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Solar Absorption Chiller- A Review

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Abstract ***— Absorption chiller is a cooling system that uses heat instead of electricity to cool something. The different types of absorption chillers are solar, water, gas and bromide with steam.Absorption cooling is essentially a cooling system driven not by electricity but by a heat source, in this case the sun. Flat plate solar collectors and solar panels absorb the sun's heat which is then used to heat the refrigerant-absorbent solution in solar collector where refrigerant is released from absorbent as vapour. The gas then moves to the condenser where the heat dissipates and it is turned back into liquid phase. This liquid further passes through throttling process by expansion valve where it expands from liquid to liquid-vapour mixture and passed to evaporator. In evaporator the refrigerant takes heat from cooling space as it completely evaporates. He low pressure vapour goes to absorber where it is reabsorbed by weak solution to create strong refrigerant solution which is passed on to generator.It is important to have high velocity for flow of refrigerant and fluid over the evaporator. For the generator, it is an energy source for the absorption chiller system and usually flate plate collector will be used as the generator because of their potential and efficiencies even though it is the reason why absorption is highly cost. To determine the efficiency of a system, it can be shown by COP for system.***

Keywords-   crane, material handling, pneumatic, hydraulic, fabrication ayushsingh2910

I. *INTRODUCTION*

The fossil fuel supplies of the world are limited and the fuel reserves are getting depleted. It is difficult to predict exact quantities of recoverable reserves of fossil fuels in the world. In Western Europe, there is a declining trend in energy consumption. However, the rate of decline in energy consumption has reduced. This is largely due to some slight recovery in economic activity and falling energy costs.

It is not envisaged that the type of energy sources, to meet the anticipated energy demand. Modern technologies, to extract energy from sources such as solar or wind/wave energy, are not expected to give a significant contribution in this century. However, research in these areas is required to reduce the dependence on fossil fuels.

Various estimates have been made of the time available before the reserves of fossil fuels are depleted. These estimates are all based on assumptions as to how industrial and domestic energy trends will vary with time and are all doubtful. What is certain is that, at whatever level the industrial and domestic energy demands might be, changes in the method of using that energy have been re-examined. It is possible to increase the efficiencies of conversion processes e. g., the efficiencies of power producing equipment.

A better alternative is to reduce the amount of energy wasted. The conversion of energy should include reuse wherever possible. One way is to reuse the thermal waste heat streams from industrial sources, such as power stations, rather than to discharge them as thermal pollutant to air and water. This means that the temperatures of the waste streams should be high enough to be useful. In some cases a heat pump may be used-to raise the temperature of low grade heat energy to a more useful level by using a relatively small amount of high grade energy.

Solar energy is a renewable resource that can be utilized in different forms. Photovoltaic systems convert solar energy into electricity that can be used to power conventional electronic devices while solar thermal systems directly use solar energy to heat fluids for use in various thermal processes. This can be readily seen in solar water heaters where solar energy is converted to thermal energy in the form of hot water. The concept of using solar energy to heat fluids can also be applied to solar cooling systems as was done in this project.

From a climatic viewpoint, the use of solar thermal cooling matches weather patterns. When high temperatures create a need for cooling, there is generally an abundance of solar energy available to power the solar cooling system. Different solar cooling process are possible, namely absorption, adsorption and desiccant cooling, which use different fluids and materials to accomplish the desired exchange of heat.

Solar absorption cooling systems utilize a closed-loop system, closely resembling a vapor-compression cycle, to take heat in from the cooling space and expel it to the environment. A refrigerant is used as the working fluid to transfer heat in the system. While these systems are similar to conventionally powered cooling systems, they differ to allow for heat to drive the cycle and, by absorbing the gaseous refrigerant in an absorbent fluid, lower the power requirement of the pump. Subsequent heating of the absorbent-refrigerant solution releases the refrigerant for use in the cooling cycle.

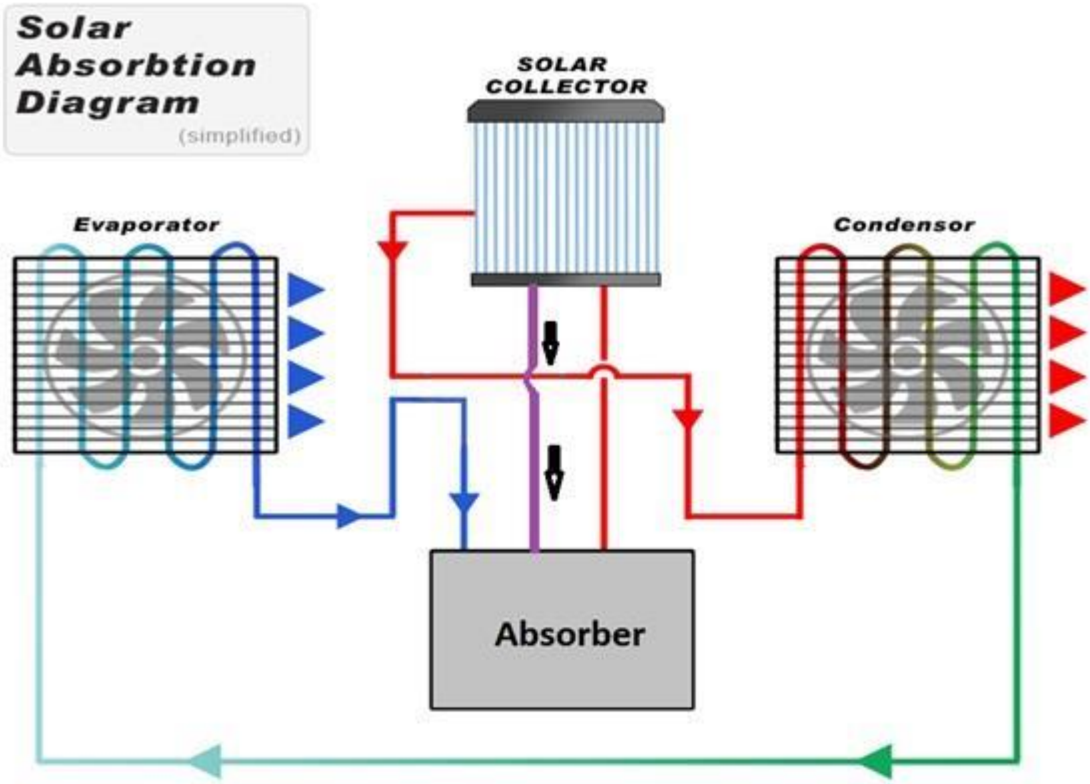

Fig. 1 SOLAR ABSORPTION DIAGRAM

The refrigerant-absorbent solution is heated in the generator where refrigerant is released from the absorbent as a vapour. The weak absorbent-refrigerant solution travels back to the absorber while the refrigerant vapour travels to the condenser where it releases heat to the environment as it is cooled to liquid phase. From here, it goes through a throttling process where it expands from liquid to liquid-vapour mixture and goes to the evaporator. In the evaporator the refrigerant takes in heat from the cooling space as it completely evaporates. This low pressure vapour goes to the absorber where it is reabsorbed by the weak solution to create a strong refrigerant solution. Heat produced during this process must be transferred out of the system to the environment. The solution is then pumped to the generator thus completing the cycle.
While there are multiple absorbent-refrigerant combinations that can be used in absorption cooling cycles, two are most commonly used: lithium bromide-water (LiBr-H2O) and ammonia-water (NH3-H2O). The lithium bromide-water system uses water as the refrigerant and lithium bromide as the absorbent while the ammonia-water system uses ammonia as the refrigerant and water as the absorbent. The two combinations offer different advantages and disadvantages that must be considered when designing a solar thermal cooling system. Due to differences in volatility between lithium bromide and water, these systems can operate at higher generator temperatures and lower pressures without the concern for creating absorbent vapor. Another advantage of this system is water's high heat of vaporization. Disadvantages of lithium bromide-water systems include the tendency of lithium bromide to crystallize at high concentrations as It returns to the absorber and the cooling is limited to temperatures above the freezing point of water at 0°C.

II. LITERATURE SURVEY

According to the Survey of Solar-Powered Refrigeration carried out, the first study undertaken to explore the use of solar energy for refrigeration was probably in 1936 at the University of Florida by Green. The steam to power a steam jet refrigerator was produced by heating water flowing in a pipe placed at the focal line of a cylindro-parabolic reflector.

Oniga reported in 1937 that researchers in Brazil tried to adapt a parabolic reflector to an absorption refrigerator but the system never got beyond the experimental stage. Kirpichev and Baum of Russia reported the successful operation of an assembly of solar refrigerators producing 250 kg of ice per day in 1954.

The design by Trombe and Foex is very promising and should be studied further although modifications may be necessary on the solar collector, boiler, and condenser. Williams and others at the University of Wisconsin built a small food cooler in 1957 intended for use in underdeveloped rural areas.

SWARTMAN and SWAMINATHAN (1971) built a simple, intermittent refrigeration system incorporating the generator-absorber with a 1.4 m2 flat-plate collector at the University of Western Ontario.

FARBER (1970) has built the most successful solar refrigeration system to date. It was a compact solar ice maker using a flat-plate collector as the energy source. Fig. 4.4 shows the flow diagram of the system. The solar collector-generator was 1.49 m2, consisting of a 6.35 cm top header. The 2.54 cm pipes were spaced on 10.2 cm centres and soldered to a 20 gauge galvanized iron sheet.

This unit was placed in a galvanized sheet metal box with a single glass cover and one inch of Styrofoam insulation behind the absorber-generator element. In addition to the usual components, such as condenser, evaporator, ice box, heat exchanger, there was an ammonia absorbing column of the shell-and-tube type and two pumps to circulate the liquid ammonia and chilled water in the evaporator. It was reported that an average of about 42,200 kJ of solar energy was collected by the collector per day and ice produced was about 18.1 kilograms. This gave an overall coefficient of performance of about 0.1 and 12.5 kilograms of ice per m2 of collector surface per day.

As far as solar refrigeration is concerned, this has been the most successful system, but it should be noted that the system was not totally solar-powered as there were two pumps operated by electricity. The system would not work in areas where electricity is not available

III.CONCLUSION

On the basis of literature survey, solar absorption chiller is cooling system that uses solar energy as heat source instead of electricity to cool something. While using a LI-BR cycle to run the system it is necessary to understand that how much the ratio of LI-BR and water will be needed. As per the calculation when 20-30 % LI-BR ratio is used then system doesn’t get any cooling effect. From 35% LI-BR ratio onwards system getting cooling effect. For 40 and 50 % LI-BR ratio results are same. So optimum LI-BR ratio for system is 40%

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