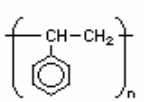


MATERIAL SAFETY DATA SHEET
POLYSTYRENE

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MATERIAL SAFETY DATA SHEET

Section 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION	
Product Name:	DENKA STYROL MF-21-301, MW-1-301, MW-1-321, HRM-2S-311
Molecular Formula:	
Chemical Name:	Polystyrene (CAS No.9003-53-6)
Molecular Weight:	Not Applicable.
Manufacturer:	DENKA SINGAPORE PRIVATE LIMITED(DSPL)
Address:	16 Raffles Quay #18-03 HONG LEONG Building, Singapore Postal Code: 048581
Emergency Telephone:	+65-6876-5593
DENKA Hot Line:	+65-6876-5575 : Hot Line is available days, nights, weekends and holidays.
FACSIMILE:	+65-6867-6090
Section 2 – HAZARDS IDENTIFICATION	
GHS Classification	This product is not classified as dangerous according to Japanese GHS Classification Manual.(Feb.10,2006)
EMERGENCY OVERVIEW:	Clear solid. Odorless. No significant immediate hazards for emergency response are known. Toxic fumes are released in fire situation.
Acute Overexposure Effect:	Polystyrene made by polymerization of styrene monomer is not expected to be chemically and biologically active against human body. Some traces of styrene monomer and possible traces of additives may be volatilized under normal processing conditions. Adequate ventilation is needed to avoid exposing person to above-mentioned substance. Inhalation of styrene vapors and dust may cause severe irritation to the upper respiratory tract, depression, and loss of balance. An ingestion result makes irritation to the mouth, esophagus and stomach.
Potential Health Effects:	<p>Eyes: Product may cause irritation or injury due to mechanical action.</p> <p>Skin: Product is not likely to cause skin irritation.</p> <p>Ingestion: Product ingestion is unlikely due to physical form. If swallowing, it may cause choking.</p> <p>Inhalation: Product inhalation is unlikely due to physical form.</p>
Chemical substance by thermal decomposition:	In case of excess heat and incomplete combustion, trace amounts of styrene monomer and additives will be volatilized, and carbon monoxide, black smoke, and carbon dioxide will be generate and it makes carbon monoxide poisoning, suffocation

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Section 3 – COMPOSITION/INFORMATION ON INGREDIENTS			
Chemical Name	wt. %	CAS No.	PEL/TLV Data
Polystyrene	>94%	9003-53-6	Not identified as Toxic substance.
White Mineral Oil	1-5%	8042-47-5	OSHA Permissible Exposure Limit (PEL): 5 mg/m ³ (as oil mist) ACGIH Threshold Limit Value (TLV): 5 mg/m ³ (as oil mist) ACGIH Short Term Exposure Limit (STEL): 10 mg/m ³ (as oil mist)
Other additives	<1%	Trade Secret	Trade Secret
Section 4 – FIRST AID MEASURES			
<p>Skin: If burned by contact with molten polystyrene, cool molten material adhering to skin as quick as possible with water, and get medical assistance for removal of adhering material and treatment of burns.</p> <p>Eyes: Immediately flush eyes with running water for over 15 minutes. If irritation develops, get medical attention.</p> <p>Ingestion: If swallowed, dilute with water and immediately induce vomiting. Never give fluids or induce vomiting if the patient is unconscious or having convulsions. Get immediate medical attention.</p> <p>Inhalation: Remove to fresh air. Aid in breathing, if necessary, and get immediate medical attention.</p>			
Section 5 - FIRE FIGHTING MEASURES			
Items	Typical		
Flash Point	>550 (Polystyrene) 296 ~ 360 (Under condition of decomposition) Excess heating decompose polystyrene and decomposed materials makes flash point lower.		
Flammability Limits	LEL = Not Applicable, UEL = Not Applicable.		
Auto Ignition Point	488 ~ 496		
Calorific Value	9,620 Kcal/kg		
Extinguishing Media	Water, CO ₂ , Dry Chemical		
Minimum ignition energy	40 mJ (milli-Joule)		
Maximum explosion pressure	7.0 kg/cm ² (at gate)		
Minimum oxygen content for ignition	14% of Oxygen		

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Fire Fighting Procedure:

Water or foam may cause frothing. Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. For fires in enclosed areas, firefighters must use self-contained breathing apparatus. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.

Unusual Fire and Explosion Hazards:

This material burns vigorously and generates a dense, black, toxic smoke. It may include black particles, carbon monoxide and styrene vapor that are generated by decomposition and imperfect combustion. High dust level of polystyrene may create a potential for explosion.

Fires are difficult to control.

Fire -Fighting Equipment:

Wear positive-pressure self-contained breathing apparatus(SCBA) and protective fire-fighting clothing(includes fire-fighting helmet, coat, pants, boots, and gloves).

If protective clothing is not available or not used, fight fire from a protected location or safe distance.

Section 6 - ACCIDENTAL RELEASE MEASURES

General:

Spills should be contained, solidified and placed in suitable containers for disposal.

Personal precaution:

Spilled material may cause a slipping hazard. Wear protective clothing specified for normal operation. Use appropriate safety equipment when clean the up spills. Avoid inhalation. Do not breathe dust. Keep away from sources of ignition and prepare fire extinguishers for safety.

Environmental precautions:

Prevent from entering into soil, ditches, sewer, waterways and/or ground water.

Clean-up method

Avoid creating dust clouds. Shovel, sweep up or use industrial vacuum cleaner to pick up. And place in a labeled container for subsequent proper disposal. Reduce airborne dust and prevent scattering by moistening with water. If heated material is spilled, allow it cool before proceeding with disposal methods.

Waste Disposal:

Incineration of large amount of polystyrene makes incomplete combustion and generates black smoke and styrene vapor. Waste disposal of large amount should be done by licensed agent and facilities.

Disposal of Packing materials:

Crushing or cutting to prevent unauthorized reuse.

Section 7 – HANDLING AND STORAGE

General:

Store in a dry place and in accordance with good manufacturing practices. Keep away from direct sunlight, other source of heat or ignition such as electrostatic charge.

Handling:

1. This material burns vigorously and generates a dense, black, toxic smoke. Fires are difficult to control. Therefore, working area should be kept clean and well ordered. Recommended, should not use near open flame.
2. Avoid accumulating polystyrene powder because there is potential for powder explosion in conditions of high density of fine powder. Grounding should be taken in air conveyer line, bag filters, hoppers, silos, and others for removing static electricity.
3. Spilled pellets should be cleared as soon as possible. Slipping hazards will exist on spilled pellets.

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4. Adequate ventilation should be used at injection molding process to prevent hydrocarbon fumes.
5. If fine polystyrene dust and powder are generated by handling, proper ventilation should be available and dust mask must be needed.
6. Safety goggle is needed to wear in case of handling powder.
7. Antipollution control measures against odors should be taken in molding process and other heating process. Heating process will generate styrene monomer.
8. Adequate measures against noise should be taken so that hearing may not be damaged in molding process.

Storage:

1. Adequate fire fighting equipments are needed in case of storage. Fire fighting equipment must be in compliance with government , local laws and regulations.
2. Don't use open flame in storage and handling area without any reason. If hot works are needed, work permit should be required and proper protection should be taken.
3. Supersacks should be stored under cool, dry conditions. If supersack is kept in sunlight, the materials in supersack could be degraded. Degraded supersack could disintegrate during handling.

Section 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION
Exposure limits : Not established
Personal protection**Eyes/face protection**

Wear safety glasses. If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles or a full-face respirator.

Skin protection:

No precautions other than clean body-covering clothing should be needed.

Hand protection:

Chemical protective gloves should not be needed when handling this material.

Use gloves to protect from chemical injury.

Selection of gloves will depend on the task.

Respiratory protection:

Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. Use an approved air-purifying respirator when vapors are generated at increased temperature or when dust or mist is present.

Ingestion:

Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering controls**Ventilation**

Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

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Items	Typical	Range
Physical state and appearance	Solid, Transparent pellets	
Color	Clear	
Odor:	Odorless.	
Specific Gravity:	1.05	1.0 to 1.1
Bulk Density:	0.63	0.58 to 0.67
Boiling Point:	Not Available	
Decomposition temp:	Equilibrium point between polymerization and de-polymerization is around 250 .	
Solubility in Water:	None.	
Partition Coefficient (n-octanol / water, Log Pow)	PolyStyrene : no data White Mineral Oil : > 6	
Section 10 - STABILITY AND REACTIVITY		
<p>Chemical Stability: Unstable at elevated temperature. This material is considered stable under recommended storage conditions of temperature and pressure.</p> <p>Conditions to avoid: Avoid temperature above 300 . Exposure to elevated temperature can cause product to decompose.</p> <p>Materials to avoid Reactive with strong oxidizing agents. Generally incompatible materials are not known.</p> <p>Hazardous Polymerization: Will not occur.</p> <p>Hazardous decomposition Decomposition products depend upon temperature, air supply and the presence of other materials. Processing may release fumes and other decomposition products. At temperatures exceeding melt temperatures, polymer fragments can be released. Fumes can be irritating. Chemicals that may be released include include styrene monomer, benzene and other hydrocarbons.</p> <p>Corrosive properties: No data.</p> <p>Oxidizer properties: No data.</p>		
Section 11 – TOXICOLOGICAL INFORMATION		
<p>Acute toxicity</p> <p>Ingestion Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts. May cause choking if swallowed.</p> <p>Eye contact Solid or dust may cause irritation or corneal injury due to mechanical action. Elevated temperatures may generate vapor levels sufficient to cause eye irritation. Effects may include discomfort and redness.</p> <p>Skin contact Essentially nonirritating to skin. Mechanical injury only. Under normal processing conditions, material is heated to elevated temperatures; contact with the material may cause thermal burns.</p> <p>Skin adsorption No adverse effects anticipated by skin adsorption.</p>		

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Inhalation

No adverse effects are anticipated from single exposure to dust.

Vapors/fumes released during thermal processing may cause respiratory irritation.

Repeated

Based on available data, repeated exposure are not anticipated to cause significant adverse effects.

Chronic Overexposure Effect:

Referring following reports, there are no reports about chronic overexposure effect by polystyrene.

Route of entry	animal	Result
Oral	Rat	Add 4% of polystyrene in feed, no influence after 55 weeks. ¹⁾
Oral	Rat	Add 5% of polystyrene in feed, no influence after 2 years. ²⁾
Oral	Rat	Add 10% of polystyrene in bread for feed, no influence after 830 days. ³⁾

Section 12 – ECOLOGICAL INFORMATION

Movement and partitioning

No bioconcentration of polymeric component is expected because of its high molecular weight.

Persistence and degradability

This water-insoluble polymeric solid is expected to be inert in the environment. Surface photodegradation is expected with exposure to sunlight. No appreciable biodegradation is expected.

Ecotoxicity

Not expected to be acutely toxic, but material in pellet or bead form may mechanically cause adverse effects if ingested by waterfowl or aquatic life.

Section 13 – DISPOSAL CONSIDERATIONS

Waste Disposal of substance

Do not dump into any sewers, on the ground, or into any body of water. All disposal methods must be in compliance regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

Section 14 – TRANSPORT INFORMATION

Transportation:

1. PP/PE woven cross paper bags, supersacks are standard packaging.
2. Air conveyer systems are should be made by metal so that static electricity is released. Adequate measures against static electricity accident should be taken. All pipes and equipment should be grounded.
3. In case of spillage on the road, local authorities must be notified. Areas affected by spillage must be isolated from traffic because polystyrene pellets can cause loss of control in brakes and handling. Note : Avoid water and careless handling to prevent damage to the container.
4. Comply with all national and local regulations.

UN Class	Not applicable
UN Number	Not applicable
Land Transport ADR/RID Classification	Not controlled under ADR
AIR Transport ADR/RID Classification	Not controlled under ADR
MaritimeTransport IMO/IMDG Classification	Not controlled under IMDG

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DOT(Department of Transportation)	Not applicable
Proper Shipping Name	Not applicable
Hazard Class	Not applicable
Identification Number	Not applicable
Packing Group	Not applicable
Section 15 – REGULATORY INFORMATION	
<p>Comply with all national and local regulations.</p> <p>U.S. Federal Regulations:</p> <p>TSCA(Toxic Substance control Act) : CAS#9003-53-6 and #8042-47-5 are listed on the TSCA inventory.</p> <p>CERCLA:(Comprehensive Response Compensation, And Liability Act): Not applicable.</p> <p>SARA TITLE :(Superfund Amendments And Reauthorization Act): Not applicable.</p>	
Section 16 – OTHER INFORMATION	
<p>Reference data:</p> <ol style="list-style-type: none"> 1) I. Phillips and G. C. Marks : British Plastics, July 1961 P.385-390 2) A. M. Thiess, N. Friedheim and H. Rossmann : Polymer Preprint <u>17</u>, 35-39 (1976) 3) B. Hunter et al, : Huntingdon Res. Cent. Rep. Feb. 13, 1-318 (1976) 4) IARC Monographs Supplemnt No.7 Overall evaluation of carcinogenicity : An updating of IARC Monographs Vol.1-42(1987) 5) Japanese GHS Classification Manual (National Institute of Technology and Evaluation, Feb.10, 2006) <p>Notice:</p> <p>This information herein is given in good faith but no warranty, express or implied, is made. To the best of our knowledge, the information contained herein is accurate. However, we can't assume any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used in caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards which exist. The information relates to this specific material. It may not be valid for this material, if used in combination with any other materials or in any process. It is the user's responsibility to satisfy himself as to the suitability and completeness of this information for his own particular use. You should execute the adequate test before using this material in the view of safety and suitability for your purpose under your responsibility.</p>	