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LiBr Absorption Refrigeration System-Based on Seebak Application

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Abstract

The global increasing demand for refrigeration in field of refrigeration air-conditioning, food preservation, vaccine storages, medical services, and cooling of electronic devices, led to production of more electricity and consequently more release of CO2 all over the world which it is contributing factor of global warming on climate change. The prices of energy have been increasing exponentially worldwide. Industrial Refrigeration is one of the most energy consuming sector. What if a refrigeration system is designed which uses no energy or minimal amount of energy? The solution lies in absorption refrigeration system. By producing an absorption refrigeration system we are not only cutting down the energy costs but also preserving our environment. This refrigeration system doesn't use any of the CFCs so our ozone layer is safe. This paper studies about LiBr/water based absorption refrigerator designed for rural application and applies solar rays based on reverse seebak effect.

Keywords: *Advanced Refrigerator, LiBR/water, Seebak Effect,*

INTRODUCTION

Refrigeration is a process in which work is done to move heat from one location to another and used to provide refrigeration for food and medicine preservation and to provide comfort cooling. The domestic refrigerator-freezers operating on alternative refrigerants such as HFC-134a, contribute indirectly to global warming by the amount of carbon dioxide produced by the power plant in generating electricity to operate over a unit over its lifetime. This contribution is nearly 100 times greater than the direct contribution of the refrigerant alone.

Moreover, approximately 62 million mew units are being manufactured worldwide every year, and hundreds of millions are currently in. use. (UNEP, 1995) it is anticipated that the production of refrigerator-freezers will substantially increase in the near future as a result of the increased demand, especially in the developing countries. IPCC estimates 10% of global warming relates to man-made greenhouse gas in refrigeration and air conditioning systems.

In Europe, bans and taxes have been established. HCFCs and fluorinated refrigerant based systems are getting more difficult and expensive to use. Challenge is to make safe, reliable and suitable refrigeration systems for the markets, facilitating access to alternative technology.

The aim is to establish and replicate best practice model on the conversion of room AC; reduce rate of HCFC conversions to HFCS. HCFC emission in china account for 260 million tones of CO2 equivalent. Solar refrigeration system is an alternative because it can convert solar energy into electricity. Therefore, thermoelectric refrigeration is greatly needed, particularly for developing countries where long life and low maintenance are needed.

This paper studies about absorption refrigeration system based on LiBr/water for rural application and solar energy. Refrigerator which runs on electricity produced by solar energy is known as solar refrigeration. Solar-powered refrigerators may be most commonly used in the future generation developing the world to help mitigate poverty and climate change.

The solar refrigeration system is needed because of areas not connected to power grid, to minimize environmental impact and fuel cost. Solar cooling can be considered to provide refrigeration for food and medicine preservation and to provide comfort cooling. Advanced absorption cooling technology offers the possibility of chillers with greater COPs and reduces cost of the system. The invention can improve refrigerating unit, raise coefficient of performance, reduce energy cost of refrigerating unit and has notably social and economic benefit. Compared with the existing compressor refrigeration system, the system realizes simplified structure, low energy consumption and reduction of ‘discharge and environmental pollution by hazardous substance.

The aim of this paper is to improve the COP of the absorption refrigerator to make it more attractive for usage, to reduce the size of the assembly by making it more compact, to reduce the weight by using polymers, to minimize the cost as far as possible. Till date absorption refrigeration is limited for industrial purposes. I aim to make it available for mass rural use as stated above in small capacities by using solar absorption refrigerator.

This study uses refrigerant the lithium bromide as primary refrigerant and Water as secondary refrigerant and Take the mixture of lithium bromide and water in the generator.

LITERATURE REVIEW

Salah A. et.al.This paper presents a thermodynamic modeling study of the utilization of an existing high potential geothermal low-temperature heat source (114 kg/s and 73º C).

Xiaolin Wang et.al. Studied about Lithium bromide-water absorption cooling technologies is underpinned by the continual circulation of water, which is the refrigerant, powered by the hygroscopic nature of aqueous lithium bromide solution. The present energy and global warming crises engender a renewed interest in thermally driven cooling systems, for which lithium bromide-water absorption chiller is an archetypal example forming the focus of this review (2009).

Mayank Awasthi et. al. studied to design and develop a working thermoelectric refrigerator interior cooling volume of 5L that utilizes the Peltier effect to refrigerate and maintain a selected temperature from 5 °C to 25 °C.(2012). Ian W. Eames presented an illustrated description of a proposed LiBr-H2O vapor absorption refrigerator which uses a thermally activated solution pumping mechanism that combines controlled variations in generator vapor pressure with changes it produces in static-head pressure difference to circulate the absorbent solution between the generator and absorber vessels.

K.Balaji et.al. illustrates the thermal and fiscal advantages of using single effect lithium bromide water absorption by means of waste heat. The objective of this work is to hypothetical design of lithium bromide water absorption Refrigeration system using waste heat from sugar industry steam turbine exhaust.

Sachin Kaushik et. al. provides an analytical study of absorption refrigeration technology. The objective of this work is to design a lithium bromide–water (LiBr-H2O) absorption refrigerator with a nominal capacity of 5.25 kW.

The refrigeration system is based on vapour absorption cycle. In this paper the energy produces by the solar cell. The COP improves by using the seebak effect. By using LiBr/water refrigerant, this advanced system can be made eco-friendly.

PRINCIPLE

The refrigeration system is based on vapour absorption cycle. The energy produces by the soler cell. The COP improve by using the seebak effect. We use LiBr+water refrigerant, which is not harmful for the environment.

TECHNICAL DETAILS

Energy Source **–** In this paper energy source is taken as Solar energy- on which sun energy is converted in the electricity by using solar cell.

Seebak Effect: In this two wires of semiconductor material as silicon carbide. On one end there is hot junction and other end is cold junction, both junction produces temperature difference.

- Hot junction of seebak effect connects with the electric source of generator which minimizes the input power.

- Cold junction of seebak effect connects to the evaporator on which it increases the cooling effect.

REFRIGERANT USED

- The lithium bromide refrigerant use as primary refrigerant and
- Water used as secondary refrigerant.
- Take the mixture of lithium bromide and water in the generator.

COSTRUCTION DETAILS

- Generator-Solution of LiBr is heated to generate water vapour which is transferred to the condenser.

- Condenser- In the condenser the vapour is cooled by circulating running water.

- Expansion valve-It maintain the condenser pressure to the evaporator pressure.

- Evaporator-The water is then throttled and moved to evaporator at a low temperature and pressure where it is evaporated.

- Absorber-The water vapour is then transferred to the absorber where it is absorbed in the concentrated solution of LiBr and heat is rejected to the cooling coils.

- Pump-The water is then pumped again to the generator from where the cycle is repeated.

Working-

1 to 2- Solution of LiBr is heated to generate water vapour which is transferred to the condenser. In the condenser the vapour is cooled by circulating running water.

2 to 3- The water is then throttled and moved to evaporator at a low temperature and pressure where it is evaporated.

3 to 4- The water vapour is then transferred to the absorber where it is absorbed in the concentrated solution of LiBr and heat is rejected to the cooling coils.

4 to 1- The water is then pumped again to the generator from where the cycle is repeated.

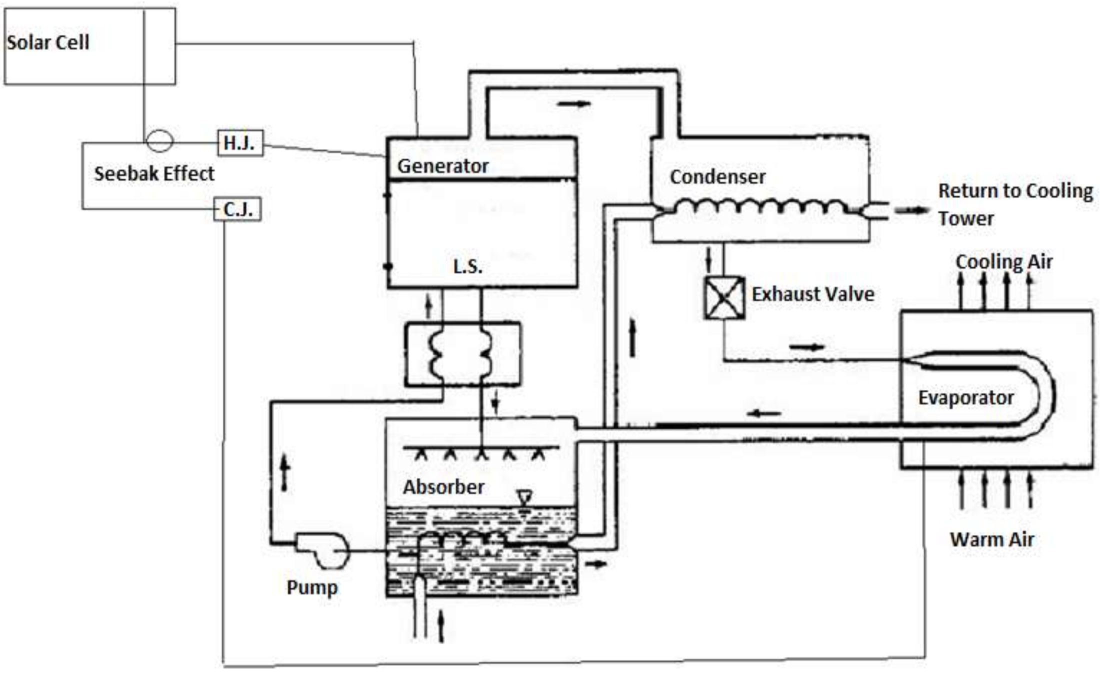

Fig.1: Schematic diagram of LiBr/water based adsorption refrigerator

The performance of the system is governed largely by the temperature difference between the generator and the condenser and absorber units. Since the generator temperatures in solar driven systems are only moderate, it is important to keep the condenser and absorber temperatures as low as possible. The LiBr system is preferred over ammonia systems for solar energy applications because of the lower generator temperatures required. Permissible generator temperatures for a water-cooled LiBr system range from 760 C-990 C compared to the 950 C-1200 C temperatures required for a water-cooled ammonia absorption system. Most, if not all, of the commercially available absorption units use LiBr and water as the absorbent-refrigerant fluid pair. Because the LiBr will crystallize at the higher absorber temperatures associated with air cooling, these units must be water cooled.

A prototype ammonia-water unit, amenable to direct air cooling, has been built by Lawrence Berkeley Laboratories. Being a salt, lithium bromide does not exert any pressure and does not boil off when heated. Thus there is no need of rectifier to separate out the absorbent vapor from the refrigerant vapour

CONCLUSIONS

The coefficient of performance for this refrigeration system is low. This refrigeration system doesn't use any of the CFCs so our ozone layer is safe. Compared with the existing compressor refrigeration system, the system realizes simplified structure, low energy consumption and reduction of 'discharge and environmental pollution by hazardous substance. The aim of the development of the refrigeration system is to provide efficient and effective cooling in the designated locations and places. Solar power nowadays is playing a major role in meeting the energy requirements of our country. It is being developed at a very fast rate and its applications in many areas are being explored. The refrigeration system is intended at exploring the same and provides an efficient and economical solution to the areas where there is no electricity and cooling is required. The application of this refrigeration system is to cool appropriate amount of medicines and injections needed at the primary health care centers in villages where there is no power supply.

FUTURE SCOPE

Though this refrigeration system will work satisfactorily, still many changes and improvements can be done in this refrigeration system to make it more users friendly and sophisticated in nature by using the peltier units, increasing the number of peltier units and by using wood as insulator material for cooling compartment.

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