



**YEARLY PERFORMANCE OF ACTIVE AND PASSIVE
SOLAR DISTILLATION SYSTEM FOR DIFFERENT
CLIMATE CONDITION IN INDIA**

ABSTRACT

of the Ph.D. Thesis

**Submitted to
Jamia Millia Islamia**

For the award of Degree of Doctor of Philosophy
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JAMIA MILLIA ISLAMIA, NEW DELHI
AUGUST, 2014

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Keywords: Solar stills, Solar Distillation, Annual Performance, Cost Analysis, Photovoltaic cell

Water is a basic necessity for human being for survival. Water available in rivers, lakes and underground water reservoirs has been polluted due to industrial, agricultural and population growth during the current years. Polluted water can play a major role in the transmission of enteric infections, and virtually all of the agents that cause diarrhea may be present in contaminated water. Solar distillation system is the most prominent method to get fresh water among other available non- conventional methods to meet- out the crisis of fresh drinking water. Comparatively this system requires minimum maintenance and simplest Technology. An air tight basin usually made of Fiber reinforced plastic (FRP) sheet with a transparent sheet cover at the top of the basin (i.e. glass), known as solar still and used for solar distillation. The basin of solar still is filled with saline or brackish water expose to the solar radiation. During distillation, three heat transfer processes namely convection, radiation and evaporation takes place inside the solar still. These three types of heat transfer processes are generally referred to as internal heat transfer.

In the field of solar distillation system the general aim of researchers is to increase the distillate yield through improvement in internal heat transfer. The aim of present work is to study experimental performance of passive and hybrid (PV/T) active solar still

(outdoor simulation) in specific conditions for wide range of operating temperature (35 – 85° C) and to develop empirical relation. Based on the experimental results the empirical relations have been developed for both active and passive solar still to predict internal heat transfer coefficients, condensing cover temperature and distillate yield in terms of basin water temperature. The experimental results have been compared with the results predicted by numerical solution of heat balance equations. The results so obtained are found to be with minimum relative deviation and in good agreement.

The hybrid (PV/T) active solar still further has been optimized for number of collectors connected in series for different mass and different water depth (i.e. 0.05 and 0.1 m) in the basin. The optimization is carried out on the basis of exergy efficiency. It has been observed that with increase of mass of water in the basin, the numbers of collector increases while the daily exergy efficiency decreases. The validation of the results has also been carried out for a typical day (September 05, 2009) of composite climatic conditions at New Delhi. It is observed that there is a fair agreement between theoretical and experimental results.

Further, performance analysis of hybrid active solar still has also been carried out for higher water mass in the solar still. Thermal modeling have been developed for the hybrid (PV/T) active solar still to predict basin liner, basin water, glass temperature and distillate yield. It has been found that the theoretical results of basin liner, water temperature, glass cover temperature and yield obtained are in close agreement with the experimental results. It has also been observed that hybrid (PV/T) active solar still the thermal efficiency and exergy efficiency has been increased significantly. Further, the yield has been predicted for hybrid (PV/T) active solar still if it operates in various zones

of India in different weather and climatic conditions. Proposed thermal mode has been used to predict the yield of the five cities of India (i.e. New Delhi, Bangalore, Jodhpur, Mumbai and Srinagar) which represent the five different climatic zones. Annual yield (2756.67 kg) for climatic conditions of Mumbai has been found to be the maximum as compared to all other cities.

LIST OF PUBLICATIONS

The present research work has been reported in the form of following International publications

1. Alam Badshah, Khan Emran, and Kumar Shiv, “Annual Performance of Passive and Hybrid (PVT) Active Solar Stills”, VSRD International Journal of Mechanical, Automobile and Production Engineering, VSRD-MAP, Vol. 2 (6), 2012.
2. Alam Badshah, Khan Emran, and Alam Shah, “*A Case Study to Fulfill the Requirement of Low Income Group(LIG) House by Installing PV Panel*”, International Journal of Scientific Research, Vol. 1, Issue 4, 2012.
3. Alam Badshah, Khan Emran, Solanki S.C., and Kumar Shiv, “*Life Cycle Cost Analysis of Passive and Active Solar Stills*”, Proceedings of Solaris- 2012, BHU, Varanasi, 7-9 Feb 2012.

BIO-DATA

Badshah Alam was born on September 20, 1963 at Gopalganj (Bihar), India. He received Bachelor of Engineering (B.E) degree in Mechanical Engineering securing First division from Jamia Millia Islamia University, New Delhi, India in 1994. He did his Master of Technology (M.Tech.) in Energy Studies in 2004 from IIT Delhi, new Delhi, India. He is working as a associate Professor in Mechanical Engineering Section in University Polytechnic, Jamia Millia Islamia Unniversity, New Delhi.

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His areas of research interest are utilization of solar Energy.