



## Performance analysis of mixed feed LT-MED desalination system with thermal vapor compressor

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### ABSTRACT

Seawater desalination has emerged as an important source of fresh water. Low-temperature multi-effect distillation (LT-MED) is one of main methods of seawater desalination. LT-MED desalination system consists of a few types, such as forward feed configuration, backward feed configuration, parallel feed configuration and mixed feed configuration. Among them, the mixed feed configuration can process higher concentration ratio of seawater than that of the others and the spray density of this configuration can be easily designed to achieve a reasonable range which are important for operation. In this study, a mathematical model of mixed feed LT-MED desalination system with thermal vapor compressor (TVC) has been established based on the mass and energy conservation. In this model, the temperature losses are calculated in terms of boiling point elevation (BPE) of sea water and steam flow pressure drop during tube bundle, demisters and pipelines. To develop this model, the property parameters of seawater are considered as the functions of temperature and concentration, and the property parameters of fresh water and saturated steam are considered as the functions of temperature. The model simulation is based on the system with a rated water production of 3500 t d<sup>-1</sup>. Taking actual operation into account, some related factors on the system performance have also been analyzed such as entrained steam position of TVC, heating steam temperature of the first effect, motive steam parameters of TVC, and position of preheater. The results show that when the entrained steam position of TVC is located at the effect just behind the mixed feed position, the gained output ratio (GOR) reaches the maximum value and the total area of evaporators reaches the minimum value, which will benefit to reduce the water cost. It is also observed that the impact of motive steam parameters of TVC on GOR is greater than on total area of evaporators. The increase of motive steam parameters and a design with the preheater before the entrained steam position of TVC will greatly contribute on reducing the cost of water.

*Keywords:* Seawater desalination; Low-temperature multi-effect distillation; Thermal vapor compressor; Mixed feed; Boiling point elevation

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