Study the effect of Eco-Friendly Refrigerant in Air Conditioning Systems-A review

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Abstract: The use of chlorofluorocarbon and hydrochlorofluorocarbon is the major reason for ozone layer depletion and a greenhouse effect. The uses of a proposed choice of refrigerants have the following benefit such as (i) easily available in local places, (ii) less expensive, and (iii) an eco- friendly nature. The parameters to be investigated are the capacity of an evaporator, compressor power, coefficient of performance (COP) and, the cooling rate. Hence, this paper has given predilection to remove the adverse effects through the use of suitable eco-friendly refrigerant in air conditioning systems and, with the help of this EPR of refrigeration systems is also improved. This paper tells us about that refrigerant which is eco-friendly and having a better performance parameter.

Key-Words: - eco-friendly refrigerant, a hydrochlorofluorocarbon, performance parameters air - conditioners

1. Introduction

1.1 Need for the eco-friendly refrigerant in air-conditioners

The major requirement of the cooling equipment and air conditioners are increasing daily. A century before, cooling systems have been used with refrigerants such as air, CO_2, etc, which were eco-friendly. There was advancement to the mechanical refrigeration industries and air conditioning industry in terms of money, extra efficiency, more authenticity, but there were many disadvantages over these cooling systems such as non-environment-friendly nature in coming future. Therefore Montreal Protocol 1987, have been decided to phase out HCFCs in the developed countries by 2030 and for developing countries by 2040 [1,2]. An experimental investigation was carried out with R290 as an alternative to replacing R22 used in the window air conditioner. Results revealed that the performance of R290 was better when compared to R22 [3]. The stratospheric O3 plays an important role in absorbing most of the life vanish ultraviolet sunlight reaching towards the earth. Ozone also plays a key role in temperature control in the earth's atmosphere. Experimental studies were conducted in a window air conditioner when it is retrofitted with a mixture of R407C, propane (R290), and isobutane (R600a) without changing mineral lubricant oil. From this study, it was observed that a blend of R407C/R290/R600a would be an appropriate alternative refrigerant to R22 [4].

With the increasing ecosystem hazards, public contingency towards sustainable growth is progressing day by day. The O3 deficient compounds (CFC and HCFC) contain a reactive gaseous atom of chlorine or bromine. Although the Chlorofluorocarbons and Hydrochlorofluorocarbon molecules are of greater weight than the molecules of air, the environment circulation took compound to the stratosphere over a large period. Experimental tests were done with hydrocarbons and different blends consist of R1270, R290, R152a, and RE170 as substitute fluids to R22 used in both heat pump and air conditioning devices. Test results revealed that the performance of all the fluids was similar to R22 or superior to that of R22 [5]. It was reported that the refrigerant mixture R290/R1270 (20/80 by wt. %) is an alternative to R22 among the other refrigerant mixtures investigated in the study [6]. Performance testing of R433A was conducted in heat pump test equipment under both heat pump and air conditioning working conditions. R433A is a binary mixture that consists of 30% R1270 and 70% R290 on a mass basis. Test results revealed that the performance of R433A was better when compared to R22. Therefore R433A was a suitable alternative refrigerant to R22 [7]. Experimental testing of R432A was carried out as a substitute to R22 used in both heat pump and air conditioning devices. R432A is a binary blend consists of 80% R1270 and 20% R170 on a mass basis. Experimental results revealed that the performance of R432A was higher than R22. Therefore R432A was an appropriate eco-friendly refrigerant to replace R22 used in both air conditioning and heat pump applications [8]. Halogen molecules react very rapidly with the ozone layer and the formation of oxide occur thus lowering the matter of space which is a major cause for ozone layer depletion and hole. Therefore, it requires to be replaced with environmentally friendly refrigerants to protect the environment (9). HFC410A (R410A) is one of the most widely used HFCs to replace R22 in household air conditioners (10). However, according to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC-2007), R410A has a high GWP of 2088.

From this point of view, R410A is also facing the challenge of being phased down, which has already attracted some research efforts searching for alternatives for R410A by Xu et al (11).

R32 has an ODP of zero and a GWP of 675, and R290 has an ODP of zero and a GWP of 3.3(12). They have much lower GWP than R410A. However, the main disadvantage of them, especially for the hydrocarbon refrigerant R290, is the flammability (13). An experimental study is conducted to obtain the air conditioners performance charged with both R32/R290 and R410A, including the refrigerant charge amount, the cooling and heating capacities, the COP under refrigerating and heating conditions, the power consumption, the discharge temperature, etc. Moreover, to further reduce the refrigerant charge and flammability, the present work also conducts experiments involving the micro-channel heat exchanger, which has a small volume and refrigerant charge (14). The R410A lubricating oil can be applied to the R32 system directly or with minor optimization (15). Literature also indicates that POE oil has good suitability with hydrocarbons, whereas a higher viscosity grade will generally be required for hydrocarbons (16).

Recent researches have shown that artificial chemicals are responsible for the ascertained exhaustion of the oxygen trioxide layer. One of the serious menaces to the environment is stratospheric ozone layer hole production. Thus earth absorbs heat. A major increase in the temperature of the earth's surface by fewer degrees is anticipated to produce negative effects. The presence of CFC and HCFC in the troposphere also plays a vital role in the greenhouse gas effect. Besides the entrapment of bouncing back of lesser wavelength radiation from the surface of the earth is in the sub stratosphere region through various types of the compound gives rise to the increment in the pile of earth surface temperature known as the greenhouse effect. Thus improvement in efficiency and concern for the environment, the attempt is being given to developing eco-friendly substitute coolant. . Thus in the present eco _awareness age, it has been noted out that manufacture, oozing, ejection, etc. Chlorofluorocarbon and HCFC refrigerants have bad effects on our environment by participating in ozone layer depletion and the greenhouse effect.

1.2 **Hydrocarbons versus CFCs**

One of the major problems in using Freon is ozone layer exhaustion. The ozone layer another name trioxide helpful reduces the harmful effect of using chlorofluorocarbon. Hydrocarbon was the best source for an alternative of CFCs since they have well thermodynamically and thermophysical properties and they were universally useable at less price. The absence of chlorine atom from hydrocarbons results in zero trioxide depletion potential. Besides global warming potential is also very less from hydrocarbons, owing to more heat of hydrocarbons compared with that of dichlorodiflourocarbon. From a previous study conducted to find out the COP and other major parameters for propane and isobutene mixtures, their results tell that also showed similar properties like R-12 that we can conclude that this mixture is the best coolant for replacing dichlorodifluorocarbon since this is having less no of a chlorine atom, the only disadvantage of this hydrocarbons is their flammability. Due to the different mass proportion of propane and butane in a domestic refrigerator is very small then, the chances of an explosion are also very less.

Temperatures and pressures at various places in the airconditioning were calculated to enable the thermodynamic states of the air conditioning system. If, dichlorodifluorocarbon is used in a window air conditioning which is superseded by four dissimilar hydrogen mixtures. If the mineral oil and naphthalene based oil is used with R-12, is also used with the hydrocarbon mixtures. The performance index has been plotted against the evaporator and condenser temperatures for each hydrocarbon mixture found.

4. CONCLUSION

Mr. R. vijyan and chinnaraj find out the performance of all the coolant in the parameter of mass flow rate and the coefficient of performance of all the frozen material. From this paper analysis carried out to analyze the performances of all the coolant like R22, R407C, and R290 using the EEV opening in a window ac of 1TR capacity they get the following result

The mass flow rate and cooling capacity of R290 with EEV opening is lesser than that of R22andR407Csystem due to its very low density of liquid having less no of the molecule and lesser latent heat of vaporization at constant pressure and constant temperature.

R290 refrigerant having more EPR than R22 coolant and R407C in the range of 8.0-2.3% and 2.0-6.6% respectively.

The frozen material is giving one of the best performances at EEV opening of 20% (546 steps) having lesser GWP (global warming potential) and utmost negligible ozone depletion potential (ODP). By studying this paper we come to know that R290 is the best alternative for R22 in Air-conditioning systems.

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