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Editorial

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Desalination Development whereas Areas with Low Water Scarcity

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Introduction

Desalination is a process that takes away mineral components from saline water. More generally, desalination refers to the removal of salts and minerals from a target substance, as in soil desalination, which is an issue for agriculture.

Saltwater (especially sea water) is desalinated to produce water suitable for human consumption or irrigation. The by-product of the desalination process is brine. Desalination is used on many seagoing ships and submarines. Most of the modern interest in desalination is focused on cost-effective provision of fresh water for human use. Along with recycled wastewater, it is one of the few rainfall-independent water sources.

There are approximately 16,000 operational desalination plants, located across 177 countries, which generate an estimated 95 million m3/day of freshwater. Currently, desalination accounts for about one percent of the world's drinking water. Desalination is particularly prevalent in countries located in the Middle East and North Africa region, such as Saudi Arabia, the UAE, and Kuwait. Desalination is also an important source of water in small island developing states. Despite the issues associated with desalination processes, public support for its development can be very high. One survey of a Southern California community saw 71.9% of all respondents being in support of desalination plant development in their community. In many cases, high freshwater scarcity corresponds to higher public support for desalination development whereas areas with low water scarcity tend to have less public support for its development. The idea of the method is in the fact that when the hydrogel is put into contact with aqueous salt solution, it swells absorbing a solution with the ion composition different from the original one. This solution can be easily squeezed out from the gel by means of sieve or microfiltration membrane. The compression of the gel in closed system lead to change in salt concentration, whereas the compression in open system, while the gel is exchanging ions with bulk, lead to the change in the number of ions. The consequence of the compression and swelling in open and closed system conditions mimics the reverse Carnot Cycle of refrigerator machine. The only difference is that instead of heat this cycle transfers salt ions from the bulk of low salinity to a bulk of high salinity. Similarly to the Carnot cycle this cycle is fully reversible, so can in principle work with an ideal thermodynamic efficiency. Because the method is free from the use of osmotic membranes it can compete with reverse osmosis method. In addition, unlike the reverse osmosis, the approach is not sensitive to the quality of feed water and its seasonal changes, and allows the production of water of any desired concentration.

Another way saline water is desalinized is by the "reverse osmosis" procedure. In most simplistic terms, water, containing dissolved salt molecules, is forced through a semi permeable membrane (essentially a filter), in which the larger salt molecules do not get through the membrane holes but the smaller water molecules do.

Reverse osmosis is an effective means to desalinate saline water, but it is more expensive than other methods. As prices come down in the future the use of reverse osmosis plants to desalinate large amounts of saline water should become more common.

Remember looking at the picture at the top of this page of a floating solar still? The same process that drives that device can also be applied if you find yourself in the desert in need of a drink of water.

The low-tech approach to accomplish this is to construct a "solar still" which uses heat from the sun to run a distillation process to cause dew to form on something like plastic sheeting. The diagram to the right illustrates this. Using seawater or plant material in the body of the distiller creates humid air, which, because of the enclosure created by the plastic sheet, is warmed by the sun.

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