

**Design, modeling, and simulation of batch RO and hybrid batch/semi-batch RO system for brackish water desalination**

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Batch reverse osmosis (RO) is one of the most prominent solution for minimizing the energy consumption in desalination system. In this study, we suggest a new modeling and simulation strategy for effective utilization of batch RO system for brackish water desalination. And, we propose a new hybrid batch/semi-batch RO (HBSRO) for overcoming the current limitations of the batch RO. Pilot-scale design (>10 m<sup>3</sup>/day) of batch RO and HBSRO has been conducted, and specific energy consumptions of these systems are compared to the continuous RO system. The simulation results reveal that the HBSRO can reduce the size of work exchange vessel less than a half only compromising energy penalty less than 5%. The reduced volume not only extends the applicability of the HBSRO but also improves energy-efficiency. Thus, our study highlights that the HBSRO is highly flexible, high recovery achievable, compact size available, and low SEC obtainable. These advantages can be effectively utilized in minimal or zero liquid discharge system.