Balaban Desalination Publications

ICEIPE'24 (2025) 15–23
doi: 10.5004/ic202403

The second International Congress on Energy and Industrial Processes Engineering
ICEIPE'24
USTHB, Algiers, 14–16 May 2024

Computational modelling of the performance of integrated building evaporative cooling system in Algeria climate

Karima Sellami*, Nadjla Cherifi, Zineb Benhenni, Nabila Labsi, Youb Khaled Benkahla

Laboratoire de Phénomènes de Transfert, RSNE, FGMGP, USTHB, Alger, Algérie, E-mail: sellami_karima@yahoo.fr

ABSTRACT

This work aims to improve the thermal performance of a building-integrated chiller for Algerian climates. This study presents a new approach in which evaporative cooling is integrated to reveal notable energy improvements compared to conventional air conditioning systems. Therefore, this paper deals with a numerical study of an integrated building evaporative cooling process of ambient air, considering the Algerian climate. The water and air streams are modelled as two coupled laminar boundary layers, incorporating non-Darcian models for inertia and boundary effects in the water flow. The governing equations and associated boundary conditions are discretised using the finite volume method, implemented on a staggered mesh. The velocity–pressure coupling is handled by the SIMPLER algorithm. The influences of Reynolds number, porous layer thickness, and porosity on the evaporative cooling process are analysed. The results show that these parameters have a significant impact on air cooling. The air temperature decreases markedly with increasing porosity and porous layer thickness. However, decreasing air velocity could improve air cooling.

Keywords: Evaporative cooler; Cooling process; Porous layer; Porosity

*Corresponding author