IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

AIR CONDITIONING SYSTEM ON SENSOR OPERATED MULTIPLE HEAT SOURCES VAPOUR ABSORPTION SYSTEM

Faraz F. Chause[1], Adil K. Shaikh[2], Shahzaib A. Shaikh[3]

[1]*BE Student, Mechanical Engineering, BNCOE Pusad, Maharashtra, India,* ***farazchause@gmail.com***

[2]*BE Student, Mechanical Engineering, BNCOE Pusad, Maharashtra, India,* ***shaikhadil98@gmail.com***

[3]*BE Student, Mechanical Engineering, BNCOE Pusad, Maharashtra, India,* ***shahzaibshaikh62@gmail.com***

Abstract

The demand of air conditioning is increasing due to the effects of climate change and global warming but for meeting this demand very high energy is required because more energy is needed to run cooling systems. But utility sectors and the people leaving in rural areas facing continuous increasing in energy demand due to high energy consumption. To overcome these problems we should develop a system which consume less power, which should be eco-friendly and economical and the system should not be affected by power failure and cloudy environment. The ammonia water vapour absorption refrigeration cycle is found to be suitable for this demand. The present work is focused towards the development of air conditioning system which is powered by multiple sources of heat in the generator that is solar collector and electric heater, these two sources will automatically perform on sensor (bimetallic strip) will make the system automatic.

Index Terms: *Vapour absorption system, Evacuated Solar water heater, electric heater, Sensor.*

---------- *** ----------

1.INTRODUCTION

Now a day's global temperature is rising due to various pollutant releasing in atmosphere due to high industrialization and automobile exhaust and due to CFC's refrigerant which causes harsh environment. Performance of equipment, man and weapons system especially sensors and electronics devices gets affected in harsh environment and there is second impact i.e. energy consumption which is occurring due to increasing global temperature. And utility sector facing continuous increasing in energy demand and more energy is needed to run a cooling system, which is not possible for people for living in rural and urban areas to be comfort and safe. Increase in global temperature have serious impact on the energy consumption for cooling purposes from various researches it has been proved that increased of ambient temperature by 1 K results to very high additional energy consumption for cooling. To avoid these problems we have to design a system which should be eco-friendly and economical and there operating cost should be low.

Therefore to overcome these problems and for meeting cooling demand, an air conditioning system is developed. This system will consume less power because vapour compression system is replaced by vapour absorption system and compressor work is neglected.

In this system there will no fear of power failure because this system will work on solar energy. The biggest advantage of this system is that energy is free of cost due to multiple sources of heat input to generator, the air conditioning system will not be affected in cloudy environment and at the time of night.

2. CONVENTIONAL VAPOUR ABSORPTION SYSTEM (EXIST SYSTEM)

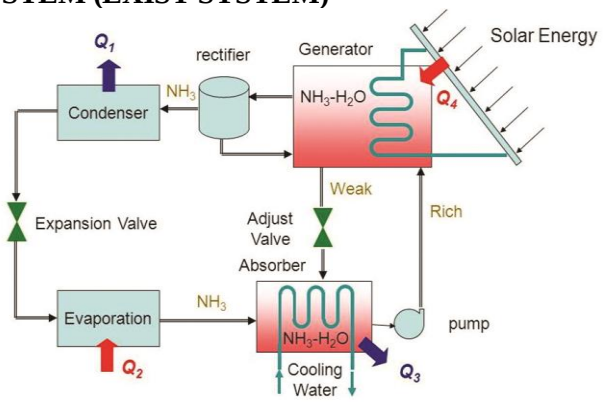

Fig-1: VAR System

2.1 Absorber

In the absorber the low pressure ammonia vapour leaving the evaporator enters and is absorbed by the cold water. The water has the ability to absorb very large quantities of the ammonia vapour and the solution thus formed, is known as aqua-ammonia. The absorption of ammonia vapour in water lowers the pressure in the absorber which in turn draws more ammonia vapour from the evaporator and thus raises the temperature of solution. Some form of cooling arrangement (usually water cooling) is employed in the absorber to remove the heat of solution evolved there. This is necessary in order

to increase the absorption capacity of water, because at higher temperature water absorbs less ammonia water.

2.2 Generator

Generator is a type of heat exchanger in which heat is transferred from external sources to vaporise the ammonia from rich aqua-solution. During the heating process, the pure ammonia will be separated from strong solution and will pass forward. And weak solution flows back to the absorber at low pressure after passing through the pressure reducing valve. The high pressure ammonia vapour from the generator is condensed in the condenser to the high pressure liquid ammonia. This liquid ammonia is passed to the evaporator through expansion valve.

2.3 Condenser

The condenser consists of coils of pipe in which high pressure and temperature vapour refrigerant is cooled and condensed. The refrigerant, while passing through the condenser, gives up its latent heat to the surrounding condensing medium which is normally air or water. The heat transfer capacity of a condenser depends upon material, amount of contact and temperature difference. The heat transfer capacity of a condenser depends upon the temperature difference between the condensing medium and vapour refrigerant. As the temperature difference increases, the heat transferred rate increases and therefore the condenser capacity increases.

2.4 Evaporator

Evaporator is a cooling chamber which consists of a coil of pipe in which the liquid vapour at low pressure and temperature is evaporated and change into vapour refrigerant at low pressure and temperature. In evaporating, the liquid vapour refrigerant absorbs its latent heat of vaporization from medium which is to be cooled. One end of evaporator is connected with suction of absorber for taking low pressure liquid ammonia and another end is connected to a receiver dryer. A regulator is provided on an evaporator which regulates the flow of cold air.

2.5 Expansion Valve

It is also called throttle valve, the function of the expansion valve is to expand the liquid refrigerant by reducing its temperature and pressure. Some of the liquid refrigerant evaporates as it passes through the expansion valve, but the greater portion is vaporized in the evaporator at the low pressure and temperature.

2.6 Pump

Pump converts the mechanical energy from a motor to energy of a moving fluid, some of the energy goes into kinetic energy of fluid motion, and some into potential energy, represented by a fluid pressure or by lifting the fluid against gravity to a higher level. When a strong solution of the refrigerant-absorbent (ammonia-water) is formed, this solution is pumped by the pump at high pressure to the generator. Thus pump increases the pressure of the solution to about 10 bar.

3. MODIFIED SYSTEM

This system works on vapour absorption refrigeration system therefore it utilize low grade energy .In this system solar energy is used for supplying heat in generator. There is an alternate source of heater which is powered by the DC or AC supply, this two sources of heat will run the system. A bimetallic sensor is provided for making the system automatic and when the solar radiations are visible, then sensor will keep the battery off and the system will work on solar radiation. When solar radiations are not visible sensor will keep the electric signal ON and generator will be powered by electric current.

Following are the additional components added in VARS and applied this system for air conditioning.

3.1 Evacuated Solar Heater

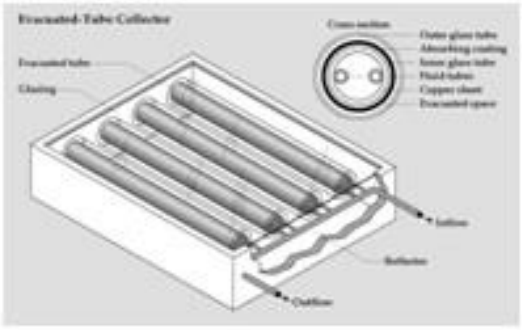

Fig-2: Evacuated solar collector

In this system solar flat plate collector is replaced by evacuated solar collector. The vacuum that surrounds the outside of the tube greatly reduces convection and conduction heat losses, therefore achieving 15 to 20 percent more efficiency than flat-plate collectors.

The area of evacuated flat plate collector can be calculated by following equation

$Q_u = K \times S \times A$ (1)

Where,

Q_u is heat transfer in generator by evacuated collector

Where

K is the efficiency of the collector

S is the average solar heat falling on the earth surface, ($6kwhr/m^2/day = 250\ W/m^2$)

Let, Efficiency of the Evacuated collector is 90%

Hence approximate area of the collectors required for providing 5070 W

$A = 5070 / 250 \times 0.90$

$A = 24\ m^2$

Therefore we can used 4 collectors having dimension $3 \times 2\ m^2$

3.2 Electric Heater

Alternate source of heat input is electric heater will be provided in the generator which is powered by AC or DC source. The heater is made up of Nicrome wire.

Fig-2: Electric Heater

3.3 Sensor

Sensor will make the system fully automated when there will be solar radiation available then sensor will keep the AC or DC signal off and generator will be powered by solar heater. If the solar radiation is not available due to cloudy environment or due to night vision, sensor keep the electric signal ON and generator will be powered by electric heater. In this system bimetallic strip will be preferred as a sensor.

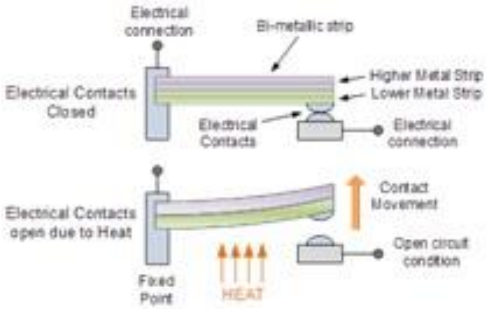

Fig-3: Bimetallic Strip

4. RESULTS AND DISCUSSIONS

- Now a days Vapour absorption system may play a vital role for industrial and commercial proposes, and required very less work input because compressor is totally replaced by absorber, generator, pump and analyser therefore electricity can be saved. In such a system only pump and evaporator fan required electricity which is very less. These two components will be powered by DC or AC current. Cloudy Environment does not affect the system and the system may also run at night.
- As per the heat removed from the conditioned space that is 303852 KJ/24hr for one ton of refrigeration the system can be efficientlyapplied for 3000 to 4000 ton of refrigeration capacity.
- The wastageand leakage problem is very less because he system works on vapour absorption refrigeration system.
- Evacuated solar collector is preferred because it is 15-20 % more efficient that liquid flat plate collector and heat losses are very less.
- Only evaporator fan and pump will operate on electric current which consumes less work.
- Water cooled condenser will preferred, water will be supplied by a single pump and water from absorber will pass in the rectifier after that it will pass through liquid to liquid heat exchanger gives heat to week solution and that cold water will further utilised in absorber.
- The COP of the system will be proportional to generator temperature, the average value of COP is taken 0.67 while using ammonia as a refrigerant and water as an absorbents.

6. CONCLUSION

It is concluded that using solar energy as the power source of the system proved to be feasible. Solar energy being a renewable source of energy proved to be efficient as compare to the electric energy with the flow ammonia through the system, we are able to use it for air conditioner and that too with the help of renewable a non-polluting source of energy. And the alternate source of heater will make the system running in every situation.

REFERENCES

[1]. Dinesh Chandarkar, N.K.Saikhedkar, Design of ammonia water vapour absorption air conditioning system for a car by waste heat recovery from engine exhaust gas, advanced physics letter, 2016, pp. 24-29.

[2]. Ramesh Batakurki, Chandra Prasad B S, Sunil S. Studies on performance of solar powered vapour absorption refrigeration system, International Journal of Mechanical Engineering and Technology Vol. 8, Issue 1 , pp. 100 to 109, January 2017.

[3]. V.R.Renji, P.J.Joshy, Vapour absorption refrigeration system using low grade energy, and eco-friendly approach, pp. 465 to 472, November 1999.

[4]. Tarik Shaikh, Prof. Yogesh J. Morabia, Review of solar absorption refrigeration system using Libr-water and simulate the performance of the system, Issue 2, Vol. 2, pp. 57 to 60,March 2013.

[5]. J.M.Abdullateef, K.Sopian and M.A.Alghoul, Optimum Design fir solar absorption refrigeration system and comparison of the performance used in ammonia water, ammonia lithium nitrate and ammonia-sodium-thiocyanate solutions, International Journal of Mechanical and material engineering Vol. 3, pp. 17-23, 2008.