PEG Stability: A Look at pH and Conductivity Changes over Time in Polyethylene Glycols

Aging of polyethylene glycols (poly(oligo)-oxyethylene-based compounds, often referred to as PEG) can alter the chemical properties of common polyethylene glycols, resulting in increased levels of aldehydes, carboxylates and peroxides, increased ionic strength, as well as increased metal binding and a reduction of pH.1,2

Hampton Research measured pH and conductivity of 8 different polyethylene glycols stored in a variety of typical laboratory storage settings over a period of 18 months. pH and conductivity were selected as suitable indicators of PEG aging (reduced pH and increased ionic strength) because pH and ionic strength can be significant crystallization variables. pH and conductivity measurements were recorded at 25 degrees Celsius. All PEGs were initially prepared at the same time, sterile filtered, filled into sterile PETG bottles and purged with argon before closing the cap on the bottles. The results are displayed in the pages that follow.

Aging affects can be accelerated by warm temperature, light, and the presence of oxygen. PEG solutions appear most stable when stored frozen (-20 degrees Celsius), and refrigerated (4 degrees Celsius) PEG solutions are more stable than those stored at room temperature. Aging of solutions stored at room temperature can be further minimized by purging atmosphere (oxygen) from filled containers using argon. Finally, the aging of PEGs can be further minimized by storing the sealed solutions protected from light.

Protein crystals can be grown in fresh PEG solutions or aged PEG solutions. But crystals grown in aged solutions will sometimes not grow in fresh solutions and vice versa. When it comes to PEG, both quality and consistency should be considered significant crystallization variables.

Hampton Research Optimize Polyethylene glycol solutions are supplied in sterile, optically a clear PETG bottle and packaged in a protective carton. The carton helps protect the Polyethylene glycol from light. The optically clear PETG bottle has low oxygen permeability and also allows one to inspect the solution for color change or the appearance of amorphous material.

References


100% v/v Polyethylene glycol 400
Conductivity Stability
Initial Conductivity: 3.7 μS/cm at 25°C
100% v/v Polyethylene glycol monomethyl ether 550
pH Stability
Initial pH: 9.78 μS/cm at 25°C

Days
0 60 120 180 240 300 360 420 480 540

pH
6.50 6.70 6.90 7.10 7.30 7.50 7.70 7.90 8.10 8.30 8.50 8.70 8.90 9.10 9.30 9.50 9.70 9.90

(range: 6.88 - 9.91; taken at 25°C)

Freezer
Refrigerator
Room Temperature
Exposed to Light
*Freezer [original bottle-first time opened: after 540 days (18 months) since production date]
*Refrigerator [original bottle-first time opened: after 540 days (18 months) since production date]
*Room Temperature [original bottle-first time opened: after 540 days (18 months) since production date]
*Exposed to Light [original bottle-first time opened: after 540 days (18 months) since production date]
50% w/v Polyethylene glycol 1000
pH Stability
Initial pH: 7.25 at 25°C

Days

pH (range: 4.42-7.25; taken at 25°C)

Freezer
Refrigerator
Room Temperature
Exposed to Light

*Freezer (original bottle-first time opened: after 510 days (17 months) since production date)
*Refrigerator (original bottle-first time opened: after 510 days (17 months) since production date)
*Room Temperature (original bottle-first time opened: after 510 days (17 months) since production date)
*Exposed to Light (original bottle-first time opened: after 510 days (17 months) since production date)
50% w/v Polyethylene glycol 1000
Conductivity Stability
Initial Conductivity: 29.8 μS/cm at 25°C

Conductivity
(range: 29.8-58.9, taken at 25°C)

Days

Freezer
Refrigerator
Room Temperature
Exposed to Light

*Freezer (original bottle-first time opened: after 510 days (17 months) since production date)
*Refrigerator (original bottle-first time opened: after 510 days (17 months) since production date)
*Room Temperature (original bottle-first time opened: after 510 days (17 months) since production date)
*Exposed to Light (original bottle-first time opened: after 510 days (17 months) since production date)
50% w/v Polyethylene glycol monomethyl ether 2000
pH Stability
Initial pH: 8.07 μS/cm at 25°C

(pH range: 7.62 - 8.07, taken at 25°C)

Days

Freezer
Refrigerator
Room Temperature
Exposed to Light

*Freezer (original bottle-first time opened: after 480 days (16 months) since production date)
*Refrigerator (original bottle-first time opened: after 480 days (16 months) since production date)
*Room Temperature (original bottle-first time opened: after 480 days (16 months) since production date)
*Exposed to Light (original bottle-first time opened: after 480 days (16 months) since production date)
50% w/v Polyethylene glycol monomethyl ether 2000
Conductivity Stability
Initial Conductivity: 28.0 μS/cm at 25°C

Conductivity
(range: 27.4-45.8, taken at 25°C)

Days

Freezer
Refrigerator
Room Temperature
Exposed to Light
*Freezer [original bottle-first time opened: after 480 days (16 months) since production date]
*Refrigerator [original bottle-first time opened: after 480 days (16 months) since production date]
*Room Temperature [original bottle-first time opened: after 480 days (16 months) since production date]
*Exposed to Light [original bottle-first time opened: after 480 days (16 months) since production date]
50% w/v Polyethylene glycol 3350
pH Stability
Initial pH: 8.8 at 25°C

Days

pH
(range: 8.66-8.92; taken at 25°C)

Freezer
Refrigerator
Room Temperature
Exposed to Light

*Freezer (original bottle-first time opened: after 540 days (18 months) since production date)
*Refrigerator (original bottle-first time opened: after 540 days (18 months) since production date)
*Room Temperature (original bottle-first time opened: after 540 days (18 months) since production date)
*Exposed to Light (original bottle-first time opened: after 540 days (18 months) since production date)
50% w/v Polyethylene glycol 3350
Conductivity Stability
Initial Conductivity: 45.5 μS/cm at 25°C

Conductivity
(range: 45.0-52.9, taken at 25°C)

Days

- Red: Freezer
- Black: Refrigerator
- Magenta: Room Temperature
- Blue:Exposed to Light

*Freezer (original bottle-first time opened: after 540 days (18 months) since production date)
*Refrigerator (original bottle-first time opened: after 540 days (18 months) since production date)
*Room Temperature (original bottle-first time opened: after 540 days (18 months) since production date)
*Exposed to Light (original bottle-first time opened: after 540 days (18 months) since production date)
50% w/v Polyethylene glycol 4000
pH Stability
Initial pH: 8.8 at 25°C

Days

pH

(range: 4.67-9.89; taken at 25°C)

Freezer
Refrigerator
Room Temperature
Exposed to Light
*Freezer [original bottle-first time opened: after 510 days (17 months) since production date]
*Refrigerator [original bottle-first time opened: after 510 days (17 months) since production date]
*Room Temperature [original bottle-first time opened: after 510 days (17 months) since production date]
*Exposed to Light [original bottle-first time opened: after 510 days (17 months) since production date]
50% w/v Polyethylene glycol 4000
Conductivity Stability
Initial Conductivity: 39.9 µS/cm at 25°C

Conductivity
(range: 39.9-62.8, taken at 25°C)

Days

- Freezer
- Refrigerator
- Room Temperature
- Exposed to Light

*Freezer (original bottle-first time opened: after 510 days (17 months) since production date)
*Refrigerator (original bottle-first time opened: after 510 days (17 months) since production date)
*Room Temperature (original bottle-first time opened: after 510 days (17 months) since production date)
*Exposed to Light (original bottle-first time opened: after 510 days (17 months) since production date)
50% w/v Polyethylene glycol monomethyl ether 5000
pH Stability
Initial pH: 8.23 µS/cm at 25°C

![Graph showing pH stability over time for different storage conditions.](image-url)
50% w/v Polyethylene glycol monomethyl ether 5000
Conductivity Stability
Initial Conductivity: 20.3 μS/cm at 25°C

Conductivity (range: 20.3-69.7, taken at 25°C)

Days

Freezer
Refrigerator
Room Temperature
Exposed to Light

*Freezer (original bottle-first time opened: after 480 days (16 months) since production date)
*Refrigerator (original bottle-first time opened: after 480 days (16 months) since production date)
*Room Temperature (original bottle-first time opened: after 480 days (16 months) since production date)
*Exposed to Light (original bottle-first time opened: after 480 days (16 months) since production date)
30% w/v Polyethylene glycol 20000
pH Stability
Initial pH: 4.9 at 25°C
30% w/v Polyethylene glycol 20000
Conductivity Stability
Initial Conductivity: 59.3 μS/cm at 25°C

Conductivity (range: 56.6-184.2; taken at 25°C)

Days

- Red: Freezer
- Black: Refrigerator
- Pink: Room Temperature
- Blue: Exposed to Light

*Freezer (original bottle-first time opened: after 480 days (16 months) since production date)
*Refrigerator (original bottle-first time opened: after 480 days (16 months) since production date)
*Room Temperature (original bottle-first time opened: after 480 days (16 months) since production date)
*Exposed to Light (original bottle-first time opened: after 480 days (16 months) since production date)