Review on Small Capacity Solar Vapor Absorption Air-Conditioning System

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Abstract-**The Utilization of solar energy is as old as human history. Air conditioning is essential for maintaining thermal comfort in indoor environment, particularly in hot and humid climate. The use of solar energy to drive cooling cycle is best an alternative solution for conventional vapour compression cycle. Conventional air conditioning systems is mostly based on vapor compression system with refrigerant-134a. Use of conventional air condition system increase the demand of electricity also it will lead to problem of CFC emission. Solar energy is available in large extend.It is better to use this available solar energy in air conditioning system. In absorption air conditioning system, the compressor is replaced by an absorber, a pump, a generator and a pressure reducing valve. Design calculations have been made for different components of the system like evaporator, generator, absorber, heat exchanger of vapor absorption system. The idea is concerned with small capacity solar absorption air conditioning system. Though its COP is low as compared to the VCC cycle, but it minimizes the dependence on non-renewable energy source as it uses the renewable energy source like solar energy.**

Keywords- **Absorption air conditioning, Solar air conditioning, Air conditioning, Solar Energy and Refrigerant.**

I. INTRODUCTION

Air conditioning is the process of removing heat and moisture from the interior of an occupied space, to improve the comfort of occupants. Refrigeration may be defined as lowering the temperature of an enclosed space by removing heat from that space and transferring it elsewhere. A device that performs this function may also be called an air conditioner, geothermal heat pump or chiller.

The power from the sun intercepted by the earth is approximately 1.8 $\times 10^{11}$ MW which is much larger than the present consumption rate on the earth of all commercial energy sources. First unlike fossil fuels and nuclear power, it is an environmental clean source of energy. Second, it is free and available in adequate quantities in almost all parts of the world where people live. All buildings are cooled by conventional electricity-powered air-conditioning systems, which consume a lot of electrical power.

III. SYSTEM DESCRIPTION

The initial flow of the refrigerant from the evaporator to the absorber occurs because the vapor pressure of the refrigerant-absorbent in the absorber is lower than the vapor pressure of the refrigerant in the evaporator. The vapor pressure of the refrigerant-absorbent inside the absorbent determines the pressure on low-pressure side of the system and also the vaporizing temperature of the refrigerant inside the evaporator. The vapor pressure of the refrigerant-absorbent solution depends on the nature of the absorbent, its temperature and concentration.

When the refrigerant entering in the absorber is absorbed by the absorbent its volume decreases, thus the compression of the refrigerant occurs. Thus absorber acts as the suction part of the compressor. The heat of absorption is also released in the absorber, which is removed by the external coolant.

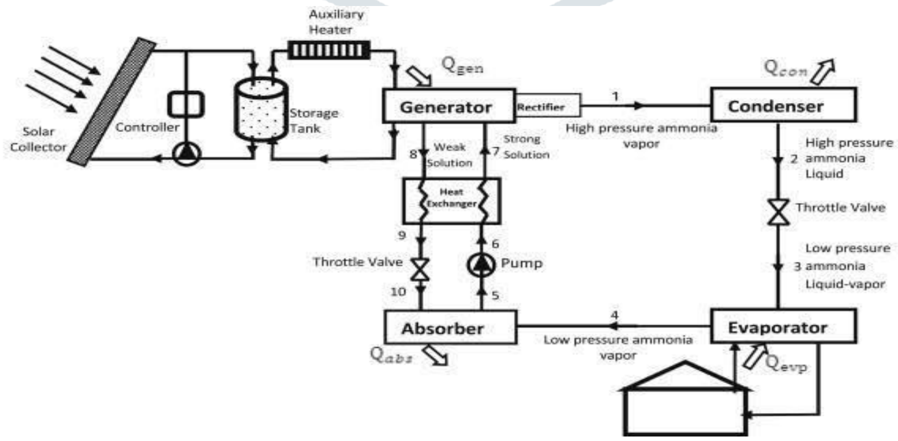

Fig 1-Schematic diagram of vapor absorption cycle working on Nh_3- H_20

III. LITERATURE REVIE

The researchers Ming Li, ChengmuXuRedaHassanienEmamHassanien, YongfengXuandBinweiZhuang[2014] found that The average efficiency and average cop was in between 0.18-0.6 and 0.11-0.27. The refrigeration quantity of the refrigeration chiller has been increased with the increasing of heat temperature. The refrigeration coefficient also substantially increased with the rising of hot water temperature. The cooling water temperature could largely influence on the performance of the refrigeration chiller. The value of thermal efficiency of collection system and instantaneous power of heat collection was very low due to very long pipelines and high heat losses. Therefore, in order to improve the cooling performance of the existing system the length of heat transfer pipelines should be shorten to reduce the heat losses. area of PTC and the operating temperature of the aperture should be increased and the water temperature for cooling system should be as low as possible.

The researcher Ali Shirazi, Sergio Pintaldi , Stephen D. White , Graham L. Morrison ,Gary Rosengarten and Robert A. Taylor have researched that A dynamic simulation model of the plant was developed in TRNSYS software to perform a complete parametric analysis on the system configurations and to select the most energy-efficient one. The results confirmed that the highest solar fraction of the plant was achieved by control scheme C3 and leading to at least 11% increase in the total solar fraction of the system compared to the traditional use of constant flow pumps in the solar circuit. The result also indicated that parallel arrangement must be preferred over series arrangement. Parallel arrangement total solar fraction is 9-13 percent greater than series arrangement.

A.A. Al-Ugla [2015] has analyzed The generator heat capacity for the heat storage system is lowest during nighttime operation and highest for the cold storage system during daytime operation. Condenser heat capacity for heat storage during nighttime operation is the lowest. The evaporator heat capacity for the cold storage systems is generally high compared to refrigerant or heat storage systems. Refrigerant storage systems require a reasonably small collector area for operation Heat storage system presents the highest COP during the night. Heat storage system has the highest storage capacity and the cold and refrigerant systems have the lowest storage capacity.

M.A.I. El-Shaarawi [2017] has found out thatIncrease in the solar intensity and the effective sunlight hours have positive effect on the design and performance parameters; improves the COP, reduces the required mass storage and collector area. Increase in the solar intensity and effective sunlight hours are dependent on both the season and the geographic location under consideration.

In this paper, authored by A. González-Gil, M. Izquierdo, J.D. Marcos, E. Palacios, a novel direct air-cooled single-effect absorption prototype is described. An adiabatic absorber using flat-fan sheets avoids crystallization of the solution. A new direct air-cooled single-effect LiBr-H2O absorption prototype is described and proposed for use in solar cooling. As distinguishing aspects, it presents: an adiabatic absorber using flat fan sheets; an air-cooling system that directly refrigerates both the condenser and the absorber and; the possibility of being operated also as a double-effect unit. Feasibility of air-cooled technology for LiBr-H2O absorption cooling is proved. . In this paper, the single-effect operation mode of the single-double effect prototype is discussed, paying special attention to the absorber description. Additionally, the solar facility used to test this prototype is described.

This paper authored by PravanjanPadhihari aims to use the renewable energy that is the solar energy to run the air conditioning system of the car. This will help in preventing the engine to run in idling. The basic principle is to drive the compressor of the air conditioning system from the solar energy stored in a battery during and after charging it from a solar panel. This idea will help in preventing the fossil fuels from getting extinguished. This paper is proposed for further development of solar powered air conditioning system using thin film metallic nanoparticles solar material. It is also focussed at optimising the shape of the solar cell for better efficiency.

In this papers authors Na Li, ChunhuanLuo, Qingquan Su have proposed a working pair of CaCl2-LiBr LiNO3(8.72:1:1)/H2O for a single-stage absorption refrigeration system driven by solar energy collected with flat plate solar collectors or vacuum glass tube solar collectors. The crystallization temperature, saturated vapor pressure, specific heat capacity, and specific enthalpy of the proposed working pair were systematically measured.

ZakariaJusoh Wan MohdFaizal Wan MohmoodMohdradzimansoor [2016] found that the COP was between 0.431 0.446. Also the results of these experiments show that solar energy can produce similar results with integrated solar energy with heating system. The study obtained the highest cooling load is 1,941 kW. The preliminary estimate cooling load for this study was 3.517 kW (1 ton).

J.F. Chen, Y.J. Dai , R.Z. Wang[2017] found that The COP decreases when the ambient temperature rises. Both condensation temperature and absorption temperature rise simultaneously with the ambient temperature which leads to a reduction of the cooling capacity and COP. Also, The COP shows a slight increasing trend when the inlet hot water temperature is increased, while the cooling capacity is also increased. Both COP and cooling capacity are improved with the increase of the outlet chilled water temperature. The evaporation temperature will also be increased when the outlet chilled water temperature is increased.

IV. CONCLUSIONS

In todays world more importance is been given for usage of renewable energy source like solar energy rather than non renewable energy sources. We all know that energy and water are the basic need for every human being to survive on the planet. From literature review it is observed that the inducement for utilizing solar cooling system was as it proved to be the alternative for electricity as the premium energy sources for air conditioning systems by a renewable heat source, i.e. low grade heat from solar collectors. The best way to address the global warming is giving more importance on using solar cooling system. Various long range data is strictly recommended to be used in order to prove the feasibility of air conditioning system.

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