SAFETY DATA SHEETS

According to Globally Harmonized System of Classification and Labelling of Chemicals (GHS) - Sixth revised edition

Version: 1.0

Creation Date: Aug 12, 2017

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1. Identification

1.1 GHS Product identifier

Product name	benzene

1.2 Other means of identification

Product number	-
Other names	Benzole

1.3 Recommended use of the chemical and restrictions on use

Identified uses	For industry use only. Hydrocarbons (contain hydrogen and carbon atoms), Volatile organic compounds
Uses advised against	no data available

2. Hazard identification

2.1 Classification of the substance or mixture

Flammable liquids, Category 2

Skin irritation, Category 2

Eye irritation, Category 2

Aspiration hazard, Category 1

Germ cell mutagenicity, Category 1B

Carcinogenicity, Category 1A

Specific target organ toxicity – repeated exposure, Category 1

2.2 GHS label elements, including precautionary statements

Pictogram(s)

Signal word

Danger

Hazard statement(s)

H225 Highly flammable liquid and vapour

H315 Causes skin irritation

H319 Causes serious eye irritation

H304 May be fatal if swallowed and enters airways

H340 May cause genetic defects

H350 May cause cancer

Precautionary statement(s)

Prevention

P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P233 Keep container tightly closed.

P240 Ground and bond container and receiving equipment.

P241 Use explosion-proof [electrical/ventilating/lighting/...] equipment.

P242 Use non-sparking tools.

P243 Take action to prevent static discharges.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P264 Wash ... thoroughly after handling.

P201 Obtain special instructions before use.

P202 Do not handle until all safety precautions have been read and understood.

	P260 Do not breathe dust/fume/gas/mist/vapours/spray.
	P270 Do not eat, drink or smoke when using this product.
Response	P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].
	P370+P378 In case of fire: Use ... to extinguish.
	P302+P352 IF ON SKIN: Wash with plenty of water/...
	P321 Specific treatment (see ... on this label).
	P332+P313 If skin irritation occurs: Get medical advice/attention.
	P362+P364 Take off contaminated clothing and wash it before reuse.
	P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
	P337+P313 If eye irritation persists: Get medical advice/attention.
	P301+P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor/⋯
	P331 Do NOT induce vomiting.
	P308+P313 IF exposed or concerned: Get medical advice/ attention.
	P314 Get medical advice/attention if you feel unwell.
Storage	P403+P235 Store in a well-ventilated place. Keep cool.
	P405 Store locked up.
Disposal	P501 Dispose of contents/container to ...

2.3 Other hazards which do not result in classification

none

3. Composition/information on ingredients

3.1 Substances

Chemical name	Common names and synonyms	CAS number	EC number	Concentration
benzene	benzene	71-43-2	none	100%

4. First-aid measures

4.1 Description of necessary first-aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled

Fresh air, rest. Refer for medical attention.

In case of skin contact

Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention .

In case of eye contact

First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.

If swallowed

Rinse mouth. Do NOT induce vomiting. Refer for medical attention .

4.2 Most important symptoms/effects, acute and delayed

Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction, nausea, and vomiting. Coma and possible death. (USCG, 1999)

4.3 Indication of immediate medical attention and special treatment needed, if necessary

Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a

demand-valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR as necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. /Benzene and Related Compounds/

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media

Approach fire from upwind to avoid hazardous vapors. Use water spray, dry chemical, foam, or carbon dioxide. Use water spray to keep fire-exposed containers cool.

5.2 Specific hazards arising from the chemical

Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. (USCG, 1999)

5.3 Special protective actions for fire-fighters

Wear self-contained breathing apparatus for firefighting if necessary.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Remove all ignition sources. Evacuate danger area! Consult an expert! Personal protection: complete protective clothing including self-contained breathing apparatus. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent. Then store and dispose of according to local regulations.

6.3 Methods and materials for containment and cleaning up

For spills on water, contain with booms or barriers, use surface acting agents to thicken spilled materials. Remove trapped materials with suction hoses.

7. Handling and storage

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Avoid exposure - obtain special instructions before use.Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Fireproof. Separated from food and feedstuffs, oxidants and halogens. Store in an area without drain or sewer access.Keep in well closed containers in a cool place and away from fire.

8. Exposure controls/personal protection

8.1 Control parameters

Occupational Exposure limit values

NIOSH usually recommends that occupational exposures to carcinogens be limited to the lowest feasible concentration.

Recommended Exposure Limit: 10 Hour Time-Weighted Average: 0.1 ppm.

Recommended Exposure Limit: 15 Minute Short-Term Exposure Limit: 1 ppm.

Biological limit values

no data available

8.2 Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 Individual protection measures, such as personal protective equipment (PPE)

Eye/face protection

Safety glasses with side-shields conforming to EN166. Use equipment for eye protection tested and approved under appropriate government standards such

as NIOSH (US) or EN 166(EU).

Skin protection

Wear impervious clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace. 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.

Respiratory protection

Wear dust mask when handling large quantities.

Thermal hazards

no data available

9. Physical and chemical properties

Physical state	clear colorless liquid with a petroleum-like odor
Colour	Clear, colorless liquid
Odour	Aromatic odor
Melting point/ freezing point	-11°C(lit.)
Boiling point or initial boiling point and boiling range	80°C(lit.)
Flammability	Highly flammable.
Lower and upper explosion limit / flammability limit	Lower flammable limit: 1.2% by volume; Upper flammable limit: 7.8% by volume
Flash point	-11°C
Auto-ignition temperature	561.67°C
Decomposition temperature	no data available
pH	no data available
Kinematic viscosity	0.604 mPa.s at 25°C
Solubility	In water:0.18 g/100 mL
Partition coefficient n-	log Kow = 2.13

octanol/water (log value)	
Vapour pressure	166 mm Hg (37.7 °C)
Density and/or relative density	0.874g/mLat 25°C(lit.)
Relative vapour density	2.77 (vs air)
Particle characteristics	no data available

10. Stability and reactivity

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

A dangerous fire hazard when exosed to heat or flame. ... Ignites on contact with sodium peroxide + water, dioxygenyl tetrafluoroborate, iodine heptafluoride, and dioxygen difluoride.The vapour is heavier than air and may travel along the ground; distant ignition possible. As a result of flow, agitation, etc., electrostatic charges can be generated.Benzene vapors are heavier than air. They will spread along the ground and collect and stay in poorly-ventilated, low-lying, or confined areas (e.g., sewers, basements, and tanks).Hazardous concentrations may develop quickly in enclosed, poorly-ventilated, or low-lying areas. Keep out of these areas. Stay upwind.Benzene liquid is less dense than water and will float on the surface of water.BENZENE reacts vigorously with allyl chloride or other alkyl halides even at -70° C in the presence of ethyl aluminum dichloride or ethyl aluminum sesquichloride. Explosions have been reported [NFPA 491M 1991]. Ignites in contact with powdered chromic anhydride [Mellor 11:235 1946-47]. Incompatible with oxidizing agents such as nitric acid. Mixtures with bromine trifluoride, bromine pentafluoride, iodine pentafluoride, iodine heptafluoride and other interhalogens can ignite upon heating [Bretherick 5th ed. 1995]. Benzene and cyanogen halides yield HCl as a byproduct (Hagedorn, F. H. Gelbke, and Federal Republic of Germany. 2002. Nitriles. In Ullmann's Encyclopedia of Industrial Chemistry. Wiley-VCH Verlag GmbH & Co. KGaA.). The reaction of benzene and trichloroacetonitrile evolves toxic chloroform and HCl gases. (Hagedorn, F., H.-P. Gelbke, and Federal Republic of Germany. 2002. Nitriles. In Ullmann's Encyclopedia of Industrial Chemistry. Wiley-VCH Verlag GmbH & Co. KGaA.).

10.4 Conditions to avoid

no data available

10.5 Incompatible materials

Reacts violently with iodine pentafluoride.

10.6 Hazardous decomposition products

no data available

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11. Toxicological information

Acute toxicity

- Oral: LD50 Rat oral 3306 mg/kg
- Inhalation: no data available
- Dermal: no data available

Skin corrosion/irritation

no data available

Serious eye damage/irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

NTP: Known to be a human carcinogen. EPA: Known human carcinogen. IARC: Carcinogenic to humans

Reproductive toxicity

There is some evidence from human epidemiological studies of reproductive and developmental toxicity of benzene, however the data do not provide conclusive evidence of a link between exposure and effect (4). Animal studies have provided limited evidence that exposure to benzene may affect

reproductive organs, however these effects were only observed at exposure levels over the maximum tolerated dose . Adverse effects on the fetus, including low birth weight, delayed bone formation, and bone marrow damage, have been observed where pregnant animals were exposed to benzene by inhalation.

STOT-single exposure

no data available

STOT-repeated exposure

no data available

Aspiration hazard

no data available

12. Ecological information

12.1 Toxicity

- Toxicity to fish: LC50; Species: Salmo trutta (brown trout) yearlings; Conditions: static bioassay; Concentration: 12 mg/L for 1 hr
- Toxicity to daphnia and other aquatic invertebrates: EC50; Species: Daphnia magna (Water Flea) age <24 hr; Conditions: freshwater, static, 20°C, pH 8.2, hardness 130 mg/L CaCO3; Concentration: 18000 ug/L for 24 hr (95% confidence interval: 14810-21900 ug/L); Effect: intoxication, immobilization />99.7% purity
- Toxicity to algae: EC50; Species: Chlorella vulgaris (Green Algae); Conditions: freshwater, static, 20°C; Concentration: 525000 ug/L for 24 hr; Effect: growth, general /formulation
- Toxicity to microorganisms: no data available

12.2 Persistence and degradability

AEROBIC: Benzene present at 100 mg/L, reached 40% of its theoretical BOD in 2 weeks using an activated sludge inoculum at 30 mg/L in the Japanese MITI test(1). Benzene reached 24% of its theoretical oxygen demand in a non-acclimated microbial population after 15 days(2). Aerobic biodegradation of benzene was studied in pre-equilibrated soil-water slurry microcosms(3). Using an enriched aerobic bacterial culture, benzene began to degrade 12 hrs after incubation in an aqueous(soil-free) solution with 50% of benzene degrading after 60 hrs and almost complete degradation within 90 hrs. Using a pre-

equilibrated soil-water slurry microcosm, benzene did not begin to degrade until 3 days after application and reached complete degradation after about 12 days(3).

12.3 Bioaccumulative potential

Benzene has BCFs ranging from 1.1-20(1). According to a classification scheme(2), this BCF range suggests the potential for bioconcentration in aquatic organisms is low. The uptake and elimination rate constants for benzene in fathead minnows were studied(3). Fathead minnows were found to have an average uptake rate of 7 L/kg/hr with an average elimination rate of 0.384/hr which corresponds to a BCF of 19(3). In a study of BCF values for various aquatic species, benzene was found to have a BCF value of 3.5 in eels(4), 4.4 in pacific herring(5), and 4.3 in goldfish(6).

12.4 Mobility in soil

An experimentally derived log Koc of 1.93 (Koc = 85) was obtained via reverse phase HPLC (high performance liquid chromatography) with a cyanopropyl column and a mobile phase of water(1). According to a classification scheme(2), this estimated Koc value suggests that benzene is expected to have high mobility in soil. The sorption equilibrium for benzene in a soil/water mixture (ratio soil/water 0.12 kg/l) took 72 hrs(3). The Koc for benzene has also been experimentally determined to be 79(4).

12.5 Other adverse effects

no data available

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13. Disposal considerations

13.1 Disposal methods

Product

The material can be disposed of by removal to a licensed chemical destruction plant or by controlled incineration with flue gas scrubbing. Do not contaminate water, foodstuffs, feed or seed by storage or disposal. Do not discharge to sewer systems.

Contaminated packaging

Containers can be triply rinsed (or equivalent) and offered for recycling or reconditioning. Alternatively, the packaging can be punctured to make it unusable for other purposes and then be disposed of in a sanitary landfill.

Controlled incineration with flue gas scrubbing is possible for combustible packaging materials.

14. Transport information

14.1 UN Number

ADR/RID: UN1114 IMDG: UN1114 IATA: UN1114

14.2 UN Proper Shipping Name

ADR/RID: BENZENE
IMDG: BENZENE
IATA: BENZENE

14.3 Transport hazard class(es)

ADR/RID: 3 IMDG: 3 IATA: 3

14.4 Packing group, if applicable

ADR/RID: II IMDG: II IATA: II

14.5 Environmental hazards

ADR/RID: no IMDG: no IATA: no

14.6 Special precautions for user

no data available

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

no data available

15. Regulatory information

15.1 Safety, health and environmental regulations specific for the product in question

Chemical name	Common names and synonyms	CAS number	EC number
benzene	benzene	71-43-2	none
European Inventory of Existing Commercial Chemical Substances (EINECS)			Listed.

EC Inventory	Listed.
United States Toxic Substances Control Act (TSCA) Inventory	Listed.
China Catalog of Hazardous chemicals 2015	Listed.
New Zealand Inventory of Chemicals (NZIoC)	Listed.
Philippines Inventory of Chemicals and Chemical Substances (PICCS)	Listed.
Vietnam National Chemical Inventory	Listed.
Chinese Chemical Inventory of Existing Chemical Substances (China IECSC)	Listed.

16. Other information

Information on revision

Creation Date	Aug 12, 2017
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Abbreviations and acronyms

- CAS: Chemical Abstracts Service
- ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
- RID: Regulation concerning the International Carriage of Dangerous Goods by Rail
- IMDG: International Maritime Dangerous Goods
- IATA: International Air Transportation Association
- TWA: Time Weighted Average
- STEL: Short term exposure limit
- LC50: Lethal Concentration 50%
- LD50: Lethal Dose 50%
- EC50: Effective Concentration 50%

References

- IPCS - The International Chemical Safety Cards (ICSC), website: http://www.ilo.org/dyn/icsc/showcard.home
- HSDB - Hazardous Substances Data Bank, website: https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm
- IARC - International Agency for Research on Cancer, website:

http://www.iarc.fr/

- eChemPortal - The Global Portal to Information on Chemical Substances by OECD, website: http://www.echemportal.org/echemportal/index?pageID=0&request_locale=en
- CAMEO Chemicals, website: http://cameochemicals.noaa.gov/search/simple
- ChemIDplus, website: http://chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp
- ERG - Emergency Response Guidebook by U.S. Department of Transportation, website: http://www.phmsa.dot.gov/hazmat/library/erg
- Germany GESTIS-database on hazard substance, website: http://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp
- ECHA - European Chemicals Agency, website: https://echa.europa.eu/
