



## Study of a water desalination unit using solar energy

Khalifa Zhani<sup>a</sup>, Habib Ben Bacha<sup>b\*</sup>, Tarek Damak<sup>c</sup>

<sup>a</sup>Laboratoire des Systèmes Electro-Mécaniques (LASEM), National Engineering School of Sfax, Sfax University, Tunisia

<sup>b</sup>College of Engineering in Alkharj, King Saud University, BP 655-11946, Kingdom of Saudi Arabia

Tel. +966 506 678 408; Fax: +966 1 553 964; email: hbacha@ksu.edu.sa

<sup>c</sup>Unité de commande des Procédés Industriels, National Engineering School of Sfax, Sfax University, Tunisia

Received 31 August 2008; Accepted 2 February 2009

---

### ABSTRACT

This paper presents the study of a water desalination new design process working with the humidification–dehumidification (HD) method using solar energy. This process was developed in order to boost the productivity of the solar multiple condensation evaporation cycle unit which is located at the national school of engineering of Sfax, Tunisia, by integrating into the latter a flat-plate solar air collector and a humidifier. The HD process is essentially composed of a flat-plate solar air collector, a flat-plate solar water collector, a humidifier, an evaporation tower and a condensation tower. A general model based on heat and mass transfers in each component of the unit has been developed in a steady-state regime. The obtained set of ordinary differential equations has been converted to a set of algebraic system of equations by the functional approximation method of orthogonal collocation. The developed model is used to simulate the HD system in order to investigate the steady-state behavior of each component of the unit and the entire system exposed to a variation of the entrance parameters and meteorological conditions.

*Keywords:* Solar energy; Water desalination; Humidification–dehumidification; Modeling; Simulation

---

---

\* Corresponding author.