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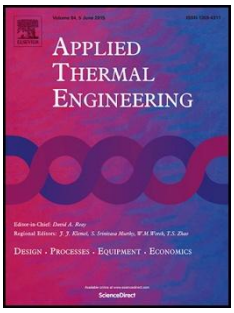

Title: Net heat gain assessment on a glazed transpired solar air collector with slit-like perforations

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Net heat gain assessment on a glazed transpired solar air collector with slit-like perforations

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Highlights

- A glazed transpired solar collector with slit-like perforations has been studied.
- Its thermal and flow characteristics is analyzed in terms of net thermal efficiency.
- Empirical correlation of ξ_p through the slit-like perforated plate is proposed.
- Optimized values of structure and flow parameters for the collector are obtained.

Abstract

Numerical simulation and experimental investigation have been performed on the heat transfer and air flow characteristics of a glazed transpired solar air collector with slit-like perforations. The values of outlet air temperature prediction by the model compare well to the measured values for four *D-P* combinations, with average deviation index of only 0.88 K. The empirical correlation of local drag coefficient is proposed. Compared with circular holes, the local resistance loss through the slit-like perforated plate at constant σ and Re_h is smaller. The effects of varying key parameters in terms of effective efficiency have been analyzed. It is found that for small heat capacity, when the air volume flow rate is beyond 160 m^3/h, the increase in the fan power is greater than that in the heat collected and then the effective efficiency begins to decrease. The effective efficiency increases with increases in the perforation diameter and ambient temperature, and decreases in the pitch, plenum thickness and inlet air temperature. Conclusions could be drawn that perforation diameter and pitch have a lesser influence on the heat collected than the pressure drop for the ranges of *D* and *P* considered in the paper. The proportion of local resistance loss to total pressure drop is great. The impact of coating absorptivity is more obvious than that of emissivity.

Keywords: Glazed transpired solar air collector; Slit-like perforations; Local drag coefficient; Effective efficiency