What is the difference between Distilled and RO water?

Distillation and reverse osmosis (RO) are both methods of purifying water. In the distillation process impure water is boiled in a chamber and converted to steam. The steam is then converted back to pure water in a separate chamber. In this way all the impurities are left behind in the first chamber. In the RO process water is pumped through a membrane at high pressure. The membrane filters out impurities from the water pumped into one side of it to give pure water on the other side of it.

The two processes can be compared across four different criteria – Chemical Purity, Cost, Wastage and Energetic Purity.

Chemical Purity

Distillation has long been considered the gold standard method of purifying water. Conceptually it is a robust process because pure water is removed from impure water by a change of state (i.e. water to steam). The impurities are physically left behind in another chamber. Additionally any germs present in the impure water are killed by the heat applied during the process. Distilled water is chemically just H_2O. Nature relies on this process in the rain cycle.

However the process of distillation is vulnerable to volatile impurities – that is to say impurities in the water that would convert to a gaseous state below 100^0C and therefore travel with the steam into the chamber that collects the pure distilled water. This weakness is addressed by using a distiller with a de-gasser.

The quality of the pure water produced by RO depends on how fine the membrane is. You can get very fine membranes which produce a pure water that is chemically very close to distilled water.

However RO as a process is vulnerable to the integrity of the membrane that filters the water. Impurities build up on the surface of the membrane. A tiny perforation anywhere on its surface will compromise the purity of the water produced. As a result it is conceivable that the pure water could actually have higher levels of certain impurities than the impure water. In order to address this weakness purity monitoring equipment needs to be used in conjunction with the RO equipment.

With the right equipment there can be little to choose between distillation and RO on the criterion of chemical purity. However due to its greater robustness as a process distillation tends to be the preferred process for certain sensitive applications like “water for intravenous injections”.

Cost

The capital cost of RO equipment tends to be significantly lower than distillation equipment. This tends to be the main reason why RO is used in preference to distillation to purify water.

Historically the running costs of RO equipment has also been lower than the running costs of distillation equipment. However with the advent of distillation equipment that recycles its energy this difference is now negligible.

Wastage

Distillation equipment is designed to work in batches or continuously. Batch distillation involves filling impure water into a chamber and then waiting for it to be emptied and then filling it again. In continuous distillation impure water continuously flows into the impure chamber as the steam leaves it. Whereas there is virtually no waste water in batch distillation in continuous distillation 25% to 40% of the input water is wasted.

The RO membrane is unable to filter all the water being pumped into it. The water that it cannot filter - waste water - is sent to the drain. Typically a new RO membrane purifies between 25% to 40% of the water pumped into it. The remaining 60% to 75% is waste water. As the membrane collects impurities its performance declines. This means that you get more waste water and less

purified water. The waste water percentage can climb up to 90%. Normally the membrane is discarded at this stage and a new membrane is installed.
On the Wastage criterion distillation is superior to RO. However as the cost of water is very low this criterion is not commonly used to differentiate between the two processes. As environmental issues gain in importance and the scarcity of water begins to become a bigger social issue this could become a significant criterion when differentiating between the two processes.

Energetic Purity

In the new paradigm for water that is currently emerging through the work of researchers across the world (Jacques Benveniste in Europe, Lee Lorensen in the USA, Masaru Emoto in Japan) water is much more than its chemical structure of H_2O. In this paradigm water is able to register and store energetic changes in the environment around it. Molecules of water organised in a hexagonal ring – also known as clustered water – sustain cellular metabolism better than disorganised molecules of water.
Distilled water has a tendency to organise itself in a hexagonal ring. In this form it is able to register and store energetic information better than disorganised molecules of water. In this context distilled water can be seen as energetically pure – a blank sheet ready to receive an imprint with minimal inherent distortions.
At present the author has not seen any research on the energetics of RO water. Hypothetically it is possible that RO as a process has no impact on the energetics of water – the organisation of the molecules of the pure water would be similar to the organisation of the molecules of the impure water. On the other hand it is reasonable to expect that the removal of impurities would improve the energetic purity of the water. Whether this energetic purity is equivalent to that of distilled water remains to be seen.

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