Desalination: Is it Worth its Salt?

Two thousand years ago, Roman soldiers were partly compensated with a salt ration because salt was so valuable for preserving food as well as seasoning. Over time, this gave rise to the expression, “Is he worth his salt”? Let’s see if desalination would be worth its salt.

People are feeling water shortages worldwide; the outcry for more water sources often calls for a desalination solution, but is desalination worth considering? Let’s dive into those waters.

Approximately 70% of the earth’s surface is covered by abundant oceanic waters, but only 3% of earth’s waters are freshwater with most of that in glaciers, ice caps, and in aquifers deep underground. So why is there so little freshwater and why can’t we just get the fresh water back from the seas? Considering millions of years where water runs downhill, our rivers transport rain over land back to the oceans. So, we end up with a disproportionate amount of water being “salty.” What’s keeping us from taking the salt out?

First, there are limits to our technology which make desalination problematic. The two most common methods, distillation and reverse osmosis, have the same two drawbacks. Each requires substantial energy input and byproduct (brine) disposal. But new techniques are being studied. Four terms you need to know are potable water (water you can drink), distilled water (pure water, lacking minerals), seawater (taken from the ocean) and brine (highly salty concentrated seawater).

Distillation is the process of simply heating the seawater and then catching & cooling the steam vapor. Some minerals are then reintroduced to the distilled water to make potable water. The residue from the process may be a brine or it may be dried into a cake-like powder. Sea salt contains many useful minerals beyond the table salt we typically use, so a small portion of the brine could ultimately be marketed.

Reverse osmosis, like in home systems, passes water through a semi-permeable membrane which allows the water to go through but holds back unwanted minerals, like salt. However, it, too, must then dispose of the water containing the concentrated minerals (brine). On an industrial scale, that is a big problem because if you just return it to the ocean, the brine sinks to the bottom due to its higher density. That highly salty water then kills off deep sea life and affects the oceanic food chain. Imagine no more shrimp in the Gulf of America!

Both processes have high energy input requirements, so application in places short on electricity are costly or impractical. Despite the downsides, global desalination has grown in the last 27 years from 20 million cubic meters daily to over 100 million cubic meters daily.

There is hope.

One group of university researchers has proposed vacuuming the air layer only a foot or more above the ocean’s surface which is at 100% humidity most of the time. They would circulate the moist air through deep water pipes to condense the vapor into distilled water.

A California company (OceanWell) is studying the use of deep water “pods” offshore which would use the weight of the seawater above them to press the seawater through semi-permeable membranes without the need for electrical high-pressure pumps. Lower electrical demand pumps would transfer the potable water to shore. The pods would periodically be brought to the surface for maintenance.

An Australian company (SolDesal) has proposed a system which uses concentrated sunlight using reflecting mirrors to superheat seawater. Instead of directly cooling the distilled water, they send it through turbines to generate electricity and cool it downstream. The only by-product is sea salt which could supply sodium for new and promising batteries.