



Contents lists available at ScienceDirect

MethodsX

journal homepage: www.elsevier.com/locate/mex

Method Article

Condensate loss estimation and transient solar-to-vapor conversion efficiency for effective performance evaluation of the inclined solar still



Tijani Oladoyin Abimbola^{a,*}, Husna Takaijudin^a,
 Balbir Singh Mahinder Singh^b, Khamaruzaman Wan Yusof^a,
 Abdurrasheed Said Abdurrasheed^{a,c},
 Ebrahim Hamid Hussein Al-Qadami^{a,d}, Abubakar Sadiq Isah^a,
 Kai Xian Wong^a, Nur Farhanah Ahmad Nadzri^a, Samiat Abike Ishola^e,
 Suleiman Akilu^f, Tunji Adetayo Owoseni^g

^a Department of Civil and Environmental Engineering, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, Malaysia

^b Department of Fundamental and Applied Sciences, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, Malaysia

^c Department of Civil Engineering, Ahmadu Bello University, Zaria, Kaduna State, Nigeria

^d Department of Civil and Environmental Engineering, University of Nottingham, Semenyih 43500, Selangor, Malaysia

^e Department of Marine Sciences, University of Lagos, Akoka, Lagos State, Nigeria

^f Centre for Nanotechnology Research, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, Malaysia

^g Department of Mechanical Engineering, the University of Nottingham, NG72RD, United Kingdom

A B S T R A C T

Previously, freshwater yields of the solar still were quantified only based on the actual distillate recovery, not considering condensate losses by any means. Likewise, solar-to-vapor conversion efficiencies of the solar still were conventionally considered and evaluated as one-off -rigid values- based on the latent heat of the average water temperature. In most cases, these approaches do not give a comprehensive performance details of the solar still. Thus, we suggest two considerations for effective performance evaluation of the inclined solar still. The first consideration is theoretical estimation of the condensate loss due to the condensate collection channel slope, while the other is the use of a transient method to evaluate the solar-to-vapor conversion efficiency. We demonstrated, geometrically, that the condensate loss on the inclined solar still can be significant—hence the need to consider it alongside the overall yield. We formulated a model to estimate the condensate loss and validated the model by comparing an estimated condensate loss with experimental loss. Similarly, we demonstrated a transient approach to evaluate the solar-to-vapor conversion efficiency by using the latent heat of the hourly water temperature. Accordingly, the optimum hourly efficiency of the investigated solar still prototype

DOI of original article: [10.1016/j.jclepro.2021.130214](https://doi.org/10.1016/j.jclepro.2021.130214)

* Corresponding author at: Department of Civil and Environmental Engineering, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, Malaysia.

E-mail address: tijani_18003161@utp.edu.my (T.O. Abimbola).

<https://doi.org/10.1016/j.mex.2022.101837>

2215-0161/© 2022 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>)