis to determine the appropriate levels of personal protective equipment for a given job.

Environment:

When bromine is used as a chemical intermediate, it is destroyed during use. Systems that use bromine control the potential for emissions using adsorption systems, chemical scrubbers, recycle systems or other capture systems. If bromine is released into the environment, the area should be evacuated and hazardous materials professionals must be called to address the situation and clean up the spill.

Consumers:

Consumers are not expected to be exposed to bromine because it is not sold directly to them.

LANXESS Solutions US Inc. conducts an ongoing analysis of its products to evaluate potential risk areas throughout the product's life cycle. Chemical risks are identified at the very early stage of new products. They are evaluated by stage-gated reviews using environmental, health and safety (EHS) criteria. The analysis of existing products will evaluate raw materials, manufacturing, transportation, customer end-use and disposal. Additionally, before changes in existing product formulations are made, a detailed evaluation is made of the proposed change. A critical component of all of these processes is the Safety Data Sheet, which lists detailed product hazard information.

Potential product risks are reviewed according to current controls. In the context of a continually improving risk-reduction program, periodic reviews of current controls occur in order to identify opportunities for improvements or enhancements. This includes adaption of existing procedures to changes in regulations (e.g., covering workplace and transportation).

Conclusion

Bromine is a unique substance with a wide variety of uses in manufacturing. Though it is a hazardous material, it is only handled by highly-trained people in manufacturing environments utilizing highly engineered systems, safety controls and personal protective equipment. There are relatively few locations around the world where bromine is made or used, but many important and useful products are manufactured using bromine-based chemistry.

Contact Information

LANXESS Solutions US Inc.

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Notices

Use and Application Information

The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.