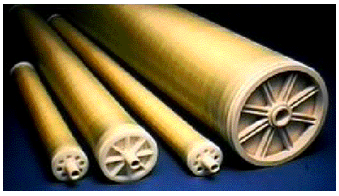
ION EXCHANGE PROCESS OR REVERSE OSMOSIS
IX or RO Technology to Produce Demi Water?

or



1. WHAT TO INSTALL

The decision to install an ion exchange resin system IX or a RO reverse osmosis system depends on many factors, from the simplest of a management nature, to the more complex ones that include investment costs, specific cost cubic meter of water produced, availability of chemical products and problems related to the discharge and environmental impact.

Other indispensable factors to be taken into account are:

- type of water to be treated
- potential / size of the system, capacity
- required quality of treated water
- incidence of ion exchange resins & membranes cost
- labor and energy costs
- ordinary and scheduled maintenance cost
- return on investment

2. HOW TO DECIDE

➢ TYPE OF WATER TO BE TREATED

Until not long ago it was simplified by affirming that for salinity of the influent below 350 ÷ 400 ppm the ion exchange was more convenient; now this limit is gone.
The difference is in the quality of the water: well water, river water with adequate pre-treatment, good quality water, are certainly to be treated by reverse osmosis; surface waters, perhaps with a high content of suspended solids or organic substances with limited pre-treatment, make the decision in favour of an ion exchange lean.

➢ DIMENSION AND SCOPE OF THE SYSTEM

The new demineralization plants with flow rates lower than 80 ÷ 100 m^3/h are now made entirely with reverse osmosis adequately pre-treated, possibly followed by a second RO step or a Mixed Bed or an EDI system, if the required quality cannot be reached by the individual stage RO.

Viale delle Orchidee, 41 CAP 20065 INZAGO – MI – ITALY
Phone/Fax: +39 02 9549535 Mobile: +39 348 1213413 & +39 339 8478349
e-mail: egmastudioassociato@gmail.com
Partita IVA/Codice Fiscale 04063710968

For plants with higher potential, ion exchange can still be an alternative, especially if there are specific conditions that make it more interesting, such as: simplicity of operation, lower probability of having problems, longer duration, totally automatic operation.

- QUALITY REQUIRED FOR WATER TREATED

For effluents required with conductivity <5 µS/cm, easily obtainable both by ion exchange and reverse osmosis, the tendency is to consider the RO technology. More qualitative and restrictive effluents, with conductivity <1 µS/cm and 10 ppb of residual SiO_2, can be achieved only by finishing with Polishing Mixed Bed with resins and alternatively with EDI electrodeionization. In fact, the best osmosis membranes have 99.7% saline rejection, forcing, as already mentioned, subsequent refinement steps to achieve the desired quality.

- COST OF ION EXCHANGER RESINS

While the cost of the reverse osmosis modules continues a downward trend due to the greater demand from the market, in contrast to the cost of the ion exchangers tends to increase, also by virtue of the widespread use of resins with highly selected screen size, compared to conventional resins, recommended CounterCurrent, FloatingBed and CompactBed processes.

- COST OF WORK AND ENERGY

Certainly, the exchange technology is more advantageous from both points of view, since both the incidence of manpower (more specialized on the RO system) and the cost of energy are much lower; the latter is in fact one of the fundamental costs of reverse osmosis.

- RETURN OF THE INVESTMENT

• IX Investment Cost

IX Plant capacity 200 m^3/h	0.30 ÷ 0.40 USD/m^3 day
IX Plant capacity 50 m^3/h	0.60 ÷ 0.70 USD/m^3 day

• RO Investment Cost

RO + IX Plant capacity 200 m^3/h	0.25 ÷ 0.35 USD/m^3 day
RO + IX Plant capacity 50 m^3/h	0.50 ÷ 0.60 USD/m^3 day

• Operating Cost IX

IX Plant capacity 200 m^3/h	0.30 ÷ 0.45 USD/m^3 H_2O
IX Plant capacity 50 m^3/h	0.50 ÷ 0.70 USD/m^3 H_2O

Viale delle Orchidee, 41 CAP 20065 INZAGO – MI – ITALY
Phone/Fax: +39 02 9549535 Mobile: +39 348 1213413 & +39 339 8478349
e-mail: egmastudioassociato@gmail.com
Partita IVA/Codice Fiscale 04063710968

• RO operating cost

RO + IX Plant capacity 200 m^3/h	0.15 ÷ 0.25 USD/m^3 H_2O
RO + IX Plant capacity 50 m^3/h	0.20 ÷ 0.30 USD/m^3 H_2O

3. ECONOMIC RESULT

By reason of the foregoing, it follows that the return on the investment of a Reverse Osmosis plant RO, thanks to the lower cost/m^3 produced, even at parity, +/- of investment cost, is 8 - 10 months, comparable to 14 - 16 months in the case of the ion exchangers IX solution.

4. ENVIRONMENTAL IMPACT

As a result of the aforementioned and in relation to the current water requirements that are always growing over time, it is quite clear that greater demands for demineralised water require more frequent regeneration cycles of the ion exchangers system in ideal condition.

It follows that the more marked use of regeneration chemicals such as Hydrochloric Acid & Caustic Soda, generate a high overall salinity load of sure impact on the final waste waters.

The blending of the regeneration eluate water with other central blow-down water, such as from the cooling towers, is not able to ensure adequate final dilutions. The regulations in force in this regard are very restrictive and strongly limit their maneuverability.

For this reason, it is inevitable to consider an adequate state-of-the-art technological solution for the treatment of Make Up water, which sees less use of chemicals and alternative plant types to the current ion exchangers, such as demineralized water production technology by osmotic membranes, according to the Reverse Osmosis principle.

The latest technological generations of Reverse Osmosis systems are offered skid-formula with packages modules, versatile and implementable over time with continuous reject flows, which can be managed in the global context of Centrale water discharges on salinity, limited to the final wastewater.

Egmadoc April 15th, 2019

Viale delle Orchidee, 41 CAP 20065 INZAGO – MI – ITALY
Phone/Fax: +39 02 9549535 Mobile: +39 348 1213413 & +39 339 8478349
e-mail: egmastudioassociato@gmail.com
Partita IVA/Codice Fiscale 04063710968