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REMOTE MONITORING AND DATA ANALYSIS OF AN INCLINED FLAT SOLAR STILL WITH YELLOW SPONGE

***Safya M. El-Gayar**

ABSTRACT

Fresh water and energy are essential for the life of mankind. Due to increasing population growth and rapid industrialization, today's world is facing challenge of meeting the current demands for these two commodities. One approach to face this crisis is to utilize solar energy to produce freshwater. The development of solar distillation systems has demonstrated their suitability for desalination when the demand is less than 200m^3/d. This paper investigates experimentally the performance of an inclined flat solar still with local maid yellow sponge that immersed in water and is exposed to solar radiation. The sponge is used as full sheet covering the whole basin and strips. The water is distributed from the still top across copper, plastic tubes and suppressions. The setup is suitably instrumented to measure total solar radiation on the tilted surface, amount of distilled water, ambient air temperature, sponge (top, middle and bottom), the inner glass and under box *temperatures. This work proves that it is possible to operate such solar still remotely with a computer to reduce the cost of the distilled water production.* The experimental work was carried out on the roof of the Thermal engineering laboratory, Mechanical power department, Faculty of Engineering, Mansoura University, latitude 31.0408° N and longitude 31.486° E. The experiments were performed during different sunny days throughout February, March, April, May, June and July months 2012 under El-Mansoura city climatic conditions. *The results are given in graphical form and show that ambient temperature and solar radiation have direct effect on the still performance. Water distribution using suppressions is better than by plastic or copper tube. Using sponge slices yields poorer performance than that of flat sponge.*

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In general, using this local type of sponge shows lower performance (0.486-1.352 liters/m^2 day) than that of simple solar still (3-4 liters/m^2 day). The possible reason for that is the poor water distribution and the bad absorptance of the sponge to the water.

KEYWORDS: Remote monitoring - Flat solar still - Yellow sponges.

INTRODUCTION.

Potable water is not only important for life and consistency of environment, but also for domestic, industrial and agricultural purposes. Water, a necessity to daily life, is currently in great deficiency because of the rapid growth of global population and the accelerated industrialization and urbanization **(Escobar, 2010)**. The fresh water available in the earth surface is 2.5% in the form of deep wells and natural aqueducts. From that, less than 1% of the earth's fresh water is within human reach for drinking and agricultural purposes. It has been predicted that in many parts of the world, two thirds of humanity will face a shortage of drinking water by 2025 due to the poor quality of fresh water **(Kumar and Tiwari, 2008)**.

The demand for fresh water is rapidly increasing, while supply has been decreasing over decades. This is the right time for technology to take an important role and match the supply with demand for fresh water. Nowadays the pollution in rivers and lakes by industrial effluents and sewage disposal resulted in scarcity of fresh water in many big cities around the world. In addition, with an ever increasing population and rapid growth of industrialization, there is a great demand for fresh water, especially for drinking **(Omara et al., 2011)**. In the world, 3.575 million people die each year from water related diseases Sampath **(kumar and Tiwari, 2010)**. Available water on the earth's surface is usually impure **(El-Sebaii et al., 2009)**, and this problem is exacerbated by pollution of fresh water resources. This results in limited access to safe drinking water, especially in developing countries, **(WHO, 2008)**. In such cases, the quality of water can be improved through desalination. Salts and organisms will be present and the maximum salt level in fresh water for human consumption is only 550 ppm, **(Garg, 1991)**. Many types of renewable energy resources are available for the desalination of water and have been reviewed in detail by **Kalogirou (2005)**. He reported that solar distillation has become more popular in recent years, particularly in rural areas. It is a simple technology and more economical than the other available methods. A solar still operates similar to the natural hydrological cycle of evaporation and condensation but the procedure takes place in a very small closed system. Distillation technologies have been used for about a century in land-based plants and on ships to provide water for a crew. The regular use of distillation technologies accelerated after World War II, as the demand for fresh water in arid countries increased. The cost for distillation has been decreasing rapidly, especially in recent years with the introduction of efficient and more cost effective technologies. Distillation is one of the many processes available for water purification, and sunlight is one of the several forms of heat energy that can be used to power that process.

Because of their advantages, solar stills have been an interesting subject for many researchers. In recent years, many attempts have been made either for setting up various types or to increase the performance and productivity of solar stills. **Samee (2007)** made a simple basin solar still and measured its performance. His still's performance was about 30% and its daily productivity was 3.1 L/m^2. The effects of using fin, wick and sponge, in still productivity were studied by **Murugavel and Srithar (2011)**. They achieved 29%, 15.3% and 45.5% increasing in productivity by using wick, sponge and fin, respectively. **Sadineni (2008)** studied the performance of a weir-type inclined solar still. Their still's daily productivity was 5.5 L/m^2. They also found that still has higher performance with thinner water films and by increasing the temperature difference between water and condensing surface. The same results (about the effect of water depth) have been also obtained by **Phadatare and Verma (2007)**. The still was made by Plexiglas and its maximum daily productivity and efficiency were 2.1 L/m^2 and 30%, respectively.

Productivity of fresh water increases 18% when sponge cubes were used in the saline water as reported by **Bassam et al. (2003)**. Fresh water productivity increases by 20%, when a baffle suspended absorber was used by **El- Sebaii et al. (2000)**. A theoretical analysis of a tilted-wick solar still with an inclined at plate external reflector on a winter solstice day at 30° N latitude was studied by **Tanaka, and Nakatake (2009).** The daily amount of distillate of a still with an inclined reflector would be about 15% or 27% greater than that with a vertical reflector when the reflector's length is half of or the same as the still's length. Wick concave type solar still was also designed and constructed by **Kabeel (2009)**; a concave shaped wick surface increases an evaporation rate because the water surface level is lower than the upper limit of the wick surface. Results show that average distillate productivity in day time was 4.1 L/m^2 and the maximum instantaneous system efficiency was found to be 45% and the daily efficiency of the still was 30%. The maximum hourly yield was 0.5 L/h per m^2 after solar noon.

When the exposed area of basin water is high, then the air mass subjected to natural convection inside the still will take more amounts of water particles. The water wets the surface of the materials available in the basin and exposed to a larger area and ready for diffusion. **Nafey et al. (2001 and 2002)** used black rubber and gravel for augmenting the productivity of the solar still. They showed that black rubber, black gravel and floating perforated black aluminum plate in the solar still increase the solar still productivity by 20%, 19% and 15% each, respectively. Several types of solar stills have been developed; the simplest type is the single-basin type, which is simple in construction and operation. Normally, this is termed a passive solar still); one of the main drawbacks of this design is the low yield, which is depending on the season, the region and the intensity of solar radiation, the yield of a passive solar still is 2 kg/d m^2 (winter) to 5.5 kg/d m^2 (summer) **Sakthivel and Shanmugasundaram (2008).**

El-Zahaby et al. (2011) conducted an experimental study on the enhancement of solar still performance using a reciprocating spray feeding system and found that an accumulated productivity of 6.355 l/m^2 was gained. An experimental study on the utilization of thermoelectric cooling in a portable active solar still was studied by **Esfahani et al. (2011). Sampathkumar and Senthilkumar (2012)** found that the productivity of the coupled solar still was doubled when compared with the simple solar still. The modification increased the yield by 77%, even if the collector and solar still were coupled only after the storage tank water temperature reached 60 °C. This system operated with a hybrid nature and was capable of producing hot water and distilled water based on the situational requirement.

Theoretical and experimental analyses were made for fin type, sponge type, combination of fin and sponge type stepped solar still. When the fin and sponge type stepped solar still was used, the average daily water production has been found to be 80% higher than the ordinary single basin solar still. The productivity of the single basin solar still was augmented by integrating fins at the basin plate **(Velmurugan et al., 2008a)**.The evaporation rate increased by about 53% when fins were integrated at the basin plate. A comparison between the performance of ordinary single basin solar still and wick type still was performed by **Velmurugan et al., 2008b)**. The enhanced evaporation of the still basin water, fins and sponges was integrated at the basin of the still. It was found that productivity increased by 29.6%, when wick type solar still was used, productivity increased 15.3% when sponges were used and productivity increased 45.5% when fins were used.

Abu-Hijleh and Rababah (2003) used, cubes made from black steel, black coal, and black spray painted sponge in place of the yellow sponge cubes to study their effects on the production ratio. They found that, black colored material tends to be better than materials with other colors in absorbing the incident radiation then transferring it to the basin water. Steel cubes increased the production ratio more than coal cubes. This could be attributed to the higher thermal conductivity of steel. This means that the steel cubes were more efficient in transferring the energy they absorbed to the basin water than the coal cubes. Still the yellow sponge cubes were more effective in increasing the production ratio than both black steel and coal cubes. They indicated also that the increase in distillate production of the still ranged from 18% to 27% as compared with an identical still without sponge cubes under the same conditions.

In the present work, a new technique is used and experimentally tested. A data acquisition system is designed for reading, recording and analyzing (with the aid of MATLAB software) the measurements data from the numerous temperature sensors works by a computer program values to produce the maximum thermal efficiency of the system. The current work is focused on placing sponge sheet and sections in the basin in order to increase the wetted surface area in contact with the hot air inside the still. The small openings in the sponge sheet also reduce the surface tension between the water molecules, thus making it easier for the water molecules to evaporate. The presence of sponge sheet also suppresses heat transfer convection currents in the basin that reduce the amount of solar radiation reaching the basin. This reduces the heat transfer losses from the bottom of the still. The use of sponge sheet in the basin is a passive enhancement method and does not require frequent nor expensive maintenance once installed.

EXPERIMENTAL SETUP AND PROCEDURE

The simplest structure of the tilted flat solar still, as shown in Fig. 1, consists of a tilted basin having a certain quantity of brackish water and a transparent glass cover to solar radiation, yet blocks the long wavelengths radiation emitted by the interior surfaces of the still. The sloped cover, which provides a cool surface for condensation of water vapor, facilitates an easy flow of water droplets into the condensate channel. The base of the still is normally blackened on the interior surface to maximize absorption of solar radiation. Figure1shows also a schematic diagram of the setup which consists of the solar still with the control data acquisition system. The basin is a wooden box having gross dimensions of 80 cm long, 60 cm wide and 15 cm deep from inside. The box is painted with matt black paint several times from inside and covered with plastic sheet to prevent leakage. The still is fixed on an iron frame with an inclination angle of 30° facing south. The distillate is collected at the lower edge of the glass cover (3 mm thick) via a thin iron trough to a calibrated Jar. The compensate water is added through a distributer tube from the still top as shown in Fig. 1.

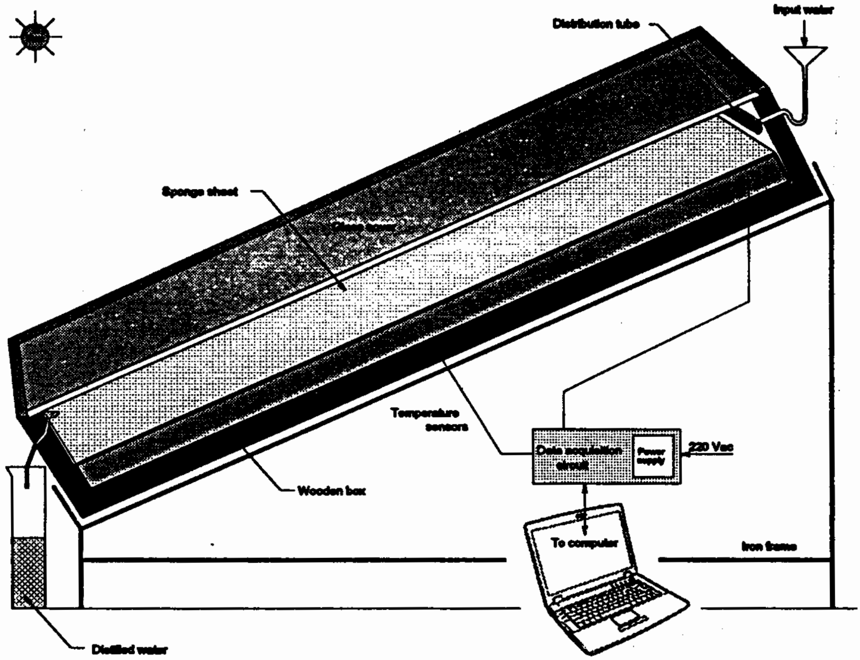

Fig. 1 The experimental setup.

The sponge sheet is fixed in stills basin and immersed in the water. Seven temperature sensors (LM35DZ) are fixed in the experimental setup, to measure the sponge top, middle and bottom temperature. The other sensors are fixed to measure the above glass cover temperature, inner glass cover temperature and the inner still bottom temperature. The seventh sensor is fixed under the setup to measure the ambient air temperature. The sampling rate of recorded data is adjusted via the computer program by 10 minutes. The total solar radiation on tilted surface is also measured with a solar power meter TES1333. The solar radiation data and distilled water were collected nearly each 30 minutes.

The experimental work was carried out on the roof of the Thermal engineering laboratory, Mechanical power department, Faculty of Engineering, Mansoura University, latitude 31.0408° N and longitude 31.486° E. The experiments were performed during some different sunny days throughout February, March, April, May, June and July months 2012 under El-Mansoura city climatic conditions. The experiments were started at 8:30 am local time and ended at 4:00 pm. Hence, a single-slope solar still was manufactured and oriented to south direction. The still cover angle was permanently adjusted to be 30° with the horizontal, as shown schematically in Fig. 1.

The sponges powder is imported from the European Union and manufactured in Egypt by Fomex (The Engineering Company of Manufacturing), New Demitta.

The temperature sensor is LM35DZ from National Semiconductor, which is a high precision integrated circuit temperature sensor. The output voltage of this sensor is linearly proportional to the Celsius temperature. The LM35DZ sensor does not require any external calibration. Also, it provide a typical accuracies of ± 0.25 °C at room temperature and ± 0.75 °C over a full −55 to +150°C temperature range. Moreover, this sensor has a very low self-heating, which it is less than 0.1°C in stagnant air LM(2000). However, a noise suppression circuit must be added to the output of each sensor to reduce the effect of the electromagnetic noise from AC and DC sources from the surround environment LM(2000).

In this work, a special purpose data acquisition system was designed for reading, recording and analyzing (with the aid of MATLAB software) the measured data from the temperature sensors as shown in Fig. 2. The circuit of data acquisition system could be connected to the computer using the Internet or the Local Area Network (LAN) connection. However, to use this type of connections; a protocol called TCP/IP must be used in order to send or receive data to and from the computer, which is reliable protocol that is usually used to transfer the data in a secure way and without errors (Jeremy, 2002). Moreover, by using this protocol, the data can be transferred using Wireless Network Infrastructures (WiFi) (Jeremy, 2002), and it can be recorded and analyzed using any mathematical program that support this protocol such as MATLAB software. The main component of this circuit is a microcontroller called PIC18F46K20 as shown in the same figure, which is a powerful and low cost microcontroller that is usually used in many applications that require a large memory size (64 KB program memory and 4 KB data memory) and a higher processing capabilities (PIC 2008). Also, in this circuit a network interface card is designed to provide the microcontroller with the ability of connecting it to the computer through LAN connection as shown in the figure. Also, a power supply circuit is added to the circuit to provide the whole system with a regulated 5 voltages.

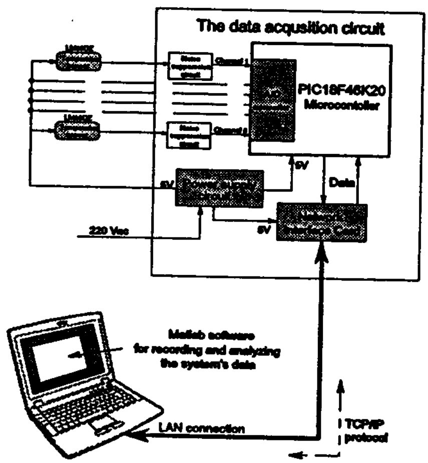

Fig. 2 A block diagram of the data acquisition system.

Figure3 (a) shows a photograph of the setup where the computer, the control data acquisition system are fixed in the shadow under the solar still. While, solar still with sponge slices is shown in Fig. 3(b).The sampling rate of recording readings is also decided by 10 minutes. The computer program is subjected to some problems in the beginning of experiment because of the higher ambient temperature. For a stable operation, the microcontroller must work in a moderate ambient temperature.

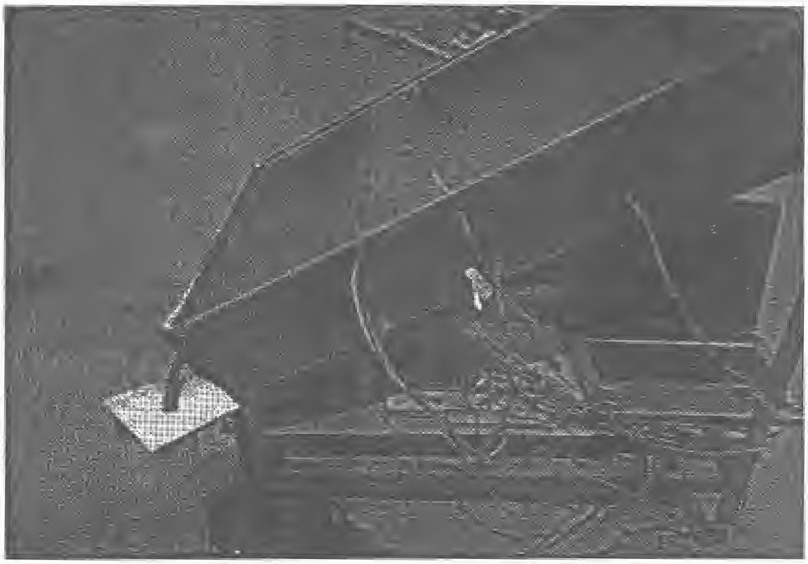

Fig. 3 (a) A photograph of the experimental setup with sponge and distributor tube.

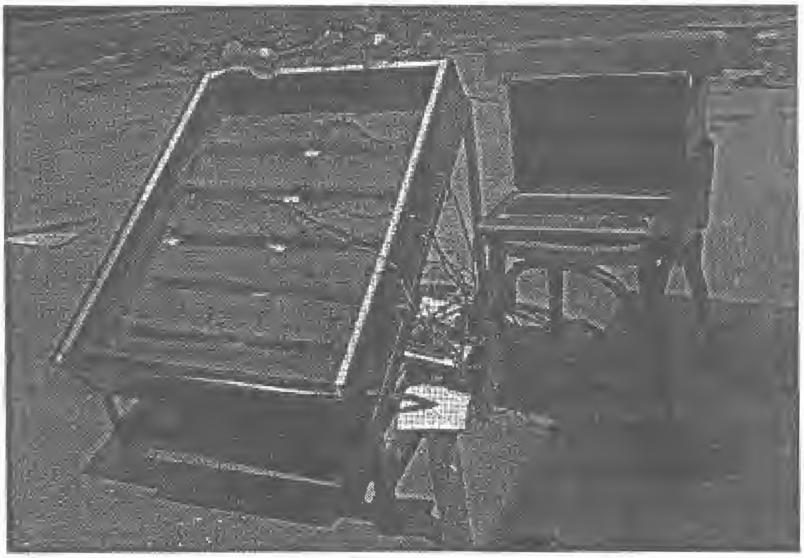

Fig. 3 (b) A photograph of the experimental setup with sponge slices. Water distribution by suppressions

RESULTS AND DISCUSSION

The figures from 4 through 6 show the performance of the still with sponge in 5, 13 February and 19 March, respectively. The temperatures at different points of the still are shown in Figs. from 4 (a) through 6 (a). The temperatures at three points in the lower, middle and sponge top are recorded. The above and under glass middle temperature, ambient air and the under box temperatures are also shown. All readings increase to the mid day and then decrease again. The ambient air temperature is shown to be the least temperature with a maximum value at noon and around. The under box temperature starts in the morning less than the ambient temperature and then increases by few degrees above the ambient temperature. The highest temperature recorded as expected are at three points in the lower, middle and sponge top as shown in these figures. It is clear that sponge top has the highest absorptance for solar radiation. The above glass temperature recorded lower than that of under glass temperature. While, figures from 4 (b) through 6 (b) show the total solar intensity on the tilted surface (W/m^2) and the accumulated distilled water volume (mm^3). The total solar radiation data measured on tilted surface (30^o tilt angle and facing south) .It was noticed that, the peak of the global solar radiation intensity was achieved by med-day (at 12 noon) as cleared in these figures. Moreover, the distilled water changed from 200, 205 and 295 mm^3 or 417, 427 and 615 mm^3 (mille-Liters)/m^2, respectively during the 24 hours. The water distribution was conducted by a copper tubes fixed at the upper end of the still. This tube have holes (3 mm diameter), 10 mm apart and blocked from ends and is supplied by water from the upper middle is used for water distribution on the sponge.

The Figs. from 7(a) through 11 (a) presents the results of the measurements different temperatures versus time. The sponge top, middle and bottom temperature, the above glass cover temperature, inner glass cover temperature ,the inner still bottom temperature and the ambient air temperature obtained during the five days of experimentation indicate that the temperatures increase and reach the maximum value then it diminishes from 15 LT (Local time).

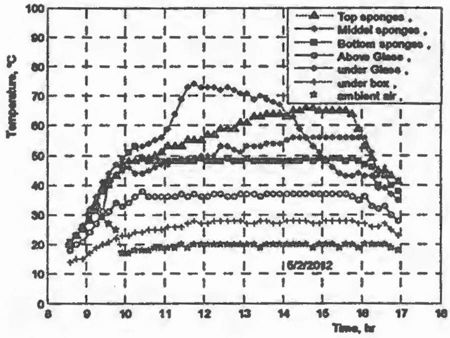

Fig. 4(a) Temperature at different points of the system (Water distribution by a copper tube).

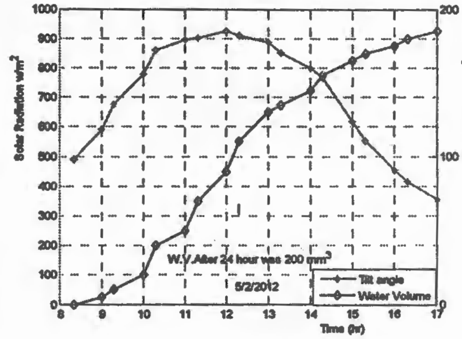

Fig. 4(b) Solar radiation and water volume accumulation.

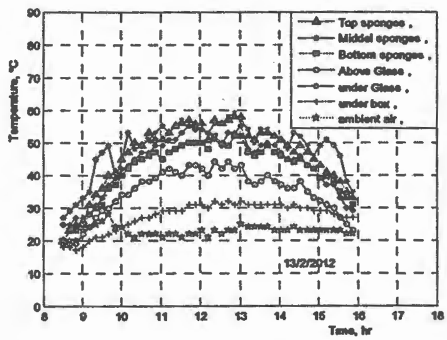

Fig. 5(a) Temperature at different points of the system. (Water distribution by a copper tube).

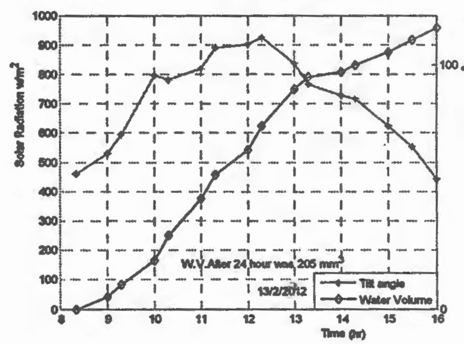

Fig. 5(b) Solar radiation and water volume accumulation.

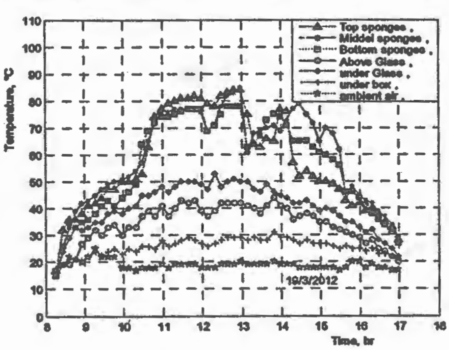

Fig. 6(a) Temperature at different points of the system. (Water distribution by a copper tube).

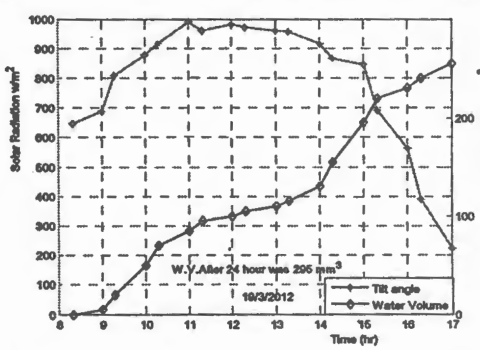

Fig. 6(b) Solar radiation and water volume accumulation.

It can be noted a strong variation in the temperatures of the sheet of sponge, inner glass cover temperature and the external glass; this favors the evaporation and the condensation processes. It is found that the distillate production increases when the difference between water and glass temperatures decreases.

The variation of solar radiation received by an inclined glazing during the experimental tests is shown in Figures from 7 (b) through 11(b). The results show that the solar radiation becomes preponderant and more intense between 12 noon and to 13 LT and decrease from 14 LT. The measurements of solar irradiation obtained show a slightly significant deviation between the five days from 9 am to 13 LT. These results indicate that the production of the distilled water depends strongly of the incidental solar energy.

The distilled water changed from 700, 790, 640, 610 and 505 mm^3 or 1458, 1646, 1333, 1271 and 1052 mm^3 (mille-Liters)/m^2, respectively during the 24 hours on 29 April and 8, 16, 22, 30 May as shown in Figs. 7 (b) through 11(b). The water distribution was conducted by suppressions fixed at the upper end of the still.

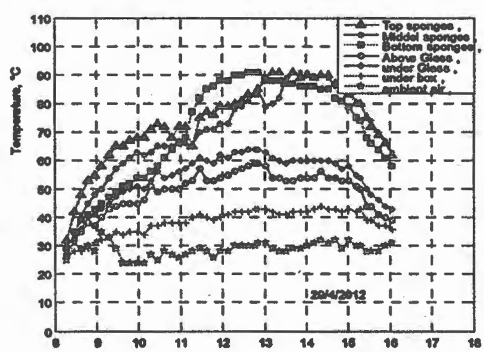

Fig. 7(a) Temperature at different points of the system. (Water distribution by a copper tube).

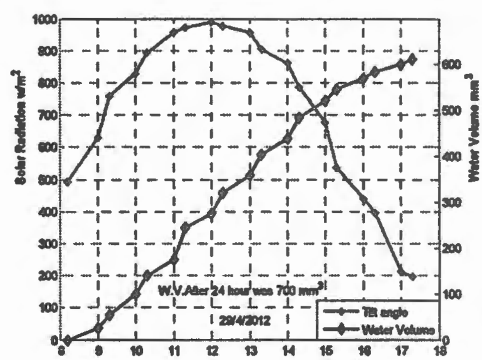

Fig. 7(b) Solar radiation and water volume accumulation.

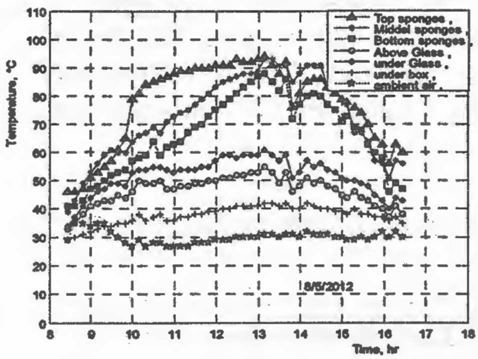

Fig. 8(a) Temperature at different points of the system. (Water distribution by suppressions).

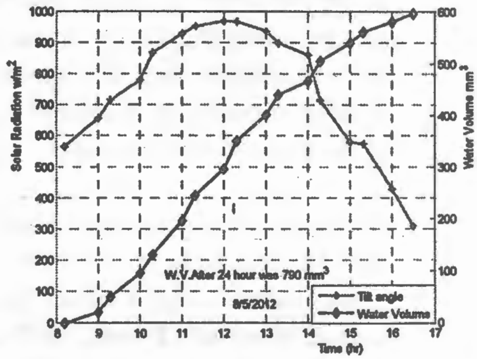

Fig. 8(b) Solar radiation and water volume accumulation.

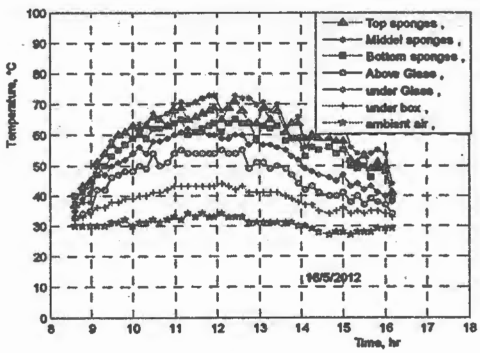

Fig. 9(a) Temperature at different points of the system. (Water distribution by suppressions).

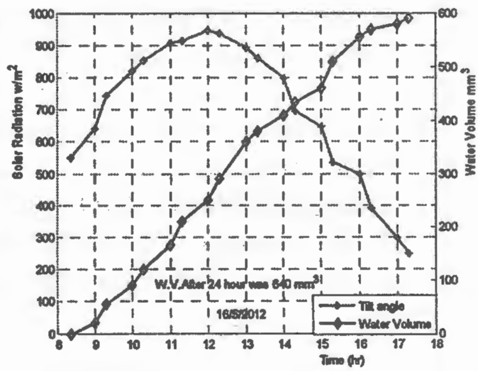

Fig. 9(b) Solar radiation and water volume accumulation.

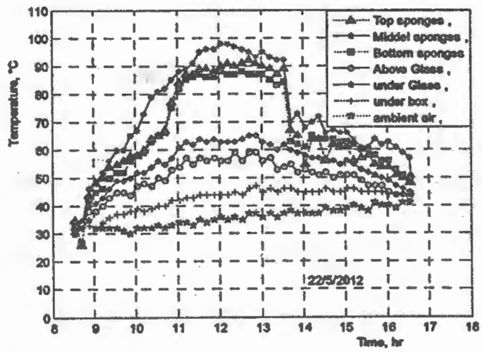

Fig. 10(a) Temperature at different points of the system. (Water distribution by suppressions).

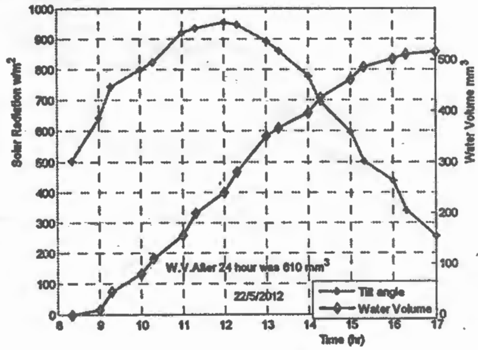

Fig. 10(b) Solar radiation and water volume accumulation.

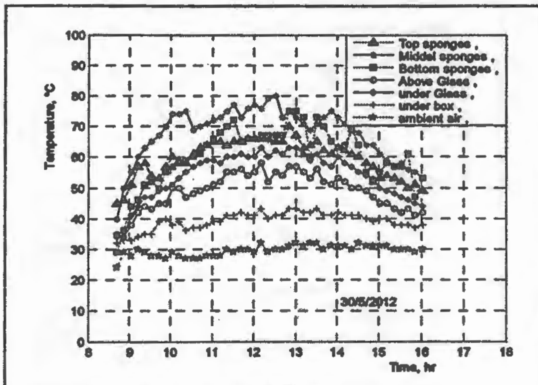

Fig. 11(a) Temperature at different points of the system. (Water distribution by suppressions).

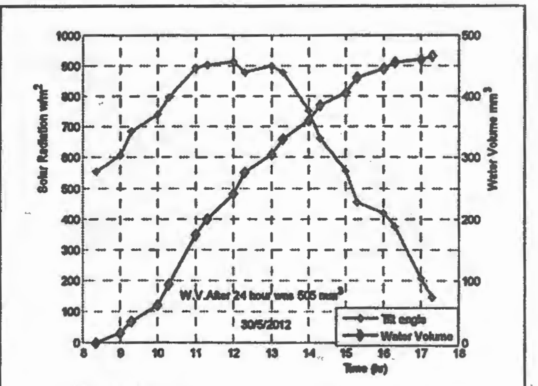

Fig. 11(b) Solar radiation and water volume accumulation.

The same results were obtained where water distribution takes place with a plastic tube with the same holes as plotted in Figs. from 12 through 16 during summer, 3, 12, 25 and 27 June and 2 July, respectively. The distilled water as shown in Figs. from 12 (b) through 16 (b) changed from 479, 1354, 1313, 1521 and 1729 mm^3 (mille-Liters)/m^2, respectively during the 24 hours.

Figures from 12 (b) through 16 (b) represent also the daily evolution of the distillated water production versus time. It notes that the condensate production increases steadily and the maximum quantity obtained reaches 830 mm^3 at 16.30 LT during the days of 2/7/2012. It observed that the external parameter has decreased the rate of production during the morning, so the production rate remains constant from 13 to 14 LT.

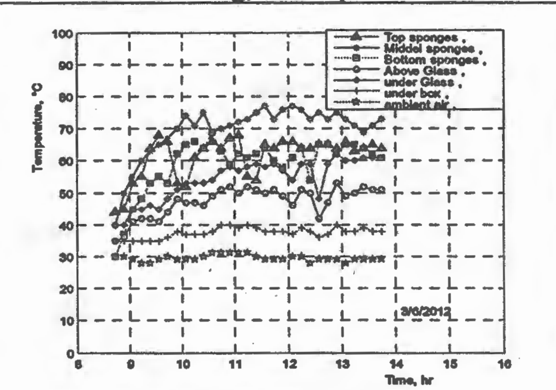

Fig. 12(a) Temperature at different points of the system. (Water distribution by suppressions).

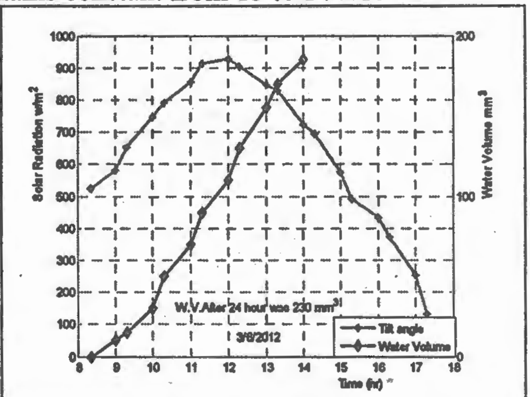

Fig. 12(b) Solar radiation and water volume accumulation.

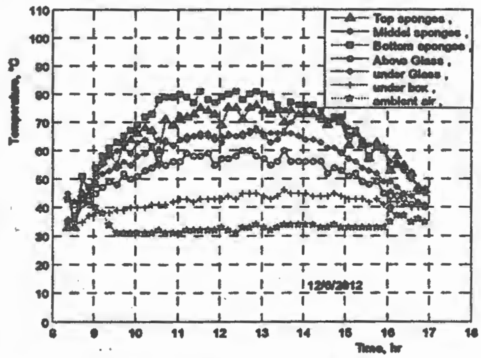

Fig. 13(a) Temperature at different points of the system. (Water distribution by a plastic tube).

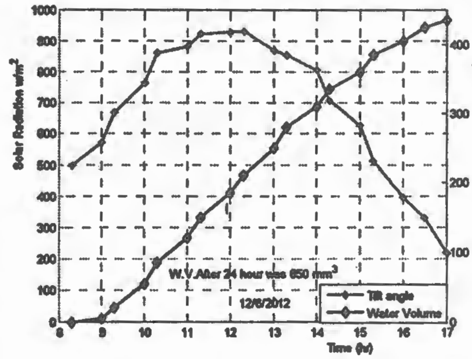

Fig. 13(b) Solar radiation and water volume accumulation.

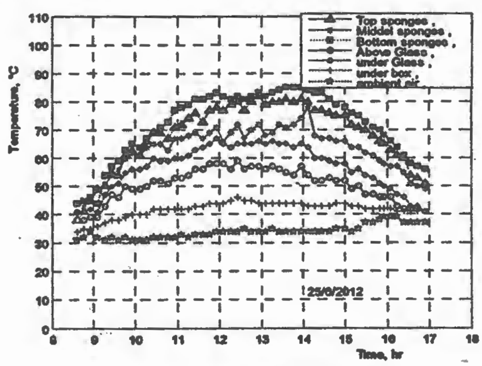

Fig. 14(a) Temperature at different points of the system. (Water distribution by a plastic tube).

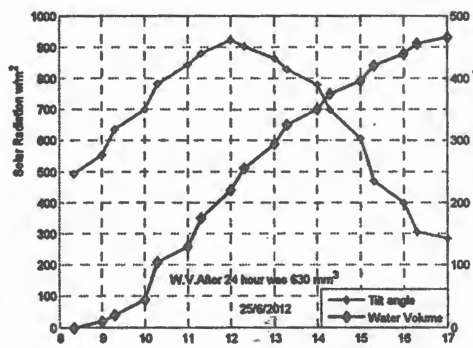

Fig. 14(b) Solar radiation and water volume accumulation.

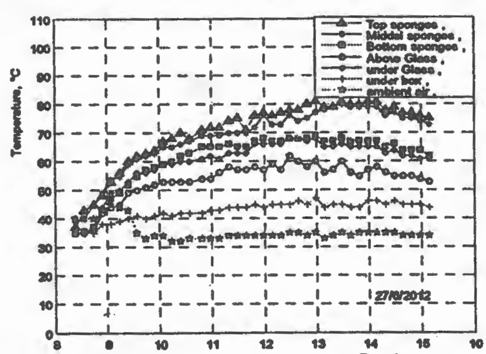

Fig. 15(a) Temperature at different points of the system. (Water distribution by a plastic tube).

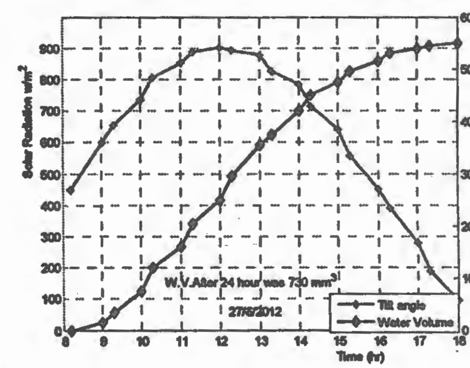

Fig. 15(b) Solar radiation and water volume accumulation.

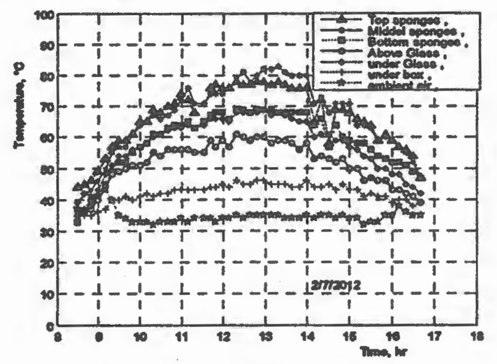

Fig. 16(a) Temperature at different points of the system. (Water distribution by a plastic tube).

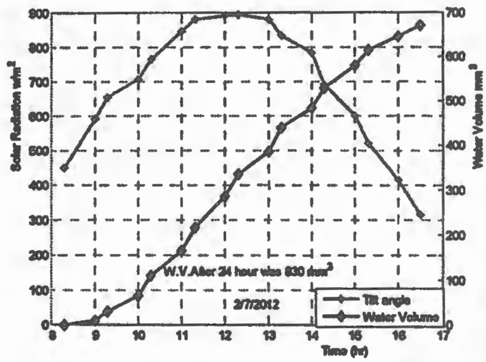

Fig. 16(b) Solar radiation and water volume accumulation.

The same results were obtained where water distribution takes place by suppressions fixed in the upper still and the sponges consists of 6 slices (Fig. 3 (b)). The highest temperature recorded as expected are at three points in the lower, middle and sponge top as shown in Figs. from 18 (a) through 21 (a). It is clear that sponge middle has the highest temperature and absorptance for solar radiation.

The same results also are plotted in Figs. from 17 (b) through 21 (b). The experiments are performed in summer days 4, 9, 11, 15 and 16 July. The distilled water as shown in these figures change from 1031, 771, 1531, 1302 to 1573 mm^3 (mille-Liters)/m^2, respectively during the 24 hours.

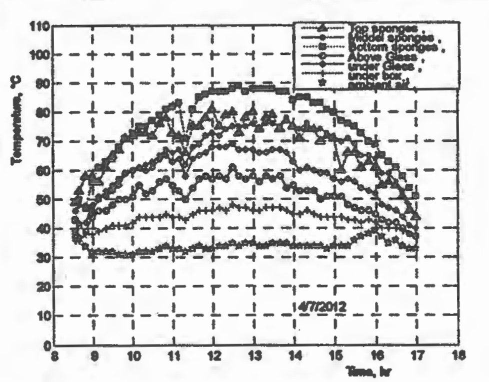

Fig. 17(a) Temperature at different points of the system. (Water distribution by a plastic tube).

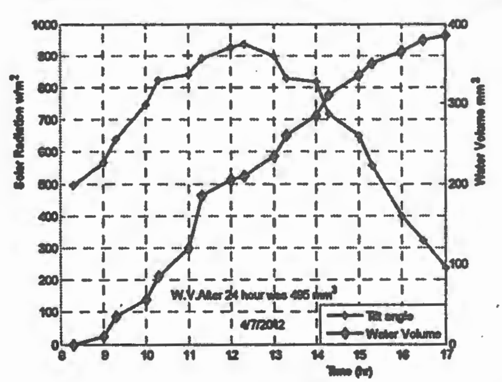

Fig. 17(b) Solar radiation and water volume accumulation.

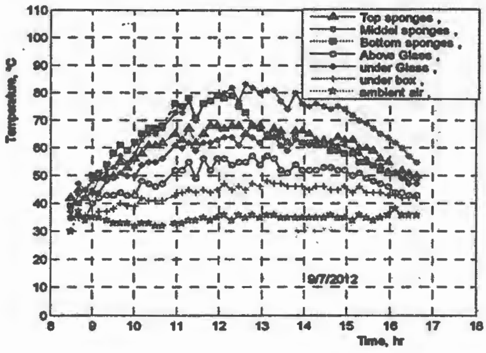

Fig. 18(a) Temperature at different points of the system with sponge slices. (Water distribution by suppressions).

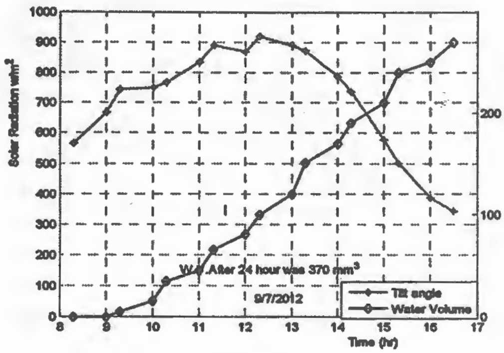

Fig. 18(b) Solar radiation and water volume accumulation.

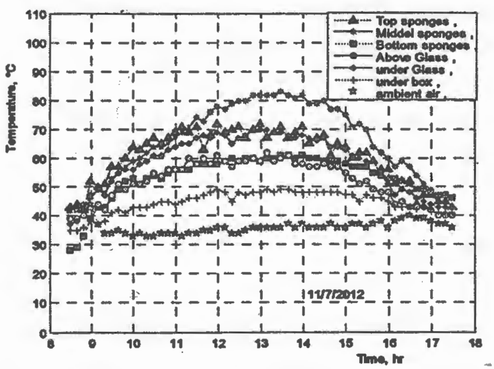

Fig. 19(a) Temperature at different points of the system with sponge slices. (Water distribution by suppressions).

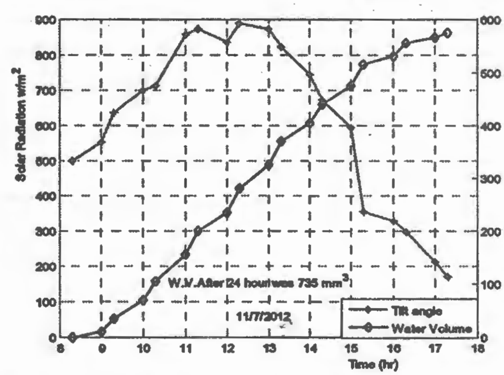

Fig. 19(b) Solar radiation and water volume accumulation.

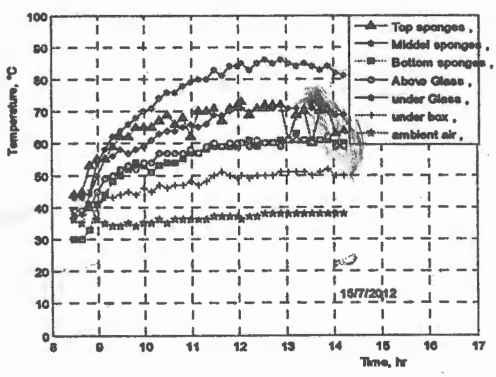

Fig. 20(a) Temperature at different points of the system with section sponges. (Water distribution by suppressions).

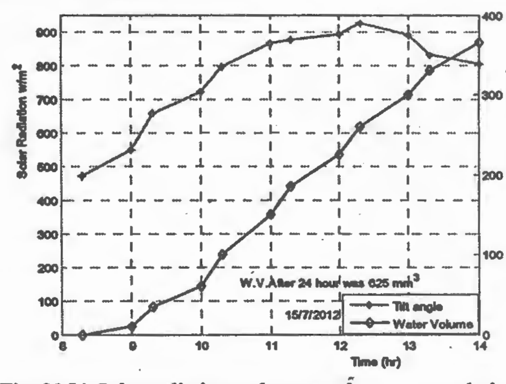

Fig. 20(b) Solar radiation and water volume accumulation.

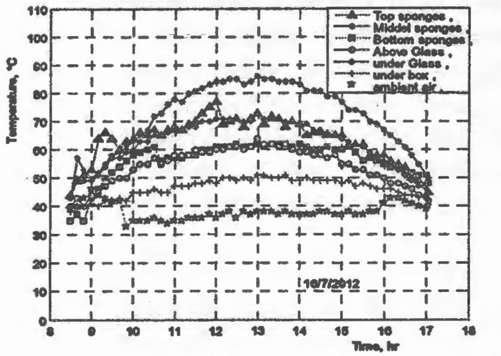

Fig. 21(a) Temperature at different points of the system with sponge slices. (Water distribution by suppressions).

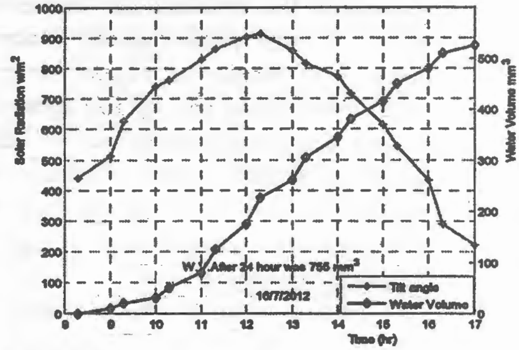

Fig. 21(b) Solar radiation and water volume accumulation.

Table (1) summarized and listed the average of experimental results. It clear that accumulated water quantity per 24 hours .The effect of solar intensity on productivity is more than the effect of ambient temperature on productivity. The table shows also that water distribution using suppressions is better than plastic or copper tube and using sponge slices yields poorer performance than that of flat sponge.

Table (1) shows a summary of the average experimental results

Month	Distilled water, mm^3/m^2 day*	Water distribution	Sponge	Max. Solar radiation intensity, W/m^2	Ambient air temperature, °C
2 and 3	486	Copper tube	Sheet	946.6	21.1
4 and 5	1352	suppressions	Sheet	954.1	31.6
6 and 7	1279	Plastic tube	Sheet	915.3	33.2
7	1242	suppressions	Slices	917.4	36.8

*Accumulated water quantity per 24 hours.

CONCLUSIONS

This paper investigates experimentally the performance of a simple flat solar still with yellow sponge. The experimental work was carried out on the roof of the Thermal engineering laboratory, Mechanical power department, Faculty of Engineering, Mansoura University, latitude 31.0408° N and longitude 31.486° E. The experiments were performed during different sunny days throughout February, March, April, May, June and July months 2012 under El-Mansoura city climatic conditions for plain sponge and slices. Water distribution is made by copper, plastic tubes and suppressions. Results are given in graphical form. Results show that the ambient air temperature and solar radiation have direct effect on still performance. Water distribution using suppressions is better than plastic or copper tube. Using sponge slices yields poorer performance than that of flat sponge. In general, using this local type of sponge show lower performance: (0.486–1.352 liters/m^2 day) than that of simple solar still (3-4 liters/m^2 day) for the simple solar still. The possible reason for that may due to the poor water distribution and the bad absorptance of the sponge to the water.

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The author wish to thank the Engineer **Hesham E. Gad**, assistant lecturer, department of Computer and Systems, who designed and implemented the data acquisition system.

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الملخص العربي

المراقبة عن بعد وتحليل بيانات من مقطرة مسطحة شمسيّة مائلة بالإسفنج الأصفر

د/ صفية مصطفى الجبار*

تعتبر المياه العذبة والطاقة ضرورية للحياة البشرية. بسبب النمو السكانى المتزايد والتصنيع السريع، اليوم يواجه العالم التحدى فى تلبية الطلبات الحالية لهاتين السلعتين. نهج واحد لمواجهة هذه الأزمة هو استغلال الطاقة الشمسية لإنتاج المياة العذبة. وقد أثبتت تطوير نظم التقطير الشمسى مناسباتها لتحلية المياة عندما يكون الطلب أقل من ٢٠٠ م^{٣}/ يوم. تبحث هذه الدراسة تجريبيا أداء مقطرة شمسية مسطحة مائلة بالاسفنج الأصفر المحلى الصنع مغمورة في الماء وتتعرض لأشعة الشمس. يتم استخدام الإسفنج كلوح كامل يغطى الحوض بالكامل وشرائح. يتم توزيع المياة من أعلى المقطرة عبر أنابيب نحاس وبلاستيك وأقماع. الجهاز معد لقياس الإشعاع الشمسى الكلى على سطح مائل، وكمية الماء المقطر، درجة حرارة الهواء المحيط، ودرجة حرارة الاسفنج (من أعلى والوسط ومن أسفل)، ودرجة حرارة الزجاج الداخلي ودرجة الحرارة تحت الصندوق. يتضح من هذا العمل أنه من الممكن أن يعمل هذا المقطر الشمسي عن بعد مع جهاز كمبيوتر لخفض تكلفة إنتاج الماء المقطر. نفذت التجارب على سطح معمل الهندسة الحرارية بقسم هندسة القوى الميكانيكية، كلية الهندسة بجامعة المنصورة عند خط عرض ٣١,٠٤٠٨ شمالا وخط طول ٣١,٤٨٦ شرقا فى بعض الأيام المشمسة من أشهر فبراير ومارس وأبريل ومايو ويونيو ويوليو خلال (بعض أيام فصلى الشتاء والصيف) تحت ظروف مناخ مدينة المنصورة مع عرض النتائج بيانيا حيث بينت أن درجة الحرارة المحيطة والإشعاع الشمسى لهما تأثير مباشر على أداء المقطرة. توزيع المياه باستخدام الأقماع تظهر أداء أفضل من الأنابيب البلاستيك أو النحاس. ينتج من استخدام شرائح الاسفنج أقل فى الأداء من الإسفنج المسطحة. بشكل عام، باستخدام هذا النوع من الإسفنج المحلية تظهر انخفاض فى الأداء (٠.٤٨٦-١.٣٥٢ لتر/م^{٢} اليوم) من المقطرة الشمسية البسيطة (٣-٤ لتر/م^{٢} اليوم). والأسباب المحتملة لهذا هو سوء توزيع المياه وسوء امتصاصة بواسطة الإسفنج.

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