

EPS R160

Expendable Polystyrene

Description

Flame Retardant

Application

Insulation Board, Sandwich Panel
Civil Engineering & Construction Materials

Properties	Test Condition	Test Method	Unit	Typical Value	
Physical					
Water Absorption		KS M 3808			
	15g/L		g/100cm ²	0.70	
	20g/L		g/100cm ²	0.38	
	25g/L		g/100cm ²	0.30	
Thermal Conductivity	30g/L		g/100cm ²	0.30	
		KS M 3808			
	15g/L		Kcal/m·hr·°C	0.035	
	20g/L		Kcal/m·hr·°C	0.032	
Mechanical	25g/L		Kcal/m·hr·°C	0.030	
	30g/L		Kcal/m·hr·°C	0.029	
	Impact Strength		KS M 3808		
		15g/L		kg/cm ²	0.89
20g/L			kg/cm ²	1.30	
25g/L			kg/cm ²	1.79	
Flexural Strength	30g/L		kg/cm ²	2.34	
		KS M 3808			
	15g/L		kg/cm ²	1.96	
	20g/L		kg/cm ²	2.76	
Thermal	25g/L		kg/cm ²	3.69	
	30g/L		kg/cm ²	4.40	
	Flexural Strength		KS M 3808		
		15g/L		sec.	0.8
20g/L			sec.	0.7	
25g/L			sec.	0.8	
			sec.	0.6	

Note) Typical values are only for material selection purpose, and variation within normal tolerances are for various colors.

Values given should not be interpreted as specification and not be used for part or tool design.

All properties, except melt flow rate are measured on injection moulded specimens and after 48 hours storage at 23°C, 50% relative humidity.

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1. Identification of the product and the supplier

- 1) Chemical Name : EPS Resin (Flame Retardant Grade)
- 2) Advisable use and Restriction
- Advisable use :Plastic product
 - Restriction of product using :Used for recommended use.
- 3) Manufacturer/Supplier/Distributor information
- Company : LG Chem, LTD. Yeosu plant
 - Address : 70-1, Hwachi-dong, Yeosu-si, Jeollanam-do
 - Emergency response number : +82-61-680-1874
 - Respondent : EPS Production P C/R

2. Hazard identification

- 1) Hazard classification :
- Acute toxicity (dermal) : Category 5
 - Aquatic toxicity (acute): Category 1
 - Aquatic toxicity (chronic): Category 1

2) Allocation label elements

<input type="radio"/> Pictogram and symbol	<input type="radio"/> Signal word	<input type="radio"/> Hazard statement
	Warning	H313: May be harmful in contact with skin H400: Very toxic to aquatic life H410: Very toxic to aquatic life with long lasting effects

Precautionary statements

[Prevention]

P273: Avoid release to the environment.

[Response]

P312: Call a POISON CENTER or doctor/physician if you feel unwell.

P391: Collect spillage.

[Storage]

Not applicable

[Disposal]

P501: Dispose of contents/container to in accordance with local/regional/national/international regulations (to be specified).

3) Other hazard information not included in hazard classification

- NFPA Rating system : Health: **1**, Flammability: **1**, Reactivity: -

3. Composition/information on ingredients

Chemical Name	Common name Synonyms	CAS No.	Content (%)
Polystyrene	<ul style="list-style-type: none"> • Benzene, ethenyl-, homopolymer • Toporex • Vestyron • Styron • Esbrite 	9003-53-6	93~95 %
Pentane	<ul style="list-style-type: none"> • Pentane • Amyl hydride • Skellysolve A 	109-66-0	5~6 %
HBCD	<ul style="list-style-type: none"> • CYCLODODECANE, 1,2,5,6,9,10 HEXABROMO- 	3194-55-6	<1 %
Butane	<ul style="list-style-type: none"> • Butane 	106-97-8	<1 %

4. First-aid measures

1) Eye contact:

- Keep away from exposure if exposure effect occurred.
- In case of contact with substance, flush eyes with amount of water for at least 15 minutes.
- In case of contact with chemicals, get medical advice/attention.

2) Skin contact:

- Remove contaminated clothing and shoes. Wash skin with soap and water for at least 15 minutes.
- Get medical attention if skin symptoms occurred.
- Removal of solidified molten material from skin requires medical assistance.

3) Inhalation:

- Move victim to non-contaminated place in fresh air.
- Get medical attention if irritation or symptoms occurred.
- Keep victim warm and quiet.

4) Ingestion:

- Get medical attention if swallowed amount of substance.
- Get medical attention if irritation or symptoms occurred.

5) Indication of immediate medical attention and notes for physician:

- Move victim to fresh air.
- Administer oxygen if breathing is difficult.
- Give artificial respiration if victim is not breathing.
- Call 911 or emergency medical service.
- Remove and isolate contaminated clothing and shoes.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves

5. Fire-fighting measures

1) Suitable (and unsuitable) extinguishing media:

- Suitable extinguishing media: dry chemical, CO₂, sand/earth, water, regular foam
- In case of major fire and large quantities:
 - Use water spray, fog or regular foam.
 - Move containers from fire area if you can do it without risk.
- Tank/trailer/train truck fire:
 - Cool containers with flooding quantities of water until well after fire is out.
 - Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
 - Always stay away from tanks engulfed in fire.
 - If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

2) Specific hazards arising from the chemical (ex: hazardous combustion products):

- May be ignited by friction, heat, sparks or flames.
- Some may burn rapidly with flare burning effect.
- Powders, dusts, shavings, borings, turnings or cuttings may explode or burn with explosive violence.
- Substance may be transported in a molten form at a temperature that may be above its flash point.
- May re-ignite after fire is extinguished.
- It may produce irritating, corrosive and/or toxic gases.

3) Special protective equipment and precautions for fire-fighters:

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

6. Accidental release measures

1) Personal precautions, protective equipment and emergency procedures:

- CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
- As an immediate precautionary measure, isolate spill or leak area for at least 25 meters (75 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Consider initial downwind evacuation for at least 100 meters.

2) Environmental precautions and protective procedures:

- Ensure adequate ventilation..
- Runoff from fire control may cause pollution.

3) The methods of purification and removal:

- With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- Wet down with water and dike for later disposal.
- Prevent entry into waterways, sewers, basements or confined areas.

7. Handling and storage

- 1) Precautions for safe handling:
- Wash thoroughly after handling.
- 2) Conditions for safe storage:
- Store in a closed container.
 - Do not get water inside containers.
 - Keep away from waterways and sewers

8. Exposure controls/personal protection

1) Occupational Exposure Limits

	Polystyrene	Pentane	HBCD	Butane
Korean Occupation of Safety and Health Regulation	Not available	TWA : 600 ppm (1,800 mg/m ³) STEL : 750 ppm (2,250 mg/m ³)	Not available	Not available
ACGIH	Not available	TWA: 600 ppm	Not available	Not available
OSHA	Not available	TWA : 600 ppm (1,800 mg/m ³)	Not available	Not available
NIOSH	Not available	TWA: 120 ppm (350 mg/m ³)	Not available	Not available
Biological exposure index	Not available	Not available	Not available	Not available
EU Regulation	Not available	TWA: 1,000 ppm (3,000 mg/m ³)	Not available	Not available
Other	-Czech Republic: OEL-TWAs=5.0 mg/m ³ (aerosol) -Russia: OEL-MACs=10 mg/m ³ -Slovak Republic: OEL-TWAs= 5.0 mg/m ³ (total solid aerosol)	-Australia: OEL-TWAs=1,770mg/m ³ , OEL-STEL=2,210 mg/m ³ -Belgium: OEL-TWAs=1,800 mg/m ³ , OEL-STEL=3,600 mg/m ³ -Bulgaria: OEL-TWAs=3,000 mg/m ³ -China: OEL-TWAs=500 mg/m ³ , OEL-STEL=1,000 mg/m ³ -Czech Republic: OEL-TWAs=2,000 mg/m ³ -Denmark: OEL-TWAs=1,500 mg/m ³ -Finland: OEL-TWAs=1,500 mg/m ³ , OEL-STEL=1,900 mg/m ³ -Greece: OEL-TWAs=2,950 mg/m ³ , OEL-STEL=2,950 mg/m ³ -Italy: OEL-TWAs=2,000 mg/m ³ -Slovak Republic: OEL-TWAs=3,000mg/m ³	Not available	-Australia: OEL-TWAs=800 ppm, OEL-STEL=1,600 ppm -Belgium: OEL-TWAs=1,000 ppm -Bulgaria: OEL-TWAs=1,900 mg/m ³ -Canada: OEL-TWAs=600 ppm OEL-STEL=750 ppm -Denmark: OEL-TWAs=1,200 mg/m ³ -Finland: OEL-TWAs=800 ppm OEL-STEL=1,000 ppm -Germany: OEL-TWAs=1,000 ppm -Greece: OEL-TWAs=1,000 ppm -Ireland: OEL-TWAs=1,000 ppm -Slovak Republic: OEL-TWAs=1,000 ppm, OEL-STEL=5,000 ppm -Spain: OEL-TWAs=1,000 ppm

- 2) Appropriate engineering controls
 - Check legal suitability of exposure level.

3) Personal protective equipment:

- Respiratory protection: Wear NIOSH or European Standard EN 149 approved full or half face piece (with goggles) respiratory protective equipment when necessary.
- Eye protection:
 - An eye wash unit and safety shower station should be available nearby work place.
 - Wear safety glasses to protect eyes from scattering toxic substance.
- Hand protection: When material is heated, wear gloves to protect against thermal burns.
- Body protection: Please minimize body contact with appropriate industrial hygiene management.

9. Physical and chemical properties

1) Appearance	White sphericity bead / Solid
2) Odor	Odorless
3) Threshold of odor	Not applicable
4) pH	Not applicable
5) Melting point/freezing point	240 °C
6) Initial boiling point and boiling range	Not applicable
7) Flash point	345~360 °C
8) Evaporation rate	Not applicable
9) Flammability (solid, gas)	Not available
10) Upper/lower flammability or explosive limits.	Not applicable
11) Vapour pressure	Not applicable
12) Solubility(ies)	Insoluble
13) vapour density	Not applicable
14) Specific gravity /Density	1.04~1.111 g/cm ³ (20 °C)
15) n-octanol/water partition coefficient	Not available
16) Auto ignition temperature	488~496 °C
17) Degradation temperature	Not available
18) Viscosity	Not applicable
19) Molecular weight	Not available

10. Stability and reactivity

1) Chemical stability and Possibility of hazardous reactions:

- Stable under normal temperatures and pressures.

2) Conditions to avoid (e.g., static discharge, shock or vibration):

- Avoid heat, flames, sparks and other sources of ignition.
- Avoid contact with incompatible materials.

3) Incompatible materials: Not available

4) Hazardous decomposition products: Not available

11. Toxicological information

Information of Health Hazardous:

○ Acute toxicity:

- oral: Not classified (<94~96 % of this product consist of an ingredient of unknown toxicity)
ATEmix > 5,365.86 mg/kg bw
 - **Pentane:** LD50= 5,000 mg/kg bw (rat)
 - **HBCD:** LD50> 20,000 mg/kg bw (rat)
- dermal: Category 5 (<94~96 % of this product consist of an ingredient of unknown toxicity)
ATEmix > 3,251.234 mg/kg bw
 - **Pentane:** LD50= 3,000 mg/kg bw (rabbit)
 - **HBCD:** LD50> 20,000 mg/kg bw (rabbit)
- Inhalation: Not classified
ATEmix > 7.1113 mg/L/4hr
 - **Polystyrene(solid):** LC50=56.6 mg/L/30min (unit conversion: 7.075 mg/L/4hr) (rat)
 - **HBCD(solid):** LC50>200 mg/L/4hr (rat)
 - **Pentane(liquid):** LC50=295 mg/l/2hr (unit conversion: 147.5 mg/l/4hr) (mouse)
 - **Butane(gas):** LC50>658 mg/L/4hr(unit conversion: 27,680 ppm/4hr) (rat)

○ Skin Corrosion/ Irritation: Not classified (<94~96 % of this product consist of an ingredient of unknown toxicity)

- **Pentane:** In test on skin irritation with rabbits, skin irritation was not observed. (OECD TG 404)
- **HBCD:** In a primary skin irritation study three male and three female New Zealand White rabbits were used. Only a very slight erythema and barely perceptible irritation were noted. The results indicate that the test substance is not a primary skin irritant and minimally irritating to the skin.

○ Serious Eye Damage/Irritation: Not classified (93~95 % of this product consist of an ingredient of unknown toxicity)

- **Pentane:** Transient injury to the conjunctiva was observed after ocular exposure to a single installation of 0.1 ml n-pentane, whereas no corneal or iridal responses were observed.
- **HBCD:** Three male and 3 female New Zealand White rabbits were used for an eye irritation study. The group average scores 0.6, 1.0, 1.0, and 0 at the different time points respectively.
- **Butane:** In test with rabbits, eye irritation was not observed.

○ Respiratory sensitizer: Not available

○ Skin Sensitization: Not classified (<95~97% of this product consist of an ingredient of unknown toxicity)

- **Pentane:** In a Guinea Pig Maximisation test n-pentane did not show any sensitisation potential.

- Carcinogenicity: Not classified (<6~7 % of this product consist of an ingredient of unknown toxicity)
 - **Polystyrene:** IARC: 3
 - **HBCD:** Data from one lifetime bioassay with oral exposure for 18 months in mice is available. Responses associated with tumors were not observed.

- Mutagenicity: Not classified (93~95 % of this product consist of an ingredient of unknown toxicity)
 - **Pentane:** Negative reactions were observed in vitro(Ames test, Reverse mutation assay) and in vivo (Dominant lethal assay)
 - **HBCD:** HBCD was negative in both an in vitro chromosome aberration test and an in vivo micronucleus test.
 - **Butane:** Negative reactions were observed in vitro (Ames test) (OECD guideline 479)

- Reproductive toxicity: Not classified (<95~97 % of this product consist of an ingredient of unknown toxicity)
 - **Pentane:** In a 13-week subchronic inhalation toxicity study with male and female rats, no signs of toxicity were observed on the reproductive system by macroscopic or microscopic evaluation after exposure to n-pentane up to 20,000 mg/m³ (6,660 ppm).

- Specific target organ toxicity (single exposure): Not classified (<94~96 % of this product consist of an ingredient of unknown toxicity)
 - **Pentane:** It has caused narcotic effects in mice after 5 min exposure at a concentration of 96mg/l .
 - **HBCD:** In an acute oral toxicity study of HBCDD, 5 male and 5 female rats (Charles River CD strain) were used. Females: diarrhea in 1 out of 5, hypoactivity in 1 out of 5. Males: hypoactivity in 3 out of 5, corneal opacity in 3 out of 5 and ptosis in 3 out of 5. None of the animals died.

- Specific target organ toxicity (repeat exposure): Not classified (93~95 % of this product consist of an ingredient of unknown toxicity)
 - **Pentane:** In a recent 13-week sub-chronic inhalation toxicity study with rats, no systemic toxicity was observed following n-pentane exposure up to 20,000 mg/m³ (6,660 ppm).
 - **HBCD:** In 90-day oral toxicity with rats, liver weights increased at the lowest dose (100 mg/kg/day) in both sexes. Thyroid weights were increased at a mid dose in females. (300 mg/kg/day)
 - **Butane:** In 90-day inhalation toxicity with rats, there were no deaths and no other significant toxicological effects were found. (NOAEL=4489 ppm)

- Aspiration Hazard: Not classified (<95~97 % of this product consist of an ingredient of unknown toxicity)
 - **Pentane:** Based on the value of the kinematic viscosity for n-pentane ($3.58 \cdot 10^{-7}$ m²/s), n- pentane has the potential to cause chemical pneumonia.

12. Ecological information

1) Ecological toxicity:

- Acute toxicity: Category 1
- Chronic toxicity: Category 1

• Fish:

- **Polystyrene:** 48hr-LC50(*Oryzias latipes*)> 500 mg/l
- **Pentane:** 96hr-LC50(*Ozyrias latipes*)= 9.6 mg/l
- **HBCD:** 96hr-LC50(*Lepomis macrochirus*)>100 mg/l
- **Butane:** 96hr-LC50>1,000 mg/l

• Crustacea:

- **Pentane:** 96hr-EC50(*Daphnia magna*)= 9.74 mg/l
- **HBCD:** 48hr-EC50(*Daphnia magna*)> 0.0032 mg/l (OECD TG 202)

• Algae:

- **Pentane:** 96hr-EC50(*Scenedesmus subspicatus*)= 1.1 mg/l
- **HBCD:** 96hr-EC50(*Selenastrum capricornutum*)> 0.0025 mg/l (OECD TG 201)

2) Persistence and degradability:

 Persistence:

- **Pentane:** Low persistency (log Kow is less than 4 estimated. (log Kow=3.45)
- **HBCD:** High persistency (log Kow is more than 4 estimated. (log Kow=7.74 (estimated))
- **Butane:** Low persistency (log Kow is less than 4 estimated. (log Kow=2.89)

 Degradability: Not available

3) Bioaccumulative potential:

 Bioaccumulation:

- **Pentane:** Bioaccumulation is expected to be low according to the value of logKow<4 (log Kow=3.45) and BCF<500(BCF=171)
- **HBCD:** Bioaccumulation is expected to be high according to the value of logKow>4 (log Kow=7.74(estimated)) and BCF<500(BCF=181,000)

 Biodegradation:

- **Polystyrene:** In biodegradation test with activated sludge(30 mg/l), 2% biodegradation was observed after 28 days(OECD TG 302C)
- **Pentane:** In biodegradation test, 70% biodegradation was observed after 192 hours.
- **HBCD:** Not biodegradation (OECD TG 301D)
- **Butane:** In biodegradation test, 72.6 % biodegradation was observed after 35 day.

4) Mobility in soil:

- **Pentane:** Low potency of mobility to soil. (Koc values = 80 (estimated) L/kg)

13. Disposal considerations

1) Disposal method:

- Thermosetting waste synthetic resins and other waste synthetic polymer compounds shall be crushed, cut or melted to a size at which the maximum diameter is 15 cm or less and thereafter be disposed in a stable landfill facility.
- Non-thermosetting waste synthetic resins and other waste synthetic polymer compounds shall be incinerated.

2) Disposal precaution:

- Standard and method for disposing the designated waste
- All the generated waste shall be disposed in accordance with the specific standard and method prescribed in the Act so that the environmental pollution may be minimized in the course of collecting, carrying, keep and disposing the waste.
- The waste shall not flutter or flow out, and a bad smell shall not be diffused.
- The pollutants shall be disposed below the allowable exhaust standard.
- The waste shall be disposed in the waste disposal facility.

14. Transport information

- 1) UN Number: UN 2211
- 2) UN Proper shipping name: POLYMERIC BEADS, EXPANDABLE evolving flammable vapour
- 3) Transport Hazard class: 9
- 4) Packing group: III
- 5) Marine pollutant: Applicable
- 6) Special precautions:
 - in case of fire: F-A
 - in case of leakage: S-I

15. Regulatory information

Korea:

- Occupational Safety and Health Regulation:
 - **Pentane:** Occupational exposure limits listed
 - **Butane:** Occupational exposure limits listed
- Toxic Chemical Control Act:
 - **Polystyrene:** KE-13257 (Existing Chemical Substance)
 - **Pentane:** KE-27968 (Existing Chemical Substance)
 - **HBCD:** KE-18398 (Existing Chemical Substance), 2002-2-11 (Observational Chemicals)
- Dangerous Material Safety Management Regulation:
 - **Pentane:** Special inflammable, class 4 (50ℓ)
- Wastes Control Act:
 - **Polystyrene:** Public Controlled Waste (waste synthetic polymer compound)
 - **Pentane:** Public Controlled Waste

EU classification:

- **Pentane:**
 - Classification: F+; R12 Xn; R65 R66 R67 N; R51-53
 - Risk phrases: R12, R51/53, R65, R66, R67
 - Safety phrases: S2, S9, S16, S29, S33, S61, S62
 - EU Regulation 1272/2008: Flam. Liq. 2, Asp. Tox. 1, STOT SE 3, Aquatic Chronic 2
- **HBCD:** Candidate list of SVHC (Date of publication: Oct. 28, 2008)
- **Butane:**
 - Classification: F+; R12
 - Risk phrases: R12
 - Safety phrases: S2, S9, S16
 - EU Regulation 1272/2008: Flam. Gas 1, Press. Gas

U.S.A management information:

- OSHA (29CFR1910.119) : Not regulated
- CERCLA 103 (40CFR302.4): Not regulated
- EPCRA 302 (40CFR355.3): Not regulated
- EPCRA 304 (40CFR355.4): Not regulated
- EPCRA 313 (40CFR372.65): Not regulated
- **Polystyrene:** Inventory - United States - Section 8(b) Inventory (TSCA): XU

- **Pentane:** Inventory - United States - Section 8(b) Inventory (TSCA): T
- **HBCD:** Inventory - United States - Section 8(b) Inventory (TSCA): T
- **Butane:** Inventory - United States - Section 8(b) Inventory (TSCA): Butane

○ Japan management information:

- **Polystyrene:** Inventory-Existing and New Chemical Substances (ENCS): (6)-120
- **Pentane:** Inventory-Existing and New Chemical Substances (ENCS): (2)-5
- **HBCD:** Inventory-Existing and New Chemical Substances (ENCS): (3)-2254
- **Butane:** Inventory-Existing and New Chemical Substances (ENCS): (2)-4

○ China management information:

- **Polystyrene:** Inventory of Existing Chemical Substances (IECSC): Present
- **Pentane:** Inventory of Existing Chemical Substances (IECSC): Present
- **HBCD:** Inventory of Existing Chemical Substances (IECSC): Present
- **Butane:** Inventory of Existing Chemical Substances (IECSC): Present

○ Canada management information:

- **Polystyrene:** Inventory-Domestic Substances List (DSL): Present
- **Pentane:** Inventory-Domestic Substances List (DSL): Present
- **HBCD:** Inventory-Domestic Substances List (DSL): Present
- **Butane:** Inventory-Domestic Substances List (DSL): Present

○ Australia management information:

- **Polystyrene:** Inventory-Australia Inventory of Chemical Substances (AICS): Present
- **Pentane:** Inventory-Australia Inventory of Chemical Substances (AICS): Present
- **HBCD:** Inventory-Australia Inventory of Chemical Substances (AICS): Present
- **Butane:** Inventory-Australia Inventory of Chemical Substances (AICS): Present

○ New Zealand management information:

- **Polystyrene:** Inventory-New Zealand - Inventory of Chemicals (NZIoC): Present
- **Pentane:** Inventory-New Zealand - Inventory of Chemicals (NZIoC): Present
- **HBCD:** Inventory-New Zealand - Inventory of Chemicals (NZIoC): Present
- **Butane:** Inventory-New Zealand - Inventory of Chemicals (NZIoC): Present

○ Substance of Rotterdame Protocol: Not regulated

○ Substance of Stockholme Protocol: Not regulated

○ Substance of Montreal Protocol: Not regulated

1) Information source and references:

- ECB:ESIS (European chemical Substances Information System) (<http://ecb.jrc.it/esis>)
- International Uniform Chemical Information Database (IUCLID) (<http://ecb.jrc.it/esis>)
- RAR: http://ecb.jrc.ec.europa.eu/DOCUMENTS/Existing-Chemicals/RISK_ASSESSMENT/SUMMARY/n-pentanesum043.pdf
- U.S. National library of Medicine (NLM) Hazardous Substances Data Bank (HSDB):
<http://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+hsdb:@term+@na+PENTANE>

- IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT (Multivolume work)., p. S7 216 (1987)
- INCHEM: <http://www.inchem.org/documents/icsc/icsc/eics1043.htm>
- CHRIP: http://www.safe.nite.go.jp/data/hazkizon/pk_e_kizon_disp.html?k_no=0535
- RTECS: <http://csi.micromedex.com/DATA/RT/RTRZ9450000.HTM?Top=Yes>
- Envichem: http://wwwp.ymparisto.fi/scripts/Kemrek/Kemrek_uk.asp?Method=MAKECHEMdetails form&txtChemId=2477
- AKRON: <http://ull.chemistry.uakron.edu/erd/>
- ECHA SVHC support document
- THOMSON;LOLI: <http://csi.micromedex.com/fraMain.asp?Mnu=0>
- Korea Occupational Health & Safety Agency: <http://www.kosha.net>
- National chemicals information systems (<http://ncis.nier.go.kr>)

2) Issue date : 1996. 06. 01

3) Revision number and date : 2011. 03. 30 (6th)

4) Other material safety data sheet information:

- The contents of this MSDS documented and the information based on current knowledge and information. Some of the information contained in the information provided by the Korea Occupational Safety & Health Agency
- This MSDS were made of the informational purposes for the safe handling when education or use of the production department workers. Therefore we make no guarantee for result obtained, and assume no responsibility for damages incurred by use of this product. But the material used for the purpose of the data requested is available for further information.

<Record management>

Revision	Revision categories	Revision content	Revision date	Personnel
6th	Overall	Written in the form of GHS	2009.04.01	Kim Dae Gyeong
7th	Overall	Written in the form of GHS	2011.04.26	Kim Jae Pil