Environmental water FAQs



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

Environmental water quality and contamination can have significant and wide-ranging impacts on ecosystems, human health, and biodiversity. Contaminants arise from numerous locations including agricultural, industrial, and domestic sources.

Rigorous testing can help ensure that water is safe, fit for purpose, and compliant with relevant regulations.

Following are a number of common environmental water testing frequently asked questions.

What is eDNA analysis?

Environmental DNA (eDNA) analysis is a powerful and rapidly evolving scientific technique that involves extracting and analyzing DNA from various environmental samples such as water, soil, or air.

eDNA refers to genetic material (such as DNA) that is released into the environment by organisms through shedding of cells, skin, feces, or other biological materials.

The main uses of eDNA analysis include biodiversity monitoring, invasive species detection, endangered species conservation, water quality assessment, environmental impact assessments, forensic applications, biosecurity, and disease monitoring.

Overall, eDNA analysis offers a non-invasive and sensitive tool for ecological and environmental studies, contributing to our understanding of ecosystems and supporting conservation and management efforts.

How is environmental eDNA analysis performed?

eDNA analysis involves non-invasive sampling methods, which reduces the impact on target species and their habitats. This is especially important when studying sensitive or endangered species.

eDNA analysis involves several steps starting with sampling, nucleic acid capture and concentration, sample preservation, extraction, amplification, and sequencing. Due to the low concentration and potential complexity of nucleic acid within an eDNA sample, the sample capture and preservation steps are critical to achieve reliable results.

Filtration can be used in the capture step for concentrating nucleic acid samples. Filtration also helps remove particulate matter, leaving behind a cleaner sample for DNA extraction.

The filtration capture step may be actioned onsite (at the sample source) or in the laboratory. When performing the filtration step onsite the desired volume of water is filtered through a filtration device, a preservative added, and the filter unit transported to the laboratory for extraction. Typically syringe filters, capsule devices or pre-assembled filter funnels are used in this type of sampling.

Alternatively, a sample of water can be transported back to the laboratory and filtered. Typically, a filter disc and filter funnel are used in this type of sampling.

What are PFAS and how is PFAS analysis performed?

PFAS, which stands for per- and polyfluoroalkyl substances, are a group of man-made chemicals that have been used in a wide range of industrial and consumer products for many years. PFAS are known for their resistance to heat, water, and oil, making them useful in applications such as non-stick cookware, waterproof clothing, food packaging, firefighting foams, and more. They have also been associated with potential health and environmental risks due to their persistence in the environment and bioaccumulation in living organisms.

PFAS testing is performed to detect and measure the presence and levels of these chemicals in various environmental and biological samples. There are several methods and techniques used for PFAS testing, depending on the sample type and the specific PFAS compounds of interest.

Liquid Chromatography-Mass Spectrometry (LC-MS) is a widely used analytical technique for PFAS testing. It involves separating PFAS compounds in a sample using liquid chromatography and then detecting and quantifying them using mass spectrometry. LC-MS can provide high sensitivity and specificity for a wide range of PFAS chemicals.

Why are filters recommended for use in sample preparation when performing PFAS testing?

Liquid Chromatography-Mass Spectrometry (LC-MS) is a widely used analytical technique for PFAS testing and can provide high sensitivity and specificity for the detection and identification of a wide range of PFAS chemicals.

Filtration of both analytical samples and mobile phase solutions using the correct device is a simple and economical way to protect liquid chromatography columns and instruments from unwanted particulate contamination. Particulate can cause blockages in injection ports, pumps, capillary tubes, and columns that can lead to premature column replacement, system downtime and incorrect or inconsistent results.

Membrane filters constructed from nylon, regenerated cellulose or polyether sulphone are typically used and sample preparation steps. Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS, references a 0.2 µm, nylon, Acrodisc™ syringe filter.

What is suspended solids testing?

Suspended solids testing is a laboratory or analytical procedure used to measure the concentration of solid particles that are suspended in a liquid. These solid particles are typically not dissolved in the liquid and can include a variety of materials such as sediment, particles, and organic matter. Suspended solids are commonly found in wastewater, surface water, and industrial effluents.

The measurement of suspended solids is important in various fields and industries, including environmental monitoring, water treatment, and wastewater management. It helps assess the quality of water bodies, evaluate the effectiveness of treatment processes, and ensure compliance with regulatory standards.

There are different methods for conducting suspended solids testing, but one of the most common techniques involves filtering a known volume of the liquid through a pre-weighed filter paper or membrane. The solid particles are trapped on the filter, while the liquid passes through. After drying and weighing the filter with the trapped solids, the concentration of suspended solids can be calculated as grams of solids per liter (or milligrams per liter) of the liquid sample.

What are the guidelines for environmental suspended solids testing?

Generally, each country will have its own standard test method for assessing solids in wastewaters, however in some cases, standards may be published by international standards bodies and adopted in other countries or regions. While there may be some differences in the methodologies and filter preparation steps, most solids methods are broadly similar in their general approach. Two of the more common methods are EN872 and Standard Method 2540.

EN 872 is a European standard method used for the determination of suspended solids in water samples. It is part of a series of standards developed by the European Committee for Standardization (CEN) for water quality analysis.

Standard Method 2540, also known as U.S. EPA Method 160.2, is a widely used method in the United States for the determination of suspended solids in water and wastewater samples. This method follows a similar principle to EN 872, involving the filtration of a known volume of water through a pre-weighed filter or glass fiber filter.

What's the difference between Cytiva standard products and ready-to-use (RTU)?

We supply several ready-to-use (abbreviated to RTU) products. The Whatman™ RTU filter family are certified pre-treated in line with key requirements for sample preparation, helping you to support an accurate analysis while reducing time spent on sample preparation.

For example, our Whatman glass microfiber filter papers in grade 934-AH™ RTU for suspended and dissolved solids are pre-washed, dried, cooled, and weighed filters with certified mass loss between washing and drying steps of the lesser of less than 0.5 mg or 4% in accordance with US EPA Lab Standard Method 2540 parts C and D.

The GF/C™ RTU line, part of the Whatman GF/C filter paper family, is pre-treated with washing, drying, cooling (in a desiccator), and weighing steps aligned to the requirements of EN 872, the European norm for testing suspended solids in water. Our quality organization certifies that these filter paper have weight loss of less than 0.017 mg/cm^2 after preparation, as required by the standard. Each ready-to-use glass filter paper is placed in an individually barcoded aluminum pan that notes the filter paper weight.



GF/C and 934-AH glass fiber filters meets the requirements of EN872 and EPA 2540D.

How are filters typically used in microplastics analysis?

Microplastics are defined as small plastic particles, typically less than 5 millimeters in size, that can be found in the environment. They originate from various sources, including the breakdown of larger plastic debris, the abrasion of plastic products, and the direct release of micro-sized plastic particles in personal care products or industrial processes. These particles can persist in the environment for long periods and pose risks to ecosystems and organisms.

Filtration is commonly used in microplastics analysis to separate microplastic particles from environmental samples such as water, sediment, or biological tissues. Before filtration a sample may undergo pre-treatment steps to remove larger debris, this can involve processes such as sieving, settling, or centrifugation.

The sample is passed through a filter membrane or other filtration media with a specific pore size. The pore size of the filter is chosen to retain microplastics while allowing smaller particles and dissolved materials to pass through. Common pore sizes range from 20 µm to 1 µm, depending on the study objectives and the expected size range of microplastics in the sample.

The filtration step both collects and concentrates any potential microplastic contaminants. Analysis can be performed using different methods including, microscopic identification (based on physical characteristics, such as size, shape, color, and surface texture) or chemical analysis, for example Fourier-transform infrared spectroscopy (FTIR) or Raman spectroscopy.

How is the Envirochek™ HV sampling capsule used in concentration and recovery of *Cryptosporidium* and *Giardia* cysts from source or finished water?

Envirochek HV capsules are used for collection and recovery of *Cryptosporidium* oocysts and *Giardia* cysts in source, finished, or disinfected water including surface water, municipal water supply and effluent, samples in containers, or wells.

The Envirochek HV sampling capsules can be used to filter the water in the field or by shipping a “grab” sample of water back to the lab and filtering it on the bench top. It is generally more cost effective to filter in the field and easier to maintain the right sample preservation temperatures by shipping the capped filters back to the lab. The capsule is then filled with an elution solution, placed on a laboratory shaker, and vigorously shaken to elute any captured oocysts and cysts. The elution solution is decanted and centrifuged to a pellet for further examination by the user’s method of choice.

Envirochek HV capsules are validated and listed in U.S. EPA Methods 1622 and 1623, 1623.1 and 1693 and used for sampling a variety of water for *Cryptosporidium* and *Giardia*. Together, the EPA method and Envirochek HV capsule present a major improvement over the previous string wound cartridge method, offering typically greater than 70% recovery of target organisms. The Envirochek HV capsule is also listed in ISO/DIS 15553.

Envirochek HV capsules are designed for sampling up to 1,000 L of drinking water, up to 50 L of source water and 10 L of disinfected water. The Envirochek HV capsule incorporates a track etched membrane designed to process high volumes of treated water while maintaining high recovery characteristics and meeting U.S. EPA requirements. Envirochek HV capsules are also approved by the United Kingdom DWI standard operating protocols for monitoring drinking water for *Cryptosporidium*.



Envirochek HV capsule for *Cryptosporidium* and *Giardia* monitoring.

Which microbiology products are recommended for environmental water quality testing?

Microbial quality testing of environmental water samples, including municipal water sources, public bodies of water, natural water sources, and wastewater can be difficult work during field collection and in the laboratory.
Microbiology QC laboratory workflows need to consider efficiency, budget, and regulatory requirements. They also need to limit the possibility of cross-contamination between samples.

The membrane filtration (MF) technique is a reliable method for fast, flexible testing whether you're testing materials with concentrated or very low levels of microbes. The MF technique offers the advantage of isolating discrete colonies of bacteria, whereas the most probable number (MPN) procedure only indicates the presence or absence of an approximate number of organisms (indicated by turbidity in test tubes). The MF technique also permits testing of large sample volumes, which is ideal when testing larger volumes of environmental waters.

The MF technique can be performed by utilizing different laboratory workflows that may implement the use of individual disposable funnels, partially disposable products, or reusable hardware. The choice of workflow needs to consider laboratory efficiency, budget, and contamination risks and meet regulatory requirements. Other factors may influence the workflow including the number of daily samples, number of laboratory technicians, availability of laboratory space, sample logistics, autoclave size, and personal choice.
We offer microbiology products that provide efficient solutions for high volume sampling, products that help reduce the risk of sample-to-sample cross contamination, and improved ergonomics while meeting necessary regulatory requirements.

Our products include a range of membrane discs, membrane dispensers, filter funnels, pumps, and manifolds.
Visit here to learn more.

cytiva.com

Cytiva and the Drop logo are trademarks of Life Sciences IP Holdings Corporation or an affiliate doing business as Cytiva.

934-AH, Acrodisc, Envirochek, GF/C, and Whatman are trademarks of Global Life Sciences Solutions USA LLC or an affiliate doing business as Cytiva.

© 2024 Cytiva

For local office contact information, visit cytiva.com/contact

CY41793-16FEB24-FL