A Guide to

Filtration and Water Treatment Technologies

fileder

EXPERTS IN FILTRATION

Interested in water filtration, purification and treatment technologies?

Fileder Filter Systems is here to help. We are an award-winning, ISO 9001 certified company that specialises in filtration and water purification products across the UK and Europe. We invest in strong relationships with our clients across all industries to provide quality water filter systems, water treatment products, filter housings, particulate filtration process filtration, micro-filtration filter cartridges, UV disinfection systems and reverse osmosis systems.

We pride ourselves on providing expert advice alongside our products and work hard to exceed expectations, by providing top-quality products paired with superb customer service. Our experts are highly trained, qualified and experienced in their field and will be able to understand your unique needs, the operational parameters of your desired application and the best solutions that will meet your objectives for water cleanliness, regulatory compliance and cost-effectiveness.

In this document you will find...

- *Depth Filtration*
- *Surface Filtration*
- *Bag Filtration*
- *Carbon Cartridges*
- *Treatment with Resin*
- *UV Disinfection*
- *Reverse Osmosis*

As well as water purification and treatment technology products, we provide spares, accessories and value-added services such as servicing and maintenance so that you can simply invest in your treatment system and know that it will be running perfectly and in line with strict water quality legislation. Our water purification products help you to run a healthy and safe business, to deliver a better product to your own clients and to act as a responsible business within the wider community that you serve.

Read on to learn more about the different types of water filtration and treatment technologies that are available to ensure that today's water supply is clean, fresh, free from contaminants and healthy for all.

Depth Filtration

In summary: Depth filters are constructed to create a porous media that catches unwanted particles throughout the medium itself, rather than just on its surface. They are typically used in instances when the water has a heavy degree of particles. Unlike some other filtration technologies, depth filters can catch and hold a large volume of particles before they become clogged.

The detail

Depth filtration is used to remove a broad range of particles, such as dirt, grit, sand, organic solids and rust particles. The depth filter cartridges are made of carefully selected materials such as polypropylene, cotton and glass fibre to physically intercept these particles. There are two primary types of depth filtration media and these are rolled depth and graded density media. With the former, bands of media are used with known micron ratings for different applications. With the latter, a graded density of microns is created throughout the media and this can be used across a broad range of different particle sizes.

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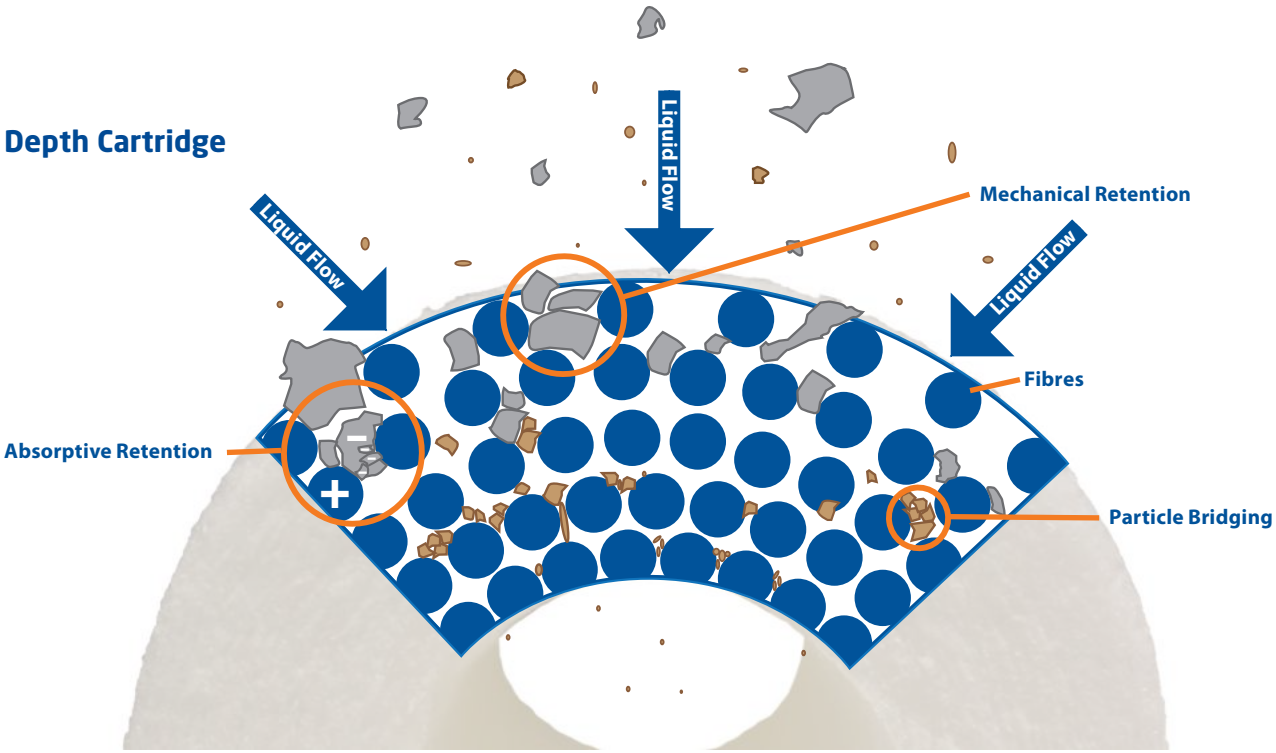
Depth Cartridge



How the process works

At the first stage of the process, large particulate matter is captured as the water travels through the cartridge media, seeking to find the path of least resistance as it does. At the same time, it is forced to travel in a twisting and turning motion to ensure that the maximum volume of particles is captured by the packed fibres. This sieving mechanism is called mechanical retention, and as a result, the fibres become increasingly packed and are able pick up smaller particles.

'the outer media is designed to catch the bigger particles and the inner media is positioned to grab smaller particles'

On the exterior of the cartridge, the outer media is designed to catch the bigger particles and the inner, more tightly packed media is positioned to grab increasingly smaller particles. This approach ensures that particulate is captured across every element of the depth media. An additional process called particle bridging will take place at various points along the filtration media too, which increases build-up and maximises the cartridge's efficiency. Alongside the physical capture of particles, the cartridge fibres use electrostatic charges to attract particles in a process called adsorptive retention. The result of these combined processes is a highly efficient filtration mechanism suitable for a variety of applications.

Depth Cartridge in a Housing

Different cartridges for different applications

There is a wide variety of depth filtration products available to suit individual needs and varied industrial applications. These include spun-bonded cartridges (with economic, standard and premier options depending on the degree of filtration required), wound cartridges and resin-bonded cartridges. As an example:

Spun-bonded cartridges are highly-efficient and available in different grades that are FDA compliant with no glues, binders or resins that can leach into the liquid.

Wound cartridges are efficient and versatile and commonly used as a pre-filter to help protect final or more expensive secondary systems. Three medias are available - polypropylene, cotton and glass fibre - all with a wide micron span. Resin-bonded cartridges are designed for ink, adhesive and polymer filtration and are suitable for high-temperature and/or viscous filtration situations.

'Wound Cartridges are efficient and versatile and commonly used as a pre-filter'

Choosing the right depth filtration cartridge

The right cartridge choice will depend on the necessary application, the temperature used within the process, the pressure of liquid, the housing requirements, the particle band size for removal and other factors such as length, approvals, size and micron ratings.

Pleated Cartridge

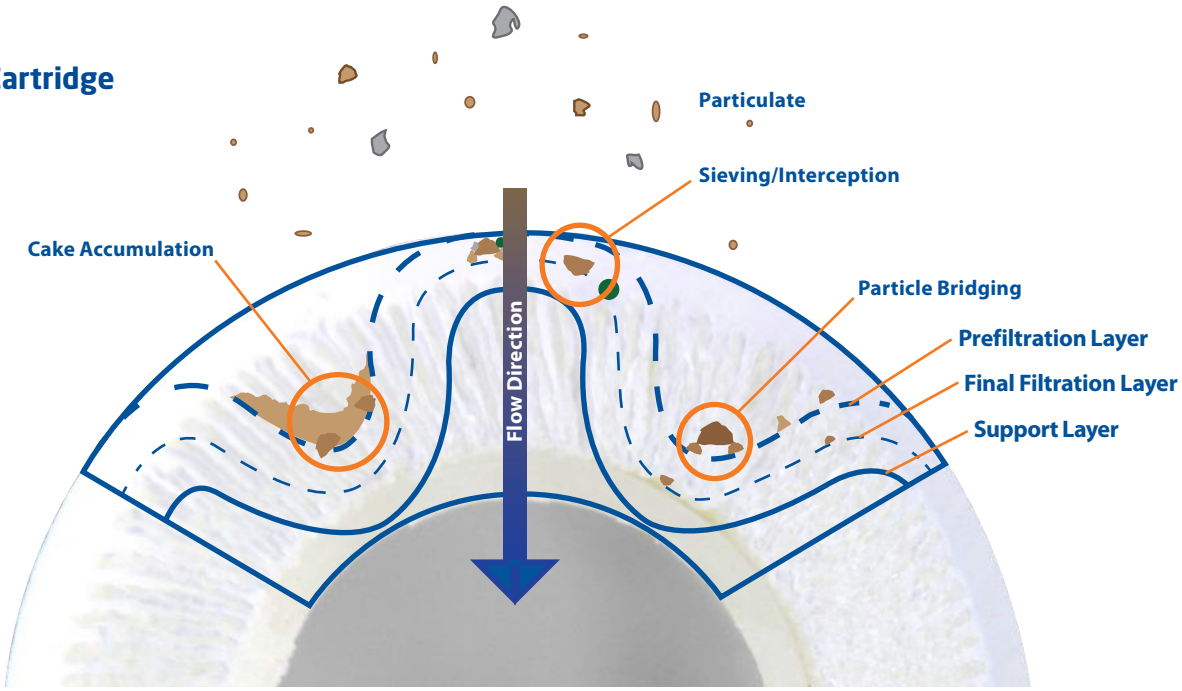
Surface Filtration

In summary: Surface filtration treatments will commonly use a range of pleated fillers with a large surface area. These are highly efficient and have excellent flow rates. The pleating mechanism allows the media to be packed tightly within the cartridge which greatly increases the usable surface area. With different materials available, such as polypropylene, polyester, glass fibre, polyethersulfone, PTFE, nylon and stainless steel. Surface filtration offers removal of bacteria, Cryptosporidium, cysts, silt and fine particulate. The polyester, glass fibre and polyethersulfone media are all WRAS approved.

In detail: Pleated filters are extremely effective at delivering surface filtration thanks to their high-efficiency and advanced flow rates. By using a pleated design, media with depth characteristics to support particle retention can be tightly packed into the cartridge for a maximised surface area. The particulate gathers across the filter's surface forming a 'cake' and ensuring that as much material is retained as possible. From this point, the particulate is sieved and intercepted by the media, which can have micron ratings as low as 0.03 and up to 100, often with a support layer and a final filtration layer

'particulate gathers across the filter's surface forming a 'cake' and ensuring that as much material is retained as possible'

Pleated Cartridge



all combining to maximise efficiency and effectiveness of the filtration process. There is also an option to include extra stainless steel Q/Z end-caps where steam sterilisation will be used within the process.

There is a wide variety of different pleat filters available, all with specific properties designed to meet the exacting and individual needs of different industries. Our technical team can work with you to assess your needs and recommend the most suitable product, with different degrees of efficiency and effectiveness available for each application and price point.

Complementary approaches

Surface filtration will be just one method of treatment used to treat and clean the water. There are many varied filtration systems available which catch particles and microorganisms so that they can be removed from the water. Where the liquid is particularly dirty with a high level of suspended particles, other pre-treatment systems, such as coagulation, will be used before the filtration process. After the surface filtration process has been applied - other treatments may be required.

The right approach will be determined by a water purification and treatment specialist who will analyse the water, its conditions and the desired final application, as well as the technology, automation, staffing and other factors in place at the processing point. These factors will help to determine the right approach to treating and purifying the water to the necessary degree and custom systems may be built according to need.

Bag Filtration

In summary: Bag filtration uses a bag manufactured from filtering material. The bag sits inside the filter housing and as it fills up, the water passes through the tiny holes in the material and leaves behind unwanted particles. These systems are quick and easy to use, cost-effective and easy to maintain.

In detail: Bag filtration systems are an excellent option for water treatment scenarios where basic filtration and a high rate of water flow is needed. The technology is simple with the bag sitting in the opening of the filtration system using a sturdy ring. This can make bag filtration a good choice where the technology fits the user's application needs and where the ease of installation is required. The main job of the bag filter happens at the point of water entry into the system and it acts to lessen the degree of sand, silt, dirt and other forms of sediment that are present in the water. Some models on the market come with particularly small micron ratings that can be used to filter out a certain amount of particulates, however, they will not remove bacteria or chemicals, such as chloramines. Additional water treatment systems are needed to remove both chemicals and unwanted bacteria.

Main applications

Bag filters are primarily used in industrial, agricultural and commercial settings and very rarely in homes. The benefit of bag filters for industries is that they can rapidly capture sediment whilst still

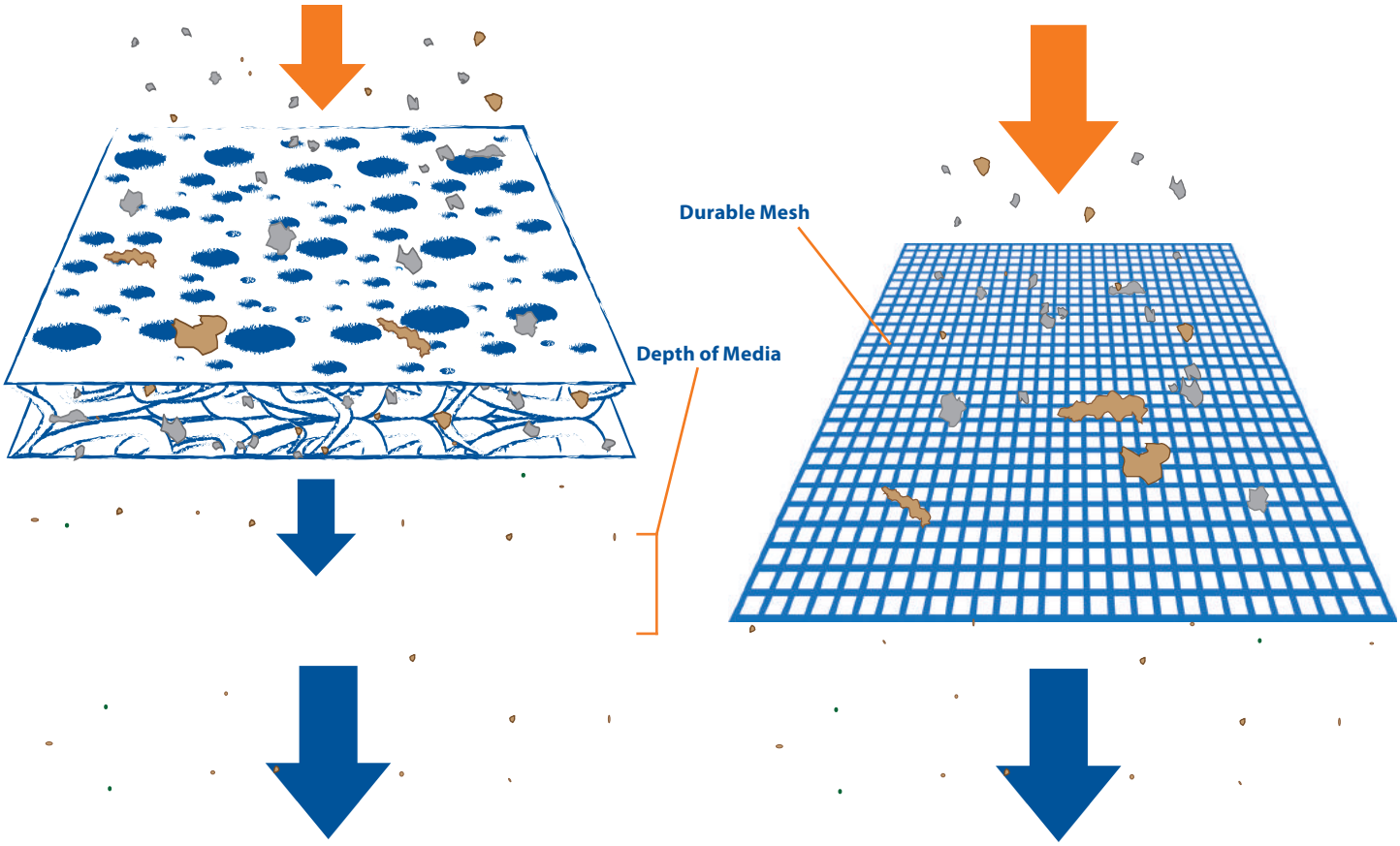
Filter Bag in a Housing

allowing the flow of water to continue at speed. The water flow will not even be compromised if a larger single piece of sediment is captured in the bag, as the large surface area allows the water to simply flow around it. This is a key benefit over filters with naturally small openings, where trapped sediment can either stop or slow the water flow. Maintaining the flow of water is desirable for commercial applications, and it is possible to remove the bag filter easily and to take out the trapped material. Another key benefit of bag filters is that some types can be reused, making them a more environmentally friendly choice and supporting waste minimisation.

'Bag filters are primarily used in industrial, agricultural and commercial settings'

Felt Bag Media

Monofilament Mesh Media



Choosing the right bag filtration system

Where the priority for water filtration is to remove sediment in a commercial, agricultural or industrial setting, a bag filter system may well be an excellent choice for your needs and there is a large variety on the market. The choice you will make will depend on factors such as the type and size of sediment that you will be filtering from the liquid. This will help you to choose the right micron rating, which defines the size of the filter holes in the bag, and also its material, which can include nylon, polypropylene or polyester. The type of sediment is another factor. For example, a filter housing made from polypropylene is preferred for applications where electroplating chemicals are present.

Another key consideration is the water temperature, as this will affect water performance, the water flow rate as this will affect the necessary micron rating that you need and the pH level of the filtered water, as this can impact the housing material. Fileder can help you to pick the perfect product for your need and budget and will carry out a detailed on-site assessment to fully understand the parameters of your operation and desired water quality.

Carbon Cartridges

In summary: Activated carbon or charcoal is also used as a common method of filtering and treating water, and it's one that is common with domestic users as filters can be purchased readily for home filtration systems.

In detail: The addition of granular activated carbon, to give it its full name, is used in water filtration to remove residual disinfectants and organic compounds in the water supply to improve the taste and to lessen the risk of any health hazards. The process is popular because it can be used easily in a range of domestic and commercial applications using simple cartridges. It also adds nothing damaging to the water and tends to use activated natural carbon sources derived from materials such as coal, wood and nutshells.

Due to the properties of activated carbon, which can vary in density, hardness, particle size, pore size and surface area, each type of filter will have its most appropriate applications. Each will use 2 primary methods of removing water contaminants, known as catalytic reduction and adsorption. The former removes residual disinfectants that may be present in the water and the latter removes unwanted organics.

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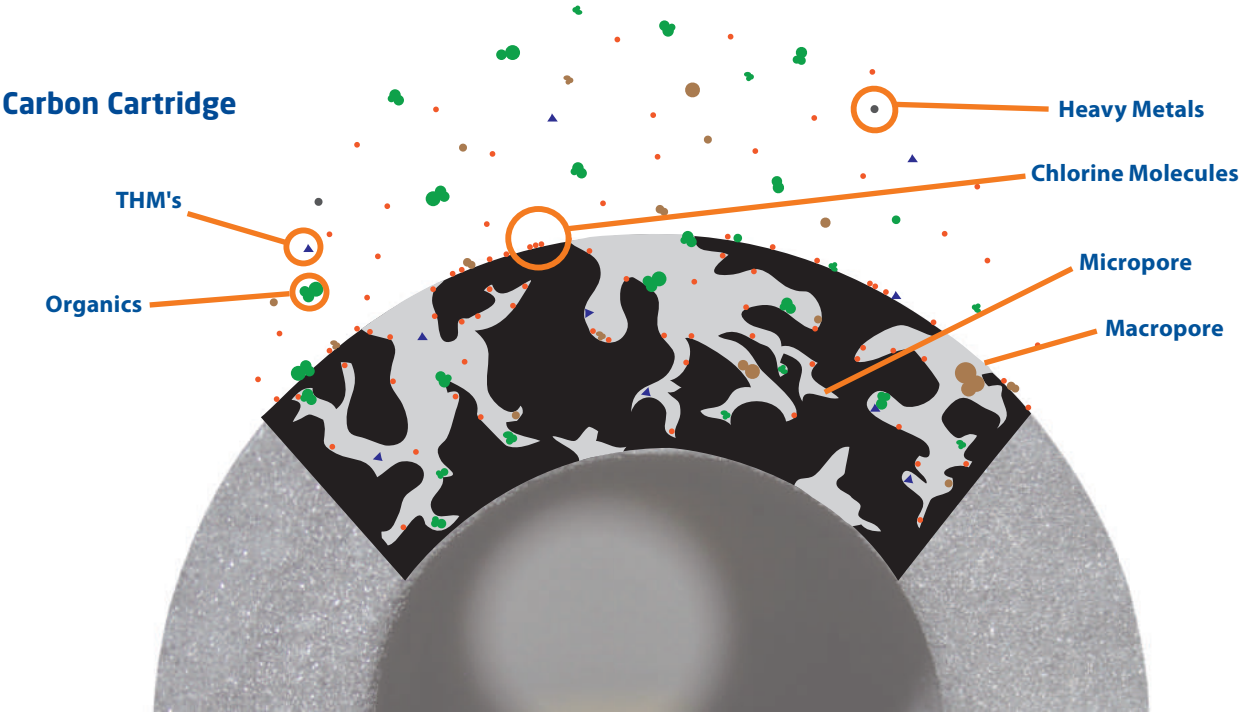
easy to deal with



Activated carbon can remove or treat chlorine, chloramine and other residual disinfectants by using a reaction called catalytic reduction. This chemical reaction transfers electrons from the carbon surface to the residual disinfectant, acting as a reducing agent. With chlorine, it reduces the chemical to a non-oxidative ion in just a few seconds contact with activated carbon. The treatment of chloramine is slower - unless specific chloramine cartridges are used - but no less effective.
The use of filters makes carbon technology very easy to use

'Activated carbon can remove or treat chlorine, chloramine and other residual disinfectants'

and many of us will be familiar with domestic water purification systems that simply use 'plug in' filters that can be replaced at periodic intervals as their efficacy begins to degrade.

There is a wide range of activated carbon filters available, along with different grades that include specialist products for the medical industries, for electroplating use and for treating or removing specific contaminants. This offers a great variety of choice and the opportunity to pick the perfect activated carbon filter system for your particular needs.

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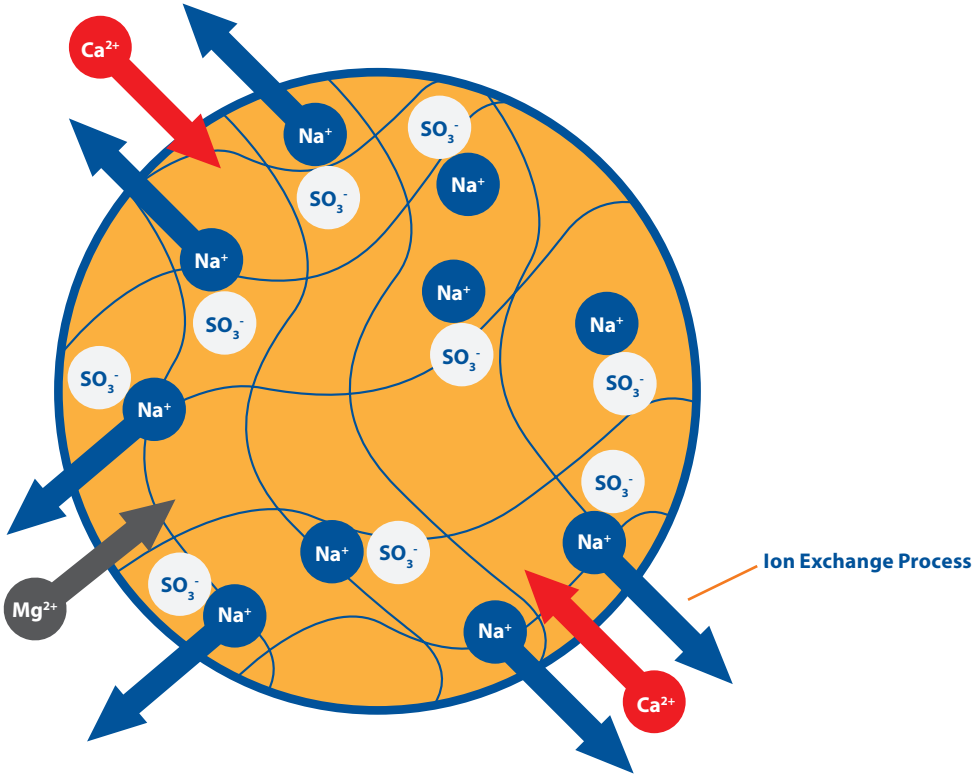
Treatment with resin

In summary: Water can be treated with resin cartridges, to remove unwanted contaminants or prevent them from causing any issues for the industrial or commercial process.

In detail: Resin is used commonly in the industrial treatment of water, and there are four main categories of this treatment approach - strong acid cation through to weak acid cation, and weak base anion through to strong base anion. Each class has its own distinct characteristics and chemical variations, which each offer their own operating properties. Resin or ion exchange systems are typically designed bespoke to client specifications, using the right resin that allows the treatment system to work as effectively as possible whilst maintaining cost efficiency.

Choosing the best resin

Modern resins were actually developed in the 1930s, and the most commonly used type today utilises a structure styrene-divinylbenzene copolymer beads or acrylic resins. There is no 'best resin' as each will have its best-fit uses depending on the operating conditions of the site. There are also differences in the resin structure, with gel resins and macroporous resins available. Gel resins have smaller pores and high capacity for initial exchange. They are also cost-effective. Macroporous resins typically have larger pores which tend to be ideal for more challenging operating environments. There are also UPS resins, or uniform particle sized resins. Earlier manufacturing processes made



resin beads in different sizes, but today's processes can make single particle sizes which allow manufacturers to create resins specifically directed for use in specific environments. UPS resins will generally be used to soften and demineralise water and can rinse down and backwash with less water and use lower pressure drops for their bed depths. However, the advantages are only unlocked when the system is expertly monitored and adjusted for changing conditions.

Perhaps the most common resin in use today is the strong acid cation or SAC. These are used for demineralising and softening, with different percentages of crosslinking depending on the user's needs. For example, an SAC resin with under 8% crosslinkage might be used for polishing applications with electricity utility condensate, to remove corrosion products from the condensate.

Assessing individual needs

Fileder will be able to assess the best fit according to the site's objectives and operational parameters, choosing from an array of products, chemical compositions and manufacturer products. Fileder will require analysis of the raw water and then offer specifications for its post-treatment quality and quantity. Different resins will suit different applications, especially once larger systems are in use, with additional considerations of waste minimisation, cost-effectiveness, automation, ion exchange system life expectancy and on-site staff expertise. Often, with today's wide resin combinations on the market, it is possible that there will be more than one type that will work for the application in question.

UV Disinfection

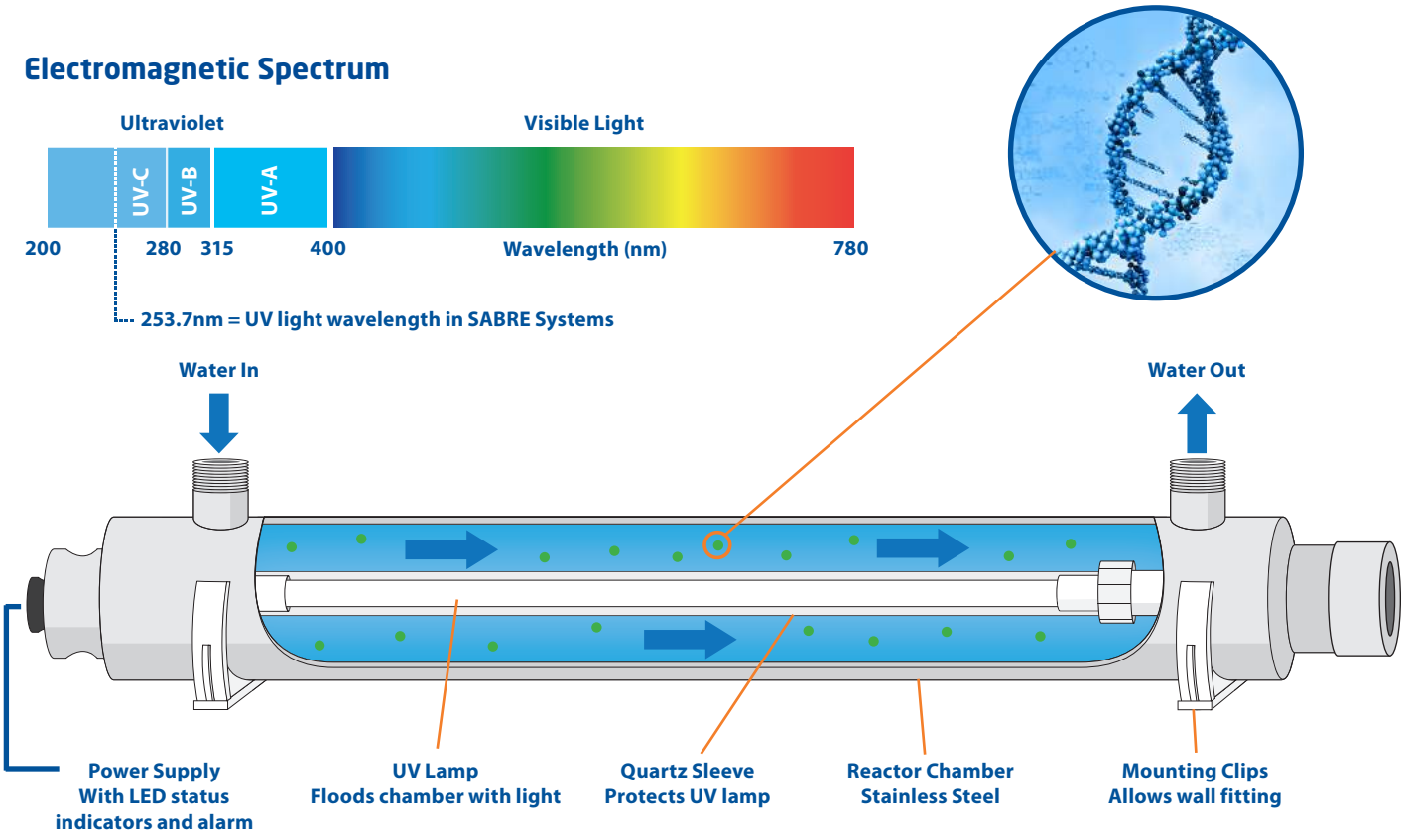
In summary: UV treatment systems are designed to destroy the DNA of bacteria present in water and to make it safe for drinking.

In detail: Ultra-violet treatment systems, also called UV sterilisers, destroy the DNA in unwanted bacteria in water meaning they do not grow or reproduce and are often used to purify drinking water in wells, boreholes and from springs in order to ensure it is safe to drink. They are also commonly used in the food and drink manufacturing industries as health and safety legislation has tightened over the years.

We are surrounded by micro-organisms of all kinds including bacteria, algae, viruses and parasites - and indeed, many of these invisible organisms live within our own digestive tracts and help to keep us healthy! However, although most are harmless, or even beneficial in the right context, exposure to unwanted micro-organisms can cause serious illness in those with compromised immune systems, including the elderly, young infants and people with an immunocompromised illnesses.

Killing hidden dangers

There are many treatment products on the market which can help to improve the taste and look of water, but these are not designed to tackle hidden bacteria. One of the safest and easiest ways to



disinfect water to make it safe to drink is with ultra-violet treatment system. UV rays are naturally present in sunlight which means that no chemicals need to be added to purify the water. This removes the risk of incorrect chemical dosing or the creation of unwanted aftertastes.

Considerations for system choice

There are UV water purification systems available for domestic and industrial usage, depending on needs. Domestic systems are popular where the water comes from a private source or where there are known issues with bacterial contaminants. The important thing is to choose a model that will be able to deal with the necessary water flow. If the water flow is more rapid than the system is designed to treat, then it will pass through the system too quickly for all the bacteria to be treated. Another important factor is the sediment level of the water. If this is high, or if the water is naturally cloudy, then a pre-filter will need to be added so that particle shadows don't affect the UV rays from treating the bacteria.

UV water purification for commercial uses use the same technology, but with systems designed to handle higher water flow rates and to operate in line with stringent EU legislation. The systems may also be combined with other methods of water purification and treatment depending on the application and circumstances.

RO System

Reverse Osmosis

In summary: Reverse osmosis uses a membrane process to purify drinking or process water and to clean wastewater. It is used commonly by industries including the food and drink manufacturing industries and in the production of many components. It can be used to remove personal care product contaminants and pharmaceutical drugs which are often present in wastewater, but which cannot be removed by other conventional processes for filtration or treatment before being sent to drain.

In detail: Reverse osmosis is a highly efficient means of water purification. The system operates by using a pump that guides water along a semi-permeable membrane. An applied back pressure forces the water molecules through the tight-mesh membrane, which rejects up to 99% of dissolved salts on the membrane itself and leaves the water much purer.

'Reverse osmosis is a highly efficient means of water purification'

Harnessing the power of science

The technology is based on the naturally occurring scientific process of osmosis, which sees weaker saline solutions migrating towards strong saline solutions. An example can be found in the human body, where our kidneys absorb water from the blood, or in nature, where plant roots use osmosis to gather water from the soil.

Twist-Lock

In reverse osmosis, the process works 'backwards', requiring energy to be applied to the more concentrated saline solution. The membrane used in the process will allow some molecules to pass through - like a screen door - but not others. For example, it will allow water molecules to pass through, but it will reject organics, dissolved salts, pyrogens and bacteria on the concentrate surface of the membrane, which then wash away into a waste channel. The result is Reverse Osmosis quality water, that has been desalinated and purified.

Reverse osmosis systems use cross-flow filtration mechanisms where the solution flows across the filter and passes into one of two outlets. Filtered water will travel one way and the contaminated water will travel the other. Turbulence is also present to keep the surface of the membrane clear.

Highly impressive results

The systems can remove up to 99% of dissolved particles, bacteria, dissolved ions, colloids and pyrogens from the water source, and the membrane will be designed to reject each contaminant based on its charge and size. The system is ideal for treating groundwater, surface and brackish water for both small and large flows. Industries that tend to use the technology include food and drink manufacturing, pharmaceutical, boiler feed water, semiconductor manufacturing and metal finishing. Because 100% of contaminants cannot be removed, however, reverse osmosis systems are often combined with a secondary form of advanced treatment if higher levels (above 99%) of purification are required.

Choosing the right water filtration system for your needs

Every industrial, commercial, agricultural and domestic buyer of water filtration products will have varying needs and circumstances that will affect the best type of system for their needs. Factors include the quality of the raw water, its source and the location of the plant. Other factors include the presence of water treatment operators on-site and their skill (where in place), the degree of automation that is possible - and desired - and whether the client prefers to have the system maintained and operated through on-site staff or via an outsourced specialist service. There is a wide range of different technologies that offer choice, variety and flexibility when it comes to water filtration and treatment products.

'There is a wide range of different technologies that offer choice, variety and flexibility when it comes to water filtration'

To discuss your individual circumstances and to learn more about the water filtration and treatment systems that are likely to meet your unique objectives, please contact us for an informal, no-obligation discussion.

We will be delighted to visit your premises, carry out a viability assessment and to provide expert guidance on the solutions that will deliver reliable, effective and safe clean water for your employees, your customers and the community around you.

For more information
Contact our support team

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