



## Illizi city sand impact on the output of a conventional solar still

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### ABSTRACT

Lack of drinking water is a global problem and especially in overdeveloped countries. This is why many research laboratories are focused on solving this problem. One of the simplest, economical, and environmental methods is the use of conventional solar stills. Sand from the city of Illizi in southern Algeria was used in our research to see how it affected solar distillation. So, with a dimension of (0.50 x 0.50 m), two identical solar stills were evaluated, one as a solar still reference (SSR) and the other as a solar still modified (SSM). The SSM contains sand. The findings reveal that there is no discernible difference in performance and that the improvement rate is extremely low, at 0.67 %.

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## 1. INTRODUCTION

From its geographical location, Algeria has one of the highest solar deposits in the world, especially in the south. The duration of sunstroke on almost all of its territory is more than 2000 hours annually in general. In the highlands in the south area, it exceeds 3,900 hours.

Algeria is one of the countries affected by climate change (Khechekhouche *et al.*, 2017; Berhail, 2019). To resolve this dilemma, several areas in this country are suffering. To have pure water there is no better than solar distillation which is a technique that happens on repair and condensation (Kechiched *et al.*, 2020; Khechekhouche *et al.*, 2019). Algeria has a very large energy potential one also has a large quantity of groundwater but unfortunately this polluted water (Pahlavan *et al.*, 2018; Khechekhouche *et al.*, 2019; Khechekhouche, *et al.*, 2020; Cherraye & Bouchekima, 2020). These two parameters favor the use of solar distillation, especially in isolated areas. Several experimental works and also by simulations have been made to improve the production rate of solar stills and several simple and complex techniques have been used. The techniques used by researchers around the world come undone. Some research groups play on refractors to accelerate the evaporation of water (Essa *et al.*, 2021a; Essa *et al.*, 2021b; Khechekhouche *et al.*, 2020; Assari *et al.*, 2019). Other researchers have played on the nail of the glass cover, the variation in the thickness of the glazing of a still, or the number of glazing because the double glazing has a very important influence on the output of the solar still (Khechekhouche *et al.*, 2020; Khechekhouche *et al.*, 2019a; Zeroual *et al.*, 2011; Khechekhouche *et al.*, 2019b; Khechekhouche *et al.*, 2017). On the other hand, other studies are to pose different materials in water. Researchers in different countries have used natural materials as they are used metallic and industrial materials. Of course, each technique has its advantages and its disadvantages according to the simplicity of the method, the availability of the materials used, the total cost of the technique, without forgetting the health and environmental side (Cherraye *et al.*, 2021; Khechekhouche *et al.*, 2019)

There are several parameters that positively and negatively influence the production of solar still. The objective of our study is to see the effect of sand from the city of Illizi, (South Algeria) on the productivity of pure water from a conventional solar still.

## 2. METHODS

The experiment was carried out on 30 May 2021 at the University of Ouargla in Algeria in good weather conditions (clear skies and hardly any wind). The experience was run from 8:00 until 20:00. In every hour, the temperatures and quantity of pure water output were measured. Two identical stills were exposed to the sun. The reference solar still (SSR) had the same amount of water as the modified solar (SSM). the latter has, in addition, a layer of sand from the city of Illizi. The experiment aims to see the impact of this sand on the productivity of pure water. The experiment was done for 12 hours and the measurements were made every hour as shown in **Figure 1**.



Figure 1. Setup of the experiment.

### 3. RESULTS AND DISCUSSION

Figure 2 shows the variation of the ambient temperature and the variation of solar radiation as a function of time. We noticed that the ambient temperature varied between 23 and 26°C throughout the day to reach a maximum of 33°C at 13:00. At 13:00, it was also the maximum of the solar radiation in the value and 400 W/h. According to Figure 2, the value of the radiation at the start of the experiment was 521W/m<sup>2</sup>, and the value at the end of the experiment was 0 W/m<sup>2</sup>.

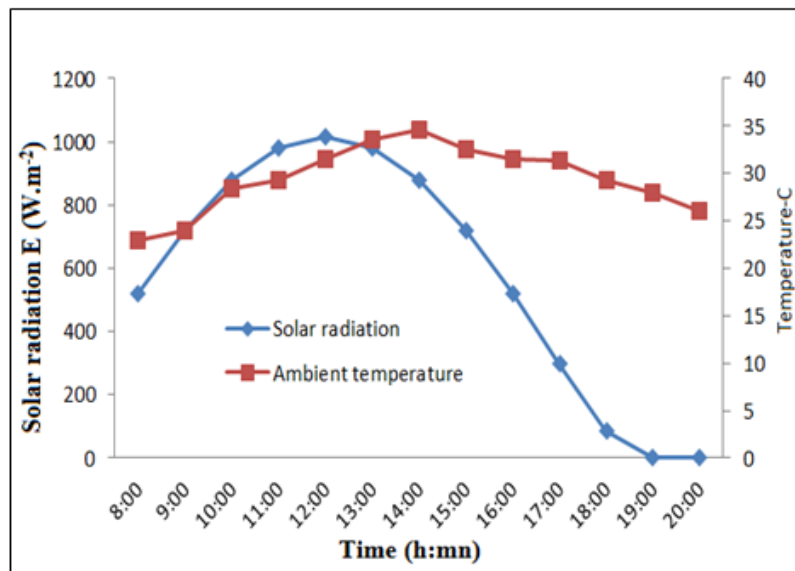


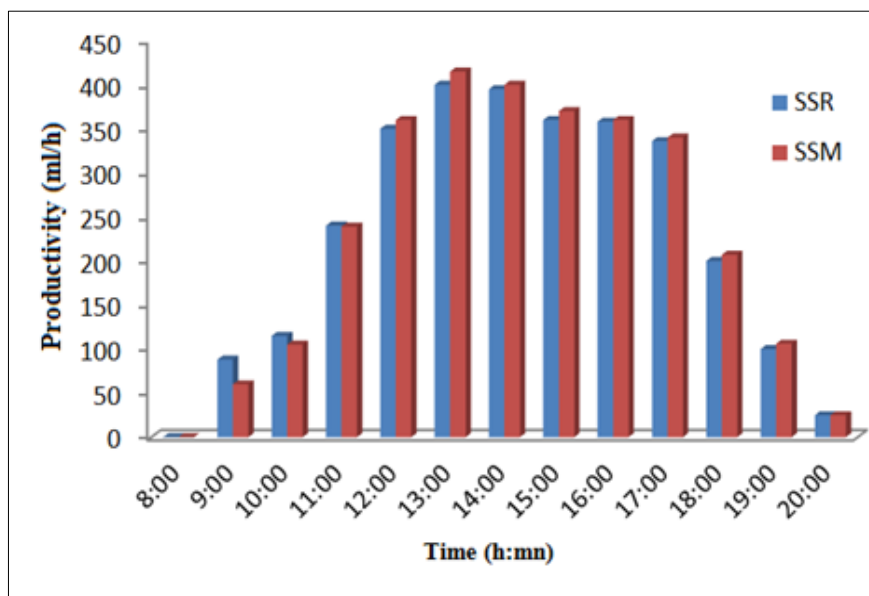
Figure 2. Ambient temperature and solar radiation evolution.

### 3.2. Hourly productivity of pure water

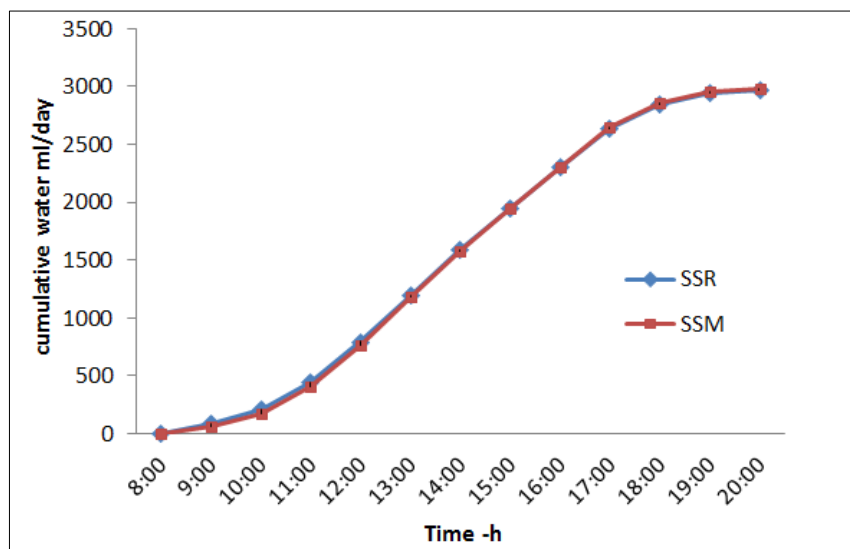
**Figure 3** shows the variation in the quantity of water produced by the two solar stills as a function of time. We noticed that the two solar stills (RSS and MSS) had almost the same quantity produced throughout the day. At the start of the experiment, it was noticed that the productivity of the pure water from SSR was higher than that of MSS. At 11:00, the production of the two stills had become almost the same. We also noticed that there was a small slight improvement in the solar still improving with a rate of 0.67%.

### 3.3. Cumulative pure water

**Figure 4** shows the variation in the cumulative pure water produced by the two solar stills as a function of time. We noticed there was no difference between the two solar stills. SSR produced 2967 mL/day and SSM produced 2987 mL/day. The figure gives a clear idea of the effect of the sand of the city Illizi on the production of pure water from conventional solar distillation.



**Figure 3.** Hourly productivity of pure water.



**Figure 4.** Cumulative pure water

#### 4. CONCLUSION

All the studies and experiments made around the world by researchers have one goal, which is to improve the productivity of the solar still and that by using several materials. In our experience, sand is not an improvement factor because the improvement rate is very low in the value is 0.67%.

#### 5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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