

Experimental analysis on vapour compression refrigeration system by using nozzle as inlet of evaporator and R-32 as refrigerant with copper oxide as nanoparticle

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Abstract : New refrigerant in recent days causes zero ozone depletion, there will be generation gap also in refrigerants. In olden days the refrigerant leakage causes ozone layer depletion. But now a day's leakage of refrigerant not at all a problem. We can place a nozzle at inlet of evaporator such that the nozzle is decreases the pressure energy and it leads to increases the coefficient of performance. We can use R-32 as refrigerant to get cool faster and very small ozone depletion. We can use copper oxide as nanoparticle. By using nanoparticles work done on the compressor reduces. Overall in this project copis increased by 4.346 percent and compressor work is decreased by 4.117 percent and power consumption is decreased by 4.1335 percent.

IndexTerms - Domestic Refrigerator, R-32, Nano Particle CUO, Nozzle

I. INTRODUCTION

Now a days we all are using domestic refrigerator. There will be generation gap also in refrigerants. In olden days the refrigerant leakage causes ozone layer reduction. But now a day's leakage of refrigerant is not much effect of older refrigerator.

2. EXPERIMENTAL SET UP:

Preparation of nozzle: We can place a nozzle in front of evaporator to decrease pressure. We can manufacture nozzle in lathe by various operations and drawn nozzle in NX-CAD software. Dimensions of nozzle are 6mm at inlet and 3mm at outlet of length 10mm.

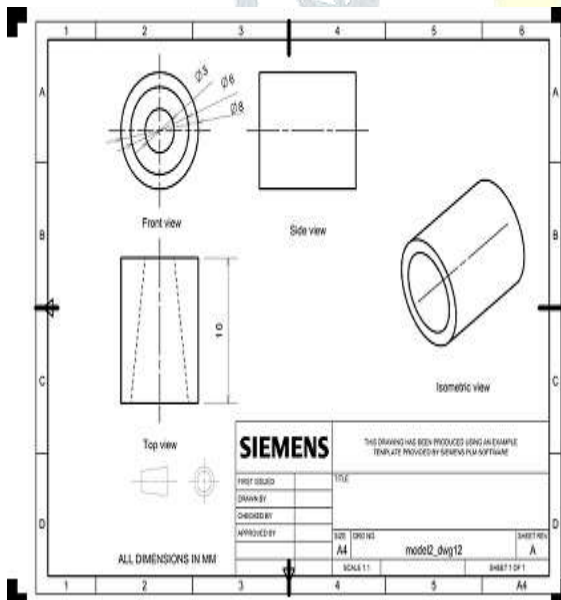


Fig.2.1 Nozzle in NX-CAD



Fig. 2.2 After Manufacturing Nozzle



Fig 2.3 Experimental setup

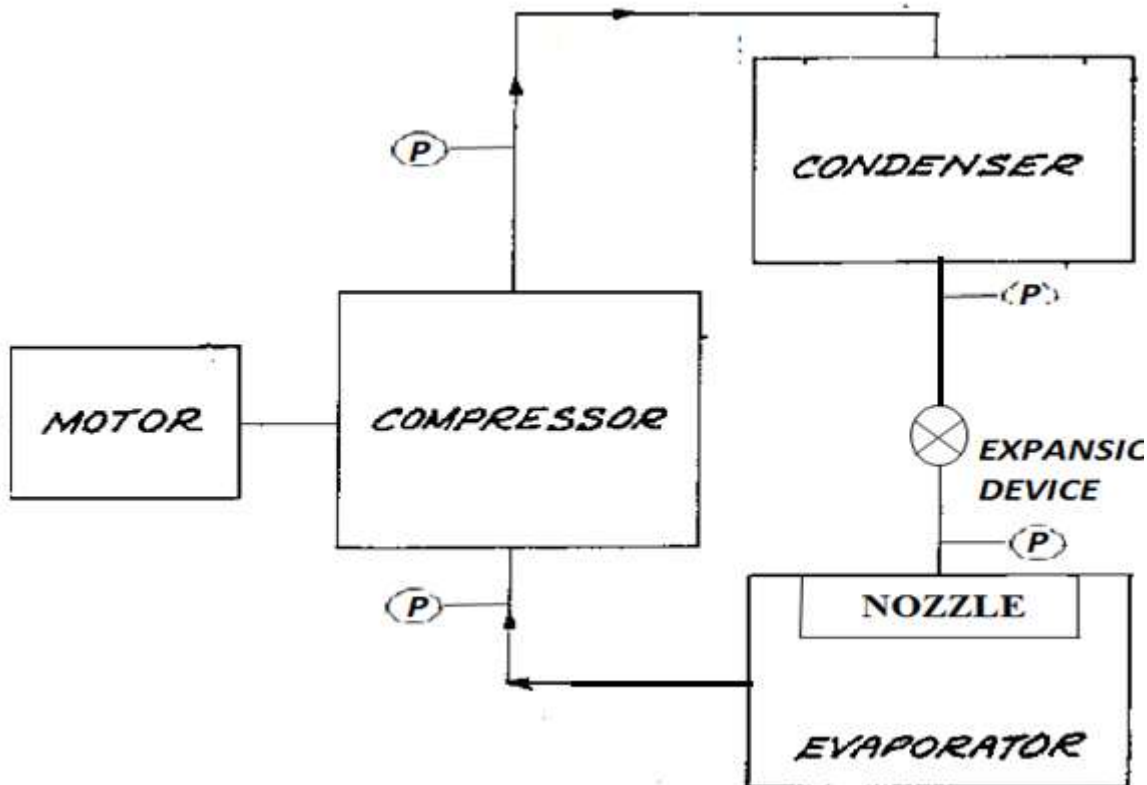


Fig 2.4 Schematic Diagram of Experimental Setup

Leakage Test:

This test can find the leakage in refrigerator by simply applying soap bubble test. Wherever the bubble is coming when we switch on the refrigerator it means there is leakage. We can identify and replace that part.

Refrigerant:

Difluoromethane, also called HFC-32 or R-32, is an organic compound and the chemical formula is CH_2F_2 . We have different types of refrigerant in the market but next generation refrigerant is R-32. Some properties of R-32 refrigerant is Zero Ozone Depletion - 1/3 GWP of HFC 410, Superior energy efficiency, High refrigeration capacity & thermal conductivity, Low pressure drop, Single component refrigerant easy to handle and recover, Low toxicity, Readily available and Less power consumption.

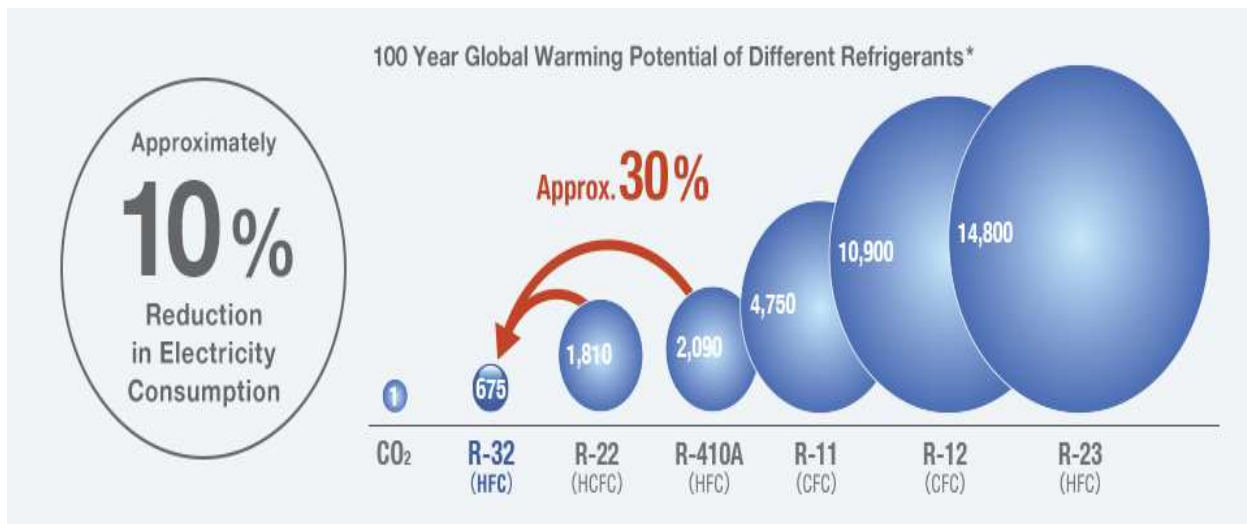


Fig 2.5 Global Warming Potential of R-32

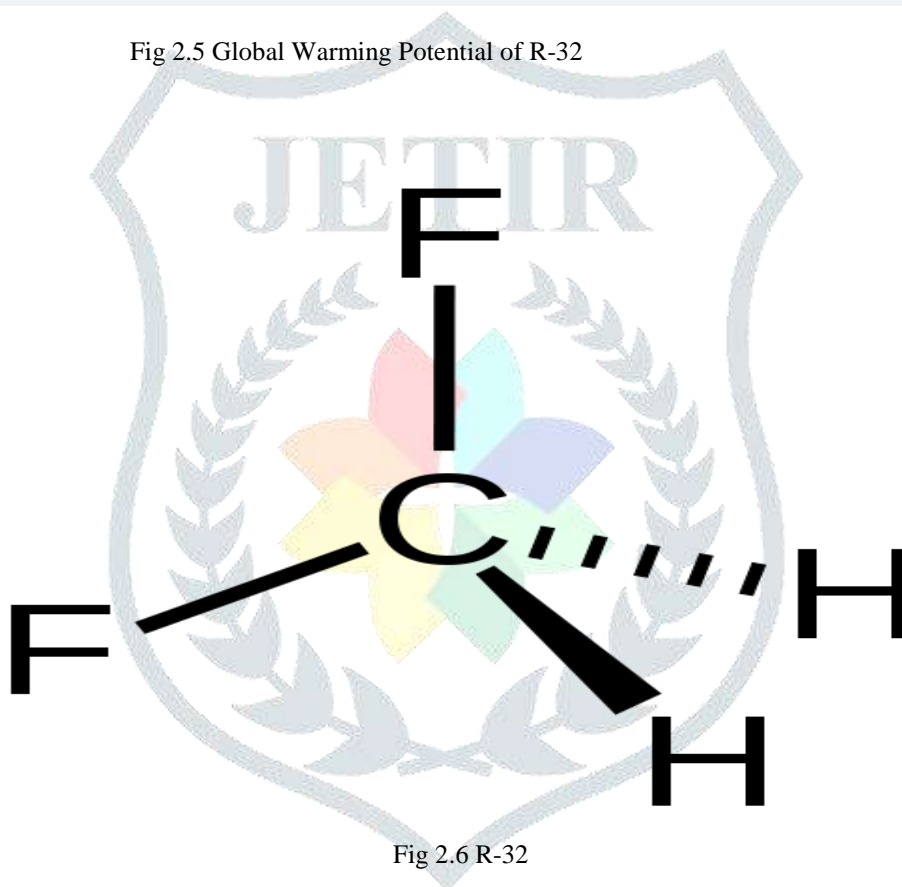


Fig 2.6 R-32

3. Nano particles:

Copper oxide nanoparticles appear as a brownish-black colour. They can be reduced to metallic copper when exposed to hydrogen or carbon monoxide under high temperature. They are graded harmful to humans and as dangerous for the environment with adverse effect on aquatic life.

4. RESULTS AND DISCUSSIONS

COP:

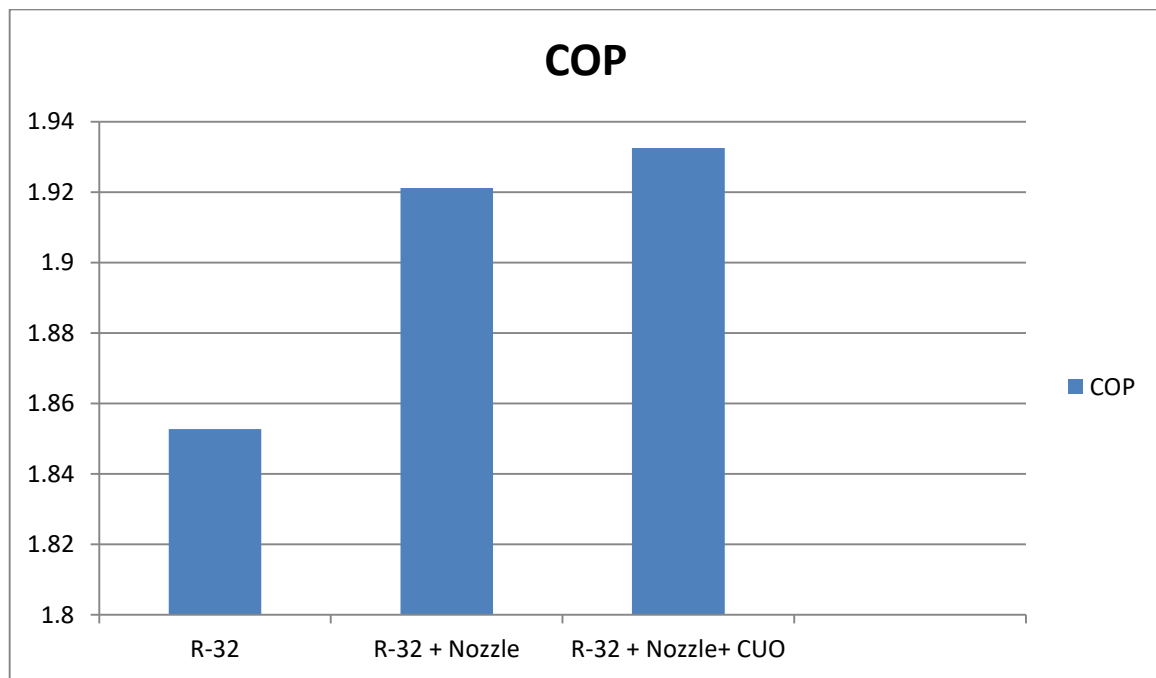


Fig 4.1 variation of COP

By using only R-32a as a refrigerant to R-32a refrigerant with nozzle cop is increasing cop is increased by 3.736 percent and by using nano particles to the nozzle and R-32a refrigerant with nozzle cop is increased by 0.588 percent. Overall we can say cop is increased by 4.346 percent.

WORK DONE OF COMPRESSOR IN kJ/kg

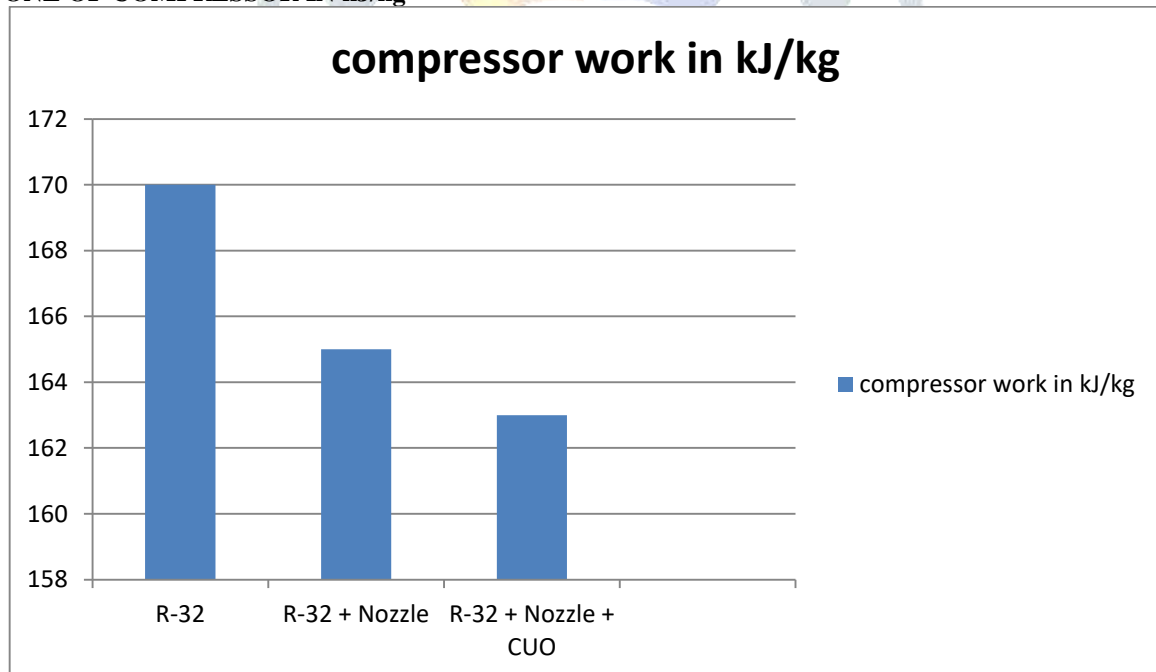


Fig 4.2 variation in work done

By using only R-32a as a refrigerant to R-32a refrigerant with nozzle compressor work is decreased cop by 2.941 percent and by using nano particles to the nozzle with R-32a as a refrigerant compressor work is decreased by 1.212 percent. Overall we can decreased by 4.117 percent.

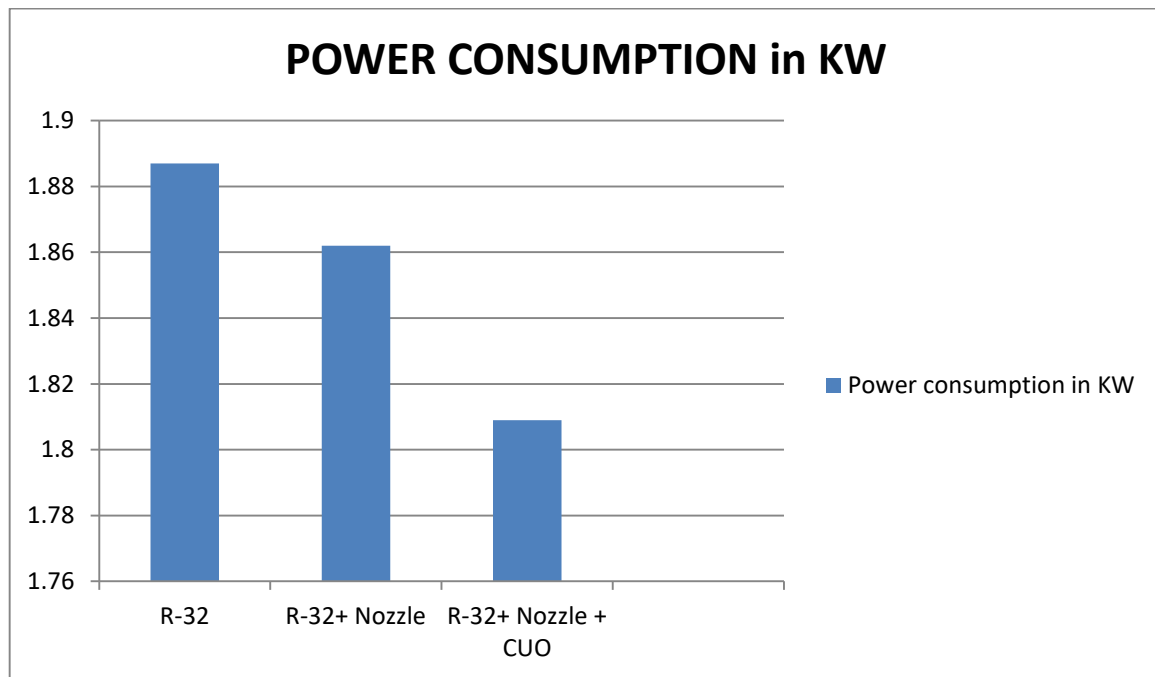
Power consumption

Fig 4.3 Power Consumption

By using only R-32a as a refrigerant to R-32a refrigerant with nozzle power consumption is decreased by 1.2824 percent and by using nano particles to the nozzle with R-32a as a refrigerant power consumption is decreased by 2.88 percent. Overall we can decrease power consumption is decreased by 4.1335 percent.

5. Conclusions

By using only R-32 as a refrigerant to R-32 refrigerant with nozzle cop is increased by 3.736 percent and compressor work is decreased cop by 2.941 percent and power consumption is decreased by 1.2824 percent. By using nano particles to the nozzle with R-32 as a refrigerant cop is increased by 0.588 percent and compressor work is decreased by 1021 percent and power consumption is decreased by 2.88 percent. Overall cop is increased by 4.346 percent and compressor work is decreased by 4.117 percent and power consumption is decreased by 4.1335 percent.

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