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## Properties

### Styropor foam – ecological aspects

Questions on its compatibility with the environment arise when expanded Styropor is used.

#### Raw materials and manufacture

Expandable polystyrene (EPS) is predominantly manufactured by polymerization of styrene and simultaneous addition of blowing agent (pentane).

Styropor is BASF Aktiengesellschaft's registered trademark for expandable polystyrene and the *Industrieverband Hartschaum e.V.'s* for thermal insulating board produced from it.

Styropor and the cellular materials produced from it consist of carbon (C) and hydrogen (H). Neither during its production nor during its application are fluorocarbons used.

#### Components

Styropor is manufactured in general-purpose and in special grades. The general-purpose grades of the P series do not contain any special additives. Those of the F series contain small amounts of a flame retardant containing bromine (in numerous European countries, cellular materials for applications in the building trade must be difficultly inflammable). Special grades, e.g. for coloured expanded plastics, contain pigments.

#### Blowing agents

The blowing agent, pentane, is a component of crude oil and is derived from it.

Pentane is decomposed very rapidly in the atmosphere. In the end effect, carbon dioxide and water are formed.

#### Handling expanded plastics

Freshly prepared cellular material (in the form of blocks and mouldings) still emits existing blowing agent and traces of styrene. After an adequate period of ageing, emission of styrene into the atmosphere can no longer be detected, as a study on insulated Styropor panels installed in inhabited rooms has revealed. The emission of residual blowing agent has also practically ended.

#### Radioactivity

Neither alpha, beta, or gamma radiation nor radon emanation can be detected. (Certificate dated 07.03.1987 R. Reiter, Garmisch-Partenkirchen).

#### Fire behaviour and combustion

Styropor and expanded Styropor are combustible. The gaseous products of combustion formed in the event of a fire do not differ very much from the fumes given off by other organic materials. They consist predominately of carbon dioxide and water. They also contain carbon monoxide and soot to an extent dependent on the conditions of burning. In addition, traces of hydrogen bromide occur in the fumes given off by difficultly inflammable expanded Styropor.

Styropor and expanded plastics produced from it including those that contain a flame retardant may be burnt at temperatures of ca. 1000 °C in incinerators if adequate air is supplied.

In the event of a fire, no risk or hazard to the environment by toxic fumes nor a risk of contaminating water may generally be expected. The gaseous products of combustion are comparable to those that are given off by wood-based materials. Slight traces of hydrogen bromide, which is precipitated by the water used for extinguishing and thus finds its way into natural water

courses, can be regarded as harmless. (See TI 0/1/2-810, TI 0/1-130).

Brominated dioxins were not detected either in the gas phase or in the fire residues in the experiments described in DIN 53436 with Styropor F. All that was detected where negligible amounts of brominated furans, all of which, however, do not fall under the chemical prohibition ordinance of 1994.

### **Hygienic aspects**

Styropor and expanded Styropor have been manufactured and processed for decades. No adverse influences on health, which could have been brought into causal relationship with these materials, have become known in this time.

Styropor and expanded Styropor are chemically neutral. They are insoluble in water and do not give off any water-soluble substances that could lead to contamination of the ground water. They are not decomposed by microorganisms and are not nutritive substrata for moulds and bacteria. Likewise, Styropor and expanded Styropor do not allow their use as nutrients or substitute nutrients for human beings and animals.

Even external influences, e.g. manure, earth that has been fertilized with phosphates, acid rain, etc., do not have any significant effect. The expanded material does not rot.

Styropor or expanded Styropor that has been accidentally ingested by persons or animals pass through the stomach and digestive track and are eliminated again chemically unchanged.

### **Queries concerning food**

Styropor is also used for the manufacture of packaging for food and, to a small extent, of toys. The food and toys concerned are those in the sense of the German *Lebensmittel- und Bedarfsgegenständegesetz*. The German Health Authorities have published recommendations in accordance with the current state of the art. These stipulate under which conditions a plastic that comes into contact with food or toys conforms to the requirements laid down in the corresponding paragraphs of the *Lebensmittel- und Bedarfsgegenständegesetz*.

In addition, international legal requirements and provisions must be adhered to and satisfied.

### **Food legislation**

The monomer used in the production of Styropor conforms to the EEC Guideline 90/128/EEC dated 23.02.1990 and the German Ordinance on articles that come into contact with foods dated 10.04.1992.

Furthermore, the processing and production aids used in the manufacture of Styropor are listed in corresponding recommendations issued by the German Health Authorities on polymers that contain polystyrene, colorants, and/or those listed in EEC Synoptic Documents.

The composition of Styropor grades satisfy all requirements in the corresponding recommendations of the German Health Authorities.

The manufacturer or packer must check for themselves whether an article is suitable for food contact applications.

### **Biological aspects**

A series of various studies have been carried out to determine the behaviour of expanded Styropor towards biological material.

Germination tests with seeds and pupation tests with mealworms have revealed that expanded plastics or comparable untreated wooden panels do not effect any changes in seeds or mealworms.

Experiments have failed to reveal any morbid or degenerative mutations in microorganisms, algae, and lichen. (These experiments were carried out by the Institut Bio-Bauforschung K.H. Sirtl, Karlsfeld).

### **Recycling and waste disposal**

After it has been originally used, expanded Styropor can be often recycled and further recycled. Before an article is dumped or incinerated, recycling offers a number of possibilities. For instance, there is recycling in the form of expanded material, the use as Styromull® (expanded Styropor flocs), and melting and granulating to yield compact polystyrene for injection moulded products and regenerated raw material. Details are given in the Technical Information Bulletin TI 0/1/2-810 (methods of recycling and disposing of used expanded Styropor).

### **Note**

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve processors of the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

BASF Aktiengesellschaft  
67056 Ludwigshafen, Germany

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