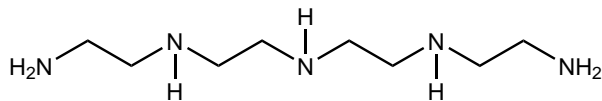


Technical Bulletin

HUNTSMAN

TETRAETHYLENEPENTAMINE (TEPA)

STRUCTURE



DESCRIPTION

Tetraethylenepentamine is principally a mixture of four TEPA ethyleneamines with close boiling points including linear, branched, and two cyclic TEPA products, and higher molecular weight products.

These compounds are:

- TEPA (CAS #000112-57-2, N-(2-aminoethyl)-N'-{2-[(2-aminoethyl)amino]ethyl}-1,2-ethanediamine)
- AETETA (CAS #031295-46-2, 4-(2-aminoethyl)-N-(2-aminoethyl)-N'-{2-[(2-aminoethyl)amino]ethyl}-1,2-ethanediamine)
- APEEDA (CAS #031295-54-2, 1-(2-aminoethyl)-4-[(2-aminoethyl)amino]ethyl]-piperazine)
- PEDETA (CAS #031295-49-5, 1-[2-[[2-[(2-aminoethyl)amino]ethyl]-amino]ethyl]-piperazine)

APPLICATIONS

- Asphalt additives
- Corrosion inhibitors
- Epoxy curing agents
- Hydrocarbon purification
- Lube oil & fuel additives
- Mineral processing aids
- Polyamide resins
- Surfactants
- Textile additives

SALES SPECIFICATIONS

Appearance	Liquid, yellow
Assay, wt. %	95.0 min.
Color, Gardner	4 max.
Amines, mol. wt. <TEPA, wt. %	3.0 max.
Amines, mol. wt. >TEPA, wt. %	3.0 max.
Water, wt. %	0.5 max.
Substituted piperazines, wt. %	38 max.
Drum shelf life	24 months

TYPICAL PROPERTIES

Property	SI Units
Molecular weight (Linear component)	189.30
(Typical product)	200
Boiling point, 760 mm Hg, °C	332
Freezing point, °C ^a	-30
Density, g/ml, 20°C ^b	0.991
Specific gravity 20°/20° ^b	0.993
Viscosity, cp, 20°C	23.4
Kinematic viscosity, cSt, 25°C ^b	54.1
Kinematic viscosity, cSt, 40°C ^b	24.6
Vapor pressure, 20°C, mm Hg	<0.01
Specific heat, cal/g °C, 20°C	0.451
Thermal conductivity, cal/cm-sec-°C, 20°C	0.000435
Surface tension, dynes/cm, 20°C	39.3
Coefficient of expansion, 1/°C, 20°C	0.000681
Refractive index, 25°C ^b	1.534
Dielectric constant, 25°C and 1 kHz ^b	12.0
Electrical conductivity, µmhos/cm, 24°C ^b	0.0065
Heat of formation, kcal/mol	-19.7
Heat of vaporization, BTU/lb	131.5
Heat of combustion, BTU/lb	14437
Ionization constants, K _b 1 @ 25°C K _b 2	6.5E-5 6.5E-6
pH of 1 wt% solution ^b	11.5
Nitrogen content, % ^b	35.1
Amine value, mg KOH/g ^b	1343

^aPour point

^bProperty of typical sales product

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AVAILABILITY

Tetraethylenepentamine (TEPA) is available in bulk and in 55-gallon drums of 205 Kg net weight. Requests for samples can be made through any Huntsman Corporation sales office.

STORAGE AND HANDLING

In order to maintain the high degree of purity with which tetraethylenepentamine (TEPA) is manufactured and shipped, the following storage and handling considerations are recommended:

Dry Inert Gas Blanket

This product should be stored under a dry inert gas blanket, such as nitrogen, to minimize contamination resulting from contact with air and water.

Materials of Construction

If slight coloration of the ethyleneamine is acceptable, storage tanks may be made of carbon steel or black iron, provided they are free of rust and mill scale. However, if the amine is stored in such tanks, color may develop due to iron contamination. If iron contamination cannot be tolerated, tanks constructed of types 304 or 316 stainless steel should be used. (Note: Because they are quickly corroded by amines, do not use copper, copper alloys, brass, or bronze in tanks or lines.) Recommended storage construction for TEPA is stainless steel or carbon steel.

Storage Temperature

Tetraethylenepentamine (TEPA) has a pour point of -30°C . To avoid freezing, the product should be maintained above this temperature.

Spills or Leaks

Small spills should be covered with inorganic absorbents and disposed of properly. Organic

absorbents have been known to ignite when contaminated with amines in closed containers. Certain cellulosic materials used for spill cleanup such as wood chips or sawdust have shown reactivity with ethyleneamines and should be avoided. Large spills should be contained and recovered. Water may be used for clean-up purposes, but avoid disposing of the material into sewers or natural water bodies. Disposal should be in accordance with all federal, state and local laws, regulations, and ordinances. Ethyleneamine leaks will frequently be identified by the odor (ammoniacal) or by the formation of a white, solid, waxy substance (amine carbamates). Inorganic absorbents or water may be used to clean up the amine waste.

TOXICITY AND SAFETY

Because of the fragility of eye tissue, almost any eye contact with any ethyleneamine may cause irreparable damage, even blindness. A single, short exposure to ethyleneamines, may cause severe skin burns, while a single, prolonged exposure may result in the material being absorbed through the skin in harmful amounts. Exposures has caused allergic skin reactions in some individuals. Single dose oral toxicity of ethyleneamines is low. The oral LD_{50} for rats is in the range of 1000 to 4500 mg/kg for the ethyleneamines.

The principal hazards that arise in working with tetraethylenepentamine (TEPA) are those associated with similar organic amines; namely, a corrosive action on skin and eyes. Precautions should be taken to prevent contact with these parts of the body such as by use of protective clothing and chemical goggles. If contact occurs, immediately flush the exposed area with plenty of water for at least 15 minutes. Eye exposures should be examined by a physician. Contaminated clothing should be laundered before reuse. If ingestion occurs, do not induce vomiting. Have the individual drink a large amount of water (or milk, if it is readily available) and transport them to a medical facility immediately.

A Material Safety Data Sheet for tetraethylenepentamine (TEPA) may be obtained on request from any Huntsman Corporation sales office.