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"ENERGETIC PERFORMANCE OF ZEOTROPIC BLENDS REFRIGERATOR AND ITS ATLTERNATIVE REFRIGERANTS"

Shahzad Akhter [1], Mr. Inder Singh Nagar [2], Mr. Rajesh Kumar Soni [3]

[1] *M.Tech Scholer Dept. of Mechanical Engineering, School of Research and Technology, People's University, India*
[2] *Asst. Prof. Dept. of Mechanical Engineering, School of Research and Technology, People's University, India*
[3] *HOD Dept. of Mechanical Engineering, School of Research and Technology, People's University, India*

ABSTRACT

Vapor pressure refrigeration strategy is a productive technique for refrigeration among the diverse strategies, yet the vitality contributions to the Vapor pressure framework are high review vitality. This investigation centers around a test investigation of hydrocarbon mix of isobutene (R-600a) and propane (R-290) as a domain well-disposed fridges with zero ozone consumption potential (ODP) and low a dangerous atmospheric deviation potential (GWP), to supplant ordinary coolers tetra-fluoro-ethane R-134a of every a local iceboxes. The execution is watched for a household icebox by utilizing mix of hydrocarbon R-600a and R-290 and its execution is contrasted and R-134a without change in unique framework. Because of the higher estimation of inactive warmth of hydrocarbons the measure of refrigerant charge expected observed to be decreased as contrasted and hydro-fluoro-carbon R-134a. Comparative performance study has shown refrigerating effect will improved by using HC blends, reduction of 40% in the refrigerant charge, the energy consumption per day reduced by 5%

Keyword: *VCRS, Refrigerants isobutene and propane, HC, CFC*

I. INTRODUCTION

Refrigeration might be characterized as the way toward accomplishing and keeping up a temperature underneath that of the environment, the point being to cool some item or space to the required temperature. Safe-guarding of short-lived sustenance. The refrigeration and cooling division in India has long history from the early long periods of a century ago. India is by and by creating R134a, R22, R717 and hydro carbon based refrigeration and cooling units in vast amounts. The halogenated refrigerants, for example, R12, R22, R134a and normal refrigerant like R717 are promptly accessible at low costs. The Hydro-carbon (HC) and Hydro-Fluro-Carbon (HFC) blends, (for example, R404a, R407, and R410A) are not as of now produced indigenously and thus must be foreign made at a higher expense. This is probably going to influence the development in refrigeration and cooling division in India and furthermore the aggregate transformation to ecological neighborly choices soon. Green House gas (GHG) discharges from petroleum product ignition for power age and emanation of halogenated refrigerants from vapor pressure based refrigeration, cooling and warmth pump frameworks contribute fundamentally to an Earth-wide temperature boost. A decrease in GHG emanations must be accomplished by utilizing condition well-disposed and vitality proficient refrigerants. The high ecological effects due to halogenated refrigerant emanations prompt recognizing a long haul choice to meet all the framework necessities including framework execution, refrigerant – grease connection, vitality proficiency, wellbeing and administration. Halogenated refrigerants are broadly utilized in the refrigeration and cooling ventures over numerous decades due to their amazing thermodynamic and thermo-physical properties. According to the Montreal Protocol 1987, creating nations like India, with a for every capita utilization under 0.3 kg of ozone exhaustion substance have been ordered as Article-5 nations. This nation has required eliminating all Chloro-Fluro-carbons (CFCs)

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by 2010 and all hydro Chloro-Fluro-carbons (HCFCs) by 2040. HFC refrigerants are considered as one of among the six focused on ozone depleting substance under Kyoto convention of UNFCCC in 1997. The second major ecological effect is GWP, or, in other words the retention of infrared discharges from the earth, causing an expansion in worldwide earth surface temperature. While sun based radiation at 5800 K and 1360 W/m2 arrives the earth, over 30% is reflected once again into space and the greater part of the rest of the radiation goes through the environment and achieves the ground. This sun based radiation warms up the earth, or, in other words a dark body emanating vitality with a ghastly top in the infrared wavelength run. This infrared radiation can't go through the climate in view of assimilation by GHG including the halogenated refrigerants. Since this examination has been centered around retrofitting of existing R-22 frameworks with elective refrigerants, a nitty gritty writing review identified with the execution of HFCs, HCs and their blends in refrigeration and cooling frameworks has been made. Moo-Yeon Lee, Dong-Yeon Lee, Yongchan Kim In this investigation, the execution of a little limit specifically cooled fridge was assessed by utilizing the blend of R290 and R600a with mass part of 55:45 as an option in contrast to R134a. The blower relocation volume of the elective framework with R290/R600a (55/45) was changed from that of the first framework with R134a to coordinate the refrigeration limit. The two frameworks with R290/R600a (55/45) and R134a were tried, and after that upgraded by changing the refrigerant charge and slender tube length under test conditions for both the draw down test and the power utilization test. The refrigerant charge of the upgraded R290/R600a framework was roughly half of that of the improved R134a framework. The slender tube lengths for each evaporator in the enhanced R290/R600a framework were 500mm longer than those in the advanced R134a framework. The power utilization of the upgraded R134a framework was 12.3% higher than that of the advanced R290/R600a framework. The cooling rate of the advanced R290/R600a (55/45) framework at the on the off chance that setting temperature of _15 _C was enhanced by 28.8% over that of the streamlined R134a framework. II. Issue DEFINITION The Global Warming Potential (GWP) of as of now utilized R134a is high as 1300.The Ozone Depleting Potential (ODP) of R134a is additionally moderately high.

II. PROBLEM DEFINITION

The Montreal and Kyoto Protocol of UNO proposes limiting of Hydro-Fluro-carbons (HFCs) to use as refrigerants. Looks into show HFC 134a very little miscible with grease oil in the blower. European nations have officially prohibited R134a. Mixing of R134a with other HFC is an issue. R-22 and R134a will be eliminated because of ecological issues. To conquer the above issue, Zoetrope refrigerant R290 and R600a is proposed in the present examination on the grounds that zoetrope of R290 and R600a has low and a less estimation of 120 as Global Warming Potential (GWP) when contrasted with different refrigerants.

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III. DESIRABLE THERMOPHYSICAL PROPERTIES OF REFRIGERANTS

1) Evaporator and Condenser Pressures: In request to maintain a strategic distance from any spillage of air and dampness from outside and to have the capacity to distinguish spillage of refrigerant from the framework, it is ideal that both evaporator and condenser weights ought to be over the climatic weight; yet then these weights ought not be high on the grounds that the development of blower, condenser and evaporator should be substantial and thusly introductory expense will increment. The pressure proportion ought to be as little as conceivable to keep away from spillage over the cylinder.

2) Critical Temperature and Pressure: If the basic temperature of a refrigerant is exceptionally close to the gathering temperature, the power necessities are huge.

3) Freezing Temperature: A refrigerant is required to have its frigid temperature much underneath the task temperature in the plant.

4) Latent Heat of Vaporization: The more is the idle warmth of vaporization, the more is the refrigeration impact. Subsequently mass of refrigerant required for per ton of refrigeration will be diminished.

5) Specific Volume: The hypothetical blower uprooting relies upon the particular volume of the refrigerant vapor at evaporator temperature, i.e. at suction to blower and the refrigerating impact per kg of refrigerant.

6) Stability and Inertness: A perfect refrigerant ought not break down at temperature of task in the cycle and ought not get polymerized.

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7) Viscosity: It is alluring that both the fluid and vapor refrigerants ought to have low consistency so the weight drops amid stream are little.

8) Thermal Conductivity: High warm conductivity is alluring for productive warmth move in evaporator and condenser.

IV. PERFORMANCE STUDIES ON VAPOUR COMPRESSION REFRIGERATION SYSTEM WITH DIFFERENT REFRIGERANTS

Simple modelling is one of the practices to study the performance of VCR system with environmental friendly refrigerants. This journal deals with the experimental study and prediction of performance characteristics of the VCR system with R134a, R290 and R600a and the proposed alternative refrigerant mixture.

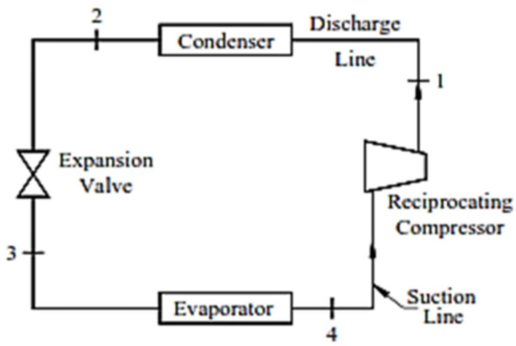

Figure 1 Schematic Diagram of VRCS Cycle

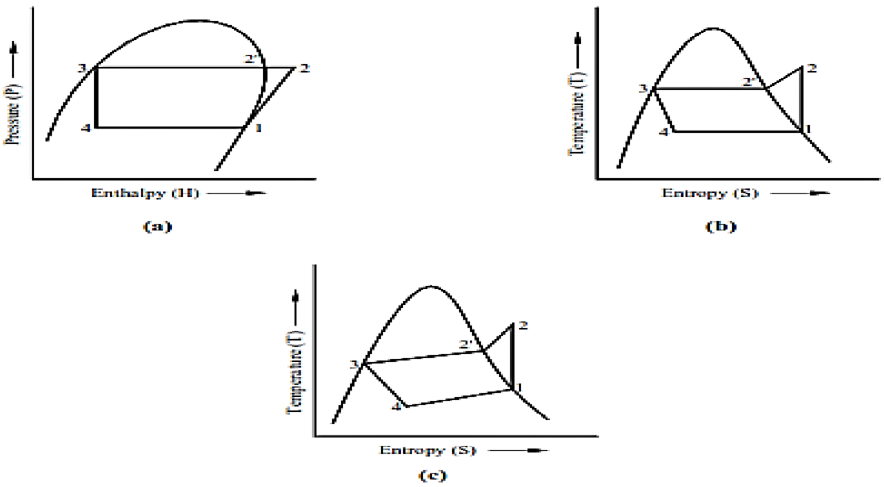

Figure 2 P-H and T-S diagram (a) P-H diagram for Pure and Zeotropic Refrigerant Mixture (b) T-S diagram

V. STUDIES ON THE PERFORMANCE PARAMETERS

This system performance parameters as a pressure ratio, specific refrigerating effect, specific compressor work and displacement and COP has calculated with evaporating temperature varying from -30°C to -10°C and condensing temperature of 40°C using the following mathematical models.

Pressure Ratio (PR) = P_{co}/P_{ev} (1)

Specific Refrigerating Effect (q_{ref}) = $h_1 - h_4$ (2)

Specific Compressor Work (w_{comp}) = $h_2 - h_1$ (3)

Specific Compressor Displacement (SCD) = $1/\rho_1 q_{ref}$ (4)

Coefficient of Performance (COP_{th}) = q_{ref} / w_{comp} (5)

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VI. RESULTS

Pressure Ratio: Figure 3 shows the variation of Pressure Ratio (PR) with evaporating temperature for a condensing temperature (T_{CO}) of 40℃. The pressure ratio of R134a has higher than that of R290 and R600a. The PR values of propane and isobutene mixtures are higher than that of R134a. At the rating conditions, the descending order of pressure ratios for the refrigerants is R134a, R290, R600a, R290/R600a (70/30), R290/R600 (60/40), R290/R600a (50/50), R290/R600 (40/60) and R290/R600 (30/70).

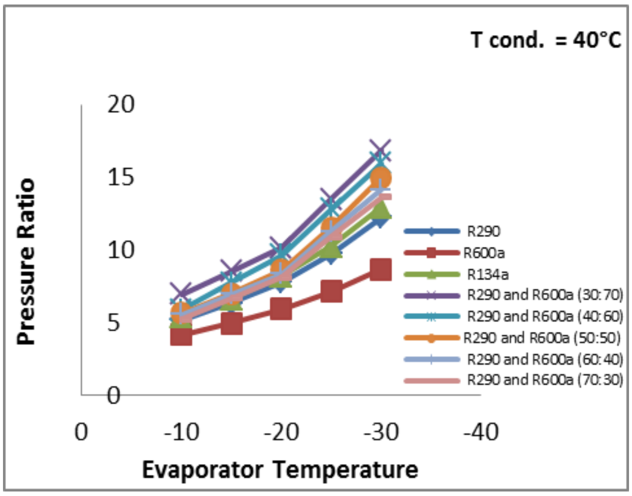

Figure 3 Variation of PR with T_{ev} for T_{CO} = 40°C Compressor Heat Transfer Rate

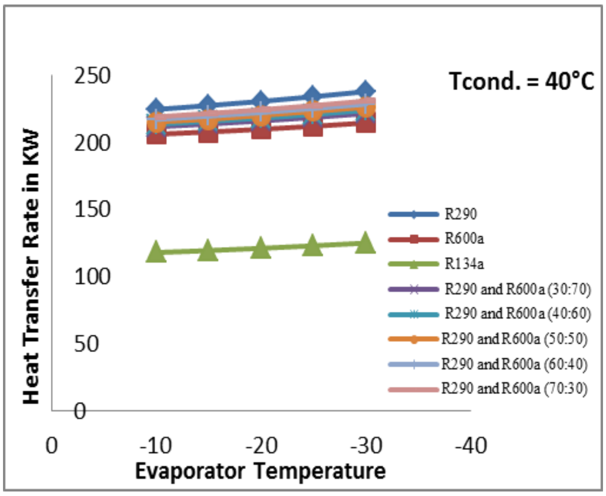

Figure 4 Variation of Heat Transfer Rate with T_{ev} for T_{CO} = 40°C Evaporated Heat Transfer Rate

Figure 4 shows the Compressor Heat Transfer Rate (KW) with different evaporating temperature for condensing temperature T_{CO} = 40°C. The CHTR of all the refrigerants increases with decreasing evaporator temperature. This behavior is due to the constant entropy lines in the superheated region on P-H diagram. All the alternative refrigerant mixtures has higher CHTR than that of R134a. The refrigerant R134a is the lowest CHTR.

Figure 5 shows the Evaporated Heat Transfer Rate (KW) with different evaporating temperature for condensing temperature T_{CO} = 40°C. The EHTR of all the refrigerants decreases with increasing evaporator temperature. This behavior is due to the constant entropy lines in the superheated region on P-H diagram. All the alternative refrigerant mixtures have higher EHTR than that of R134a. The refrigerant R134a is the lowest EHTR.

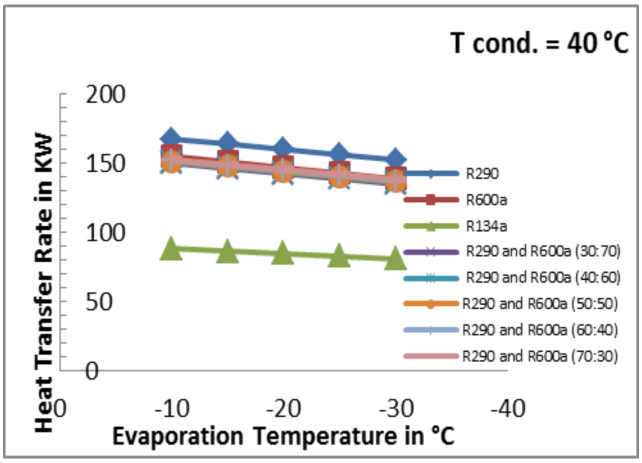

Figure 5 Variation of Heat Transfer Rate with Tev for Tco = 40°C Compressor Work

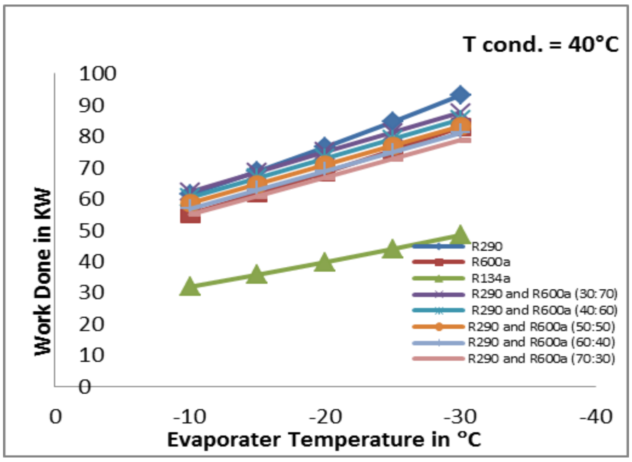

Figure 6. Variation of CW with T_{ev} for T_{CO} = 40°C Coefficient of Performance

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Figure 6 shows the Compressor Work (CW) with evaporating temperature for T_{co} = 40°C. The CW of all the refrigerants increases with decreasing evaporator temperature. This behavior is due to the constant entropy lines in the superheated region on P-H diagram. All the alternative refrigerant mixtures require higher CW than that of R134a. The refrigerant R134a requires the lowest CW. R134a requires 32% higher CW than that of R290/R600a. The descending order of refrigerants for CW is R134a, R290, R600a, R290/R600a (70/30), R290/R600 (60/40), R290/R600a (50/50), R290/R600 (40/60) and R290/R600 (30/70).

Figure 7 shows the Coefficient of Performance (COP) R134a, R290, R600a, R290/R600a (30/70), R290/R600 (40/60), R290/R600a (50/50), R290/R600 (60/40) and R290/R600 (70/30) for various evaporating temperatures for T_{co} = 40°C. The COP of propane and isobutene mixtures is higher than that of R290, R600a and R134a. R290/R600a (40:60) mixture has the highest COP. The mixture of R290/R600a ratio of (30:70 and 50:50) has 0.5-6% and 2-12% higher COP than that of R290/R600a (40:60) respectively for the range of temperatures considered in this study. The descending order of refrigerants for COP is R134a, R290, R600a, R290/R600a (30/70), R290/R600 (40/60), R290/R600a (50/50), R290/R600 (60/40) and R290/R600 (70/30).

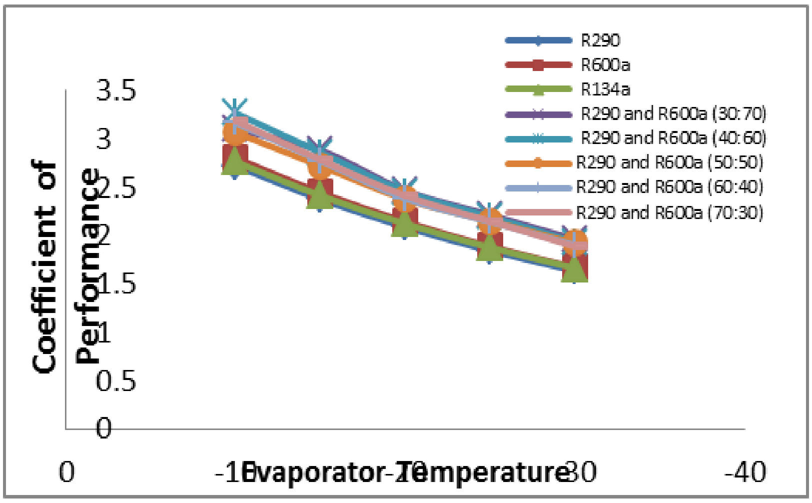

Figure 7 Variation of COP with T_{ev} for T_{co} = 40°C

VII. CONCLUSION

Concentrates on ternary blends can be done with the equivalent test setup. The investigations performed with magnets can be completed as a different work by changing the Gauss level and position of the magnets. These chose blends can be considered in a household cooler and the slim tube length can be upgraded. The experimentation can be additionally stretched out to various marked frameworks and blowers with the goal that the required charge amount, fine length and condenser length can be suggested all the more precisely for the diverse refrigeration frameworks applications accessible in the market.

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