Increasing the productivity of pyramid solar still augmented with biomass heat source and analytical validation using RSM

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\textbf{ABSTRACT}

A pyramid type solar still with $0.82 \times 0.81 \times 0.75$ m has been fabricated with galvanized iron sheet and tried with different water depths of 2–4 cm integrated with biomass heat source. The tail of the basin was attached with a heat exchanger having 0.025 m diameter and 3.5 m length, and having five numbers of bends. The function of the heat exchanger is to remove high temperature energy from biomass heat source to the saline water in the still at a constant current rate using circulation pump. Various solid, sensible, latent heat storage materials and evaporative surface materials are used in the still to increase the saline water temperature. To bring down the glass cover temperature, the outer glass was cooled using sprinkler manually at regular interval of fourth dimension. Experiments were conducted with biomass heat source for once flow mode and continuous stream mode and solar heat radiation mode. Theoretical analysis was performed using response surface methodology (RSM) software trial 9.01 version and compared with experimental values. The performances of modified still were compared with conventional still of the same size running under the same meteorological conditions. Productivity of sensible and evaporative materials was analyzed using RSM. Various heat transfer coefficients and efficiency were found out and the optimization levels were found using RSM. The substantial, sensible heat storage materials produce 48% more productivity than conventional still. Also, evaporative materials produce 19% more productivity than conventional still. The efficiency of the pyramid still with continuous flow mode produces more efficiency than once flow mode and solar mode. The efficiency of conventional still was depressed when compared with all other styles of operation.

\textbf{Keywords:} Solid sensible heat storage materials; Glass cooling; Evaporative surfaces; Water depths; Once flow; Continuous fashion; Pyramid still; Solar mode; RSM; Optimization

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