International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 02 Issue: 05 | Aug-2015 www.irjet.net p-ISSN: 2395-0072

Experimental Analysis and Performance Evaluation of 1kW,Li/Br Vapour Absorption Solar Air Conditioning System

Mr.Anil Jadhav[1],Prof. M. M. Wagh[2], Prof. N.N.shinde[3]

[1]Research Student, Department of Energy Technology, Shivaji University Kolhapur, Maharashtra, India
[2,3]Prof.Department of Energy Technology, Shivaji University Kolhapur, Maharashtra, India

---

Abstract:*Solar based absorption systems are used to reduce the electricity load due to use of compressors. Various absorption pairs have been tried for space cooling applications by using different solar heat inputs. The NH3-H2O based absorption system requires operating temperature ranging 120° to 150°, and needs concentrators with tracking ,attracting higher values ,however the Li-Br-H2o vapour absorption systems can operate at lower temperatures and can use FPC or ETC solar Water Heating systems as generators. This will also have low cost and low maintenance in near future. This research work has tried single effect 1 KW, LiBr-H2O absorption with evacuated tube solar collector. This system is tested and COPs are compared with standard vapour absorption SAC systems.*

Keywords:*Absorption; solar energy; lithium–bromide; evacuated tube collector;space cooling; coefficient of performance*

1.Introduction

Today most of the small office buildings deployed a conventional cooling technology which typically uses an electrically driven compressor system that exhibits several disadvantages such as high energy consumption, high electricity peak load demands and in general it employs refrigerants which have several negative impacts on the environment. A number of refrigerant-absorbent pairs are used, for which the most common are water-lithium bromide and ammonia-water. Single effect chillers can operate with hot water temperature ranging from about 75°C to 120°C when water is pressurized. Coefficient of performance is ranging from 0.65 to 0.75

2. Methodology

a. A 1kw Li-Br vapor absorption system is designed using ETC based solar hot water system considering solar data for Kolhapur India with Latitude 16.699°N,Longitude 74.228°E, for final specifications.
b. The component viz, generator, condenser, evaporator, absorber and heat exchanger are designed, fabricated and assembled for test setup as shown in fig 2

2.2 Test Setup

In the process diagram the generator and condenser are shown horizontally and the orientation of the evaporator and absorber are vertical. The hot water will be circulated in to the storage tank, and after utilization it will be send to the collector, for heating purpose. The water in storage tank will get heated and by using pump that water will be circulated in the generator.

Auxiliary heater is provided into the storage tank for compensation of heat or temperature, which is required in the system for vaporization in the generator. In the generator the mixture is sent by absorber, in that the refrigerant will be converted into vapour and will be sending to condenser for condensation. Over there the vapour refrigerant will be converted into cold liquid and will be sending to the evaporator through capillary tubes. In the evaporator this cold liquid will absorb the temperature of chilled water, and self will get added into the absorber. Over there this refrigerant will be converted into hot refrigerant and will be sending into the generator for recycling.

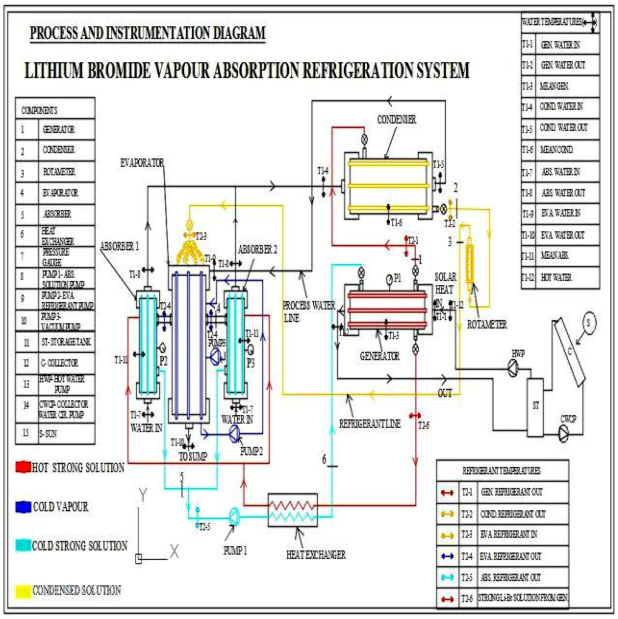


Fig-2: Process, instrumentation and test set up

Fig3 shows all the system parts in which the generator and condenser are horizontally, and evaporator and absorber are placed vertically. In fig2 shown the temperature sensor locations, from which external circulation water and refrigerant temperatures are noted for further analysis.

Fig-3:Assembly of Experimental set up for LiBr-H2O absorption system

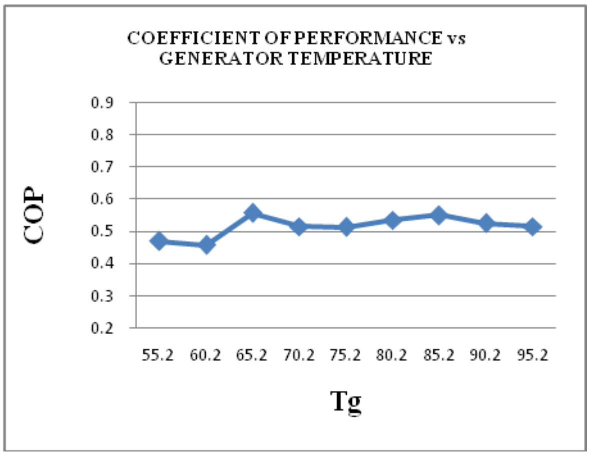
2.3 Testing

The testing is carried out under control conditions of generator temperatures at 55, 60, 65, 70, 75, 80, 85, 90 and 95°c. The hot water from ETC hot solar water system is collected and circulated from generator to the system.The performance is evaluated against input conditions such as generator,evaporator inlet temperature The hot water is collected from evacuated tube collector in generator. The testing is carried out Vs COP of the system.

2.4 Analysis of the system

The performance analysis is done to study the influence of generator temperature on efficiency of the system which will help to decide design criteria for Li-Br vapour absorption solar AC systems where the generator inlet temperatures will vary depending up on solar radiation available at the locations. The generator temperature is controlled to get uniform system performance and achieve energy conservation.

Chart-1:Coefficient of performance Vs generator temperature



.

Chart-2: Coefficient of performance Vs evaporator temperature

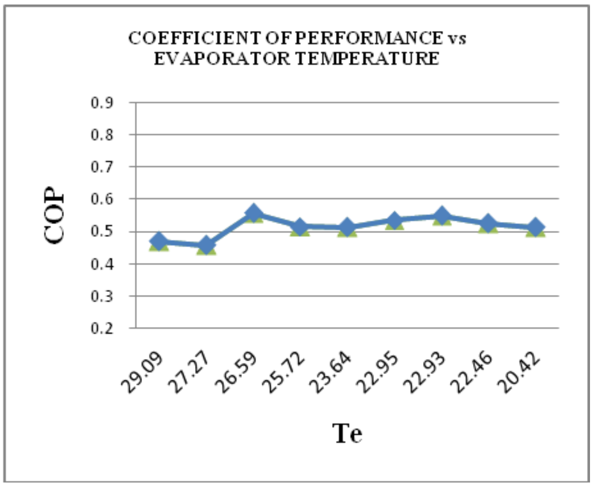


Chart-3: Coefficient of performance Vs generator load (Qg)

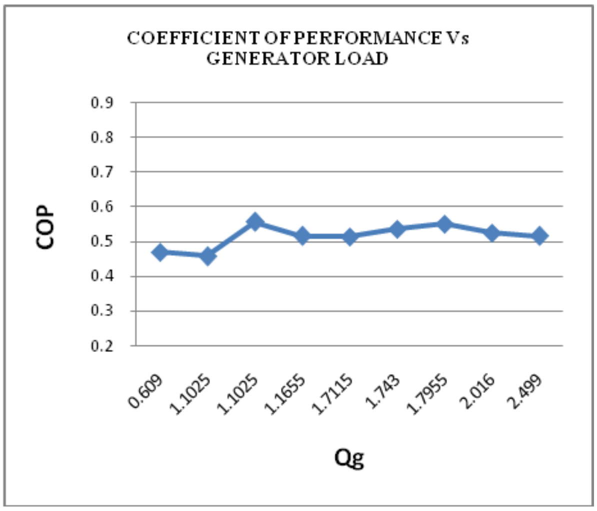
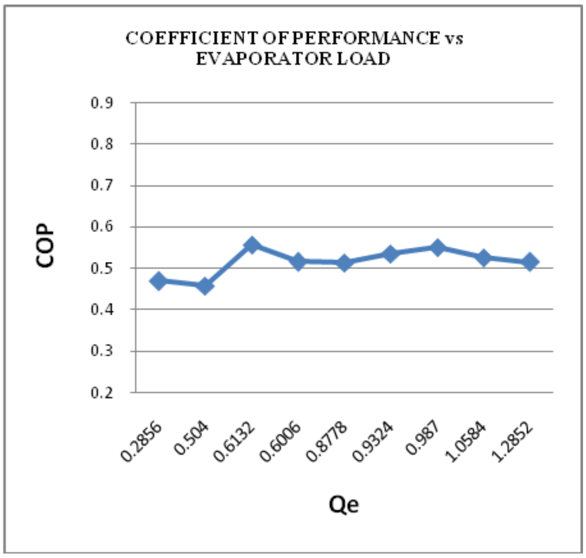


Chart-4: Coefficient of performance Vs evaporator load (Qe)

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 02 Issue: 05 | Aug-2015 www.irjet.net p-ISSN: 2395-0072



2.5 Conclusion

A LiBr-H2O absorption system is designed and tested for desired cooling load for various components like generator, condenser, evaporator, absorber and heat exchanger with suitable vacuum and water circulation system.

It is seen that the COP of the system increases with increasing generator temperature, however the cop stabilizes at higher generator temperature. The best COP achieved is at, generator temperature of 85.2°c and evaporator temperature of 26.59 °cin the present case.

The corresponding cooling load varies between 0.987 to 1.79KW.The COP of the system is comparable with the existing NH3 based absorption systems.

References

[1] Goswami Y1., KreithF2.,Kredider J3. "*Principles of solar engineering (2nd ed.) Philadelphia*", Taylor & Francis Books Inc. ISBN 1-56032-714-6

[2] C F Kettleborough :"*Solar-assisted comfort conditioning*", MechEng, vol 105 n 12 Dec 1983 p 48-55.

[3] Ameel TA1, Gee KG2, Wood BD3. *"Performance predictions of alternative, low-cost absorbents foropen-cyleabsorption solar cooling"*Solar Energy 1995; 54:65-73.

[4] Brousse E1, Claudel B2, Martine JP3. "*Solar-operated water-ammonia absorption heat pump for air conditioning:modeling and simulation"* Applied Energy 1983;14:131-42.

[5] Warren ML1, Wahlig M2. *"Analysis and comparison of active solar desiccant and absorption cooling systems"*part II Ð annual simulation results. Journal of Solar Energy Engineering 1991; 113:31-5.

[6] Jensen RN. *"Performance evaluation of the solar building test facility"*, NASA-TM-83127, L-14595, 1981.

[7] Hadstrom JC1, Murray HS2.*"Solar heating and cooling in the Los Alamos National Security and ResourcesStudy Center"*, LA-8622-MS, Los Alamos Sciatic Laboratory, December 1980.

[8] Hattem DV1, Dato PA2. *"Description and performance of an active solar cooling system using a LiBr-H2Oabsorption machine"*, Energy and Building 1981; 3:169-96.

[9] Wilbur PJ1, Mitchell CE2. *"Solar absorption air conditioning alternatives"*, Solar Energy 1975; 17:193-9.

[10] Ward DS. *"Solar absorption cooling feasibility"*, Solar Energy 1979; 22:259-68.