gke

Aqua solutions

Treatment Solutions



ENGINEERED WATER

COMPANY PROFILE

GKE Aqua Solutions cc is a 100% black owned water treatment company that was started in March 2007 and is currently run by the founder and managing member.

The main drive behind this venture was the realisation that although there are a lot of water treatment companies in existence in South Africa, many are unable to meet customers' needs in terms of providing client-specific engineered solutions.

COMPANY PROFILE

GKE Aqua Solutions covers a wide spectrum of water treatment, from ultrapure water, to drinking water, to process water, and wastewater.

Due to the company's appreciation of the fact that no two applications are the same, however similar they may be, GKE Aqua Solutions has moved away from the norm of building standard water treatment plants. Instead, each water treatment plant will be designed and built based on the prevailing conditions where it is to be installed, to suit the customer's and environmental needs.

COMPANY PROFILE

As such, in most cases, pilot testing will be recommended so that the design parameters specific to the client's needs and application are acquired before the full scale plant is built. This also enables the customer to give their input into the design of the water treatment plant.

The customer will therefore be familiar with design and operation of the full scale plant once it has been installed and commissioned.

This will ensure that the customer gets the best value for money, and is satisfied with the product supplied and service rendered.

COMPANY MISSION

To provide water treatment engineered solutions based on sound water treatment principles and thorough understanding of the client's problem and needs.

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SERVICES OFFERED

- TREATMENT PROCESS DESIGN
- WATER TREATMENT PLANT INSTALLATION
- WATER TREATMENT PLANT REFURBISHMENT
- WATER TREATMENT PLANT COMMISSIONING
- WATER TREATMENT PLANT OPERATION AND OPTIMISATION
- WATER TREATMENT PLANT OPERATOR TRAINING

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SERVICES OFFERED

TREATMENT PROCESS DESIGN

It is virtually impossible to have a "one type fits all" water treatment plant. For this reason, it is always best to design a fit-for-purpose treatment process for a client. This is the approach that GKE Aqua Solutions takes.

The appropriate treatment process will be decided upon based on the following:

- The quality of the water that needs to be treated. This will include the types of contaminants in the water, as well as their concentrations.
- The desired quality of the treated water.
- The volume of water that needs to be treated.

SERVICES OFFERED

TREATMENT PROCESS DESIGN

The appropriate treatment process will be decided upon based on the following:

- The extent of involvement in the operation and maintenance of the plant from the client.
- The type and volume of effluent that will be produced by the water treatment plant, and the applicable environmental regulations governing the disposal of the effluent.

SERVICES OFFERED

TREATMENT PROCESS DESIGN

In some cases, GKE Aqua Solutions will recommend that a pilot plant be operated for some time before the process design can be finalised. Running a pilot plant helps give the best process design (especially for difficult waters), it gives guidance on the appropriate sizing of the water treatment plant, and it helps the client see first hand how the proposed treatment plant will operate, as well as to give their own input into how the plant should be designed and operated.

SERVICES OFFERED

WATER TREATMENT PLANT INSTALLATION

GKE Aqua Solutions will do the installation of the water treatment plant, following the finalisation of the process design.

With the well established network that GKE Aqua Solutions has, we will ensure that the installation of the plant is done to the satisfaction of the client, and that the water treatment plant will perform as per the design and the client's requirements.

SERVICES OFFERED

WATER TREATMENT PLANT REFURBISHMENT

There are cases where an existing plant is not operational, or does not meet the client's expectation. In cases like this, it is always best to first explore the possibility of refurbishment of the existing plant, and get it to work at its optimum. This will usually save on the cost of installation of a new water treatment plant.

The addition of more systems, or the re-design of the current system, can be considered thereafter if necessary.

SERVICES OFFERED

WATER TREATMENT PLANT COMMISSIONING

The commissioning of a plant, i.e. the startup of a new plant, is usually challenging, and requires a lot of skill, experience, and dedication.

GKE Aqua Solutions has had a lot of experience in the commissioning of a number of different types of water treatment plants.

With the experience in water treatment plant commissioning, as well as thorough knowledge of water treatment processes and technologies, GKE Aqua Solutions can commission a water treatment plant, even if it was not involved in the design thereof.

SERVICES OFFERED

WATER TREATMENT PLANT OPERATION AND OPTIMISATION

Following the commissioning of a water treatment plant, the client's operating staff will usually need assistance with the operation and optimisation of the plant.

The optimum operation of a water treatment plant requires time, dedication, scrutiny, and thorough knowledge of the treatment process. GKE Aqua Solutions has a lot of experience in this regard, and can assist clients when needed.

GKE Aqua Solutions will also assist the client with the compilation of the plant operating manuals as required.

SERVICES OFFERED

WATER TREATMENT PLANT OPERATOR TRAINING

GKE Aqua Solutions has assisted a number of clients with the compilation of their plant operator training manuals, as well as the provision of site-specific training for the operating staff, from the assistant operator to the plant engineer.

The approach that the company takes in this regard is to break the client's water treatment process into the different treatment technologies. The operating staff is then given training on the specifics of each treatment technology. Thereafter, training is given on how the different treatment technologies combine to achieve the desired outcome as per the plant design.

SERVICES OFFERED

WATER TREATMENT PLANT OPERATOR TRAINING

This approach also helps to identify design and operational shortcomings of the water treatment plant. The client will better understand the plant limitations due to these shortcomings, and can be advised on how best to deal with those shortcomings.

WATER TREATMENT TECHNOLOGIES

- COAGULATION AND FLOCCULATION
- GRAVITY SEPARATION
- GRANULAR MEDIA FILTRATION
- MEMBRANE FILTRATION
- REVERSE OSMOSIS
- ION EXCHANGE
- GAS TRANSFER MEMBRANES
- CONTINUOUS ELECTRODEIONISATION (CEDI)
- BIOLOGICAL WATER TREATMENT
- OXIDATION AND DISINFECTION

gke Aqua solutions

WATER TREATMENT TECHNOLOGIES

COAGULATION AND FLOCCULATION

Surface water (water from a river, dam, reservoir, etc) often has particles that give it its brownish (dirty) colour, and sometimes impart an unpleasant taste in the water. These particles are very small in size, and usually have a negative charge on them. This makes them repel one another in the water, and are therefore unable to come together to form bigger particles that are heavy enough to separate from the water by gravity. The particles are said to be stable in the suspension.

WATER TREATMENT TECHNOLOGIES

COAGULATION AND FLOCCULATION

By the addition of chemicals that are known as coagulants and flocculents, these particles can be destabilised, and they can be made to come together to form bigger and heavier particles that can be easily separated from the water.

WATER TREATMENT TECHNOLOGIES

GRAVITY SEPARATION

If water containing suspended particles is made to flow through a basin under non-turbulent conditions, the suspended particles that are heavy enough will separate from the water, resulting in the production of clarified water with a lower concentration of the suspended particles.

Clarifiers (or settlers), degritters, and thickeners are all used for this purpose. The particles that separate from the water form sludge at the bottom of the clarifier. The sludge is pumped out of the clarifier, and can be further processed and disposed of or, in some cases, used as manure.

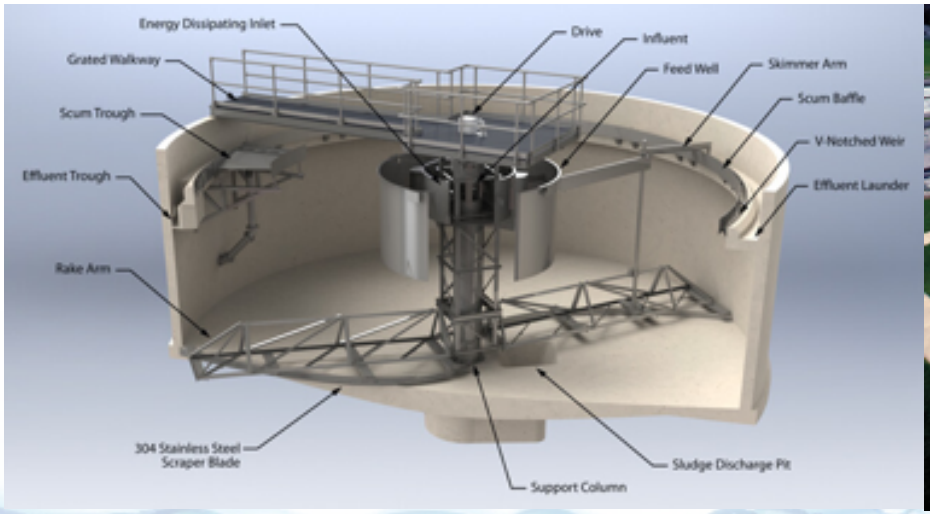
WATER TREATMENT TECHNOLOGIES

GRAVITY SEPARATION

Clarifiers are normally preceded by coagulation and flocculation.

Drinking water plants, especially in municipalities, typically utilise clarifiers in their treatment processes.

Pictures of some of the clarifiers used in the industry are shown below.





WATER TREATMENT TECHNOLOGIES

GRAVITY SEPARATION

In some cases, the particles may be suspended in the water, but may be too light to settle at the bottom of a clarifier. In this case, air bubbles can be introduced into the water. The air bubbles attach to the suspended particles, making them float more easily. They particles are then skimmed off the top of the basin, and the clarified water is discharged from the bottom. This process is known as dissolved air flotation, or DAF.

WATER TREATMENT TECHNOLOGIES

GRANULAR MEDIA FILTRATION

In some cases where the suspended solids concentration in the water is relatively low, the suspended solids can be filtered out of the water, instead of using the gravity separation process. In this case, a vessel containing appropriately graded sand (or other granular media) is used.



A typical granular media filter

WATER TREATMENT TECHNOLOGIES

GRANULAR MEDIA FILTRATION

The water containing suspended solids goes in at the top of the vessel, passes through the granular media, and goes out at the bottom of the vessel. The suspended particles are trapped within the granular media. On a regular basis, the suspended particles are removed from the filter by reversing the flow of water. This is a process known as filter backwash.

Another type of granular media that is used is activated carbon. This is typically used to remove excess chlorine from water, substances that impart an undesirable taste in water, and some toxic dissolved substances.

Granular media is also used following the gravity separation process.

WATER TREATMENT TECHNOLOGIES

MEMBRANE FILTRATION

If water containing suspended solids is passed through a membrane barrier that has tiny pores, the suspended solids that have a size bigger than the membrane pore size will be excluded from the water, thus producing solids-free water.

The membrane filtration technologies currently in use are microfiltration and ultrafiltration. The pores of the membranes are so small that they are capable of excluding some bacteria and some viruses. As such, they are ideal for drinking water treatment processes, and for post-treatment of water from a sewage treatment plant for reuse.

WATER TREATMENT TECHNOLOGIES

MEMBRANE FILTRATION

There are various designs and types of membrane filtration systems. Some of these are shown in the photographs below.





WATER TREATMENT TECHNOLOGIES

MEMBRANE FILTRATION

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WATER TREATMENT TECHNOLOGIES

REVERSE OSMOSIS

When water is passed through a membrane barrier that allows easy passage of water molecules, but restricts the passage of dissolved salts and other dissolved solids, the concentration of the dissolved solids and salts can be reduced to a desirable level.

Reverse osmosis (RO) has a wide range of applications, including seawater desalination to produce drinking water, wastewater treatment to produce water that can be reused, and the production of ultrapure water in the power plant industry.

WATER TREATMENT TECHNOLOGIES

REVERSE OSMOSIS

Reverse osmosis membranes are interconnected, then installed into pressure vessels.

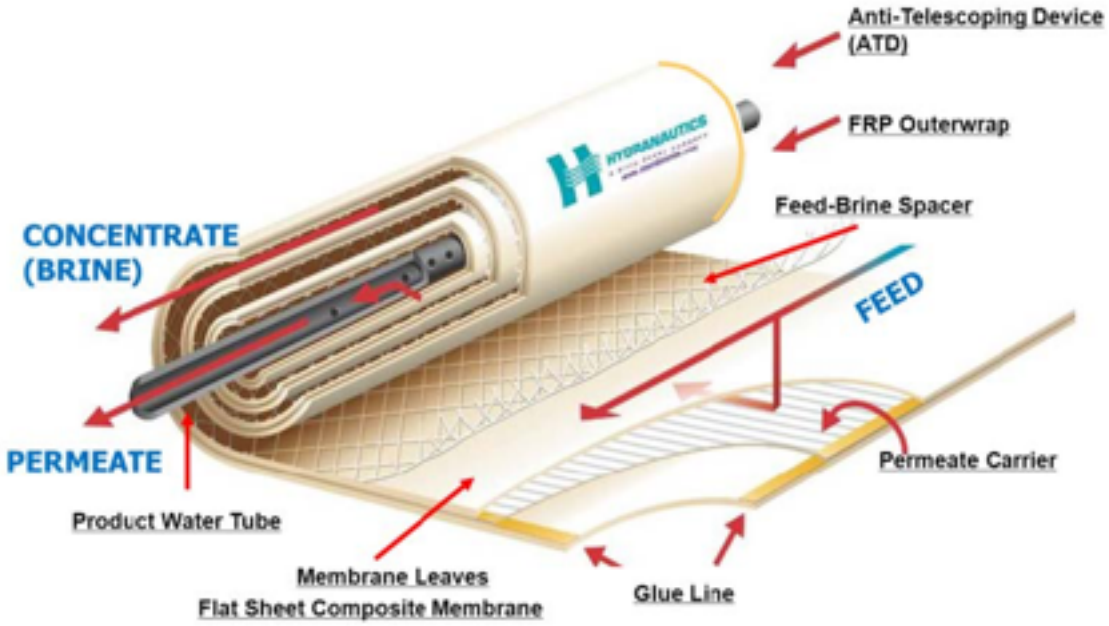
Reverse osmosis systems operate at high pressures. The higher the salt content of the water to be treated, the higher the pressure required for the plant to operate.

Pictures of a typical reverse osmosis membrane and a reverse osmosis plant respectively are shown below.

WATER TREATMENT TECHNOLOGIES

REVERSE OSMOSIS

Pictures of a typical reverse osmosis membrane and a reverse osmosis plant respectively





WATER TREATMENT TECHNOLOGIES

ION EXCHANGE

Synthetic resin beads, known as ion exchange resin, can be charged with a particular ion, typically hydrogen or hydroxide. When water containing dissolved salts is passed through a series of vessels that are loaded with the ion exchange resin, the hydrogen and hydroxide ions in the different vessels are exchanged for positively charged ions (e.g. sodium, potassium, calcium, and magnesium) and negatively charged ions (e.g. chlorides, sulphates, and bicarbonates) respectively. The hydrogen and hydroxide combine to form water molecules. This way, undesirable salts are removed from water.

The most common use of ion exchange technology is in the production of ultrapure water in power plants.

WATER TREATMENT TECHNOLOGIES

GAS TRANSFER MEMBRANES

Gases that are found in the atmosphere get dissolved in water. Some of these gases are undesirable in certain industrial applications, such as the steam generators in power plants.

When the gases in the atmosphere are in contact with the water, an equilibrium (balance) is created, and the gases remain dissolved in the water. If the equilibrium is disturbed, the gases can be driven off the water back into the atmosphere, thus reducing the concentration of the gases in the water. This is how gas transfer membranes work.

Pictures of a gas transfer membrane and a gas transfer membrane installation respectively are shown below.

WATER TREATMENT TECHNOLOGIES

GAS TRANSFER MEMBRANES

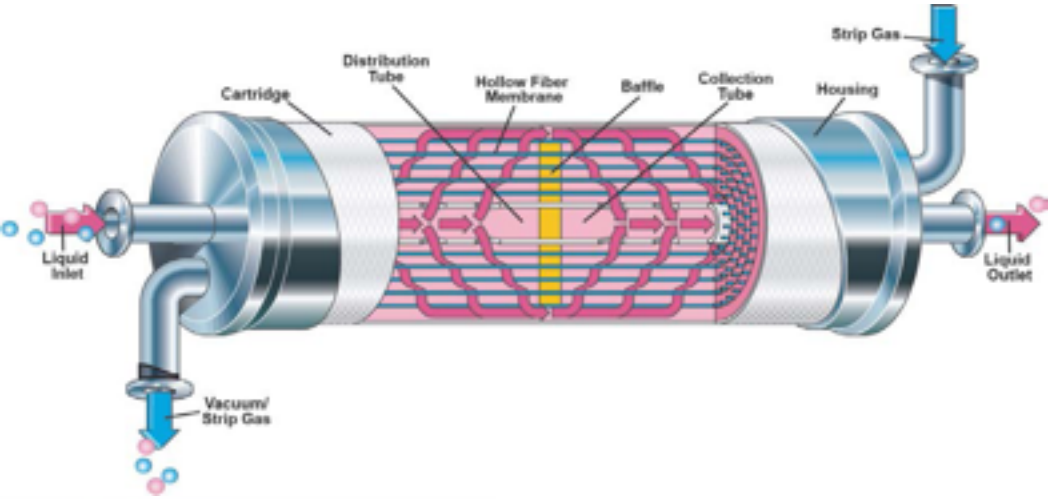
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WATER TREATMENT TECHNOLOGIES

GAS TRANSFER MEMBRANES

Pictures of a gas transfer membrane and a gas transfer membrane installation respectively.





WATER TREATMENT TECHNOLOGIES

CONTINUOUS ELECTRODEIONISATION (CEDI)

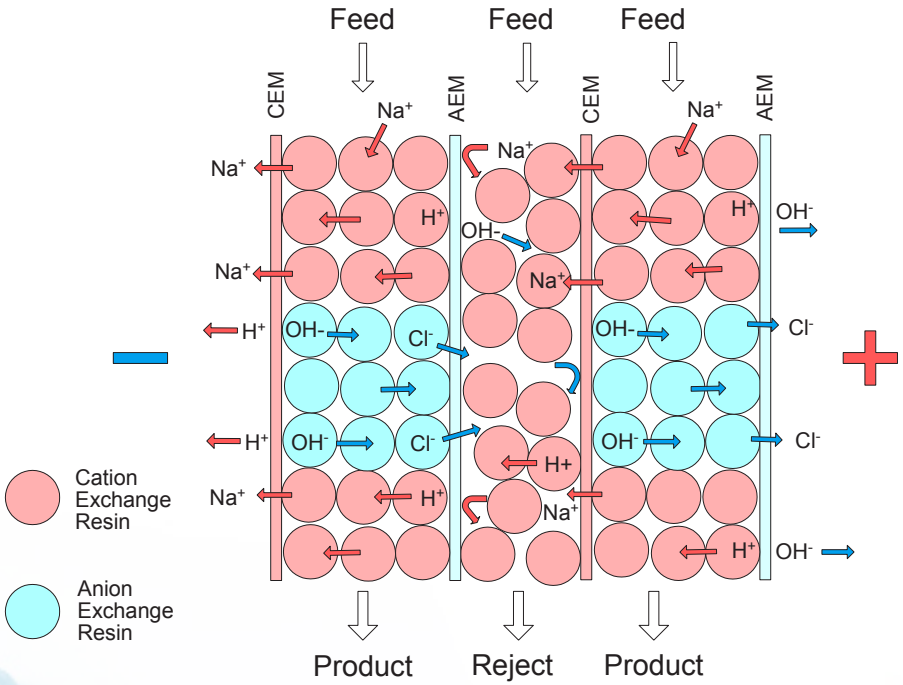
A module can be constructed that will contain ion exchange resin, cation-repelling membranes, and anion-repelling membranes, with electrodes at the two ends of the module. This is the CEDI module. When water is passed through the module, and an electric current is passed through the electrodes, dissolved salts can be removed from water.

One application of CEDI technology is in the power plant industry. CEDI systems are typically installed after reverse osmosis units. The CEDI systems treat the water from the reverse osmosis units, to produce the ultrapure water with the required quality.

WATER TREATMENT TECHNOLOGIES

GAS TRANSFER MEMBRANES

Pictures of the CEDI process schematic and a typical CEDI unit are shown below.

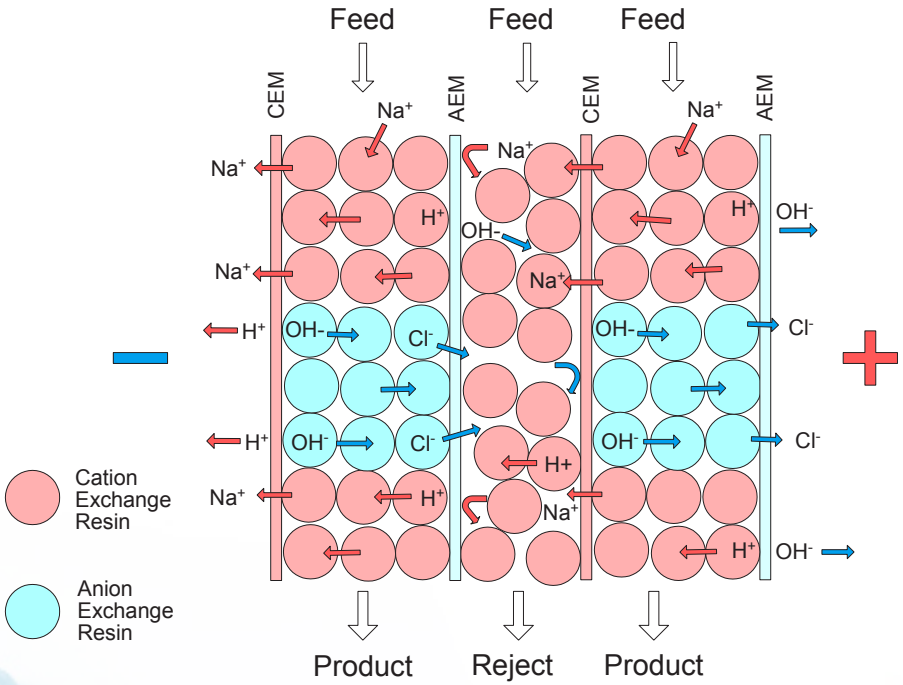




WATER TREATMENT TECHNOLOGIES

GAS TRANSFER MEMBRANES

Pictures of the CEDI process schematic and a typical CEDI unit are shown below.





WATER TREATMENT TECHNOLOGIES

BIOLOGICAL WATER TREATMENT

If conditions are created in water where a certain type of microorganisms are allowed to multiply, the microorganisms will feed off some of the dissolved substances in the water.

Biological water treatment is typically used in sewage treatment to remove substances such as phosphates, ammonia, nitrates, and dissolved organic matter.

Biological water treatment plants can be designed with a wide variety of configurations. Pictures showing some of the biological water treatment plants are shown below.

WATER TREATMENT TECHNOLOGIES

BIOLOGICAL WATER TREATMENT

Pictures showing some of the biological water treatment plants are shown below.





WATER TREATMENT TECHNOLOGIES

OXIDATION AND DISINFECTION

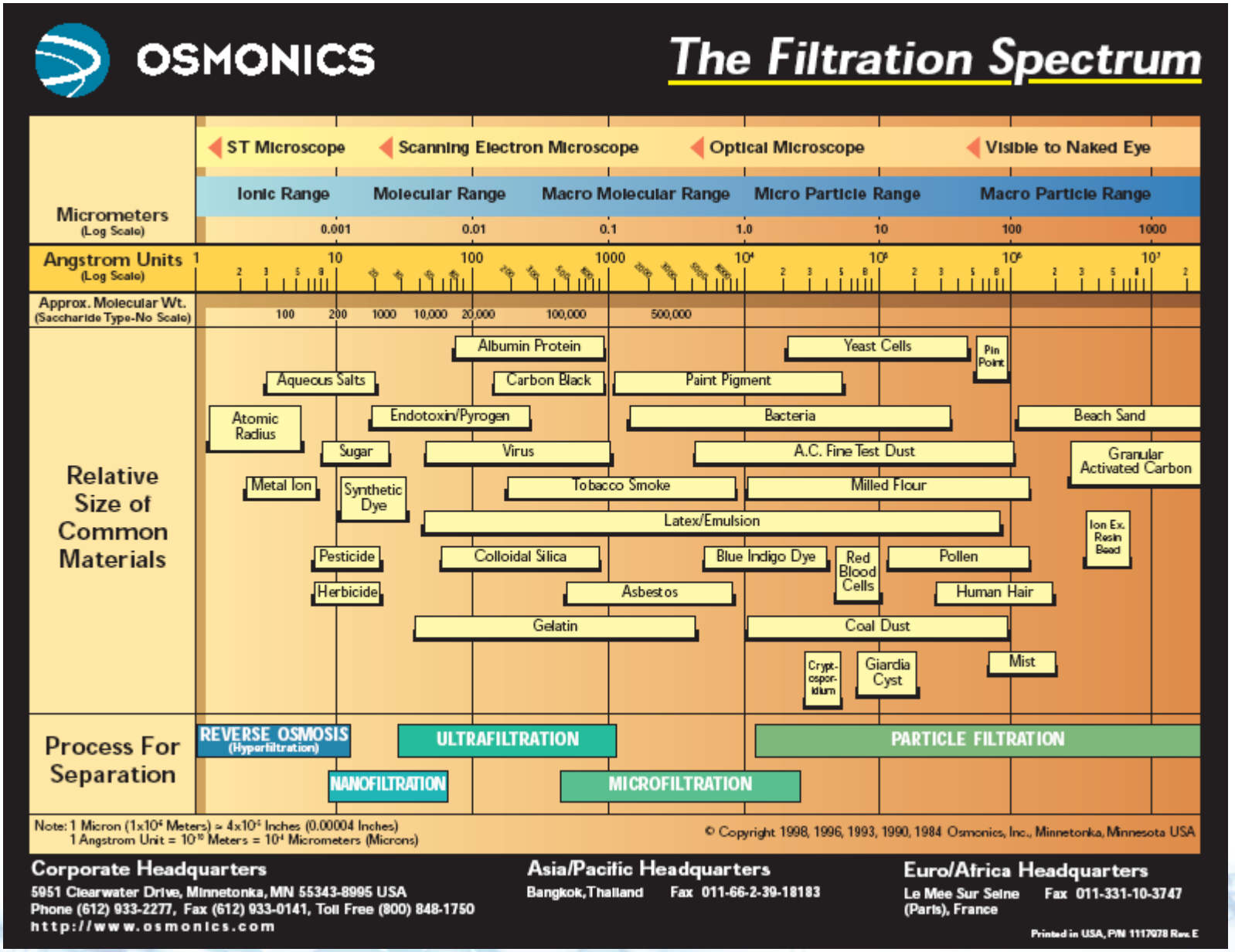
Following the filtration step in a drinking water plant, or a biological water treatment plant, the water is typically disinfected. In most cases, chlorine, in one form or another, is used. However, other disinfectants can be used, such as ozone and chlorine dioxide.

Disinfection is used to kill microorganisms in the water. In drinking water systems, this final step in the treatment process makes the water safe for human consumption.

WATER TREATMENT TECHNOLOGIES

OXIDATION AND DISINFECTION

The disinfectants mentioned herein, as well as others, can also be used as oxidising agents. They can be used in their original forms, or in other chemically modified forms. The oxidising agents are used to change the form of some dissolved substances in water into forms that are harmless or forms that can be removed more easily from the water. The oxidising agents can also be used to destroy some harmful dissolved organic substances that are difficult to remove by other means.


OSMONICS
The Filtration Spectrum
ST Microscope
Scanning Electron Microscope
Optical Microscope
Visible to Naked Eye
Ionic Range
Molecular Range
Macro Molecular Range
Micro Particle Range
Macro Particle Range
Micrometers (Log Scale)
0.001
0.01
0.1
1.0
10
100
1000
Angstrom Units (Log Scale)
1
10
100
1000
Approx. Molecular Wt. (Saccharide Type-No Scale)
100
200
1000
10,000
20,000
100,000
500,000
Relative Size of Common Materials
Albumin Protein
Yeast Cells
Pin Point
Aqueous Salts
Carbon Black
Paint Pigment
Atomic Radius
Endotoxin/Pyrogen
Bacteria
Beach Sand
Sugar
Virus
A.C. Fine Test Dust
Granular Activated Carbon
Metal Ion
Synthetic Dye
Tobacco Smoke
Milled Flour
Latex/Emulsion
Ion Ex. Resin Bead
Pesticide
Colloidal Silica
Blue Indigo Dye
Red Blood Cells
Pollen
Herbicide
Asbestos
Human Hair
Gelatin
Coal Dust
Crypt-ospor-idium
Giardia Cyst
Mist
Process For Separation
REVERSE OSMOSIS (Hyperfiltration)
ULTRAFILTRATION
PARTICLE FILTRATION
NANOFILTRATION
MICROFILTRATION
Note: 1 Micron (1x10⁻⁶ Meters) = 4x10⁻⁵ Inches (0.00004 Inches)
1 Angstrom Unit = 10⁻¹⁰ Meters = 10⁻⁴ Micrometers (Microns)
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Le Mee Sur Seine (Paris), France Fax 011-331-10-3747
Printed in USA, P/N 1117078 Rev. E

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