

WATER TREATMENT SYSTEMS

Several water treatment options are available to treat water to improve the quality. The selection of the process should be made on the basis of its intended application. Many of the popular processes are discussed below.

Ultra-Violet

This unit uses a ultra-violet light source to destroy bacteria. The feed water passes through a transparent tube and ultra-violet light illuminates the water prior to filtration. Those bacteria contacted by the light are killed. In large commercial units the number of light sources can be increased and a swirling effect introduced to attempt total contact and hence control of all bacteria. The efficiency is always subject to doubt and is affected by age of the lamps, cleanliness of the transparent tubes, amount of cloudiness in the water etc. If only a very small number escape the light, re-infection of the filtered water occurs quickly unless a biocide levels are adequate after disinfection. Ultra-Violet is not bacteria-static.

Reverse Osmosis

This process can most easily be described as "squeezing" water through an extremely fine filter or membrane to remove most of the salts and other materials from the filtered water stream including bacteria, fungi, viruses etc. In a domestic unit, water pressure is used to force some water through the fine membrane but water is produced very slowly and at the cost of about 5 litres of initial supply to produce 1 litre of product. The membrane is susceptible to damage by incorrect cleaning or water borne contaminants. In commercial Reverse Osmosis plants, the feed water must be refiltered to remove contaminants and pumped to a high pressure to increase the efficiency of the process. Higher recovery of water is achieved but the quality of the feed water and the operation of the plant must be carefully monitored and controlled. RO is the appropriate choice for some applications but these units are costly, bulky, and/or wasteful but can produce, when well maintained and working effectively, water of high quality suitable for medical type uses. This process is not bacteria-static and re-infection of the filtered water occurs quickly unless appropriate action is taken.

Ion Exchange

Ion exchange is used to remove salts from the water solution to produce water of a very high quality suitable for medical and laboratory uses. The salts are composed of electrically charged ions, which absorb into the resins contained inside the unit. The resin eventually becomes "exhausted" when it has absorbed as much ionic material as it can. The resin must then be replaced or the salts will not be removed. Measuring the electrical conductivity of the treated water can monitor this condition. It is not designed to remove dissolved organic materials from solution and therefore it is useful only as a final treatment stage after filtration to remove sediment and organic materials. The water from the ion exchange is not bacteria-static and re-infection of the treated water can occur unless appropriate precautions are taken.

Carbon Filters

Carbon filters are used to remove organic materials from water and are cost effective when there are small amounts of organic material in the water. The organic material in water comes from a variety of sources and could be from decaying plant matter, dead bacteria, etc. In this process, the organic materials and some other materials are adsorbed onto the surface of the carbon material contained inside the unit. Carbon filters are very effective at removing the materials that cause taste in drinking water but chlorine is also removed. Because the chlorine is removed the water from a carbon filter is not bacteria-static and re-infection of the treated water can occur

unless appropriate precautions are taken. Carbon filters are not designed to remove sediment and should be installed after a protective sediment filter.

Filtration

When water is filtered it passes through a porous physical barrier (the medium) that retains the particles that are larger than the pore size of the medium. The filter media are available in a range of different materials and pore size. The selection of the correct filter medium and filter size will significantly affect the cost of operating the unit. The sediment filters form an important part of the water treatment plant as these protect the more specialised unit’s down-stream therefore extending the life of these more expensive units.

Many variables determine the selection of the correct filter set for an application; pore size, filter media, filter area, cleaning method and configuration of the filter set are all critical for optimum performance.

Filter media, for example, is usually available in a number of materials, in nominal or absolute pore size, as charged (anionic, cationic) or not charged, as depth media or surface media etc.

Filter area; flow and change-out timing determine the selection of a filter with the appropriate surface area (named “flux” and has units of volume per time per area). Installation of a small filter is problematic; a halving of area may result in only a quarter of life until renewal.

Renewal: Filters can be “renewed” by replacement of the media or by cleaning it. Cleaning can be by manual or automated cleaning. Cleaning can be by purge with water, chemical, solvent or gas. Selection is on the basis of the application. More sophisticated systems use cross flow techniques to continually purge the media of contaminants.

Recovery; is the average production rate of filtered water versus the average total input rate expressed as a percentage. The recovery rate in automated systems are usually inversely proportional the level of contamination in the feed. The more contamination, the lower the recovery rate.

Bio-contamination; this will occur when the conditions for biological growth are suitable. It has to be controlled by biocide addition, filter changes, or by altering the conditions.

Property	Type:	Pore size:	Material:	Surface Charge:
<u>Media</u>	Depth or	Absolute or	PTFE	Positive
	surface	Nominal	Cotton	Negative
			Ceramic	None
			Steel mesh	
			Polyester	
<u>Surface area</u> Determined by :-	Capacity required	Fouling rate of feed	Maximum pressure drop	Timing of filter replacement
<u>Renewal</u>	Regeneration by:	Technique:		
	Manual flush	Water Flush		
	Automatic flush	Air Flush		
	replacement	Chemical		
<u>Biological contamination</u>	Retention time in filter	Pore size	Chemical additives	Timing of filter replacement