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ANALYSIS OF THE INFLUENCE OF THE FUEL COMPOSITION ON THE CARBON GAS EMISSION INDICATOR WHEN USING DIFFERENT ENERGY INSTALLATIONS**АНАЛІЗ ВПЛИВУ СКЛАДУ ПАЛИВА НА ПОКАЗНИК ЕМІСІЇ ВУГЛЕКИСЛОГО ГАЗУ ПРИ ВИКОРИСТАННІ РІЗНИХ ЕНЕРГЕТИЧНИХ УСТАНОВОК****Sheleshey T.V. / Шелешей Т.В.***senior lecturer / ст. викл.***Bednarska I. S. / Беднарська І.С.***assist. / асист.*

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Abstract. Much of the energy sector is based on the combustion of fossil fuels, which include coal, natural gas and fuel oil. There are currently 18 thermal power plants and many industrial facilities in Ukraine that use fuel oil as the main and reserve fuel. Since there are different types of fuel oil, it is worth exploring which of them is less threatening to our environment.

Key words: harmful emissions, emission index, carbon dioxide, lower heat of combustion, fuel oil composition

Introduction

When burning fossil fuels, a large amount of harmful substances enters the atmosphere, including the largest amount of carbon dioxide. Carbon dioxide (CO₂) refers to triatomic gases, commonly referred to as greenhouse gases. Greenhouse gases are characterized by the ability to absorb infrared radiation. It is through the repeated absorption of infrared radiation that the greenhouse effect occurs, ie carbon dioxide is directly related to global warming, this gas makes a major contribution to the retention of heat on the Earth's surface. The consequences of global warming we can observe today: in Ukraine, the winter of 2019-2020 was held with an average temperature of +2 degrees Celsius, which is an excess of climatic norms by 6 degrees. Also, according to the Copernicus Climate Change Service, between December 2019 and February 2020, world temperatures were 3.4 degrees higher than the average temperature in 1981-2010. Global warming has long ceased to be a myth, as the average temperature on the Earth's surface rises every year, which will inevitably affect terrestrial ecosystems, including ecosystems such as tundra, mangroves and coral reefs. [1]

For millions of years, the Earth has had a natural balance of carbon dioxide in the atmosphere, today this balance is significantly disturbed, primarily due to human activities.



Combustion of fossil fuels will be the basis of world energy for at least the next 30 years. During this period of time, the growth of CO₂ content will not stop, but will increase several times.

The main text.

Much of the energy sector is based on the combustion of fossil fuels, which include coal, natural gas and fuel oil. There are currently 18 thermal power plants and many industrial facilities in Ukraine that use fuel oil as the main and reserve fuel. Since there are different types of fuel oil, it is worth exploring which of them is less threatening to our environment.

In the course of the study, in accordance with [2], the emission values of carbon oxides and nitrogen, sulfur dioxide and solid particles were calculated. The calculation took into account the types of solid fuels most often used in Ukraine at thermal power plants (Table 1).

Table 1

The composition of fuel oil [2]

Indicators	Brand of fuel oil				
	high sulfur			low-sulfur	
	40	100	200	40	100
S ^{daf} , %	2,50	2,70	3,00	0,40	0,40
C ^{daf} , %	85,50	85,70	85,90	87,50	87,50
H ^{daf} , %	11,20	10,60	10,20	11,50	11,10
(O + N) ^{daf} , %	0,80	1,00	0,90	0,60	1,00
Q ^{daf} , МДж/кг	40,40	40,03	39,77	41,24	40,82

The results of the calculations are summarized in table 2.

Table 2.

The results of the calculations

Indicators	Brand of fuel oil				
	high sulfur			low-sulfur	
	40	100	200	40	100
k(CO ₂)	76998,0042	77892,3908	78534,2928	77192,1102	77987,3409

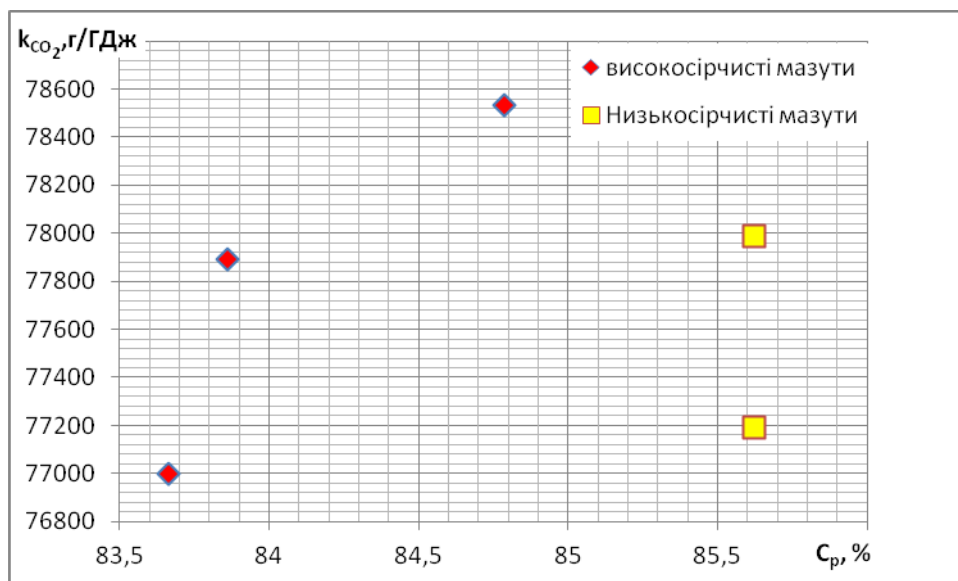
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Given the constructed dependence of the carbon dioxide emission index on the carbon content of the fuel, shown in Figure 1, it is seen that the amount of carbon dioxide emissions is influenced by the brand of fuel oil. When using high-sulfur fuel oils can be noted a significant impact on the quantitative indicators of CO₂ emissions of carbon content in the elementary composition of the fuel. However, it should be noted that k(CO₂) does not change when using various low-sulfur fuel oils in thermal power plants and industrial facilities. Therefore, it is advisable to establish another factor influencing the emission indicators of carbon dioxide emissions. In the course of the calculation study, such a factor determined the lower heat of combustion. Dependences of carbon monoxide emissions on the lower heat of combustion are presented in Figure 2.

As can be seen from Figure 2 for all types of fuel oil is characterized by an

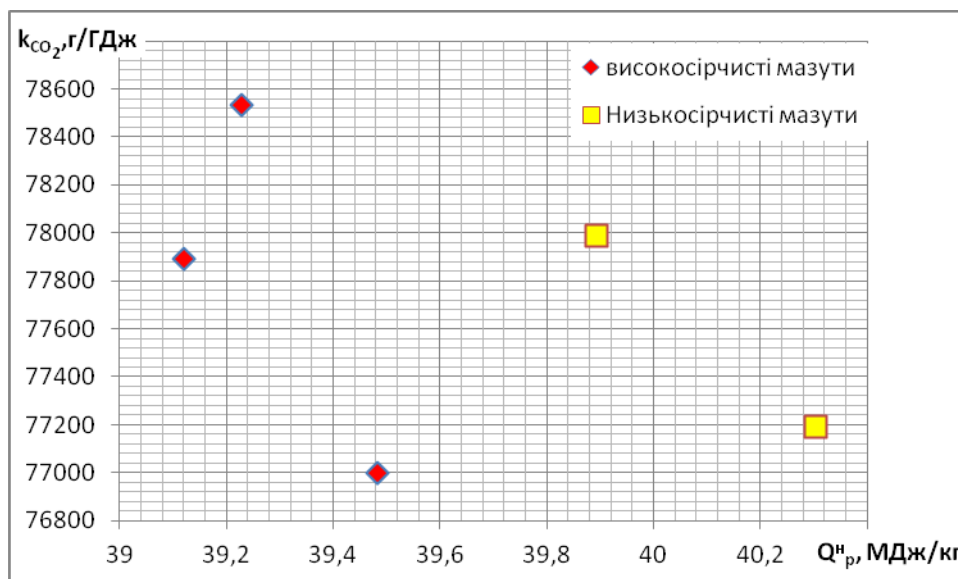


inversely proportional dependence of CO₂ emissions on the lower heat of combustion. As the lower heat of combustion increases, carbon dioxide emissions decrease.



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Figure 1. Graph of the dependence of carbon dioxide emissions on the carbon content in the fuel.



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Figure 2. Graph of the dependence of carbon dioxide emissions on the lower heat of combustion.

The highest rates of carbon dioxide emissions are observed when burning high-sulfur fuel oil brand 200, and the lowest when using high-sulfur brand 40.

Conclusions.

Therefore, when using high-sulfur fuel oils, it is possible to note the significant influence of the carbon content in the elementary composition of the fuel on the quantitative indicators of carbon dioxide emissions. When using different low-sulfur fuel oils k (CO₂) does not change. All types of fuel oil are characterized by an



inversely proportional dependence of the CO₂ emission index on the lower heat of combustion. As the lower heat of combustion increases, carbon dioxide emissions decrease.

The highest rates of carbon dioxide emissions are observed when burning high-sulfur fuel oil brand 200, and the lowest when using high-sulfur brand 40.

References:

1. National plan to reduce emissions from large power plants, dated November 8, 2017 № 796-r. Order, Cabinet of Ministers of Ukraine. Kyiv, 99 p.
2. GKD 34.02.305-2002. Emissions of pollutants into the atmosphere from power plants. Method of determination. Kyiv, 2002.

Анотація. *Значна частина енергетичної галузі базується на спалюванні органічного викопного палива, до якого відносяться вугілля, природний газ та мазут. В Україні працюють на сьогоднішній день 18 ТЕС і безліч промислових об'єктів, що використовують мазут як основне і резервне паливо. Оскільки є різні види мазуту, то варто дослідити, який із них є менш загрозливим для нашого середовища.*

Ключові слова: *шкідливі викиди, показник емісії, діоксид вуглецю, нижча теплота згорання, склад мазуту.*

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