Heat transfer coefficients and yield analysis of a double-slope solar still hybrid with rubber scrapers: an experimental and theoretical study

ABSTRACT

In this study, a new double-slope solar still hybrid with rubber scrapers (DSSSHS) and a double-slope solar still (DSSS) were designed, manufactured and tested. The proposed design of DSSSHS makes use of the advantages of using a small slope of the condensing cover of the still that allows higher solar radiation to enter into the still. Disadvantages resulting from using the small slope are overcome by using the rubber scrapers. No researcher has yet used the scrapers in solar still. Experimental measurements and results were used to calculate the theoretical values of convective and evaporative heat transfer coefficients, in addition to the theoretical values of the yields. Results of the two models were compared to evaluate the advantages of using rubber scrapers in the new model. Using rubber scrapers in DSSSHS model enhanced the total internal heat transfer coefficient (h_1) as well as the productivity. The maximum recorded value of the total internal heat transfer coefficient for the DSSSHS is found as 38.754 W/m^2 °C and the daily yield as 4.24 L/m^2 day with productivity improvement of 63%, for the case when the inclination angle of the glass cover is quite small (about 3.0°).

Keyword: Double-slope; Rubber scrapers; Hybrid solar still; Heat transfer coefficient; Yields