


MSDS	Material Safety Data Sheet
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TOLUENE

1. IDENTIFICATION OF THE SUBSTANCE AND OF THE COMPANY

PRODUCT NAME	Toluene
RECOMMENDED USE & RESTRICTIONS ON USE	Research use only
INFORMATION OF MANUFACTURER/IMPORTER/SUPPLIER	
COMPANY	
ADDRESS	
EMERGENCY PHONE	
E-MAIL ADDRESS	

2. HAZARDS IDENTIFICATION

GHS CLASSIFICATION	<p>Flammable liquids : Category 2 Acute toxicity(inhalation:vapour) : Category 4 Skin corrosion/irritation : Category 2 Serious eye damage/Eye irritation : Category 2 Reproductive toxicity : Category 1A Specific target organ toxicity Single exposure : Category 1 Specific target organ toxicity Single exposure : Category 3(anesthesia) Specific target organ toxicity Single exposure : Category 3(respiratory irritation) Specific target organ systemic toxicity Repeated exposure : Category 1 Aspiration toxicity : Category 1</p>	
	PICTOGRAM	
LABEL ELEMENTS	HAZARD SYMBOL	DANGER
	HAZARD STATEMENTS	<p>Highly flammable liquid and vapour. May be fatal if swallowed and enters airways. Causes skin irritation. Causes serious eye irritation.</p>

		<p>Harmful if inhaled.</p> <p>May cause drowsiness or dizziness.</p> <p>May cause respiratory irritation.</p> <p>Causes damage to organs.</p> <p>May damage fertility or the unborn child.</p> <p>Causes damage to organs through prolonged or repeated exposure.</p>
	<p>PRECAUTIONARY STATEMENTS</p>	<p>Obtain special instructions before use.</p> <p>Do not handle until all safety precautions have been read and understood.</p> <p>Keep away from heat/sparks/open flames/hot surfaces. No smoking.</p> <p>Keep container tightly closed.</p> <p>Ground/bond container and receiving equipment.</p> <p>Use explosion-proof electrical/ventilating/lighting equipment.</p> <p>Use only non-sparking tools.</p> <p>Take precautionary measures against static discharge.</p> <p>Do not breathe dust/fume/gas/mist/vapours/spray.</p> <p>Avoid breathing dust/fume/gas/mist/vapours/spray.</p> <p>Wash thoroughly after handling.</p> <p>Do not eat, drink or smoke when using this product.</p> <p>Use only outdoors or in a well-ventilated area.</p> <p>Wear protective gloves/protective clothing/eye protection/face protection.</p> <p>Use personal protective equipment as required.</p> <p>IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.</p> <p>IF ON SKIN: Gently wash with plenty of soap and water.</p> <p>IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.</p> <p>IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.</p> <p>IF IN EYES: Rinse cautiously with water for several minutes.</p> <p>Remove contact lenses, if present and easy to do. Continue</p>

		<p>rinsing.</p> <p>IF exposed: Call a POISON CENTER or doctor/physician.</p> <p>IF exposed or concerned: Get medical advice/attention.</p> <p>Call a POISON CENTER or doctor/physician if you feel unwell.</p> <p>Get medical advice/attention if you feel unwell.</p> <p>Specific treatment (see ... on this label).</p> <p>Do NOT induce vomiting.</p> <p>If skin irritation occurs: Get medical advice/attention.</p> <p>If eye irritation persists: Get medical advice/attention.</p> <p>Take off contaminated clothing and wash before reuse.</p> <p>In case of fire: Use ... for extinction.</p> <p>Store locked up.</p> <p>Store in a well-ventilated place. Keep container tightly closed.</p> <p>Store in a well-ventilated place. Keep cool.</p> <p>Dispose of this material and its container in accordance with local/regional/national/international regulation.</p>
OTHER HAZARDS (NFPA)	Health	2
	Fire	3
	Reactivity	0

3. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL IDENTITY	SYNONYMS	CAS NUMBER	ASSAY
Toluene	Methyl benzene; Methyl benzol; Phenylmethane; Toluol	108-88-3	Above 99.8%(HPLC); Above 99.7%(GR); Above 99.5%(EP)

4. FIRST AID MEASURES

GENERAL ADVICE	Wash off immediately with soap and plenty of water. In the case of respirable dust and/or fumes, use self-contained breathing apparatus and dust impervious protective suit. Use personal protective equipment.
IN CASE OF EYE CONTACT	Remove any contact lenses at once. Flush eyes well with flooding amounts of running water for at least 15 minutes. Assure adequate flushing by

	separating the eyelids with sterile fingers. If irritation persists, transport to a hospital immediately.
IN CASE OF SKIN CONTACT	Remove contaminated clothes and shoes, rinse skin with plenty of water or shower. Use soap to help assure removal. If irritation persists, transport to a hospital immediately.
IF INHALED	Move victim to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, administer artificial respiration. Maintain normal body temperature with a blanket. If irritation persists, transport to a hospital immediately.
IF SWALLOWED	Rinse mouth, give plenty of water to dilute the substance. Do not induce vomiting. Never give anything by mouth to an unconscious person. Transport to a hospital immediately.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA	Carbon dioxide, dry chemical powder, foam, water fog
SPECIFIC HAZARDS ARISING FROM THE CHEMICAL	Flammable liquid. Hazardous toxic and irritating fumes or smoke may be emitted. Vapors may travel considerable distance to ignition source and flash back.
SPECIAL PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS:	Firemen should wear normal protective equipment(full bunker gear)and positive-pressure self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS	Remove ignition sources and ventilate the area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin and eyes.
ENVIRONMENTAL PRECAUTIONS	Prevent spills from entering sewers, watercourses or low areas.
METHODS FOR CLEANING UP	Do not touch spilled material without suitable protection. After material is completely picked up, wash the spill site with soap and water and ventilate the area. Put all wastes in a plastic bag for disposal and seal it tightly.

	Remove, clean, or dispose of contaminated clothing.
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7. HANDLING AND STORAGE

PRECAUTION FOR SAFE HANDLING	Avoid contact with eyes, skin and clothing. Avoid prolonged or repeated exposure. Handle material with suitable protection away from source of heat or ignition and use non-sparking type tools. This material is highly volatile.
CONDITIONS FOR SAFE STORAGE	Store away from sunlight in well-ventilated dry place at room temperature (preferably cool place). Keep container tightly closed. See also the indication described on label for handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE STANDARDS	ACGIH	TWA 50 ppm
APPROPRIATE ENGINEERING CONTROLS:	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.	
INDIVIDUAL PROTECTION MEASURES	RESPIRATORY PROTECTION	Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup Sigma-Aldrich - 270997 Page 4 of 7 to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
	EYE PROTECTION	Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
	SKIN PROTECTION	Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique(without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws

		and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.
	BODY PROTECTION	Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	FORM	Liquid
	COLOR	Colorless
ODOUR		Characteristic odor
ODORODOUR THRESHOLD VALUE		2.14 ppm
pH		No data
FREEZING POINT :		-95 °C
INITIAL BOILING POINT		111 °C
FLASH POINT		4 °C (c.c.)
EVAPORATING RATE		No data
FLAMMABILITY(solid, gas)		No data
EXPLOSIVE LIMITS		7.1 / 1.1 %
VAPOR PRESSURE		28.4 mmHg (25°C)
SOLUBILITY IN	WATER	0.0526 g/100mL (25 °C)
VAPOR DENSITY		3.1 (Air=1)
RELATIVE DENSITY		0.8636
PARTITION COEFFICIENT: N-OCTANOL/WATER		2.73
AUTOIGNITION TEMPERATURE		480 °C
DECOMPOSITION TEMPERATURE		No data
VISCOSITY		0.56 cP (25 °C)
MOLECULAR WEIGHT		92.14

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY & POSSIBILITY	Highly flammable liquid and vapour. May cause fire and
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OF HAZARDOUS REACTIONS	explosion by violent polymerization. At(or above) flash point, may form explosive mixture. Container may explode when heated. High flammable: easily ignite by heat, sparks, flames.
CONDITIONS TO AVOID	Sunlight, heat, open flames, high temperature, sparks, static electrical charge, other ignition sources
INCOMPATIBLE MATERIALS	Oxidizers, dinitrogen tetraoxide, silver perchlorate, tetranitromethane, uranium hexafluoride
HAZARDOUS DECOMPOSITION PRODUCTS	Carbon monoxide

11. TOXICOLOGICAL INFORMATION

INFORMATION ON THE LIKELY ROUTES OF EXPOSURES:	No data	
HEALTH HAZARD INFORMATION	ACUTE TOXICITY	LD50(oral,rat): 636mg/kg(RTECS) LC50(ihl,rat): 49gm/m ³ /4H(RTECS) LD50(skin,rabbit): 14100µL/kg(RTECS) LD50(oral,rat): 2600,5500,5580,5900,6400,7000,7530mg/kg(EU-RAR No.30,2003) LD50(oral,rat): 4800mg/kg(Calculate) TCLo(ihl,human): 750mg/m ³ /8H(RTECS) LC50(ihl,rat): 12.5, 28.1, 28.8, 33mg/m ³ /4H(EU-RAR No.30,2003) LC50(ihl,rat): 18mg/m ³ /4H = 4.800ppm(Calculate)
	SKIN CORROSION/ SKIN IRRITATION	Rabbit; 20mg/24H; Moderate(RTECS)
	EYE DAMAGE/ EYE IRRITATION	Rabbit; Moderate(EU-RAR)
	RESPIRATORY SENSITIZATION	No data
	SKIN SENSITIZATION	Guinea pig; Negative

	CARCINOGENICITY	IARC: Group 3 OSHA: No data ACGIH: A4 NTP: No data EU CLP: No data
	GERM CELL MUTAGENICITY	Micronucleus test; mouse; ipr; 433µg/kg/24H (RTECS) Sister chromatid exchange; human; ihl; 252µg/L/19Y (RTECS)
	TOXIC TO REPRODUCTION	TDLo(ori,rat): 16mL/kg(6-21D preg); Effects on Newborn - phisycal(RTECS) TCLo(ihl,rat): 1800ppm(7-20D preg); Specific Developmental Abnormalities - Central Nervous System (RTECS) Human; "the study suggests an increased risk of late spontaneous abortions associated with exposure to toluene at levels around 88 ppm (range 50-150 ppm). The results of this study are used as a basis for the risk characterisation of developmental toxicity in humans."(EU-RAR)(IRIS,IARC,EHC,ATSDR)
	SPECIFIC TARGET ORGAN TOXICITY SINGLE EXPOSURE	Human;ihl, 50-100ppm, feebleness, sleepiness, dizziness(CERI) Human;ihl, 200-400ppm, paresthesia, vomituration(CERI) Human;ihl, 500-800ppm, drunkenness, derangement, gait abonormality(CERI) Human: irritation for eye, nose and throat(EU-RAR)
	SPECIFIC TARGET ORGAN TOXICITY REPEATED EXPOSURE	Human; ihl, stenosis for range of vision, headache with deafness and eye nystagmus, trembling, dynamic ataxia, amnesia, cerebral atrophy, renal dysfunction(CERI hazard sheet, 96-4,1997) Human; The increasing of SGOT, hepatotoxicity with the adipose degeneration in liver cell and lymphocyte cell wetting(EU-RAR No.30, 2003)Animal; "The decrease in the number of red blood cells and the

		lymphocyte , the malformation of the circulating erythrocyte and the neutrophilic leukocyte. ""The decrease in the number of circulating erythrocyte and the lymphocyte and nucleated cell in spleen" "Decrease of white blood corpuscle" "Decrease of solid myeloma cell having nucleus cell, and Decrease in number of marrow multipotent stem cells" (EHC 150 1993),"Increase in the mean corpuscular volume in red blood cell, and Decrease of red blood corpuscle, white blood corpuscle, lymphocyte, hematocrit " (IRIS 2002)
	ASPIRATION HAZARD	This substance is a hydrocarbon. kinematic viscosity = 0.65mm ² /s(25 °C =77 °F)

12. ECOLOGICAL INFORMATION

ECOTOXICITY	TO FISH	LC50(orange-red killifish): 25mg/L/96hr
	TO CRUSTACEA	EC50(brown shrimp): 3.5mg/L/96hr (EU-RAR,2003) EC50(daphnids): 4.1mg/L/48hr
	TO OTHER AQUATIC LIFE	No data
PERSISTENCE/ DEGRADABILITY	PERSISTENCE	log Kow 2.73 (HSDB (2005))
	DEGRADABILITY	No data
BIOACCUMULATION POTENTIAL	ACCUMULATION	No data
	BIODEGRADABILITY	86 (%) 20 day
MOBILITY IN SOIL		No data
OTHER ADVERSE EFFECTS		No data

13. DISPOSAL CONSIDERATION

DISPOSAL METHODS	Use only licensed transporters and permitted facilities for waste disposal.
DISPOSAL CONSIDERATIONS	Dispose of this material and its container in accordance with local/regional/national/international regulation.

14. TRANSPORT INFORMATION

IATA	
UN NUMBER	1294
UN PROPER SHIPPING NAME	TOLUENE
TRANSPORT HAZARD CLASS	3
PACKING GROUP	2
MARINE POLLUTANT	No data
SPECIAL PRECAUTIONS FOR USER	
IN CASE OF FIRE	F – E
IN CASE OF LEAK	S - D

15. REGULATORY INFORMATION

Occupational Safety and Health Act	Substance Requiring Working Environment Measurement (period : 6 month) Hazardous Substance Requiring Management Substance Requiring Exposure Standards	
Toxic Chemicals Control Act	Listed	
Safety Control of Dangerous Substance Act	4-I ; 200L	
Wastes Control Act	Controlled Waste	
Persistent Organic Pollutants Control Act	Not listed	
US REGULATIONS	OSHA	Not listed
	CERCLA	453.599 kg 1000 lb
	EPCRA302	Not listed
	EPCRA304	Not listed
	EPCRA313	Listed
	ROTTERDAM CONVENTION	Not listed
	STOCKHOLM CONVENTION	Not listed
	MONTREAL PROTOCOL	Not listed
EU CLASSIFICATION INFORMATION	CLASSIFICATION	F; R11 Repr.Cat.3; R63 Xn; R48/20-65 Xi; R38 R67
	RISK PHRASES	R11, R38, R48/20, R63, R65, R67

	SAFETY PHRASES	S2, S36/37, S46, S62
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15. OTHER INFORMATION	
REFERENCES AND SOURCES FOR DATA	Korea Occupational Safety & Health Agency Wako Corporation Sigma Aldrich Corporation
ORIGINATED DATE	
REVISION NUMBER AND DATE	
OTHER	The information in this MSDS is based on several references and the present state of our knowledge. However, the MSDS dose not always cover all information about product. The information in this MSDS is only provision of information, and It does not represent any guarantee of the properties of the product.