Performance of embedded photovoltaic solar still for water purification system in the tropics

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A B S T R A C T

A massive amount of energy is needed to generate clean and safe potable drinking water. Malaysia, strategically located on the earth’s equator, is turning to solar energy as a solution. This study focuses on the integration of a solar photo voltaic system with the existing solar still technology. It is designed by harvesting the heat energy directly from the Sun and partially combining it with the shaded section using PV modules together with the PV Water Purification System (PvWPS). The experiment was conducted for three days in November 2017, in Malaysia. A stainless steel basin of 1 m long and 0.54 m wide together with a clear glass cover of 0.33 m long and 0.54 m wide served as a new solar still. Results showed that the internal temperature of the still basin increased by more than 5% above the average temperature, accelerating the evaporation process in the purification system. The power efficiency increased by 0.325%, increasing the expected PV module efficiency to 14.15%. Water production using the PV Water Purification System (PvWPS) was expected to increase by 10%. This study also discusses the cooling mechanism justification, the water quality produced and the cost involved to observe the social and economic benefits of the system.

Keywords: Embedded photo voltaic; Shading effect; Solar still; Water purification; Tropical temperature; Heat storage; Cost analysis; Cooling mechanism; Greenhouse