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Humidification Dehumidification Spray Column Direct Contact Condenser Part I: Countercurrent Flow

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Humidification-dehumidification (HDH) is a low grade energy desalination technology. The waste heat from power plant (such NPP) can be used as heat source to preheat water (in evaporator) and air (in condenser) . Hot humid air and cooled spray water in counter current flow with direct contact is theoretically analyzing in the present work. Direct contact spray condenser is studied to provide the effect of various parameters on its performance. A computer program describing the theoretical model is designed to solve a one-dimensional differential equations by using Rung-Kutta method. The program predicts the droplet radius, velocity and temperature, besides, the humidity and temperature of air. The results show that, the length of column has great effect on the performance of spray condenser. At column height of 0.762, 2, 5, 10, and 20 m the humidity of the output air decreases by 50, 72, 89, 97, and 99% respectively. The condensate increases about 35% when the length increase from 5 to 10 m at ΔT=15oC while increase only 18% at ΔT=30oC. Also, it is found that, at ΔT=25oC the condensate decrease from H=10 To 5m about 31% and increases from 10 to 20m about32%. While these results for ΔT=15oC are 32% from H=10 To 5m and 36% from 10 to 20m.The increase of both water and air mass fluxes increases the condensate mass flow rate.

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