DESIGN AND FABRICATION OF MODIFIED DRUM SOLAR STILL FOR WATER DESALINATION

Students: Amer Saeed, Khalid Aldosari, Abdulaziz Alharthi

Supervisors: Prof. Abdelkader Abdullah, Dr. Umar Alqsair, Dr. Mutabe Aljaghtham.

جامعة الأمير سطام بن عبد العزيز
Prince Sattam Bin Abdulaziz University
كلية الهندسة
College of Engineering

2nd Semester 2021/2022 (GP 2)

Abstract

Solar stills are the simplest devices used to obtain fresh water using solar energy as a sole energy supply. It uses a process in which the energy of the sun is directly used to evaporate freshwater from sea or brackish water. The goal of this study was to increase productivity and thermal performance of the solar stills. This was accomplished by utilizing a corrugated rotating drum inside the basin. The drum aids in increasing evaporative surface area and reducing salty water film thickness. Different rotational rates were examined, including 0.2, 1.0, and 3.0 rpm. The highest production was reached at 0.2 rpm, according to the findings. At this speed, the freshwater productivity was 5490 mL/m^2 for the drum still compared to 1650 mL/m^2 for the conventional still with an enhancement percentage of 233%.

Objective

Propose a design to improve productivity of solar still, then conduct an experiment to see the effect of the modification, and then discuss the results

Description

Solar energy is energy from the sun that is converted into thermal or electrical energy.
Sun desalination is the process of purifying saline water using solar energy. Direct and indirect solar desalination are the two methods of solar desalination. Direct type of desalination uses solar energy to desalinate the input water directly. Solar radiation is used to warm saline water in a basin covered in transparent glass in the SS process. The inner surface of the top cover condenses, and a tube collects the potable water that results.

Advantages of solar still

- Simple to operate
- Cost effective
- Requiring no technical maintenance
- Suitable for small-scale use

Project Design

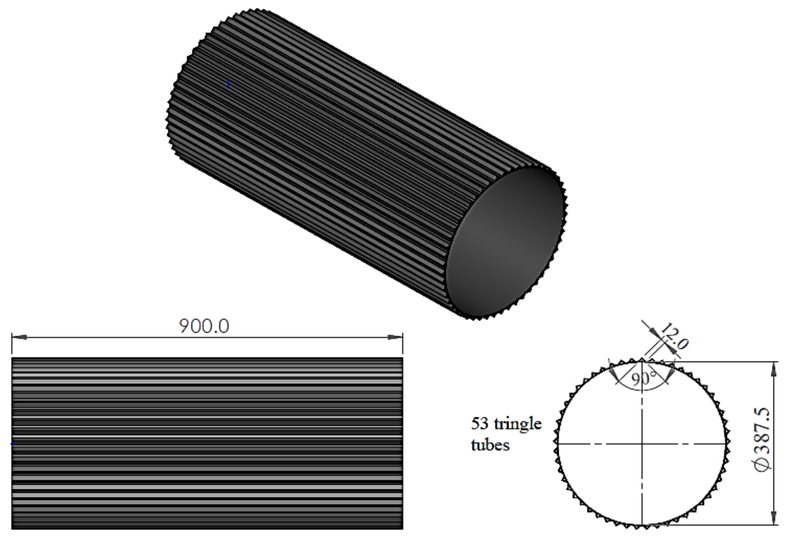

Fig. 1: Isometric and side views of corrugated and open ends rotating-drum.

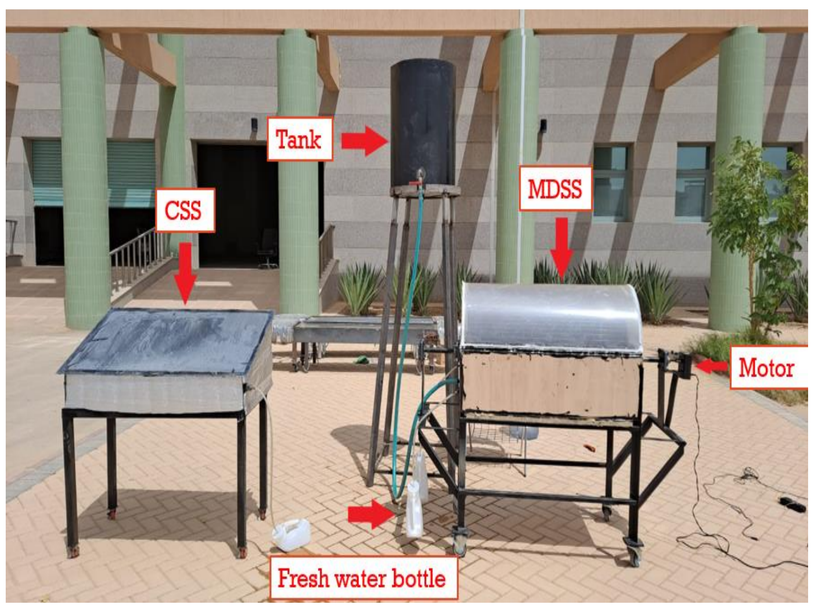

Fig. 2: Experiment setup

Results

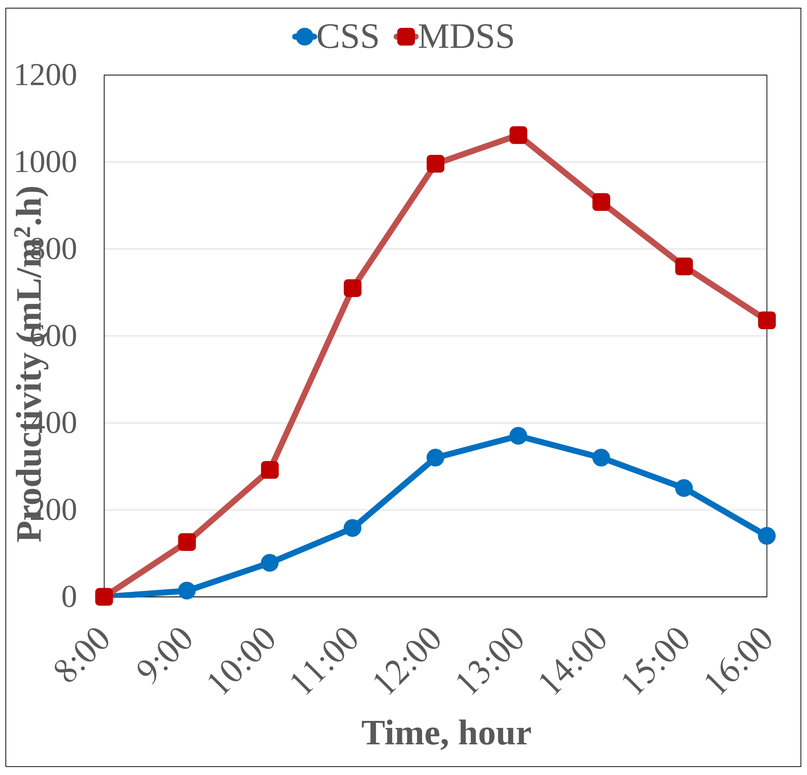

Fig. 3: Hourly freshwater productivity at 0.2 rpm

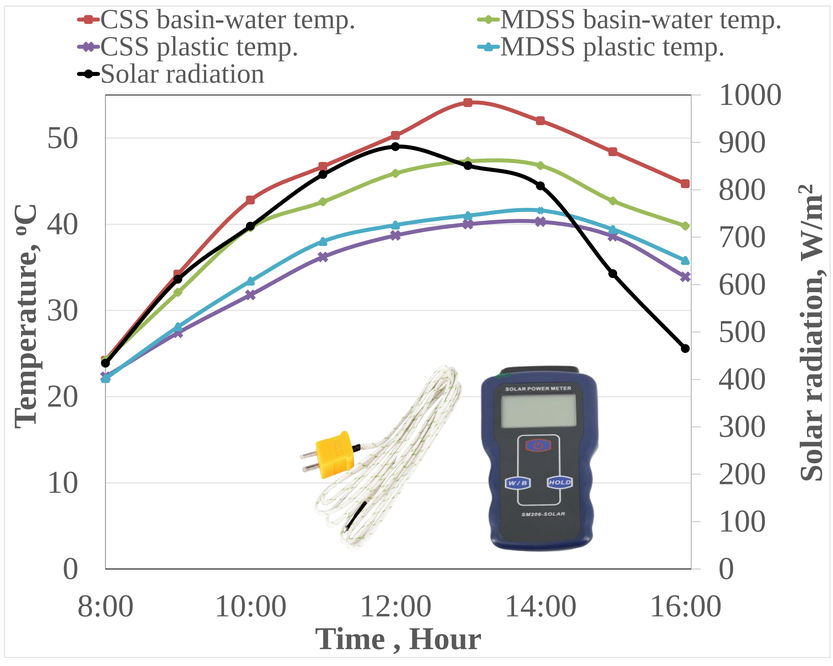

Fig. 4: Hourly solar radiation and temperatures of the tested solar stills at drum speed 0.2 rpm.

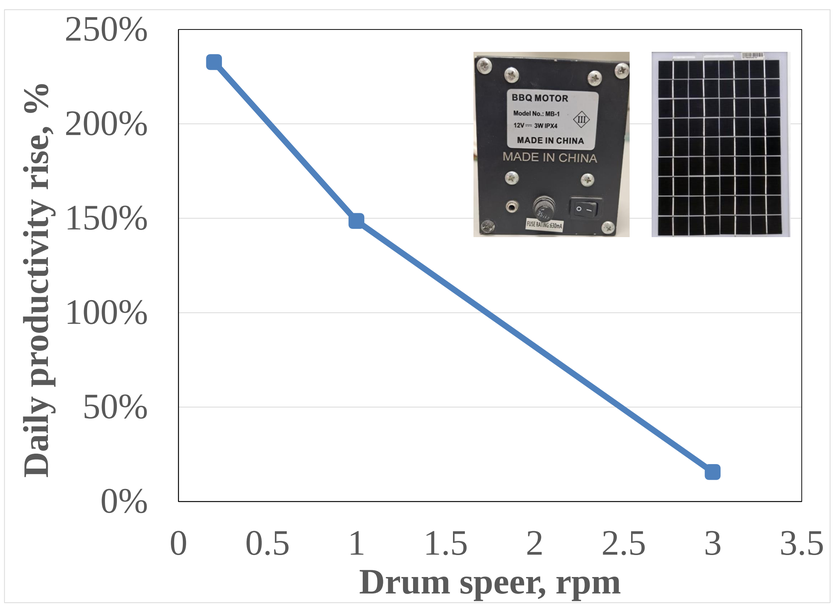

Fig. 5: Comparison between the daily distillate rise of the drum distiller under different drum rpm.

Conclusion

- ✓ Significant increase in performance of system 233% (5.49 L/m^2 .day) compared to CSS at 0.2 rpm.
- ✓ Productivity of SS is related to the amount of solar radiation that hits the SS.As solar radiation increases, the productivity of fresh water increases as well.
- ✓ At a drum speed of 0.2 rpm, the drum's performance was superior compared to other drum speeds.
- ✓ Cost of the unit: 3200 SR

Recommendation

1. Study the effect of using different geometry for corrugated tubes, as semi-circle tubes.
2. Study the effect of increasing thickness of drum and tubes.
3. Using a rotating drum with tubular solar still.

Saudi Arabia, Prince Sattam bin Abdulaziz University, College of Engineering, Mechanical Engineering Department