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COMPARISON OF R410A AND R404A IN DOMESTIC REFRIGERATOR

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ABSTRACT:

In this work, an experimental work was investigated on the R-410A and R-404A which are eco friendly refrigerants and have zero ozone depletion potential and low global warming potential than R-134a used in a domestic refrigerator without any system reconstruction. The refrigerator performance was then investigated using energy consumption test and freeze capacity test. The results indicate that R-410A and R-404A work normally and safely in the refrigerator. The refrigerator performance was better than the pure R404A, thus R-410A refrigerant in domestic refrigerators is feasible and can replace the R-134a. To do experiment some parameters like food compartment temperature, freezer compartment temperature, operating pressure, compressor temperature, condenser temperature are taken and performance analyzed.

INTRODUCTION:

Refrigeration may be defined as the process of achieving and maintaining a temperature below that of the surroundings, the aim being to cool some product or space to the required temperature. One of the most important applications of refrigeration has been the preservation of perishable food products by storing them at low temperatures. Refrigeration systems are also used extensively for providing thermal comfort to human beings by means of air conditioning. Air Conditioning refers to the treatment of air so as to simultaneously control its temperature, moisture content, cleanliness, odour and circulation, as required by occupants, a process, or products in the space. The subject of refrigeration and air conditioning has evolved out of human need for food and comfort, and its history dates back to centuries. The history of refrigeration is very interesting since every aspect of it, the availability of refrigerants, the prime movers and the developments in compressors and the methods of refrigeration all are a part of it. The French scientist Roger ThÝvenot has written an excellent book on the history of refrigeration throughout the world. Here we present only a brief history of the subject with special mention of the pioneers in the field and some important events.

THE VAPOR COMPRESSION REFRIGERATION CYCLE:

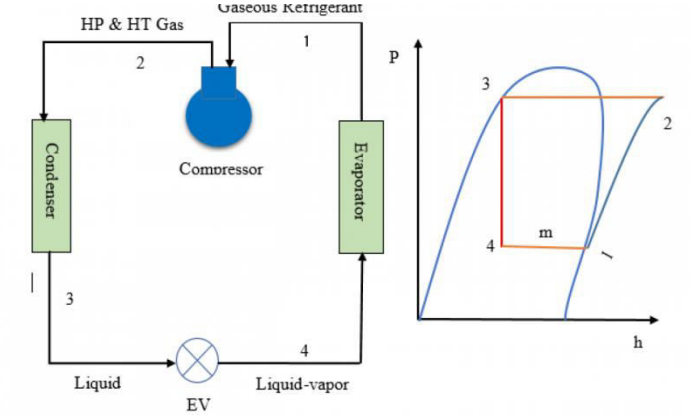
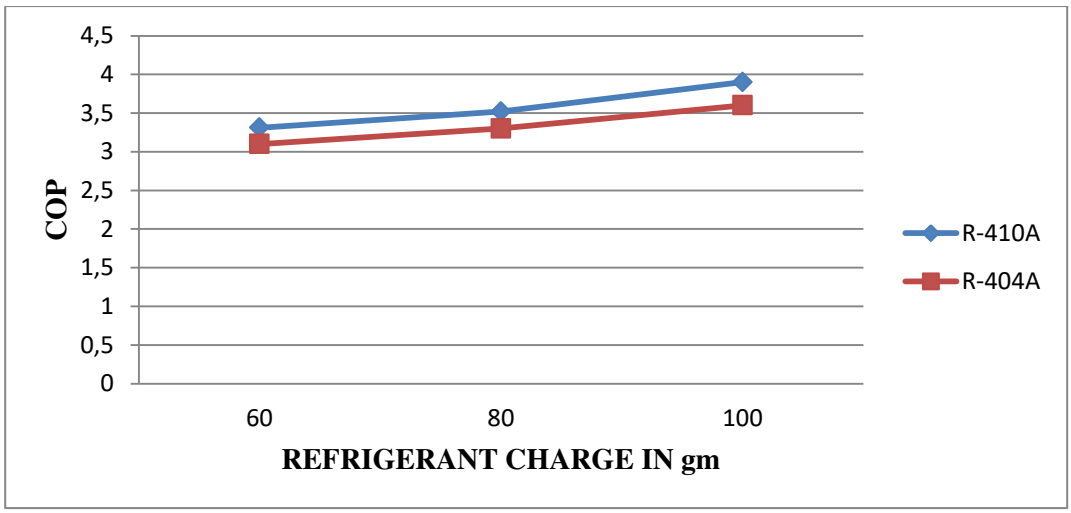


Fig 1.1: VCRS cycle of domestic refrigeration system

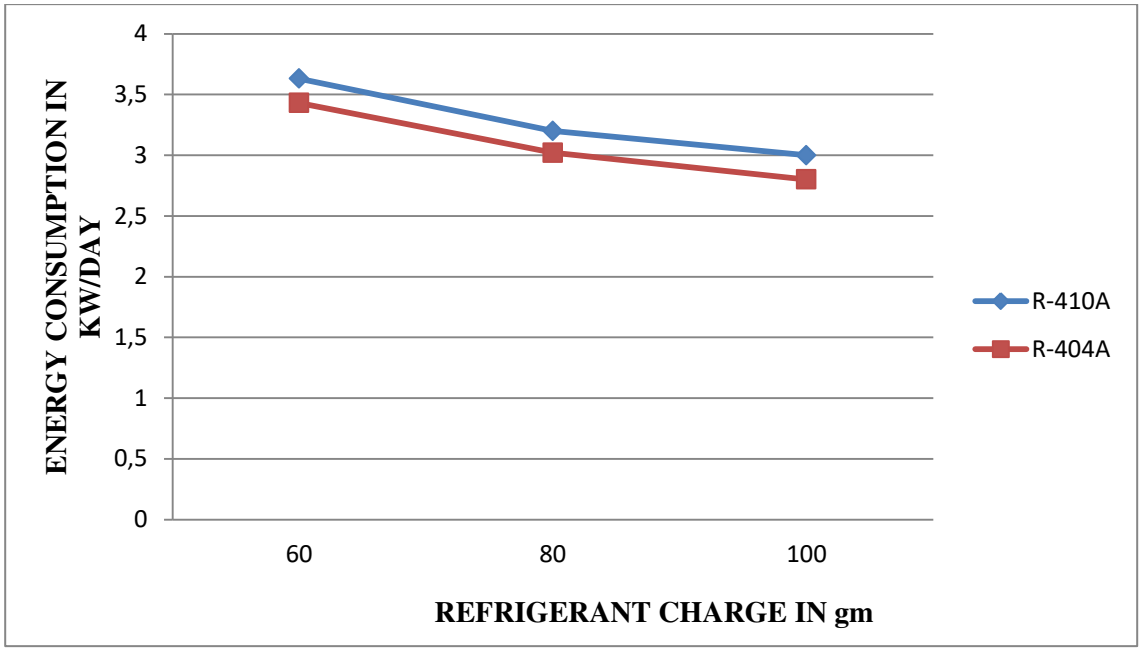
RESULTS AND DISCUSSION:



GRAPH 2.1 EFFECTS OF REFRIGERANTS CHARGES ON THE SYSTEM (COP).

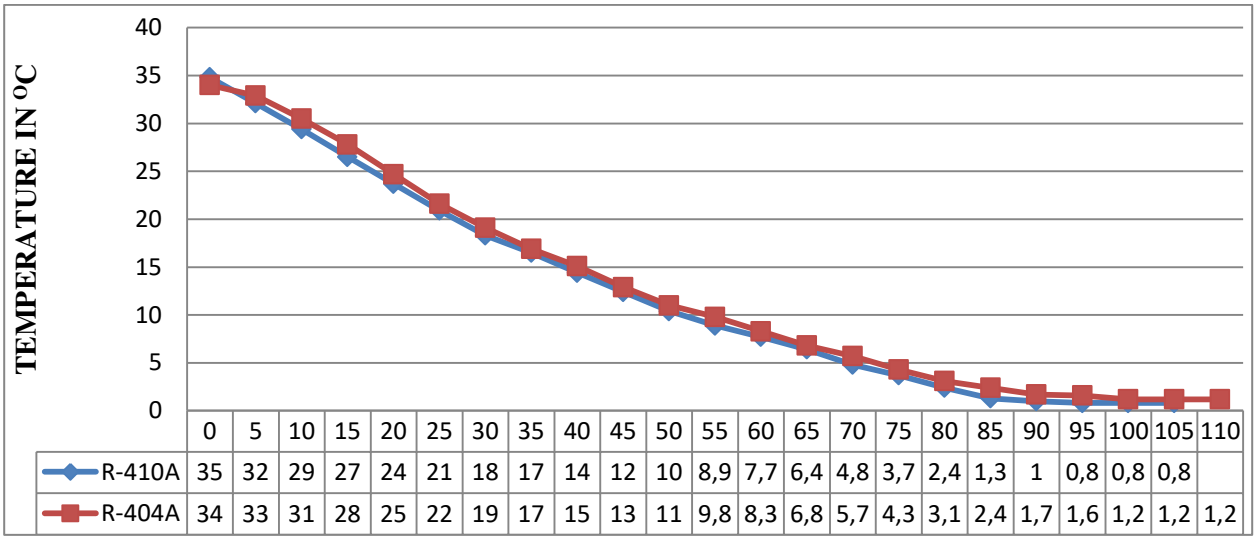
Graph 2.1 shows the effect of refrigerant charges on the system COP. The COP increases with refrigerant charge for all the refrigerants. Increase in refrigerant charge increases the quantity of refrigerant in the system, which increased the cooling capacity and also the COP of the system. COPs of 3.31 and 3.1 were obtained with 60 gm charge for R410A and R404A, respectively, While COPs of 3.52 and 3.3 were obtained with 80

gm charge for R410A and R404A, respectively. Highest COPs of 3.9 and 3.6 were obtained with 100 gm charge for R410A and R404A respectively.



GRAPH 2.2 EFFECT OF REFRIGERANT CHARGES ON THE ENERGY ON THE CONSUMPTION

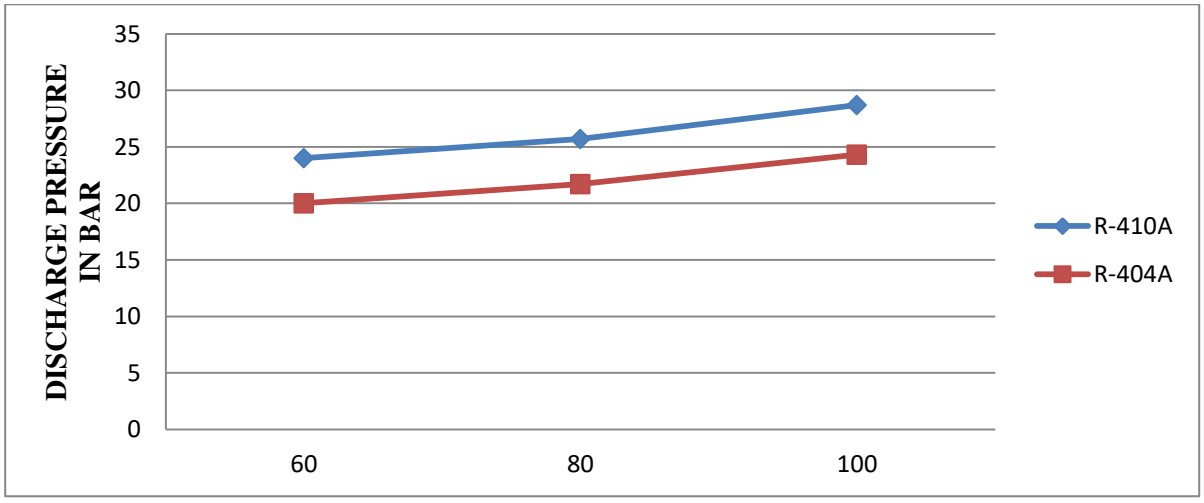
Graph 2.2 shows the effect of the refrigerant charge on the energy consumption. The graph shows that the power consumption reduces as the refrigerant charge increases until it reached the minimum power consumption. As shown in the figure, the average optimal refrigerant charge, which corresponds to the minimum power consumption, for the two refrigerants, was 100 gm. The power consumptions of 3.63, 3.2 and 3.0, 3.43 and 3.02, 2.8 KWh/day were obtained during the test at 60,80 and 100 gm for R410A and, R404A, respectively.



	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110
R-410A	35	32	29	27	24	21	18	17	14	12	10	8,9	7,7	6,4	4,8	3,7	2,4	1,3	1	0,8	0,8	0,8	
R-404A	34	33	31	28	25	22	19	17	15	13	11	9,8	8,3	6,8	5,7	4,3	3,1	2,4	1,7	1,6	1,2	1,2	1,2

GRAPH 2.3 FOOD STORAGE COMPARTMENT TEMPERATURES.

Graph 2.3 is plotted between time and temperature, where graph shows that at 60 gm refrigerant R-410A achieved up to 0.8°c temperature in 95 minute, while R-404A achieved up to 1.2 °c in 100 minute. While using R-410A, Food compartment temperatures of refrigerator get stable earlier than R-404A.



GRAPH 2.4 EFFECTS OF REFRIGERANT CHARGES ON THE COMPRESSOR DISCHARGE PRESSURE.

Fig.2.4 shows the effect of refrigerant charges on the compressor discharge pressure. The discharge pressure is an important parameter that affects the performance of a refrigerating system. It influences the stability of the lubricants and compressor components. Fig. 8 shows that increase in refrigerant charge

increases the discharge pressure. As shown in the figure, the value of discharge pressures at 60 gm were obtained 20 and 24 bar for two refrigerants R-404A and R-410A respectively, while value of discharge pressures at 80 gm were obtained 21.7 and 25.7 bar for two refrigerants R-404A and R-410A respectively, highest value achieved at 100 gm which were 24.3 and 28.7 for refrigerants R-404A and R-410A respectively

CONCLUSION:

Thus, it can be concluded that R410A could be ozone friendly, and safe viable alternative to R-134a for domestic and small commercial refrigeration systems with the main advantage that it can be replaced directly without the need to replace or modify any system component.

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