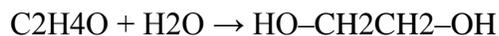


Ethylene glycol

Ethylene glycol (IUPAC name: ethane-1,2-diol) is an organic compound primarily used as a raw material in the manufacture of polyester fibers and fabric industry, and polyethylene terephthalate resins (PET) used in bottling. A small percent is also used in industrial applications like antifreeze formulations and other industrial products. It is an odorless, colorless, syrupy, sweet-tasting liquid. Ethylene glycol is moderately toxic, with children having been particularly at risk because of its sweet taste, until it became common to add bitter flavoring to consumer antifreezes containing it.

Production

Ethylene glycol is produced from ethylene (ethene), via the intermediate ethylene oxide. Ethylene oxide reacts with water to produce ethylene glycol according to the chemical equation:



This reaction can be catalyzed by either acids or bases, or can occur at neutral pH under elevated temperatures. The highest yields of ethylene glycol occur at acidic or neutral pH with a large excess of water. Under these conditions, ethylene glycol yields of 90% can be achieved. The major byproducts are the ethylene glycol oligomers diethylene glycol, triethylene glycol, and tetraethylene glycol. About 6.7 billion kilograms are produced annually.

A higher selectivity is achieved by use of Shell's OMEGA process. In the OMEGA process, the ethylene oxide is first converted with carbon dioxide (CO₂) to ethylene carbonate to then react with water in a second step to selectively produce mono-ethylene glycol. The carbon dioxide is released in this step again and can be fed back into the process circuit. The carbon dioxide comes in part from the ethylene oxide production, where a part of the ethylene is completely oxidized.

Toxicity

Ethylene glycol is moderately toxic with an oral LDLo = 786 mg/kg for humans. The major danger is due to its sweet taste. Because of that, children and animals are more inclined to consume large quantities of it than of other poisons. Upon ingestion, ethylene glycol is oxidized to glycolic acid which is, in turn, oxidized to oxalic acid, which is toxic. It and its toxic byproducts first affect the central nervous system, then the heart, and finally the kidneys. Ingestion of sufficient amounts can be fatal if untreated.

According to the annual report of the American Association of Poison Control Centers' National Poison Data System in 2007, there were about 1000 total cases resulting in 16 deaths. The 2008 American Association of Poison Control Centers' National Poison Data System annual report lists 7 deaths.

Antifreeze products for automotive use containing propylene glycol in place of ethylene glycol are available. They are generally considered safer to use, as propylene glycol possesses an

unpleasant taste and is converted in the body to lactic acid, a normal product of metabolism and exercise.