



Polyhexamethylene Biguanide (PHMB)

Product Stewardship Summary

April 2008

Chemical Name:	Polyhexamethylene biguanide
Synonyms:	Poly(hexamethylene) biguanide hydrochloride; polymeric biguanide hydrochloride; polyhexanide; biguanide
CAS Number:	27083-27-8 32289-58-0
IUPAC Name:	Poly(iminoimidocarbonyl)iminohexamethylene hydrochloride
EC (EINECS) Number:	Not listed on the EINECS inventory because PHMB is a polymer. Polymers are exempt from listing if the monomers are listed.

- *General Description.* Polyhexamethylene biguanide (PHMB) concentrate is sold as a white to pale yellow solid or as an aqueous solution and used as a preservative or disinfectant. PHMB is an effective public health biocide registered for numerous applications by the U.S. EPA under the Federal Insecticide, Fungicide, and Rodenticide Act, and supported under the Biocidal Products Directive in Europe.
- *Manufacture.* During the manufacture and formulation of PHMB, potential exposure to the concentrate by humans and the environment is tightly controlled and confined through strong industrial hygiene protocols and processes, engineering of the manufacturing equipment, and the use of personal protective equipment.

- *Applications.* PHMB is used as a sanitizer or preservative to kill bacteria and viruses and to control algae in a wide range of applications globally.

As a sanitizer, PHMB is used to preserve wet wipes; to control odor in textiles; to prevent microbial contamination in wound irrigation and sterile dressings; to disinfect medical/dental utensil and trays, farm equipment, animal drinking water, and hard surfaces for food handling institutions and hospitals; and to deodorize vacuums and toilets. PHMB is used in antimicrobial hand washes and rubs and air filter treatments as an alternative to ozone. PHMB is also used as an active ingredient for recreational water treatment, as a chlorine-free polymeric sanitizer, which is effective against a wide variety of microorganisms.

As a preservative, PHMB is used in cosmetics, personal care products, fabric softeners, contact lens solutions, hand washes, and more.

- *Benefits.* PHMB is an effective sanitizer in recreational water, such as swimming pools and hot tubs, and is sold through retail stores to pool and spa owners for this use. It is not affected by sunlight, water temperature, or pH fluctuations. This stability allows a pool to be properly maintained for longer periods, generally 7-14 days before additional PHMB is required. The water in a PHMB pool or hot tub has a softer, more comfortable feel. Because it forms insoluble complexes with pool and hot tub contaminants, it works in conjunction with the filter to physically remove impurities from the water as it sanitizes.

PHMB is a fast acting, broad spectrum biocide effective at low concentrations against Gram positive and Gram negative bacteria, and is a broad spectrum virucide. It retains activity in hard water and does not cause surface streaks or tackiness. PHMB is stable over a wide pH range (1-11), has low foaming properties, contains zero VOCs, and is formaldehyde free.

- *General Precautions.* PHMB concentrate is harmful if swallowed. PHMB is not expected to be toxic from inhalation, not expected to be absorbed through the skin, and may cause mild irreversible irritation. However, inhalation of the concentrated form may produce irritation to the respiratory tract. PHMB is a mild skin irritant. Based on test results in humans, the threshold concentration for skin irritation from PHMB is considered to be 1%. In certain tests, PHMB concentrate was found to produce severe irritation to the eye. Laboratory studies determined PHMB concentrate to have moderate potential to produce skin sensitization; however, skin sensitization tests with human volunteers were inconclusive. Based on the human test results and the long history of use of PHMB without report of skin sensitization, it is very unlikely that exposure to end-use concentrations will cause this effect.

PHMB has been tested in a series of in vitro and in vivo mutagenicity assays and found not to be mutagenic.

The primary effects from repeated oral exposure to the concentrate are a decrease in bodyweight gain and damage to the kidneys.

Evaluation of the results of laboratory carcinogenicity studies both internally by Arch and by outside independent scientists indicate that the potential of PHMB to produce cancer in humans is not significant. The Reregistration Eligibility Decision (RED) document issued by the U.S. EPA classified the carcinogenicity potential for PHMB as: “Suggestive Evidence of Carcinogenicity, but not sufficient to Assess Human Carcinogenic Potential by the oral and dermal routes. Quantification of human cancer risk is not required.”

PHMB does not impair reproductive performance, fertility, or fetal development.

PHMB as a concentrate is highly toxic to fish, aquatic invertebrates and aquatic plants; however, in diluted form and in its end-use environment, it does not pose a significant risk.

Upon absorption, PHMB is excreted rapidly from the body with

no potential for bioaccumulation.

- *Likelihood of Exposure.* Although most transfers of PHMB concentrate are contained in enclosed spaces, exposure to the chemical concentrate could occur at a manufacturing facility, treating plant and site of an accidental release during shipment. End users of PHMB pool products are unlikely to be exposed when transferring the product from its container to the pool through a floater, feeder or skimmer. Exposure for consumers to preservative, disinfection, and sanitizing formulations is in highly diluted form; thus, there is no significant risk to health from exposure to PHMB at end-use concentrations. Such antimicrobial formulations can be highly beneficial as a biocide against harmful microbes.
- *Risk Management.* Consumers using concentrated PHMB pool products are advised to wear goggles or a face shield, gloves, long pants, and a long sleeve shirt to minimize exposure. Once dissolved in pool water and diluted, PHMB will cause no harm to the bathers in the water, and actually protects bathers from harmful waterborne pathogens.

When using or handling either the concentrate or formulations containing PHMB, it is important to read and follow all label directions carefully.

For additional information, please visit our web site at www.archchemicals.com and click on “Contact Us”.

This summary is intended to give general information about the chemical or categories of chemicals addressed. It is not intended to be, and should not be relied upon as, a substitute for the detailed health and safety information contained in the Material Safety Data Sheet (or any other required hazard communication material) for this product, which should be consulted before use of the chemical or treatment for exposure. As with any product, it is very important to read and carefully follow all label directions and warnings. This summary does not amend, modify, or replace required regulatory and/or legal communication documents.