

Reverse osmosis purified drinking water systems

Reverse osmosis (RO) is viewed as the ultimate in drinking water quality. Its popularity, in recent years, has clearly shown that RO can give water a totally new dimension. The result is a highly refined water, which once experienced, activates the taste buds in a marvellously thirst quenching way.

Unlike filtration RO water is exceptionally pure. The process can remove a wide variety of contaminants in water including organics, inorganics, bacteria and particulate matter. It provides a barrier to most 'nasties' in water, including cysts, like cryptosporidium, which makes it an ideal choice for use on private well and bore hole supplies in addition to ordinary mains tap water.

The term reverse osmosis is the opposite of osmosis. Osmosis is the means by which water and nutrients are supplied to living cells. Cell walls are natural semi-permeable membranes. They are selective allowing only certain materials to pass through the membrane while rejecting others. The natural flow is from the dilute solution to the concentrated solution. Reverse osmosis is the process of utilising pressure to reverse the natural flow through an artificial semi-permeable membrane.

In an RO system water pressure is used to separate water into two streams. The water forced through the membrane is almost pure H₂O and referred to as product water or permeate. The remainder flows through the unit to drain. Unlike filtration there is no accumulation of contaminants as these are continually washed away in the rejected water.

The membrane in an RO is exceedingly fine. The pore sizes are about 5 angstroms (five hundred millionths of a centimetre). As productivity of the membrane is proportional to size, the membrane is packaged into a spiral wound element. There are several types available but thin film composite (TFC) membranes are the most effective.

The membrane module or cartridge is the heart of an RO drinking water system. Attached to the front end is a granular activated carbon (GAC) pre-filter to protect the membrane. Before the water is drunk it passes through a carbon post filter which 'polishes' the water to remove any final taste elements. As the pure water is produced relatively slowly it is necessary to store the permeate in a small pressurised tank. This is linked to a separate drinking tap.

A good RO system can perform well over a long period of time and consistently remove 99% of bacteria. It will also remove giarda cysts and the majority of viruses. The system will also eliminate 90% of simple organics and 99% of larger organic material.

The following is a list of contaminants which can be removed by an in-home RO system. The content has been compiled to show the excellent rejection characteristics of reverse osmosis and does not imply existence in a municipal water supply.

Nominal rejection characteristics of an RO membrane

Aluminium	80 - 92%	Ferrous iron	98 - 99%
Ammonium	94 - 98%	Lead	98 - 99%
Asbestos	99.9%	Magnesium	94 - 98%
Arsenic	94 - 96%	Manganese	96 - 99%
Bicarbonate	90 - 96%	Mercury	96 - 98%
Bromide	94 - 96%	Nickel	93 - 96%
Cadmium	87 - 94%	Nitrate	60 - 90%
Calcium	95 - 98%	Pesticides	98 - 99%
Chloride	90 - 95%	Phosphates	99%+
Chromate	90 - 98%	Potassium	96 - 98%
Chromium	96 - 98%	Sodium	96 - 98%
Copper	86 - 92%	Silver	96 - 98%
Cyanide	90 - 95%	Sugar	99.9%
Detergent / Dyes	99%	Sulphate	98 - 99%
Fluoride	90 - 96%	Water hardness	98 - 99%

There are several types of RO system. These include the larger desalination plants providing for whole communities to the much smaller membranes used for marine fish by aquaria enthusiasts. For drinking water the equipment is very specific. In a good system the dissolved oxygen in the incoming water supply penetrates the membrane at an equivalent rate to the water. This is significant since it is the oxygen, in the water, which gives good taste and not the mineral content. If oxygen is lacking the water can taste 'flat'.

An in-home RO system can be installed under or in the vicinity of the kitchen sink. In a hard water area it is advisable to use an RO in conjunction with a water softener. Chalk and lime will block the membrane pores. A membrane will last twice as long on softened water as well as removing the sodium content. The minimum water pressure required is 2.7 bar (40psi). Small RO pumps are available to provide the correct incoming pressure if it is insufficient.

As the flow of water across the membrane constantly keeps it clean an RO system can continuously perform well for many years. A system is usually sanitised on installation and periodically to maintain the water quality. Pre and post filters usually require changing annually. Some systems have an automatic safety cut off facility to avoid over use. Membranes can last three to seven years plus, dependent on the quality of the water and the rate of usage.

The reverse osmosis water purification process is the best you can get when it comes to comparing water quality. It will improve beverage mixes, ice cubes, cooking and baking. RO water is known to enhance aromas and give rich flavours. It is better than bottled water at a fraction of the price. If you have concerns about the fitness of your water, as well as taste, then installing an RO drinking water system is the best choice you can make.