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Synergetic integration of machining metal scrap for enhanced evaporation in solar stills: A sustainable novel solution for potable water production

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ABSTRACT

The global water crisis necessitates innovative solutions for sustainable potable water production. Solar stills represent a promising technology for harnessing solar energy to meet this demand. However, solar stills often face limitations regarding yield and cost-effectiveness. This research addresses the pressing need to augment the performance of solar stills by introducing amendments such as utilizing black-coated metal scrap as a photothermal absorber in the absorber basin. These modifications aim to boost the absorption of solar radiation, thereby increasing potable water yield and improving the system's economic viability. The study explores the utilization of black-coated metal scrap as a photothermal absorber to modify the absorber basin. Experimental results demonstrate a significant improvement in potable water yield, with a 129.85 % increase on day 1 and 127.21 % on day 2, reaching 3080 mL/m^2 and 3090 mL/m^2, respectively. Compared to conventional solar stills, the newly developed double slope solar still with an absorber basin featuring metal scrap exhibits a remarkable economic advantage, with a payback period (PBP) of 5.4 months, as opposed to 9.45 months for the traditional system. Additionally, the cost per liter (CPL) of potable water generated by the innovative system is 75.53 % lower than that of the conventional solar still system.

Abbreviations

AC	annual cost
ASV	annual salvage value
AMC	annual maintenance cost
CC	capital cost
CPL	cost per liter
CRF	capital recovery factor
FAC	fixed annual cost
SV	salvage value
SFF	sinking fund factor
PBP	payback period
DSSS	MS, double slope solar still with metal scrap

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