Cutting Commercial Costs

By Diego Bonta

New RO elements can lower total water costs

Commercial reverse osmosis (RO) systems encompass a wide variety of applications. Some applications, such as metal plating or boiler feed water, require pure water with low dissolved solids. Other applications, in which a higher dissolved solids content is acceptable, such as car wash or drinking water applications, need to produce as much water as possible, or just enough water at the lowest cost possible.

Each of these categories presents unique challenges to commercial OEMs to configure systems that reduce the total water cost (TWC) to their customers.

Reducing Chemical Use

Commercial systems sold into high purity water applications usually comprise of pretreatment filters, followed by RO filters, followed by polishing filters. The pretreatment filters are the standard sediment and carbon filters used in most systems. Sediment filters remove suspended solids that would plug the RO filter, and carbon filters remove the chlorine that would degrade the RO filter and reduce its life span.

The RO filter itself is rated in terms of its flow and rejection rates at a given operating condition. For high purity applications, most OEMs choose to use RO filters that have as high a rejection rate as possible, even if it means sacrificing some product flow rate.

The final polishing step is usually a mixed-bed ion exchange bed capable of removing any residual dissolved ions in the system. These ion exchange beds need to be periodically regenerated, which provides an opportunity for RO filters to reduce the TWC.

High-rejection RO filters that provide product water with low salt content will extend the throughput of the resin bed, reducing the number of times the resin needs to be regenerated. This saves costs on labor and chemicals (acid and base) needed for regeneration, and reduces downtime or other inconveniences to the industrial process if the skid must be taken off line. While energy costs usually comprise the bulk of the operating costs for commercial RO systems, chemical costs can also become significant and are a growing regional concern due to the perceived environmental cost of their use.

Most RO filters used in commercial applications are 4 in. in diameter and 40 in. long. Each element usually can produce more than 2,000 gal per day at more than 98% rejection, depending on operating conditions. RO elements designed for high-purity applications can reach rejection rates as high as 99.7% at standard test conditions.

Reducing Energy Use

Commercial systems for drinking water applications may cause some concerns about reducing the amount of energy needed to produce water. Historically, brackish water feeds had to be treated with pressures as high as 250 psi; however, recent improvements in commercial RO membranes have reduced operating pressures to less than 100 psi. This benefits OEMs that can size smaller pumps for systems, as well as end users, who use less energy when operating their skids.

One challenge may occur when retrofitting an existing commercial system with a new RO element with a higher flow rate. If the commercial

system is equipped with a variable frequency drive, it may not be able to take advantage of the lower-energy-consuming RO element. Check with the OEM before retrofitting the system with a new element.

Reducing Fouling

Another opportunity for reducing the TWC for commercial systems is with new RO elements that require less cleaning. As RO elements age, the membrane surface may become coated with biofoulants or scale, which decrease the water quantity and quality produced. Periodic high- and low-pH cleanings can extend the life of the RO element, prolonging the time before elements must be replaced.

RO elements that are fouling resistant reduce the frequency of cleanings. Fouling resistance can be achieved in several ways. The first is an element with novel feed spacers that minimize pressure drop and allow contaminants to pass through. The second is increased active areas in the RO element, which reduce the operating flux of the membrane. (If two elements have the same product flow rate, the one with a higher active area will operate at a lower flux.) The membrane flux is important because it determines the rate at which contaminants, which promote fouling, are drawn toward the membrane surface.

Conclusions

In summary, three opportunities for RO filters to reduce the cost of commercial systems include:

1. Use higher rejection to reduce chemical use in resin polishing;
2. Lower energy consumption; and
3. Increase fouling resistance to reduce chemical use in RO membrane cleaning.

The relative savings of each of these depends on the particular application. In many applications, energy reductions are the biggest opportunity for cost savings; however, chemical consumption can be significant as well. *wqp*

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