



Design, development and performance evaluation of non-tracking cooker type solar water purifier

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ABSTRACT

In remote areas of arid region in India, people often use stored rainwater in surface water reservoirs, for example, ponds, tanks, etc. as drinking water where supply of fresh drinking water is not available. Before using the pond water for drinking purpose, it should be cleaned from the presence of any harmful bacteria to avoid contamination. The stored rainwater in pond may be made bacteria-free by heating the water at a specified temperature using solar thermal technology. Considering this, a solar water purifier was designed and developed that can purify 30 L of pond water in a day. Thermal performance of the developed device has also been evaluated. Length to width ratio of the solar water purifier has been kept 2.5:1 to eliminate the tracking requirement. Average maximum stagnation temperature inside the chamber of solar water purifier was observed to be 147.5°C while ambient temperature was 37.5°C. Overall efficiency of the solar water purifier was observed to be 29%. Microbiological examination indicated that pond water contained $\sim 1 \times 10^7$ cells mL⁻¹ in contrast to the colony count of 1×10^1 cells mL⁻¹ in treated water by the solar water purifier which indicated a significant improvement in quality of the drinking water. Thermal performance of the solar water purifier was tested as per different test procedures as standardized by the American Society of Agricultural Engineers (ASAE) and the Bureau of Indian Standards (BIS). Experimental evaluation showed the first figure of merit (F_1) as 0.122 m² °C W⁻¹ under no load condition and second figure of merit (F_2) as 0.418 under water load condition, which indicates that the developed non-tracking cooker type solar water purifier falls under category 'A', as per ASAE and BIS standards.

Keywords: Solar water purifier; Pond water; Bacteria; Stagnation temperature; Water boil test

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