

PRODUCT SAFETY SUMMARY:

SEMI-SOLID BISPHENOL-A-BASED EPOXY RESIN

This Product Safety Summary is intended to provide a general description of certain Huntsman chemical substances and products containing the chemical substance(s). The information in this Summary is not intended to replace the information included on the Safety Data Sheet (SDS), Product Safety Label, and other safe use and handling literature for the chemical substance(s).

Chemical Identity

This Product Safety Summary covers the chemical substance below:

Name	Other Identifiers
Semi-Solid Bisphenol-A-Based Epoxy Resin (CAS# 25068-38-6 and CAS# 25036-25-3)*	Bisphenol-A diglycidylether (BADGE) 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bisoxirane Oxirane, 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bis; CAS: 1675-54-3
<p>* Two different CAS numbers cover the entire semi-solid to solid domains. The epoxy resin CAS numbers are process related and not defined on molecular weight.</p>	

General Product Overview

In Huntsman, semi-solid bisphenol-A-based epoxy resins are manufactured and marketed as a raw material to produce, formulations and chemicals. Semi-solid bisphenol-A-based epoxy resins are marketed by Huntsman for downstream use to industrial, professional, and competent chemical producers.

Semi-solid bisphenol-A-based epoxy resins are a reaction product of lower molecular weight-based Bisphenol-A epoxy resins (see also the Product Safety Summary on bisphenol-A-based liquid epoxy resins, or BLR) and Bisphenol-A.

Due to the nature of the process using excess bisphenol-A based liquid epoxy resins, typically BADGE, bisphenol-A is almost fully consumed and only traces are detectable. However, BLR monomer remains unreacted and is detectable at $\leq 15\text{wt}\%$.

Applications and Uses

Semi-solid bisphenol-A-based epoxy resins are mostly used as part of two-component systems to create epoxy coatings and as modifiers for other applications.

Potential routes of human exposure to semi-solid bisphenol-A-based epoxy resins is through dermal contact and, to a minor extent, through inhalation in spray application. Ingestion is not an anticipated route of exposure. Worker exposure can occur in industrial facilities where the substance is produced or formulated into end-use products or used as an industrial intermediate. Within this assessment both industrial workers and trained professionals are evaluated. In general, all of the worker situations are controlled to avoid any direct contact with the semi-solid bisphenol-A-based epoxy resins, either through process engineering controls, procedural controls and/or through the use of personal protective equipment (PPE).

When cured, the semi-solid bisphenol-A-based epoxy resin is expected to react to a large degree in all applications. Due to the very low concentrations of free (unreacted) bisphenol-A-based epoxy resins in end-use applications, development of exposure scenarios covering downstream uses (service life, waste treatment) are not required and have not been conducted. The cure time for these products varies and depends on a hardener component used in the formulation.

Physical and Chemical Properties

Semi-solid bisphenol-A-based epoxy resins, once warmed above ambient temperature, become sticky viscous liquids and difficult to handle.

Certain physical properties for a representative semi-solid bisphenol-A-based epoxy resin are summarized below.

Reference: Araldite GT 6071

Boiling point	>320°C (decomposition temperature stated)
Softening point (Mettler, DIN 51920)	70 - 75°C
Density	1.18 g/cm ³ @ 20°C
Partition coefficient (LogKow)	3.242 @ 25°C

Additional physical and chemical property information is available on the product Safety Data Sheet (SDS), which can be requested at SDS@huntsman.com.

Human Health Information

The probability of experiencing health effects associated with exposure to semi-solid bisphenol-A-based epoxy resins is considered negligible providing the recommendations stated in the material safety data sheet are implemented and followed. Adverse health effects will be driven by the concentration of residual monomeric bisphenol-A-based liquid epoxy, subject to dose level, route, and duration of exposure. Semi-solid bisphenol-A-based epoxy resins are classified as a category 1 skin sensitizer under the Globally Harmonized System (GHS) for Hazard Communication, so if exposure occurs an individual's susceptibility should also be considered.

The potential health effects from exposure to semi-solid bisphenol-A-based epoxy resins are discussed below. Different regulatory classification criteria apply in different geographic regions. These different criteria may result in different human health regulatory classifications for the same product in different geographic regions. Specific regulatory classification information is contained in the Safety Data Sheet for each product in use in specific geographic regions. The acute and chronic health effects information set forth below is based on Safety Data Sheets in use in the United States.

Acute Health Effects

Acute exposure of humans to semi-solid bisphenol-A-based epoxy resins by inhalation is highly unlikely due to the physical state and dilution effect by incorporation of additives and curing agents. Acute animal tests in rats, mice, rabbits, and guinea pigs have demonstrated semi-solid bisphenol-A-based epoxy resins to have low acute toxicity by ingestion and from dermal exposure. Animal studies and exposure-related observations in humans have identified skin-sensitizing properties of semi-solid bisphenol-A-based epoxy resins resulting in symptoms of erythema, dermatitis, and eczematous reactions developing on exposed skin.

Skin contact may cause no to moderate local irritation and may produce an allergic skin reaction in sensitive individuals. Ingestion of semi-solid bisphenol-A-based epoxy resins may cause digestive tract burns.

Eye contact may cause no to moderate eye irritation with symptoms of redness and conjunctivitis.

Chronic Health Effects

Currently there is no toxicological data available for semi-solid bisphenol-A-based epoxy resins. However, it is anticipated that any adverse health effects following an accidental exposure event will be driven by the residual concentrations of bisphenol-A-based liquid epoxy. The current data set available for bisphenol-A-based liquid epoxy is considered conservative and protective of exposure to semi-solid bisphenol-A-based epoxy resins .

Repeated or prolonged exposure studies to monomeric bisphenol-A-based liquid epoxy resins by oral ingestion at >50 mg/kg body weight per day (bw/d) has shown a slight decrease in body weight and food consumption in rats. Inflammation and chronic dermatitis have been observed in rats during prolonged exposure.

In reproductive/developmental toxicity studies, toxicity on fertility, teratogenic, or fetotoxic effects were not observed in the rats exposed orally to bisphenol-A-based liquid epoxy.

Extensive in-vitro and in-vivo animal studies have been conducted, and the weight of evidence indicates that BADGE appears to be genotoxic in some in-vitro test systems. Following the conduct of in-vivo tests (transgenic rodent assay), bisphenol-A-based liquid epoxy resins did not show evidence for mutagenicity or genotoxicity.

More information can be obtained in the specific product Safety Data Sheet.

Environmental Information

In Huntsman, semi-solid bisphenol-A-based epoxy resins are industrial raw materials. During normal operating conditions, semi-solid bisphenol-A-based epoxy resins are not expected to be released to the air, soil, or water. Procedural and/or control technologies are used to minimize emissions and potential exposure during cleaning and maintenance activities. Prior to use, semi-solid bisphenol-A-based epoxy resins are mixed in semi-closed systems with other chemicals and/or monomers (additives/colorants and hardeners) which inherently mitigates any hazardous properties via dilution.

Environmental Fate

Semi-solid bisphenol-A-based epoxy resins are susceptible to indirect photolysis, which results in yellowing of cured products. Semi-solid bisphenol-A-based epoxy resins are insoluble due to the physical state. Semi-solid bisphenol-A-based epoxy resins are not expected to be bio-accumulative.

Environmental Toxicity Testing

As stated above, currently there is no environmental toxicological data available for semi-solid bisphenol-A-based epoxy resins. However, it is anticipated that any adverse effects following an accidental exposure event will be driven by the residual concentrations of bisphenol-A-based liquid epoxy. Therefore, the current data set available for bisphenol-A-based liquid epoxy resins is considered conservative and protective of exposure to semi-solid bisphenol-A-based epoxy resins.

Environmental toxicity test data from several aquatic species show that bisphenol-A-based liquid epoxy resins do present toxicity at concentrations below the limit of water solubility (<10 mg/L). The lowest aquatic toxicity value for bisphenol-A-based liquid epoxy resins was determined in an Organisation for Economic Co-operation and Development (OECD) 21-day Daphnia magna reproduction test (NOEC: 0.3 mg/L). As a result, semi-solid bisphenol-A-based epoxy resins are also classified as Aquatic Acute and Chronic Category 2 in the Globally Harmonized System (GHS) for Hazard Communication. More information can be obtained in the product Safety Data Sheet.

Potential Occupational Exposure

In Huntsman, semi-solid bisphenol-A-based epoxy resins are manufactured in closed systems. During normal operating conditions, occupational exposure to semi-solid bisphenol-A-based epoxy resins is not expected in the manufacturing process. Procedural and/or control

technologies are used to minimize exposure during sampling, cleaning, maintenance, or in more open handling systems. In those cases, appropriate engineering controls (i.e., ventilation) and personal protective equipment should be used in accordance with to the exposure guidelines and workplace practices identified in the Safety Data Sheet.

Potential Consumer Exposure

Semi-solid bisphenol-A-based epoxy resins are not used in do-it-yourself (DIY) applications.

Safe Use Recommendations/Workplace Exposure Controls

Huntsman follows and recommends that customers follow workplace exposure guidelines through a variety of industrial hygiene and ventilation measures. Workplace exposure guidelines include workplace limit values.

The following values are referenced by the National Institute for Occupational Safety and Health (NIOSH) for diglycidyl ether¹, which may be considered protective of workplace exposure to semi-solid bisphenol-A-based epoxy resins.

Diglycidyl ether

- Occupational Safety and Health Administration (OSHA): 2.8 mg/m³ (TWA)
- NIOSH: 1 mg/m³ (ceiling 15 min)

Because of the possibility of sensitization, employees who are assigned to an epoxy resin work area should undergo a pre-placement medical evaluation and be part of a comprehensive medical surveillance program. Once a worker has been diagnosed as sensitized to any epoxy resins, no further epoxy resin exposure should be permitted.

See the Safety Data Sheets for semi-solid bisphenol-A-based epoxy resins and specific epoxy-based products for additional information about first aid measures, accidental releases (spills and leaks), waste disposal, toxicity, transportation, regulatory requirements and other important topics.

¹ <https://www.cdc.gov/niosh/docs/79-104/default.html>

Regulatory Information/Classification and Labeling

Under the Globally Harmonized System (GHS) for Hazard Communication, substances are classified according to their physical, health, and environmental hazards. The hazards are communicated via specific labels and the Safety Data Sheets. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemicals in use.

The hazard statements and symbols presented here refer to the hazard properties of the concentrated substance and are meant to provide a brief overview of the substance's labeling. It is not intended to be comprehensive or to replace information found in the Safety Data Sheet.

Labeling according to OSHA 1910.1200 (GHS)



Signal Word
Warning

GHS Classification	
Skin irritation	Category 2
Eye irritation	Category 2A
Skin sensitization	Category 1
Aquatic acute	Category 2
Aquatic chronic	Category 2
Hazard Statements	
H315	Causes skin irritation
H319	Causes serious eye irritation
H317	May cause an allergic skin reaction
H411	Toxic to aquatic life with long-lasting effects



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Additional Information

Information on registered substances is available on the European Chemicals Agency (ECHA) website at <https://echa.europa.eu>.

References

Pearce, D., (2013) Bisphenol A Diglycidyl Ether of Bisphenol A, Methods Development Team Industrial Hygiene Chemistry Division, OSHA Salt Lake Technical Center, Sandy UT 84070-6406.

Glycidyl ethers, IARC Monographs Vol. 47, pp 238 - 261.

Disclaimer

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