DEPARTMENT OF INFRASTRUCTURE ENGINEERING
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A Review on Unconventional Designs of Passive Solar Desalination Systems

Introduction

The scarcity of natural freshwater resources causes the lack of potable water in many human communities. It has become one of the major issues that affects the quality of human life. Although the vast majority of water on earth is saline (around 97%,), the huge cost of conventional water filtration units does not allow poor remote communities to supply their drinking water needs. In this regard, passive solar desalination systems are a cost-effective solution in remote areas that usually receive high solar radiation.

Problem Statement

The low water yield and low reliability of conventional passive solar stills (Fig. 1) are their main shortcomings aimed to be improved.

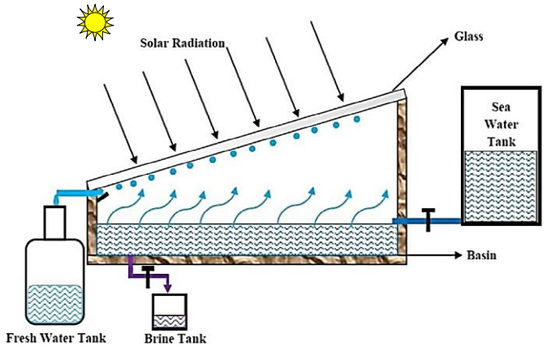

Fig. 1. Conventional passive solar still

Aim

At the beginning of any study, having a knowledge on previous research outcomes is crucial. Therefore, In this study various designs of passive solar stills are reviewed, and water yield, thermal efficiency, and unit water cost of the designs are determined. It helps to determine the most effective designs of components that can be applied on a conventional passive solar still to improve water yield when it is used in remote areas.

Results

The review on design improvements and modifications of passive solar stills is focused on four major steps of desalination process in the solar still: insolation collection, heat absorption [31], heat storage, surface evaporation & film condensation [32]. The most significant researches on the design modification of each step are listed in Fig. 2.

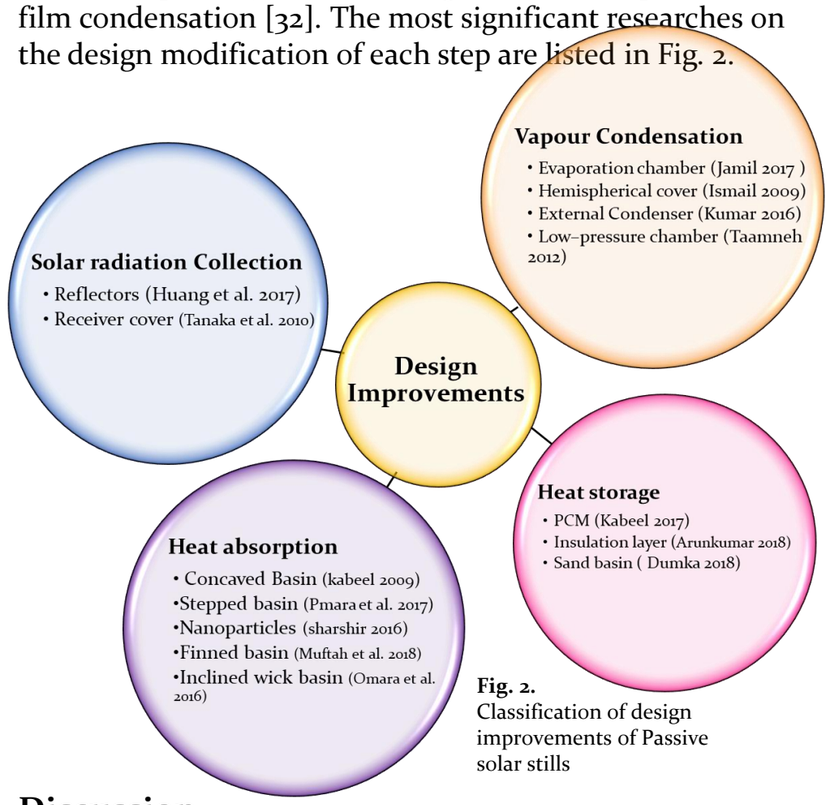

Fig. 2. Classification of design improvements of Passive solar stills

Discussion

Based on the analysis results of various designs on water generation (Fig. 3), the main findings of the review are as follows:

- The use of **flat plate reflectors** on the receiver of the solar still can double the water yield. This modification increases the initial cost by 35%.
- Using **concaved wick basin** can significantly increase the water interface areas and lead to 90% increase in water yield.
- **Phase change material** under the basin increases the water yield by 32%.
- **Hemispherical shape cover** increases the condensation area and result in about 58% increase in eater yield.

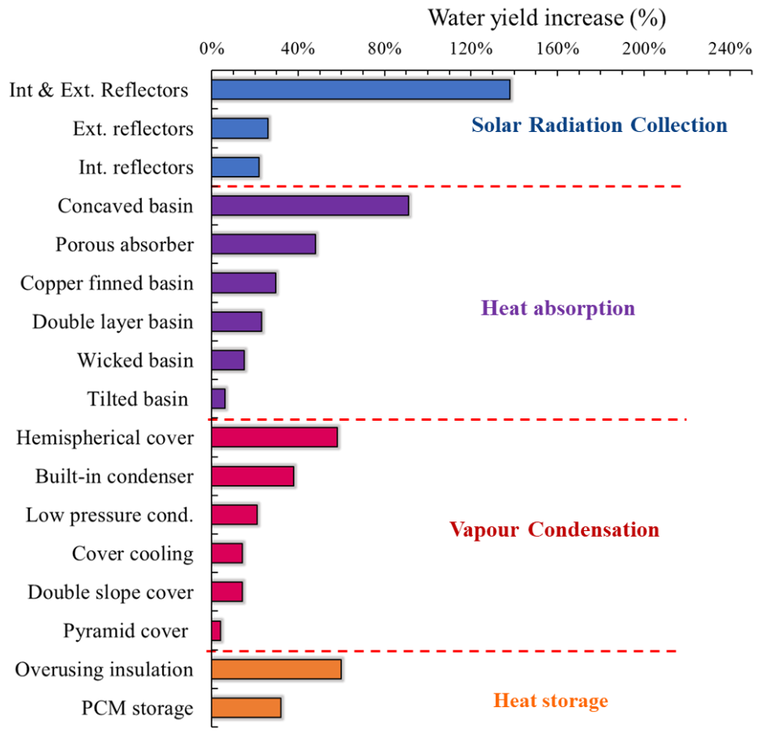

Fig. 3. The results of various designs on water generation increase

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