White Paper

Laboratory water

A key reagent for experimental success

Contents

Introduction

Every day, scientists around the world are using water for a multitude of purposes. But the quality of this reagent is too important to ignore - contaminants and variabilities in laboratory water are putting too many results at risk.

In this guide, we share ELGA's expert knowledge about laboratory water, which we have gained since the 1950's from our pioneering development in water purification technologies. We explore the different levels of water purity and look at some of the challenges around choosing what to use for a successful experimental outcome at the most economical cost. And we discuss the different options available for achieving a reliable source of purified water in your laboratory.

We will demonstrate why using the right level of water purity is an essential way to help you achieve more consistent, accurate results. And that installing an in-house purification system can save you time, money and reduce your environmental impact.

1 What's in your laboratory water?

Water is essential for our everyday lives. We drink it. We wash in it. We clean with it.
As we know, life on Earth is dependent on it.

And water is used for a myriad of purposes in laboratories all over the world. In fact, a typical laboratory is estimated to use around five-times as much water as a comparably sized office block – that's about 35 million litres per year .[1]

But how much do you really know about the water you're using for your experiments?

Two important factors you need to be aware of are:

- **Water contains a myriad of contaminants**

  Due to its incredible solvent properties, water mixes with and dissolves a wide variety of substances -meaning lab water sources contain many different contaminants (see Table 1). **Even trace levels of impurities can affect a variety of scientific applications[2] – putting your results at risk.**

- **Water sources are highly variable**

  Drinking water needs to conform to local regulations and have acceptable clarity, taste and odor. This is achieved by treating natural water sources, such as reservoirs, rivers or underground aquifers through a series of steps, which vary with the water source, local and national regulations, and the choice of technologies.[3] So, it's easy to appreciate that water will vary significantly from one geographical location to another - and it can even change from season to season.[4] **Water is a source of variability in your experiments that you can't afford to ignore.**

Contaminant	Examples of problems or detrimental effects on laboratory applications
Suspended particles and colloids	Inaccurate or poor results from most laboratory assays and methodologies Block filters, chromatography columns or membranes
Dissolved inorganic compounds	Ionic instability will affect protein solubility and protein-protein and protein-lipid interactions – which can affect enzymatic reactions Heavy metals are toxic to various cells in cell culture
Dissolved organic compounds	Can support growth of unwanted microorganisms Poor results from sensitive processes such as chromatography Can degrade other experimental targets e.g. proteins and nucleic acids Can interfere with spectrophotometric testing Deactivates enzymatic reactions and inhibits cell growth in cultures
Microorganisms & biomolecules (including endotoxins, enzymes and nuleases)	Failure of techniques requiring sterile conditions Poor results from molecular biology techniques Blocking filters and tubing
Dissolved gases	Oxygen and nitrogen in water can affect biochemical reaction rates. High concentrations can even result in bubble formation, disrupting spectrophotometric measurements and impeding flow through micro-channels and columns. Chlorine can bleach immunohistochemistry staining on slides

Table 1: Water contaminants and examples of their potential impact on laboratory applications.[2]

2 Why should you worry about water impurities?

As a scientist, we know that you care about getting reliable, accurate results from your experiments. And, as you will be all too aware, producing good data from your experiments is highly dependent on the quality of your reagents.

It's simple. Poor reagents in = poor results out

You wouldn't dream of cutting costs using a sub-standard enzyme or chemical reagent - it's just not worth the wasted time and frustration of failed experiments or unreproducible results. And it's no different with laboratory water, that frequently-used substance that underpins so many scientific and medical applications. Making sure that you use the correct level of water purity is an easy step towards producing consistent, accurate results.

Did you know?

- Contaminants or ionic imbalances in your laboratory water can seriously impact on your data
- Water impurities can affect most enzymatic reactions needed for basic molecular biology techniques
- Storing purified water will introduce leachables into the water and encourage proliferation of bacteria

Here are just a few examples of how water impurities could affect various experimental techniques:

Blotting techniques

- Your success with Southern, Northern or Western blotting will depend upon the water quality you use for preparing your samples and solutions. For example, bacterial contamination could introduce additional proteins that can compromise Western blotting. Bacterial nucleases can degrade nucleic acids during Northern and Southern blotting – and stray organic molecules can interfere with hybridization by binding non-specifically in place of DNA or RNA. And excessively high ionic contamination can disrupt migration during electrophoresis.

Trace analysis

- A high level of water purity is essential for these highly sensitive analytical techniques such as LC-MS, GC-MS and GFAAS. For example, performing inductively coupled plasma mass spectrometry (ICP-MS) demands your solutions to have virtually zero levels of additional elements or ions. With detection levels down into the parts per trillion (ppt), impurities can lead to artificially high sample concentrations or errors in blanks and calibration samples, meaning the accuracy of results will be severely affected.

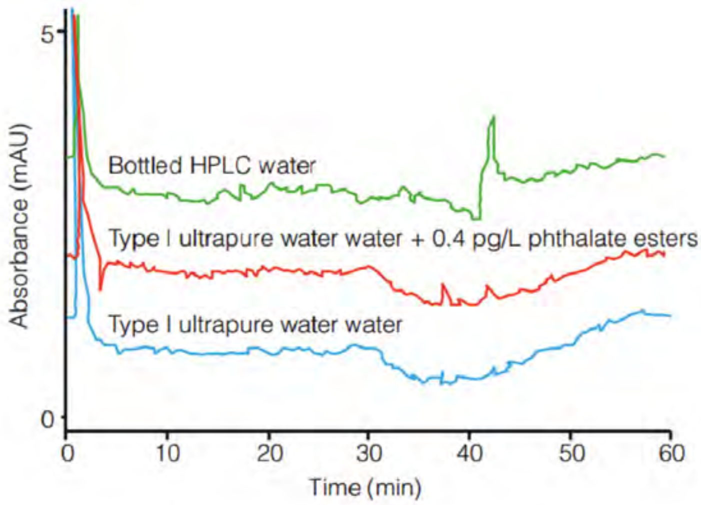


Figure 1. A comparison of purified water qualities used in HPLC. 50 ml water concentrated on a C18 column and eluted with a water:acetonitrile gradient, 0–100% at 5%/min, flow rate 2 ml/min, with UV detection at 254 nm.[9]

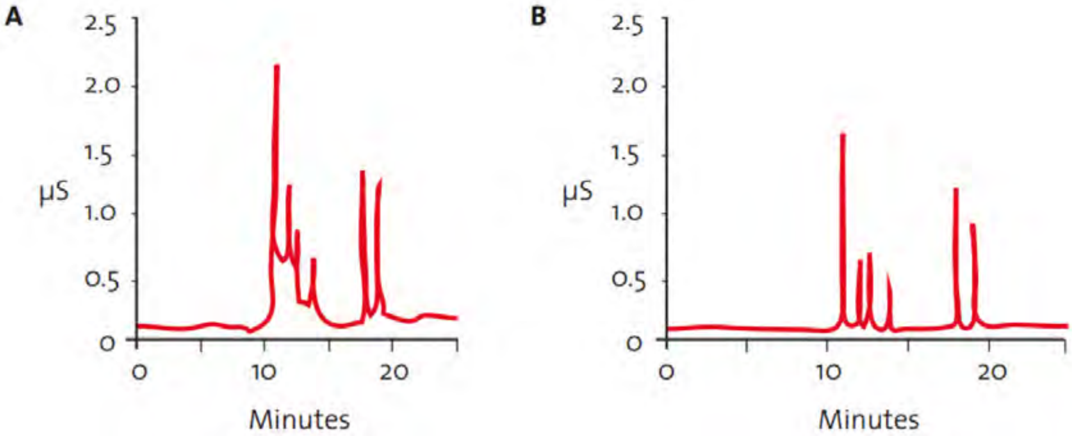


Figure 2. The effect of ionic contaminants from water on baseline used in ion chromatography, integration and resolution: (A) poor water quality and (B) Type I (18.2 MΩ-cm) water. The 'noise' introduced around the 10–15 minute mark is clearly apparent.[10]

Chromatography

- As high-performance liquid chromatography (HPLC) is used to detect constituents of complex mixtures, sometimes in the parts per billion (ppb) ranges, it's unsurprising that results are highly dependent on water purity (figure 1). Organic compounds can compete with the analyte, reducing levels retained in the column. Other concerns include bacteria and ionic contaminants which can affect some chromatographic separations.

- When using ion chromatography (IC), trace levels of ions can have a much more pronounced effect than with HPLC (figure 2), and can lead to inaccurate or poor results. Dissolved gases, such as carbon dioxide, can alter the pH of the mobile phase, which in turn can alter elution times or reduce the effective capacity of the stationary phase. Bacteria and organic compounds can also have detrimental effects – and particles and colloids can result in elevated back pressure, affecting pumps and impacting on the integrity of the analysis.

Polymerase chain reaction

- Water quality can impact on a universal molecular biology technique – the polymerase chain reaction (PCR). The reaction can be inhibited by water contaminants such as nucleases that can leave you without a stable product – making nuclease-free water a must! And no-one wants to inadvertently amplify lengths of contaminating bacteria DNA. Inorganic contaminants also pose a risk, with DNA polymerases highly sensitive to common cations that can disrupt substrate binding and inhibit enzymatic activity. Negatively charged inorganic compounds can also compete with DNA at the polymerase active site, disrupting experiments.

Histology and immunohistochemistry

- Water quality is often a key area to troubleshoot when immunohistochemistry (IHC) experiments are not working. For example, bacteria can stick to tissue sections leading to artefacts in mounted samples. Bacterial contaminants in water can also release alkaline phosphatase (AP) which can interfere with certain IHC procedures that use AP for chromogenic detection. Metal ions can cause unwanted precipitation in staining solutions or even interfere with antibody-antigen binding.

3 What quality of water do you need - and for what?

It's obvious that different techniques require different water purity levels. So, you don't need to use the same water for washing your glassware as you do for highly sensitive analytical techniques - where even trace levels of contamination can ruin experiments.

But what limits are considered right for what applications? How is laboratory water categorised into different grades or types?

There are several parameters used to measure various properties of water as a way of assessing its quality (Table 2). And around the world, several international boards have been established to generate consistent, high-quality standards for laboratory water quality across all industries (Table 3). Some laboratories will also adopt standards outlined in the European, US or Japanese Pharmacopoeia.

Factor	What is it measuring?	Measurements
Conductivity	Provides an important, non-specific indication of the level of ions in the water	µS/cm (microsiemens)
Resistivity	Also provides a measure of ionic content. Primarily used in assessment of ultrapure water	MΩ-cm (megohm)
Organic compound levels	Total organic carbon (TOC) is used as a 'universal indicator' for the presence of organic impurities	Total organic carbon (TOC) – parts per billion carbon (ppbc)
Biological contamination	Individual bacterial species and total viable cells counts Endotoxins produced from gram-negative bacteria	Colony forming units per millilitre (CFU/ml) Endotoxin units per millilitre (EU/ml)
Presence of colloids	Suspended particles defined as being less than 0.5 µm in size and may contain iron, silica, aluminium or organic materials	Nephelometric turbidity units (NTU) Fouling Index (FI)

Table 2: An overview of the key factors used to define water purity.

What	Who	Categories
Laboratory applications	American Society for Testing and Materials (ASTM®)	Uses D1193-06 – four grades of water (Type I-IV)[5]
	International Organization for Standardization (ISO®) 3696	Based on ISO 3696:1987 – three grades (Grades 1-3)[6]
Clinical laboratories	Clinical and Laboratory Standards Institute (CLSI®) – formerly National Committee for Clinical Laboratory Standards (NCCLS)	Previously three main types of water (Type I-III), which have now been replaced with the terms[6]: • Clinical Reagent Laboratory Water (CRLW) • Special Reagent Water (SRW) • Instrument Feed Water

Table 3: Some of the most commonly used international standards for defining water quality

Choosing which water type the ELGA way – it's as easy as I, II, III

At ELGA, we understand that working out the best water purity for a variety of specific applications can be challenging – going too far will result in unnecessary expense or not far enough will endanger your results.

So our experts have done the hard work for you! We have created an easy-to-use system that classifies water purity into broad types (Table 4 & 5) as well as a more detailed list of common applications and the water purity they require (Table 6). Together, these will help you to match your application with the recommended level of water purity quickly and effectively – giving your experiments the best chance of success at the most economical cost.

	Resistivity (MΩ-cm)	TOC (ppb)	Bacteria (CFU/ml)	Endotoxins (EU/ml)
Type I$^+$	18.2	<5.0	<1.0	<0.03
Type I	>18.0	<10.0	<1.0	<0.03
Type II$^+$	>10.0	<50.0	<10.0	N/A
Type II	>1.0	<50.0	<100	N/A
Type III	>0.05	<200.0	<1000	N/A

Table 4: 'Types' of water classified by ELGA LabWater as defined by their measurable physical and chemical properties

Laboratory water purity level	Examples of when to use it
Type I$^+$	Goes beyond the purity requirements of Type I - use this for the most sensitive analytical techniques, such as ICP-MS or ion chromatography
Type I	Often referred to as ultrapure water, required for some of the most water-critical applications including key analytical techniques and molecular biology applications
Type II$^+$	For general laboratory applications requiring higher than standard Type II water levels of inorganic purity Required for clinical biochemistry techniques at CLRW standards
Type II	For general laboratory use – including media preparation, pH solutions and buffers Type II systems are often used as a feed to a Type I system
Type III	Non-critical work, such as glassware rinsing, water baths, autoclave and disinfector feeds, as well as environmental chambers and plant growth rooms Can also be used to feed Type I systems

Table 5: 'Types' of water classified by ELGA LabWater and examples of their uses.

Technique	Application sensitivity required	Water type
Feed to still	Low	III
Feed to ultra pure water system	General - High	III to I
General chemistry	General	II+
Glassware washing	General - High	III to I
Media preparation	General	II
Solution preparation and dilutions	General - High	I
Steam generation	General	I
Bacterial cell culture	General	I
Clinical biochemistry	USP/EP CLSI	II+
Electrophoresis	High	I
Electrophysiology	General	I
ELISA	General	I
Endotoxin analysis	Standard - High	I
Histology	General	I
Hydroponics	General	III
Immunocyto-chemistry	High	I
Mammalian cell culture	High	I
Microbiological analysis	General	I
Molecular biology	High	I
Monoclonal antibody research	General - High	I
Plant tissue culture	High	I
Radioimmuno-assay	General	I
Electrochemistry	General - High	II to I
Flame-AAS	General	II +
GC-MS	High	I+
GF-AAS	High	I+
HPLC	General - High	II to I
ICP-AES	General - High	II+ to I+
ICP-MS	General - High	II+ to I+
Ion chromatography	General - High	II+ to I+
Solid phase extraction	General - High	II+ to I+
Spectrophoto-metry	General - High	II+ to I+
TOC analysis	General - High	II+ to I+
Trace metal detection	General - High	I+
Water analysis	General - High	II+ to I+

Table 6: Common Applications and their Water Types

4 Getting a reliable supply of laboratory water

Now that we've established that water impurities are a threat to the reproducibility and accuracy of your results, the good news is that it's something that can be avoided!

Your options for how to source purified water include installing an in-house water purification system or buying purified bottled water. Both routes will give you water of different grades, but there are many differences between them.

Ultimately, the best choice for your laboratory will depend on your specific situation. When you're deciding, it's important to consider the following questions:

- How much ultrapure water will you be using every day?
- What flexibility do you need in terms of purity levels?
- What is your budget?
- How important is saving money in the long term to you?

In this section, we explore these two routes in more detail, which we hope will help you to decide on the best solution for your laboratory.

A. Installing an in-house water purification system

Laboratory water purification systems aim to remove impurities from drinking water without adding any new contaminants. They achieve this through a multi-stage process, the exact choice of components and technologies will depend on the requirements of each laboratory . The system will be designed using all or some of the following stages:

- **Primary treatment** – starting the purification process with relatively simple pre-treatment technologies can effectively enhance subsequent steps and keep costs down. Choice of technologies will depend on the characteristics of your feedwater.
- **Storage** - every system is likely to require a reservoir to store pre-treated water, usually to ensure that you have enough purified water available at peak times. Water can be stored in either a recirculating or a static system, preferably the former.
- **Polishing** – after primary treatment, there are different, more complex technologies that you can use to increase water purity, each with their own advantages and disadvantages (Table 7).

There are often additional components included:

- **Membranes** - fitted as the final purification step to remove traces of bacteria or prevent back contamination.
- **Monitors** - it is important that you are sure the water you're using is as pure as you think it is. The best way to do this is through continuous measurement - ideally in real-time with in-line systems built into the purification process.

Technology	What	Advantages	Restrictions
Reverse Osmosis (RO)	Uses semi-permeable membranes	Removes most types of contaminants to varying degrees (bacteria, colloids, dissolved inorganics, organics and particles) Cost effective Relatively easy process to monitor Requires minimal maintenance	Does not remove dissolved gases Limited production flow rates – requires either large membrane surface or temporary water storage May require good pre-treatment of feedwater to avoid contaminants damaging membrane
Ion exchange (IX)	Beds of cation and anion IX resins that remove ions from the water by exchanging them for H^+ and OH^- ions	Mixed IX resins remove all dissolved ionic compounds and CO_2, giving a resistivity of up to 18.2 MΩ.cm ; <1ppb ionic contamination Relatively inexpensive	Resins need replacement or regeneration Single-use resins require pre-treated water Very large surface area of IX resins are a potential breeding ground for microorganisms
Electro deionization (EDI)	IX resin beds held in an electric field. Resins are regenerated continuously	No need to replace resins EDI beds typically are smaller and remain in service for long periods Chemical and electrical conditions within system inhibit bacterial growth Environmentally friendly in comparison with normal IX	Requires RO treated feed water Removal of ions is limited by size of beds, so will not be complete. Needs to be followed by mixed IX to remove residual ions for type 1 water
Filtration	Microfiltration (MF) using microporous screen filters Ultrafiltration (UF) using membrane filters Both of which are carried out after the initial RO process	MF removes colloids, bacteria and particulates UF effectively removes most colloids, enzymes, microorganisms, particles and endotoxins Efficient operation Easy maintenance	Filters can become blocked when surface covered with contaminants Does not remove dissolved inorganics or organics Must be regularly sanitized and/or replaced
Ultraviolet (UV) light	Exposure to UV light usually at wavelengths of 254nm and 185nm	UV light kills bacteria (254nm) Oxidation of organic compounds (185nm)	185nm UV Needs to be followed by mixed IX to remove oxidized organics and CO_2
Distillation	Produced by boiling water and collecting condensed water vapour	Effectively separates the water from a wide range of contaminants and deactivates bacteria	Slow at purifying water - usually in batches Prolonged storage can lead to re-contamination Most effectively performed with pre-treated water Not economical or environmentally friendly – requires large amounts of energy
Degassing	Uses a hydrophobic membrane filter to remove gases such as carbon dioxide and oxygen	Prevents micro bubble formation. Removal of CO2 extends life of IX consumables	Only partial removal of CO_2
Vent filters	Microporous filters, and possibly other media, fitted to a reservoir to prevent contaminants from entering the stored water	Filter removes bacteria, other media minimize carbon dioxide and organic contamination	Regular replacement essential to maintain effectiveness

Table 7: The main water purification methods and their advantages and restrictions

B. Buying bottled water

After finding out more about the potential complexities of choosing a good design for your in-house purification system, we can appreciate it's tempting to think that buying bottled water is a simpler alternative!

But you should also be aware that there are many misunderstandings (and full-blown myths) about using in-house purification systems. To help you make the best decision for your laboratory, we explore and debunk some of these for you (Table 8).

Myth	Facts
In-house water purification systems are an expensive option	If you consider your lifetime costs, an in-house system can provide better long-term economy. After the initial upfront costs, subsequent running costs are generally lower than buying bottled water In-house systems can be even more economical if you can share the costs of installation across several laboratories. Could you save money by installing a single unit with multiple dispensers? Do you have a busy laboratory that uses lots of water? – an in-house system will probably meet your demands better, and it will be quicker to start saving money compared to buying bottled water. If your laboratory is quieter, you should consider how long you can justify leaving bottled water sitting around risking microbial and airborne contamination before needing to re-test or replace it. Do you need flexibility with water purity levels? This may mean buying several different bottles of water which are then left for long periods, which can impact on purity. But some in-house purification systems allow easy reconfiguration depending on the purity you need To help save you money, there are in-house purification systems available that give you clear indications of cartridge exhaustion, meaning you can replace only when necessary You can free up staff time – and operating costs - by choosing a system which has an auto-dispense function, meaning no hands-on waiting time for large volumes to be dispensed, as well as an auto-rinse function that reduces user-maintenance when system usage is low.
Once you've bought a system, you have less choice of purity level	There is no one-size-fits-all when it comes to choosing the best system for your laboratory. ELGA experts can help you to choose a water purification system that is optimized to your purity level needs, water volume requirements as well as to your feedwater quality. They can also help identify whether a modular system is the best option, giving you the flexibility for easy reconfiguration if things change in the future
There's rarely enough space to fit a water purification system	If you're limited for space, this can be a worry. However, large bottles of water can be big and cumbersome too and if you need several bottles of different types then they could soon take up more space than a purpose-built purification system Some modular systems provide flexible location options. Systems can be configured in a way that fits best – with components wall-mounted, stacked or even physically separated and connected. And if required, storage reservoirs can be put into unfrequented spaces

It's difficult to ensure purity on an ongoing basis with in-house systems	With proper maintenance, regular replacement of consumables and automated sanitization, a properly designed water purification system can give you consistently pure water for years For peace of mind, real-time purity indicators make it easy to check on your system at any point – and can also provide an option to download water purity data If you're storing purified water in a reservoir, there are extra things you can use to protect it: • Point of use (POU) filters • Recirculation at the POU and auto-rinse system to avert standing water • Vent filtration, a hygienic overflow system and a self-draining base also help protect entry points Bottled water also requires regular testing to ensure it has not become contaminated
In-house systems are often difficult to operate and maintain	Modern systems are easy-to-use and maintain. Some systems can even give advanced warning for cartridge replacement Systems are available that display purity status on the dispenser. Alarms can also alert to any major problems Choosing a supplier with a reliable global service network ready to help you with any problems is also a good idea
Buying bottled water is more environmentally friendly	There are hidden environmental effects from bottled water: • A **significant carbon footprint** from transportation to laboratories around the world • An **environmental impact of plastic waste**, which poses a huge threat to our marine ecosystems. One bioscience department estimated they generated around 267 tonnes of plastic waste in just one year – which they scaled up to quate to around **5.5 million tonnes from labs worldwide**, roughly the combined weight of 67 cruise liners[8] Whereas, modern in-house systems often employ innovative solutions to reduce energy consumption. Technology is used to maximize efficiency and prevent waste, e.g. the ability to select a lower level of water purity for less sensitive applications. You can also take steps to reduce consumable use by your in-house system, e.g. not changing cartridges until they're exhausted.
In-house purification systems aren't reliable enough	In-house systems are often more reliable than putting your faith in external suppliers to provide bottled water on time and to specification. Some systems offer specific features to enhance reliability and give you extra peace-of-mind, such as auto-rinse to prevent contamination, real-time TOC monitoring and notification systems to change purification packs. If necessary, you can always run systems in parallel to make sure you have a guaranteed source of pure water no matter what
Using specialized bottled water is better for sensitive analytical techniques	Commercially available bottled HPLC grade water, when used as an eluent can give significantly inferior results to water purified using an in-house system[9] Once opened bottle water can rapidly become contaminated Quality consistency is dependent on storage duration

Table 8: Common misconceptions about in-house water purification systems.

5 Choosing an in-house water purification system

We hope that we have convinced you that an in-house water purification system can:

- Help ensure you're using the correct water for your experiment – improving your chance of achieving accurate and reliable results
- Save you time and money
- Reduce your impact on the environment

So, if you've now come to the decision that installing a purification system is the best solution for your laboratory, there are a still some other practical factors you need to consider that will influence which system to select – importantly, how much space you have and how many laboratories you need it to serve.

Every laboratory is unique - there is no 'one size fits all' for an in-house water purification system.

In addition, you will want to consider the following questions:

- Will your users need to use it for a broad range of applications, or just restricted to a particular one?
- How much pure water will you use, on average, per day?
- What will be the peak times and how will you keep up with demand?
- What about your laboratory water feed quality – will it need pre-treatment?
- What types of water quality do you need?
- Will your laboratory need the ability to validate and track water purity?
- Is there a need for accessory systems, such as degassing?
- What other apparatus – such as primary treatment process, reservoirs, 'polishing' storage or dispensing - will you need as well?

We know your time is best spent focusing on getting accurate and reliable results from your experiments. So why not save time by leaving your most important reagent to ELGA LabWater purification technologies? Our representatives will be happy to analyze your feedwater and discuss the various options with you, providing expert advice to help you to select a system that best meets your needs.

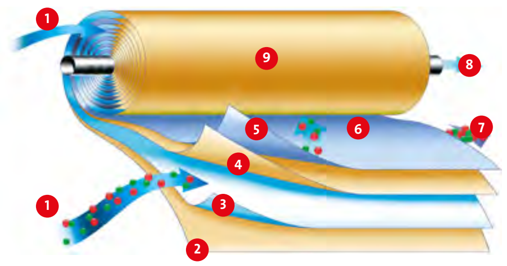
Our experts understand how important it is for scientists to have a choice of water qualities that range from primary grade for simple routine washing and rinsing, through to ultrapure water for the most critical applications. With our wide range of systems , we can help you choose the right one for your laboratory, enabling you to achieve the correct level of water purity for your applications, cost-effectively.

Our reliable water purification systems are constructed from the highest quality components to ensure optimal purity, while a rapid and easy sanitization program contributes towards an uninterrupted work-flow. Built-in economical processes result in the lowest consumable costs consistent with the highest water quality and precision.

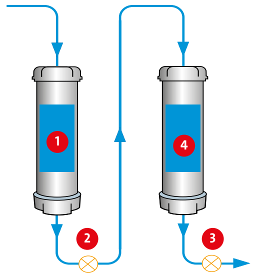
When combined, the technologies used in ELGA equipment can remove impurities from water down to extremely low levels; some technologies focus on specific contaminants while others have a broader spectrum of targets (Table 7). To achieve the correct water purity for a particular application, in a cost-effective manner, we arrange a combination of different technologies and optimize their operation.

Technologies used in ELGA systems:

- **Activated carbon** – in pre-treatment cartridges, composite vent filters and final purification cartridges.
- **Microporous Depth Filters** – to treat water before it enters the ELGA purification process, these filters act to protect subsequent RO systems from fouling and blockage.
- **Reverse Osmosis (RO)** – uses pressure to push purified water through a semi-permeable membrane and to reject contaminants that are >1nm diameter.



- **Ion Exchange** – often used as part of a final treatment step.
- **Electrodeionisation (EDI)** – combines ion-exchange resins and ion-selective membranes. This technology can be used as an alternative to single-use purification cartridges.
- **PureSure® Technology** – in all deionization processes, there is a risk that weakly ionised impurities will elute from the resins and into your application as they approach exhaustion (this happens even before the resistivity has fallen below 18.2 MΩ-cm). But ELGA's unique PureSure® technology prevents this, ensuring your water quality is maintained. This double purification pack and monitoring system ensures accurate results with uninterrupted workflow, by retaining any organics and silica that may be released by the first purification pack as it approaches exhaustion and providing you with the time to change the consumable.



- **Real Time TOC monitoring** – an ultra-rapid TOC monitor, this provides a reliable and timely indication of organic purity.
- **Ultraviolet (UV) Light** – Typically the UV lamp forms part of a 'polishing' treatment loop including ion-exchange, through which water is repeatedly circulated to maintain quality.
- **Sub-micron filtration** - including micro, ultra-micro and ultrafilters (1-200nm) are used as part of a 'polishing' loop or at the point-of-use (POU).
- **Integrated filters** – the PURELAB® Chorus provides integrated ultrafiltration and microfiltration systems. This integrated system provides a more effective total system approach, combining technologies such as RO, ion exchange, UV and micro- or ultra-filtration to provide ultrapure water rather than relying on a single point-of-use (POU) system. The benefits of this over typical POU filters are:
  - Levels of bacteria or endotoxins can be further filtered or recycled before use, as integrated filters are cleared of impurities by recirculating ultrapure water through them.
  - Extra security and peace of mind, as monitoring of the final water quality is possible.
- **Recirculating** – recirculating purified water through the systems purification process ensures the consistent supply of ultrapure and pure laboratory water. Passing the water repeatedly through a UV chamber and purification media removes bacteria and other impurities on an ongoing basis, minimizing build-up. This is the best option for maintaining low contamination levels. You can be sure that the water you are dispensing is of the highest quality at the point of use.

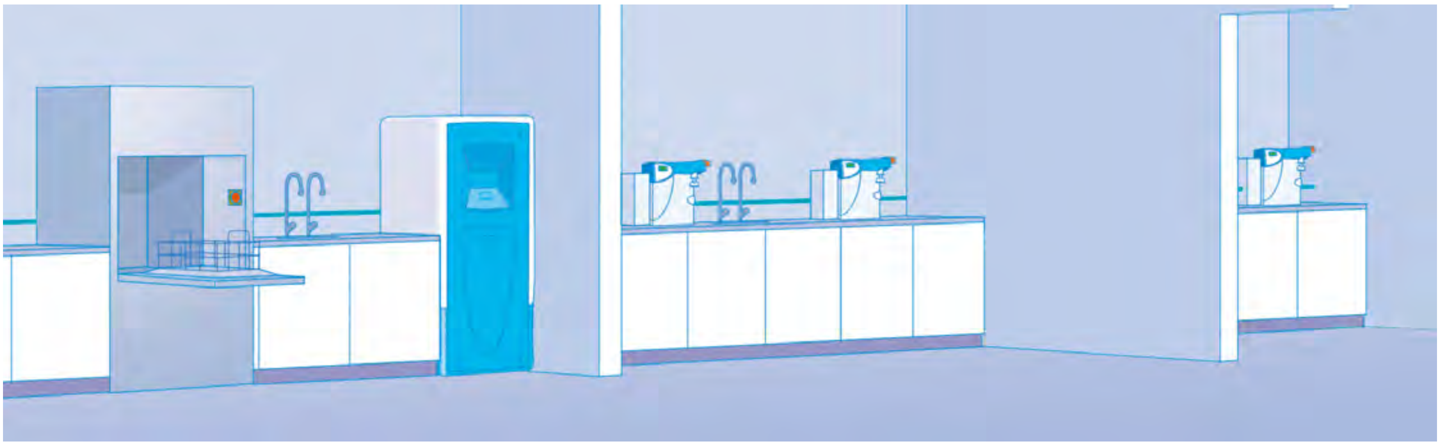
So, if you are looking to install an in-house water purification system for:

A research laboratory:

- Our award-winning PURELAB® range of water purification systems provide different options to fit your budget and requirements. From primary grade water for simple routine washing and rinsing - to ultrapure water for the most critical science and analytical applications – we can help you choose the system that suits you best. The PURELAB Chorus range of systems are modular, powerful and highly flexible, so you can design and specify the precise system to meet your unique needs, with the confidence that it can be modified if needed.

A clinical laboratory:

- We know it's critical to have a constant and reliable supply of ultrapure water. Working in partnership with major clinical diagnostic companies, we have designed our unrivaled MEDICA® range of clinical water purification systems. Our technologies deliver Clinical Laboratory Reagent Water (CLRW standard water), ensuring you have a guaranteed supply 24/7.



Larger laboratories or a whole building:

- Look towards CENTRA®, which has revolutionized the way that large volumes of pure water are produced, stored and distributed. Instead of a central laboratory system cobbled together from different components, you can have just one integrated system box, offering an economic alternative, with savings from distribution piping and equipment costs. These can supply Type I to III water at high flow rates, combined with the flexibility to integrate other equipment around the system as your laboratory grows.

Discover more about:

PURELAB® MEDICA® CENTRA®

by visiting our website: https://www.elgalabwater.com/products

6 Why choose ELGA?

We are the LabWater Specialists. Since the 1950's, we have been working with scientists to guarantee pure and ultrapure water for their experiments and laboratory work, making us the world leaders in water treatment in the laboratory. As an organization, we are committed to ensuring that the water needs of those working in the laboratory are met with the highest quality professionalism.

As an integral part of Veolia, the world's leading water service company, ELGA LabWater provides a reliable source of laboratory water that economically meets the required compliancy of all our customer's scientific and medical applications.

With more than six decades of experience dedicated to pioneering water purification systems, we are continuing to apply cutting-edge research with innovative and ergonomic design. ELGA LabWater delivers robust and easy-to-install systems that economically meet our customers' ever-changing need for ultrapure water.

We also work very closely with leading laboratory instrument companies to customize water purification systems for specific applications. Additionally, we play a proactive role with the water standards organizations which develop and recommend laboratory water quality requirements.

We pride ourselves on being:

- **Customer-focused** – our commitment to developing and providing you with pure water means that you can focus and concentrate on obtaining accurate and reliable results.
- **Innovative** – our UK R&D facilities are always looking to provide products dedicated to supplying you with the right water quality for your application.
- **Sustainable** – our products are designed to have the lowest possible impact on the environment at all stages: manufacture, in service and at end of life. We can calculate the carbon value of all our products through their lifetime.
- **British Engineered** – all our systems are designed in the UK and we are accredited to ISO:9001 and ISO:14001.

But don't just take our word for it, here are just some of our satisfied customers in laboratories around the world:

"For the foreseeable future, the water quantity and quality from the PURELAB® Pulse meets all our needs. In addition, the ELGA service department is always available and is very competent. On site response time from an ELGA technician is very good and the service available by phone is also helpful and has saved Cenix money."

Cenix BioScience , Germany

"Overall, ELGA's service and technical support are an excellent match for our own operations in South Asia. It's a very good partnership, with a helpful and dedicated team, and it is good to know that they are always on hand if a customer has a problem. We have complete peace of mind in the MEDICA systems and the ELGA team; our in-house engineers know they can depend on the systems to perform reliably, and the customer receives a more efficient, comprehensive service."

Brian Hilton, Regional Service Manager for South Asia, Abbott Laboratories

"The PURELAB® flex is a very successful system both technically and aesthetically. We are very satisfied with our choice. The compact design, easy operation and maintenance are ideal. The PURELAB® flex is ready for use very quickly after it is switched on. It has a good flow rate with a 0.2µm point-of-use filter fitted to the dispenser. It does not cause any problems to our daily requirements."

Dieter Dirk, Senior Teacher & Head of Laboratory, Olsberg Vocational College, Germany

ELGA installed a customized skid system for the Biomedical Physical Sciences Building at Michigan State University, supplying laboratory water to 4 floors of labs. *"I am so grateful for your assistance with our RO system. I've saved our department thousands of dollars."*

Melissa Parsons, Biomedical Physical Sciences, Michigan State University

"Veolia demonstrated through the quality, accuracy and flexibility of its standalone PURELAB units that it could deliver a comprehensive solution for a wide range of applications."

Fiona May, Senior Laboratory Technician, Imperial College London, Department of Life Sciences

https://www.veoliawatertechnologies.co.uk/case-studies/imperial-college-london-department-life-sciences

"This has been one of the most reliable new systems we have ever installed."

Chief Engineer of the Oxford Molecular Pathology Institute

https://www.veoliawatertechnologies.co.uk/case-studies/bespoke-laboratory-central-water-system

"We must be sure that what we are analyzing has come from the sample and is not due to contaminants introduced into the bottle, and our ELGA water purification systems ensure that we have ultrapure water constantly available."

Dr Warren Cairns, Analytical Chemist at CNR Institute , University of Venice, Italy

https://www.elgalabwater.com/about-us/case-studies/unlocking-secrets-antarctic-aid-ultrapure-water

7 Working with ELGA

We hope that the information presented here is useful and you can now better appreciate that:

- Selecting the right level of water purity for your application will help you to achieve consistent, accurate results
- For most users, installing an in-house purification system offers an attractive long-term solution that can save you time and money and reduce your impact on the environment

By choosing ELGA, you will work with one of our representatives who will help you to select an optimal in-house water purification system for your laboratory – helping make sure that you have access to a guaranteed source of pure water for your experiments.

At ELGA, we do not speculate or work on assumptions about your water quality. On our first visit to your laboratory, we will carry out a test, on site, that checks your feed water quality. We will also work closely with you to fully understand your laboratory water requirements, providing expert advice to help you to select the best system for your situation.

We also understand that future needs change and so we have developed a unique and modular set of solutions that can grow as you and your laboratory grow. So, you do not need to feel restricted to one solution for the next 10 years.

And it doesn't stop there - we develop long-term relationships with our customers. With a network of over 600 service centers worldwide, ELGA guarantees an unrivaled package of service and support, no matter where you are, for our entire range of water purification systems.

- Our highly-trained service engineers will apply their expertise to the installation, validation and maintenance of your water purification system. Before, during and after the installation, our validation engineers will answer any questions you have regarding the process.
- We can provide tailored user training, and our products all come with easy to use manual and quick consumable guides. You will be able to choose from a wide range of services depending on your application, operation and budget.
- ELGA also provides a validation support service for our water purification systems.

8 References

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The LabWater Specialists

ELGA is an integral part of Veolia, the global leader in optimized resource management. Veolia has a worldwide team of over 200,000 people and is renowned for its capabilities in providing water, waste and energy management solutions that contribute to the sustainable development of communities and industries.

The ELGA team focuses exclusively on water and its purification. It continually contributes to the unique technical and scientific applications and expertise developed since 1937. We are experienced in meeting the challenges that arise during the development, installation and servicing of single point-of-use water purification systems as well as large projects involving consultation with architects, consultants and clients.

Get in touch

If you would like to find out more about how ELGA can help you, please get in touch with our experts

ELGA offices and distributors are located in more than 60 countries and are fully trained in all ELGA systems.

To find your nearest ELGA representative, go to www.elgalabwater.com and select your country for contact details.

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