Performance enhancement of a baffle-type solar heat collector through cfd simulation study

ABSTRACT

The application of solar energy conversion has been extensively utilized as an alternative energy source to generate heat. This approach would be a step towards sustainable energy development particularly in the manufacturing industry with energy-intensive process. In this paper, thermal enhancement on the key component of a solar energy device – solar heat collector (SHC), has been evaluated by proposing a baffle-type SHC with various geometric configuration in the air passage namely longitudinal baffle and transversal baffle. The performance of SHC is evaluated in term of efficiency, temperature distribution, airflow pattern and pressure drop across the collector outlet through Computational Fluid Dynamic (CFD) investigation. It was observed that maximum collector efficiency was achieved in the Longitudinal-SHC (L-SHC), with a value of 46.2 % followed by Transversal-SHC (T-SHC) and without baffles. Maximum drying temperature at the collector outlet was 332.43 K for L-SHC, showing temperature rise of 0.35 % and 4.21 % from T-SHC and without baffles, respectively. The velocity vector indicated that turbulence flow was created in the T-SHC which consequently improved the heat transfer. Whereas in L-SHC, enhancement was achieved through the prolonged heating time in the passage. Considering the thermo-hydraulic performance factor evaluated, these enhancement features had diminished the effect of pressure drop.