

The effect of increasing Reverse Osmosis (RO) Recovery

How does RO work?

Reverse Osmosis (RO) is a separation **AND** concentration process. Water with impurities is fed under pressure to a semi-permeable membrane and some of the water crosses the membrane (permeate), leaving virtually all the impurities behind in the remaining water (concentrate), which goes to drain. The proportion of feedwater which becomes permeate is known as the RO recovery rate (usually expressed as a percentage).

Why is RO recovery typically <25%?

Water will hold a certain maximum amount of each type of impurity and if these limits are exceeded then precipitation (often called scaling and/or fouling) will occur. If this happens inside an RO module then blockage of the membrane will result. This can be prevented by either ensuring the solubility limits are not exceeded (by running at a lower recovery rate) or by removing the less soluble impurities using pre-treatment processes (such as cartridge filtration, adsorption, softening etc). A balance is needed between operating at higher recovery with lots of pretreatment and running at lower recovery with minimal pretreatment.

When can we adjust the RO recovery?

The RO recovery rate can be increased if the water entering the unit is free from low solubility impurities, either because they have been removed by pre-treatment or due to the feedwater not containing them in the first place. Conversely, if the feedwater quality worsens or the pretreatment system fails, the recovery rate can be reduced to prevent membrane scaling/fouling.

Benefit of higher recovery operation.

The principal reason for increasing recovery rate is to waste less water to drain. However, doing this is not without some possible negative effects, depending on the quality of the feedwater.

The negative effects of higher recovery operation.

As RO recovery increases there is a much greater likelihood of –

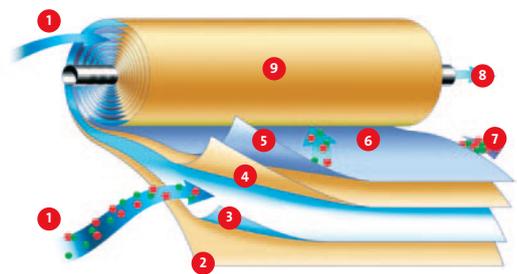
- Poorer permeate quality (leading to shorter purification pack life)
- Increased cleaning/sanitization frequency
- Shorter RO membrane life
- Increased need for more/pre-treatment processes

When is increasing recovery a viable option?

It is difficult to be too definitive since every feedwater is different but, in general, for larger units being fed with consistently low scaling/fouling waters where the best RO permeate quality is not essential, then increasing the RO recovery to 50% or more may be possible. We can provide further advice on a case-by-case basis if a full water analysis with fouling index test result is available.

A cautionary footnote

Increasing the recovery means there will be less concentrate going to drain, NOT more permeate available to be used. Purified water output is already maximised in accordance with RO membrane design limits.



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|------------------|--------------------------|
| 1 Feedwater | 6 Permeate |
| 2 RO Membrane | 7 Concentrate |
| 3 Feed Spacer | 8 Permeate |
| 4 RO Membrane | 9 Spiral-wound RO Module |
| 5 Product Spacer | |

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