FILMTEC Membranes
System Design: Batch vs. Continuous Process
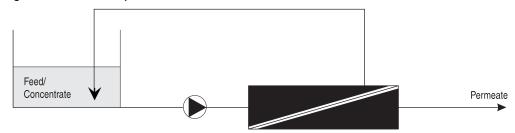
Batch vs. Continuous Process

An RO/NF system is usually designed for continuous operation. The operating conditions of every membrane element in the plant are constant with time. Figure 3.1 illustrates the continuous process mode.

Figure 3.1 Continuous RO process

In certain applications, when relatively small volumes (batches) of special feed waters occur discontinuously, e.g., waste water or industrial process solutions, the batch operation mode is preferred. The feed water is collected in a tank and treated subsequently. The permeate is removed and the concentrate is recycled back to the tank. At the end of the batch process, a small volume of concentrate remains in the feed tank. After this has been drained, the membranes are typically cleaned before the tank is filled again with a new batch. Figure 3.2 shows the batch operation mode.

Figure 3.2 Batch RO process

The semi-batch mode is a modification of the batch mode. In semi-batch mode of operation the feed tank is refilled with feed water already during operation. The batch is terminated with the feed tank full of concentrate. This allows a smaller tank to be used.

Batch systems are usually designed with constant feed pressure and declining permeate flow while the feed becomes more concentrated. The guidelines given in *Design Guidelines for 8-inch (Section 3.9.1)* and *Midsize FILMTEC™ elements (Section 3.9.2)* should be applied to batch systems as well. However, the permeate flow limits are conservative and may be exceeded, if justified by preceding test runs, and if an appropriate cleaning frequency is taken into account.

Batch vs. Continuous Process (cont.)

The batch process has the following advantages versus the continuous process:
- Flexibility when the feed water quality changes
- System recovery can be maximized batch by batch
- Cleaning is easily implemented
- Simple automatic controls
- Permeate quality can be controlled by termination of the process
- Permeate quality can be improved by total or partial second-pass treatment
- Favorable operating conditions for single (or low number) element systems, because the membranes are only in contact with the final concentrate for a short time
- Expansion is rather easy
- Lower investment costs

The disadvantages are:
- No continuous permeate flow
- No constant permeate quality
- Large feed tank required
- Larger pump required
- Larger power consumption
- Longer residence time for feed/concentrate
- Higher total running costs

The majority of RO systems are designed for continuous operation with constant permeate flow and constant system recovery. Variations in feed water temperature and fouling effects are compensated for by adjusting the feed pressure. The focus of this manual is therefore on the continuous process.

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