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System Design

3. Batch vs. Continuous Process

4-3. Batch vs. Continuous Process

The majority of RO systems are designed for continuous operation with constant permeate flow and constant system recovery as shown in Figure 1. Variations in feed water temperature and fouling effects are compensated by adjusting the feed pressure.

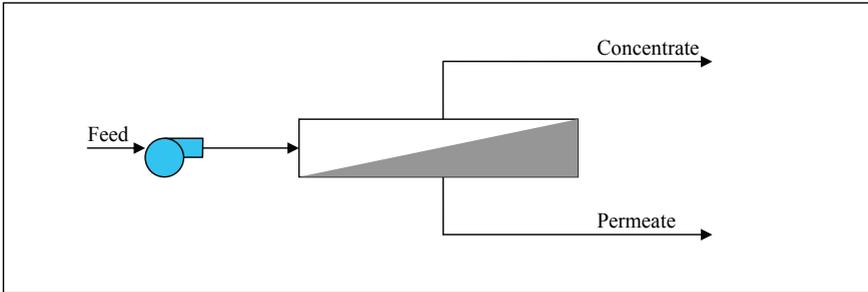


Figure 1 : Continuous RO Process

In certain applications, when relatively small volumes (batches) of special feed waters occur discontinuously, e.g. wastewater 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 2 shows the batch operation mode.

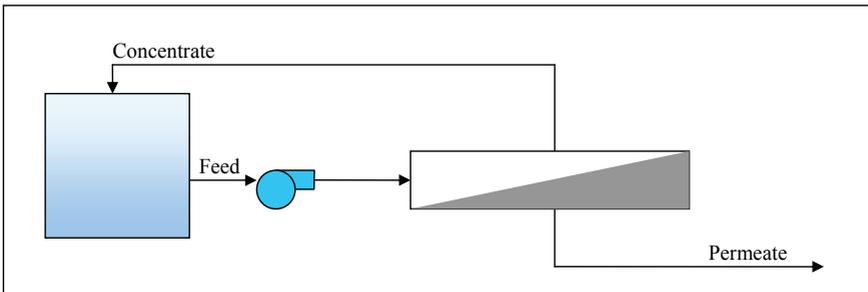


Figure 2 : Batch RO Process

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A modification of the batch mode is the semi-batch mode. 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 a constant feed pressure and a declining permeate flow while the feed becomes more concentrated. The guidelines given in Table 1 should be applied to batch systems as well. The permeate flow limits however, are conservative and may be exceeded, if an appropriate cleaning frequency is taken into account.

Some advantages of the batch process over the continuous process are :

- System recovery can be maximized batch by batch
- Cleaning is easily implemented

The disadvantages are :

- No constant permeate quality;
- Larger pump required;
- Higher total running costs.