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CONDENSATION AND WATER VAPOUR RAISE CHARACTERISTICS OF REFRIGERANTS WITH COMPARATIVE ANALYSIS OF COP

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ABSTRACT

The aim of this project is to raise water vapour content in the atmosphere by adopting blended refrigerants to alter various CFC which has more cooling effect and less GWP. As the Global warming increases day to day, it may leads to extinct some live species due to high heat in the earth's surface. We design a condensing unit for cooling and producing water vapour content in the atmosphere. The blended refrigerants gives more efficient than practicing of R134a alone and gives zero depletions with increased cooling effect. In this project the atmospheric air is going to be used instead of using for the preservation of foods. This convection delivers the cool air without any harmful emissions as the blends gives less GWP. The refrigeration unit cools the inlet atmospheric air and delivers the cold air and also gives droplet of pure water by giving high pressure and circulation within the cooling medium. In the result, increase of watervapour content in the atmosphere, High COP, High cooing effect as in air conditioner and may have doplets of water from the output, thus leads to formation of water from the atmosphere.

Keywords-Refrigeration, Blends, Convection, Water vapour, GWP.

INTRODUCTION

The globalization increases yearly that leads to high pollution, High level of carbon content leads to high global temperature. Using Air conditioner, we can decrease the temperature level inside the room or hall but it results high level of temperature in the atmosphere. According to the Law of Conservation of Energy, "***Energy can neither created nor destroyed, but can convert from one form to an other form".*** From these statement, we can control the level of temperature in some area that results in the varying level of temperature in some other areas.

The Vapour compression cycle is the most base for all the refrigerators which used for preservations. And it consist mainly of compressor, condenser, expansion valves, and the evaporator. Apart from these devices, the heart of the refrigeration is Compressor, where the working fluid (Refrigerants) inserted. The function is to increase the pressure of these refrigerants through the piston movements for condensation. Through the Second law Thermodynamics,"***Heat flow from hot body to cold body***" the flowing of these refrigerant(Blends) can absorb the most of the temperature in the medium and continue the stable medium. And this absorbed heat will be refracted through the water which used for decrease the temperature of refrigerants from the compressor, which can also be used as heater.

There is no possible of Dry air in the atmosphere even in the high temperature

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areas. Because there will be some humidity in there that only leads for chillness when the air crossed over us. Through this small humidity we can boost the level through this condensation unit.

RAW MATERIALS

The setup is mainly of two units,1.)refrigeration unit, 2.)condensation unit.

1.)Domestic refrigerator

A domestic refrigerator work upon vapour compression refrigeration cycles. In vapour compression cycles there are basically four basic process:

1) Isentropic compression process
2) Constant Pressure heat rejection process
3) Isenthalpic expansion and
4) Constant pressure and constant temperature heat extraction.

a) **Isentropic compression process:-**The Isentropic compression is shown by the line 1**-**2.Since the vapour is dry and saturated at the start of compression it becomes superheated at the end of compression as given by point 2.
b) **Constant pressure heat rejection process:-**The Isobaric heat rejection process is shown by the line 2-3.The process of condensation which takes place at constant pressure line 2-3.
c) **Isenthalpic expansion process:-**The vapour now reduced to saturated liquid is throttle through the expansion valve and line as shown by 3-4
d) **Constant pressure and constant temperature heat extraction Process:-** The dry saturated vapour is drawn by compressor from evaporator at lower pressure P_4 and then it vapor is compressed isentropic ally to the pressure P_2.

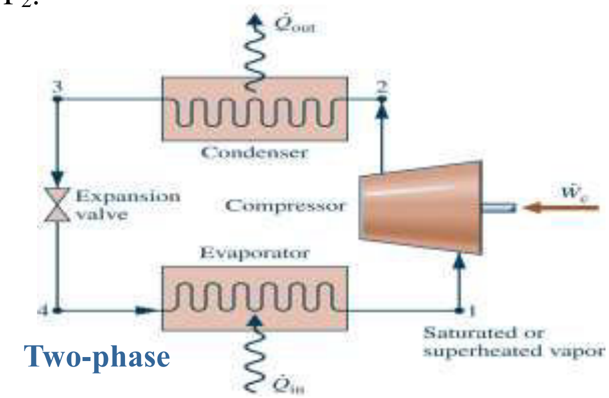

Figure1: Vapour compression cycle

From the performance of the refrigerator, the coefficient of performance is calculated and it is expressed as,

COP=Refrigerant effect / compressor work $=(h_1-h_2) /(h_2-h_3)$

And it includes compressor, condenser, expansion valve, evaporator which made of copper tubes because of its high thermal conductivity.

2.)Condensation Unit

We design a unit made of PVC pipes which available in cheap with Open/Close valve. Using Reducer the pipes and the valves are connected. There are two Lines,

- Suction line,
- Receiver line.

The suction line sucks the atmospheric air into the cooling medium where the refrigerants are passing out and the suction is done by a device called Fan(6 cm dia) which is run by 9 V battery. Similar to suction line, Receiver line receives the

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fluid(cold air) from the cooling medium and made constant circulation in the unit.

Figure2: Consensation unit

3.) Refrigerants

The refrigerants are the working fluid which absorb the temperature and these can be blend by mixing different refrigerants with several compositions. It may use as two or three refrigerants. Here we use R134a, R600a, R600a/R601a.

1. **R134a (TETRAFLUROETHANE):-** R134a is the long-term replacement refrigerant for R12 because of having favorable characteristics such as zero ODP, non-flammability, stability and similar vapour pressure as that of R12. The ODP of R134a is zero, but it has a relatively high global warming potential. Many studies are being carried out which are concentrating on the application of environmen-tally friendly refrigerants in refrigeration systems.

2. **R600a (ISOBUTANE):-** This work presents an study on the application of HFC134a to replace R600a in a domestic refrigerator. A refrigerator designed to work with R600a with a gross capacity experiment.R600a low pressure level is connected to a relatively high critical temperature, good Performance and Increased efficiency .Zero ozone depletion and negligible global warning potential.

3. **R601a (ISOPENTENE):-** Similar to the R600a, R601a is a Hydrocarbon(HC) family which has zero ozone depletion and low global warming potential.

Refrigerant	*R 600a*	*R 134a*	*R 601a*
Name	Isobutene	TetraFluro -Ethane	Isopentane
Formula	C_4H_{10}	CH_3CH_2F	C_5H_{12}
Critical Temp°C	135	**101**	187
Molecular W in kg/k Mole	58.1	102	72.15
Normal Boil point	-11.6	-26.5	27.8

Table 1: Properties of R600a, R134a & R601a used in household applications

Design and experimental setup of Refrgerator

In this chapter an experimental set up is designed to find the COP of the domestic vapour compression system. The system consists of 1/8 HP domestic refrigerator. The main objectives of the set up will be to stabilize the evaporator temperature constant during the experiment on explain in the aim of the present work. In this experimental R-

600a is compared with the R-134a and R600/R601 with the R134a in a domestic refrigeration system. The hermit sealed compressor, the air cool natural convection condenser and the capillary tube used for the set up are the same as for domestic refrigerator. The evaporator is placed in an insulated box which may be the use itself. The compressor is usually of 1/8 th it's a approximate 100 watt. If the overall COP of the refrigerator is assumed unity at full load. The refrigerator effect will be 100 watt. In the experimental set up, the cooling load may be provided by lamp bank. The load can be varied by with 15 watt, 30 watt, 45 watt lamp. The vapour compression refrigeration system, so that the experimental can be carried out at different load. The watt of lamp is calculated the experiment set up as shown in fig.

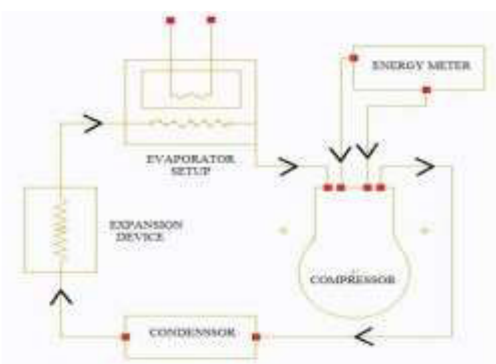

Figure3: Design layout of Experiment setup
The experiment set up consists of following component.

1) The compressor usually sealed. The power to the compressor (watt) is measured by an energy meter disc type. And a stop watches. The digital thermometer is used.
2) The condenser
3) The expansion device (capillary tube)
4) The evaporator
5) Lamp bank.

The evaporator lamp bank be placed is an insulated chamber the instrument.

- Pressure gauge is fit the suction and discharge of the compressor.
- Thermocouple is measured by temperature at various points.

EXPERIMENTAL PROCEDURE

The compressor delivers the pressurized working fluid (blended refrigerant) with high temperature. This high temperature reduced by continuously circulating the water over the refrigerants as the conduction and the circulation is done by a submerged pump. The heat exchanger (condenser) dissipates the additional heat in the refrigerant to the surrounding, thus vapour condensed to liquid. And in the throttling device, the refrigerant should have high pressured and it restricts the flow, which causes a pressure drop results in lower boiling point, starts to evaporate.

From the suction line The sir gets enters in to the cooing medium through the fan. In the evaporator which is covered by Thermo resin, the cold refrigerant transfers the heat from the inlet air through the cooling medium as convection, then the hot refrigerant circulate the refrigeration unit. The air gets more wet by close the suction valve and circulate in the medium. By opening the receiver valve, the wet air gets entered in to the receiver by receiver fan where the outlet valve is closed. Then, the air gets circulated in the receiver and gets more wet in the air. After some period, by open the outlet valve and closing of receiver valve, we can get cold air and droplet of water repeatly.

To calculating COP, for the first 15 minute

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Cooling temperature	compressor In		Compressor Out		Condenser Out	
	P1	T1	P2	T2	P3	T3
12	1.8	20	10.3	70	8.6	10.4
10	1.8	15	11.4	72	8.8	8.4
8	1.7	15	11.6	72	8.6	5.5
5	1.6	14	12	74	9.1	5.3
4	1.6	15	12.5	74	9.2	4.2

From the suction line The sir gets enters in to the cooing medium through the fan. In the evaporator which is covered by Thermo resin, the cold refrigerant transfers the heat from the inlet air through the cooling medium as convection, then the hot refrigerant circulate the refrigeration unit. The air gets more wet by close the suction valve and circulate in the medium. By opening the receiver valve, the wet air gets entered in to the receiver by receiver fan where the outlet valve is closed. Then, the air gets circulated in the receiver and gets more wet in the air. After some period, by open the outlet valve and closing of receiver valve, we can get cold air and droplet of water repeatly.

To calculating COP, for the first 15 minute

Figure4:- Temperature of evaporator

RESULT

Time	*Evaporator temperature*	*Atmospheric temperature*	*Energy consumed reading (Kwh)*
10:00	30.2	30	0.77
11:00	-12	32	0.85
12:00	-19	34	0.92
01:00	-21	35	0.99
02:00	-24	37	1.07
03:00	-26	37	1.14
04:00	-28	35	1.20
05:00	-28	33	1.26

Table3: working of unit with atmospheric condition

From the result, it is observed that the atmospheric temperature does not interfere with the cooling medium and it used to cool the atmosphere for any temperature conditions varing with different areas. And it can be reused for several years where the atmospheric life is high and the refrigerants can be reused repeatedly.

It results in reduction of emission of harmful depletions and also decrease of global temperature. We can use this thesis, when the scarcity of water occurs. **A little droplet will change the future.**

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