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Freons, Environmental Aspects And Classification In CN FEA

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ABSTRACT

The article provides data on the history, types, physicochemical properties of freons, applications, ozone-depleting substances, their importance in the economy, their place in the CN FEA as goods and classification problems in the commodity nomenclature.

KEYWORDS

Freon, inert, halogen, ozone, refrigerant, pesticide, aerosol, hypoxia, indicator, CN FEA.

INTRODUCTION

Thomas Midgley Jr. (1928), a chemist at General Motors Research Corporation, was the first to synthesize a chemical compound in his laboratory and call it freon (Latin frigor - cold) [1]. Subsequently, many compounds similar to this substance were synthesized and expressed by the letter R (R - Refrigerator).

Freons are chemically halogenated derivatives of carbon (CFC – chlorofluorocarbons) [2]. They are colorless and odorless gases or liquids

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and are insoluble in water, but are well soluble in organic solvents and some oils. To date, about 100 freons have been synthesized, almost all of which are used in industry. These include freons belonging to different types, which differ in chemical formula and physical properties, including trichlorofluoromethane - freon R-11, freon 11, chladon 11; diphthorochloromethane - freon R-12, freon 12, xladon 12: trifluorochloromethane - freon R-13, freon 13, xladon 13: tetraftormethane - freon R-14, freon 14, xladon 14; difluorochloromethane - freon R-22, freon 22, chladon 22; chlorofluorocarbonate - freon R-410A [3].

Freons are "wonderful" substances with a number of thermodynamic properties. Insoluble in water, does not burn, does not decompose quickly under normal conditions, is relatively non-toxic, does not react with other substances and, most importantly, is well preserved. Due to these properties, they are in high demand in many industries, and since 1930 they have been produced in millions of tons.

They are used as refrigerators, air conditioners, fire extinguishers, paints and varnishes, household appliances, pesticides, organic solvents, cosmetics, perfumes and aerosols in medicine. In countries that produce such goods, there are huge economic benefits from their trade. In the United States, for example, CFC compounds ranked second only to drugs in terms of revenue [4].

RELEVANCE OF THE TOPIC

First of all, freons are environmentally hazardous substances, despite being chemically inert. Because they decompose in the atmosphere and deplete the ozone layer, as a result, ozone is converted into ordinary oxygen [5]:

$$O_3 = O_2$$

Therefore, in 1987, according to the UN Environment Program, the Montreal Protocol on Ozone Depleting Substances was adopted, which provides for a phased cessation of production of freons, including the most dangerous freons (R-12 and R-22) is prohibited for use in household appliances.

Secondly, the creation of new generations of freons requires an improvement in their classification as a commodity. Many alternative refrigerants are being developed, including a number of short-term freons that can replace R-22 freon: R-134a, the original chlorine-free freon, has been used successfully in refrigerators and air conditioners; synthesized R-1234yf (tetraftorpropylene) has been widely used since 2011 (but the substance turned out to be highly flammable); as well as chlorine-free refrigerants R-32, R-125, R-143a were synthesized [6].

Thirdly, although freons are said to be relatively safe, Chladon 22 (Freon 22) is classified as a Class 4 substance on the "harmfulness" scale. In addition, they have narcotic effects, causing fatigue, memory impairment, insomnia, and, worst of all, suffocation under the influence of high concentrations of freon, which can lead to subsequent excitement and nervous excitability in humans. When liquid freon falls on the skin, "freezing" is observed, followed by blistering and necrosis on its place [7,8].

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Today, 90% of air conditioners use R 22 Freon. An alternative to R 22 is R 134a, R 407c and R 410A. Their activity, which disrupts the ozone layer, is assessed by the value of the ozone-absorbing potential. The ozone-absorbing potential can range from 0 (ozone safe refrigerant) to 13 (ozone-depleting refrigerant). The ozone-absorbing potential of R 12 is 1,0; R 22 is equal to 0,05, R 134a-0, R 407c-0. Despite the indicators, the ideal freon is not yet available. Freons that do not break the ozone layer are not perfect in terms of their thermodynamic properties. The main factor in choosing Freon is its thermodynamic and thermophysical properties. They affect the efficiency, performance and design of the instruments. Having the necessary thermodynamic and thermophysical properties, freons with fluoruclide have found their wide application in cooling. In addition to the main environmental, chemical and physical indicators, any freon used in everyday life and in industry has the following important properties: pressure, critical density and boiling temperature.

Freon	Chemical formula	Boiling temperature °C	Critical temperature °C	ODP	GWP	Flammability
R12	$CF_2 Cl_2$	-29.74	112	0.9	8500	NF
R22	$CHClF_2$	-40.85	96.1	0.055	1700	NF
R123	$CHCl_2CF_3$	-27.8	183.7	0.02	90	NF
R134a	$C_2H_2F_4$	-26.1	101.0	—	1430	NF
R125	C_2HF_5	-48.1	67.7	—	3200	NF
R404A	(R134a+R125+R143a)	-47	72.1	—	3922	NF
R410A	(R32+R125)	-51	72.5	—	2088	NF
R407C	(R32+R125+R134a)	-44	87.3	—	1824	NF
R245fa	$C_3H_3F_5$	15.1	157.6	—	930	LF
RE347mcc	$C_4H_3F_7$	34.2	~200	—	368	LF
R365mfc	$C_4H_5F_5$	40.11	~208	—	<1500	LF
R32	CH_2F_2	-51.7	78.1	—	675	LF (A2L)
R161	C_2H_5F	-37.1	102.2	—	12	LF (A2L)
R152a	$C_2H_4F_2$	-24.0	113.3	—	140	LF (A2L)

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R1234yf	$C_3H_2F_4$	-29.45	95.65	—	4	LF
R507	(R125+R143a)	-47	71	—	3900	NF
R508A	(R23+R116)	-86	13	—	12000	NF
R404a	(R125+R143a+R134a)	-46.6	72.1	—	3922	NF
R410a	(R32+R125)	-51.6	70.2	—	1890	NF

These are the characteristics that determine whether the refrigerator is suitable or not to solve the specific task. In the table below are some key features of mass coolers, the same in particular, their "climate" factors – ozone layer distortion potential (ODP) and global the warming potential (GWP) is briefly described [6].

The properties of freons also depend on the structure of the substance molecule, the ratio of molecules of fluorine, chlorine and hydrogen in its composition. Freons with a high content of hydrogen atoms are dangerous to fire. freons with low fluorine content are poisonous, freons with low hydrogen content do not melt in the atmosphere for a long time and are environmentally undesirable. R 32 freon (23%) helps to increase the working capacity), R 125 ((25%) excludes the flammability of the mixture), R 134a ((52%) determines the working pressure in the freon pellet) the mixture received the mark of R 407C. Like R 22 freon, the toxicity of R 407C is low, chemically stable and non-flammable. If freon flies, then the performance of the device will be negatively affected not only by the lack of Freon, but also by the change in its composition, because the variability of these freons is different and they do not go smoothly. The problem is that the assembly of the old Freon is so time-consuming that it requires special equipment, as well as highly qualified personnel. The freon remaining in the system has a different composition, so during its repair it is necessary to pour it completely and fill the system with a new R 407C freon. The main difference and characteristics of the old freon CHF CI (R 22) and the new R 407C are the pressure values in the working temperature and the type of oils that are suitable for this refrigerator. With R 22 freon, mineral oil is used, which in combination with R 407C is incompatible. Fresh freon is poorly mixed with mineral oil, especially in low temperatures and forms a separating two-phase mixture with it. Moreover, poorly soluble oil in a refrigerant with high viscosity at low temperatures closes the capillary tubes and disrupts the circulation of freon. In addition, its environmental friendliness can practically bring about an additional burden on the environment. Although R 407C is not dangerous for the ozone layer, it is one of the most powerful "greenhouse gases". Consisting of R 32 (50%) and R 125 (50%), R 410A R is conditionally considered an isotropic, that is, during the leakage, the mixture almost does not change its composition, and therefore it is possible to simply fill the air conditioner with it. At the same time, R 410A has some drawbacks, for example, parts of the air conditioner compressor are greased with a special oil melted in Freon. For each freon, it is necessary to strictly use the oil brand, which is suitable for

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this refrigerator. Incorrect filling of the oil will raise the probability of the compressor from work to almost 100%. Unlike easily soluble 22 in ordinary mineral oil, the new freons imply the use of synthetic polyurethane oil. The new R 32 Freon, which runs on the latest models of air conditioners, has an undeniable advantage. This is primarily due to the potential for global warming. If we compare freon R410A and R32, then R410A is distinguished by an increase in the global warming potential by more than 65 percent, which means freon R32 has less impact on the environment. Also, the consistency and density of R 32 is low, hence the consumption of Freon making rate decreases taking into account the same power indicators. The density of diphthermethane is 30% lower compared to freon R 410A. The lower viscosity also helps to reduce pressure losses in the cooling circuit and increase the energy efficiency of the air conditioner. In terms of thermal conductivity, R32 is superior to R 410A. This positively increases the cooling volume, i.e. by 4%. Compared to the R 410A, the R32 is a one-component material that is very convenient to operate due to the possibility of additional charging without completely removing the refrigerator from the system and the need to fully charge it [6].

Freon inhalation of air for a period of time (at least 5 minutes) causes pathological conditions in the cardiovascular and central nervous systems, as well as in the lungs. Moreover, Hypoxia is observed due to lack of oxygen. Freons decompose at temperatures above 250°C to form highly toxic substances, such as phosgene ($COCl_2$). This substance was used as a chemical weapon during the First World War. In addition, at temperatures above 400 ° C, freons are decomposed into Class 4 tetrafluoroethylene, hydrogen chloride-2 class, hydrogen fluoride - Class 1 substances with highly toxic properties.

The damage of freon also depends on the degree of purification from other substances added during its production. As a result of thermal oxidation at temperatures in the range of 180-380°C number of substances such as hydrogen fluoride; tetrafluoroethylene; 2-triftormethyl, pentaftorpropen are released into the environment.

Therefore, two aspects must be taken into account while determining the toxicity of freons: the toxicity of the refrigerant itself and, secondly, the toxicity of the substances formed from its decomposition.

Scientists of the Fergana Medical Institute of Public Health are conducting in-depth theoretical and practical research in this area.

The sale of freons and their products in the Republic of Uzbekistan is managed by the State Committee for Nature Protection, the Agency for Foreign Economic Relations and the State Customs Committee. Although they are included in List A, B, C (CFCs) and List D (products containing freon), in some cases, such goods are traded, causing significant economic damage to the state. The reason for this is the classification of freons in the nomenclature of goods of foreign economic activity.

Trade name	Chemical name	Chemical formula	HS codes
Galon-1211	Bromochlordiftormethane	$CBrClF_2$	2903 46 100 0

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Galon-1301	Бромтрифторметан	$CBrF_3$	2903 46 200 0
Galon-2402	Dibrometetraftoretanes	$C_2Br_2F_4$	2903 46 900 0
CFC-13	Chlortriftormethane	$CC1F_3$	2903 45 100 0
CFC -111	Pentachlorofluoroethane	C_2C1_5F	2903 45 150 0
CFC -112	Tetrachlordiftorpropanes	$C_3H_2C1_4F_2$	2903 49 100 0
CFC -211	Heptaxlorftorpropane	C_3C1_7F	2903 45 250 0
CFC -212	Hexachlordiftorpropans	$C_3C1_6F_2$	2903 45 300 0
CFC -213	Pentaxlortriftorpropane	$C_3C1_5F_3$	2903 45 350 0
CFC -214	Trixlortetraftorpropane	$C_3HC1_3F_4$	2903 49 100 0
CFC -215	Trichloropentaftorpropanes	$C_3C1_3F_5$	2903 45 450 0
CFC -216	Dichlorhexaftorpropanes	$C_3C1_2F_6$	2903 45 500 0
CFC -217	Chlorheptaftorpropanes	C_3C1F_7	2903 45 550 0

The National Seminar on "Regulation of Import and Export of Ozone Depleting Substances and Products Containing the Ozone Layer" held in Tashkent in 2002 also noted that the classification of freons no longer correspond to current standards [9,10].

It is known that in the nomenclature of commodities of the first foreign economic activity adopted in Belgium (1983), freons were classified in 29 groups in 2903 positions in subheadings 290314, 290319, 290341-290349. The following is a list of freons banned from entering the territory of the Republic of Uzbekistan.

To conclude, the development of trade in freons and their products, the occurrence of many criminal cases related to their sale in practice, resulting in significant economic damage to our country, as well as the above-mentioned views on the solution of this problem, freons' nomenclature should be studied and their classification needs to be improved. The solution to this problem is to study their physical and chemical properties and propose new codes for classification in order to identify the underlying indicators in the classification.

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