

## 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.<sup>1,2</sup>

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.

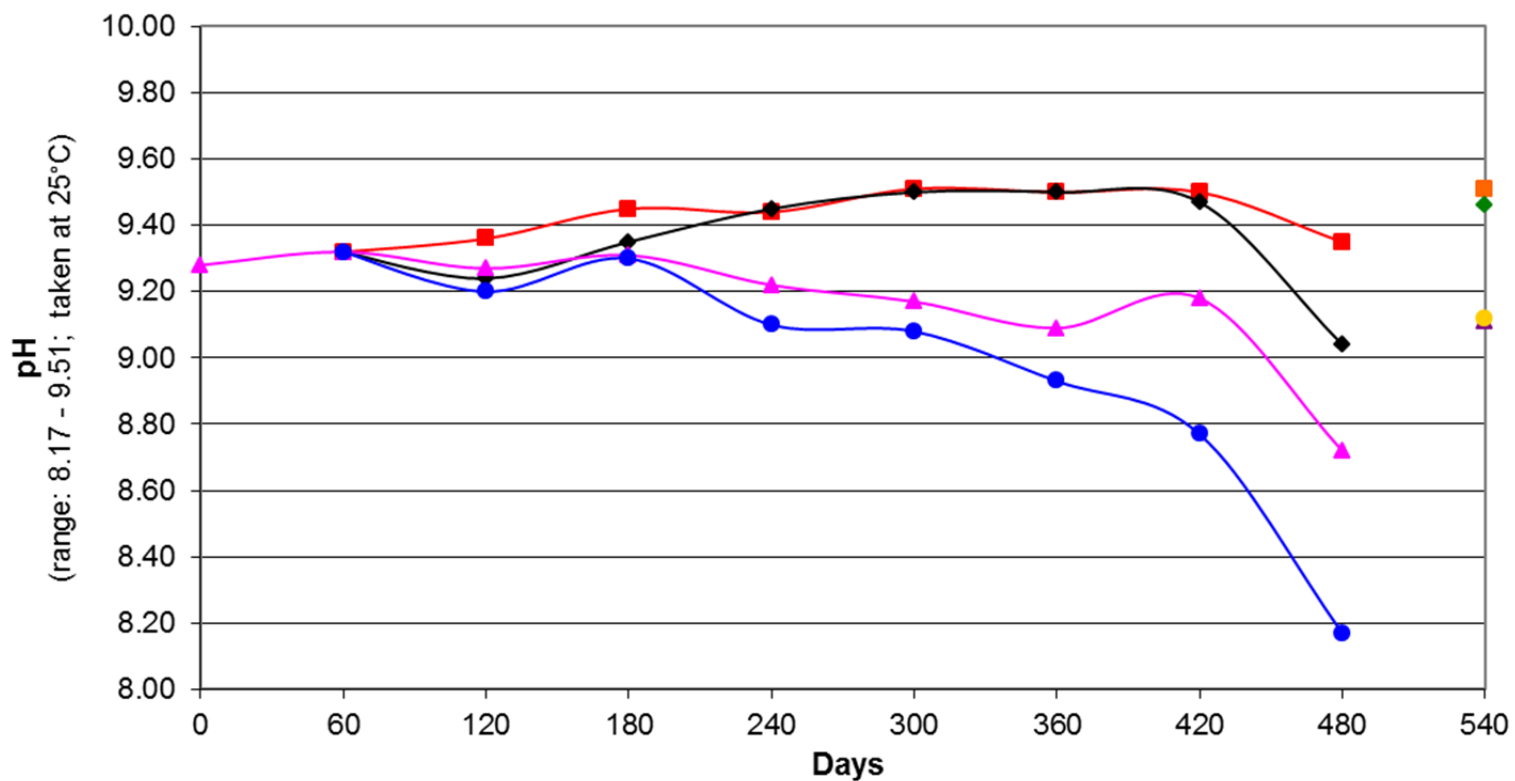
### References

1. A simple procedure for removing contaminating aldehydes and peroxides from aqueous solutions of polyethylene glycols and of nonionic detergents that are based on the polyoxyethylene linkage. William J. Ray, Jr. and Joseph M. Puvathingal. Analytical Biochemistry, Volume 146, Issue 2, 1 May 1985, Pages 307-312.
2. Effect of chemical impurities in polyethylene glycol on macromolecular crystallization. Frances Journak. Journal of Crystal Growth, Volume 76, Issue 3, 2 August 1986, Pages 577-582.

# 100% v/v Polyethylene glycol 400

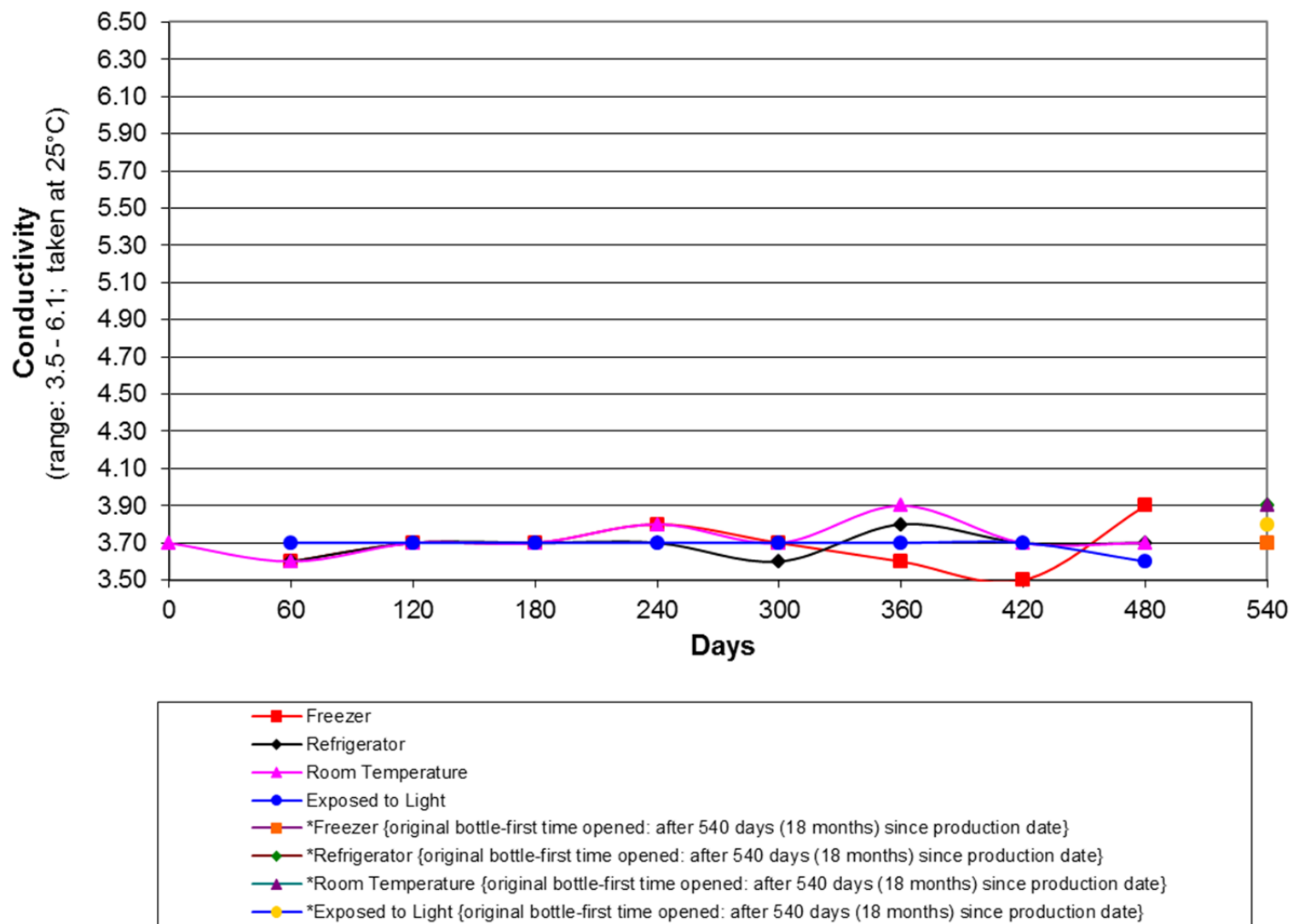
## pH Stability

Initial pH: 9.28 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}

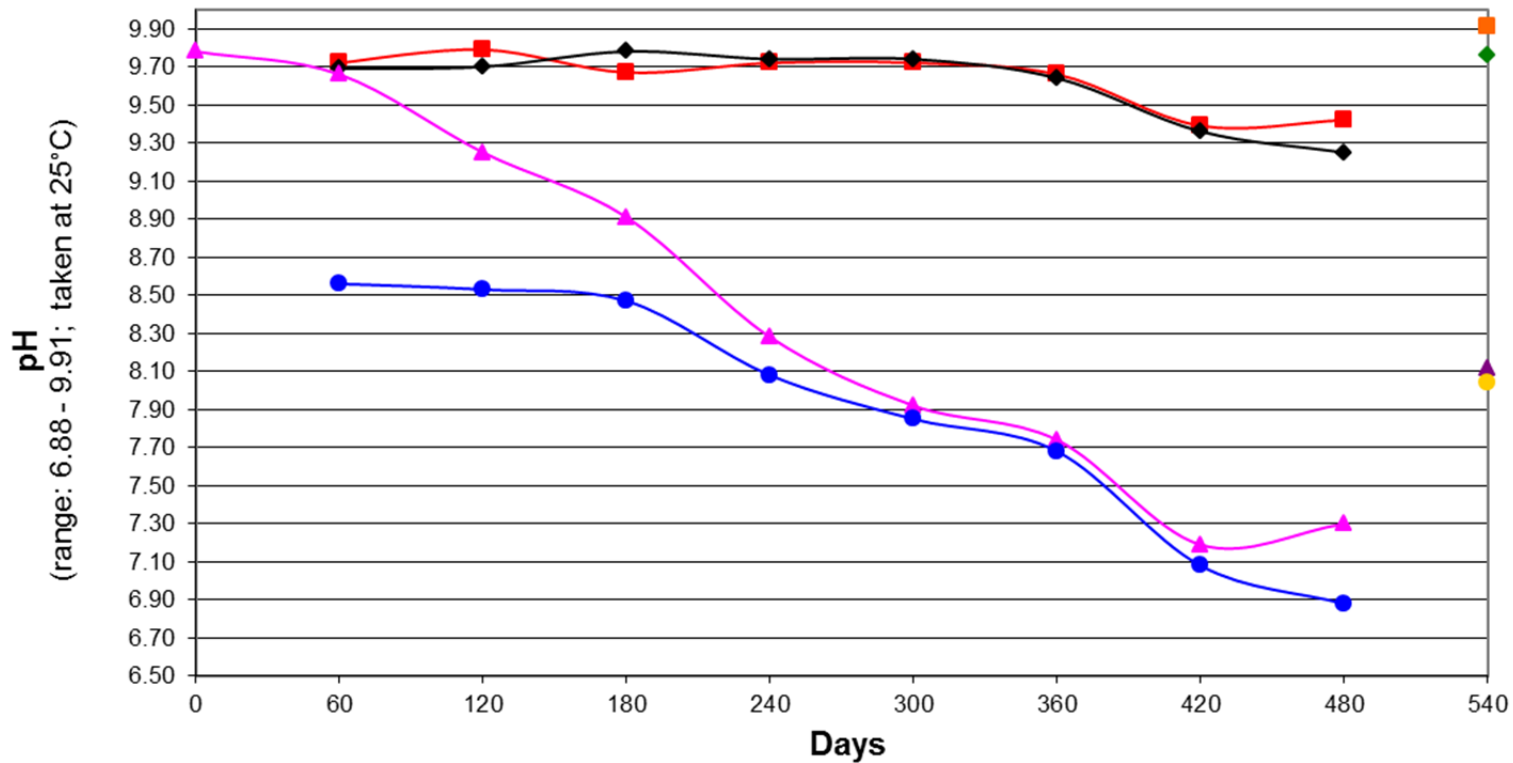
**100% v/v Polyethylene glycol 400**  
**Conductivity Stability**  
 Initial Conductivity: 3.7  $\mu\text{S}/\text{cm}$  at 25°C



# 100% v/v Polyethylene glycol monomethyl ether 550

## pH Stability

Initial pH: 9.78  $\mu\text{S}/\text{cm}$  at 25°C

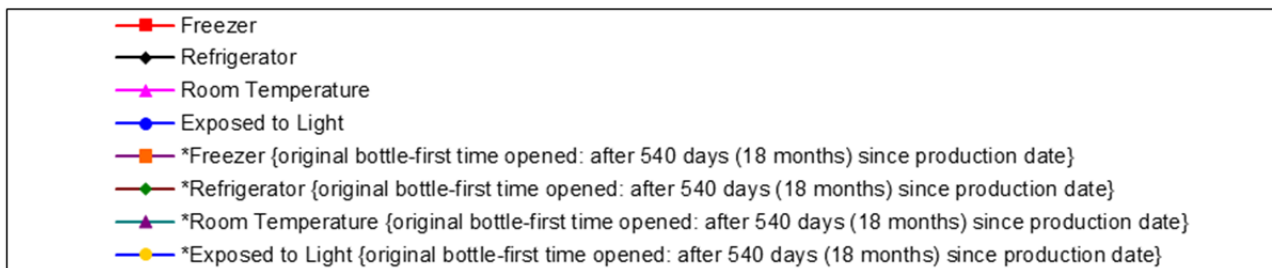
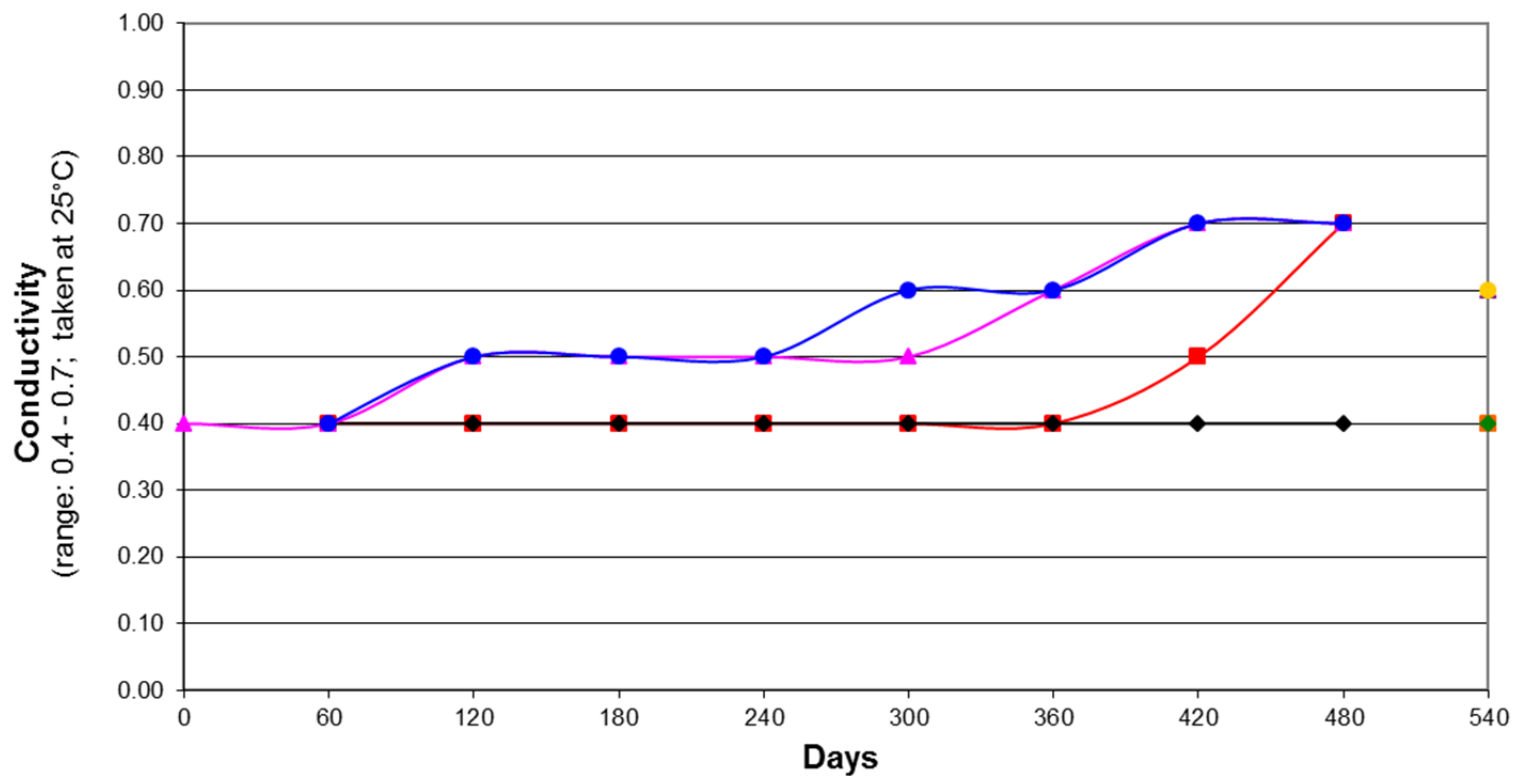


- Freezer
- ◆ Refrigerator
- ▲ Room Temperature
- Exposed to Light
- \*Freezer {original bottle-first time opened: after 540 days (18 months) since production date}
- ◆ \*Refrigerator {original bottle-first time opened: after 540 days (18 months) since production date}
- ▲ \*Room Temperature {original 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}

# 100% v/v Polyethylene glycol monomethyl ether 550

## Conductivity Stability

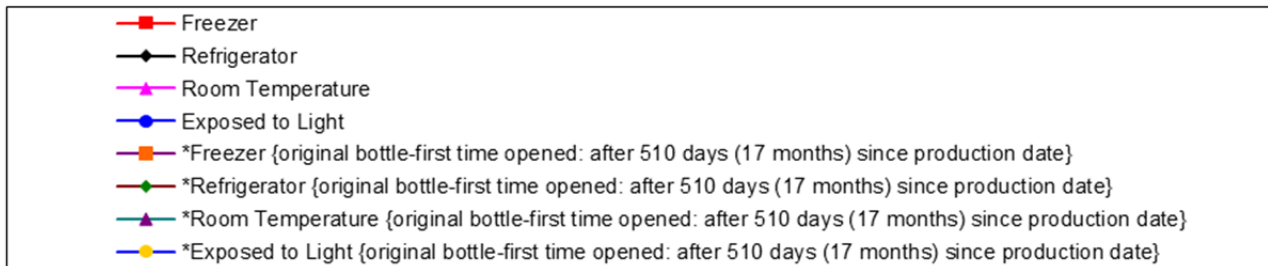
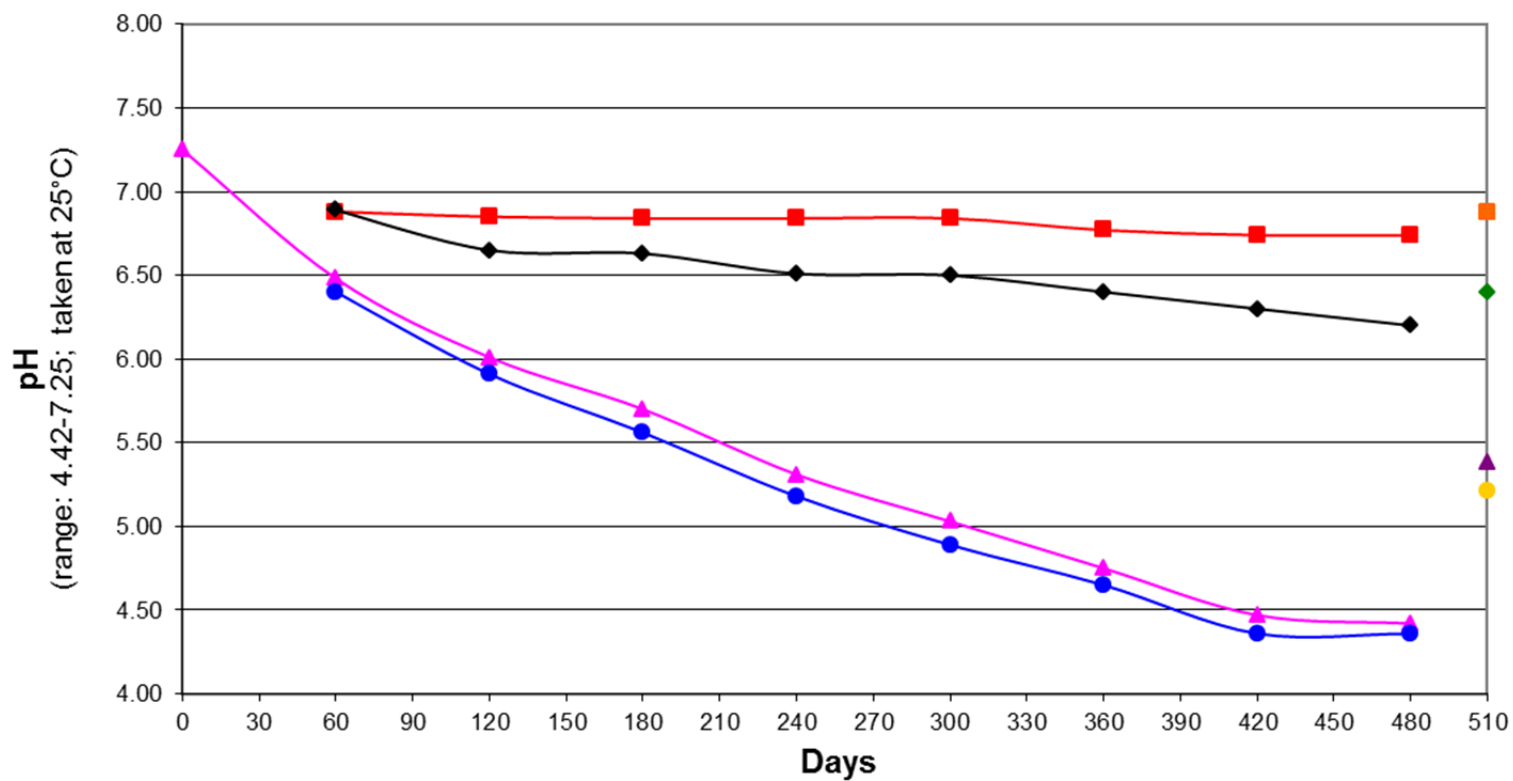
Initial Conductivity: 0.4  $\mu\text{S}/\text{cm}$  at 25°C



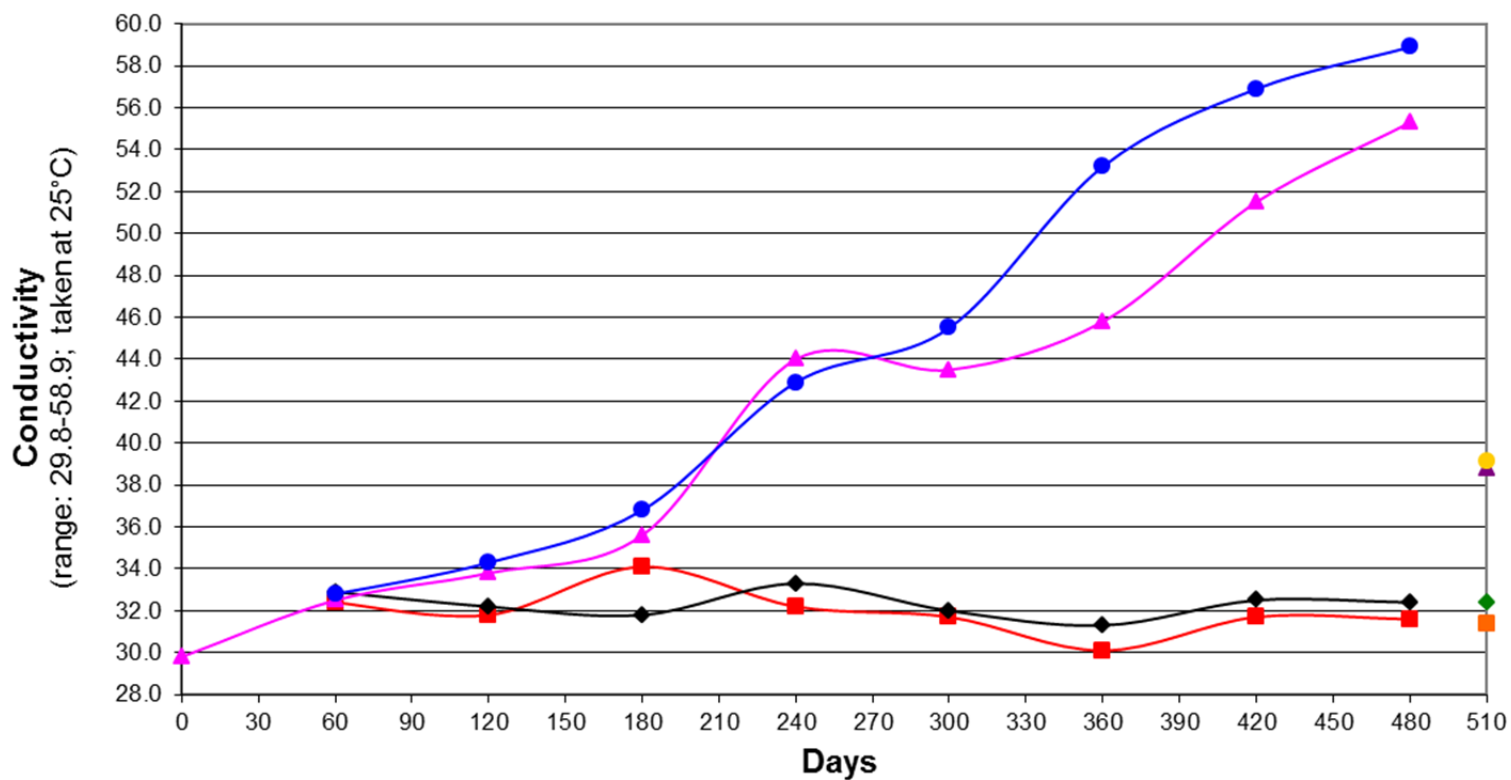
### 50% w/v Polyethylene glycol 1000

#### pH Stability

Initial pH: 7.25 at 25°C



**50% w/v Polyethylene glycol 1000**  
**Conductivity Stability**  
 Initial Conductivity: 29.8  $\mu\text{S}/\text{cm}$  at 25°C

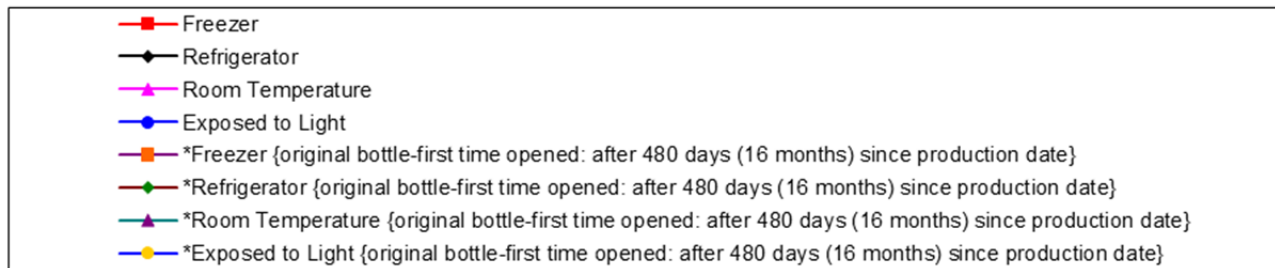
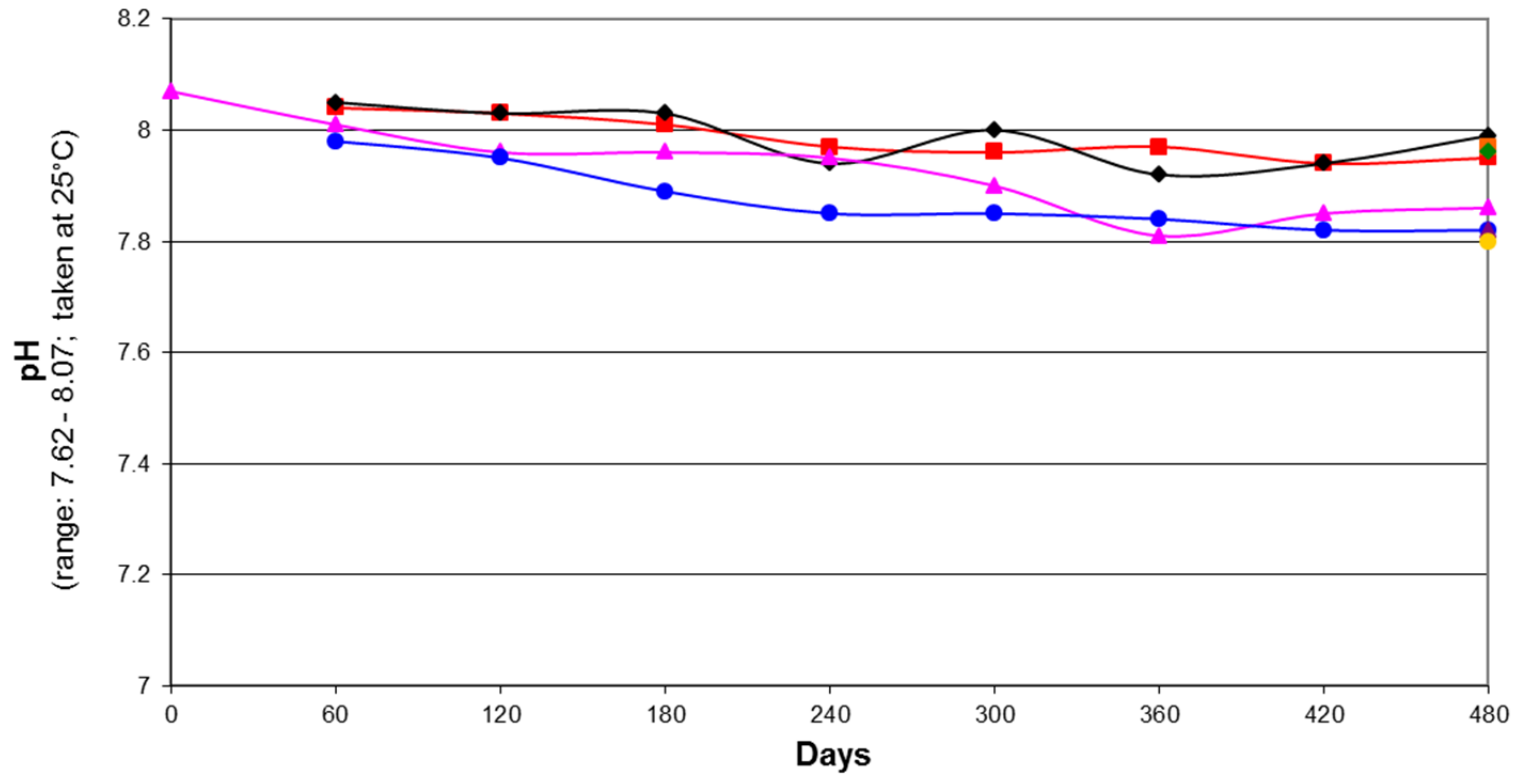


- Freezer
- ◆ Refrigerator
- ▲ Room Temperature
- Exposed to Light
- \*Freezer {original bottle-first time opened: after 510 days (17 months) since production date}
- ◆ \*Refrigerator {original bottle-first time opened: after 510 days (17 months) since production date}
- ▲ \*Room Temperature {original 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 monomethyl ether 2000

#### pH Stability

Initial pH: 8.07  $\mu\text{S}/\text{cm}$  at 25°C

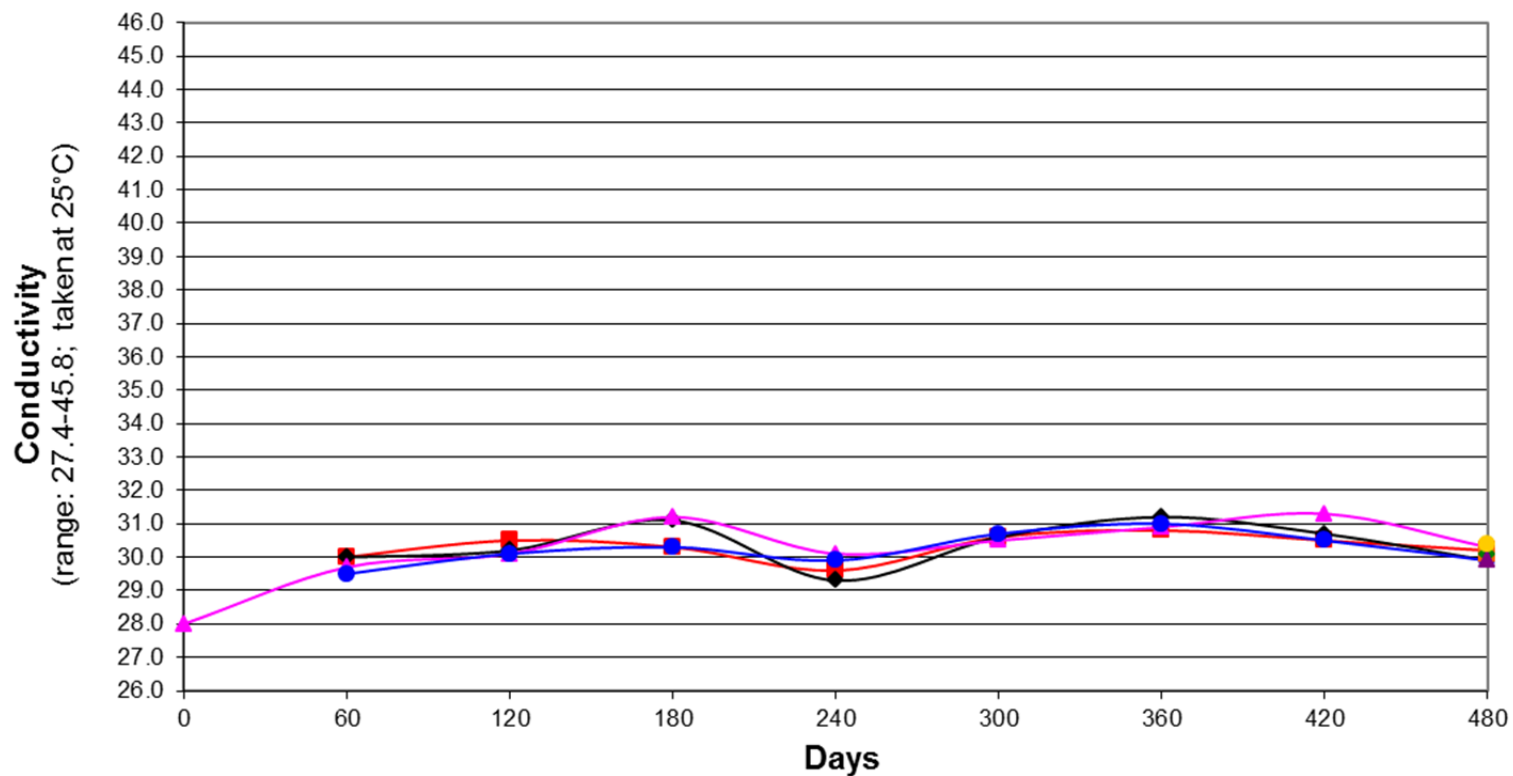




### 50% w/v Polyethylene glycol monomethyl ether 2000

#### Conductivity Stability

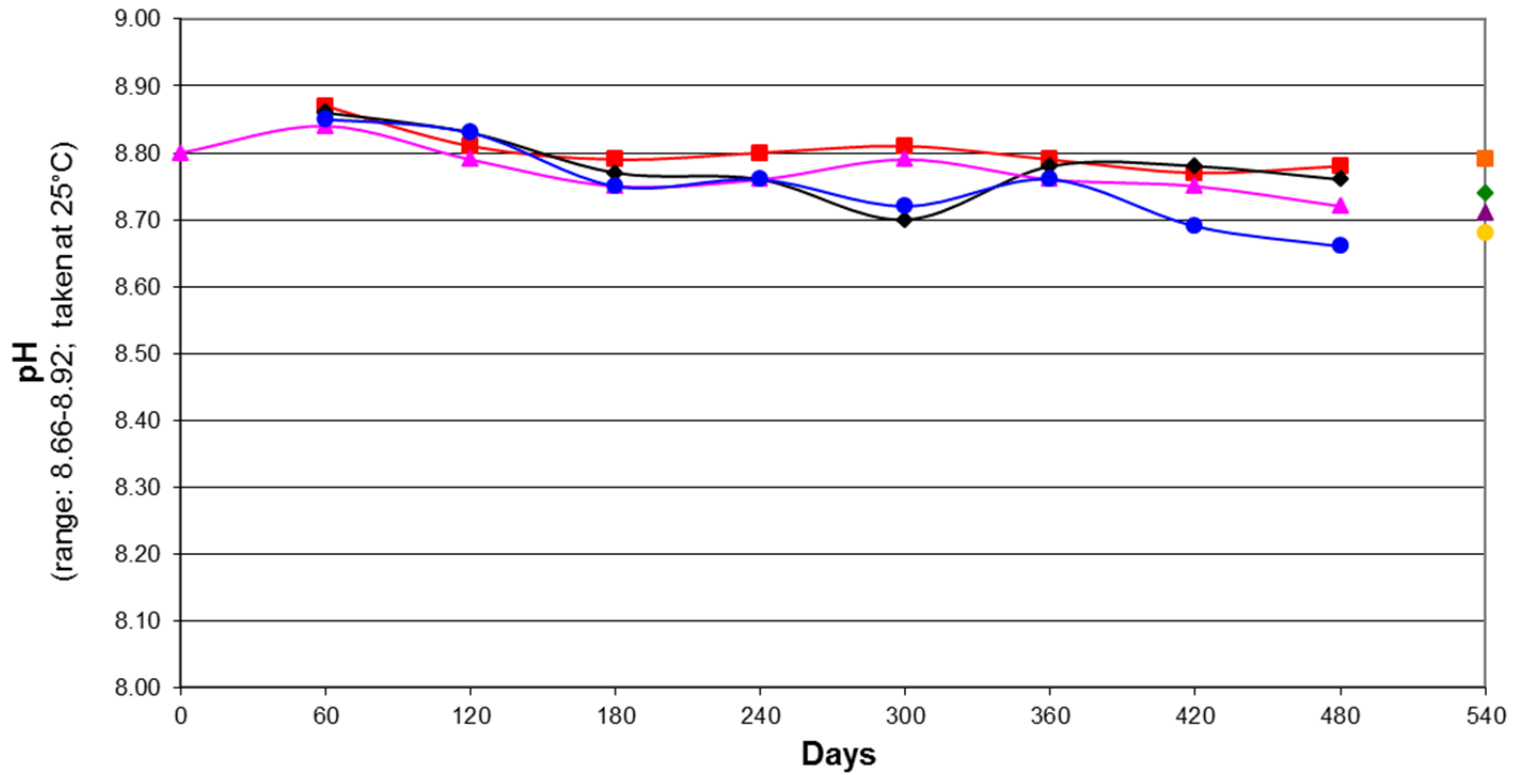
Initial Conductivity: 28.0  $\mu\text{S}/\text{cm}$  at 25°C



### 50% w/v Polyethylene glycol 3350

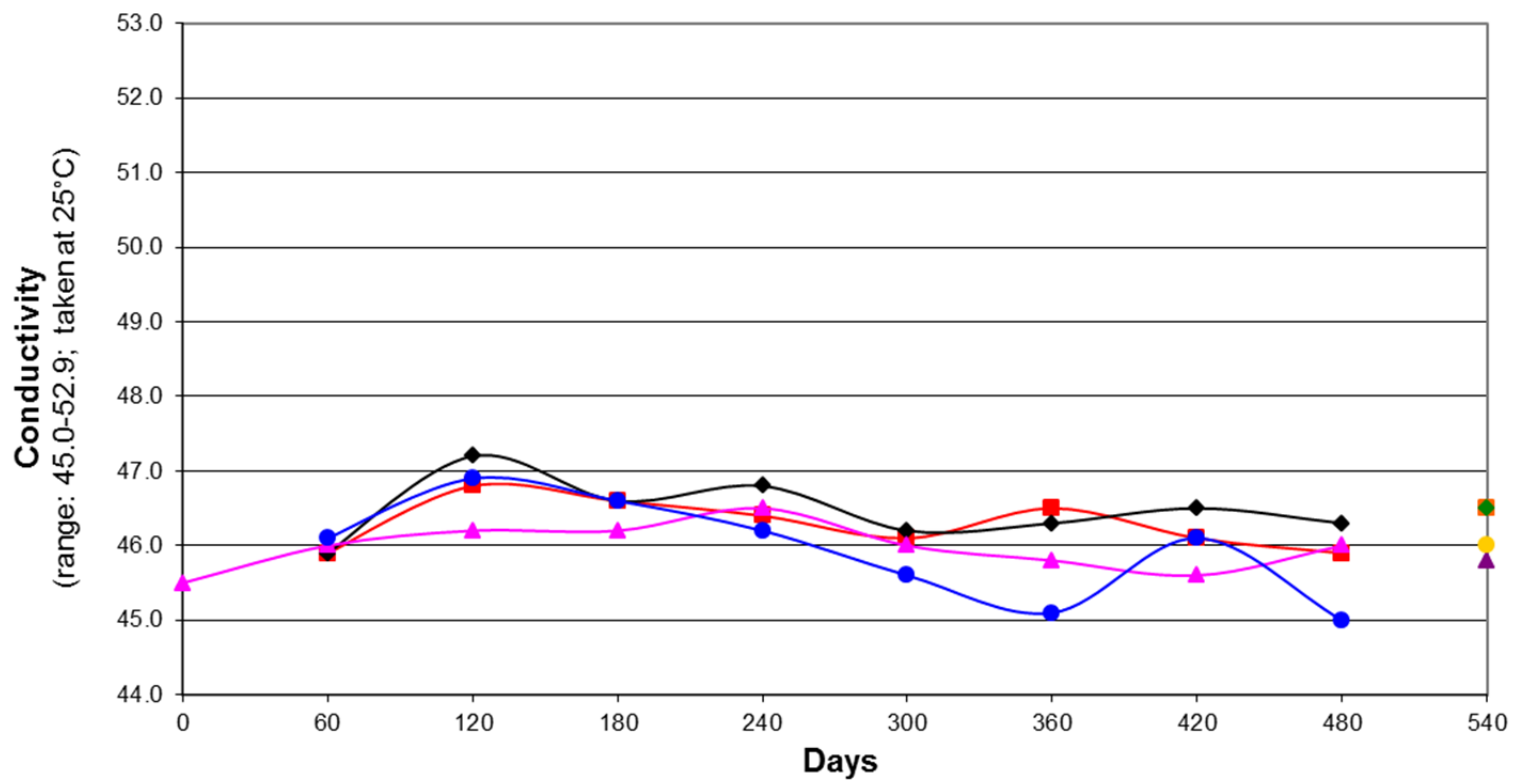
#### pH Stability

Initial pH: 8.8 at 25°C

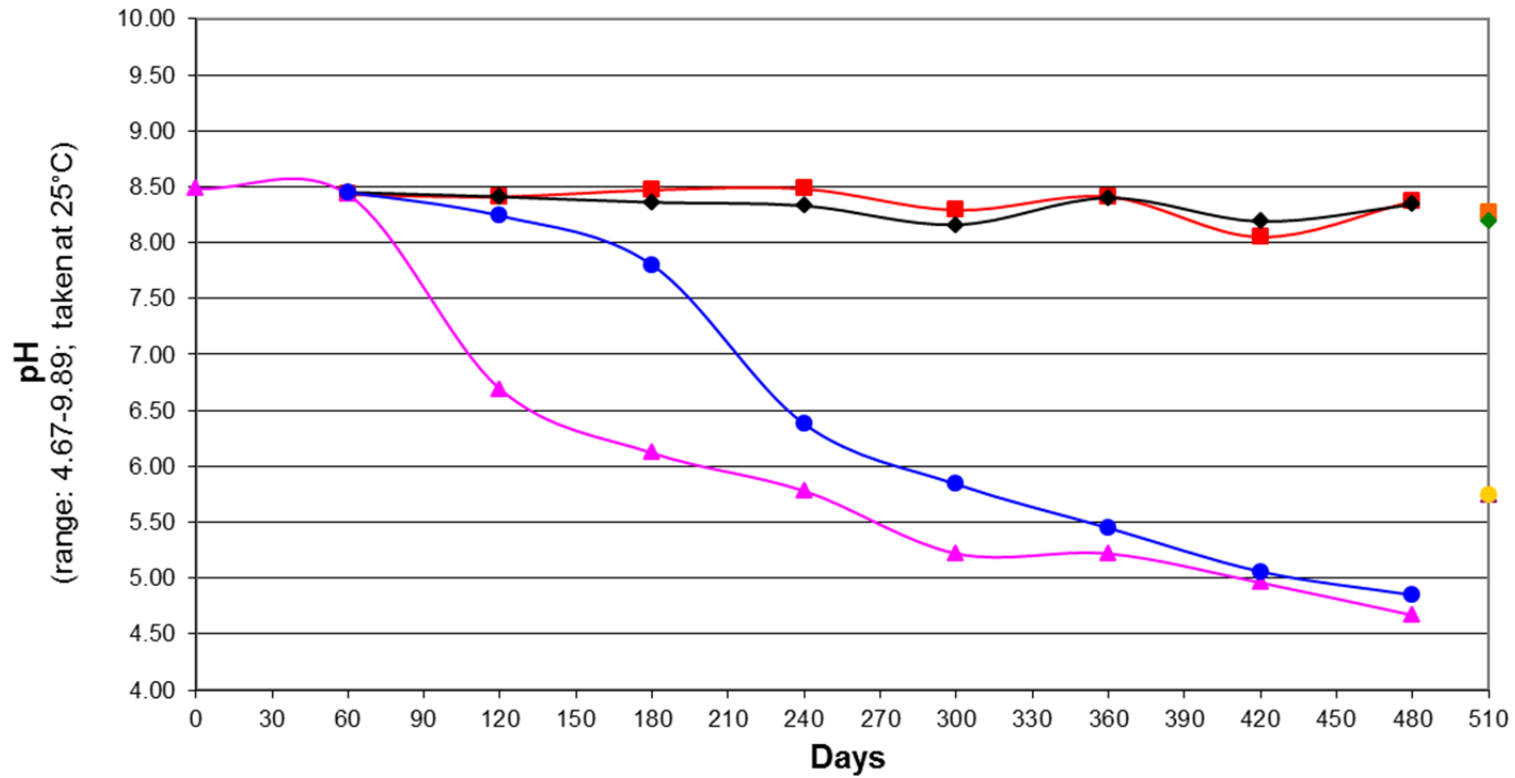


- Freezer
- Refrigerator
- Room Temperature
- Exposed to Light
- \*Freezer {original bottle-first time opened: after 540 days (18 months) since production date}
- \*Refrigerator {original bottle-first time opened: after 540 days (18 months) since production date}
- \*Room Temperature {original bottle-first 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  $\mu\text{S}/\text{cm}$  at 25°C

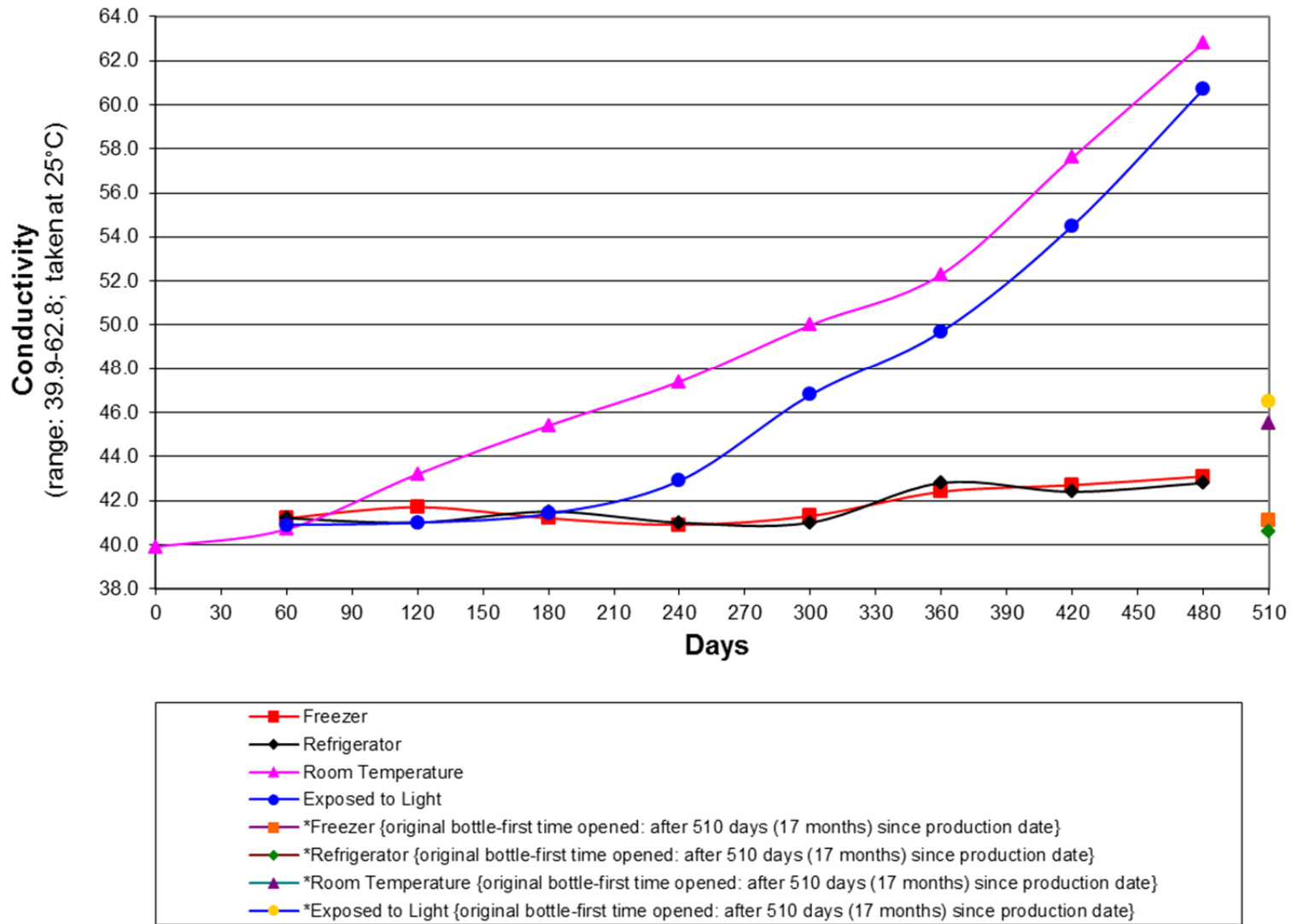


**50% w/v Polyethylene glycol 4000**  
**pH Stability**  
 Initial pH: 8.8 at 25°C



- 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}

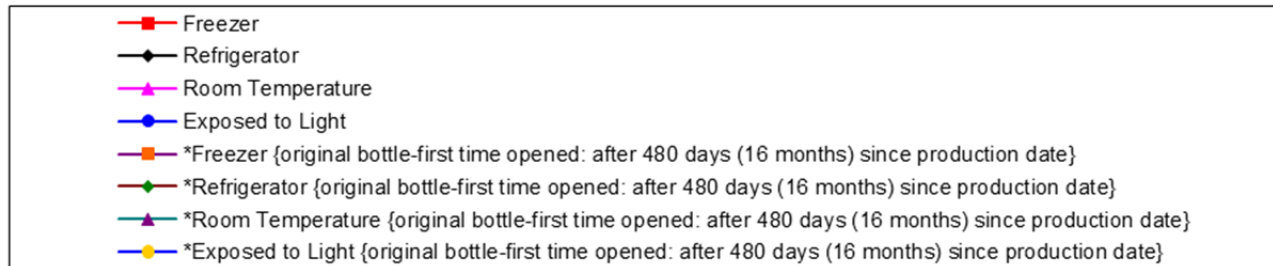
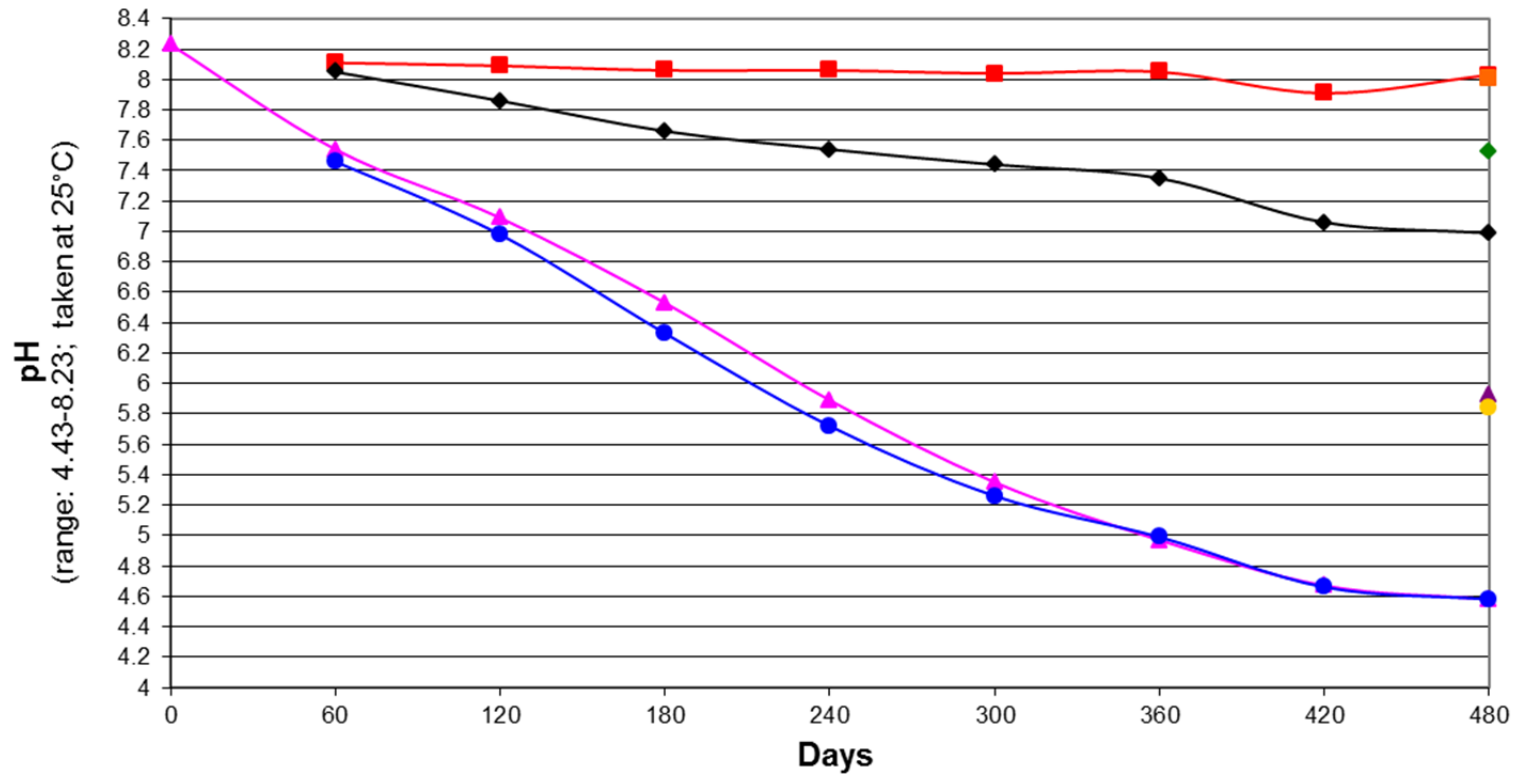
**50% w/v Polyethylene glycol 4000**  
**Conductivity Stability**  
 Initial Conductivity: 39.9  $\mu\text{S}/\text{cm}$  at 25°C



### 50% w/v Polyethylene glycol monomethyl ether 5000

### pH Stability

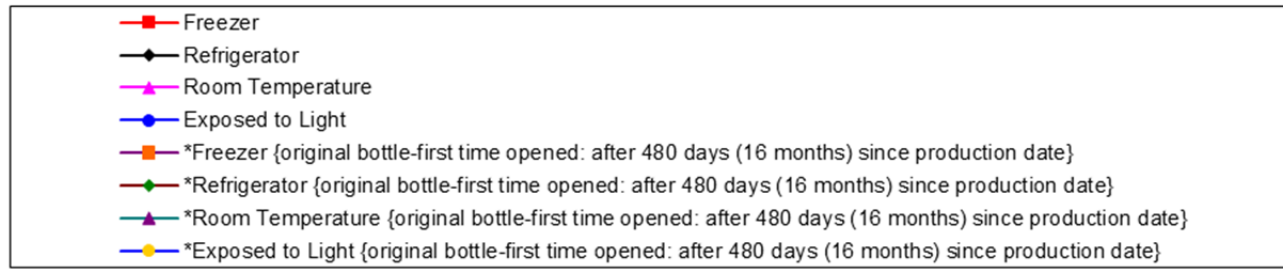
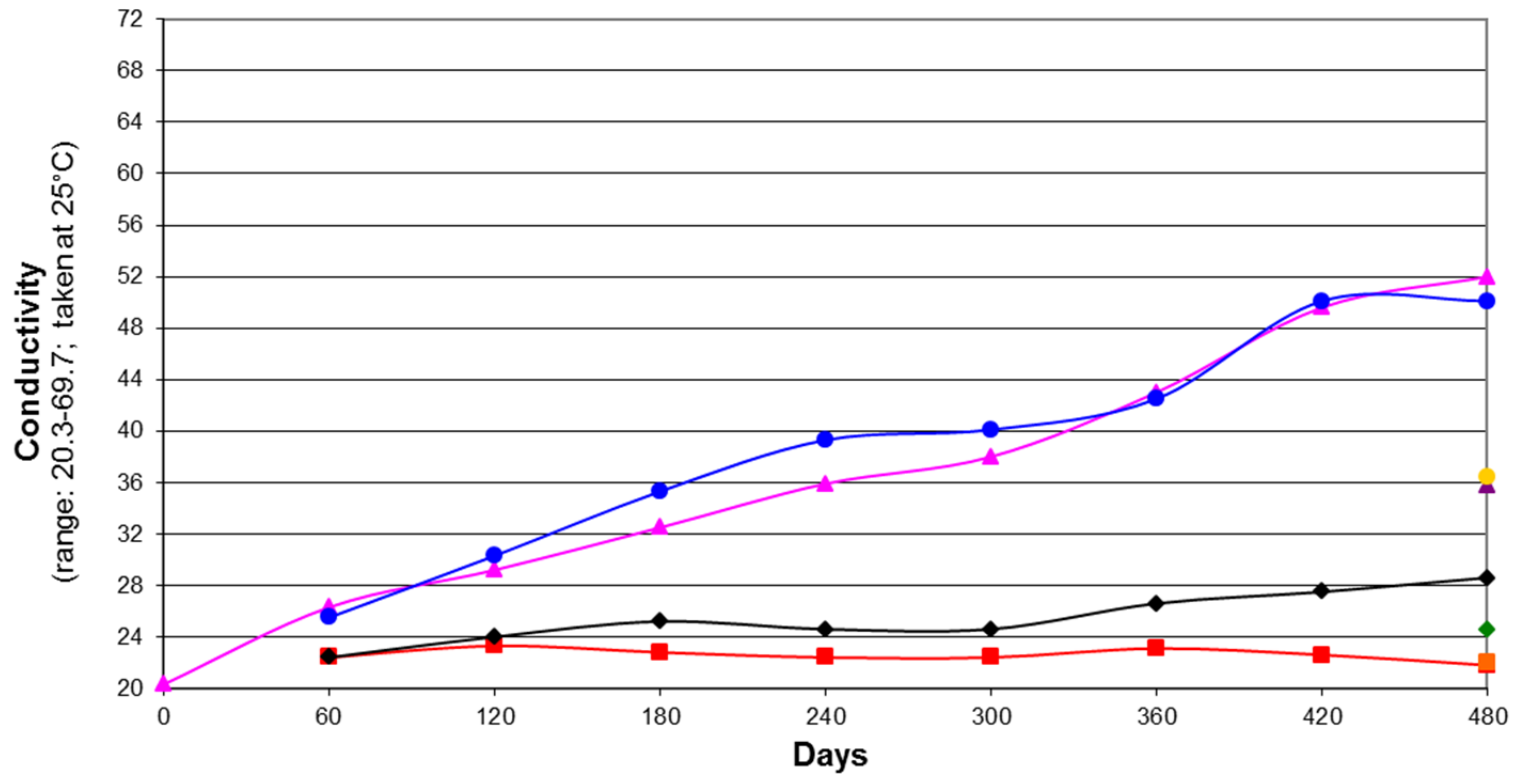
Initial pH: 8.23  $\mu$ S/cm at 25°C



### 50% w/v Polyethylene glycol monomethyl ether 5000

#### Conductivity Stability

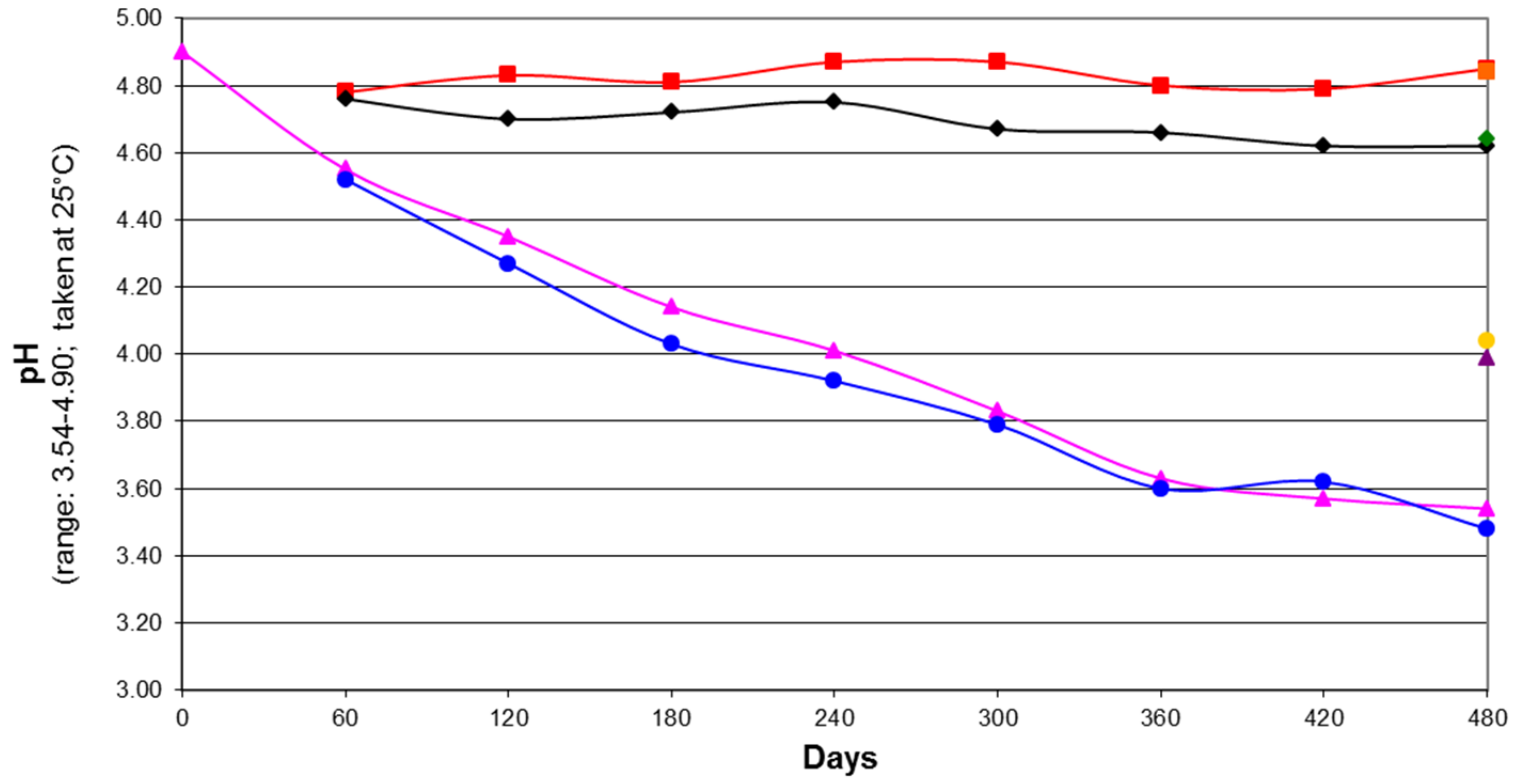
Initial Conductivity: 20.3  $\mu\text{S}/\text{cm}$  at 25°C



### 30% w/v Polyethylene glycol 20000

#### pH Stability

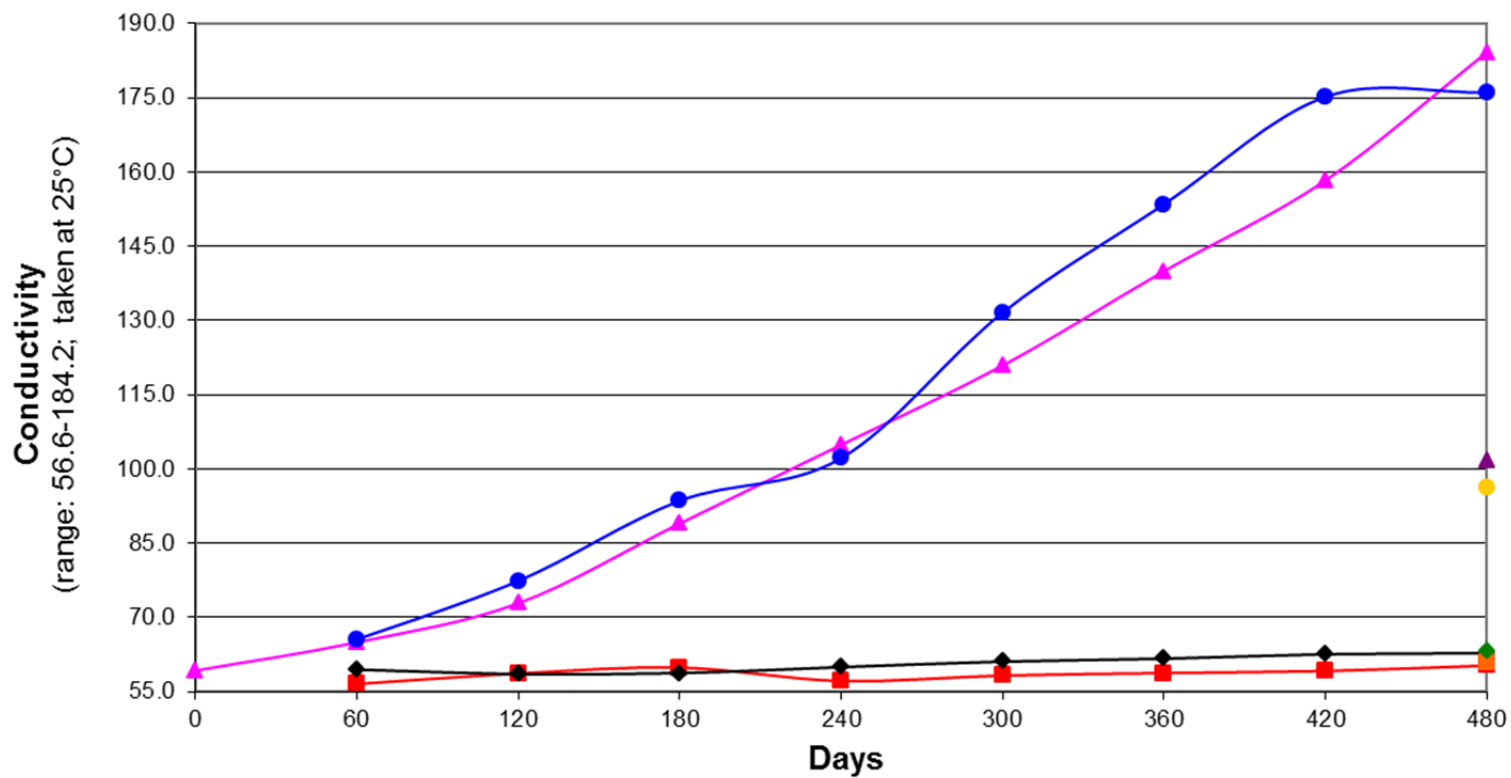
Initial pH: 4.9 at 25°C



- 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**  
**Conductivity Stability**  
 Initial Conductivity: 59.3  $\mu\text{S}/\text{cm}$  at 25°C



- 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}