

Smart Solar Desalination using Energy Storage Material and Sprinkler Condensation Cooling

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Abstract

Freshwater scarcity is become a major global problem due to population growth and increasing water demand. Solar desalination is an environmentally friendly method for producing fresh water from saline and contaminated water sources. However, the productivity of conventional solar stills is limited due to low evaporation and condensation rates.

This research focuses on improving the performance of a solar still by enhancing both evaporation and condensation processes. Calcium Chloride Tetrahydrate ($\text{CaCl}_2 \cdot \text{H}_2\text{O}$) is used inside the basin as a thermal energy storage material to increase the evaporation rate. An automatic sprinkler system is installed over the glass cover to reduce the glass temperature and improve the condensation process.

The performance of the modified solar still is experimentally compared with a conventional solar still. Key parameters such as basin plate temperature, basin water temperature, glass cover temperature, and total water yield are recorded and analyzed. The results indicate that the modified solar still produces higher freshwater yield compared to the conventional system due to improved heat transfer and enhanced evaporation-condensation mechanisms

Index Terms

Solar Still, Solar Desalination, Calcium Chloride, Sensible Heat Energy Storage, Automatic Sprinkler Cooling System, ESP32, IoT-Based Real-Time Monitoring, Blynk Platform, Fresh- Water Production