Filtering out inconsistencies:

The simple answer for reproducible results and increased productivity in water testing

Wastewater | **Drinking water** | **Ground water**

Water testing includes everything from routine drinking water screenings to targeted safety investigations following a Legionella outbreak. Regardless of the sample, water testing laboratories have the dual aim of obtaining reproducible results and driving productivity.

A straightforward way to achieve these goals is by using the right filter.

This article covers the importance of filtration in water testing, and how an informed approach to filter selection can save laboratories time and money, and contribute to consistent results.

Reproducibility and productivity – the dual aim of water testing laboratories everywhere

Water is Earth's life force. Whether you work in wastewater, drinking water, or ground and surface water — laboratory testing is a huge part of everyday life.

Rigorous testing is the only way that we can be sure water is safe, fit for purpose, and compliant with relevant regulations.

Modern chemistry can detect thousands of harmful chemicals and pathogens in water, and regulations vary from region to region.

Two simple objectives drive the business of laboratory testing: the need for reliable, reproducible results and increased productivity.

Reproducibility is a scientific necessity. If results are unreliable laboratories risk noncompliance with local regulations and put public health in danger. It can lead to unnecessary retests, which adds to technicians' workloads.

Water testing is expensive, time-consuming, labor-intensive, and entirely unavoidable. Laboratories must be conscious of ways to reduce costs while prioritizing safety.

Meeting the dual aim with filtration

Filtration is often overlooked when working to improve reliability and productivity. This workflow step has potential to make a significant difference in the lab.

Choosing the correct filter matters. In some workflows, filters are regulatory mandated. It is also worth noting that incorrect filter selection can lead to inconsistency of results. For example, during sample preparation filter impurities can leech and contaminate samples. This results in unreliable, unreproducible data.

Using a filter with the wrong pore size for the analytical technique can lead to particulate contamination. This may clog and damage machinery and reduce the lifespan of expensive equipment. Broken equipment increases down time and maintenance costs.

Filtration is a time-consuming step of the water testing journey, often taking multiple hours.

Ultimately, filtration matters. And taking it seriously can add quality to your processes while boosting output.

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Driving reproducibility and productivity: Wastewater testing

Testing the treated wastewater generated by industrial processes and domestic use before it's released into the sewer system is a matter of public and environmental health.

Organizations have a responsibility to ensure compliance with regional regulations regarding pollution and pathogens. In addition to health risks, business consequences of releasing contaminants back into the environment are significant.

Quality monitoring

Monitoring general water quality relies on the measurement of different parameters, including total suspended solids (TSS) and total dissolved solids (TDS), which are the molecules and ions that remain in a water sample after filtration.

High levels of TDS can indicate minerals, such as iron or manganese, were not removed by the treatment process. High TSS can signify solid sewage that protects pathogens from chlorine during disinfection.

Regulations on workflows and thresholds vary depending on country, region, or city., Regardless of the location, wastewater quality testing is a long, manual process. One of the most common parameters when determining water quality is total solids (TS), or the total weight of TDS and TSS. Proper filtration is vital in this process.

Regulations

In Europe, EN 872 describes a standard method for measuring suspended solids in water, while the United States Environmental Protection Agency mandates Method 2540D from its Standard Methods for the Examination of Water and Wastewater.

Although each country has their own testing standards, they generally use the same type of approach and may even adopt the exact same methodology as EN 872 or US standard method 2540.

The workflow involves passing a sample of water through a glass microfiber filter and then measuring:

- the solid residue left on the filter (suspended solids)
- the solid residue from the filter that incinerates at high temperatures (volatile solids)
- the solids residue present after evaporating the water that passed through the filter (dissolved solids)

Choosing the right filter

In order to comply with local regulations, choosing the correct filter is essential.

For example, EN 872 lists the following specifications for laboratories determining TSS:

- filter should be borosilicate glass fiber
- filter should not contain binders
- mass per unit area should be between 50 and 100 g/m2
- mass loss in a blank measurement should be less than 0.017 mg/cm2

Suspended solids testing methods often involve complex, time-consuming filter pre-treatment. For example, in method 2540D, the filter must be rinsed three times, then dried and weighed until a constant weight is obtained. When testing for volatile suspended solids, as per method 2540E, it must also be ignited in a furnace at 550°C. Additionally, this process needs to be done in a way that returns reliable results.

Laboratories can generate reliable results by working with a trusted brand with a proven track record of quality. Cytiva has been making high-quality Whatman™ filters for more than 100 years. By generating consistent results, organizations avoid unnecessary retests, saving both time and money.

The advent of ready-to-use products, such as 943-AH, can cut timelines significantly. Pre-treated in accordance with US Standard Method 2540, they provide time and cost savings, and with fewer steps in the process, there is less room for human error.

Which filter is right for you?

943-AH: Pre-weighed and prewashed, these ready-to-use Whatman™ glass microfiber filter papers are the time-saving version of 934-AH™ glass microfiber filter papers. Use for total suspended solids analysis, dissolved solids, and volatiles.

GF/C: Whatman™ filter paper grade GF/C glass filters offer fine particle retention, good flow rate, and high loading capacity. GF/C filter papers support total suspended solids analysis.

Driving reproducibility and productivity: Drinking water testing

Drinking water is subject to some of the strictest quality regulations in the world. Ensuring water is safe to ingest is a cornerstone of effective public health policy.

Private and public organizations have an ethical and regulatory duty to avoid the bacterial and chemical contamination that can spread disease and damage health.

Quality monitoring

The techniques used frequently include high-performance liquid chromatography (HPLC), liquid chromatography–mass spectrometry (LC–MS), inductively coupled plasma (ICP), and spectrophotometry.

These advanced methods require some degree of manual sample preparation – including filtration. The impact of this step on productivity and quality assurance can be overlooked.

If particulate matter is not removed from the sample effectively, it can clog and damage equipment and components. In HPLC, particulates can block column frits, reduce column life, and damage the injection valve seal. This reduces the lifespan of expensive equipment, while increasing down time and maintenance costs.

Ineffective filtration can have a negative impact on an organization's quality assurance processes. Any visible particulate matter not removed from the sample prior to spectrophotometry decreases reliability and reproducibility of results.

Regulations

According to the 2018 A global overview of national regulations and standards for drinking-water quality, published by the World Health Organization, national or regional drinking standards should be led by a country's specific circumstances, needs, and resources.

The report, which summarizes the aesthetic, chemical, microbiological, and radiological parameters in and 104 countries and territories, says the majority of regulations state that water intended for human consumption should not:

- contain concentrations of compounds which could, either alone or in combination with other compounds, be harmful to human health
- contain any microorganisms and parasites in such a number that could be harmful to human health

Choosing the right filter

Drinking water monitoring includes a variety of chemical and biological analyses. Laboratories need to match the right filter to the right sample preparation technique.

Chemical processes

One important consideration is ensuring sample preparation does not interfere with the analytes of interest. This includes non-specific binding of compounds or release of interfering extractables. Both can introduce variability and inaccuracy into results.

In HPLC processes, extractables can interfere with UV-Vis detection methods, especially when working at very low levels of analytes. Using syringe filters or capsules with low levels of UV-Vis absorbing extractables under typical solvent conditions can help alleviate the problem. The SPARTAN™ syringe filter features a regenerated cellulose (RC) membrane with broad solvent resistance, making it low in extractables. It has also been assessed under a variety of conditions as part of the QC release step.

When preparing samples containing chemical elements or compounds for Ion chromatography (IC) analysis, laboratories may encounter anionic extractables. This can interfere with IC applications and significantly impact the reliability of results. Products with low levels of anionic leachable, such as the Anotop™ IC Syringe Filter, ensure anionic extractables in parts per billion.

Blank values are an important consideration when preparing samples for chemical oxygen demand (COD) and dissolved organic carbon (DOC) analyses. Puradisc™ Aqua 30 syringe filter with prewashed hydrophilic cellulose acetate membrane was developed to ensure low blank values in the determination of TOC and DOC.

Biological processes

From the general detection of microorganisms to the identification of specific strains, microbial enumeration using the membrane filtration technique is a common method for determining the bioburden of water.

The choice of filter is important, it needs to meet the requirements for retaining organisms at a level that allows detection.

The filter diameter is governed by the volume of the sample to be prepared, and the anticipated number of colonies after incubation. Laboratory technicians need to be able to quickly and efficiently count the number of colonies at the end of the process.

A sterile, white, gridded 0.45 µm filter such as the Whatman™ ME 25/21 ST membrane, is a commonly used membrane for this task.

Bioburden evaluation has a complex process of sample preparation and incubation period steps. Membrane filters for microbiological quality control testing must be handled aseptically to ensure they remain sterile and provide accurate test results, making the workflow resource intensive.

Membrane dispensers, such as the Whatman™ eButler, provide one disc at a time by peeling open a continuous web of individually sealed discs. The result is a more efficient workflow that maintains integrity of results.

Which filter is right for you?

SPARTAN™ syringe filters with RC membrane provide reproducible filtration of organic and aqueous solutions for HPLC and UHPLC sample preparation.

Anotop™ IC Syringe Filters are designed for efficient filtration prior to ion chromatography. Each batch is certified for low levels of anion leaching in ion chromatography (IC) filtration

Puradisc™ Aqua 30 is specifically designed for environmental sample filtration prior to DOC and COD analysis. Prewashed cellulose acetate means reduced organic carbon extractables. It is also recyclable.

Whatman™ eButler Membrane Dispenser rapidly dispenses a sterile disc of membrane either hands free or with push-button operation, enabling a more efficient microbiology quality control testing workflow.

Driving reproducibility and productivity: Ground and surface water testing

Ground and surface water account for a large proportion of water on our planet, making it a significant component of the global water cycle.

Ground and surface water may be used for drinking, recreation, irrigation, and for watering livestock. If these water sources become contaminated, they can potentially put people and animals at risk.

Those working in the ground and surface water testing field are aware of their responsibility to protect our water from agricultural and industrial pollution, and chemical and pathogen contamination.

Quality monitoring

Surface and ground water quality testing are wide-ranging fields. Laboratories carry out multiple physical, chemical, and biological tests every day.

Chemical and physical tests include high-performance liquid chromatography (HPLC), liquid chromatography–mass spectrometry (LC–MS), inductively coupled plasma (ICP), and spectrophotometry.

These are advanced methods, and sample preparation is essential to their success. Filtration has a significant impact on productivity and quality assurance.

Incorrect pore size can result in unwanted particulate matter in the prepared sample. This can block column frits and damage the injection valve seal, while increasing wear and tear. Ineffectively filtered samples can mean more down time, higher maintenance costs, and shorter lifespans for expensive laboratory equipment.

Ineffective filtration can have a negative impact on an organization's quality assurance processes. Any visible particulate matter not removed from the sample prior to optical test can occlude the light beam and lead to unreliable results.

Regulations

Regulations and thresholds vary between regions, but compliance with local standards is essential for business and public health. Therefore laboratories spend their days testing samples for a long list of compounds and pathogens in ground and surface water.

Choosing the right filter

Ground and surface water monitoring includes a variety of physical, chemical, and biological tests. Sample preparation is driven by method of analysis, leaving laboratories to match the right filter to the right technique if they want reliable, reproducible results and maximum efficiency.

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Physical and chemical processes

A common test in the ground water arena is total suspended solids (TSS). Sample filtration in this test is a complex process. Steps include rinsing the filter three times, drying, and weighing the filter until it is at a constant weight. These steps must be done consistently to obtain reliable results.

The advent of ready-to-use products, such as 943-AH™, has presented laboratories with a productivity boost. Pre-treated in accordance with US Standard Method 2540, they provide time and cost savings by eliminating the need for multiple rinsing.

When preparing samples for chemical oxygen demand (COD) and dissolved organic carbon (DOC) analyses, blank values are an important consideration. Syringe filters with prewashed hydrophilic cellulose acetate membrane, such as the Puradisc™ Aqua 30, have been specially developed to ensure low blank values.

When testing for metals in ground water, some countries, including the USA, require the sample to be filtered at source, often in large volumes. This can be logistically challenging, and often necessitates the use of multiple devices. But solutions with expanded capacity, such as the 50mL Whatman™ Polycap Ground Water capsule filter, can streamline field testing.

Laboratories also often work with syringe filters and ensure the sample preparation step does not interfere with the analytes of interest, either with regards to the non-specific binding of the compounds or by the release of extractables. Syringe filters with regenerated cellulose (RC) membranes and broad solvent resistance, like the SPARTAN™ filter, are low in extractables, meaning they can help avoid introducing variability and inaccuracy into results.

Biological processes

Membrane filter enumeration is commonly used to evaluate the bioburden of water. This involves detecting microorganisms and identifying specific strains. The crucial role of filter selection in this complex workflow is often overlooked.

The filters must be able to retain the organisms at a level that allows technicians to detect them under a microscope.

Considerations include the volume of the sample to be prepared and the anticipated number of colonies after incubation. A sterile, white, gridded 0.45 µm filter, such as the Whatman™ ME 25/21 ST membranes, is a useful choice.

Membrane filters for microbiological quality control testing must be handled aseptically. This ensures they remain sterile and provide accurate test results, but it also adds to the resource-intensive nature of the workflow.

Fortunately, productivity boosting solutions now exist. Membrane dispensers, such as the Whatman™ eButler for example, provide one disc at a time by peeling open a continuous web of individually sealed discs. This results in a more efficient workflow while maintaining the high standards that drive reliable, reproducible results.

Which filter is right for you?

Whatman™ Polycap Ground Water capsule filters are specifically designed for sample preparation of ground water samples for dissolved metals analysis. The in-line design with stepped hose barbs and hydrophilic polyethersulfone (PES) membrane make it easy to use for field sampling.

Whatman™ Polydisc In-Line Filters, for ground water are specifically designed for preparation of ground water samples for dissolved metals analysis. The hydrophilic, durable nylon membrane is compatible with aqueous samples, and the 100% quartz fiber prefilter with low heavy metal content allows filtration of larger volumes of even heavily particle-laden samples.

Puradisc™ Aqua 30 is specifically designed for environmental sample filtration prior to DOC and COD analysis. The prewashed cellulose acetate means reduced organic carbon extractables. It is also recyclable.

Whatman™ eButler Membrane Dispenser rapidly dispenses a sterile disc of membrane either hands free or with push-button operation, enabling a more efficient microbiology quality control testing workflow.

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Find out more

Whether you work in wastewater, drinking water, ground or surface water testing, we have the products and the expertise you need to meet the dual aims of laboratories everywhere: generating reliable, reproducible results and boosting productivity.

Selecting the right filter for the right sample preparation task can make a significant difference.

With the Whatman™ range, Cytiva combines the widest portfolio of filtration products available on the market with extensive, in-depth knowledge of testing and filtration processes.

Speak to us to discover which membrane is right for you and start reaping the benefits today.

Request a free sample from Midland Scientific

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Contact your local Cytiva representative for the most current information.
For local office contact information, visit cytiva.com/contact

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