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Experimental estimation of the performance of the homemade single slop Solar distilled

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ABSTRACT

Water pollution and scarcity have created problems in all aspects of life, especially in poor countries. In This work the fabricated of a single slop distilled from cheap materials, with a glass lid for use for desalination. The study noted that solar radiation is of good magnitude in the study area for the implementation of solar energy projects. The solar-drip production increases with increased solar radiation, which increases the efficiency of the distilled, and the reduction of the water level in the basin decreases the speed of productivity and increases it, where efficiency was 40%, at the highest in the experiments 1.5 mm then rose to 50% at 1mm and increased to more than 65% at 0.5 mm.

I. Introduction

The lack of energy and its lack of availability due to high prices and the increase in pollution have led to the trend toward natural and renewable sources of pollution reduction and energy provision in developing and remote countries. So many researchers in the world and Iraq have built renewable energy systems [1,3]. Also Fabricated inverted solar distiller. The IASS is an optimized design for the solar sloping distiller with a curve reflector below the bowl. This arrangement helps to increase the heating of the solar distilled bowl on both sides (i.e., the upper and lower surfaces) directly and indirectly. The reflector under the tub adds extra heat to increase the temperature of the bowl, water, and glass lid than the conventional sloping distiller. They concluded that the production of the solar distiller is over 3.5 L/m^2, in 12 hours, from 7:00 am to 7:00 pm. It was also found that the IASS is unable to maintain thermal energy for a long time after 16:00[4]. Create a device that converts dirty, salt water into clean, drinking water using renewable energy (solar energy). The basic methods of heat transfer are radiation, convection, and conduction. They got the results by evaporating salt water and making it safe for drinking water. The designed model produces 1.5 liters of pure water from 14 liters of dirty water in six hours. Factory efficiency 64.37%. Total TDS in pure water 81 ppm.[5]. Make a single slope solar distiller and a 1x1 meter inner tub with a layer of copper plates in the bowl. They provided the drip device in order to pour salt water droplets after a drop in the tub. They tested the system with salt water and various heat storage materials such as white marble stones, pebbles, black stones, calcium stones and iron waste. They concluded that calcium stones in the tub with salt water distillation to maintain the lowest water depth had a significant effect on production and were validated with experimental results. [6].The effect of different condensation surfaces on the total water production in solar water distillation. they also found that the contact angle is the most important factor in choosing the surface material of condensation inside the water distillation system with solar energy. They also concluded that the reflection of solar radiation from the surface is the most important phenomenon affecting differences in water production from solar distillation [7]. A solar distilled water to produce fresh, safe drinking water, from various samples of water from 5 sources (river, well, water teeth, pond and lake), in addition, two samples of water were prepared by adding sodium chloride and sugar to tap water to indicate their effect on distillation. He concluded that 98.4% of the water is pure, 86% is fresh, 84.5% is well, 78% is pond, 76.7% is lake, 57.6% is salt water and 53.8% is water[8]. The ability to enhance the productivity of the solar distiller with PCM and by changing the angle of the solar distiller

from Earth's surface. Phase-changing materials are thermal energy storage materials. It stores power in the process of changing its overall state from solid to liquid. The PCM begins to melt as temperature exceeds the melting point. One empirical finding was that the use of PCM and angle contrast with the solar distiller are cost-effective and applicable in promoting evaporation as well as thermal conduction and thus freshwater production. Based on performance assessment, daily freshwater productivity has increased compared to a conventional solar distiller[9].A single -slope used to determine the effect of temperature, condenser thickness and water level within the complex on the thermal efficiency of the distillation process. After measuring temperature, solar radiation, and the volume of distilled water. They obtained trend lines between the volume of distilled water as a function of the falling solar radiation, and the temperature difference between the water and the internal air of the distiller and the air and condenser in the real operating state, allowing for optimal design parameters to be defined. After analyzing the results, they noted a linear relationship between solar radiation and the volume of distilled water, as well as the adoption of distilled volume at different temperatures of water, internal air, and condenser inside the distiller[10].Improve the productivity of an individual slope solar drip machine. He introduced an electric heater powered by the photoelectric generator and a gradual room design to a traditional solar distillers. Conducted a test study to see the effect of adding the above adjustments on the productivity of the modified solar distillers. Conclude that the inclusion of the photoelectric Heating coil and the gradual design of the chamber enhance the drip device's productivity by up to 1098%[11]. The concentration of sunlight by a separate device (isotropic center) and used the transformer oil as a liquid to transfer heat to the distilled basin and indicated that design and operating variables are necessary, such as distilled dimensions, concentration ratio, pressure, temperature, and concluded that the best performance of the distillatory was at TW = 100 ° C. PG = 10000 PA, TG = 20 ° C, PW = 20000 PA, 30 concentration ratio. This study used FL)) to analyze the drip device performance and determine the optimal temperature, pressure, and concentration ratio to improve the productivity of the Sunflower device[12].Collect the solar energy from the PTC-FPC with two separate rings of fins that operate as heat exchangers in the drip pan. They conducted experiments during the winter and summer seasons at a depth of 50 mm in salt water. They concluded that the solar distillers integrated with PTC, FPC and PlGB has a higher fresh water production rate of 6.036 Kg/m^2/day during summer and 2.775 Kg/m^2/day in winter. Moreover, they found that the FPC-PTC-PlGB solar distillers increased productivity by 172% in winter and 203% in summer, compared to the traditional solar distillers. They also found that solar distilled efficiency with FPC-PTC-PLGB was 16.24% in winter compared to 21.83% in summer, higher than the traditional solar distilled efficiency of 8.1% (winter) and 12.15% (summer)[13].

II. Theoretical part

In the most thermal systems, the solar distilled efficiency figure (1) and feedback can be found Known as the ratio of heat transfer from water to cover an area from the glass to solar radiation equation (1).

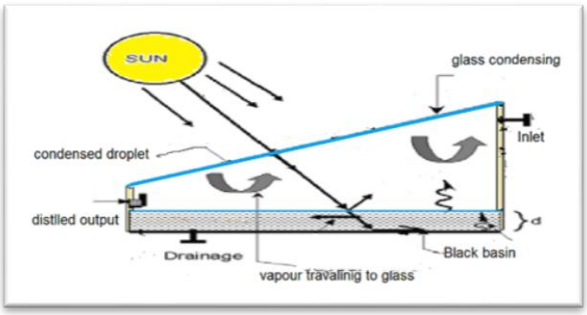

Fig. 1: heat transfer for solar stiller.

$$\eta = \frac{\dot{q}_{ev}}{I_t} = \frac{h_{ew}(T_w - T_g)}{I_t} \quad \ldots\ldots(1)$$

where (η) efficiency ,($\dot{q}_{ev}$) ratio of the evaporative, heat transfer rate, (I_t) solar radiation, (h_{ew}) evaporative heat transfer coefficient, (T_w) average water temperature, (T_g) average glass temperature.

The performance of the distilled can also be defined as the ratio between Output to input so this is the product of the distilled, also we can defined, the production rate performance (PRP) of black absorber plate, as

$$PRP = \frac{Total\ distilled\ water\ witin\ time\ Interval}{Total\ solar\ energy\ absorbed\ within\ time\ interval} \ldots(2)$$

$$PRP = \frac{\sum \dot{m_i}.\Delta t}{\sum I_t.\Delta t} \ldots\ldots(3)$$

where

(m_i (Kg/s)) condensation rate,(Δt) is the time interval over which,

Distilled or system efficiency depends on variables of atmospheric factors such as solar radiation, wind speed, sky temperature, and ambient temperature. It also depends on water quality, salt concentration and basin mineral type [14].

III. Experimental set-up

Two solar distilled, of local and available materials, use compressed wood called plywood with front height dimensions of 10 cm, rear height of 60 cm, width of 78 cm as shown in the figure (1).

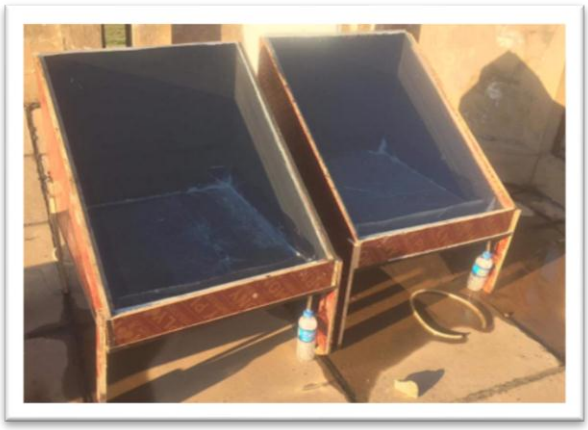

Fig. 1: Shows the parts of the solar Stilled that were made.

The rubber silicon was added in the contact areas between the pieces to increase insulation and the two inner-cut tomb was painted with a black paint to increase the absorption of solar radiation, and was painted from the outside to reduce humidity and increase thermal insulation as shown in the figure (2). Also, A 93 cm long, 71.5 cm wide, 4 mm thick glass plate was used.

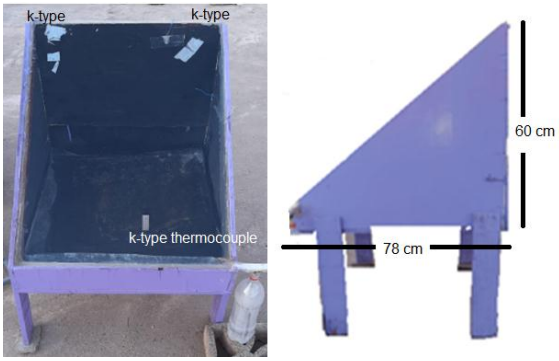

Fig. 2: Shows the Solar distilled after it is painted.

water collection basin figure (3) made of iron with dimensions 71.5 cm, 70 cm wide and 5 cm high, is also made. also, used K-type Thermocouple is used to perform measurements and the sensor is installed in Inside the basin to measure the temperature of the water and on the glass from inside External to measure the temperature of the glass and the ocean and calculate heat transfers.

Fig. 3: Shows the basin for solar stilled.

IV. Results and discussion

The distilled was directed southward and measurements were made in Salah al-Din al-Shirqat at (35.492) latitude and longitude (43.242), where solar radiation was measured in September and the readings were taken from 9 a.m. to 3 p.m. using the solar radiation meter. It was found that radiation increases from morning to mid-afternoon as high as possible and after that radiation drops until the sun sets, which is true for the rest of the days. From measurements it is observed that solar radiation within the middle limits is sufficient to conduct solar energy experiments that may be affected by the passage of clouds or dust that obscures or reduces its intensity, figure (4) and this is agreed with [1].

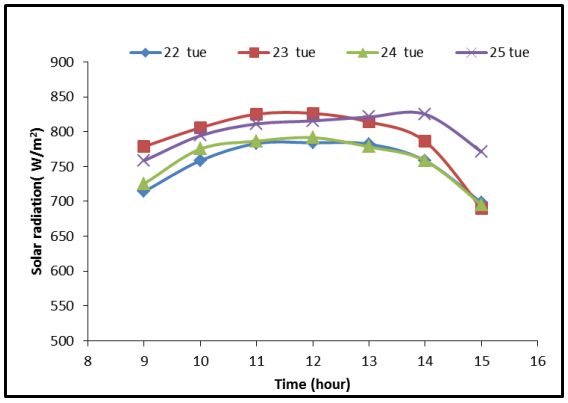

Fig.4: Relation between solar radiation with time.

From studying the impact of high temperature on glass and water, As in the figure after the introduction of water, the observation of the rise in temperature every hour resulting from an increase in solar radiation intensity that results in a rise in temperature because the solar distilled is well isolated so the temperature increases continuously, and the pressure inside the distilled is also increasing and is consistent with [15].

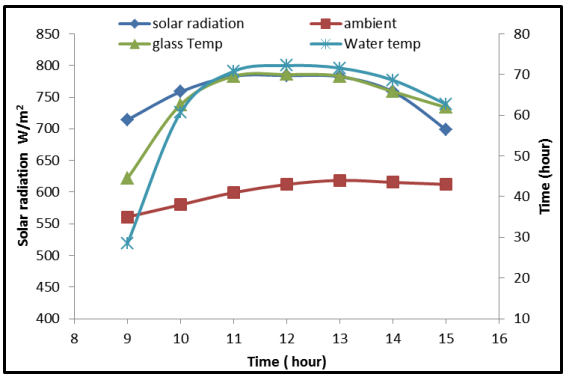

Fig. 5: Relation between solar radiation and temperature with time

Distillate productivity was studied for three consecutive days with the addition of one liter Of river water to keep the water level high in a basin Solar distilled, and solar radiation was close to those days With little difference where we observe through the figure (6) Distillate productivity rises more in the second day than in the first day The third is caused by the rise of solar radiation on that day 24 September more than 23 and 22 depended in the figure (4) and it agrees with [16]**.**

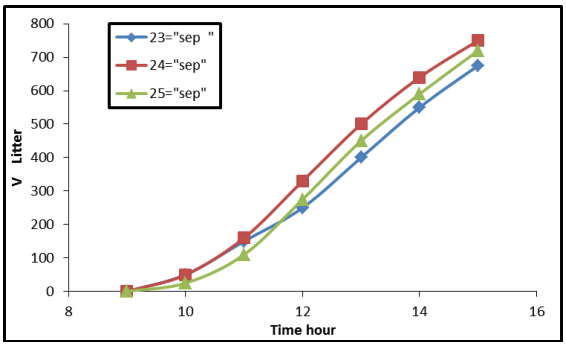

Fig. 6: Shows the relationship between the volume of water produced during experiments with time

Water was added to the solar distilled so that the water level rises from the beginning and the water is raised in the basin in the first experiment 0.5mm In the second experiment, 1mm and in the third, 1.5mm figure (7), From the results we observe the rise in efficiency over time. The result of the high yield during the trial period when the water level was low and the efficiency decreases as the primary level is higher, with the relative consistency of other variables such as solar radiation and temperature, this is the result of the speed of Heating water when the level is low and thus the speed of evaporation that increases daily yield and increases the amount of water Efficiency agreed with [17].

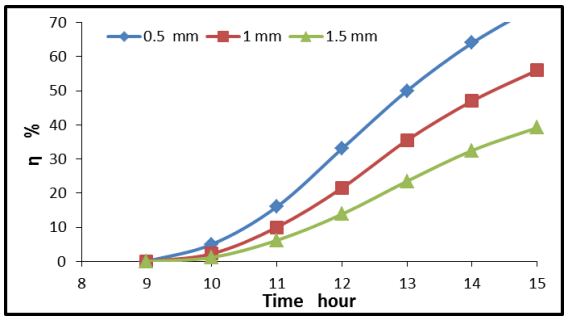

Fig. 7: Relation between efficiency and time with different water level

V. Conclusions

The study found that solar radiation was good In the study area, sufficient solar energy projects are to be carried out Locally made solar with a mineral black basin as a method of storing heat For an extended period of steam. The productivity of the distilled increases The more pain is in the water collection basin of the color Black is low and efficiency has clearly increased to distillation Solar distilled water is a promising and cheap way to provide potable water For humans and non-living in remote areas.

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التقييم التجريبي لأداء المقطر الشمسي ذو الميل الواحد محلي الصنع

ياسين حميد محمود ، عبير ابراهيم اعشوي

قسم الفيزياء ، كلية العلوم ، جامعة تكريت ، تكريت ، العراق

الملخص

خلق تلوث المياه وندرتها مشاكل في جميع جوانب الحياة، ولا سيما في البلدان الفقيرة. وفي هذا العمل، تم تصنيع مقطر شمسي ذو ميل واحدة من المواد الرخيصة، مع غطاء زجاجي لاستخدامه في تحلية المياه. ولوحظ في الدراسة أن الاشعاع الشمسي ذو مقدار جيد في مكان الدراسة لتنفيذ مشاريع الطاقة الشمسية. وقد ازدادت إنتاج المقطر الشمسية بزيادة الإشعاع الشمسي، مما يزيد من كفاءة المقطر، كما أن انخفاض مستوى المياه في الحوض يزيد من سرعة الإنتاجية ويزيد الكفاءة ، حيث بلغت الكفاءة 40%، وعند أعلى مستوى في التجارب 1.5 ملم ،ثم ارتفعت إلى 50% عند 1 ملم، وزادت إلى أكثر من 65% عند 0.5 ملم.