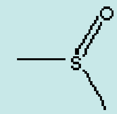
DIMETHYL SULFOXIDE



PRODUCT IDENTIFICATION	
CAS NO.	67-68-5
EINECS NO.	200-664-3
FORMULA	$(CH_3)_2SO$
MOL WT.	78.13
H.S. CODE	2930.90
TOXICITY	Oral rat LD50: 14500 mg/kg
SYNONYMS	Methylsulfinylmethane; Dimethyl sulfoxyde; Methyl sulfoxide; DMSO; Sulfinylbis(methane); Dimetil sulfóxido (Spanish); Diméthylsulfoxyde (French);
DERIVATION	
CLASSIFICATION	

PHYSICAL AND CHEMICAL PROPERTIES	
PHYSICAL STATE	Clear liquid with garlic like odor
MELTING POINT	18.0 - 18.5 C
BOILING POINT	189 C
SPECIFIC GRAVITY	1.101
SOLUBILITY IN WATER	Soluble
pH	
VAPOR DENSITY	2.7
AUTOIGNITION	
NFPA RATINGS	Health: 1; Flammability: 1; Reactivity: 0
REFRACTIVE INDEX	1.4775 - 1.4790
FLASH POINT	
STABILITY	Stable under ordinary conditions. Hygroscopic

GENERAL DESCRIPTION & APPLICATIONS

Sulfoxide (R_2SO) is any of various organic sulfur compounds having the group -SO (sulfinyl group) whereas sulfone (RSOOR) with the group $-SO_2$ (sulfonyl group). They are derived from oxidation of sulfides ((R-S-R). Thioethers (organic sulfides) can be oxidized either to oxidation state -1 "disulfides (R-S-S-R)" or to oxidation state 0 "sulfoxides (R-S(=O)-R)" which can be further oxidized to the corresponding oxidation state +2 "sulfones $(R-S(=O)_2-R)$" depending on the structure of the thioether. They are widely used as solvent of both extraction and reaction as well as intermediates for the synthesis of textile chemicals and pharmaceuticals and agrochemicals.

Dimethyl sulfoxide (DMSO) is a clear hygroscopic liquid; melting point 18 C; boiling point 189 C. It is has little odor. It smells garlic like odor due to the impurity of dimethyl sulfide. It is miscible with water; readily soluble in almost all organic solvents such as alcohols, esters, ketones, chlorinated solvents and aromatic hydrocarbons. Dimethyl sulfoxide is produced as a by-product of wood pulping. DMSO is a highly dipolar organic liquid, that is used as a powerful solvent in organic synthesis and industrial applications including paint stripper and coating remover as the alternative to chlorinated solvents and nitroalkanes. DMSO's high polarity solvates polymeric materials by itself or in combination with other solvents. Its application is extended as a chemical reactant undergoing a chemical change. DMSO proved to be an excellent reaction solvent for S_N2 alkylation. DMSO is used in oxidation reactions which a primary or secondary alcohol is oxidized to the corresponding aldehyde or ketone (Swern oxidation). Sulfoxonium ion reacts with sodium hydride to form sulfur ylide which converts carbonyl to epoxide (Johnson-Corey-Chaykovsky reaction). It is widely used in the synthesis of pharmaceuticals, biocides and pesticides insecticides as a reactant, reaction solvent, in combinations of these applications. Some examples arediphenyl ether compounds, imidazolinone compounds, and pyrethroids.

The catalysts in hydrocracking, hydrodenitrification, hydrodesulfurization and reforming processes are used in oxide forms, which must be converted to the active sulfide form during the start-up to prevent the reduction of the catalysts to their base material by heat. The sulfur sources include alkyl mercaptans (methyl mercaptan, ethyl mercaptan, butyl mercaptan), dimethyl sulfide, dimethyl sulfoxide, dimethyl disulfide, and tert-nolyl polysulfide. They are used to modify the reactivity of catalysts to use in high temperature process furnaces. Dimethyl Sulfoxide is used as an effective extraction solvent and solvent improver for the separation of aromatic compounds (benzene, toluene and xylenes) from aliphatic hydrocarbons, and for fractionation of unsaturated components (olefins and alkynes) from saturated feedstock.

Pharmaceutical grade DMSO demonstrates a range of pharmacological activity including analgesia and anti-inflammation. Due to its ability to penetrate biological membranes, it is used as a vehicle for the transdermal delivery of active pharmaceuticals. It is also used to protect tissue during cryopreservation

SALES SPECIFICATION

INDUSTRIAL GRADE	
APPEARANCE	Clear liquid
ASSAY (GLC)	99.8% min
MELTING POINT	18 C min
ACID VALUE	0.03 max ((mg KOH/g)
COLOR, APHA	10 max
WATER	0.1% max
PHARMACEUTICAL GRADE	
APPEARANCE	Clear liquid
ASSAY (GLC)	99.9% min
ACID VALUE	0.03 max ((mg KOH/g)
WATER	0.1% max
UV ABSORBANCE	0.3 max (275nm), 0.2 max (295nm)
COLOR, APHA	10 max

TRANSPORTATION

PACKING	220kgs in drum
HAZARD CLASS	
UN NO.	

OTHER INFORMATION

European Hazard Symbols: XI, Risk Phrases: 36/37/38, Safety Phrases: 26-37/39

GENERAL DESCRIPTION OF SOLVENT

Solvent is a substance, usually a liquid, that acts as a dissolving agent or that is capable of dissolving another substance. In solutions of solids or gases in a liquid, the liquid is the solvent. In all other homogeneous mixtures (i.e., liquids, solids, or gases dissolved in liquids; solids in solids; and gases in gases), solvent is the component of the greatest amount. The minor proportion substances are called solutes. The solvent offers several functions during a chemical reaction. It solves not only the substance that reacts with another one to produce a new set of substances (reactant) but also the compound that supplies the molecule, ion, or free radical, which is considered as the attacking species in a chemical reaction (reagent). The solvent is conductive to collisions between the reactants and reagents to transform the reactants to new products. The solvent also takes roll of temperature control, either to provide the energy of the colliding particles for speedy reaction and to absorb heat in exothermic reaction. The appropriate solvent should be selected based on the inactivity in the reaction conditions, dissolving the reagents as well as reactants, appropriate boiling point and easy removal at the end of the reaction.

Polarity

The most common solvent is water. Other common solvents which dissolve substances that are insoluble (or nearly insoluble) in water are acetone, alcohol, formic acid, acetic acid, formamide. BTX, carbon disulfide, diemthyl sulfoxide, carbon tetrachloride, chloroform, ether, tetrahydrofuran, furfural, hexane and turpentine. They may be classified as polar and non-polar. Polar solvents, like water, have molecules whose electric charges are unequally distributed, leaving one end of each molecule more positive than the other. Usually polar solvent has O-H bond of which water (HOH), (CH_3OH) and acetic acid (CH_3COOH) are examples. Propanol, butanol, formic acid, formamide are polar solvents. Dipolar solvents which contain a C-O solid bond without O-H bond are acetone [$(CH_3)_2C=O$], ethyl acetate ($CH_3COOCH_2CH_3$), methyl ethyl ketone, acetonitrile, N,N-dimethylformamide and diemthyl sulfoxide. Nonpolar solvents, like carbon tetrachloride (CCl_4), benzene (C_6H_6), and diethyl ether ($CH_3CH_2OCH_2CH_3$), have molecules whose electric charges are equally distributed and are not miscible with water. Hexane, tetrahydrofuran and methylene chloride are non-polar solvents. Polar solvents are hydrophilic but non-polar solvents are lipophilic. Polar reactants will dissolve in polar solvents. Non-polar solvents dissolve non-polar compounds best. Oil and water don't mix but separate into two layers. There are three measures of the polarity as "dipole moment", "dielectric constant" and "miscibility with water". Though low dipole moments and small dielectric constants indicates non-polar solvents, sharp boundaries between polar and non-polar solvents are not available. The polarity reflects the balance between a polar component (OH) and a non-polar hydrocarbon component, existing in the same molecule. If hydrocarbon character increases relatively, the polarity decreases. On an operational basis, solvents that are miscible with water are polar.

Polar Protic and Dipolar Aprotic

Protic refers to a hydrogen atom attached to an electronegative atom. Protic solvents can donate an H+ (proton) since they contain dissociable H+, such as hydrogen attached to oxygen as in a hydroxyl group, nitrogen as in a amine group. Examples are water, methanol, ethanol, formic acid, hydrogen fluoride and ammonia. Aprotic solvents don't has O-H bond but a C=O bond typically. Examples are acetone [$(CH_3)_2C=O$] and ethyl acetate ($CH_3COOCH_2CH_3$). Polar protic solvents are useful in S_N1 reaction, while polar aprotic solvents are S_N2 reaction.