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Research Of Refrigerant Of R22, R410A, R290 And R32 In Different External Conditions

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ABSTRACT

The article examines the cooling agents that cause the depletion of the ozone layer and the alternatives to these cooling agents. The study was presented at different outdoor temperatures, cooling modes, and bound to environmentally friendly refrigerants. The study compared the refrigerants R22, R410A, 290 and R32 used in a split air conditioner with a capacity of 12000 Btu / s.

KEYWORDS

R22, R410A, 290, R32, split conditioner, refrigerant, alternative, Ozone, XFU, GXFU, cooling efficiency, cooling coefficient.

INTRODUCTION

The production of artificial cooling, obtaining temperatures below ambient temperatures, is widely used in many areas of the economy in the implementation of various technological processes. Refrigeration technology is needed in many areas of human activity.

Life on Earth has been preserved for thousands of years because of its protective atmosphere.

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This layer is called ozone and protects the Earth from the sun's harmful ultraviolet rays. If the protective layer is broken, the harmful part of the sun's ultraviolet rays will affect the Earth's surface, killing most living organisms possible. One of the industries that has a negative impact on ozone is artificial cooling. It is impossible to imagine our lives and activities today without artificial cold.[1,2,4]

It is known that refrigeration machines use various refrigerants as working substances. They more or less affect the ozone layer. The chemical composition of the working substances can be chlorine, fluorine, bromine and hydrocarbons.

In the 1980s, chlorofluorocarbons (XFUs) and hydrochlorofluorocarbons (GXFUs) were proven to have an effect on the ozone layer, which protects the earth's flora and fauna from the sun's harmful ultraviolet rays.

According to the 1985 Vienna Convention for the Protection of the Ozone Layer and the 1987 Montreal Protocol on the Control of Ozone Depleters, the use of XFUs is limited to 1996 for developed countries and until 2010 for developing countries. The use of it was allowed until 2020 for developed countries and until 2030 for developing countries. [1,6,7,8,9,10]

RESEARCH METHODOLOGY AND RESULTS

R32 refrigerant is an alternative to R410A, which is currently used instead of R22 refrigerant. The reason can be seen in Table 3.1. The global heating potential (GWP) of R32 is much lower than that of R410A. So R32 is environmentally friendly.

Comparison of R32 and R410A refrigerants:

- The GWPsi of R32 is 675 and that of R410A is 2100;
- R32 has high energy efficiency (4% in a 6 kW system);
- Less refrigerant is poured into the devices running on R32 (18% in a 4 kW system);
- The R32 is one-component, meaning it can be recycled and reused. R410A is a two-component mixture containing R32 and R125.

Table 1 shows the characteristics of R32, R410A, R22 and R290. The physical properties of R410A and R32 are very close, so copper pipes of the same diameter are used in the operating mode of the split system. It should be noted that the same oil is used.

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Table 1
Comparison of some properties of refrigerants under study

	R32	**R410A**	**R22**	**R290**
Category	GFU	GFU	GXFU	propan
Formula	CH_2F_2	CH_2F_2 / CHF_2CF_3	$CHClF_2$	C_3H_8
Composition (Mixture Ratio wt%)	–	R32/R125 (50/50)	–	-
Boiling temperature(°C)	-51,7	-51,5	-40,8	-42
ODP	0	0	0,055	0
GWP	675	2100	1810	3
Refrigerant oil	Synthetic oil (ether)	Synthetic oil (ether)	Mineral oil (suniso)	

The following is a study of a ozone-safe refrigerant R410A, R290 and R32 for a split air conditioner with a cooling capacity of 12000 Btu / s.

The results are presented in the form of diagrams, tables and graphs. For comparison, the results of a study on ozone-hazardous R22, which has been used to date in these studies, are also presented.

Today's world is living and adapting to global warming. The fact that the average temperature of our winters increases every year, and the extreme heat of our summers requires additional experiments. Therefore, we graphically present the results of the study obtained when the ambient temperature is 30, 40, 50. In cooling mode, the air conditioning temperature is always higher than the outside temperature. That is, if the outside temperature is 30, the condensing temperature will be around 10. [1,5]

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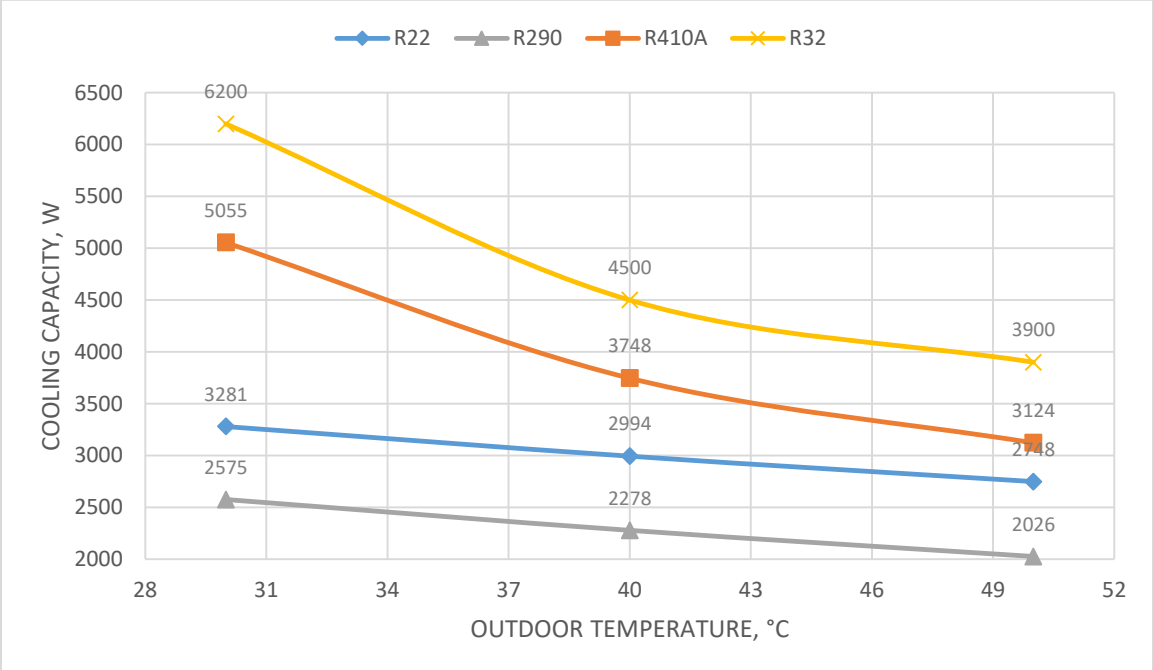

Figure 1. Graph of correlation of cooling capacity of cooling agents R22, R410A, R290and R32 to outdoor temperature.

Figure 1 is a graph of the correlation between the cooling efficiency of a split air conditioner with a cooling capacity of 12000 Btu / s and the outside temperature listed. In this case, the air conditioner in the four refrigerants was at the same boiling point, t_0=8,9 °C. Summer temperature for Uzbekistan is 40÷50°C degrees. In this range, the productivity of the four refrigerants does not change proportionally. As a result, the cooling agent R410A had higher cooling performance than R22 and R290, and the spring and fall months were 1.54 times higher than R22 and 1.96 times higher than R290. However, our R32 refrigerant, which is used as a close cooling agent in split air conditioners, has shown that it is 1.2 times more efficient than R410A, which has the highest performance. R290 is 1.27 times lower than R22. As can be seen, as the outside temperature increased, that is, in summer conditions, the results of all four cooling agents decreased. This is because as the outside temperature increases, the specific mass cooling efficiency (q0) of the refrigerant decreases, which in turn affects the self-cooling efficiency (Q0). Under these conditions, the R32 refrigerant performed better than other refrigerants, but it dropped by 38% compared to the initial result. This figure was 38% in R410A and showed the same negative result as R32. However, these figures were 16% in R22 and 21% in R290, a positive result for them. [1,4]

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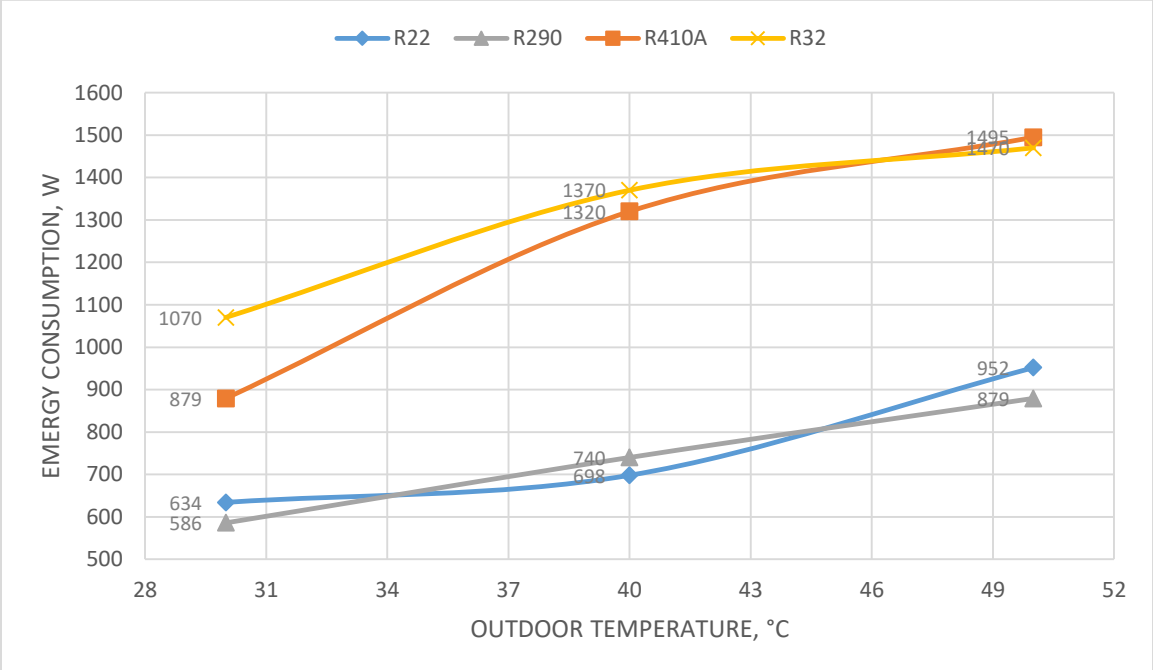

Figure 2. Graph of correlation of electrical power of cooling agents R22, R410A, R290 and R32 to outdoor temperature.

In Figure 2, the electrical capacities of each cooling agent in the cooling system were studied at different external temperatures. According to the study, the cooling agent R32 was 1.96 times more negative than R22, 1.85 times more negative than R290, and 1.04 times more negative than R410A. The R410A refrigerant consumed an average of 1.89 times more electricity than the R22 and 1.78 times more power than the R290. The results were similar to those of R32, and the results of R22 and R290 were also close to each other, but the results of these two refrigerants were found to be very different from those of R410A and R32. Considering that the lower the power consumption, the better, we will not be mistaken if we use the same phrase for R410A.

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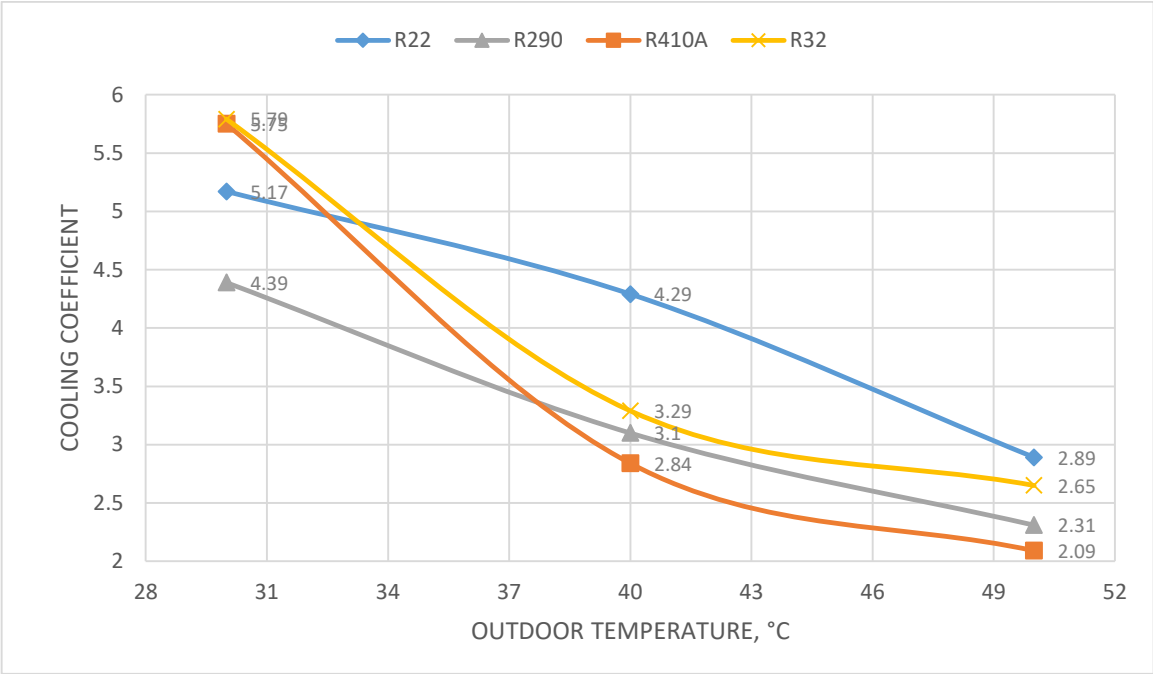

Figure 3. Graph of the correlation of the cooling coefficient of the cooling agents R22,R410A, R290 and R32 to outdoor temperature.

Figure 3 shows the results of a study of the cooling coefficients of four refrigerants at different outdoor temperatures. If we look at the essence of the cooling coefficient, the cooling coefficient is equal to the ratio of cooling efficiency to electricity. That is, the relationship between cooling efficiency and electricity. The study found that refrigerants R410A and R32 performed 1.11 times higher than R22 when the outside temperature was 30, and R290 1.3 times higher. However, with an increase in outside temperature of 10, the refrigerant R410A itself decreased 1.51 times compared to R22, 1.09 times compared to R290, and 1.16 times compared to R32. The results showed that the refrigerant R410A did not change to a certain extent. Except R22 and R290.

CONCLUSION

The results of the study of refrigerants R22, R410A, R290 and R32 at different outdoor temperatures are as follows:

- The refrigerant R32 is 1.2 times higher than R410A, 1.5 times higher than R22, and 1.98 times higher than R290;
- In terms of power consumption, refrigerants R22 and R290 showed positive results compared to R410A and R32. Although R32 has high cooling efficiency, it also consumes a lot of electricity;
- In terms of cooling coefficient, the cooling agent R22 averaged 1.3 times higher than R32,

- 1.38 times higher than R290, and 1.51 times higher than R410A.

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