Tetraethyl orthosilicate

This document is a high-level summary intended to provide the general public with an overview of product safety for this substance. It is not intended to replace the Material Safety Data Sheet (MSDS), which is available from suppliers and should be referred to for full details of recommended safety procedures for each type of use. It is not intended to replace or supersede manufacturer's instructions and warnings for their consumer products containing this substance.

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Substance Name and Chemical Identity

Chemical Name:
Tetraethyl orthosilicate

CAS Number:
78-10-4

Molecular formula:
$C_8H_{20}O_4Si$

Uses and Applications

Tetraethyl orthosilicate is an alkoxysilane that has been used in the following applications:

- Use as a monomer ('building block') in the production of silicone polymers. Silicone polymers may be oils, greases, rubbers and resins, and have a wide range of uses.
- Use as an intermediate (starting material) in the production of other organic and inorganic chemicals.
- Use in the production of surface-modified particles or substrates (non-metal and metal surface treatment).
- Use in semiconductor manufacturing.
- Use in polymer preparation for manufacturing of silicone elastomers.
- Use in coatings, sealants, masonry and mould making applications.

Most of the applications described generally take place in industrial settings under controlled conditions. The end uses of products made from tetraethyl orthosilicate will vary.

In coatings, tetraethyl orthosilicate offers improved hardness and scratch-, temperature-solvent and acid-resistance. Examples of typical industrial uses are automotive refinishing and coating of beverage cans. Professional and consumer uses include paints, wood and metal primers and stains and varnishes. In sealants, tetraethyl orthosilicate is used as a cross-linking agent and an adhesion promoter during sealant manufacture and sealant application. The use of sealants is widespread with various industrial, professional and consumer end uses, including construction and automotive industry.

Tetraethyl orthosilicate is also used in non-metal and metal pigment surface treatment, in semi-conductor manufacturing, masonry, preparation of moulds and as a laboratory chemical, with most uses exploiting the cross-linking capacity of the substance.

Physical/Chemical Properties

Tetraethyl orthosilicate is a liquid at standard temperature and pressure. It has low volatility and is classified as flammable on the basis of its flashpoint and boiling point. When in contact with water, tetraethyl orthosilicate reacts rapidly, breaking down to silicic acid and ethanol. The substance is classified under the EU Globally Harmonized System (GHS) as:

- Flammable Liquid Category 3; 'H226: Flammable liquid and vapor'

Property	Value
Physical state	Liquid
Color	Colorless
Odor	Faint inherent odor/aromatic odor
Molecular weight	208.33 g/mol
Melting/boiling point	-82.5°C/165-166°C
Density	0.94g/cm^3 at 20°C
Vapor pressure	110 Pa at 20°C
Flammability	Flammable
Flash point	45°C
Self-ignition temperature	222°C at 96.08 to 96.28 kPa
Explosive properties	Not explosive

Health Information

Tetraethyl orthosilicate is classified for human health hazards under the EU Globally Harmonized System (GHS) as:

- Acute Toxic Category 4 (Inhalation); 'H332: Harmful if inhaled'
- Eye Irritation Category 2; 'H319: Causes serious eye irritation'
- Specific target organ toxicity Single Exposure 3; 'H335: May cause respiratory irritation'

Environmental Information

Tetraethyl orthosilicate is not classified for environmental effects under the GHS.

Exposure Potential

Professional and consumer exposure: Use of coating and sealant products containing tetraethyl orthosilicate by professionals in building construction, furniture coating, decorative coating and vehicle refinishing are generally representative of exposure to professional exposure. It is expected that tetraethyl orthosilicate is rarely used in water-based decorative coating products meant for the "Do It Yourself" (DIY) consumer market. Where it is used in such products, the substance is invariably no longer present in its original form due to a hydrolysis reaction and therefore its end-use in aqueous coating products is not expected to pose a significant exposure risk to consumers. Tetraethyl orthosilicate is also present in some solvent-based DIY-coatings, but the frequency of use is expected to be low and once the coating has been applied and has set, there is no further potential for consumer exposure. In sealants, the parent material is negligible at end use. Regardless of the end use of the coating/sealant, the application techniques by consumers and professionals are similar. Masonry products formulated with tetraethyl orthosilicate for masonry treatment in building construction and maintenance, by spraying, injection or roller application are also used by professionals and consumers.

Workplace exposure: This refers to potential for worker exposure at manufacturing sites or industrial workplaces. Industrial uses include coatings and masonry products formulated with tetraethyl orthosilicate, the application of which is typically by spraying, dipping and roll or flow-coating. All aspects of tetraethyl orthosilicate handling, including on-site storage and transfer of the neat substance, are subject to highly controlled conditions, due to its flammability hazard. Further details are given in the Safety Data Sheet.

Environmental releases: Releases to the environment can vary depending on the industry and processes used. However, manufacturing occurs under controlled conditions and is typically subject to stringent regulations, with minimal releases to air and wastewater. Environmental exposure can be minimized by applying air and wastewater abatement technologies to remove unreacted substance and reaction products. The use of appropriate measures to manage environmental release is described in the Safety Data Sheet.

Risk Management Recommendations

Consumer and professional risk management: Adequate ventilation, protective clothing such as rubber type gloves, respiratory protective equipment and appropriate worker training for professionals are essential to consumer and professional risk management. Masonry products must contain a maximum of 2.5% of the substance or be diluted to this concentration for safe use of the product by consumers, without additional PPE.

Industrial risk management: For more detailed information please refer to the Safety Data Sheet for information on protecting workers and limiting environmental exposure at industrial sites. In summary, when using this chemical, there must be adequate ventilation. Suitable respiratory protection must be worn if the product is handled in large quantities in confined spaces. Chemical-resistant clothing and gloves, and safety glasses or other suitable eye protection must be worn. Avoid sources of ignition and keep containers tightly closed, in a dry and cool place.

Conclusions

Tetraethyl orthosilicate is used under highly controlled conditions at industrial sites. In both industrial and consumer applications, the manufacturing and use of tetraethyl orthosilicate does not pose a significant risk to humans or the environment if instructions in the Safety Data Sheet and applicable legal requirements are followed.

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