Proceedings of the 5th World Congress on Momentum, Heat and Mass Transfer (MHMT'20)
~~Lisbon, Portugal~~ Virtual Congress – October 2020
Paper No. ENFHT 195
DOI: 10.11159/enfht20.195

Theoretical Analysis of the Effect of Properties on the Solar Still Performance

Ghaleb Ibrahim[1] and Husham M. Ahmed[2]
[1]Associate Professor, [2]Professor
[1]American University in Dubai, School of Engineering,
Dubai, United Arab Emirates
[2]AMA International University – Bahrain, College of Engineering,
Kingdom of Bahrain
gibrahim@aud.edu; hmahmed@amaiu.edu.bh

Abstract - Potable water not only is important for life but also for industrial and agricultural purposes. For many decades, the problem of water shortage has been one of the main challenges facing the world. Solar distillation is regarded by many investigators as one of the important methods to solve water scarcity problems. A solar still is a simple device which can be effectively used to convert saline water into fresh water. The productivity depends on many parameters, which among them are transmittance of the cover, thermal properties of the basin and water, and heat loss through the solar still. In this research, the effect of three design parameters (basin heat transfer coefficient, glass absorptivity and glass transmissivity) on performance of the conventional solar still was theoretically investigated and compared with experimental results. Iteration was necessary to obtain the values of the design parameters that produce good matching between the theoretical and experimental results. The effect of overall heat transfer coefficient U_b found to be significantly large especially at low values. It was found that reducing the overall heat transfer coefficient from 30 to 0.0 W/m^2 K will increase the production rate by 64.02%. It was also found that reducing the absorptivity from 0.1 to 0.01 will increase the production rate by 23.28%. The results showed that the solution is highly sensitive and depending on the precision of these parameters. It can be concluded that an accurate prior knowledge of these parameters is essential to obtain reasonable results. The experimental and theoretical hourly production rate are in good agreement at $U_b = 5.9 W/m^2K, \alpha_g = 0.075$ and $\tau_g = 0.845$ where the maximum discrepancy between them is 23% at around 14:00.

Keywords: Productivity; Solar stills; Water desalination; Wick materials.