

Hexabromocyclododecane

Hexabromocyclododecane, commonly referred to as HBCD, is added to polystyrene foam products to make them less flammable. It also has secondary uses in textile and polymer applications. HBCD is used, because it can either deter flame ignition of the polymer matrix in which it is embedded, or, if ignition does occur, it can slow the spread of fire and allow for more escape and response time. HBCD is typically added in combination with a number of other chemicals that are used in the manufacture of plastic, latex or polystyrene products. HBCD is handled in industrial facilities designed for the manufacture of EPS (Expanded Polystyrene), XPS (Extruded Polystyrene), plastics, textiles and other materials or products that benefit from reduced flammability characteristics.

Identification

Hexabromocyclododecane marketed by LANXESS Solutions US Inc. can be referred to by a number of different names, including:

- Hexabromocyclododecane
- HBCD
- CD-75P™
- SP-75™
- CAS number 25637-99-4
- HBCDD

Commercial HBCD mixtures are manufactured by the bromination of cyclododeca-1,5,9-triene. A large portion of the mixture is made up of 1,2,5,6,9,10-Hexabromocyclododecane (IUPAC – CAS number 3194-55-6), which exists as a mixture of “diastereoisomers,” molecules which all share the same basic structure but whose atoms “point” in different directions.

Description

Production:

HBCD is produced in dedicated manufacturing units. The resulting reaction product is refined to meet end application specifications before being packaged in bulk, semi-bulk and smaller packages for use in customer polymer systems.

Uses:

HBCD is primarily used to reduce the flammability of EPS and XPS rigid foam used as insulation in commercial buildings and homes. Until recently, HBCD was the only chemical that was useful for this purpose, because it alone could be added to the foam in low enough concentrations to maintain required structural performance while at the same time meeting minimum standards for flammability performance. HBCD has also seen limited use in the manufacture of textile back-coatings and as a flame retardant for High Impact Polystyrene (HIPS). In all cases, the base polymers where HBCD is used are based upon organic materials or are derived from petroleum. Consequently, they can be highly flammable, if left untreated. After the addition of HBCD, the base materials are less likely to ignite. If ignition does occur, the fire will spread more slowly than if the materials were left untreated.

Properties:

Appearance: white to off-white powder or granules

Melting Range: 180-197 °C

Water Solubility: <0.1 g/100 g

Potential Human Health Effects

Health Effects:

Toxicity studies in animals indicate that the primary health concerns associated with HBCD are long-term (chronic) effects on the developing fetus and the young. This means that it possesses a significant level of toxicity that must be understood and safeguarded against through the use of engineering controls, personal protective equipment and through appropriate procedures. The safety data sheets are the best resource to consult for understanding the specific health hazard risks associated with HBCD.

HBCD is not supplied for use by the general public and is safe to use in industrial settings equipped with suitable engineering controls, when appropriate personal protective equipment is worn during use and when

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proper hygiene measures are applied after use. Employing these practices means significant exposure to HBCD is unlikely to occur under normal work conditions. In the unlikely event that high level exposure did occur, it is notable that HBCD is not considered acutely hazardous and workers subjected to high levels of HBCD for short durations are unlikely to experience any serious or significant health effects.

Because HBCD is sold as either a powder or a granulated solid, the most likely exposure scenario is due to dust that could form while the bags are being discharged or the material is otherwise handled in an industrial setting. If poor there is ventilation or personal protective equipment is not worn, dust that is inhaled could irritate the respiratory system in a manner similar to sawdust generated when cutting wood.

In all applications, HBCD becomes part of the polymer matrix making direct exposure unlikely. In XPS and EPS applications, human exposure is even less likely as insulation foam is typically enclosed by additional finishing products like dry wall/plasterboard, siding, plaster and paint.

Industrial Use:

HBCD is primarily used in polystyrene insulation products for construction applications. HBCD is handled in well-controlled manufacturing facilities by people trained in the handling of chemicals. HBCD used in a manufacturing setting is processed using best practice techniques developed to minimize any potential risk of exposure to the solids or associated dust. Manufacturing sites utilize engineered systems and administrative controls to minimize the potential for exposure to all the chemicals used in the process. Unplanned releases or spills of HBCD are unlikely to represent a life-threatening situation due to its chemical characteristics. In any spill or release incident, all non-essential personnel are immediately evacuated upwind of the spilled material. All personnel involved with cleaning a spill are trained and properly equipped with the required personal protective equipment.

Consumer Use:

It is very unlikely that consumers would be exposed to HBCD in its concentrated form, because it is only sold for industrial use to make polystyrene foam, textile and polymer products and is not sold directly to consumers. Because of its low solubility in water, HBCD cannot readily leach out of products in a manner that represents a significant risk to consumers.

Environmental Release:

When used in an industrial setting, HBCD is typically handled using engineered systems designed to control releases from the facility.

HBCD that is released will collect on hard surfaces and could embed into more porous surfaces. Contained portions of these products should be collected. Soils contaminated by spills should be collected and disposed in an appropriate manner.

Physical Hazards

HBCD is sold as either a powder or granulated solid. HBCD that forms dust in air during handling is combustible. It possesses a characteristic odor and is essentially insoluble in water.

Potential Environmental Impact

Environmental Fate Information:

HBCD has been determined to be a persistent, bioaccumulative and toxic chemical (a 'PBT' chemical) and consequently has been listed as a Substance of Very High Concern (SVHC) by the European Union and a Persistent Organic Pollutant (POP) by the United Nations Environment Programme (UNEP) Stockholm convention. Unintentionally released HBCD is persistent in the environment. Consequently, it is necessary to limit environmental releases while manufacturing and processing HBCD.

HBCD that has been incorporated into a polymer matrix is not readily released into the environment.

Aquatic and/or Terrestrial Toxicity:

Significant release of HBCD into the environment could be harmful to fish and aquatic animals. It also has the potential to bioaccumulate. Releases of HBCD to the aquatic or terrestrial environment should be avoided. Spills onto soils and surfaces need to be removed and quickly disposed of properly to avoid dispersion into the environment.

Product Stewardship

Manufacturing locations:

Facility management procedures, Safety Data Sheets (SDS), technical guidance documents, and training are used to communicate safe handling, risk mitigation measures and emergency response requirements to employees at HBCD processing locations.

In locations where powdered or granular HBCD is handled, local exhaust ventilation is recommended and employees should wear high efficiency respirators. HBCD solid wastes must be collected and disposed of in accordance with relevant regulations. Waste water should be collected and treated on-site or by municipal treatment facilities prior to discharge into the environment.

Environment:

Managing emissions during manufacture and processing of polymer additives is the focus of the Voluntary Emissions Control Action Program (VECAP), a product stewardship initiative introduced and managed by major manufacturers of treatments to reduce the flammability of plastic products. VECAP is used by our industry to partner with the supply chain to understand, control and reduce releases into the environment through application of best practices.

LANXESS Solutions US Inc. further recommends that solid waste and packaging waste be either incinerated with an adequate gas cleaning system or sent to a controlled landfill.

Consumers:

Consumers do not handle HBCD supplied by LANXESS Solutions US Inc., because it is an industrial product not sold directly to consumers.

LANXESS Solutions US Inc. conducts ongoing analyses 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 (SDS), which lists detailed product hazard information.

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Potential product risks are managed using internal and external controls. In the context of a continually improving risk-reduction program, periodic reviews of the current controls are conducted 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

HBCD is a material with a rare ability to reduce the flammability of polystyrene, plastics and other materials in a manner that maintains the desired performance characteristics of the final product. Though there are potential hazards associated with HBCD, it is only handled by highly trained people in manufacturing environments utilizing specialty equipment, safety controls, and personal protective equipment.

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.