



Product Stewardship Summary Styrene Monomer

Product Overview

Styrene is a building block, or monomer, for the manufacture of a broad range of materials used in thousands of plastics products throughout the world. In 2006, TOTAL Petrochemicals USA, Inc. (TPI) manufactured over 2 billion lbs/yr of styrene for its own use in the manufacture of polystyrene and sold 250 million lbs for use by others to produce polymers.

The most recognizable material is probably polystyrene, often encountered as expanded polystyrene foam (EPS). Other styrene-based materials include acrylonitrile-butadiene styrene (ABS), styrene-acrylonitrile (SAN), styrene-butadiene rubber (SBR), and unsaturated polyester resin (UPR), which is better known as fiberglass.

Chemical Identity

Name: Styrene
Also known as: Ethenylbenzene; Phenylethylene
CAS#: 100-42-5

Uses

Styrene-based polymers add convenience, value, and quality to daily life. Some examples of these uses include:

Application/Function

Packaging
Toys/Recreational Equipment
Consumer Electronics
Construction
Transportation
Medical Supplies

Benefits of styrene-based materials:

Styrene-based materials offer unique characteristics of toughness, high performance, versatile design and simplicity of production. They provide excellent hygiene, sanitation and safety benefits. Styrene-based products offer superior insulation qualities for use in building construction and lightweight components resulting in energy use reduction. They have the ability to be recycled where collection systems are available. In many cases, styrene helps create products for which there are few, if any, substitutes.

Physical/chemical properties:

Specific Gravity:	0.91
Appearance:	clear liquid
Boiling Point:	145 °C (293 °F)
Flash Point:	31°C (88°F)
Vapor Pressure:	4.3 mm Hg (@20°C)
Solubility in water:	very slightly soluble in hot water
Molecular weight:	104
Molecular Formula:	C8H8
Odor Threshold:	0.01 - 0.1 ppm

Health Effects:

High levels of exposure to styrene monomer can cause adverse health effects. Regulations require exposures to remain within safe limits by use of appropriate industrial hygiene practices and emission controls.

Short-term over-exposure to styrene in humans can result in throat irritation and lung constriction, irritation to the eyes, and dizziness. The styrene concentrations that cause these effects are more than 1,000 times higher than the levels normally found in the environment. Permissible levels of styrene exposure do not cause these effects. Styrene monomer has not been classified as a reproductive or developmental toxicant.

Different governmental and non-governmental agencies rate the cancer causing potential (carcinogenicity) of different chemicals. Some results for Styrene Monomer include:

Agency	Carcinogenicity
International Agency for Research on Cancer (IARC)	Possibly carcinogenic to humans
National Toxicity Program (NTP)	Not listed
American Conference for Governmental Industrial Hygienists (ACGIH)	Not considered to be carcinogenic
Occupational Safety and Health Administration	Not listed

Styrene Monomer can cause damage to the following organs:

- Skin (irritant)
- Lungs
- Central Nervous System
- Respiratory Tract
- Eyes
- Kidney
- Liver

Potential for Exposure

Environmental Exposure

Styrene readily biodegrades and does not present a hazard to organisms in the environment. Measured environmental concentrations of styrene in the air, water and soil are too low to cause effects on mammals, non-mammals or microorganisms. Styrene is moderately toxic to aquatic organisms, but the compound's properties keep exposure levels below that required for toxicity.

Industrial Worker Exposure:

Styrene monomer is a recognized toxic substance with air exposure limits. Ventilation and engineering controls must be used in areas where styrene monomer is present in order to keep exposure levels below established standards. Workers should wear respiratory protection, splash goggles or safety glasses, flame retardant clothing covering the entire body, and chemical resistant gloves and boots. If inhalation above industry standards is possible, an appropriate respirator must be worn.

The monomer has a distinct odor at a very low threshold of 0.1 ppm. This allows it to be readily detected in the workplace at concentrations well below exposure limits.

Consumer/General Public Exposure:

Foods such as coffee, strawberries and cinnamon naturally contain styrene. Small amounts of styrene are also produced naturally by plants, bacteria, and fungi. Styrene is also present in combustion products such as cigarette smoke and automobile exhaust.

Consumers use polymers containing styrene and are exposed to very small amounts of residual monomer. Safe food contact use is regulated by the US Federal Food and Drug Administration (FDA).

A study of children's indoor exposure to styrene in a conservative, screening-level risk assessment has concluded that styrene monomer exposures to children are very low and are well below levels of public health concern.

Risk Management/Product Stewardship

TPI practices product stewardship, the safe management and use of its chemical products, in many ways:

- TPI participates in the American Chemistry Council's Responsible Care ® program and routinely reviews and enhances its practices for safe manufacture, transportation, use and disposal of styrene monomer. For example:
 - TPI works with terminals on storage processes and creating a formal audit program
 - TPI has implemented a distributor review process, which includes auditing and follow-up.
 - TPI has updated procedures for loading and unloading, and communicates them on the TPI intranet.

- TPI is an active member of SIRC, the Styrene Information Research Center, whose principal objectives include:
 - Development of sound medical, scientific and technical information for the guidance of industry and federal/state regulators on health and environmental issues associated with styrene.
 - Communication of this information effectively to plant managers, employees and communities, as well as federal, state and local officials, and the news media.

Contact Information:

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References:

TOTAL PETROCHEMICALS USA, INC. Material Safety Data Sheet for Styrene Monomer
<http://www.totalpetrochemicalsusa.com>

Styrene Producers Association/CEFIC <http://www.styrenemonomer.org/index.html>

Agency for Toxic Substances and Disease Registry (ATSDR) summary for styrene
<http://www.atsdr.cdc.gov/toxprofiles/tp53.html>

Detailed summaries of available toxicity studies for styrene can be found at the Styrene Information Research Center (SIRC) website:
<http://www.styrene.org/science/health/overview.html>

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