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White Paper

The *Do's* and *Don'ts* of Working with Purified Water

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Water is probably the most commonly used reagent in every laboratory. From reagent and buffer preparation, to sample and standards dilution, used as experimental blanks, and for simple glassware rinsing, water is everywhere. The potential impact of water quality on experimental results cannot be overlooked, especially as analytical techniques are becoming increasingly sensitive.

It is important to learn to follow a few simple 'Do's and Don'ts' when handling purified water. This will help you obtain the highest quality water from your laboratory's water purification system, and to avoid common mistakes when handling high purity water for your sensitive applications.

The *Do's* of Handling Purified Water

Flush the system before collecting water

High purity water can readily absorb chemicals from its surroundings. If a water purification system has been idle overnight or for a few days, volatile molecules from the laboratory air (organic solvents, cleaning products, etc.) may eventually contaminate the water at the system's point-of-use. It is therefore good practice to first discard a small volume of water (one or two liters), in order to collect high quality, freshly purified water for use with sensitive experiments.

Monitor your water's quality

Many ultrapure water systems display a "Resistivity" value and some also display a "TOC" (Total Oxidizable Carbon) value. Both values describe the water quality delivered by the purification system. Resistivity is commonly used to assess the ionic purity of water. If your system delivers ultrapure water with a resistivity of 18.2 MOhm.cm, it is free of any ionic impurity — as ultrapure water should be. Any drop in resistivity below 18.2 for ultrapure water and your system may have an issue that needs to be resolved. Certain systems are also able to monitor organic contamination and provide a TOC value. The TOC of ultrapure water is expected to be at or below 5 ppb (or µg/L). Some modern purification systems are equipped with digital touchscreen interfaces, which make monitoring your water quality parameters and managing your system settings even easier and more intuitive.

Pay close attention to the final filter of your water purification system

Modern water purification systems offer the opportunity to tailor the ultrapure water they deliver to specific uses in the lab. For example, there are some specific final filters designed to deliver nuclease-free water, or water optimized for LC-MS analyses. Before collecting water for your experiments, make sure that the filter placed at the point of use of the system is the most appropriate for your specific needs. If your lab's water demands vary from user to user, modern purification systems also make it possible to have multiple dispensing units, each with a different final filter, feeding out from a single purification unit.

Select the appropriate container for your sensitive applications

You may need to collect ultrapure water in an intermediary container when preparing eluents or reagents for analyses. In these situations, the container should be chosen very carefully according to the application the water is intended for. For organic analyses (e.g., HPLC), borosilicate bottles are preferred since they will not release any organic molecules into the water. For ionic analyses, polyethylene or polypropylene containers are often recommended as they release fewer ions than glass. For ICP-MS, fluoropolymers such as PFA are best. Remember to cap the container to limit direct contact with laboratory air, particles and bacteria.

Clean containers properly

The containers used to collect high purity water should be very clean to avoid contaminating the water. The cleaning procedure depends on the type of analyses being performed (diluted acid, acetone, etc.). In all cases, it is very important to rinse the containers with ultrapure water several times. For trace analyses, avoid detergents and mixing glassware used for these experiments with the glassware used for other types of work in the lab. Also, don't forget to clean and rinse the caps with the same care as the containers.

Watch out for extractables and other contaminants

When performing trace or ultra-trace analyses, everyday laboratory items can become a source of contamination. Gloves, paraffin film, marker pens, and even new furniture or floor cleaning products may release contaminants that affect water quality. For these sensitive analyses, it is recommended to minimize the use of these products and to work under a hood, thereby controlling the air in the environment of the water and the samples.

Choose your system's location wisely

If you perform trace analyses, you can help prevent contamination by making sure you place your ultrapure water dispensers in a clean part of the laboratory — away from heavy foot traffic, areas where many chemicals are used, and from windows and air conditioning vents. On the other hand, you may wish to place your source of pure water close to your laboratory's washing area, or the weighing station where you prepare common reagents. Modern water purification systems give you the flexibility to place pure water dispensers (e.g., E-POD® dispenser) and ultrapure water dispensers (e.g., Q-POD® dispenser) in different locations for greater efficiency.

The *Don'ts* of Handling Purified Water

Do not delay changing your water purification system's cartridges

It is not good practice to keep using water purification system cartridges beyond the manufacturer's recommendations — even if the system continues to deliver good quality water. Unfortunately, some purification technologies, such as ion exchange resins, will suddenly and unpredictably release large amounts of impurities when exhausted. This may occur on the day of a crucial experiment, potentially impacting results. Changing cartridges as recommended by the manufacturer will protect you from variations in water quality.

Do not store ultrapure water

When stored, ultrapure water quickly absorbs carbon dioxide from the air, leading to the formation of carbonic acid, carbonate and bicarbonate. In addition, bacteria and algae may develop in stagnant water, especially near a window or a source of heat. Bacteria release by-products, such as nucleases, endotoxins, and other organics, which can impact experiments. The storage container itself may also contaminate the water, especially large carboys whose inner walls can be difficult to clean. Whenever possible, it is best to dispense freshly purified water from the system just before use.

Avoid using plastic tubing at the outlet of the system

Placing a piece of plastic tubing at the outlet of your water system may cause several issues. First, plasticizers may leach into the ultrapure water dispensed by the system. In addition, water drops remaining inside the tubing may foster the development of bacteria or algae, contaminating the next batch of ultrapure water collected. Many modern water purification systems have a point-of-delivery device that can easily be adjusted to fit your glassware. This avoids splashes and eliminates the need for additional tubing.

Do not generate bubbles when dispensing water

When dispensing ultrapure water into a container for trace analyses, it is important to avoid generating air bubbles. Increasing the surface of contact between laboratory air and ultrapure water increases the risk of introducing airborne contaminants into the water. Contaminants include potentially volatile organics, or inorganics such as ammonia or chloride, which are ubiquitous in laboratories. To achieve an optimal dispense, tilt the container so that the stream of water slides along the wall of the flask, instead of flowing straight to the bottom and generating bubbles.

Beyond carefully selecting a suitable water purification system for your laboratory, it is important to know how to obtain, handle and use that water correctly. Following these do's and don'ts will not only help you take full advantage of your water system, but will also allow you to obtain high purity water that fits the requirements of even the most sensitive analytical techniques.

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