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Chapter 27

Experimental Investigation of a Multistage Evacuated Solar Still

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Abstract

A new concept of a multistage evacuated solar still was developed; a full size prototype was constructed and tested. The amounts of condensate produced generated from each stage was collected separately and measured frequently. The overall results showed that the productivity of the new concept is highly better under the cloudy low solar radiation conditions.

Keywords: solar still, evacuated, multistage, experimental

INTRODUCTION

The availability of potable water for drinking and other uses has been considered as one of the biggest problems facing the development of many communities. Sea water and brackish water are abundant around many locations where clean drinking water is considered scares. Desalination is required to utilize the available sea or brackish water to satisfy the local needs for clean water. For many poor countries, desalination by conventional methods is unaffordable due to the intensive energy requirements.

Solar thermal energy has been used for desalination of salty water since few centuries ago. It is found that solar desalination systems can produce clean water at a reasonable cost. The simple single basin solar still is the most practical and economic one. The problem with the basin type is its low productivity, which is limited to about 4L/m^2/d. A lot of Theoretical and experimental studies were performed to improve the efficiency and increase the productivity of the basin type solar still, but with only little improvement. The technical and economical feasibility of many other solar operated desalination systems were proved, but most of the proposed designs failed to be disseminated widely due to operational and maintenance considerations.

This work introduces the new concept of a multistage evacuated solar still, which solves some problems associated with the previously proposed multistage systems. Leaking of the water vapor between the stages was found to be one of the factors that reduce the multistage solar still efficiency. The built up of salt layers at the bottom of the saline water bed was one of the problems which make the maintenance more difficult. Evacuation of the non-condensable gases from the still will result in a