УДК 504.06:629.33

РОЛЬ ЭКОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ АВТОМОБИЛЕЙ В ОБЛАСТИ ОХРАНЫ ОКРУЖАЮЩЕЙ СРЕДЫ

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Аннотация. В статье проанализировано значение экологической безопасности автомобилей в сфере охраны окружающей среды и основные направления её обеспечения. Исследовано влияние вредных выбросов автомобильного транспорта на атмосферный воздух, здоровье человека и экологические системы. Рассмотрены вопросы снижения расхода топлива, уменьшения содержания токсичных веществ в выхлопных газах и внедрения технологий, соответствующих современным экологическим стандартам. Проведён анализ методов оценки экологических показателей автомобилей и возможностей применения экологических требований. Установлено, что повышение экологической безопасности транспортных средств способствует снижению загрязнения окружающей среды, защите здоровья населения и развитию устойчивой транспортной системы. Полученные результаты могут быть использованы при разработке мер по обеспечению экологической безопасности в транспортной сфере.

Ключевые слова: *автомобильный транспорт, экологическая безопасность, охрана окружающей среды, атмосферный воздух, вредные выбросы, транспортная экология, экологические стандарты, устойчивое развитие.*

THE ROLE OF AUTOMOBILE ENVIRONMENTAL SAFETY IN ENVIRONMENTAL PROTECTION

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Abstract: The article analyzes the importance of vehicle environmental safety in the field of environmental protection and the main directions for its improvement. The impact of harmful emissions from road transport on air quality, human health, and ecological systems is examined. Particular attention is paid to reducing fuel consumption, decreasing the concentration of toxic substances in exhaust gases, and implementing technologies that comply with modern environmental standards. The study also analyzes methods for assessing the environmental performance of vehicles and the possibilities of applying current environmental requirements. The results show that improving vehicle environmental safety contributes to reducing environmental pollution, protecting public health, and promoting the development of a sustainable transport system. The findings can be used in the development of measures aimed at enhancing environmental safety in the transport sector.

Keywords: *road transport, environmental safety, environmental protection, atmospheric air, harmful emissions, transport ecology, environmental standards, sustainable development.*

The main measures aimed at reducing or eliminating the negative impact of automobiles on the environment include the following:

- Designing vehicles in such a way that they emit fewer toxic components into the atmosphere and produce lower noise levels;
- Improving vehicle operation, maintenance, and repair methods, as well as enhancing engine performance to reduce the concentration of toxic substances in exhaust gases and decrease vehicle noise levels;
- Complying with environmental requirements during the design and construction of highways in order to preserve the ecological balance of the surrounding area;
- Applying traffic management and control methods that ensure optimal traffic flow, such as separating lanes for fast- and slow-moving vehicles, constructing additional lanes, reducing delays at traffic signals, and implementing other traffic optimization measures.

Methods for Reducing Environmental Pollution Caused by Automobiles

Methods for reducing atmospheric pollution caused by internal combustion engines can be divided into two groups: reducing the toxicity of emissions and reducing the volume of emissions.

Methods for reducing the toxicity of emissions can be classified into four main groups:

- Modifying the design, operating processes, manufacturing technologies, and special systems of internal combustion engines;
- Using alternative fuels or changing the physicochemical properties of conventional fuels;
- Purifying exhaust gases from toxic components through the use of additional treatment devices;
- Replacing conventional engines with new low-emission technologies.

The main pollutants emitted into the atmosphere by internal combustion engines include carbon monoxide (CO), nitrogen oxides, unburned hydrocarbons, aldehydes, sulfur compounds, lead compounds, and soot [1].

Carbon Monoxide (CO)

Carbon monoxide blocks the active centers responsible for oxygen transport in hemoglobin, disrupting oxidation processes within the human body and potentially leading to death. When the concentration of carbon monoxide in the air exceeds 0.01% by volume, significant poisoning may occur. Initial symptoms include headaches, rapid heartbeat, shortness of breath, and nausea. In more severe cases, drowsiness and loss of consciousness may occur. Drivers, traffic police officers, and pedestrians in large cities are particularly vulnerable to such exposure. Chronic poisoning may manifest as persistent headaches, ringing in the ears, breathing difficulties, general weakness, and reduced vitality.

Nitrogen Oxides

Nitrogen dioxide (NO_2) and nitrogen pentoxide (N_2O_5) are highly dangerous pollutants. In the presence of moisture, they can form nitric acid, a highly toxic substance. Nitrogen oxides irritate the mucous membranes of the eyes and lungs and

may cause irreversible damage to the cardiovascular system. Even very low concentrations of nitrogen oxides are considered hazardous.

Hydrocarbons

Unburned hydrocarbons consist of mixtures of hundreds of chemical compounds. These substances often have unpleasant odors and may contribute to the development of various chronic diseases.

Soot

Although soot itself is not highly toxic, it serves as a carrier for numerous toxic hydrocarbons and therefore poses a significant environmental and health risk.

Aldehydes and Sulfur Compounds

Aldehydes irritate the respiratory tract and mucous membranes and can damage the nervous system, liver, and kidneys. Sulfur compounds have toxic effects similar to those of aldehydes.

It should be emphasized that the widely used carburetor engines can be replaced with other engine types that produce lower levels of harmful emissions, including diesel engines (particularly low-emission diesel technologies), gas-powered engines, gas-turbine engines, and electric propulsion systems.

Vehicle Noise Pollution

Noise generated by moving vehicles originates from the engine, chassis, various mechanisms and components, as well as from the interaction between vehicle structures and the road surface.

The level of noise that humans can tolerate for prolonged periods without adverse effects is approximately 80–90 dB. However, noise levels in urban streets and along highways often reach 120–130 dB or even higher, which can have serious negative impacts on human health [2].

Methods for Reducing Vehicle Noise

The following approaches are commonly used to reduce vehicle noise:

- Designing low-noise mechanical connections and assemblies;
- Reducing the number of impact-based processes;

- Decreasing the impact velocity between gas flows and mechanical components, as well as reducing collision frequencies;
- Improving the lubrication of components and assemblies;
- Using sound-absorbing and sound-insulating devices.

Conclusion. The study showed that road transport is one of the major sources of environmental pollution, negatively affecting air quality, human health, and ecological systems through harmful emissions and noise. The main pollutants include carbon monoxide, nitrogen oxides, hydrocarbons, soot, aldehydes, and sulfur compounds, which pose significant environmental and health risks. The research confirmed that reducing fuel consumption, improving engine technologies, using alternative fuels, implementing exhaust gas treatment systems, and replacing conventional engines with low-emission technologies are effective measures for minimizing environmental impacts. In addition, noise pollution can be reduced through improved vehicle design and the application of sound-insulating technologies. Overall, enhancing the environmental safety of vehicles is an essential factor in protecting the environment, improving public health, and promoting sustainable transport development.

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