The effect of air velocity on the performance of the direct evaporative cooling system

ABSTRACT

This experimental study aimed to determine the effect of airflow velocity on the performance of a direct evaporative cooling system. Rectangular-shaped honeycomb cooling pads with a length of 34 cm, a width of 25 cm, and a thickness of 3.5 cm are used as cooling media. The main parameters of the study are low air velocity (2.3 ms^{-1}), medium (3.2 ms^{-1}), and high velocity (3.7 ms^{-1}). The data collected include dry bulb temperature, wet bulb temperature, output air temperature, input and output air velocity, input and output humidity, and solar radiation. These data are used to determine saturation efficiency, cooling capacity, temperature decreases, and feasibility index. The experimental results are presented in the form of tables and graphs and analysed based on existing theories. The results showed that the evaporative cooling system could produce output temperatures up to 27.5°C with input 31.4°C at low airspeed, 27.97°C with input 31.47°C at medium speed, and 27.7°C with input 31.30°C at high air speed. It was concluded that a low airflow rate would add to the cooling efficiency, and the higher the airflow rate, the lower the cooling efficiency. The results showed that evaporative cooling is achievable with a feasibility index of $19.89 \leq F^* \leq 20.67$. The results also affirmed that cooling capability is higher where the feasibility indexes are comparatively low.