

(17) Triethanolamine,  $C_6H_{15}NO_3$   
CAS No. 102.71.6  
HS No. 29.22.13.00  
NIOSH/RTECS No. KL 9275000  
Merck 9581

**Synonyms:** TEA; 2,2',2"-nitrilotriethanol; Tris (2-hydroxyethyl) amine

**Physical properties:** MW: 149.2; mp: 21.6°; bp: 336°, d. 1.1248;  $n_D^{20}$  1.4835. A clear, colourless, viscous and hygroscopic liquid at room temperature and miscible with water, alcohol and acetone.

**Synthesis:** Reaction of ethylene chlorohydrin and aqueous ammonia. Ethanolamines are produced industrially by the reaction of ethylene oxide and excess ammonia. The product distribution between mono-, di- and tri ethanolamine is controlled by reactant ratios. The ethylene oxide has to be added to the aqueous ammonia. The reaction is carried out under pressure (16MPa) at temperatures up to 150°C and up to 40 mol excess of ammonia.

**Reactivity:** Exhibits the chemical properties of both amines and alcohols. Thionyl chloride or phosphorus pentachloride can be used to replace the hydroxyl group(s) by chlorine. The resulting chloroethylamines are hazardous because of skin toxicity. Triethanolamine can react further with ethylene oxide to give stable ethers as the end product. Thermal decomposition leads to CO, CO<sub>2</sub>, and NO<sub>x</sub>.

**Toxicity:** Skin irritant. Harmful by inhalation, ingestion and skin absorption. LD<sub>50</sub> (rat) is 7.2 g/kg.

**Uses:** Ethanolamines are used widely in the production of surfactants that are important as detergents, textile and leather chemicals, and emulsifiers. Other uses range from drilling and cutting oils to soaps and toiletries. Triethanolamine is a component of coolants for automobile engines where it acts as a corrosion inhibitor. It is also used in the cement industry as an additive to improve flow and setting behaviour. In 1985 world ethanolamine capacity was about 600,000 t/a with production at the 427 000 t level; about 15-20% of production would be triethanolamine.

**Suppliers:** There are 33 suppliers listed in 15 countries: Argentina (1), Brazil (2), Canada (2), Mexico (2), USA (5), PRC (1), Japan (3), Australia (1), Austria (1), France (4), Germany (4), UK (4), Italy (1), Spain (1) and Switzerland (1).