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Design optimization of the parallel-feeding multi-effect evaporation system using multi-objective genetic algorithm

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ABSTRACT

Multi-effect evaporation (MEE) system design is a complex task and affected by a series of variables. Design optimization of the parallel-feeding multi-effect evaporation system using a multi-objective genetic algorithm is studied in the paper. Gain output ratio (GOR) and simplified cost of water are considered as two objective functions and the number of the effect (n), the top brine temperature (T_b), the apparent temperature difference (Δt), and the recovery ratio of the first effect (RR_1) are defined as the input variables. It is found that for satisfying the objective function requirement the top brine temperature (T_b) and recovery ratio (RR_1) are always the upper limits of the simulation interval, which are 80°C and 4, respectively. Simultaneously, two design approaches DS and DTD and two evaluation criteria optimal yield and optimal economical are proposed to evaluate the various optimal solutions. Two case studies are presented to illustrate the optimization process and result selection in detail. The multi-objective genetic algorithm proposed in the paper not only can optimize the existing scheme but also can provide several scenarios with their advantages to decision-makers at the design process. The present study has demonstrated the successful application of a multi-objective genetic algorithm for the optimal design of parallel-feeding configuration.

Keywords: Parallel feed; Multi-effect evaporation; Design optimization; Multi-objective genetic algorithm

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