Numerical study of heat and mass transfer in a solar distillation cell

H.Doukkali[1], M.L.Lahlaouti[1] , A.Khamlichi[2]

[1] Department of Physics, Faculty of Sciences at Tetouan, Abdelmalek Essaadi University, Tetouan, 93030 Morocco
Email :hana-dkl@hotmail.com
[1] Department of Physics, Faculty of Sciences at Tetouan, Abdelmalek Essaadi University, Tetouan, 93030 Morocco
Email : hlahlaouti@hotmail.com
[2] Department STIC, National School of Applied Sciences at Tetouan, Abdelmalek Essaadi University, Tetouan, 93030 Morocco
E-mail: khamlichi7@yahoo.es

ABSTRACT

A numerical model is presented for the study of natural convective heat and mass transfer in a rectangular cavity. This configuration is encountered in greenhouse solar stills where vertical temperature and concentration gradients between the saline water and transparent cover induce flows in a confined space [1]. This phenomenon plays a decisive role in the water distillation process and in the biological comfort.

The bottom wall, on which flows a water film, is heated and the top wall is cooled at constant temperatures, Th and Tc respectively. The concentrations of water vapor are fixed at the top and the bottom of the still, Cc and Ch respectively. The left and the right walls are impermeable and thermally insulated. The steady state 2-D governing flow equations, expressed here in a velocity–pressure formulation, along with the energy and concentration equations [2] have been solved by the finite-element method. Here, relative low values of the Rayleigh numbers are encountered ($\leq 10^6$). Considering different inclination angles and different aspect ratios, streamlines, isotherms, iso-concentration of water vapor, mass flow rate of distillate and average Nusselt and Sherwood numbers are presented.

REFERENCES

[1]. I. Hajri, A. Omri, S. Ben Nasrallah. A numerical model for the simulation of double-diffusive natural convection in a triangular cavity using equal order and control volume based on the finite element method, *Desalination* 206 (2007) 579–588.

[2]. R. Alvarado, J.Xamàn, G.Alvarez, I.HernàndezLopez. Numerical study of heat and mass transfer in a solar still device, *Desalination* 359 (2015) 200-211.