Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2022.28287

254 (2022) 1–14
April

Enhancing solar still productivity by optimizing operational parameters

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Received 5 July 2021; Accepted 8 February 2022

ABSTRACT

This study aimed at enhancing the distillate production in the conventional solar still by incorporating modifications in four operational parameters-compartmental basin (*A*), basin water depth (*B*), size (diameter) of cylindrical wicks (*C*) and thickness of basin glass cover (*D*). The objective was to identify the combination of parameter levels that optimize/maximize the distillate yield using Taguchi method. For each parameter, four parameter levels were selected. The parameter levels were combined as per L_{16} orthogonal array and experiments were conducted. The experimental findings were analyzed using S/N ratio analysis, mean response method, analysis of variance and regression analysis. The parameter levels identified for optimizing production were – 100 compartments in the still basin, 20 mm basin water depth, 30 mm size wick and 4 mm thick basin glass cover. The most significant contributor (parameter) to distillate production was basin water depth (48.5%) followed by wicks (29.4%) and number of compartments in the basin (20.6%). The regression analysis revealed that as the basin water depth decreases, the yield increases. The increase in the number of compartments and the size of wicks increase the yield. Incorporating the identified parameter levels, robust design solar still was fabricated and the production was experimentally determined. The optimum production was estimated using mean response method and regression analysis. The optimum production estimated was 5,934 mL/m^2 d. But the experimental production obtained was 5,280 mL/m^2 d and it was 82% of the estimated optimum production.

Keywords: Taguchi method; S/N ratio; Mean response; Regression analysis; Optimum production

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