Smart Notes

Greater efficiency and productivity in the lab

Water Purification

Q&A

When I check the purity of ultrapure water in a beaker, it does not match the purity on the water system display. Is there a problem with my water system?

This is an ultrapure water myth. When the purity on the display doesn't match the purity in the dispensed ultrapure water, this is not necessarily an indication that a problem exists. The truth is the purity of ultrapure water can quickly change after being dispensed from a lab water system. CO_2 in the air is readily absorbed in the pure water and creates carbonic acid, which lowers the purity and can even lower the pH.

When there is no air and no CO_2 in contact with ultrapure water, the expected conductivity of the water is 0.055 µS/cm (18.2 Mohm-cm). For outdoor or ambient air, 300 to 500 ppm CO_2 is typical. When the ultrapure water is in contact with ambient air containing up to 500 ppm CO_2, the expected conductivity of the water rises to around 1 µS/cm (or 1 Mohm-cm). What causes these varying CO_2 levels? The season of the year, plant respiration, human respiration, decaying vegetation, ventilation in a room, and more. As these CO_2 levels vary in the air, so does the CO_2 level and the conductivity reading of your ultrapure water in a beaker.

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myths

Understanding common myths and truths of ultrapure water

Measuring conductivity, resistivity, and pH in ultrapure water leads to frequent questions and "lab myths" about the measurements and what they mean to the lab. The following are some common myths and truths related to ultrapure water:

MYTH	TRUTH
Ultrapure water conductivity after dispensing should match the water system display	**Ultrapure water immediately picks up carbon dioxide and conductivity upon dispensing.** Due to this volatility, the conductivity level of the ultrapure water once dispensed will not match what is on the display. However, the CO_2 can be easily accounted for in the water as described in USP <645> Water Conductivity.
The pH of ultrapure water should be 7.0	**Fresh ultrapure water can read anywhere between pH 5.0 and 8.0.** The pH level can quickly decrease after the water has been dispensed from the water purification system. This is can be attributed to innocuous exposure to CO_2 in the air. In addition, pH is not considered a useful indicator of ultrapure water quality, because of the expected CO_2 absorption.
An ultrapure water system display will measure all the impurities in water	**The purity displayed on the water system is based on specific impurity measurements in water.** Resistivity or conductivity measures the Total Ionized Solids (TIS) or the positive and negative ions and metals in the water, organics are not included in this measurement. Total Organic Carbon (TOC) can be measured and displayed if the water system has a TOC option. Impurities such as bacteria, particulates, endotoxins, and nucleases need to be measured with additional tests.
Accessories added to ultrapure water systems will always improve purity	**Accessories could adversely affect purity depending on where it is added to the system.** Accessories such as filters and cartridges can further purify the water for specific impurities, when well chosen and well placed. However, non-recirculated water or even using additional external tubing to the system could leach ions and/or organics into the water or encourage the growth of bacteria. Check with the manufacturer before adding any additional components to the ultrapure water system to determine how it could affect the water quality.

How can I verify the purity on my display is correct?

The best way to measure the conductivity or resistivity of ultrapure water is with an inline measurement using a conductivity meter with a flow cell to exclude air and preserve the ionic purity. The purity display does not represent all impurities; therefore, additional testing based on the applications may need to be done. To prevent inaccurate results, poor analytical baselines and down time, consistent maintenance of the water system is highly recommended.

Summary

Safeguard your critical research and experiments. Separate fact from fiction when it comes to ultrapure water.

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