Polyethylene Glycol
6000
6. POLYETHYLENE GLYCOL 6000

Polyethylene glycol 6000 (PEG) is a polyether compound with many applications from industrial manufacturing to medicine. The structure of PEG is (note the repeated element in parentheses):

\[ \text{HO-CH}_2-(\text{CH}_2-\text{O-CH}_2)_n-\text{CH}_2-\text{OH} \]

PEG is also known as polyethylene oxide (PEO) or polyoxyethylene (POE), depending on its molecular weight.

Polyethylene glycol, referred to as PEG, is used as an inactive ingredient in the pharmaceutical industry as a solvent, plasticizer, surfactant, ointments and suppository base, and tablet and capsule lubricant. PEG has low toxicity with systemic absorption less than 0.5%.

PEGylation occurs when PEGs are attached to various protein medications, allowing for greater solubility for certain drugs. Examples of PEG medications include PEG-interferon alpha (Pegintron) and PEG-filgrastim (Neulasta). PEG is also available as a bowel prep for colonoscopy procedures and as a laxative.

PEG 400 indicates the average molecular weight of the specific PEG at 400.\textsuperscript{13} PEG 3350 is a laxative available over-the-counter by the name of Miralax. In this case, PEG is considered an "active" ingredient, even though systemic absorption is less than 0.5%.

**Structure**

![Structure of PEG-6000](image)
1) Nonproprietary Names

1. Carbowax, GoLYTELY
2. GlycoLax, Fortrans
3. TriLyte, Colyte
4. Halflytely,
5. Macrogol,
6. MiraLAX

2) Boiling Pt: Min. 250°C (1013 hPa)

3) Melting Pt: 55 to 62 °C

4) Density: 1.13 g/cm³ (20°C)

5) Appearance White or almost white, waxy or paraffin-like

6) Solubility: Soluble in water

7) Synonyms

PEG; Macrogol; Polyoxyethlene; Aquaffin; Nycoline alpha-hydro-omega-hydroxypoly(oxy-1,2-ethanediyl); polyethylene glycols; Poly Ethylene Oxide; Polyoxyethylene; Polyglycol; 1,2-ethanediol Ethoxylated; Polyoxyethylene ether; Polyoxyethylene; Poly(ethylene glycol);

Chemical Name and CAS registry Number

poly(oxyethylene, (25322-68-3 )

Empirical Formula and Mol. Weight

H(OCH2CH2)nOH [average 6000 g/mol ]

Functional Category

Lubricating agent , solubilizing agent, coating agent

Applications in Pharmaceutical Formulation or Technology

Chemical uses

Polyethylene glycol has a low toxicity and is used in a variety of products.[16] The polymer is used as a lubricating coating for various surfaces in aqueous and non-aqueous environments.

Since PEG is a flexible, water-soluble polymer, it can be used to create very high osmotic pressures (on the order of tens of atmospheres). It also is unlikely to have specific
interactions with biological chemicals. These properties make PEG one of the most useful molecules for applying osmotic pressure in biochemistry, and biomembrane experiments, in particular when using the osmotic stress technique.

Polyethylene glycol is also commonly used as a polar stationary phase for gas chromatography, as well as a heat transfer fluid in electronic testers.

PEG has also been used to preserve objects that have been salvaged from underwater, as was the case with the warship Vasa in Stockholm,\textsuperscript{[19]} the Mary Rose in England and the Ma'agan Michael Ship in Israel. It replaces water in wooden objects, making the wood dimensionally stable and preventing warping or shrinking of the wood when it dries. In addition, PEG is used when working with green wood as a stabilizer, and to prevent shrinkage.

PEG is often used (as an internal calibration compound) in mass spectrometry experiments, with its characteristic fragmentation pattern allowing accurate and reproducible tuning.

PEG derivatives, such as narrow range ethoxylates, are used as surfactants.

PEG has been used as the hydrophilic block of amphiphilic block copolymers used to create some polymersomes.

**Industrial uses**

Nitrate ester-plasticized polyethylene glycol is used in Trident II ballistic missile solid rocket fuel.

Dimethyl ethers of PEG are the key ingredient of Selexol, a solvent used by coal-burning, integrated gasification combined cycle (IGCC) power plants to remove carbon dioxide and hydrogen sulfide from the gas waste stream.

PEG has been used as the gate insulator in an electric double-layer transistor to induce superconductivity in an insulator.

PEG is also used as a polymer host for solid polymer electrolytes. Although not yet in commercial production, many groups around the globe are engaged in research on solid polymer electrolytes involving PEG, with the aim of improving their properties, and in permitting their use in batteries, electro-chromic display systems, and other products in the future.