

THE EFFECTS OF TRANSPORT ON THE ECOSYSTEM AND HUMAN HEALTH

ВОЗДЕЙСТВИЕ ТРАНСПОРТА НА ЭКОСИСТЕМЫ И ЗДОРОВЬЕ ЧЕЛОВЕКА

Assoc.Prof. Dr. Kamladze A¹., Prof. Dr. Kochadze T¹., Doctoral candidate Markelia B.¹, student Kochadze A.²

AkakiTsereteli state University¹ - Kutaisi, Georgia

Tbilisi State Medical University² - Tbilisi, Georgia

E-mail: AleksandreKamladze@gmail.com ; Temko1954@mail.ru ; bachanamarkelia.91@gmail.com ; ana.kochadze@yahoo.com

Abstract: The growth rates vehicles pose a significant threat to the physical and chemical status of the atmosphere and negatively impact on human health and viability of other living organisms. The ecological status of airspace in the cities of the modern world, is determined by numerous factors, among which the leading position is taken by motor vehicles, during operation of which, along with the exhaust gases, more than 200 chemical compounds are emitted into the atmosphere.

The paper describes the results of studies of motor vehicles on highways adjacent to the territory of Kutaisi, from ecological standpoint.

As a realistic way for solving the problems would be the use of alternative fuels, rational organization and management of traffic flow, and the large-scale introduction of electric cars and hybrid motor vehicles.

KEYWORDS : HARMFUL EXHAUSTS ; ECOLOGY ; HEALTH ; ALTERNATIVE FUEL.

1. Introduction

The current growth rates of vehicles pose a significant threat to the physical and chemical status of the atmosphere, since toxic compounds emitted during transportation and the radiated acoustic energy cause disruption of ecological balance of the atmosphere. The negative effect of transport implies its negative impact on the ecosystem and human health, which is caused by the existence of toxic impurities in combustion products, consumption of oxygen, the release of wear products into the environment, contamination of effluent waters, noise and vibration arising during the work.

Ecological status of airspace in the large cities of the contemporary world is determined by numerous factors, prominent among which is motor transport, during operation of which, along with the exhaust gases, more than 200 chemical compounds are emitted into the atmosphere. They include such compounds, which do not affect negatively the human body (nitrogen, water steam, oxygen), although the most part is represented by toxic substances negatively affecting as the human body, so plant and animal life.

Asphyxiating gas (carbon dioxide CO₂) is not only production of fuel combustion in the engine's cylinder. It is a colorless, tasteless, odorless, and poorly water soluble gas, and it arises as a result of incomplete combustion of carbon under conditions of the lack of oxygen. Carbon dioxide taken into the organism together with the inspiratory air binds to hemoglobin and creates pink-color compound, causes lack of oxygen in the blood and strains normal respiration, due to which it is called asphyxiating gas. Asphyxiating gas causes dizziness, headache, coughing, a person loses the ability to sense, and often proved lethal.

Of nitrogen compounds in the airspace of highways, we mostly find monoxide (NO) and dioxide (NO₂). Nitrogen monoxide is a colorless gas and oxidized until dioxide (NO₂), which has dark yellow color, and is by 7-times more toxic than monoxide. Nitrogen dioxide impairs eyesight and particularly effects on people (especially on children) suffering from asthma and bronchitis.

Activity of low-molecular gaseous hydrocarbons in the combustion products is manifested in a narcotic effect on the human organism, and evokes a state of euphoria. As to polycyclic aromatic hydrocarbons, they are carcinogenic – cause lung cancer and central

nervous system disorder. Among them, Benzo(α)pyrene - C₂₀H₁₂, is characterized by highest activity. Nitrogen oxides, under the photochemical effect of sunlight, react with hydrocarbon compounds and create poisonous mist, which strongly effects on the tissues, plant and animal life, the mucous membrane and respiratory organs.

Sulphur anhydride is a colorless gas having bad smell, whose even small concentration (20-30 mg/m³) causes irritation of the mucous membrane of eyes and respiratory organs and human poisoning within minutes. A long-term effect of the compound of sulphur (SO₂) and carbon (CO) oxides causes impairment of the genetic function.

Of solid particles released into the atmosphere, the most carcinogenic are plumbic compounds, the amount of which is considerable when using ethylated petrol. Intake of plumbic compounds into the human body causes headache, fatigue, normal sleep disorder, and lowering enzymatic activity of proteins. Plumbic compounds are supplied to all parts of the organism through the blood, then they are deposited in the bone system and return back into the blood. Signs of the disease are manifested, when the concentration of plumbic compounds in the blood is 200-400 mg/l. In the child's organism, even the presence of its small concentration may prevent mental development of the child. Intake of plumbic compounds into the human body is also possible in the form of lead accumulated in the plants growing on the territory adjacent to highways.

Dust is an important source of environmental pollution, the impact of which causes various diseases. In particular, the effect of dust particles causes the irritation of the mucous membrane of respiratory organs, and leads to manifestation of conjunctiva and dermatosis.

Special mention should be made of the release of soot together with combustion products, which a black finely divided substance (sizes 0,19-0,54 mcm), and arises as a result of fuel incomplete combustion or thermal breakdown. In addition to fact that soot particles are toxic, the different-type carcinogenic substances are absorbed on their surface, and then are deposited in respiratory tracheae and bronchi.

It is important to mention that a three-fourfold increase in maximum permissible standard of tropospheric ozone and its long-term effect on the human body lead to irreversible changes in respiratory organs. According to experts, each lost percent of tropospheric ozone causes 150 thousand additional cataract cases, and incidence of skin cancer is rising by 2,6%.

Continuous effect of the polluted environment negatively affects the human body, and causes various serious diseases that is manifested in the increased incidence of diseases and the mortality rate. Life in such environment has especially negatively affects children. It causes reductions in IQ among them, memory impairment, they frequently fall ill and their learning achievements are low. For example, IQ among children living in the environment polluted by exhaust gases is by 20% lower in comparison with children, who are less affected by polluted air.

2. Preconditions and means for resolving the problem

The results of studies we carried out in Kutais can be cited for assessing the above stated facts. Because of the contraction of the industrial sector, the main source of contamination of the atmospheric air is road transport. A decrease in the quality and quantity of the air basin is caused by the sharp increase in the number of vehicles, nonstationary distribution of transport flows, relatively low quality of consumed liquid fuel, congestion of highways and so on. The carried out studies revealed that the concentration of lead, nitrogen dioxide, carbon acid, benzene and dust in the city's atmospheric air exceed maximum permissible level. In addition, air pollution is proportional to growing intensity of the number of vehicles. It has been established that by essential growing incidence in the city, there are characterized such diseases, as pneumonia, allergy, bronchial asthma, eye diseases, cancer and cardiovascular diseases.

Table 1: The action effect of the composition (g/m³) of impurities in the air on human health

No	The action effect	CO	NO ₂	SO ₂
1	The effect is subtle within hours.	115	15	6
2	In 2-3 hours, manifestation of signs of poisoning or irritation of the mucous membrane	115-575	20	130
3	Poisoning in 30 minutes	2300-3500	100	210-400
4	Short-term impact is life threatening	5700	150	1600

Numerous studies have revealed the essential role of road transport in pollution of the territories adjacent to highways, from which special emphasis should be placed on heavy metals: lead, zinc, chromium, cadmium, mercury, copper, tin and others, which are widely used in manufacturing industry, energy sector and transport. Heavy metals are released into environment mostly as the combustion products, they are accumulated in the soil and actively included in the ecological chain "chain-water-plant-product", and ended up in the human body and causing numerous diseases.

Sedimentation of heavy metals in the human body significantly affects development of the plant world, since their compounds are maximally intensely accumulated by herbaceous crops, especially by: salads, sorrel, spinach, table beet, corn stover and seed, walnut, pea, etc. Protein content is low in forage grass. Due to the morphological changes, stone fruits contain low a small amount of sugar and vitamins, agricultural productivity is declining and so on. For example, the presence of mercury in the soil accelerates drying of the plants, prevents photosynthesis process and causes disruption of activity. Lead and cadmium taken into the human body cause infarction, severe damage of the circulatory system, malignant tumors and so on.

Based on the above stated, it is important to study the agro-ecological state of the territories adjacent to the main highways, for which it is necessary to determine the accumulation dynamics of heavy metals in the agricultural products, as well as their distribution by the sections of the areas.

It is interesting that the presence of heavy metals in herbage of the plants can be also seen as a result of visual surveillance, since the existence of a certain amount of different chemical elements in them leads to obtaining special coloring, that is the formation of the pathology. For example:

- in the presence of copper, the plant leaves have dark green coloring, short and thick roots;
- iron content causes dark green coloring of leaves, and slower growth of aerial parts of plants is observed;
- in case of lead content, the plant leaves have dark green color, and relatively old leaves are bent, roots are short and have brown coloring;
- in the presence of zinc, in the ends of leaves, there is observed a plant disease – chlorism, during which leaves and shoots loose green coloring. In the leaf mass, there occurs dying of a group of cells of of the entire organ or its part;
- in case of cadmium content, leaves are bent, shoots have reddish coloring and the development of roots is restricted.

3. Conclusion

The aim of our research was to study the agro-ecological situation in the territories adjacent to the main highways of Kutaisi City. In particular, the distribution of heavy metals on the territory near highway by the sections of the areas, and the accumulation dynamics of heavy metals in the agricultural products, dependent on traffic intensity and composition. The content of heavy metals in the agricultural products was determined by using the atomic absorption analysis, but the composition of heavy metals in the soils near the highway was determined by using XRF analyzer.

The studies carried out have revealed as follows:

- on the both sides of the carriageway, at 30 m from the road, lead content is growing and at the distance of 150 m, it is within the permissible limits;

- nickel content exceeds permissible level, but the content of heavy metals (Cu, Zn, Mn) in the taken objects is the permissible limits;

- near the road, normal development-growth of plants and quality characteristics of the products are impaired, agricultural productive is decreased; sugar and vitamin contents are low in stone fruits;

- agricultural crops exhibit contrasting relationships to heavy and toxic elements. For example, in larger amount of lead content is observed in corn stover than in a seed. A large amount of zinc is contained by corn stover walnut leaves.

- It should be noted that the arable layer (0-20 cm) in the territories adjacent to highways of Kutaisi contains a wide range of radionuclides, which are actively included in the ecological chain ("soil-water-plant-product") and are taken into the human body that causes numerous diseases.

○ **This work was supported by Shota Rustaveli National Science Foundation (SRNSF) [DP 2016_5. Organization and management of transport processes]**

If we take into account that the central highways cross arable lands, obtaining of environmentally safe agricultural products is impossible without taking radical measures. In practical terms, the promising way to address the mentioned problems consists in the use of alternative fuel, rational organization and management of traffic flows, widespread application of electric and hybrid vehicles.

4. References

1. Lukanin V.N., Trofimenko Yu.V. Industrial-transport ecology. – M., Higher School. 2005. – 207 p. (in Russian)
2. Vyatkin M.A., Kuimova M.V. On the issue of the effect of vehicle exhaust gases on human health. Young Scientist. – 2015. №10. (in Russian)