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A new cascade solar desalination system with integrated thermosyphons

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Abstrak

Current cascade solar desalination systems can convert sea water into fresh water, but they can only produce small quantities. To produce more fresh water, there is a solution that can be applied, i.e. modification of the existing desalination system by adding thermosyphons. The objective of this research is to design a cascade solar desalination system with integrated thermosyphons and to establish its ability to produce fresh water. The experimental study was conducted by adding an aluminum absorber plate as a heat absorber in the upper tub, and nine copper thermosyphons with each length of 60 cm in the bottom of the tub. Thermosyphons with an inclination angle of 15° were used as a solar energy absorber and heat enhancer for sea water. The experiment was performed with varying sea water flow rates of 3600, 7200, and 10800 mL/h, and levels of sea water in the upper tub of 2, 3, and 4 cm. To compare the amount of fresh water obtained from the utilization of the thermosyphons, we also used the cascade solar desalination system without the thermosyphons. The results show that the cascade solar desalination system with integrated thermosyphons was able to produce an average amount of fresh water of 38.6 mL/h, with an average daily thermal efficiency of 18.78%. On the other hand, the same system without the thermosyphons produced on average 9.9 mL/h of fresh water, with an average daily thermal efficiency of 8%. The results indicate that the use of thermosyphons in the cascade solar desalination system can increase fresh water productivity by up to 3.89 times, and increase the thermal efficiency of the system by up to 2.35 times.