



- وءاية لهم الليل نسلخ منه النهار فإذا هم مظلمون (37)
- (والشمس تجرى لمستقر لها ذلك تقدير العزيز العليم (38)
- والقمر قدرناه منازل حتى عاد كالعرجون القديم (39)
- لا الشمس ينبغي لها ان تدرك القمر ولا الليل سابق النهار)
- وكل في فلك يسبحون (40).

صدق الله العظيم

List of symbols

λ =wave length of electromagnetic radiation.

(λ) = Spectral.

I = radiation intensity.

θ =angle between surface normal and a given direction.

ϕ =azimuth angle.

t =thermal, when used as subscript, denotes a quantity summed up over the IR range of wave length 2.5 μm to50 μm in all direction.

T = time in seconds or minute.

s = solar, when used as subscript, denotes a quantity summed up over the range of wave lengths 0.3 μm to2.5 μm .

ρ =reflectance.

ρ_s =solar reflectance.

$\rho_{N(\lambda)}$ =mono chromatic, near-normal hemispherical reflectance.

ρ_N =near normal total reflectance.

α = absorptivity.

α_s =solar absorption.

\mathcal{E} =emittance.

\mathcal{E}_N =near normal, total-hemispherical emittance.

\mathcal{E}_t =thermal emittance.

τ =transmittance.

ν =frequency.

σ = Boltzman constant.

T = absolute temperature, K° .

E = energy flux.

I = Solar radiation intensity

K = thermal conductivity.

Q_u = useful energy;

A_c = Collector area.

U_L = heat transfer coefficient ($W m^{-2} K^{-1}$).

δ = declination angle.

h = heat transfer coefficient ($W m^{-2} K^{-1}$).

β' = volumetric coefficient at expansion.

V = kinematics viscosity (m^2 / s).

q_x = rate of heat flow in x direction by conduction.

β = collector tilt (degrees).

h_w = wind heat transfer coefficient.

ε_g = emittance of glass.

ε_p = emittance of plate.

U_b = bottom heat loss coefficient.

U_e = edge (side) heat loss coefficient.

U_t = top heat loss coefficient.

h_p = convection heat transfer coefficient from the plate and the fluid.

h_r = radiation heat transfer coefficient.

F' =the collector efficiency factor.

Nu = the Nusselt number.

T_p =plate temperature ($^{\circ}\text{C}$);

T_{av} =average temperature ($^{\circ}\text{C}$);

C =vacuum light velocity equal to 2.998×10 (m /s);

M_b = Radiation energy (radiosity);

h =Blank's constant equal 6.626×10 (w s);

θ_z =The solar zenith angle.

δ =solar declination angle.

R_s = the sun radius. w/m^2

T_s = surface temperature ($^{\circ}\text{C}$);

α = the solar altitude angle.

I_d =diffuse radiation wm^{-2} .

I_b = beam radian wm^{-2} .

I_N =is the intensity of beam radiation wm^{-2} .

R_b = beam radiation.

β =collector tilt angle (degrees).

q' =The direction of heat flux (w)

ρ' =the reflection coefficient of the ground.

K_o = is the thermal conductivity at temperature T_o .

T_a =ambient temperature ($^{\circ}\text{K}$);

R_a = the Raleigh number.

P_r = the Prandtl Number.

Re = Reynolds number.

Gr = the Grashof number

α_λ = monochromatic absorptance.

ϵ_λ = is monochromatic emittance.

g = gravitational constant (9.8 m/s^2).

β' = volumetric coefficient at expansion (For ideal gas $\beta' = 1/T$).

ΔT = temperature difference between plates (K°);

ν = kinematics viscosity (m^2/s);

α = thermal diffusivity (m^2/s);

ρ = Fluid density (kg/m^3);

q'_u = the useful energy Wm^{-2} .

U_L = overall heat loss coefficient for collector ($\text{Wm}^{-2} \text{K}^{-1}$).

Q_u = useful energy (W);

S = the solar radiation absorbed by a collector (Wm^2);

$T_{p,m}$ = the mean absorber plate temperature (K°);

F_R = Collector Heat Removed Factor.

\dot{m} = fluid flow rate Kg/s .

ε_g = emittance of glass.

ε_p = emittance of plate;

$T_{p,m}$ = mean plate temperature (K°);

h_w = wind heat transfer coefficient ($W m^{-2} K^{-1}$);

اهداء

الى منهل الحنان والمربية الفاضلة ... والدتى
الى معلمى الكبير وقدوتى والدى
الى روح اخى انس
الى سندی وعضدى .. اخوتى الكرام
الى حياتى القادمة اغاريد
الى كل من عرفت من اصدقاء ورفاق درب ...

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ملخص البحث

هدف هذا البحث لدراسة أثر الطلاء على كفاءة وأداء المجمع الشمسي المسطح .
لدراسة أثر التكسية السطحية على أداء المجمع الشمسي، استخدم ثلاثة أنواع من المجمعات، النوع (A) بدون طلاء والنوع الثاني (B) مطلي بطلاء اسود، والنوع الثالث (C) مطلي بخام المنجنيزو و بقياس درجات حرارة الماء الداخل والخارج للنوعين (A) و (B)، وقياس درجة حرارة السطح (C) وتغير درجة حرارة المجمع الشمسي نفسه، وذلك وفقاً لارتفاع وانخفاض الطاقة الشمسية الساقطة على المجمع. وقد أخذت القراءات كل نصف ساعة خلال اليوم من الساعة 9 صباحاً وحتى الساعة 6:30 مساءً.

وقد لوحظ تغير في كفاءة المجمع الشمسي وفقاً للطاقة الشمسية الساقطة عليه خلال اليوم، إذ وجد أن درجة حرارة الخارج ترتفع مع ارتفاع الطاقة الشمسية الساقطة عليها وبالعكس. حيث أن درجة حرارة الخارج المجمع الشمسي (A) تصل أعلى قيمة لها وذلك عند أعلى قيمة للطاقة الشمسية الساقطة، النوع (B) نجد أن أعلى درجة حرارة الخارج عند أعلى قيمة للطاقة الشمسية الساقطة، هذه القيمة أكبر مقارنة مع النوع (A)، مما يؤكد أهمية الطلاء في رفع كفاءة المجمع الشمسي المسطح، أيضاً نجد زيادة درجة حرارة السطح (C) أكبر من درجة حرارة السطح (B) مما يؤكد أهمية السطوح المنتقية في مجمعات الطاقة الشمسية. كما لوحظ أيضاً أن للمسافة الفاصلة بين الأنابيب تأثير على أداء المجمع الشمسي، فوجد أن أعلى قيمة للكفاءة تحدث عندما تكون هذه المسافة 10 سم، فاستخدم هذا في تصميم المجمعات. في هذا البحث حصلنا على كفاءة عالية في حالة الطلاء، ولكن من الممكن رفع الكفاءة أكثر بدراسة أعمق حول المجمعات، وذلك بتطوير المواد المستخدمة في تصميم المجمعات الشمسية، من حيث زيادة الامتصاصية وتقليل الانبعاثية، وذلك بالاستفادة من علم السطوح، في رفع كفاءة المجمعات الشمسية بصفة خاصة، وتحسين خصائص المواد بصفة عامة.

Abstract

The objective of the present work is to investigate the effect of paint coating on the efficiency of the flat plate collector.

In this study two types of the collector were been designed:

Type (A) uncoated and type (B) paint coated collectors and type (C) coated with Rhoddonite (Mn-SiO_3). The inlet and outlet water temperatures where compared together with the rise in temperature and its change in the collector and so the rise and fall of solar radiation up on the collector. Also measured the rise in temperature of type (C). Temperature was recorded every half hour during the day (9:00am, 6:30pm). It was noticed that the collector outlet temperature changing with the solar radiation change during the day where the outlet temperature increases with the radiation and vise versa. Maximum outlet temperature of type (A) collector was found to be at 917 w/m^2 where as that of type (B) was at 926 w/m^2 and hence it could be said that the paint coating increased the efficiency of the collector. The distance between the tubes was set to be 10 cm in both types.

It was found that it is possible to raise the efficiency of the collector by improvise properties of the materials used in the design special high absorbativity to infrared radiation and decreased reflectivity via studying surfaces which may improve efficiency of the collector

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