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Replacement of R-134A with Environment Friendly Refrigerate in Ejector Expansion Vapor Compression Refrigeration System (EEVCRS)

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Abstract: *The household refrigeration (HR), commercial refrigeration (CR) and automobile air conditioner (AAC) applications have an important essential function: they transfer heat from a low temperature enclosed space into the high-temperature external surrounding. The most common way to transmit heat between a source and a sink in refrigeration applications is by using single-stage vapour compression refrigeration (VCR) systems. The VCR system used in the refrigeration devices, run on halogenated refrigerants as working fluid like chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) as well as hydrofluorocarbons (HFCs), which are widely available, affordable and have excellent thermodynamic and thermo-physical properties. Mixture of refrigerant obtained to replace R134a is analyzed on the basis of their COP, GWP, their density, enthalpy and entropy in liquid as well as in vapour phase. Based on our experimental analysis of two refrigerant can be selected as possible replacement of R-134a namely M1 and M2 having R32, R152a and R245a in ratio by mass as 0.1:0.4:0.5 and 0.1:0.5:0.4 respectively. Also due comparatively low GWP, M2 composition can be suggested as best possible replacement out of M1 and M2.*

Keywords: Refrigerant, Vapour, Compression, Enthalpy, Entropy, Density.

Introduction

Refrigeration will be laid out a method of moving or transferring heat from one area or point to an alternate area or point. basically it's a craft of keeping up temp of framework not exactly surrounding and it will be accomplished by transferring heat from lower to higher temp to achieve this work should be provided to the framework. Work will be mechanical work, attraction, power and a lot of elective supply. It has outsizedly affected a few ventures, life, agribusiness and a lot of other issue. The idea nourishment safeguarding goes back to the old civilization. Be that as it may, refrigeration innovation has immediately developed inside the only remaining century, from ice reap to temperature-controlled rail vehicles. The presentation of virus rail autos added toward the westbound broadening of the us, allowing settlement in areas that weren't on primary transport channels like waterways, harbors, or discouragement trails. Settlements were conjointly creating in sterile segments of the nation, brimming with new common assets. These new settlement designs started the structure of tremendous urban communities that are prepared to flourish in areas that were generally thought to be aloof, similar to Houston, Texas and city, Nevada. In most created nations, urban communities are vigorously reliant

upon refrigeration in grocery stores, in order to get their sustenance for day by day utilization. the ascent in nourishment sources has prompted a greater grouping of rural deals coming back from a littler offer of existing homesteads. Homesteads nowadays have a way bigger yield for each individual contrasted with the late 1800s. This has brought about new sustenance sources possible to whole populaces, that has outsizedly affected the nourishment of society, applications, though that with a solitary cylinder is reasonable in the solidifying applications.

Refrigerant Selection Criterion

1. Thermo dynamic and thermo-physical properties.
2. Environmental and safety properties
3. Economics.

II. Experimentation

Table 1: Components specification

Components	Specifications
Compressor	Specifications of the compressor used in project are given below: • Application with R-134a • Type -Hermetically sealed compressor • Electrical circuit-CSIR • Operating voltage- 1ph, 180-260V AC • Start capacitor- 40-60 microF,@275V A Capacity- 240BTU
Condenser	• Single role forced air cool Condenser with fan.
Filter drier	Working pressure = 500psig (34.01bar) • For use with CFC, HCFC, HFC, R-134a, R12, R22, R40, R401a, R402a, R404a, R407a, R502a, R502a Refrigerants
Expansion device	• Type- capillary tube • Diameter of capillary tube is 1.0 mm. • Length of capillary tube is 2.5m
Evaporator coil	Specifications of the evaporator used in project are given below: • Diameter of copper coil is 0.6mm. • Length of copper coil is 7500mm.
Chilling tank	• Dimensions of tank – length=600mm, width=450mm, height=300mm • Insulation is done with the help of wood and thermo-col. • The thickness of wood and thermo-col are 10mm and 24.5mm
Energy meter	• Static watt hour meter • 3 Phase 4 wire energy meter • Rating- 10-40 Amp, 240V, 50Hz

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Table 2: Refrigerant taken from the tables as possible replacement.

Refrigerant	R32	R152a	R245a	Mol wt	GWP
M1	0.1	0.4	0.5	98.6	588
M2	0.1	0.5	0.4	91.8	505

Fig 1: Actual Photographs with set up.

III. Results & Discussion

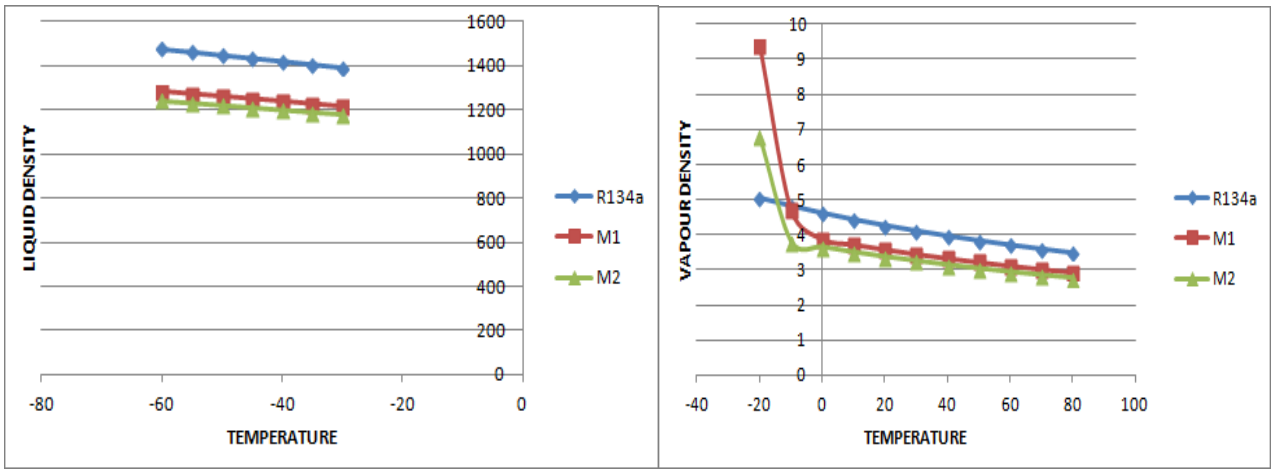

Fig 2: Liquid density vs temperature & Vapour density vs temperature.

When desity is high sp.volume will be low ,which means that for a given mass storage the required size of compressor will be small .A graph is plotted between density and temperature ,showing variation of density with temperature for R134a ,M1 and M2. From graph it is clear that R134a has highest density , M2 has lowest

density and M1 lies between M2 and R134a . Hence for a given mass storage R134a will require small size compressor.

GWP or global warming potential is a relative or comparative measure of how much heat a greenhouse gas traps or hold in the atmosphere. For GWP calculation of carbon dioxide (CO2) gas is taken as standard. It compares or consummate the amount of heat trapped or absorbed by a certain or given mass of the gas relative to the amount of heat trapped by a similar mass of carbon dioxide (CO2) gas. A column graph is plotted showing the comparison of global warming potential of R134a, M1 and M2. It can be seen from the graph that M1 and M2 has less GWP as compared to R134a. M2 has lowest GWP. While latent heat of vaporization and specific heat both these properties are very much dependent on molecular weight of refrigerant. Latent heat of vaporization will be high for refrigerant having lower molecular weight. Also higher the molecular weight lower will be specific volume hence lesser quantity of refrigerant is required to obtain the desired refrigeration effect. This is an advantage. A column graph is plotted to give a comparison between molecular weight of R134a , M1 and M2.

Table 3: **Result comparision of R134a with Mix 1 and Mix 2.**

REFRIGERENT	M1	M2	R134a
C.O.P	6.84	6.841	5.9
Molecular weight	98.1	91.8	102.01
Global warming potential	589	505.2	1300
Ozone depleting potential	0	0	0

VI. Conclusion

In this research paper, our primary focus was on the work that has recently been accomplished on the subject of recognizing fake news using a variety of methodologies and strategies. Additionally, this study illustrated the tools that are available to work on the inquiry cycle and to think about existing tactics and methodologies. Our investigation will be geared toward implementing a more effective advanced outfit strategy and will also include some outstanding word installing strategies. In addition, one of our goals is to produce consistent results with the support of standardized techniques applied to the dataset, which incorporates data collected from a variety of sources. Group techniques can produce more accurate projections and lead to improved execution, all while reducing the amount of scattering that occurs.

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