Application of MATLAB Programming In Solar Radiation System

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ABSTRACT

The emphasis is on understanding and investigating the mathematics and putting it in to practice in a wide variety of modelling situations. This is applied to large number of investigation and modelling problems from sequence of real number to Cafeteria queues MATLAB program is used to estimate the total solar radiation on a tilted panel surface. The implementation developed to allow us to extract the correct angle at which the maximum energy could be absorbed by solar energy as well as low grade energy such as waste heat

To extract the appropriate angle under which the maximum energy could be captured and absorbed by the solar cells. The performance of solar systems, to convert in to solar energy depends on its inclination angle to the horizontal plane, independently from metrological Conditions. Sunlight should fall with steep angle to extract maximum power from solar panels. Therefore, optimum fixed tilt angles of solar panels should be changed monthly and seasonally. In our study, MATLAB program is used to estimate the total solar radiation on a tilted panel surface with inclination. The implementation developed to allow us to extract the correct angle at which the maximum energy could be absorbed by the solar cells.

We can also determine the optimum tile angle for monthly, seasonal, and yearly for solar radiation relative to the site of Pune city, Maharashtra, India (latitude 180.5204' North and longitude 730.8567' East). We used the same method to draw the table of solar radiations depending on the optimum tilt angle of the solar panels in Pune. The aim of this paper is by using MATLAB software minimize the calculations, cutting down the energy cost, preserving our environment.

Keyword: - *MATLAB1, Solar radiation Energy2, Inclination3, Optimum tilt angle4.*

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1. INTRODUCTION

MATLAB programming is use to estimate the solar radiation on any inclined surface, we could determine the optimum tile angle for daily, monthly and yearly. Solar radiation relative to the site of Pune city Maharashtra India. The method could be extrapolated to other cities. How to extract the appropriate angle under which the maximum energy could be captured and absorbed by the solar cells. The availability of technical computing environment such as MATLAB is now reshaping the role and applications of computer laboratory projects to involve students in more intense problem-solving experience [7]. This availability also provides an opportunity to easily conduct numerical experiments and to tackle realistic and more complicated problems. The name MATLAB stands for Matrix Laboratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects [8]. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research. MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide.

1.1 Solar Radiation Conditions

In a given city, the annual production of solar energy depends on various factors.

Especially:

1.Incidental solar radiation at the installation site.

2. Tilt and orientation of panels.

3.Presence where there is no shading.

4. Technical performance of system components ,so we can use Adsorption System.

5. Radiation received by the ground Solar Cell (diffuse, direct and global).

6.Energy from the Sun at the Earth's Surface

In the previous section, we posed a number of definitions allowing us to formulate the concept of solar radiation outside the atmosphere. This quantity is readily measurable because it is considered that it depends only on the distance between the measuring points of the Sun. We will see in this paragraph, the passage through the atmosphere will tend to complicate the understanding of the phenomenon, the multiple interactions that may occur, in what follows, we consider the model of inclination of global radiation in the case of a clear sky.that passes in a straight line through the atmosphere to the receiver that has been scattered by molecules and aerosols in the atmosphere/that has bounced off the ground or other surface in front of the collector We have developed a code by using Matlab, and we can give the different coordinate systems used to calculate the solar irradiation, according to time in Pune city, Maharashtra, India (latitude 180.5204′ North and longitude 730.8567' East).

1.2 Direct Irradiation

This irradiation is received directly from the sun traveling through the atmosphere without modification.

The capture area is placed in the following conditions: The sun's position is defined by its elevation (h) and azimuth (φ).

The azimuth angle (φ) is measured relative to the South [2].

The collector plan is oriented with respect to the south and inclined at an angle as tilt angle.

2. Keeping track of your work session

It is possible to keep track of everything done during a MATLAB session with the diary command.

```
>> diary
```

or

give a name to a created file,

```
>> diary File Name
```

Where,

File Name could be any arbitrary name which you can choose The function diary is useful if you want to save a complete MATLAB session. They save all input and output as they appear in the MATLAB window. When you want to stop the recording, enter diary off. If you want to start recording again, enter diary on. The file that is created is a simple text file. It can be opened by an editor or a word processing program and edited to remove extraneous material, or to add your comments. You can use the function type to view the diary file or you can edit in a text editor or print. This command is useful, for example in the process of preparing a homework or lab submission [8]

2.1 Calculation of solar radiation received on the optimum tilt angle surface

We will study in this part the influence of the optimum tilt angle on the amount of solar irradiation received on a surface of 1m2, in Pune city we used the results of previous part, the optimal tilt angle is 30° and the direction of the azimuth 180° (south). Daily irradiation The Matlab code that we used, allows us to calculate and plot the daily solar irradiation received on an optimal exposure surface of the typical days of each month. We have added curves giving the daily variations of the solar irradiation, indicating the maximum of direct, diffuse and global solar energy arriving at a surface of optimal exposure [5].

2.2 Experimental data of solar irradiation in Pune city

h: The angle of the solar height —

Elevation The angle of the sun's height (h), or the altitude is the angle between the direction of the sun and the horizontal surface; the elevation from 0° to 90° towards the zenith [1].

Z: The zenith angle

It is the angle between the direction of the sun and the vertical of the place (zenith). The angle is complementary to [2]

α: The Azimuth angle

This is the angle between meridian and the location of the vertical surface passing through the sun [3]

The consumption of low grade energy by the units does not pose any problems of emission of greenhouse gases (hydrofluorocarbon, carbon dioxide, nitrous oxide, methane, perfluorocarbon and Sulphur hexafluoride). Furthermore, solar powered radiations based on adsorption cycle is simple, quiet in operation and adaptable to small, medium or large systems. Thus, adsorption refrigeration is considered alternative to the conventional vapor compression refrigerator, especially in remote areas of the world without grid connected electricity [3]. Activated carbon /methanol, activated carbon/ammonia, zeolite/water and silica gel/water are the adsorbent /adsorbate pairs commonly used in practically realized adsorption refrigeration cycles.

Pressure Swing Adsorption (PSA) simply defines a cyclical process where the pressure is alternatively raised and lowered thereby forcing an adsorbent to adsorb a particular adsorbate at its porous surface during pressurization and to release the adsorbate during de pressurization. The adsorption process is exothermic which becomes endothermic during desorption. In a PSA system, the adsorbent is regenerated by reducing the gas pressure [4].

The adsorption/desorption cycle is perfectly reversible and can be repeated for years without causing any degradation in the adsorbent. The adsorption/desorption cycle is perfectly reversible and can be repeated for years without causing any degradation in the adsorbent. The PSA system has already revolutionized the gas separation industries over the last decade, and also finding increasing use in refrigeration industries as adiabatic de-sorption for a gas can, which produces a low enough cold temperature for replacement of CFCs from any refrigeration systems [2].

Adsorption

The gas or liquid accumulates on the surface of solid is known as adsorbate. The solid substance on which adsorbate accumulates is known as adsorbent. Adsorption is the accumulation of atoms or molecules on the surface of a material. This process creates a film of the adsorbate (the molecules or atoms being accumulated) on the adsorbent's surface.

It is an exothermic and reversible process as a result of the gas-liquid phase change without modification of the solid itself the liberated energy during the adsorption is called isosteric heat of adsorption and its intensity depends on the nature of the adsorbent/ adsorbate pair, the adsorbed mass and the latent heat [5].

The principle of the solid-adsorption ice maker is explained using a Clapeyron diagram (in P versus -1/T). Fig.1 shows the idealized process undergone by adsorptive pair in achieving the refrigeration effect (producing ice). The cycle begins at a point A where the adsorbent is at a low temperature TA and at low pressure Pe (evaporator pressure). During the daylight, AB represents the heating of adsorptive pair. The progressive heating of the adsorbent from B to D causes some adsorbate to be desorbed and its vapor to be condensed at the condenser pressure Pc. When the adsorbent reaches its maximum temperature TD, desorption ceases [1].

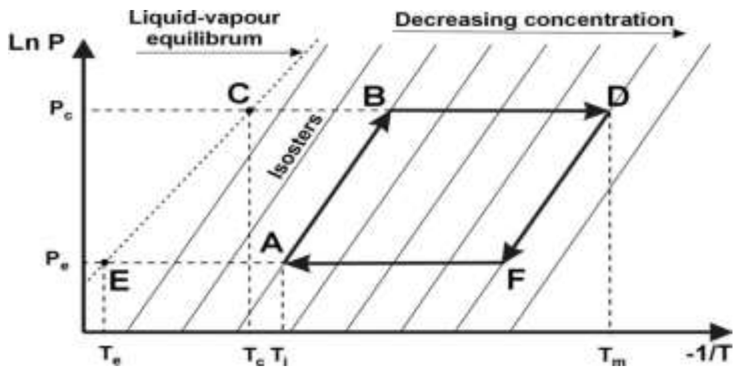

Fig -1 An ideal adsorption cooling cycle in the claperyon diagram.

Then the liquid refrigerant is transferred into the evaporator. During night, the decrease in temperature from D to F induces the decrease in pressure from Pc to Pe. Then the adsorption and evaporation occur while the adsorbent is cooled from F to A. During this cooling period heat is withdrawn both to decrease the temperature of the adsorbent and to withdraw adsorption heat[3].

Adsorption Cycle

From the Clapeyron diagram, the total energy gained by the system during the heating period QT will be the sum of the energy QAB used to raise the temperature of the A.C+ methanol from point A to B and the energy QBD used for progressive heating of the A.C to point D and desorption of methanol[6].

QT = QAB + QBD

QAB = (MA:C CpA:C + Cpm MmA) (TB - TA)

QBD = [MA:C CpA:C + Cpm { (MmA + MmD)/2}] (TD - TB) + (MmA – MmD)H

The gross heat released during the cooling period

Qe1 will be the energy of vaporization of methanol.

Qe1 = (MmA – MmD) L

But the net energy actually used to produce ice Qe will be

Qe = Qe1 +Qe2

where Qe2 is the energy necessary for cooling the liquid adsorbate from the temperature at which it is condensed to the temperature at which it evaporates [7].

Qe2 = (MmA – MmD) Cpm (Tc - Te)

Qice1 is the energy required to cool water from TA to 0 ºC and to produce ice

Qice1 = M* (L* + Cpwater (TA - 0))

where

M* and L* are the mass and latent heat of fusion of ice and net cooling produced will be

Qice = M* L*

Nomenclature

Cp specific heat, kJ/kgK
H heat of desorption, kJ/kg
L latent heat of evaporation of the methanol, kJ/kg
M mass, kg
Q energy, kJ
T temperature, ºC

Subscripts

c condenser
e evaporator
m methanol
st steel pieces
T total

3. Solar powered adsorption system

These solid adsorbent beds adsorb and desorb a refrigerant vapor in response to changes in the temperature of the adsorbent. Here adsorbent is an Activated carbon and the refrigerant used is methanol. The basic adsorption refrigeration system, commonly referred to as the adsorption heat pump loop, or an adsorption refrigeration circuit, it consists of four main components: a solid adsorbent bed, a condenser, and an evaporator ice-box.

The solid adsorbent bed desorbs refrigerant when heated and adsorb refrigerant vapour when cooled. In this manner, the bed can be used as a thermal compressor to drive the refrigerant around the system to heat or cool a heat transfer fluid or to provide space heating or cooling. Thus in this system bed (of activated carbon) acts as compressor so as to drive refrigerant(methanol) similar to compressor. The refrigerant is desorbed from the bed as it is heated to drive the refrigerant out of the bed and the refrigerant vapor is conveyed to a condenser. In the condenser, the refrigerant vapor is cooled and condensed to liquid. The low pressure condensate passes to an evaporator where the low pressure condensate is heat exchanged with the process stream or space to be conditioned to vaporize the condensate [8]. When further heating no longer produces desorbed refrigerant from the adsorbent bed, the bed is isolated and allowed to return to the adsorption conditions. When the adsorption conditions are established in the bed, the refrigerant vapor from the evaporator is reintroduced to the bed to complete the cycle. For the circulation of methanol in the system the whole system should be vacuumized [3].

3.1 PRINCIPLE OF SOLAR POWERED ADSORPTION

Fig.3 shows schematic layout of a no valve solar flat plate ice maker. The solar ice maker consists of an adsorbent bed (2), a condenser (5), an evaporator (7), water tank (8), insulation box (9) as well as connecting pipes. For this system, there are no any reservoirs, connecting valves and throttling valve, the structure of the system is very simple. The working principle of this no valve solar ice maker is described as follows[7]

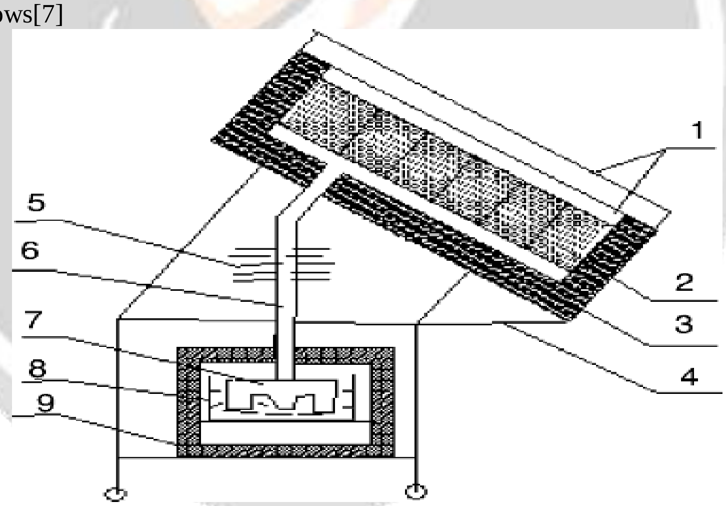

Fig-3: (1) cover plate, (2) adsorbent bed, (3) insulation materials, (4) frame, (5) condenser, (6) connecting pipe, (7) evaporator, (8) water tank, (9) insulation box

On a sunny day, the adsorbent bed absorbs solar radiation energy, which raises the temperature of adsorbent bed as well as the pressure of methanol in adsorbent bed. When the temperature of adsorbent reaches the desorption temperature, the refrigerant begins to evaporate and desorb from the bed. The desorbed refrigerant vapor will be condensed into liquid via the condenser and flows into the evaporator directly; this desorption process lasts until the temperature of adsorbent reaches the maximum desorption temperature[4]. During night, when the temperature of the adsorbent bed reduces, the refrigerant vapor from the evaporator gets adsorbent back in the bed. During this adsorption process, the cooling effect is released from refrigerant evaporation, and the ice is formed in the water tank placed inside thermal insulated water box. Likely in a vapour compression system the adsorption refrigeration system also consists of a compressor, a condenser, and an evaporator but no throttle valve is used. However, in this system the compressor is replaced by a thermal compressor which is operated by heat instead of a mechanical energy. The vaporized refrigerant is adsorbed in the pores of the adsorbent in the reaction chamber i.e. adsorbent bed.Thus the operation of the adsorption cooling system depends on adsorption/desorption characteristics of the particular adsorbent/refrigerant pair. Due to the loading of the adsorbent, the thermal compressor is operated intermittently [5].

Adsorption cycle

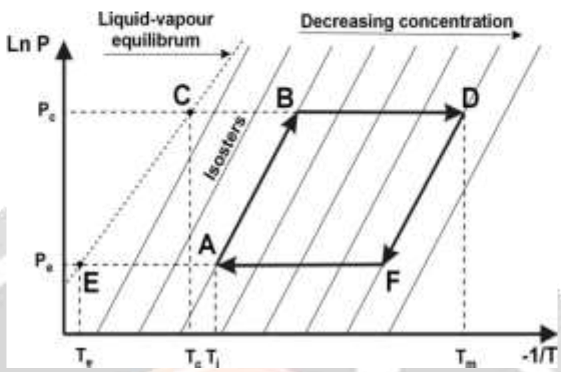

Fig-3: An ideal adsorption cooling cycle in the claperyon diagram.

Heating period: step AB (7 a.m.→10 a.m.) and step BD (10 a.m.→4 p.m.); cooling period: step DF (4p.m.→7 p.m.) and step FA (7 p.m.-7a.m) [6]

The cycle is explained in detail in (Buchter F., 2001). We can summarize it in four stages
Step 1: Isosteric heating (A→B): The system temperature and pressure increase due tosolar irradiance.
Step 2: Desorption + condensation (B→D

Desorption of the methanol vapours contained in the activated carbon bed; condensation of the methanol steam in the condenser. Step 3: Isosteric cooling (D→F)

Decrease of the period of sunshine; cooling of the activated carbon; decrease of the pressure and the temperature in the system. Step 4: Adsorption + evaporation (F→A)

Radiations are incident on the fiber glass which is situated above bed, activated carbon will try to absorb heat as much as it can and it gets heated thus temperature in the bed rises up to 90 °C to 100 °C Evaporation of methanol contained in the evaporator; cooling of the cold cabinet; production of ice in the evaporator; re-adsorption of methanol steam by the activated carbon [2].

3.2 OBSERVATIONS

Tbdes = Temperature before desorption
This temperature is taken before desorption process starts i.e. during morning session measured at adsorbent bed[2].

Tades = Temperature after desorption
This temperature is taken after desorption completes i.e at the end of day during evening session at adsorbent bed.

Ta = Temperature at point A
This temperature is taken before afternoon session at the start of isosteric heating at adsorbent bed.

Tb = Temperature at point B

This temperature is taken at afternoon time of the day and at the end of isosteric heating and desorption process at adsorbent bed.

Td = Temperature at point D

This temperature is taken during evening session after desorption completes at adsorbent bed.

Tcc = Temperature of condensate

This is temperature of condensate measured by measuring water/ice temperature at ice box during early morning session.

Tee = Temperature of evaporate

This is temperature of evaporate measured by measuring water/ice temperature at ice box during early

Temperature	Temp(K)	Temp(K)
Ta	303	304
Tb	312	313
Td	324	324
Tcc	291	292
Tee	290	290

4. OBSERVATION TABLE

Table-1: Various Temp. of the Solar Radiation

Dates / Temperatures (K)	1st 1/04/21	2nd 15/04/21	3rd 30/04/21	4th 1/05/21
Tbdes	303	302	304	303
Tade1s	323	323	321	322
Ta	303	310	304	303
Tb	311	310	312	311
Td	323	323	321	322
Tcc	288	289	288	288
Tee	287	288	287	287

Dates Temperatures(K)	5th 15/05/21	6th 31/05/21
Tbdes	303	304
Tades	324	324

During the period of 10 am to 3pm thus the temperature in bed during this period reaches to 100 ºC to 120 ºC. After 3 pm the temperature in bed gets lower and lower. Till 5.30 pm the temperature lowers to 20dgree c and desorption continues till that time [7]. After this, temperature remains almost constant till 10.30 pm, now the adsorption of methanol starts. As adsorbent bed adsorbs vapours of methanol thus the temperature of adsorbent bed increases up to 60 ºC, approximately at midnight temperature is about 60 ºC – 70 ºC. after this the temperature again starts decreasing and exothermic reaction carry on [3] And now the bed will attain temperature of surrounding i.e.25 °C[4].

4.1 Calculations Made from Observation

By Clapeyron theory the mass of methanol at point A and D is [2],[3]

Let, Mm = 1.3575 KG,
mass of total methanol in system.

Mma = Mm*(75/100), mass of methanol at point A
=1.3575*0.75
=1.018125 KG

Mmd = Mm*(25/100), mass of methanol at point D
=1.3575*0.25
=0.339375 KG

Mac =19
CPac = 0.9300
CPm =2.6060

Heat of desorption, H in KJ/KG
H=(CPm*(Tades-Tbdes)) [1]
Total solar energy input to system during day (KJ/Kg K) Qi=16.28 [2]
Energy used Qab to rise the temperature of a.c.+ methanol from point A to B

$Qab=((Mac*CPac)+(CPm*Mm))*(Tb-Ta)$ [3]

Energy Qbd used for progressive heating of the a.c to point D (KJ)
$Qbd=((((Mac*CPac)+(CPm*((Mma+Mmd)/2)))*(Td-Tb))+((Mma-Mmd)*H))$ [4]

Total energy gained by solar energy during heating period Qt (KJ)
$Qt=Qab+Qbd$ [5]

Qe1 Energy of vaporization of methanol (KJ) $Qe1=(Mma-Mmd)*L$ [6]

Qe2 Energy necessary for cooling the liquid adsorbate (KJ)
$Qe2=(Mma-Mmd)*CPm*(Tcc-Tee)$ [7]

Net energy actually used to produce ice Qe (KJ) $Qe=Qe1+Qe2$ [8]

Qice1 Energy required to cool water from Ta to 15 oC and to produce ice (KJ)
$Qice1=Mice*(Lice+(CPwater*(Ta-288)))$ [9]

Net cooling produced Qice
$Qice=Mice*Lice$ [10]

The collector/adsorbent bed efficiency (%)
$n1=(Qt/Qi)$ [11]

The evaporator efficiency (%)
$n2=(Qice1/Qe)$ [12]

The cycle COP (%)
$COPcycle=Qe1/Qt$ [13]

The net solar COP(%)
$COPsolar=Qice/Qi$ [14]

4.2 RESULTS AND DISCUSSION

Table-2: Analysis of the adsorption solar powered [7]

Dates Analyzed Parameters (Energy, KJ)	1st 1/04/21	2nd 15/04/21	3rd 30/04/21
Qi	16280	16280	16280
Qab	169.661	169.661	169.661
Qbd	268.642	289.95	205.019
Qt	438.303	459.511	374.680

Qe1	785.924	785.924	785.924
Qe2	1.7688	1.7688	1.7688
Qe	784.155	784.155	784.155
Qice1	628.525 0	607.59	649.46
Qice	314.500 0	314.500	314.500

Dates Analyzed Parameters (Energy, KJ)	4th 01/05/21	5th 15/05/21	6th 31/05/21
Qi	16280	16280	16280
Qab	169.6612	190.8688	190.8688
Qbd	247.4347	270.4111	249.2035
Qt	417,0958	461.2799	440.0723
Qe1	785.9246	785.9246	785.9246
Qe2	1.7688	1.7688	3.5376
Qe	784.1558	784.1558	782.3870
Qice1	628.5250	628.5250	649.46
Qice	314.5000	314.5000	314.5000

Table-3: Efficiency and COP For Solar Energy [4]

Dates Analyzed Parameters (Energy, KJ)	1st 1/04/21	2nd 15/04/21	3rd 30/04/21
η1	0.0269	0.0282	0.0230
η2	0.8015	0.7748	0.8282
COPcycle	1.7931	1.7103	2.0976
COPsolar	0.0193	0.0193	0.0193

Dates Analyzed Parameters (Energy, KJ)	4th 01/05/21	5th 15/05/21	6th 31/05/21
η1	0.0256	0.0283	0.0270
η2	0.8015	0.8015	0.8301
COPcycle	1.8843	1.7038	1.7859
COPsolar	0.0193	0.0193	0.0193

4.3 SAMPLE CALCULATION USING MATLAB SOFTWARE

(Input and Output for 1st reading) PROGRAM

```
clc

clear all

% KNOWN VALUES FROM THE SYSTEM %
% MASS OF ACTIVATED CARBON IN KG
%Mac=19

% SPECIFIC HEAT OF ACTIVATED CARBON IN KJ/KG*K
%CPac=0.93

% MASS OF METHANOL IN KG %
Mm=1.3575

% SPECIFIC HEAT OF METHANOL IN KJ/KG*K
%CPm=2.606

% MASS OF METHANOL AT POINT A IN KG
%Mma=1.018125

% MASS OF METHANOL AT POINT D IN KG %
%Mmd=0.339375

% TEMERATURE BEFORE DESORPTION IN K %
Tbdes= input('TEMPERATURE BEFORE DESORPTION Tbdes=')

% TEMERATURE AFTER DESORPTION IN K %
Tades= input ('TEMPERATURE AFTER DESORPTION Tades=')

% HEAT OF DESORPTION, H IN KJ/KG
%H=(CPm*(Tades-Tbdes))

% LATENT HEAT OF EVAPORATION OF METHANOL IN KJ/KG
%L=1157.9

% SPECIFIC HEAT OF WATER IN KJ/KG*K
CPwater=4.187

% MASS OF ICE IN KG
% Mice=5

% LATENT HEAT OF FUSION OF ICE IN KJ/KG
 %Lice=62.9

% TOTAL SOLAR ENERGY INPUT TO SYSTEM DURING DAY (KJ)
%Qi=16.28

% READINGS OBTAINED FROM SYSTEM %
% TEMPERATURE AT POINT B (K) %
```

```
Tb= input('TEMPERATURE AT POINT B Tb=')
% TEMPERATURE AT POINT A (K) %

Ta= input('TEMPERATURE AT POINT A Ta=')
% TEMPERATURE AT POINT D (K) %

Td= input('TEMPERATURE AT POINT D Td=')
% TEMPERATURE OF CONDENSATE Tcc (K) %

Tcc= input('TEMPERATURE OF CONDENSATE Tcc=')
% TEMPERATURE OF EVAPORATES Tee (K) %

Tee= input('TEMPERATURE OF EVAPORATE Tee=')
% ANALYSIS OF THE SOLID ADSORPTION SOLAR POWERED ICE-MAKER %

% ENERGY USED Qab TO RISE THE TEMPERATURE OF A.C.+ METHANOL FROM POINT A TO B (KJ) %

Qab=((Mac*CPac)+(CPm*Mm))*(Tb-Ta)
% ENERGY Qbd USED FOR PROGRESIVE HEATING OF THE A.C TO POINT D (KJ) %

Qbd=((((Mac*CPac)+(CPm*((Mma+Mmd)/2)))*(Td-Tb))+((Mma-Mmd)*H))
% TOTAL ENERGY GAINED BY SOLAR ENERGY DURING HEATING PERIOD Qt (KJ) %

Qt=Qab+Qbd
% Qe1 ENERGY OF VAPOURISATION OF METHANOL (KJ) %

Qe1=(Mma-Mmd)*L
% Qe2 ENERGY NECESSARY FOR COOLING THE LIQUID ADSORBATE (KJ)

 %Qe2=(Mma-Mmd)*CPm*(Tcc-Tee)
% NET ENERGY ACTUALLY USED TO PRODUCE ICE Qe (KJ) %

Qe=Qe1-Qe2

%Qice1 ENERGY REQUIRED TO COOL WATER FROM Ta TO 15 °C AND TO PRODUCE ICE (KJ) %

Qice1=Mice*(Lice+(Cpwater*(Ta-288)))

%NET COOLING PRODUCED Qice (KJ) %

Qice=Mice*Lice

%PERFORMANCE ESTIMATES OF THE SOLID ADSORPTION SOLAR POWERED ICE-MAKER %

%THE COLLECTOR/ADSORBENT BED EFFICIENCY (%)
% n1=(Qt/Qi)

%THE EVAPORATOR EFFICIENCY (%)
 % n2=(Qice1/Qe)
THE CYCLE COP %

COPcycle=Qe1/Qt

% THE NET SOLAR COP %

COPsolar=Qice/Qi
```

INPUT

Mac =19

$C_p$ac = 0.9300

Mm =1.3575

CPm =2.6060

Mma =1.0181

Mmd = 0.3394

TEMPERATURE BEFORE DESORPTION Tbdes=30+273

Tbdes =303

TEMPERATURE AFTER DESORPTION Tades=50+273

Tades =323

H =52.1200

L =1.1579e+003

CPwater =4.1870

Mice =5

Lice = 62.9000

Qi =16280

TEMPERATURE AT POINT B Tb=38+273

Tb =311

TEMPERATURE AT POINT A Ta=30+273

Ta =303

TEMPERATURE AT POINT D Td=50+273

Td =323

TEMPERATURE OF CONDENSATE Tcc=15+273

Tcc =288

TEMPERATURE OF EVAPORATE Tee=14+273

Tee =287

OUTPUT

Qab =169.6612

Qbd =268.6423

Qt =438.3035

Qe1 = 785.9246

Qe2 =1.7688

Qe =784.1558

Qice1 = 628.5250 Qice =314.5000
n1 =0.0269

n2 =0.8015

COPcycle =1.7931

COPsolar =0.0193

5. CONCLUSIONS

The end of this document contains two useful sections: which contains the brief summary of the commands and built-in functions as well as a collection of release notes. The release notes, which include several new features of the Release 14 with Service Pack 2, well known as R14SP2. All of the MATLAB commands have been tested to take advantage with new features of the current version of MATLAB. Although, most of the examples and exercises still work with previous releases.

Reductions of manufacturing costs and for the formulation of new adsorbent compounds with enhanced adsorption capacity and improved heat and mass transfer properties. Because adsorption systems are generally poor thermal machines. The performance

The following conclusions may be drawn from the Matlab Programming.

- By the Matlab Programming it's easy to reach on the Conclusion that condenser and evaporator must necessarily be close to each other and to the collector, since the system operates at low pressure, thus they are located directly under the collector such that the refrigerant flows into them by gravity.

- All Calculation done Very efficiently and simple way to track your work session.

- The heart of the system is adsorption bed and it has the greatest effect on the performance of the system.

6. REFERENCES

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