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Exergy Presentation of the Environmentally Friendly Refrigerant Mixture

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Abstract: *This work presents the exergy execution of new innocuous to the biological system refrigerants 1,1-difluoroethane (R152a) ,1,1,1,3,3-Pentafluorbutane (R365mfc) and particularly their mix. A smoke pressure refrigeration cycle was reenacted to see the introduction of a lone stage cycle at different conditions. A close to report including a broad assortment of effective parameters was done. The exergy annihilation methodology as one more part for the arrangement of the smoke pressure refrigeration cycles was completed. R365mfc has achieved higher Coefficient of Execution (COP). Other than an exergy examination was employed for each part and for the whole cycle. Among all of, the mixes of R152a and R365mfc have given higher exergy destruction, power consumption, cooling and heating capacity as compared with the pure fluids.*

Keywords: *R152a, R365mfc, Mixture, Exergy Destruction, COP, Refrigeration Cycle.*

I.INTRODUCTION

The latest twenty years have seen an enormous augmentation of the damaging materials of Chlorofluorocarbons (CFCs) and Hydro-chlorofluorocarbons (HCFCs) based refrigerants in the climate. These materials have been extensively used as solvents, foam blowing subject matter experts, sprayers and especially as refrigerants due to their extraordinary properties like consistent quality, non-harmfulness, non-instability and availability. In any case, these substances perniciously influence the world's guarded ozone layer. Since the declaration of the Montreal show in 1987 the use of these substances is accordingly controlled [1]. Furthermore the CFCs had been detected as substances contributing to global warming. Nowadays the world leading countries have legalized to stop the consumption of CFCs by replacing them with HFCs [3-5].

This paper maintains more exact energy useful for those materials, including the pure fluids and mixes of R152a and R365mfc, utilizing the exergy assessment. The R152a is a HFC type refrigerant [2. This fluid has zero ODP and a GWP worth of 120. The edge of bubbling over temperature at a strain of p=1.013 bar is □s=-24.0°C, the sub-nuclear weight M=66.1 kg/kmol. R152a is a medium strain refrigerant for the medium temperature refrigeration range [2]. The physical, thermodynamic and refrigeration credits are like those of the refrigerants R12 and R134a. Disregarding the way that R152a is a good refrigerant substitute for R12, it is not used in its pure form because of its flammability (flammabilitylimits3.7-21.8%byvolumein air). Subsequently, R152a is named as" uncommonly ignitable".

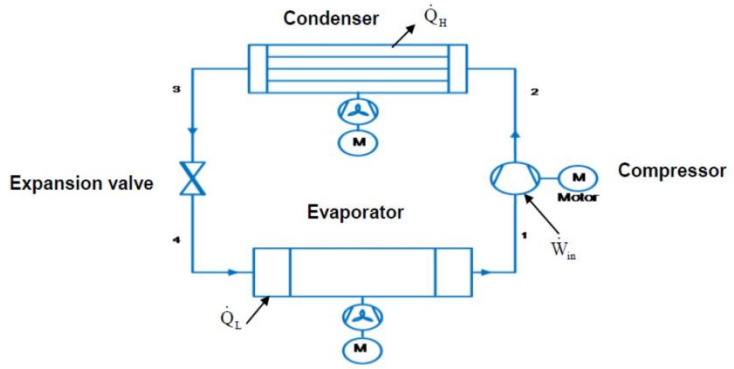

Fig.1.Components and energy diagram for a single stage vapor compression refrigeration cycle.

All the equations above were implemented into a Matlab program. The properties were calculated through the use of the REFPROP [9] program. This program, developed by the National Institute of Standards and Technology (NIST)[8], calculates the thermodynamic and transport properties of financially huge fluids and their mixes [10] [11]. REFPROP is a contraction for Reference fluid Properties, this program is went with the most solid pure fluid and blend models by and by available. The program includes three models for the thermodynamic properties of pure fluids: equations of state express in Helmholtz energy, the modified Benedict-Webb-Rubin state of state, or an extensive relating states (ECS) model [11].

II.RESULTS AND DISCUSSIONS

Fig.5 frames the effect of the cold medium temperature on the coefficient of execution COP for system with different refrigerants. It is clearly seen that there is a significant qualification between the Police for both pure fluid and the mix of R152a andR365mfc. It is seen that a couple of refrigerants are more useful than others. An assessment results exhibits that a system containing of (30%R152a, 70%R365mfc) and (50%R227ea, 50%R365mfc) are about correspondingly viable. Moreover system containing (50%R134a, 50%R365mfc), (80%R152a, 20%R365mfc) and (50%R152a, 50%R365mfc) are about likewise viable. Among all the refrigerants with show up at a high COP R365mfc is followed by R152a. It is to be seen the mix of R365mfc and R152a doesn't outperform the performance efficiency of its pure fluids.

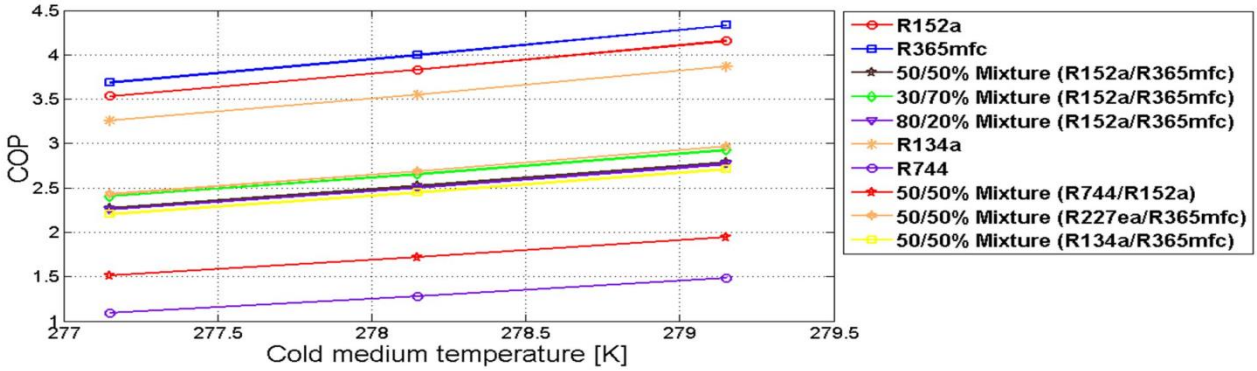

Fig.2.Variation of COP with cold medium temperature (Ambient temperatureat T=298.15K).

As shown in Fig.6 the mix sort of the refrigerants was given a higher warming cutoff stood out from pure fluids which indicated a less breaking point. Besides, the strategy engaged with cooling the refrigerant fluid underneath its solidifying temperature at a given pressure is known as a sub-cooling. Sub-cooling gives 100% refrigerant liquid to enter the advancement device, thwarting smoke bubbles from impeding the movement of refrigerant through the expansion valve and staying aware of stable movement of liquid. In case the sub-cooling is caused by a power move methodology external to the refrigeration cycle, the refrigerant effect of the structure is extended, because the sub-cooled liquid has less enthalpy than the saturated liquid.

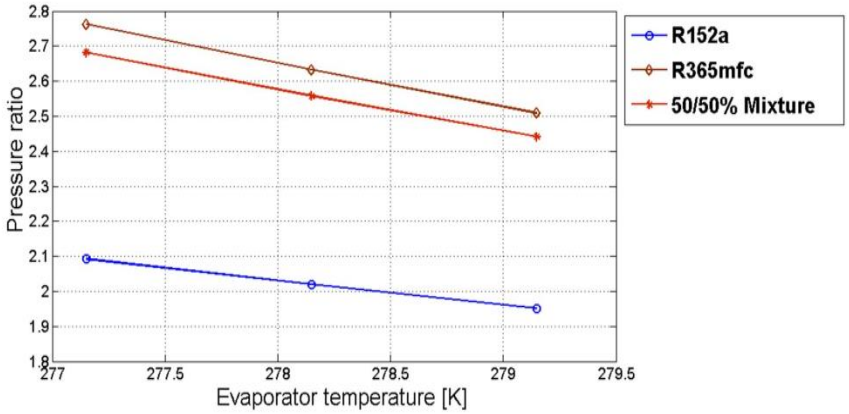

Fig.3. Variation of evaporator temperature with pressure ratio.

Note that the presentation of a fundamental smoke pressure refrigeration structure can be basically additionally evolved by extra cooling the liquid refrigerant leaving the condenser twist. This sub-cooling of the liquid refrigerant can be accomplished by adding a mechanical sub-cooling loop in a conventional vapor-compression cycle.

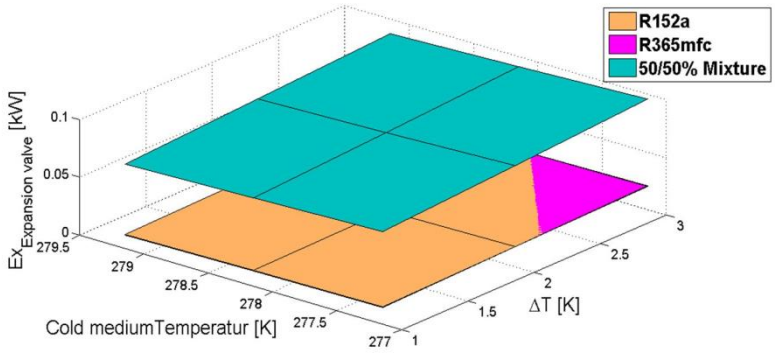

Fig.3. Total exergy destruction in expansion valve.

The strain extent for R365mfcis higher, that is to say heavier compressor work is required for R365mfc while the same compressor could be used for the others. Differentiating the overall power move coefficients in the condenser as displayed in Fig.9,the blend presents most frightfully horrible force move coefficient in differentiated and pure fluids. The power move from the two warms generating equipment in the refrigeration cycle is continually joined by exergy move. The exergy destruction of each and every part in the cycle was surveyed. As shown in Fig.10 to Fig.13; the usage of the mix sort of the refrigerants proposed a higher exergy destruction regard among all of the pieces of the cycle. The reenactment results affirmed that the best irreversibility happened in the condenser and the minimum irreversibility is occurred in the expansion valve for most working fluids. Possible irreversibilities in the evaporator and the condenser happen consistently on account of the temperature qualifications between the two power exchanger fluids, pressure incidents, stream lopsided characters and force move with the environment. The irreversibility in the blower is commonly occurs from mechanical-electrical setbacks due to imperfect electrical, mechanical and isentropic efficiencies and stress the need for careful selection of this equipment, since components of inferior performance can considerably reduce overall system performance.

III.CONCLUSIONS

The reenactment delayed consequences of this work have shown that, the best irreversibility occurred in the condenser and the minimum irreversibility is occurred in the augmentation valve for most working fluids. The results of these results were discussed in details. The results data also, proposed that the mix sort of the refrigerant requires greater power usage to drive the cycle, as well as greater exergy destruction, rather than the pure fluids R152a and R365mfc.

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