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Selective absorbent dye effect on the efficiency of sunlight solar picker

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Abstract:

We will study the properties of the non-glossy black absorbent and compare it with the non-chromosome black lacquered absorbent envelope added to the chromium trioxide. The comparison is:

Q_u = 363.312, ζ% = 19.88 less absorbent and less efficient energy for dark black coated tablet was respectively While less absorbent and less efficient energy for dark black-coated pad genitive trio looked chrome respectively (Q_u = 532.44, ζ,% = 29.10) on **9/7/2017**

Q_u = 2192.4, ζ% = 96.4 max. absorbent and max. efficient energy for dark black coated tablet was respectively While max. absorbent and max. efficient energy for dark black-coated pad genitive trio looked chrome respectively (Q_u = 2536.92, ζ,% = 99.36) on **9/7/2017**.

Q_u = **250.56**, ζ% = **12.53** less absorbent and less efficient energy for dark black coated tablet was respectively While less absorbent and less efficient energy for dark black-coated pad genitive trio looked chrome respectively (Q_u = **263.08**, ζ,% = **13.01**) on **17/8/2017**

Q_u = **1002.24, ζ%** = **43.34**max. absorbent and max. efficient energy for dark black coated tablet was respectively While max. absorbent and max. efficient energy for dark black-coated pad genitive trio looked chrome respectively (Q_u = **1033.56**, ζ,% = 44.12) on **17/8/2017**.

Note the difference between the two trials because of leaving the solar antenna for a month is exposed to atmospheric conditions of heat and dust and dirt without maintenance.

Key words: surface absorption; colour cover (paint); the rate of absorption; waveforms; selectivity.

Introduction and Research Problem:

Introduction (introduction):

The subject of solar energy and alternative energy systems is of general concern to all people, especially with the high fuel prices and the increasing level of environmental pollution resulting from the increasing use of oil derivatives. This is what drives everyone to think about developing the use of renewable energy sources and means. We always need energy sources of all kinds, Due to the rapid development in daily life and the increase in entertainment, the need for electric power in particular, and for the energy of other types that we use in various applications of life, has increased. The most important defects in fuel Fossil (oil and its derivatives, natural gas and other depleted fuels) are:

1. depletion of these sources and non-renewal over time.

2. High cost of extracting, mining and filtering.

3. Negative impact, especially combustion products that cause pollution of the environment in various types of pollution, such as air pollution, water, soil, etc.

For these reasons mentioned above, a person is alerted to the exploitation of new sources of energy that are not immature first and can be renewed and cost far less than fossil fuels Secondly and clean energy does not cause pollution. All available in the sun, which became a national income of some countries.

In this paper, we study the effect of selective absorbent coatings on the ability of storage of the solar heat pump, which are special absorbents that are excellent absorbents for solar radiation and are considered weak emitters of thermal radiation.

The absorbent surface of light waves from the sun is often from a metal coated with dark paint, especially black color, which has a rate of absorption of the solar radiation up to about 98% At the same time when the temperature of the absorbent surface is higher than the temperature of the air or fluid surrounding it, The heat is lost by heat transfer from the hot body to the cold body. The emission ratio is 90%. This reduces the absorption efficiency to about 8-10%. Thus, the energy is lost as the losses are not used to heat the solar water heater. Which have high absorption rates and are offset by radiation rates Avat energy to the outer perimeter and a few low relative to the loss that gets in metal with dark colors, especially if those colors are shiny, the emission rates which are much more than the same colors, but not shiny.

The dyes that I mentioned above and which are characterized by high absorption and low heat emission are called selective absorbent coatings. These are chromium and cobalt oxides.

Selective Materials:

Typically, a set of materials is used. One of the first selector surfaces to be investigated was simply copper with a layer of black Cobrek oxide. Chromium is black and nickel for copper coating, which is used as a selective surface resistant to moisture or oxidation when exposed to extreme weather conditions and summer temperatures and to be able to retain its selective properties - but expensive. Another mix consists of steel plated with gold, silicon, and silicon dioxide.

Although ordinary black paint has high solar absorption, it also has a high thermal emission, so it is not an eclectic surface.

[2] Typical values of a selective surface may be 0.90 solar absorption and 0.10 thermal emission. But can range from 0.8 / 0.3 for paints to metal to 0.96 / 0.05 for commercial surfaces - and low thermal emissions were obtained up to 0.02 in the laboratory.

Research problem:

The search problem is summarized below:

- Choose the type of coatings used to cover the surfaces of solar complexes.
- The amount of absorption of the collector's surface to the heat of the sun.
- The amount of heat emission from the collector's surface to the outer perimeter.

Search Goal:

The goal of the research is to reach the following:

- Choosing the best type of coating for solar panel panels in terms of:

a) the color of the coating most absorbent to the heat of the sun.
b) The color of the coating is the least radiation (emission) of heat from the board to the outer perimeter.
c) The less expensive paint type provided that the two conditions (a & b) are met.
d) The most durable coating type for weather conditions of heat, cold, dust and rain especially acid rain.

- Access to the best selective absorption leads to obtaining the largest amount of thermal energy of the solar panel.

research importance:

The importance of our research lies in the following key factors:

1. Engage the engineering cadres on the actual and extensive use of solar energy in our country, even though our country is the land of the sun.
2. Increasing the need to search for alternatives to fossil fuels and oil, especially solar energy in household appliances, as the products of burning fossil fuels of oil, gas, gasoline, diesel, etc., where about 70% of environmental pollution factors as well as the possibility of developing research to a larger size for use In the sunny atmosphere of Iraq.

3. Iraq is considered one of the sunny countries [1]
   %95 of the days of the year sunny, which means high potential for the success of such projects if the culture was created crisis.

4. Disseminate the idea and spread awareness of renewable energies in different segments of the society and begin to provide students with the skills necessary to develop these ideas to creative ideas later and to open up new horizons for learning outside the traditional curriculum.

5. The possibility of manufacturing these coatings locally and at reasonable prices.

6. Mainstreaming the idea of using the solar switches coated with these selective absorbent coatings on the companies and laboratories that manufacture the solar switches to overcome the crisis of electricity shortage

Research Methodology:

The researcher used descriptive, practical and analytical methods in the use of selective absorbent coatings for a solar collector with a absorbent plate. Because the practical aspect of the most appropriate methods of application, has been used as a researcher theoretical and practical sources.

The theoretical sources consist of specialized scientific books and journals. The practical sources included experiments carried out on the solar panel before coating and after painting. The reading table was then calculated.

The research sample:

Two solar collectors, one of which is a absorbent plate coated with a shiny black color, and the second is a absorbent plate painted with a non-shiny black coating added to the chrome oxides. The type of each compound is

The simplest of these complexes or what we call solar heaters, which are types of flat heaters and consists of the following parts:

• Parallel box of metal rectangles insulated with insulating material

• There is a cover for this box made of ordinary glass or sometimes to reduce the cost uses transparent plastic.

• Dark-brown heat-absorbent panel absorbs the largest amount of heat from the sun and is found inside the box.

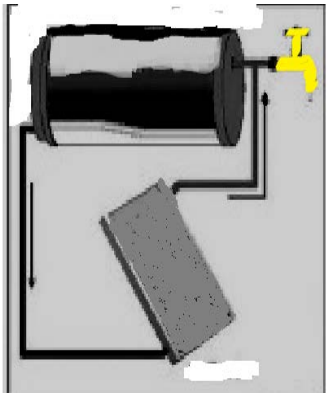
• Thin pipes are regularly distributed under or inside the board through which the fluid to be heated, whether water or air, passes. We used the water as a heat sink.

The metal sheet is usually made of copper or aluminum and sometimes aluminum and copper alloys. The main reason for the choice of these two metals is that they are conductors of heat and electricity with high capacity and high efficiency.

Copper metal has a fast and efficient heat conduction.

The hot water that will be stored in the tank insulated with one of the insulation materials and this insulating material either glass or fiber class and works the insulation to retain the heat of the water and remains hot even during the night, ie when not Provides sunshine.

The shape of the plant



Previous studies :

It was natural to think about taking advantage of the heat from the sun's heat and radiation in industrial, agricultural and commercial processes and for special practical purposes.

It gives us 20,000 times the world's most energy-consuming capacity, but the closest one was to take advantage of this energy to heat home water. The start was by creating very ordinary, open, black-colored tanks with very high absorption properties.

The black color in the absorption is the scientists' research to increase the temperature of the absorbent surface.

This research deals with how to cover the parts using improved coatings where a black oxide metal layer is deposited and our research is specifically directed to the heating panels of a solar collector.

Initially, black nickel, a good thermal conductor, was used to show that these layers were affected by moisture. Black chromium was also used for the same purpose and it was found that he could not tolerate the thermal grades.

Cobalt 1739 was discovered in Sweden by George Brandit and the cobalt name derived from the word Kobold means the evil spirit.

Its melting point = 1495 ° C and its boiling point = 2927 ° C and obtained cobalt as a by-product of nickel, copper, lead, silver and iron.

Cobalt tends to blue color and has a high position and introduces in the manufacture of solid alloy steel, as it manufactures cutting tools for milling, and manufacture of magnets and enter into the manufacture of jet engines and the manufacture of special types of ceramics and special glass and it enters the components of vitamin B1, which is important in nutrition Human .

Cobalt is found in Congo, Zambia, Canada, Australia, Russia and America, which uses one-third of the world's production and is priced at $ 21 per 100 grams.

Crawling resistance in cobalt-nickel alloys (Supper-alloys) is improved by making the structure contain a rigid solution as well as by adding spacers that have no solubility in the component, the main structure of the alloy.

Theoretical Analysis:

In this theoretical part of the research we will study and analyze first the types of loss and loss in thermal energy and methods and methods of reducing these losses and be according to the type of loss of energy and summarized as follows [5]:

•Loss of thermal energy by conduction method: conductivity is the process of heat transfer by contact between the two bodies in order to reduce energy loss. Here we have to cover the sides and base of the absorbent surface and heating pipes with insulating materials such as glass fiber, glass wool and polystyrene.

•Loss of thermal energy in pregnancy: Load is the method of heat transfer by convection currents from the thermal source to the body or fluid to be heated. In order to reduce the loss of thermal energy in this method, the air between the glass cover and the absorbent board is placed or the heating pipes located under the absorbent board and the absorbent board are also placed inside a vacuumed glass box. This is because heat transfer is carried out by medium such as air or water. Carrying a vacuum.

•The loss of thermal energy in the way of radiation: The transmission of heat by radiation does not require a medium for the transfer of heat, but the heat is transmitted in vacuum, here to reduce the loss of energy by radiation We use glass caps for solar radiation with short wavelengths and dark color to prevent long-wavelength solar radiation Of reflection on the absorbent surface.

How the solar heater works:

In the beginning, the absorbent surface facing the sun at a certain angle begins to absorb the waves of solar radiation falling directly on it and the temperature of the absorbent surface rises and the heat is transferred to the fluid to be heated. The heating mechanism is as follows:

When the absorbent surface of the direct and indirect sunlight absorbs, the temperature rises to the temperature above the fluid temperature in the tubes in or below the plate here because of the temperature difference. The heat transfer occurs from the hottest, the lowest saturated surface is the fluid passing through the tubes and rising The temperature of the fluid from less than one degree Celsius to about ten degrees according to the amount of energy transferred from the board and depends on the intensity of solar flow and also depends on the rate of flow of fluid within the tube.

Flow of fluid inside the solar heater:

When entering cold water to the bottom tube, which distributes the branches of parallel high tubes and ends these tubes to the assembly pipe at the top of the tank, the ear of the tube from which the cold water is the distribution tube is located below the heater branch from which the pipes are ascending and collect all to pour water in a tube above the heater is a tube Assembling After being heated in the fine tubes here, the assembly tube, from which the hot water is rushed to the tap, to get hot water.

Another type of fluid flow is the connected flow. In this case, the water enters the heating tube, which takes up most of the surface of the absorbent surface where the tube form is zigzag, so the water moves right and left, and upward, so that the hot water flows from the top of the heater without water discharge or branching in the pipes Or change in its diameter.

Water rush mechanism:

This mechanism is carried out through the transfer of hot water from the solar heater to the reservoir (water tank). In contrast, the cold water is transferred from the water tank to the solar heater. There are two methods of water rush and flow:

• Natural flow method.

• forced flow method.

In this research I used the first method because it is less expensive and simpler in design and depends on the principle of physics, which states (that any rise in the temperature of the fluid followed by a decrease in density) and on this principle will run the mechanism of work in the heater where the cold water under the heater and hot rise up to low intensity It must be the lowest level of the tank where the water is collected at or above the highest level of the heater, which is when entering cold water from the bottom of the heater and after heating the water in the tubes of the absorbent board decreases density and since the density is equal to mass / Ratio to unit size and e The difference between hot water and cold causes the continuation of the rise of water after the acquisition of heat followed by a decrease in density and weight, either at night and dark and the absence of the sun to heat must be found a way to prevent the return of water in the opposite direction which keeps the water flow in the same direction so as not to increase the loss of thermal energy In the case of reversing the direction of the flow of water in the pipes.

Practical part Experiments and readings:

In this section, we will show the performance of a copper-black copper-colored pick, which is non-glossy and non-selectively processed. We compare it with a solar picker of the same specifications, but it is treated with chromium oxides. Note the difference in thermal absorption and selectivity by taking readings as shown in tables 1 and 2. , In the first table represents the first case of an unhandled solar pickup and in the second table represents the state of the solar capture treated with chromium oxide.

The comparison is done by drawing the efficiency curve with the difference between the heat of the carrier water for the heat at the entrance of the collector and the ambient air temperature in the compound to the intensity of the solar radiation falling on the surface of the collector

Note that the specifications of the pumpkin as follows:

One transparent cover made of thermally treated glass with 4.5 mm thickness, copper-plated pipes and thermal insulation of 5mm glass wool. The measurements to be determined are as follows:

• The intensity of solar radiation falling (solar intensity) on the surface of the complex.

• Temperature of the heat transfer water at the entrance of the complex. Tf, i

• Temperature of the heat transfer water at the outlet of the collector Te

• The surrounding air temperature of the Ta complex.

Water transfer temperature difference between the inlet and outlet of the complex ΔT.

1. Flow ratio of heat transfer water.

As for efficiency, we calculate it as in the following equation:

$$\zeta \% = (Q_u / A.I) \ *100\% \ldots.(1)$$

Where represents the efficiency of the compound, which represents the average useful energy extracted from the compound to the average solar radiation falling on the compound hole.

Qu is the beneficial energy transferred from the compound by heat transfer water.

Qu is calculated from the following equation:

$\mathbf{Q_u}$ = $\dot{\mathbf{m}}$.**C.**Δ**T…….(2)**

$\dot{\mathbf{m}}$: mass flow **(kg / sec)**
C: Heat quality waterproof inside circuit.
C = 1.16 [W.hr/kg.0C] = 1.16 * 3600 [W.sec / kg.^{0}C

Δ**T**: Variable any amount of height and temperature increase in compound ^{0}C

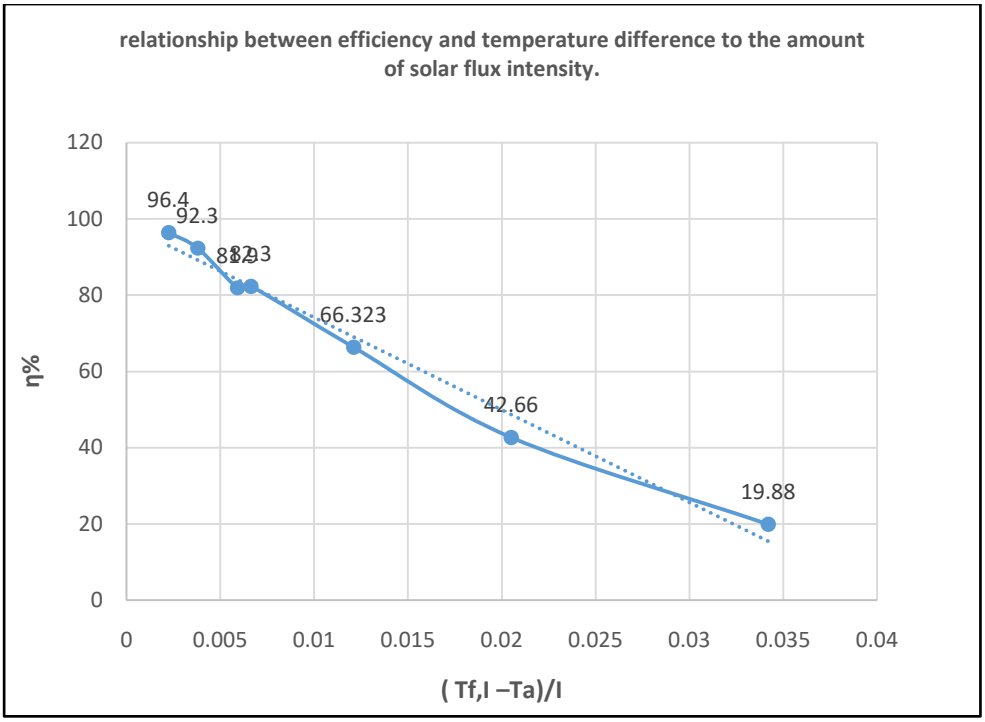
A: The pool surface area exposed to sunlight is measured at **A = 2.50 m^2**

$\dot{\mathbf{m}}$=0.015 kg/sec
The first experiment :
This experiment was conducted in July 2017
On **9/7/2017** from **9:30** am to **2:30** pm. The readings were taken as in Table (1) and Figure (1).
$\dot{\mathbf{m}}$ = 0.015 kg / sec

Table (1) The case of the first compound with a black plate is not bright**.**

T_a	$T_{f,i}$	T_e	ΔT	I	$(T_{f,I} - Ta)/I$	Q_u	%ζ
45	70	75.8	5.8	731	0.0342	363.312	19.88
45	60	72.48	12.48	733	0.0205	781.747	42.66
46	55	74.72	19.72	745	0.0121	1235.261	66.323
45	50	74.8	24.8	755	0.006623	1553.472	82.3
43.5	48	73.2	25.2	771	0.00591	1578.528	81.9
37	40	71.3	31.3	850	0.00379	1960.632	92.3
33	35	70	35	910	0.00223	2192.4	96.4

To draw a curved table efficiency (1) take the relationship between efficiency and rate of temperature difference to how much solar flood intensity.



η%	(Tf,I – Ta)/I
19.88	0.0342
42.66	0.0205
66.323	0.0121
82.3	0.006623
81.9	0.00591
92.3	0.00379
96.4	0.00224

From table (1)

Figure (1)

Table (2) The case of the second compound with a absorbent plate coated with black and non-shiny paint, in addition to chromium oxides.

T_a	$T_{f,i}$	T_e	ΔT	I	$(T_{f,I} - Ta)/I$	Q_u	%ζ
45	**90**	**98.5**	**8.5**	**733**	**0.0614**	**532.44**	**29.1**
45	**80**	**97.2**	**17.2**	**740**	**0.0541**	**1077.408**	**58.23**
46	**71**	**95.5**	**24.5**	**759**	**0.038**	**1534.68**	**80.22**
45	**60**	**87**	**27**	**765**	**0.0196**	**1691.28**	**85.8**
40.5	**50**	**83**	**33**	**788**	**0.0121**	**2067.12**	**94.25**
37	**45**	**80**	**35**	**925**	**0.00912**	**2192.4**	**94.8**
33	**35**	**75.5**	**40.5**	**1021**	**0.00209**	**2536.92**	**99.36**

%ζ	$(T_{f,I} - Ta)/I$
29.1	0.0614
58.23	0.0541
80.22	0.038
85.8	0.0196
94.25	0.0121
94.8	0.00912
99.36	0.00209

from table (2)

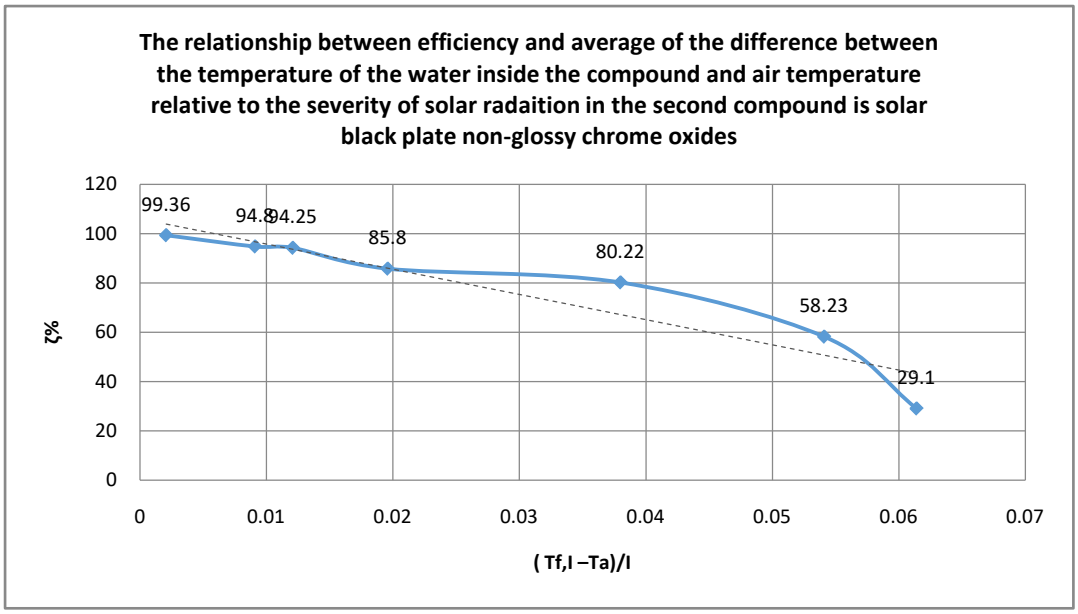


Fig.(2)The relationship between efficiency and average of the difference between the temperature of the water inside the compound and air temperature relative to the severity of the flood in the second compound is solar black plate non-glossy chrome oxides therapy.

Table (1) (Figure 1) for complex absorbent plate black gloses bye did not address the type of vehicle. Either the compound II with absorbent plate which was painted shiny black paient, infused with compounds of chromium oxides. CrxOx was also in table readings (2) (Figure 2).

Second Experiment:

On 17/8/2017 I conducted this experiment between 9:15 Am and 2:15 Pm. The temperature readings and the intensity of the solar radiation were as shown in Table (3). From this, the amount of energy transferred from the compound and efficiency was calculated according to the equations mentioned Previously.

Table (3) and Figure (3) show the statues of the first compound with a black plate painted in black and non-gloss.

T_a	$T_{f,i}$	T_e	ΔT	I	$(T_{f,I} - Ta)/I$	Q_u	%ζ
50	**91**	**95**	**4**	**800**	**0.05125**	**250.56**	**12.53**
51	**87**	**94**	**7**	**817**	**0.0441**	**438.5**	**21.5**
52	**84**	**92**	**8**	**827**	**0.0387**	**501.12**	**24.24**
52.5	**81.5**	**91**	**9.5**	**885**	**0.03276**	**595.08**	**26.9**
53	**75**	**87**	**12**	**894**	**0.02461**	**751.68**	**33.63**
53	**67**	**82**	**15**	**903**	**0.0155**	**939.6**	**41.62**
53	**64**	**80**	**16**	**925**	**0.0113**	**1002.24**	**43.34**

Table (3) The case of the first compound has a Solar black plate.

$(T_{f,I} - Ta)/I$	%ζ
0.05125	12.53
0.0441	21.5
0.0387	24.24
0.03276	26.9
0.02461	33.63
0.0155	41.62
0.0113	43.34

From Table (3)

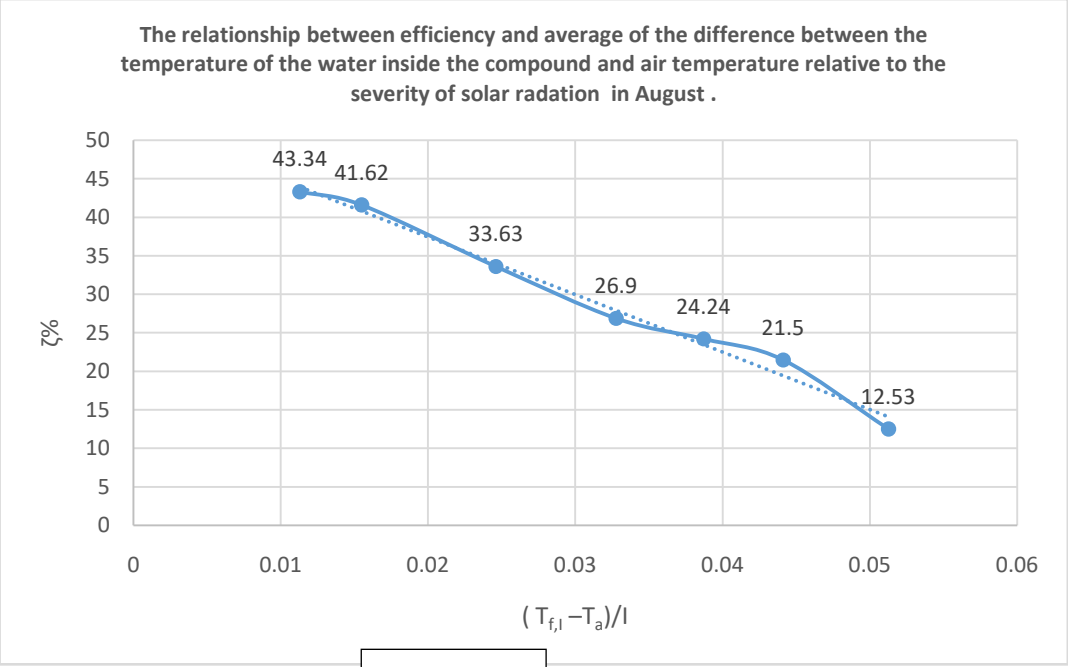


Figure (3)

Figure (3) Experiment (2) Efficiency relationship with [($T_{f,I} - T_a$)/I]Case of compound with black laminate plate.

The second compound with the black plate absorbent croate with a coating added CrxOx in August (17/8/2017) at (9:15 Am to 2:15 pm) was reading temperature and the intensity of solar radiation as in Table (4) and from which the amount of energy Moving from the complex and efficiency according to the equations mentioned earlier.

Table (4) The case of the first compound has a non-bright black plate. The coating is croate with Cr_xO_x.

T_a	$T_{f,i}$	T_e	Δ T	I	$(T_{f,I} - Ta)/I$	Q_u	%ζ
50	82	88.2	4.2	809	0.0396	263.08	13.01
51	77.5	85.5	8	830	0.0319	501.12	24.15
52	73.7	83.7	10	835	0.026	626.4	30.01
52.5	72.4	83.56	11.16	890	0.0223	657.72	31.42
53	67.5	81.5	14	899	0.0158	876.96	39.02
53	65.5	80.5	15	910	0.0137	939.6	41.31
53	63	79.5	16.5	937	0.01014	1033.56	44.12

%ζ	($T_{f,I}$ –Ta)/I
13.01	0.0396
24.15	0.0319
30.01	0.026
31.42	0.0223
39.02	0.0158
41.31	0.0137
44.12	0.01014

From Table (4)

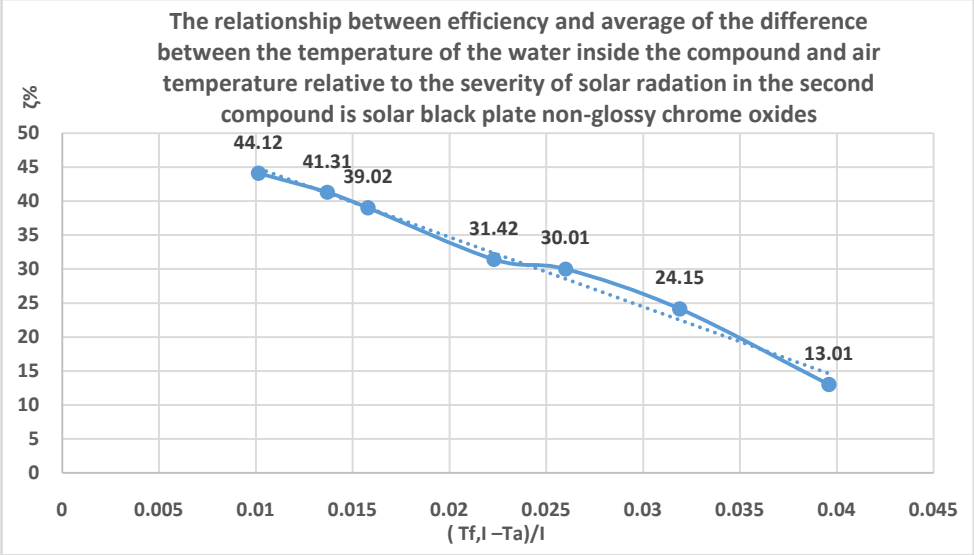


Figure (4)

Table (4) and Figure (4) show the case of the first compound with a black plate painted in black, uncoated and painted with black paient added to Cr_xO_x.

Comparing compilers in the first experiment:

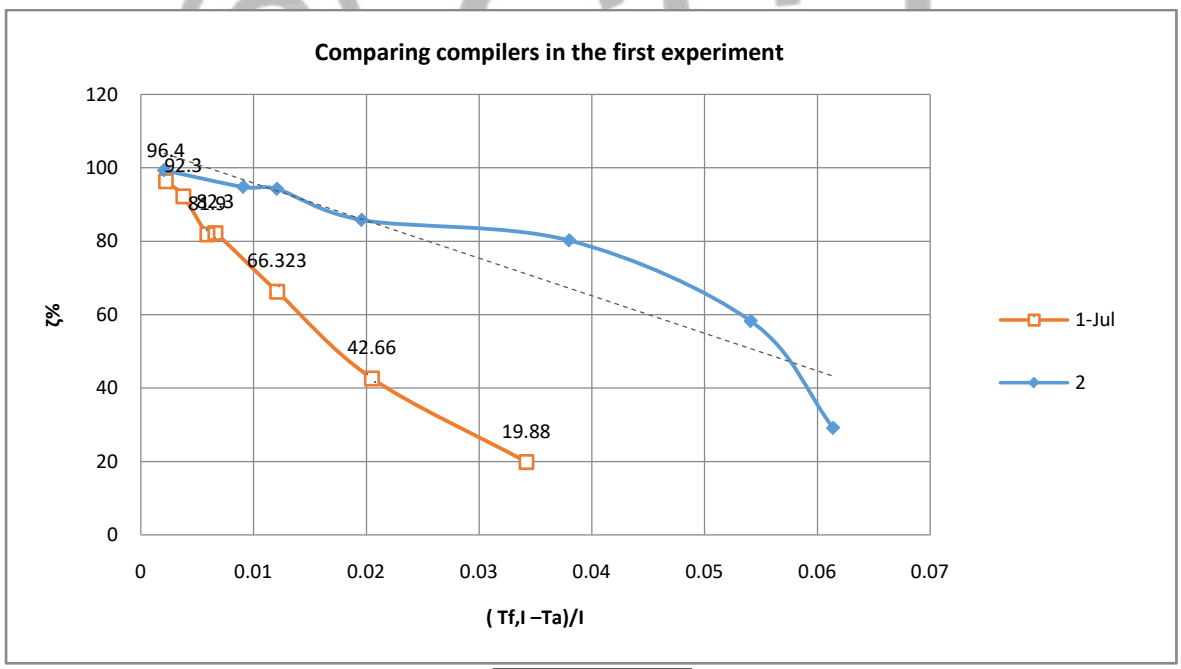


Figure (5)

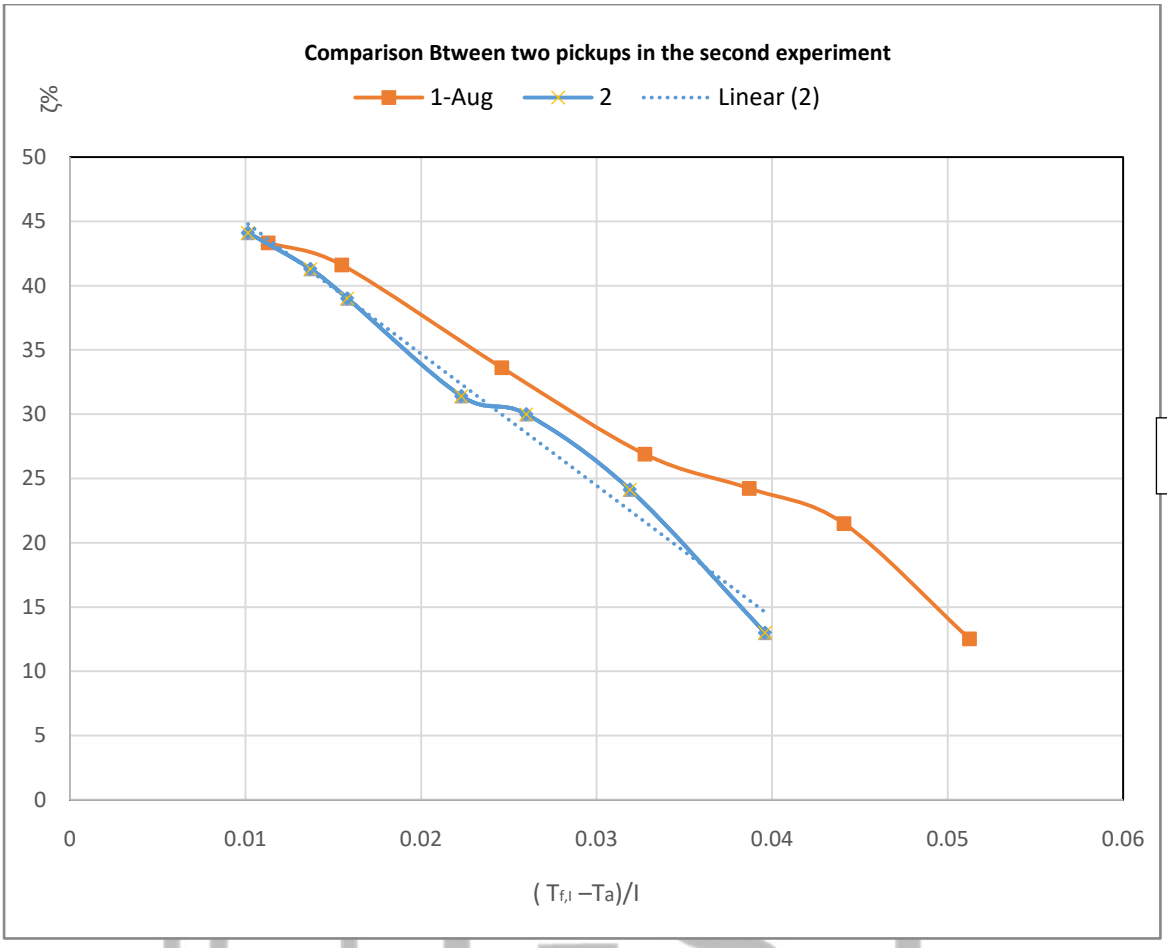


Fig.6

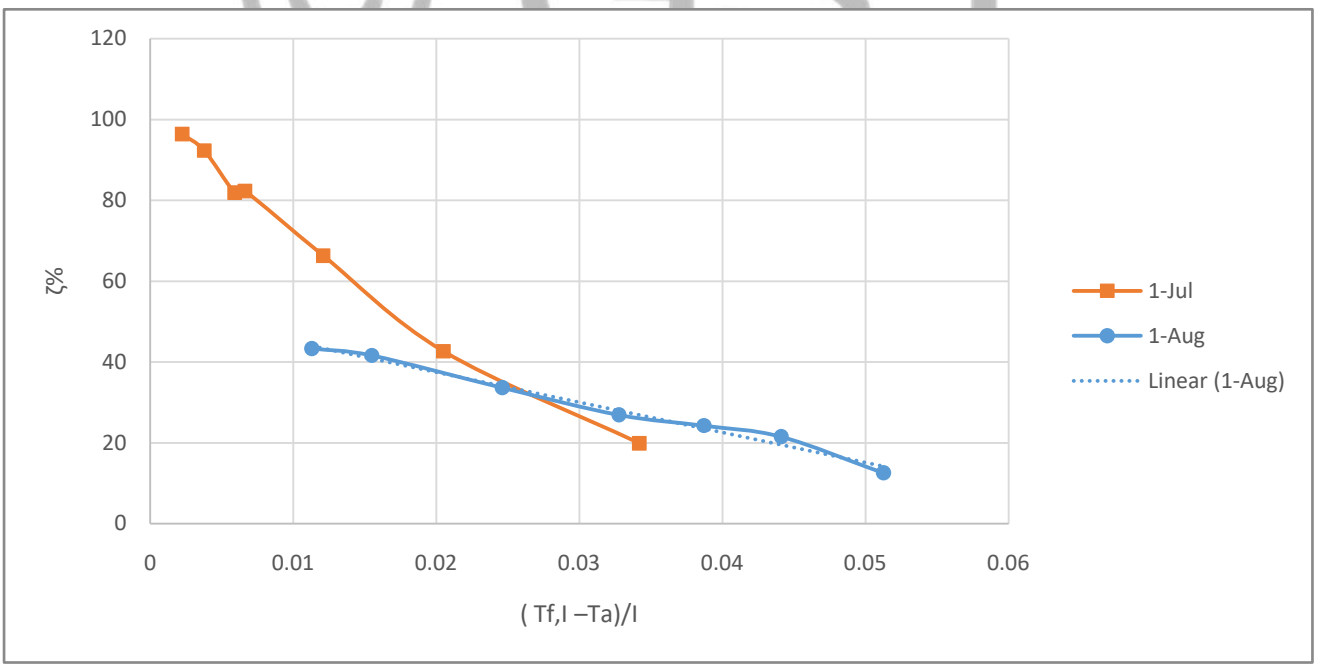
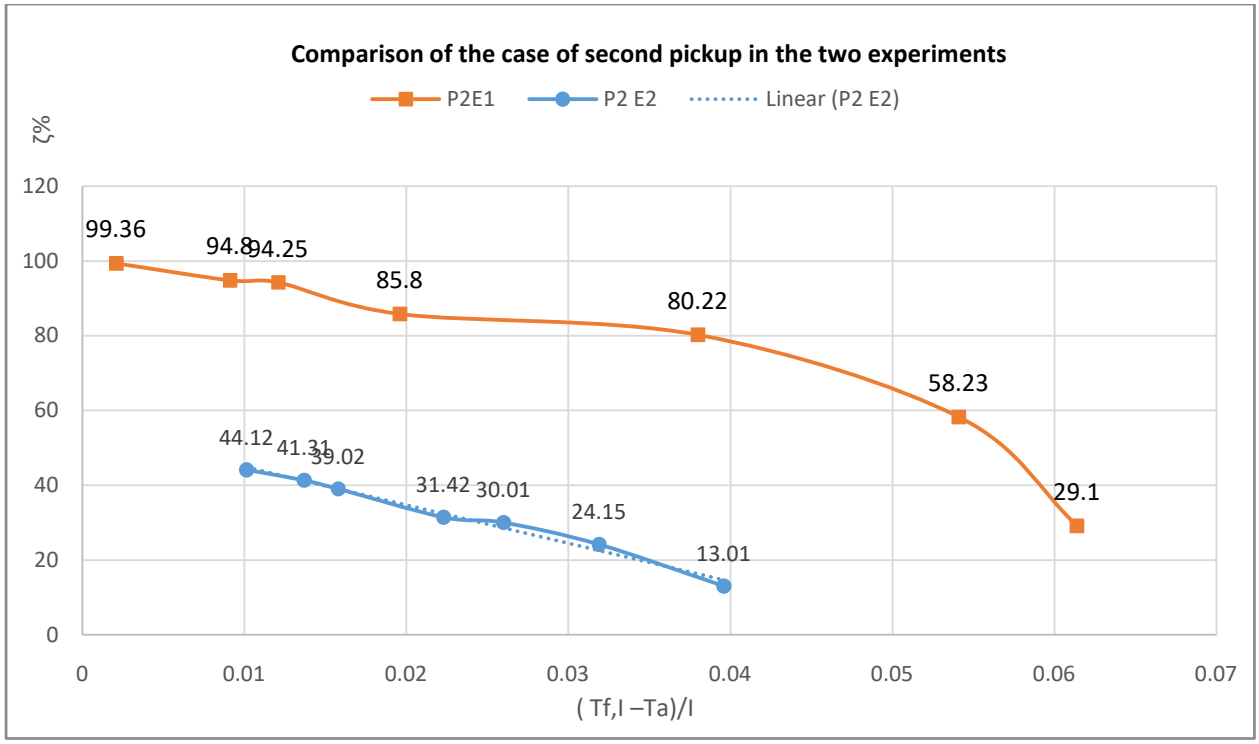


Fig. (7) Comparison of the case of first compound in the two experiments (in July & August)



Fig(8)

$P_2 E_1$ = Pickup 2 Exprimant 1

$P_2 E_2$ = Pickup 2 Exprimant 2

Discussion of results :

1. When comparing the compartments in the first experiment conducted in July, between the first shot with the absorbent plate croate with a non-gloses black paint (1) and the second pickup with the absorbent plate croate with black gloses paient weth chromium oxide added (2) The efficiency of the compound (2) is greater than the compound (1). This is due to the chromium oxide coating which made the absorbent sheet more selective in absorbing the largest amount of solar radiation and less emitting it.

2. A slowdown in the collapse of the (Tf i-Ta) / I values of any difference in temperature between input temperature Tf and i and the temperature of the external environment Ta to the intensity of the solar flux (I) relative to the first Accelerating decreases in (Tf i-Ta) / I values resulted in higher yield and efficiency in the compound (2).

3. When we left the compartments for about a month during this period, the compilers were exposed to the weather conditions of heat, wind and dust. In order to observe the effect of the weather conditions on the efficiency of the collectors in the absorption and the selectivity we observed through the second experiment that the efficiency of the complex (1) (6) However, when we compared in Figure (7) between the case of the first compound with the absorbent plate croate with a matte black color only in the experiment (2) 1) and the same compiler in experiment (2) had no efficiency yield In the first experiment was much larger than in experiment 2 because of the exposure of the absorbent plate to erosion

and weather conditions that led to the weariness of parts of the black paient, which greatly reduced the efficiency of plate absorption for solar radiation.

4. When comparing the case of the second complex in experiments (1) and (2), we observed that, as in Figure (8), the yield of the second compound in the first experiment was greater than in the second experiment after the selective absorbent plate was croate with a black, Chromium oxides for weather conditions have been less efficient in absorption and selectivity than they were a month before they were exposed to weather conditions, especially heat and dust. I took the readings without cleaning them or treating them so I knew how much heat, humidity and dust affected their efficiency.

5. Although the selective absorbent plate croate with a gloses black coating with chromium oxides added to the weather conditions from high temperature, dust and humidity within a month but still more efficient than the black-croate absorbent plate to resist the paient added to the atmospheric chromium oxides more than resistance Black paient is not treated with chrome oxides.

Sources:

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