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ENVIRONMENTAL ISSUES RELATED TO AUTOMOBILE TRANSPORT

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Abstract

Automobile transport is one of the major sources of anthropogenic impact on the environment in the modern world. Its rapid growth causes numerous environmental problems that affect all components of the environment – the atmosphere, hydrosphere, lithosphere, biota, as well as the climate and human health. This paper examines the main negative consequences of transport operations, including greenhouse gas emissions (CO₂, CH₄, NO_x), smog formation, soil contamination with heavy metals, microplastic pollution in water bodies, wildlife mortality, and disruption of ecological connections. Special attention is paid to the impact on public health, particularly the development of respiratory, cardiovascular, and oncological diseases. The problem of urban consequences, such as noise pollution and the degradation of urban spaces, is also highlighted. The role of transport in climate change and global warming is assessed. Mitigation strategies are proposed, including the transition to electric vehicles, the development of public transport, reducing car dependency, and ecological urban planning with the creation of parking spaces. This study has practical significance for shaping modern transport policies in the context of sustainable development.

Key words: *automobile transport, pollution, environment, sustainable development, parking.*

Relevance of the Topic

Considering the rapid growth in the number of cars worldwide, the environmental impact of automobile transport is becoming increasingly significant. Automobiles are the primary source of greenhouse gas emissions in cities, as well as producers of a range of harmful substances, including nitrogen oxides, carbon monoxide, sulfur compounds, particulate matter, and volatile organic compounds. These pollutants significantly degrade air quality, leading to increased rates of respiratory and cardiovascular diseases among the population. In addition, automobile transport pollutes soils and water resources through the runoff of petroleum products, heavy metals, microplastics, and chemical reagents. The destruction of natural habitats, noise pollution, and the deterioration of biodiversity are additional challenges that require comprehensive solutions. In the context of global climate change, the environmental impact of automobile transport takes on a planetary scale. Therefore, studying the ecological consequences of automobile transport is highly relevant for shaping effective environmental policies, developing sustainable cities, and implementing technologies aimed at reducing environmental burdens [1].

Research Objective

The purpose of the study is a comprehensive analysis of the environmental problems caused by the operation of automobile transport, with a focus on its impact on the main components of the environment – the atmosphere, hydrosphere, lithosphere, biota, climate, and human health [2].

Scientific Novelty

The scientific novelty of the work lies in the comprehensive consideration of the impact of automobile transport on all components of the environment simultaneously, allowing for a holistic assessment of the scale of environmental impact. The study systematizes various types of impacts and proposes approaches to reducing negative consequences based on the principles of sustainable development.

Research results

The most obvious consequence of automobile transport activities is air pollution. In megacities, the share of transport in overall air pollution reaches 80%. The problem is exacerbated by an aging vehicle fleet, low fuel quality, and congested roads.

Automobile transport pollutes water bodies in two main ways: surface runoff from roads: petroleum products, heavy metals (Pb, Zn, Cd), and brake fluids enter water bodies with rainwater and meltwater, and oil spills: accidents and maintenance cause leakage of oils and fuels, which migrate into groundwater and surface waters. Fuel and lubricants are toxic to aquatic flora and fauna, reduce biodiversity, and disrupt the self-purification processes of water ecosystems.

Automobile transport has both direct and indirect impacts on soils: Pollution with heavy metals – cadmium, lead, copper, and nickel accumulate in the topsoil near roads. Salinization – due to the use of de-icing agents for road maintenance during the winter period. Physical degradation of soils – compaction, erosion, and changes in the hydrological regime during the construction of road infrastructure. These processes reduce soil fertility, decrease ecosystem productivity, and accelerate landscape degradation [3].

Transport has a negative impact on living organisms. Direct destruction of animals – millions of individuals die on the roads every year. Noise pollution – disrupts migration routes and communication in animals. Habitat fragmentation – road construction divides ecosystems, complicating genetic exchange between populations. Emission toxicity – disrupts metabolic processes in plants, reduces photosynthesis, and decreases the viability of biocenoses.

Motor transport directly affects the quality of life and health. According to the WHO, about 4.2 million people die prematurely each year from diseases related to air pollution. Chronic diseases such as asthma, cardiovascular, and nervous system diseases are more frequently diagnosed in cities with heavy traffic. Noise impact causes stress, sleep disturbances, and reduced cognitive abilities in children.

Automobile transport is one of the key sources of greenhouse gas emissions. On a global scale, transport accounts for about 15 % of all CO₂ emissions. The increase in the number of cars and the consumption of fossil fuels intensify global warming, rising sea levels, and extreme weather events.

In cities, transport creates other types of environmental impact. Land occupation – up to 40 % of the central part of a city can be occupied by transport infrastructure (fig. 1). Smog and heat islands – temperature increases in cities by 3–5°C compared to the outskirts [4].

To reduce the environmental impact of transport, it is necessary to: transition to electric vehicles and hybrids; develop public transport and cycling infrastructure; implement Euro-6 and higher

environmental standards; ban diesel transport from city centers; encourage carpooling; create green corridors for biota within infrastructure.

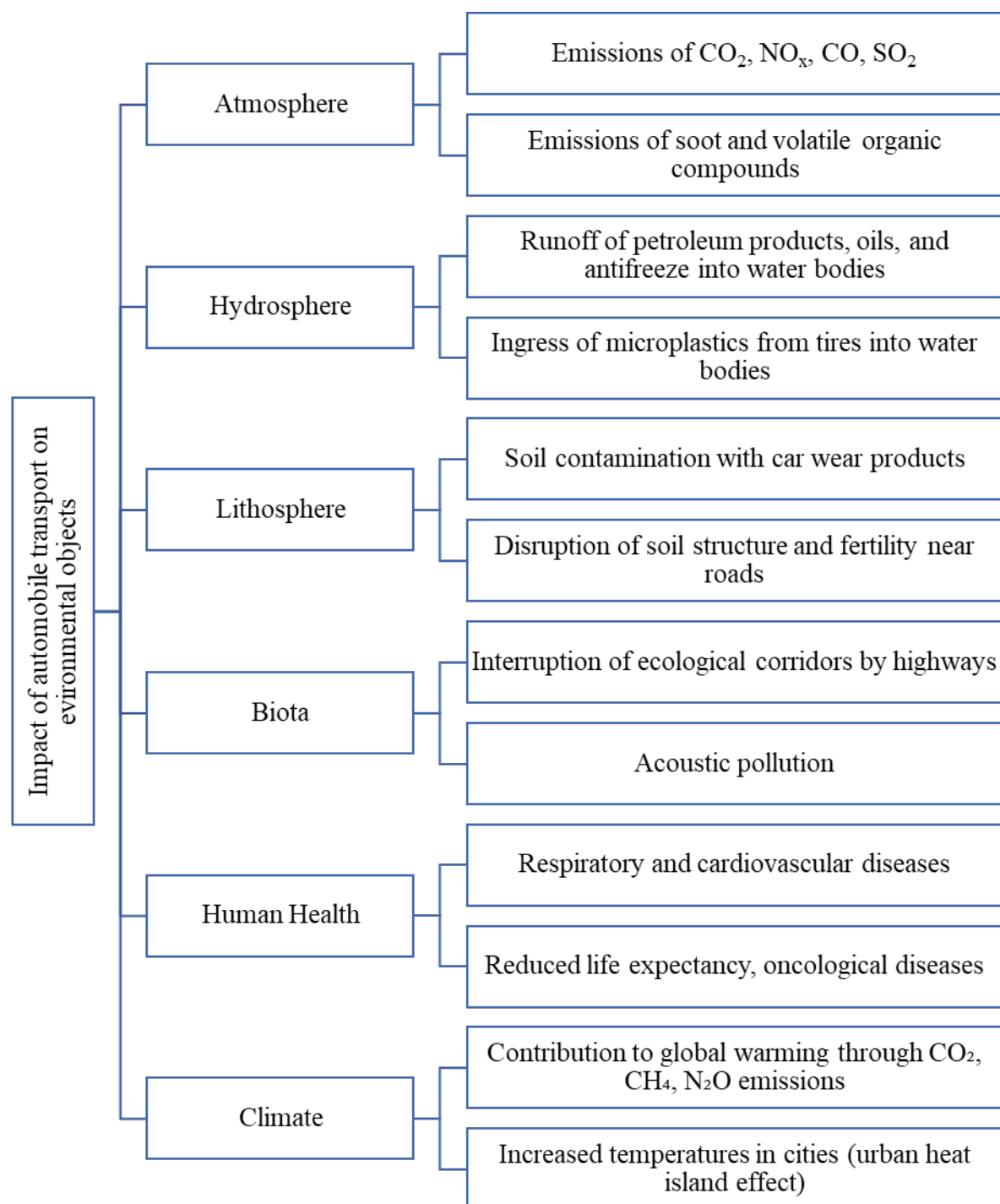


Figure 1. Pollution by automobile transport

Automobile transport is a source of many environmental problems – from air and water pollution to climate change and biodiversity loss. To minimize the negative impact, a comprehensive approach is needed: legislative regulation, development of alternative transport, public education, and

modernization of urban environments. Only a sustainable transport system can ensure a balance between mobility, the economy, and the environment.

Conclusions

As a result of the conducted research, it was established that automobile transport is one of the most significant factors of anthropogenic impact on the environment. Its operation causes a multi-level negative impact on the atmosphere, soils, water resources, living organisms, climate, and human health. The main environmental threats include the emission of harmful substances, pollution with heavy metals, microplastics, and the formation of noise and thermal pollution.

The intensification of global environmental and climate problems requires the implementation of comprehensive measures to green the transport sector. These include the development of public transport, the promotion of electric vehicle use, the introduction of stricter emission standards, the planning of green corridors, and the integration of sustainable development principles into transport policy. Thus, minimizing the negative impact of automobile transport on the environment is possible only under the conditions of an interdisciplinary approach, combining technological innovations, management decisions, and active public participation [5].

Recommendations for further applied research

To further reduce the environmental impact of automobile transport, it is recommended to focus on the development and implementation of Park-and-Ride (P+R) facilities. These facilities serve as strategically located parking areas on the outskirts of cities, where drivers can park their cars and continue their journey using public transportation. Park-and-Ride systems are designed to decrease traffic congestion in urban centers, reduce emissions from private vehicles, and promote the use of sustainable public transport options.

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ЕКОЛОГІЧНІ ПРОБЛЕМИ, ПОВ'ЯЗАНІ З АВТОМОБІЛЬНИМ ТРАНСПОРТОМ

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Анотація

Автомобільний транспорт є одним із головних джерел антропогенного впливу на довкілля в сучасному світі. Його стрімке зростання спричиняє численні екологічні проблеми, що охоплюють усі компоненти навколишнього середовища – атмосферу, гідросферу, літосферу, біоту, також впливають на клімат та здоров'я людини. У роботі розглянуто основні негативні наслідки функціонування транспорту, серед яких викиди парникових газів (CO₂, CH₄, NO_x), формування смогу, забруднення ґрунтів важкими металами, потрапляння мікропластику у водойми, загибель диких тварин і порушення екологічних зв'язків. Особливу увагу приділено впливу на здоров'я населення, зокрема розвитку респіраторних, серцево-судинних та онкологічних захворювань. Окремо висвітлено проблему урбаністичних наслідків, таких як шумове забруднення та деградація міського простору. Оцінено роль транспорту в зміні клімату та глобальному потеплінні. Запропоновано напрямки пом'якшення негативного впливу – перехід до електромобілів, розвиток громадського транспорту, зменшення автозалежності та екологічне планування міст, створення паркінгів. Робота має практичне значення для формування сучасної транспортної політики в контексті сталого розвитку.

Ключові слова: автомобільний транспорт, забруднення, навколишнє середовище, сталий розвиток, паркінг.