

Abstract

In the present work an attempt has been made to produce water fit for human uses by using a modified solar still. Although the amount of freshwater on earth has remained fairly constant over time but the population has exploded. Just 1 % of the earth's freshwater are easily accessible. In essence, only 0.007 % of the planet's water is available to fuel and feed its 7.1 billion people. The World Bank predicts that aquifers in India will reach "critical condition" after two decades. The only option India will have is to use its abundant seawater reserve. To make the saline water suitable for various industrial and drinking purposes, it needs to be purified. The best and economic way of purifying saline and contaminated water is through solar distillation. The distilled water is used in batteries, automotive cooling systems and can be used as potable water by adding the essential minerals within the permissible limit. In the present work, emphasis is laid on finding out the most appropriate economic design to obtain maximum distillate output for North-Eastern region of India. With this purpose a novel absorber plate of solar still is designed and fabricated. Hot water generated from a flat plate collector is fed to the solar still for higher distillate output. The experimental investigation is carried out in three phases, in the Department of Energy, Tezpur University. In the first stage, the double stepped absorber plate with baffle plates is used and data are recorded. In the second stage, jute is laid on the double stepped absorber plate and in the third stepping is increased to four along with jute wick laid on it. During the three stages of the experiment data was collected at an interval of one hour starting from morning 10 am to 4 pm in the afternoon. Ambient temperature, wind speed, basin liner temperature, water temperature, inside and outside glass temperature, distillate output and solar insolation are the parameters which were recorded during the experiment. Energy and exergy analysis is carried out for the stills and the results are discussed. After comparing exergy fractions it is seen that the evaporative fractional exergy dominates over the radiative and convective fractions at operating water temperature higher than 303 K. The highest instantaneous exergy efficiency among the three modified solar still is in the range 10.9 – 24.9 % for the still with four stepped absorber plate and having jute wick. The range of instantaneous efficiency is higher as that of exergy efficiency due to losses consideration during exergy analysis, in this work the range instantaneous energy efficiency is 24- 70 %, while for exergy efficiency is 3.3- 24.9 %. The still with four stepped absorber plate having jute wick results in the highest distillate yield among the compared stills with 4.45 litre. After considering all the parameters four stepped still with jute is best among all the three stills developed.

Keywords : Solar distillation, baffle plates, jute wick, instantaneous exergy efficiency, distillate.