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Water-saving eco-friendly cooling tower development and its performance evaluations

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The weak points of traditional wet cooling tower include water loss and water mist pollution to the surrounding environment as well as water freezing in cold winter. To solve these problems, a novel cooling tower that is water-saving and eco-friendly is developed. The tower realizes the water-saving and mist-suppressing by adding an air heat exchanger to achieve the non-evaporative heat rejection and reduce the dew-point temperature of the humid air at the tower outlet. A model for calculating the tower thermal performance is established and software is developed based on the model. With the help of the software, calculations can be carried out to optimize the cooling loads of the heat exchanger and the packing, with the airflow resistance being matched between the air heat exchanger and packing layer for a given fan characteristic curve. Calculations are implemented for a project that needs to reduce 60000 m^3/h circulating water temperature from 42 °C to 32 °C. The results show that, in case a single tower can treat 4000 m3/h circulating water, 15 towers are needed to guarantee the cooling capacities throughout the year. As compared with the conventional wet tower, the towers can save 3.785×10^6 m^3 water per year, so more equipment investments for the tower can be recovered in the first year; the annual net savings is 1,900 million RMB for the first year and 2900 million RMB for the year afterward, in the climate of Beijing area. In the area north of Beijing, even better water-saving effect and economy can be achieved. Expression for demist rate of the new tower against the traditional one is also proposed. The technology associated with the new tower is applied to several practical projects and good results are obtained.

Biography

Xiaomin Wu is a Professor and Deputy Director of the Institute of Engineering Thermophysics, Department of Thermal Engineering, Tsinghua University, China. Her current research interests include heat and mass transfer, meso-scale process of phase transition and frosting control, boiling and condensation heat transfer enhancement, design and optimization of heat exchanger, performance analysis and optimization of air-conditioning/refrigeration systems, water-saving and energy-saving technologies.

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