Styrene Monomer
Product Stewardship Summary

(CAS number 100-42-5)

Chemical Formula for Styrene Monomer

C8H8

What is Styrene Monomer?

Styrene Monomer is an aromatic hydrocarbon, which, under normal conditions, is a clear, colourless, flammable liquid. The conventional method for producing styrene monomer is the alkylation of benzene with ethylene followed by dehydrogenation to produce styrene monomer. The notable exception to this is the process to co-produce styrene monomer and propylene oxide via the oxidation of propylene by ethylbenzene hydroperoxide, also known as the 'SMPO' process. Shell Chemical companies operate both manufacturing processes at locations around the globe.

How is Styrene Monomer Used?

Styrene Monomer is used to make styrene-based polymers. These, in turn, are used in the manufacture of plastic and rubber products, including polystyrene (PS), expandable polystyrene (EPS), acrylonitrile butadiene styrene (ABS), styrene-acrylonitrile, styrene butadiene rubber (SBR), unsaturated polyester resins, and styrene butadiene lattices.

Much of styrene monomer is used in the production of polystyrene. General purpose, or 'crystal' polystyrene, and high impact polystyrene are used in everyday items such as CD cases, drinks cups, food containers and refrigerator door liners. Expandable polystyrene, a light weight foam, is used in home insulation, as a packaging material, as padding inside motorcycle crash helmets and car interiors, in bridge construction and to build film-set scenery.

Health, Safety and Environmental Considerations

Styrene Monomer is a volatile liquid with low toxicity following brief exposure. Liquid styrene monomer is a severe eye irritant and is a skin irritant, which can cause redness, local swelling and possibly some local tingling.

If styrene monomer is swallowed, vomiting should not be induced as it might enter the lungs and cause chemical pneumonitis which can be fatal.

Inhalation of styrene monomer vapours may lead to respiratory irritation. Repeated or prolonged exposure to high concentrations of styrene monomer vapours can impact the central nervous system and result in drowsiness. Effects on the visual system may cause a decrease in colour perception, but this does not lead to functional colour vision deficits. Exposures of laboratory animals to high styrene monomer concentrations have resulted in hearing loss. In a workplace situation, hearing

loss may be more related to exposure to noise, but high concentrations of hydrocarbons may contribute to this effect.

Styrene Monomer has been under scrutiny from regulators, health agencies and scientific bodies for many years. In terms of carcinogenicity, styrene was classified as a possible human carcinogen in 2002 by IARC, a body of the UN WHO. American Congress of Governmental Industrial Hygienists (ACGIH), a scientific body setting Occupational Exposure Levels in the US, came to the opposite conclusion in 1994, that styrene monomer is not classifiable as a human carcinogen. In June 2011, NTP, the National Toxicology Program (a part of the U.S. Department of Health and Human Services' Centers for Disease Control and Prevention) declared styrene monomer to be a reasonable anticipated human carcinogen in the 12th Report on Carcinogens (RoC). The US EPA Integrated Risk Information System (IRIS) has included styrene monomer on a high priority list for review. In the EU, Member States have been in agreement that risk management measures and occupational exposure levels set for styrene monomer in the workplace are adequate and safe for workers with regard to cancer risk. The registration dossier submitted under the REACH Regulation at the end of 2015 supports these conclusions. The styrene monomer industry believes that the available scientific evidence, together with workplace exposure studies over a 45 year period on more than 55,000 exposed workers, does not support a causal relationship between styrene monomer exposure and any type of human cancer.

Regarding reproductive toxicity, NTP in the US concluded a "negligible concern for adverse developmental and reproductive effects resulting from styrene monomer exposures in humans". In the EU, however, regulators have decided to regard styrene monomer as a "presumed human reproductive toxicant".

ACGIH's Threshold Limit Value (TLV) is twenty parts per million (20 ppm). This is based on an 8-hour day or 40 hours per week. In most other countries the occupational exposure levels are 20 ppm; in some jurisdictions, however, the exposure levels are still up to 50 -100 ppm.

In air, the odour recognition threshold of styrene monomer is approximately 0.1 ppm. This is 200 times below the lowest acceptable workplace exposure level of 20 ppm.

Styrene Monomer may be acutely toxic in the aquatic environment with the potential for some long-term effects. If styrene monomer reaches soil, it has the potential to be mobile and may contaminate ground water sources. It is readily biodegradable and has a low potential to bio-accumulate.

Styrene Monomer is a flammable liquid and very reactive. Spontaneous polymerization (exothermic reaction) may occur, if the product is not properly stabilized with a polymerisation inhibitor. If styrene monomer is exposed to high temperatures, it can affect the efficiency of the inhibitor.

Storing and Transporting Styrene Monomer

Styrene Monomer must be stored in well-ventilated areas away from direct sunlight, ignition sources and other sources of heat. Styrene Monomer temperature should be monitored and controlled to prevent product temperatures greater than 30°C. Styrene Monomer is stabilized with a certain amount of inhibitor to avoid spontaneous polymerization. If nitrogen or inert gas blanketing is used, there must be sufficient oxygen levels (6 – 10% v/v O2) in the gas mixture to inhibit polymerization but at the same time, below the minimum oxygen concentration to support combustion. Circulation capability is necessary to maintain appropriate oxygen and inhibitor levels.

Styrene Monomer is transported by tank truck, rail car and vessel/barge.

It is recommended that transport and storage containers are either stainless steel or carbon steel, but not plastic, for incompatibility reasons.

Risk Characterization Summary

Risks associated with exposure to this product have been evaluated for the following "chain-of-commerce" activities: manufacture, storage, product transfer, transportation, and customers/markets. It is manufactured, stored and transported to customers in closed systems. Depending on the customer, end uses may vary from use as an intermediate for the manufacture other chemicals, commercial products, or certain formulated consumer products. Proper equipment design and handling procedures maintain low risk from exposure where used as an intermediate. Exposures may be higher in commercial and consumer applications. To minimize risk, additional controls, such as, special handling procedures and protective packaging are implemented.

This product stewardship summary is intended to give general information about the chemical or categories of chemicals addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the chemical's applicable Safety Data Sheet, which should be consulted before use of the chemical. This product stewardship summary does not supplant or replace required regulatory and/or legal communication documents.