REVERSE OSMOSIS: Take the Plunge

by Richard Gellert

A BRIEF HISTORY OF REVERSE OSMOSIS

The process of osmosis was first described by a French scientist in 1748. More than 250 years later a modification of this process known as reverse osmosis has become the best and most efficient method to purify undesirable water into virtually pure H2O. Reverse osmosis, as we know it today, was developed in the late 1950s and has changed little since then. Reverse osmosis machines have gotten more advanced, as has membrane technology, but the essential principles remain the same. It is used for producing a few gallons of drinking water a day for residences to millions of gallons per day for industrial processes, and even for desalinating seawater.

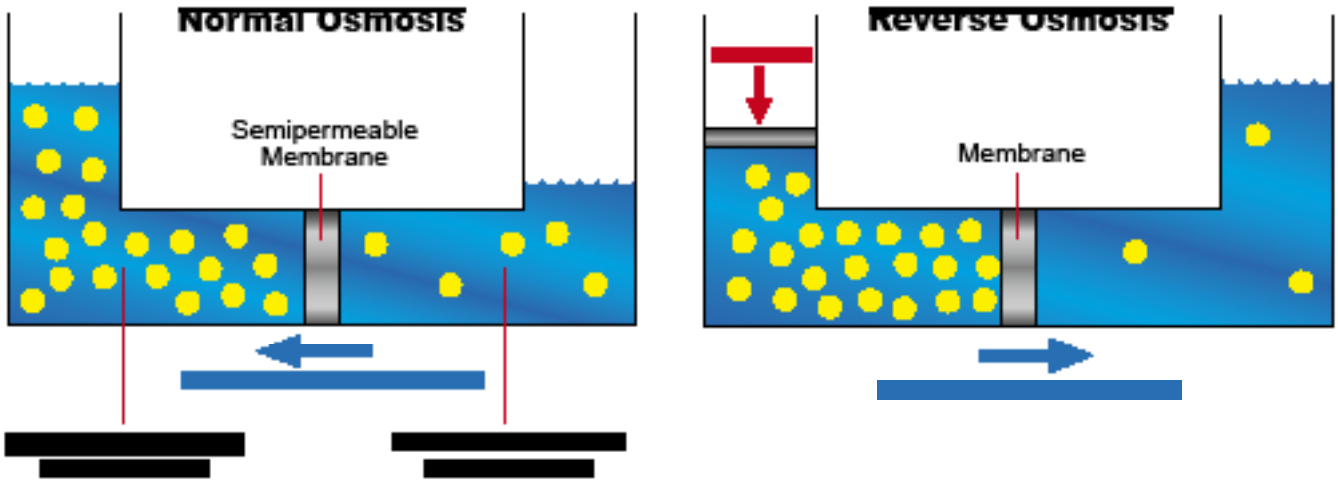
WHAT IS REVERSE OSMOSIS?

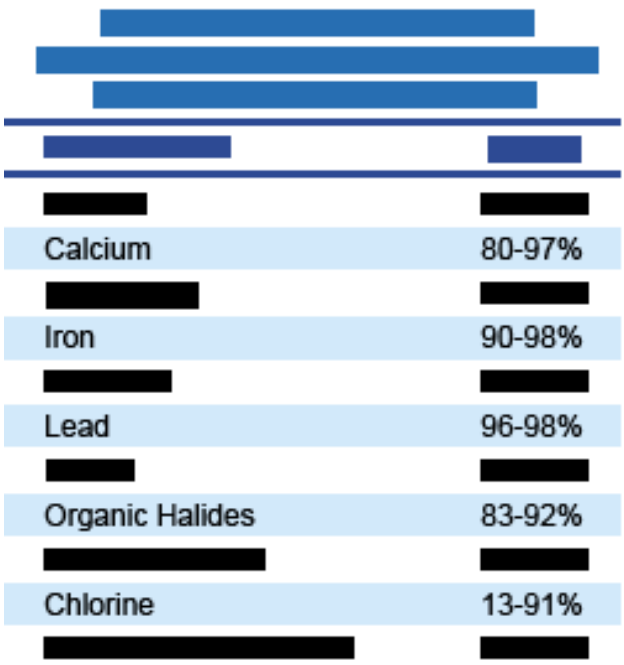
In order to describe reverse osmosis, it's best to explain the phenomenon of osmosis. Osmosis involves the selective movement of water from one side of a membrane to the other. According to Merriam-Webster's Collegiate Dictionary, osmosis is the "movement of a solvent through a semipermeable membrane into a solution of higher solute concentration that tends to equalize the concentrations of solute on the two sides of the membrane." Now, that's a brainteaser.

For the purposes of this article, reverse osmosis (RO) is essentially a water treatment process that removes undesirable materials from water by using pressure to force water molecules through a semipermeable membrane.

This process is called "reverse" osmosis because the pressure forces the water to flow in the reverse direction (from the concentrated solution to the dilute solution) to the direction of flow in the process of natural osmosis (from the dilute to the concentrated). Pressure forces contaminated water through the membrane. Since contaminants cannot cross the membrane, purer water collects on the other side and can then be used or stored. The contaminants are stopped at the membrane and continue down the wastewater stream.

The RO membrane consists of several





thin layers or sheets of film that are bonded together and rolled in a spiral configuration around a plastic tube. The material of the membrane is semi-permeable — it allows water molecules to pass through while acting as a barrier to dissolved solids. Most RO systems have two pre-filters — a sediment and a carbon — to pre-treat the water before it is passed through the RO membrane(s).

HEALTH BENEFITS FOR HUMANS

Whether or not RO water is good for your body is a hotly debated topic. Research the subject and you will find two completely separate schools of thought. One theory argues that in order for a mineral to be of any use to the body it must be presented in a form that is readily absorbed. That form involves an association with an organic (carbon-based) molecule. Carbon-based molecules are to be found in living systems, and are not found in the ground, which is where mineral water comes from. The minerals that come from ground water are in salt form. When salt is presented to the body (with rare exceptions such as sodium chloride, i.e., table salt) it must be either stored or excreted. These unusable minerals accumulate and cause all kinds of health problems, such as cataracts, kidney stones, and arteriosclerosis.

This theory also says that purified water, RO or distilled, leeches the body of minerals in the unusable, ionic form, which is a good thing. We want these to leave the body rather than be deposited and cause disease. From where, then, should we be getting our minerals? Plants, of course! Plants and vegetables have readily available forms of minerals because they are biologically bound.

The arguments against drinking demineralized water are that we lose a primary source of necessary minerals in our diet. More so, water that has lost its own minerals will attract and absorb minerals in our body, causing a mineral deficiency. The theory states that, in fact, the minerals in water are readily absorbable and constitute a percentage of the healthy mineral content in our bodies.

Proponents of mineral water say the calcium and magnesium it contains are essential elements for our body. They can be provided to us in food, but even diets rich in calcium and magnesium may not be able to fully compensate for their absence in drinking water. Nutritional studies suggest that some other micronutrients may also have a beneficial role associated with their presence in drinking water.

There are endless books written and studies done that encourage both theories. I suggest further researching the topics to become fully enlightened and to make the proper decision for your drinking water. One thing is for sure — drinking straight tap water is risky these days, and buying countless bottles of mineral water is environmentally irresponsible.

PLANTS AND REVERSE OSMOSIS WATER

There are many benefits of using reverse osmosis water for your prized plants. In order to have a successful crop and explosive yields you must start with a clean base for your water. Close to 0 ppm in your water allows you to dial in the perfect feed program and realize the biggest flowers and tastiest fruits you can imagine. People that use RO water for their plants can never go back to tap water after seeing the enormous difference it makes on their harvests.

IN AND OUTS OF RO SYSTEMS

So, if you already own an RO system or are thinking about acquiring one, you need to know how to get the most out of it. There are four basic factors that determine the flow of water from an RO system: inlet pressure, temperature, PPM and the gallons-per-day (GPD) rating of the membrane.

Arsenic +3	70%	Arsenic +5	98%
[redacted]	[redacted]	[redacted]	[redacted]
Cadmium	97%	Calcium	97%
[redacted]	[redacted]	[redacted]	[redacted]
Copper	97%	Detergents	97%
[redacted]	[redacted]	[redacted]	[redacted]
Insecticides	97%	Lead	97%
[redacted]	[redacted]	[redacted]	[redacted]
Nitrates	80%	PCB's	97%
[redacted]	[redacted]	[redacted]	[redacted]
Selenium	97%	Silicate	95%
[redacted]	[redacted]	[redacted]	[redacted]
Strontium	97%	Sulfate	97%
		[redacted]	[redacted]

The higher the inlet pressure the faster the flow. Most households on municipal water sources have between 40 and 80 pounds per square inch (psi) in their pipes. Typical residential or hydroponics-oriented RO filters require at least 40 psi and no more than 80 psi of pressure. People on well or spring water generally have a pressurizing system to create pressure in their pipes. These are adjustable and commonly set at 50 psi. If, however, neither of these situations is providing adequate pressure, a special RO booster pump may be required to increase the pressure to the RO system and obtain the proper flow needed.

The higher the inlet temperature the faster the flow. In areas where the winters are cold an RO system may slow down. Not much can be done about inlet temperature and it is not as big of a concern as the other factors that determine flow. Most RO membranes are rated at 77ºF (25ºC), so unless you live in a very warm area, you can expect slightly slower flow than the rated values.

The higher the ppm of the inlet water, the slower the flow. This is only reasonable because the more contaminated the inlet water the harder the RO system has to work to get rid of contaminants. Reverse osmosis systems typically reject 90 to 98 percent of all ppm of total dissolved solids. If the ppm is very high due to excess hardness (calcium, magnesium, or iron) then a water softener is a good idea as a pre-filter for the inlet water.

The GPD rating of the membrane or membranes is a very important factor in determining flow from an RO system. Typical residential drinking water systems use a 30 GPD membrane. Since the water flows so slowly from these systems, it is accumulated in a three to four gallon pressure tank. When the faucet is opened to draw water, it comes from the tank and not directly from the RO system itself.

Reverse osmosis systems designed for hydroponic use typically have one or two 100-GPD membranes. There are even some high-flow systems that have two 375-GPD membranes, giving a total flow of up to 750 GPD per day. These systems are designed for direct flow into an atmospheric (non-pressurized) storage tank or reservoir. People generally use a float valve system to fill the tank unattended and ensure it does not overflow.

Reverse osmosis is the best method for treating large amounts of water for your plants. The systems are affordable and can produce a gallon of pure H2O for pennies. You will notice a huge difference in yield and quality of your harvests. Many hydroponics shops carry a variety of filters and can help you decide which one is right for you and your garden. MY