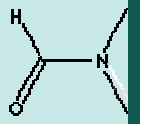
DIMETHYLFORMAMIDE



PRODUCT IDENTIFICATION

CAS NO.	68-12-2
EINECS NO.	200-679-5
FORMULA	$HCON(CH_3)_2$
MOL WT.	73.09
H.S. CODE	2924.10
TOXICITY	Oral rat LD50: 2800 mg/kg
SYNONYMS	N,N-Dimethylformamide; N-Formyldimethylamine; Dimethylamid kyseliny mravenci; (Czech); Dimethylformamid (German); Dimetilformamide (Italian) N,N-Dimetilformamida (Spanish); DMF; Dwumetyloformamid (Polish); N,N-Dimethylmethanamide; Formic acid, amide, N,N-dimethyl-;
DERIVATION	
CLASSIFICATION	

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Clear liquid
MELTING POINT	< 60 C
BOILING POINT	153 C
SPECIFIC GRAVITY	0.945
SOLUBILITY IN WATER	miscible
pH	6.6 - 8.0 (at 20 C, 20% Sol.)
VAPOR DENSITY	2.5
AUTOIGNITION	
NFPA RATINGS	Health: 1; Flammability: 2; Reactivity: 0
REFRACTIVE INDEX	
FLASH POINT	71 C
STABILITY	Stable under ordinary conditions

GENERAL DESCRIPTION & APPLICATIONS

N,N-Dimethylformamide is a clear liquid with a slightly unpleasant odor due to dimethylamine impurity; miscible with water and with most of organic solvents. DMF is a stable compound with a relatively low vapour pressure and high boiling point. DMF is not stable and can cause fires or explosions when it contacts with strong bases, strong acids, metallic halogenated hydrocarbons, or oxidizers. It is known that DMF can undergo a violent decomposition reaction when contact with sodium hydride. DMF is prepared by the reaction of dimethyl amine and formic acid. N,N-Dimethylformamide is the formic acid amide with two methyl group substituents on the nitrogen atom. The good water solubility, high dielectric constant, high boiling point, and organic properties of DMF find main use as a solvent in industry particularly for acrylic fibres an polyurethanes. It is also used as a reaction medium in pharmaceuticals and pesticides productions. DMF is used in the Grignard reagents reactions. It facilitates the S_N2 reaction mechanism. It is used as an intermediate and an additive. Other applications include special solvent for welding gas, ingredient in paint strippers, wire enamel resins, and for electrolytic capacitors.

SALES SPECIFICATION

APPEARANCE	Clear liquid
DIMETHYLFORMAMIDE	99.5 min (wt %)
MOISTURE	200 max (wt ppm)
Fe	0.05 max (wt ppm)
COLOR	10 max (APHA)

pH	6.6 - 8.0 (at 20 C, 20% Aq. Soloutioin)
ALKALINITY	20 max.(wt ppm,as DMA)
ACIDITY	20 max.(wt ppm as HCOOH)
CONDUCTIVITY	5 max
TRANSPORTATION	
PACKING	190kgs in drum
HAZARD CLASS	3 (Packing Group: III)
UN NO.	2265
OTHER INFORMATION	
European Hazard Symbols: T, Risk Phrases: 20/21-36-61, Safety Phrases: 53-45	
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.