Rethinking Reverse Osmosis

Osmosis is a process by which molecules of a solution pass through a semi-permeable membrane from a less concentrated solution into a more concentrated one, thus equalizing the concentrations on each side of the membrane. Reverse Osmosis (R.O.) is a process by which a solvent passes through a porous membrane in the opposite direction to that for natural osmosis when subjected to a hydrostatic pressure greater than the osmotic pressure. The result is the removal of ions, molecules and larger particles from a water source to create potable water. On its own, the process creates purified water by removing between 90-99.99% of all the contaminants**, including essential trace minerals, from water to create pure drinking water.**

In 1748, French physicist Jean-Antoine Nollet first observed the process of osmosis through a semi-permeable membrane. In the 200 years that followed, osmosis would be a phenomenon only visible in a lab. In 1950, the University of California at Los Angeles first investigated desalination of seawater using semi-permeable membranes. Researchers from both University of California at Los Angeles and the University of Florida were able to successfully produced fresh water from seawater using osmosis by the mid-1950s. Up to this point, reverse osmosis treated water would be used mainly for industrial, technical and laboratory purposes. The 1960s required that this technology become more extensively applied to treatment of drinking water, as coastal and inland arid areas could not meet increasing water demands resulting from increased populations, higher living standards, development of industry and mass tourism.

Following the 1960's, reverse osmosis desalinization became a widely practiced technique in providing fresh water supplies. Despite the proliferation of the technology, a range of scientific studies conducted in the decades since have many revaluating the costs and benefits of Reverse Osmosis.

Reverse Osmosis treatment removes essential trace minerals from water.

One of the most noteworthy downsides of reverse osmosis filtration is the removal of naturally occurring trace minerals. Along with the 90-99% of contaminants removed during R.O., minerals essential to human health like Calcium, Magnesium and Potassium are also removed, resulting in demineralized water. Studies conducted by the World Health Organization (W.H.O) have shown that demineralized water rates low in taste and thirst-quenching characteristics, and its consumption over time can expose people to a myriad of health issues including:

- Decreased secretion of tri-iodothyronine and aldosterone
- Increased secretion of cortisol
- Morphological changes in the kidneys (atrophy of glomeruli)
- Swollen vascular endothelium limiting the blood flow
- Reduced skeletal ossification in fetuses
- Increased diuresis (around 20%)
- Increased body water volume
- Increased elimination of minerals from the body
- Hyponatremic shock or delirium
- Increased morbidity and mortality from cardiovascular disease
- Higher risk of fracture in children
- Neurodegenerative diseases
- Pre-term birth/ Low Birth Rate

Demineralized Water becomes acidic when exposed to air.

Purified water by definition is slightly acidic. During the R.O. filtration process alkaline mineral atoms are removed from salt molecules. An example of this occurring would be the removal of a calcium atom from a molecule of Calcium Bicarbonate during R.O. The result is water absent an alkalinity buffer

that will dissolve carbon dioxide from the air until it is in equilibrium with the atmosphere. That means that the amount being dissolved balances the amount coming out of solution. The total amount in the water is determined by the concentration in the atmosphere. The dissolved carbon dioxide reacts to form carbonic acid in water. Within a relatively short period of time, R.O. water exposed to carbon dioxide will see a drop in its pH level, making it more acidic.

$$CO_2 + H_2O \leftrightarrow H_2CO_3$$

R.O. Demineralized water can negatively affect gastrointestinal health

It has been demonstrated that consuming water of low mineral content has a negative effect on homeostasis mechanisms. Homeostasis refers to the ability of an organism to adjust in order to maintain a stable, constant condition of its internal environment. According to the W.H.O report on drinking-water quality standards, "experiments in animals have repeatedly shown that the intake of demineralized water leads to diuresis (increased urination caused by substances present in the kidney tubules), extra cellular fluid volume and serum concentration of sodium and chlorine ions and their increased elimination from the body, lower volumes of red blood cells and other hematocritic changes (alteration of the number of red blood cells)". A German study carried out by the *German Society For Nutrition* proved that if demineralized water is ingested, the intestine has to add electrolytes to this water, taking them from the reserves in the body. After ingestion, the electrolytes dissolved in the bodily fluids are further diluted. Inadequate electrolyte levels in the body may compromise the function of vital organs.

In the past, acute health problems were reported in mountain climbers who had prepared their beverages with melted snow, which was not supplemented with necessary minerals. A more severe case of this condition coupled with brain edema, convulsions and metabolic acidosis was reported in infants whose drinks had been prepared with low mineral bottled water.

Drinking R.O. treated water can result in a reduced intake of essential elements

The contribution of water to provide some essential elements for humans is important because many modern diets, particularly in third world developing countries, are often an inadequate source of minerals. Epidemiological studies exist suggesting that drinking water with a low mineral content may be a factor for hypertension and coronary heart disease, gastric and duodenal ulcers, chronic gastritis, goiters, pregnancy complications and several complications in infants. As an example, a study was conducted on two Russian populations living in areas with differing levels of dissolved minerals in their drinking water. Results showed that the population with water low in minerals had higher incident rates of these diseases. Children living in this area exhibited slower physical development and more growth abnormalities, pregnant women suffered more frequently from oedema and anaemia.

Cooking with R.O. demineralized water can substantially reduce nutrients in food.

When used for cooking, demineralized water has been found to significantly reduce essential nutrient levels from food (fruits, grains, meats, vegetables). In certain cases, reductions up 60% for magnesium and calcium have been observed. For other elements, like copper and manganese, even higher rates of reduction (65-70% respectively) can occur.

Because food intake accounts for a majority of nutrients ingested, the use of low-mineral R.O. water for cooking and processing food may cause a marked deficiency in total intake of certain essential nutrients that was much higher than expected with the use of such water for drinking only. For many people, particularly in developing countries, their current dietary habits may not provide all necessary nutrients in sufficient quantities. Therefore, any factor that results in the loss of essential elements and nutrients during the processing and preparation of food could be detrimental.

Drinking R.O. treated, demineralized water can increase dietary intake of toxic metals

Demineralized R.O. water is highly aggressive to materials with which it comes into contact. It easily adsorbs metals and some organic substances from pipes, coatings, storage tanks and containers. Moreover, calcium and magnesium in water and food are known to have an antitoxic activity: they can prevent the absorption of some toxic elements from the intestine into the blood. Populations supplied with low-mineral water may be at a higher risk in terms of adverse effect from exposure to toxic substances compared to populations supplied with water of average mineralization. Calcium, and to a lesser extent magnesium, contained in both drinking water and food have previously been found to have a beneficial antitoxic effect in that they can prevent or drastically reduce the harmful effects of absorbing certain toxic elements such as heavy metals.

R.O. systems are incredibly inefficient.

From an environmental prospective, Reverse Osmosis Systems are beneficial in reducing the need to purchase bottled water which leads to less plastic waste in public landfills. However, because the typical R.O unit does not generate sufficient backpressure, only 5-15% of water produced from the process is "drinkable". Depending on the reverse osmosis system, for each gallon of drinkable water created, between 2 to 5 gallons of wastewater is produced and ultimately discarded into the septic system.

Source

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