Experimental and comparative study of a sea water-cooled surface condenser of LTTD plant with HTRI and Kern method

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ABSTRACT
Low-temperature thermal desalination is a process which involves evaporation of warm surface sea water at 28–29°C inside an evaporator which is maintained at a subatmospheric pressure of around 24–27 mbar [abs] and the resultant vapour is condensed in the condenser using deep-sea cooling water (12–13°C) drawn from a depth of around 350–400 m (approx). Designed heat load and overall heat transfer co-efficient of the condenser are around 3.4 MW and 1,790 W/m² K, respectively, for an inside tube cooling water velocity of 1.25 m/s. The primary objective of this paper is to experimentally study the performance of a shell and tube condenser and to compare it with the HTRI 6.0 results as well as Kern method for the same operating parameters. A comparative study showed that the predicted results of HTRI were in good agreement with experimental values as well as with Kern method. After the comparative study, the reasons for variation in results were identified, reviewed and discussed. Experimental study revealed that the deviation of actual inlet conditions from the design conditions at the plant site greatly influences the condenser performance. It was observed from data analysis that the effect of fouling of deep-sea cooling water on the condenser performance is insignificant. Uncertainty analysis also has been carried out and presented in this paper.

Keywords: Overall heat transfer co-efficient; LMTD; HTRI; Fouling; Condensate; Kern

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