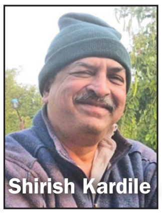
From the Board

Consider Raw Water Quality and Pretreatment for Seawater RO



Shirish Kardile

Seawater reverse osmosis (RO) systems are being employed on a large scale worldwide. The most crucial aspect of such systems is the feed water quality (seawater) to the RO membranes. Improving seawater quality improves RO performance and minimizes maintenance.

The seawater intake's location is crucial and requires a detailed study. Deep sea intakes normally produce relatively high-quality water that's free of silt, oil, grease, and algae. Such an intake is a costly proposition, but it's worth considering. For feed water with turbidity less than 5 NTU, single- or double-stage media filtration is a sufficient pretreatment to achieve turbidity less than 0.5 NTU and a silt density index less than 3.

Intakes near the shore are tricky, whether they're an intake well or an open sea intake. The feasibility of an intake well (percolation well) near shore depends on the strata. If conditions are right, such intakes produce relatively good-quality raw water. Open intakes along the seashore are most common. However, water quality is affected by shoreline pollution and contamination, and tides often increase silt content (turbidity). Sometimes creeks are used as a water source, and these can be highly contaminated as well.

The sea shelf's slope induces temperature variation in raw water during the day. Also, raw water pumping hours from near-shore intakes are restricted because of tide levels. Normally a balancing tank is required on the shore to equalize pumping during the day.

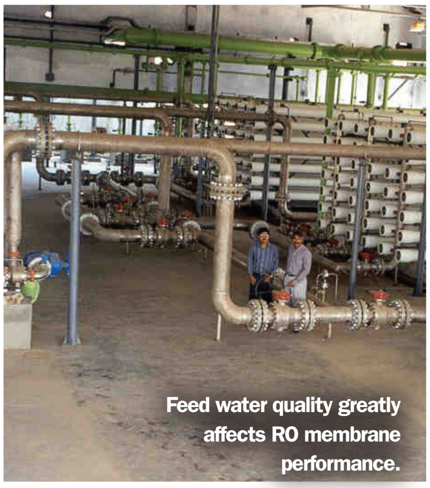
Such balancing tanks are normally shallow earthen structures. If the source is seeded with algae, then sunlight causes algae growth in the tanks, resulting in increased organic load. However, a long detention time will allow a lot of silt to settle in the tank. Pipelines to and from the tank and the treatment plant need to be buried underground, as their lengths can be substantial. If the pipelines are exposed aboveground, sunlight can cause temperature variations that can create an upheaval in settling or clarification tanks and basins.

For robust pretreatment, best practice is to construct clarification/settling tanks, followed by single- or double-stage filtration. Clarification tanks reduce the inorganic and organic load considerably before filtration. However, as mentioned previously, temperature variation throughout the day should be minimized to ensure clarifiers function efficiently. Tube or plate settling systems with a honeycomb structure dampen thermal eddy currents efficiently.

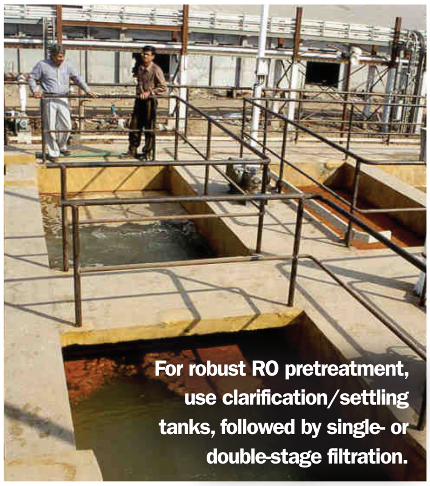
Because seawater is highly corrosive, use of corrosive metal in the internals of such plants needs to be avoided. Selecting a primary coagulant and polyelectrolyte greatly depends on membrane material composition. For example, some membrane materials have less tolerance for aluminum salts. Normally, preoxidation by chlorine or ozone is required to neutralize organics and algae.

If the treated water outlet turbidity from the clarification unit is less than 2–3 NTU, then single- or double-stage media filtration produces excellent feed water quality for RO units. For large plants, gravity filtration is often preferred. Medium and small plants frequently employ pressure filtration. Both multimedia and monomedia filters are used. Despite preoxidation at clarification units, organic growth like algae or shells are frequently found in the media. Best practice would be to use a booster dose of chlorine prior to filtration, then dechlorinate the water before feeding it to cartridge filters or RO membranes.

—Shirish Kardile,
AWWAIndia Past Board Chair



Feed water quality greatly affects RO membrane performance.



For robust RO pretreatment, use clarification/settling tanks, followed by single- or double-stage filtration.

Medium and small RO plants frequently employ pressure filtration.

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