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IMPROVING THE PERFORMANCE OF VAPOUR COMPRESSION REFRIGERATION SYSTEM BY USING PHASE CHANGE MATERIALS

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Abstract: *The main objective of this work is to evaluate the performance of a vapour compression refrigeration system by tilting the condenser by providing some angle of inclination from horizontal by exploring the possibilities of increasing the refrigerating effect by maintaining the compressor work constant. The system is using R134a as refrigerant, hermetic sealed compressor and condenser and compare with horizontal.*

With this simple technique the Net refrigeration effect is found to be increased by 4.16% for the condenser with an angle of 20^0 inclined to the horizontal gave more performance and better Coefficient of Performance (COP) 5% more than the existing system.

I. INTRODUCTION

As a demand for refrigeration and air conditioning increased greatly during the last decade, large demands of electric power and limited reserves of fossil fuels have led to a surge of interest with efficient energy application. Electrical energy consumption varies significantly during the day and night according to the demand by the, industrial, commercial and residential activities. This variation leads to a differential pricing system for peak and off peak periods of energy use. Efficient and economical technology that can be used to store large amounts of heat or cold in a definite volume is the subject of research for a long time

Structure Details:

Sensible heat storage (SHS) and latent heat storage (LHS) are the two main methods of storing cool thermal energy. Cool thermal storage using the latent heat of phase change material has the advantages of high storage density and heat retrieval at almost constant temperature during phase change. Latent heat storage is relatively new area of research. It did not receive much attention until 1970. The first application of phase change material

(PCM) was its use for heating and cooling in buildings. The use of phase change materials in solar heating systems leads to effective utilization of solar energy. Until 2005 there is not much development in the use of latent heat storage materials in the refrigeration and air conditioning field. The application of phase change materials in the refrigeration field becomes main area of research in these days.

In the present work the performance of vapor compression refrigeration machine is tested with R12, R134a, and R290/R600a, in the presence of latent heat storage materials. The phase change materials used in this study are sulphuric acid, caprylic acid, and poly ethelene glycol. The latent heat storage materials store cool thermal energy when the machine is in running condition and discharge this energy to the heat transfer fluid (HTF) in the “off” Condition of the machine. For every two hours running of refrigerating machine maintained refrigerating effect for one hour without power input to the compressor using phase change materials.

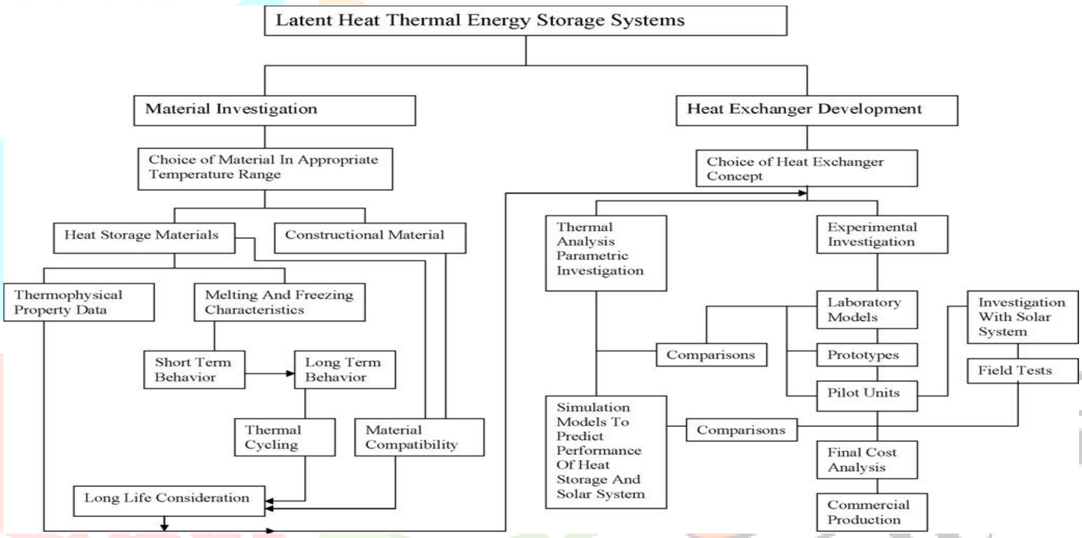
3.1Population and Sample

MATERIALS	Melting Point (^{0}C)	Thermal Conductivity (W/m K)	Melting enthalpy (kJ/kg)
Sulphuric Acid	10.4	0.26	100
Polyethylene Glycol	13	0.187	99.6
Craplyic Acid	16	0.149	148

3.2 Data and Sources of Data

Data collected from sources.

3.3 Theoretical framework



I. RESEARCH METHODOLOGY

Cool Thermal Energy Storage refers to the production and storage of cooling during low load or off-peak loads and the subsequent use of this stored cooling during high load conditions or on-peak electrical loads. Interest in cool-thermal storage has grown substantially in recent years, in particular in the domain of refrigeration and air conditioning. Cool thermal storage using the latent heat of phase change material has the advantages of high storage density and heat retrieval at almost constant temperature during phase change.

The objective of this work is to study the performance of vapor compression refrigeration machine with different refrigerants in the presence of phase change materials one at a time. These phase change materials store cool energy in the on condition of the refrigerating machine and discharge this energy to heat transfer fluid (water) in the off condition.

The performance of the system is tested experimentally with different refrigerants. The refrigerants tested include

1. R12
2. R134a
3. R290/R600a

The latent heat storage materials tested include

1. Sulphuric acid
2. Poly ethylene glycol
3. Caprylic acid

Initially the vapor compression machine tested with each refrigerant and three phase change materials one by one. Evaluate the performance of the system with and without phase change materials. Compare all the experimental results and select a suitable combination of refrigerant and phase change material for the system.

IV. RESULTS AND DISCUSSION

4.1 Results of Descriptive Statics of Study Variables

Table 4.1: Descriptive Statics

Refrigerant	Phase Change Material	Energy Saving per year(Rs)
R12	Sulphuric Acid	3230
	Polyethylene Glycol	2595
	Caprylic Acid	3355
R134a	Sulphuric Acid	4490
	Polyethylene Glycol	3925
	Caprylic Acid	4645

Acknowledgment

Thepreferredspellingoftheword “acknowledgment” inAmericaiswithoutan “e” afterthe “g”.Avoidthestiltedexpression, “Oneofus(R.B.G.)thanks...” Instead,try“R.B.G.thanks”.Putapplicablesponsoracknowledgmentshere;DONOTplacethemonthefirstpageofyourpaperorasafootnote.

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