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Effect of using sponge pieces in a solar still

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Abstract – *Solar distillation is a very effective way to obtain pure water, especially in isolated areas where the water is infected or polluted to obtain drinking water. Two conventional solar stills of the same size (0.5 x 0.5 m) were tested for 8 hours. One still is priced as an SSR reference still and the other still which contains pieces of sponge is SSM and that is the subject of our work. The results show that the use of sponge in winter improves the yield of 10 %.*

Keywords*: Solar energy, Solar distillation, Affected water, Groundwater.*

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I. Introduction

Currently in the world the back world on drinking water has become a problem, which is why governments are looking for simple and quick solutions to this problem. The treatment of polluted or salty groundwater by solar energy is a method widely used, especially in isolated areas. In its areas, note the installations of solar stills designed locally to have pure water [1-6].

Scientists have taken up this problem and have focused their work on improving solar stills by many and different methods. Since solar energy is the main factor to trigger loosening. Studies have been done on the distribution of solar rays on the earth and takes as an example the studies that have targeted Algeria [7-10].

The researchers' experiments have shown that the cooling of the glass cover leads to an improvement in the performance of the solar still, regardless of the method of cooling, whether by air or by water. [11-14]. They are also shown that the heating of the pond water results in an improvement in the output of the solar still . They are shown that the heating of the pond water also leads to an improvement of the output of the solar still.

The conclusion of the studies is based on two main axes, the first axis is the cooling of the glass cover and the second axis is the heating of the pool water. But still there are studies that have been based on two axes at the same time.

So studies have been focused on the glass cover either by cooling it, or varying the angle, or doubling the number of covers [15- 19].

Most of the studies in the world concentrate on the heating of water and this by increasing the intensity of solar radiation by using interior or exterior refractors [20-22], by the use of natural and industrial materials in the distiller in the purpose of increasing the pool water temperature [23-29].

Phase change materials and nanofluids have been rapidly integrated into solar distillation given their physical properties which promote the evaporation of water from the pool. Several experiments have been made and they have given encouraging results, although these materials are not always available in the markets of developing countries and more than that, they are expensive [30,31].

This work consists of cutting pieces of sponge and placing them in the basin of a still in order to see the effect of this abundant material on the performance of a solar still.

II. Material and method

In the University of El Oued which is located in the south east of Algeria and in March 2022, an experiment was carried out to test two solar stills of the same size (05 x 05 m) in the same climatic conditions. The first SSR still is taken as a control or reference still and the second SSM still which contains pieces of sponge as shown in Figure 1.

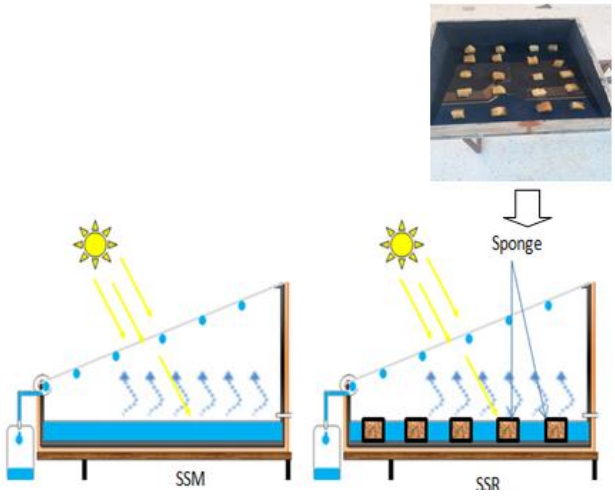

Figure 1. Measurement system setting up

III. Results and analysis

III.1. Solar radiation and ambient temperature

Figure 2 represents the evolution of the solar radiation of the day on February 15, 2002 and that according to time. Solar radiation is reported to be a major factor in solar distillation Note that the radiation is still weak. Its maximum value is 750 W/m^2 at 13:00h. We note that the ambient temperature is quite low, the maximum value being 17°C between 13:00h and 14:00h.

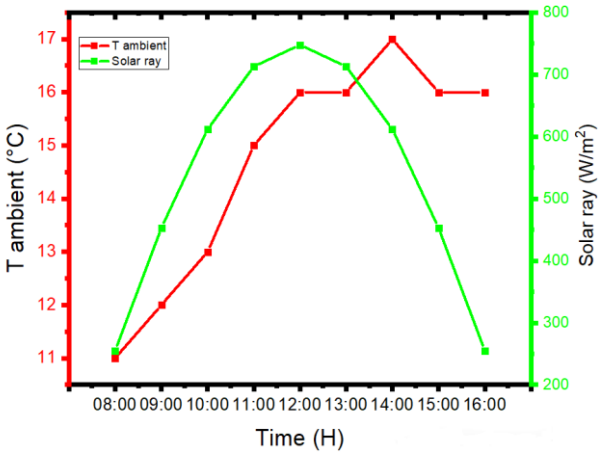

Figure 2. Evolution of solar radiation and ambient temperature

III.2. Internal glass temperature evolution

Figure 3 represents the variation of the temperature of the condenser, that is to say the glass cover (the inner face) and we notice that the two temperatures of the two stills are almost the same. this resemblance is due to the ambient temperature, because the glass cools quickly. The maximum value is noted at 13:00h and is the same for both distillers (35°C).

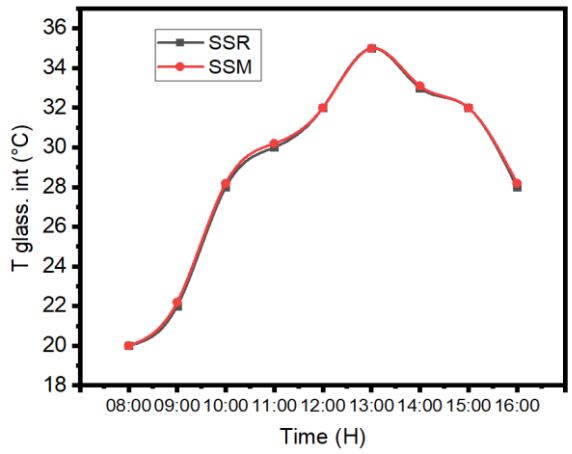

Figure 3. Evolution of internal glass cover temperature

III.3. Water temperature evolution

Figure 4 represents the variation in the temperature of the pool water of the two distillers as a function of time. We note that the temperature of the distiller modify SSM and higher than that of the SSR distiller and this throughout the experiment despite having the same maximum value 31°C at 14:00h.

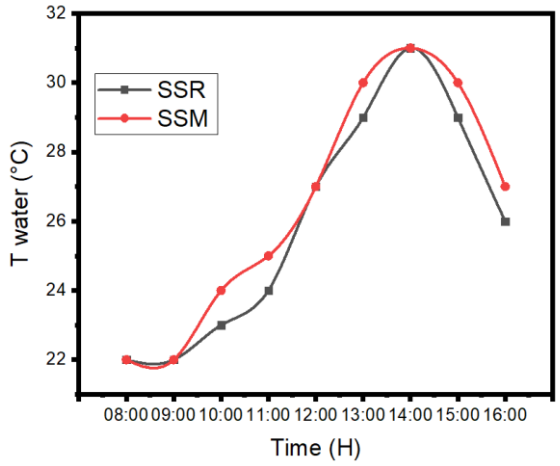

Figure 4. Water temperature evolution

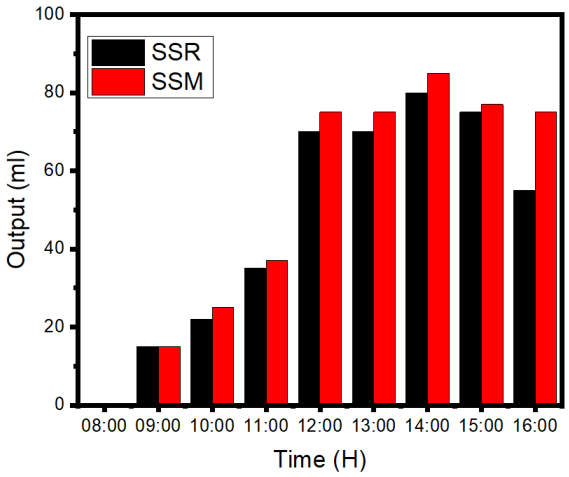

Figure 6. Evolution of hourly output

III.4. Pure water hourly output gradient temperature

Figure 5 represents the evolution of the temperature gradient between the water in the pool and the inner face of the glass. This factor is very important, whenever this value is large, its shows that the output is interesting. In Figure 5, notice that the temperature gradient of SSM is higher than that of SSR still and this gives an idea about the output of the system. Figure 6 clearly shows that the production of the modified SSM still is greater than that of the reference SSR still and this in each hour of measurement. The total amount recovered from the SSM distiller is 446ml while for SSR it is 422ml.

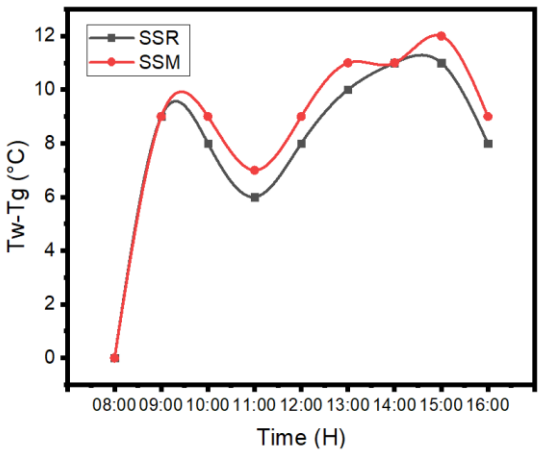

Figure 5. G*radient temperature*

IV. Conclusion

Two solar stills of the same size were tested. One is taken as SSR reference and the other contains SSM sponge pieces. After 8 hours of experiment, the result shows that:

- The temperature gradient of SSM still and greater than that of SSR.
- The amount of water produced from SSM is 446 ml while for SSR is 422 ml.
- The improvement rate is 10 %.

Declaration

- The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.
- The authors declare that this article has not been published before and is not in the process of being published in any other journal.
- The authors confirmed that the paper was free of plagiarism.

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