PHT4™ and PHT4-Diol™

Tetrabromophthalic anhydride and tetrabromophthalate diol are marketed by LANXESS Solutions US Inc. under the trade names PHT4™ and PHT4-Diol™. They are reactive flame retardants that are used to reduce the ignition and flammability characteristics of unsaturated polyester resins (PHT4) and polyurethanes (PHT4-Diol). Polyester resins and polyurethanes are derived from petroleum products and are typically highly flammable, if no flame retardants are used during manufacturing. PHT4 and PHT4-Diol are used in the manufacture of polyester and polyurethane products because they can decrease the possibility of the ignition of the base plastic, and, if ignition does occur, can slow the spread of fire and allow more escape and response time. PHT4 and PHT4-Diol will chemically bond with other chemicals used to make polyester or polyurethane to form new unique materials. PHT4 and PHT4-Diol are handled in industrial facilities designed for the manufacture of polyester or polyurethane products that can benefit from reduced flammability characteristics.

Identification

The PHT4 and PHT4-Diol that are addressed through this product safety assessment are:

- PHT4
- Tetrabromophthalic anhydride
- TBPA
- CAS No. 632-79-1

- PHT4-Diol / PHT4-Diol LV
- Tetrabromophthalate diol
- TBPD
- CAS No. 77098-07-8

The LANXESS products marketed under the trade names PHT4-Diol and PHT4-Diol LV are both represented by this Product Safety Assessment and are collectively addressed as “PHT4-Diol.”

PHT4 and PHT4-Diol are referred to as reactive flame retardants because when added to a chemical mixture, and when certain conditions are met, they chemically bond with the other chemicals present to form completely new chemicals of very high molecular weight and with unique new properties that differ greatly from the starting chemicals.

Description

Production:

PHT4 and PHT4-Diol are produced in dedicated manufacturing units. During production, the raw materials are combined in production units designed for the manufacture of chemicals. The resulting reaction products are further refined to meet their respective specifications and then packaged in bulk, semi-bulk and smaller packages for distribution to customers that use it to provide flame retardant properties to their products through a transformation reaction.

Uses:

PHT4 is used as a raw material in the manufacture of PHT4-Diol. PHT4 is also used to produce unsaturated polyester resins to reduce flammability. Similarly, PHT4-Diol is used primarily to produce rigid polyurethane foam with a reduced potential to ignite. The polymers where flame retardants are used are constructed using petroleum products or organic materials and consequently can be highly flammable, if left unmodified. After the polyester or polyurethane are modified through the addition of PHT4 or PHT4 Diol to the product mix, the base materials are much less likely to ignite. If ignition does occur, the fire will spread more slowly than if the base polymer was left unmodified.

Properties:

PHT4	Appearance:	Light Tan Powder
	Melting Range: 274-277 °C	
	Water Solubility:	<0.1 g/100 g
PHT4-Diol	Appearance:	Light brown viscous liquid
	Melting Point: -86 °C	
	Water Solubility:	<0.5 g/100 g

Potential Human Health Effects

Health Effects:

PHT4 and PHT4-Diol are safe to use in industrial settings equipped with suitable engineering controls when appropriate personal protective equipment is worn and when proper hygiene measures are followed after use. Consumers would not come into contact with these substances in end-use products as the substances are transformed in the manufacturing process and do not exist in the end-use products.

High level exposure to PHT4 and PHT4-Diol is unlikely to occur under normal working conditions. In the unlikely event that high level exposure does occur, it is notable that PHT4 and PHT4-Diol are not acutely hazardous. Workers subjected to high levels of these chemicals are not likely to be harmed.

The product form of PHT4 is a crystalline powder. Consequently, the most likely exposure scenario for PHT4 is due to dust that could form while the bags are being emptied in an industrial setting. Dust that is inhaled could irritate the respiratory system, if poor ventilation is employed or protective equipment is not worn. PHT4 contains small levels of sulphuric acid, which is a corrosive and carcinogenic chemical. Skin contact should be avoided.

The product form of PHT4-Diol is a liquid with a low vapor pressure; consequently, the most likely exposure scenario is due to skin contact. Skin contact is readily prevented through the use of proper personal protective equipment (PPE) and through proper chemical handling and hygiene.

Just as with aspirin, water, alcohol, bathroom cleaner and other commonly used chemicals and materials, PHT4 and PHT4-Diol do have an inherent level of toxicity that must be understood and safeguarded against through the use of engineering controls, PPE and appropriate procedures. The safety data sheets are the best resource to consult for understanding the health hazard risks associated with PHT4 and PHT4-Diol.

PHT4 and PHT4-Diol typically are part a pre-mix formulation when used for the respective manufacture of unsaturated polyester or rigid polyurethane applications. The pre-mix formulation is sometimes further prepared, but then reaction occurs where the reactive flame retardant is transformed and becomes a new polymer matrix with characteristics that differ greatly from the starting flame retardant. This makes any direct exposure to the reactive flame retardant unfeasible.

No known negative health effects exist for users of plastics that are made when a reactive flame retardant transforms into a new plastic with unique chemical characteristics.

Industrial Use:

PHT4 and PHT4-Diol are used to manufacture unsaturated polyester resin or rigid polyurethane foam products respectively. They are typically used in well-controlled manufacturing facilities by people trained in the hazards of polymer additives and chemicals. PHT4 and PHT4-Diol used in a manufacturing setting are handled using best practice techniques developed to minimize any potential risk of exposure to liquids, vapors or solids. Typically, use sites utilize engineered systems to minimize the potential for exposure to all the chemicals used in the process. Unplanned releases or spills of PHT4 and PHT4-Diol are not expected to represent a life threatening situation, due to their chemical characteristics. In any spill or release incident, all non-essential personnel are immediately evacuated upwind of the spilled material. All personnel involved with correcting a spill situation are trained and properly equipped with the required personal protective equipment.

Consumer Use:

It is very unlikely that consumers would be exposed to PHT4 and PHT4-Diol in their concentrated form, because they are only sold for industrial use to be transformed into polymers and other products and are not themselves consumer products, nor do they occur in their concentrated form in consumer products.

Environmental Release:

When used in an industrial setting, PHT4 and PHT4-Diol are typically handled using engineered systems designed to minimize any release to the environment.

PHT4 and PHT4-Diol that is released into the environment will collect or pool on hard surfaces and will potentially mix with or soak into soil or other porous materials. Contained volumes of solid or liquid PHT4 and PHT4-Diol can be collected in plastic or metal drums. Soils exposed to PHT4 and PHT4-Diol should be exhumed and treated.

Physical Hazards

PHT4 is a crystalline solid and PHT4-Diol is a light brown colored liquid. Both rely on bromine for their effectiveness as flame retardants, and both are odorless. Because PHT4 is an organic crystalline solid, it is possible for it to form combustible dust in air. The respective safety data sheet should be consulted for additional information on the specific physical or chemical characteristics of PHT4 or PHT4-Diol.

Potential Environmental Impact

Environmental Fate Information:

PHT4 and PHT4-Diol must exhibit a minimum level of stability to perform in their intended applications. However, when released to the environment, this stability will make it likely that they will be slow to break down and persist in the environment. Consequently, managing emissions while manufacturing with PHT4 and PHT4-Diol is a recommended practice.

PHT4 and PHT4-Diol that have been transformed into a new polymer matrix cannot be released to the environment, as they no longer exist.

Aquatic and/or Terrestrial Toxicity:

Both PHT4 and PHT4-Diol are known to be harmful to aquatic life and releases to the aquatic or terrestrial environment should be avoided. Soils containing PHT4 and PHT4-Diol should be remediated to remove all signs of the chemical. Consult the safety data sheet for specific information on the product of interest.

Product Stewardship

Manufacturing locations:

Facility management procedures, safety data sheets, technical guidance documents, and training are available to communicate safe handling, risk mitigation measures and emergency response information requirements to employees at manufacturing locations.

Environment:

When PHT4 and PHT4-Diol are chemically transformed during use in their intended application, they no longer exist. Systems that are used to handle PHT4 and PHT4-Diol in a manufacturing environment are specifically designed to minimize product loss to the environment. If PHT4 or PHT4-Diol are released in

excessive amounts to the environment, the area should be evacuated, and hazardous materials professionals must be called to manage the situation and monitor any resulting vapors that form.

Consumers:

Consumers are not exposed to PHT4 and PHT4-Diol distributed by LANXESS Solutions US Inc. because they are not sold directly to consumers. PHT4 and PHT4-Diol are among the many chemical materials that are commonly shipped to industrial manufacturing locations. Consequently, there exists the potential for the general public to be exposed to PHT4 and PHT4-Diol during a transport accident. Precautions are taken throughout transport to ensure the container movements are well controlled and the risk to the public is minimized.

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 product development. 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.

In the context of a continually improving risk-reduction program, LANXESS Solutions US Inc. conducts periodic reviews of current controls in order to identify opportunities for improvements or enhancements to the handling of our products. This includes adaptation of existing procedures to changes in regulations (e.g., covering workplace and transportation).

Conclusion

PHT4 and PHT4-Diol are chemicals that are transformed when reacted into a new polymer matrix with a unique ability to provide flame retardance to plastics in a manner that maintains the needed performance characteristics of the end product. Though there are potential hazards associated with these materials, they are only handled by highly trained people in manufacturing environments utilizing specialty equipment, safety controls, and personal protective equipment.

Contact Information

LANXESS Solutions US Inc.

www.LANXESS.com

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.