Styrene

General information

Key Points

Fire

- Flammable
- Normally stable. Can react with oxygen, strong oxidisers or acids
- Emits toxic fumes of styrene oxide when heated to decomposition
- In the event of a fire involving styrene, use normal foam and normal fire kit with breathing apparatus

Health

- Toxic by inhalation, ingestion and skin contact
- Harmful and irritant
- Possibly carcinogenic in humans
- Inhalation of styrene causes irritation of the nose and throat, coughing, wheezing, build-up of fluid in the lungs, irregular heart beats and coma
- Styrene inhalation may also lead to "styrene sickness", which includes headache, sickness, weakness, tiredness, dizziness and unsteady / clumsy motion of the limbs
- Ingestion of styrene may lead to central nervous system depression (sedation)
- Skin contact may result in irritation, itching and dermatitis. Central nervous system depression may also occur following skin contact

Environment

- Avoid release into the environment
- Inform Environment Agency of substantial release incidents

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Background

Styrene is a colourless or light yellow, flammable liquid, which has a sweet odour. It can occur naturally in some plants, but only in very small quantities.

Styrene is produced in industrial quantities from benzene and ethylene. Styrene is used in the manufacture of plastics, resins and synthetic rubbers. Very small amounts of styrene may be present in products that have been manufactured with it, such as plastics. Styrene can also be found in very small quantities in the exhaust emissions from motor vehicles, in tobacco smoke and can be released from other processes involving the burning or heating of organic products.

Exposure of the general public to extremely low concentrations of styrene from residues in plastics, or from sources occurring naturally in the environment, are unlikely to cause adverse effects on health. The most common source of exposure to considerable amounts of styrene is in the workplace, either where it is produced, or during the production of other materials.

Inhalation of styrene vapours or skin contact with styrene are the most common routes of occupational exposure which may lead to styrene toxicity. Styrene is also toxic if swallowed. However, ingestion of styrene in the workplace is extremely unlikely.

Inhalation of styrene vapour can lead to irritation of the nose and throat, wheezing and coughing. Exposures to larger amounts can result in the onset of “styrene sickness”, the signs and symptoms of which include headache, nausea, vomiting, weakness, tiredness, dizziness, confusion and clumsy or unsteady motion (known collectively as central nervous system depression).

In severe cases, inhalation of styrene vapour can cause irregular heart beat, fluid build-up in the lungs and possibly coma. Contact of the skin or eyes with vapours or liquid styrene can cause mild irritation, itching and dermatitis at the site of contact. Styrene can also be absorbed through the skin and contact with large quantities could result in central nervous system depression similar to that seen following inhalation. Similar health effects would be expected to be seen if styrene was ingested.

Repeated exposure to styrene over a long period has been reported to cause subtle changes in hearing, balance, colour vision and psychological performance. Long-term exposure to styrene may also result in the impairment of short term memory, irregular heart beat and changes in the function of the liver. There are a few reports that styrene may cause occupational asthma, although it is not known whether this is due to styrene alone. Repeated or prolonged skin contact with styrene may lead to dermatitis.

Children exposed to styrene are expected to show similar adverse health effects to those seen in exposed adults, although the effects may be more severe. There is no evidence to suggest that exposure to styrene during pregnancy will cause any adverse effects to the unborn child.

Styrene has been classified as possibly having the ability to cause cancer in humans, by the International Agency for Research on Cancer.

Production and Uses

Key Points

- Styrene does occur naturally, but only in very small quantities
- It is synthesised commercially from benzene and ethylene
- Styrene readily forms polymers and is used in the production of common plastics, resins and synthetic rubbers which have many uses, both commercial and domestic

Styrene can occur naturally in some plants, however, the amounts present in the environment from these sources are extremely small. It was first discovered from the distillation of Storax, which is a resin from the trunk of the Sweetgum tree (*Liquidambar*) found in parts of Asia and North America.

Styrene is produced industrially from benzene and ethylene. Styrene is readily polymerised when heated and so is used in the production of many polymers, plastics, resins and synthetic rubbers. Some of the most common plastics and resins produced using styrene including polystyrene and acrylonitrile-butadiene-styrene (ABS), styrene-acrylonitrile (SAN) resin and styrene-butadiene rubber (SBR). Plastics and rubbers such as these have many commercial and domestic uses, including containers for foodstuffs.

Styrene can also be released during combustion and so may be present in small quantities in vehicle exhaust emissions and tobacco smoke.

Frequently Asked Questions

What is styrene?

Styrene is a colourless or light yellow, flammable liquid. It has a sweet odour at low concentrations and a sharp, penetrating, unpleasant odour at higher concentrations. The main use of styrene is in the production of plastics, resins and synthetic rubbers for commercial and domestic uses.

How does styrene get into the environment?

Styrene does occur naturally and may be present in some plants. However the quantities of styrene present in the environment from these sources are extremely small. Styrene is most likely to enter the environment from workplaces involved with its manufacture or its use in the production of other materials (plastics, rubbers, etc). Styrene may also be present in very small quantities from the exhaust of motor vehicles or from the burning of tobacco.

How could I be exposed to styrene?

As styrene is only used in considerable quantities industrially, it is unlikely that you will be exposed to significant amounts unless you work with it. People working with styrene are at risk of inhaling the vapours if adequate protective equipment is not used, or if there is insufficient ventilation. Workers using styrene are also at risk of getting splashes on their skin or eyes if they are not adequately protected. Ingestion of significant amounts is not a common route of exposure to styrene.

If there is styrene in the environment will I have any adverse health effects?

The presence of styrene in the environment does not always lead to exposure. Clearly, in order for it to cause any adverse health effects you must come into contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact. Following exposure to any chemical, the adverse health effects you may encounter depend on several factors, including the amount to which you are exposed (dose), the way you are exposed, the duration of exposure, the form of the chemical and if you were exposed to any other chemicals.

Breathing air contaminated with styrene vapours can cause irritation of the nose and throat, coughing, wheezing and build-up of fluid in the lungs. Severe exposures can lead to “styrene sickness”, which relates to a series of health effects due to depression of the central nervous system (CNS). These symptoms include headache, nausea, vomiting, weakness, tiredness, dizziness and unsteady and clumsy motion of the limbs. In some cases exposure to styrene can also result in irregular heart beats and coma. Ingestion of styrene would be expected to give rise to similar CNS effects as seen following inhalation. Styrene is an irritant and contact with the skin can cause mild irritation, itching and dermatitis. Getting splashes of styrene or vapours in the eyes is likely to cause moderate to severe irritation.

Can styrene cause cancer?

Styrene has been classified by the International Agency for Research on Cancer as possibly causing cancer in humans.

Does styrene affect children or damage the unborn child?

Children exposed to styrene are expected to show similar adverse health effects to those seen in exposed adults, although the effects may be more severe.

There is no evidence to suggest that exposure to styrene during pregnancy will cause any adverse effects to the unborn child.

What should I do if I am exposed to styrene?

It is very unlikely that the general population will be exposed to a level of styrene high enough to cause adverse health effects.

This document from the HPA Centre for Radiation, Chemical and Environmental Hazards reflects understanding and evaluation of the current scientific evidence as presented and referenced in this document.