

Ecological Problems Caused by Motor Vehicles in the City of Sumgait and Its Surroundings

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Abstract: The purpose is to study the impact of motor vehicles passing through the city on human health and the environment and to develop an action plan to prevent negative processes in the city of Sumgait.

Materials and methods. The negative impact of motor vehicles on the environment was studied using GIS technologies, historical and geographical, mathematical-statistical, comparative, observation, systematic analysis and other methods.

Results and discussion. The article calculates the length of existing roads in Sumgait, the number of motor vehicles (cars, trucks and buses) passing through the city during the year, the amount of waste each of them emits to the surrounding areas, especially to the atmosphere. In addition, their impact on soil and vegetation, as well as on human health, has been studied. The results were analysed and compared with the established sanitary standards for their exceedance. Statistical characteristics of the level of pollution have been calculated. The analysis of the data obtained from the measurements led to conclusions about the insufficient effectiveness of structures that reduce the level of pollution only at distances of 100 and 150 m from the sources.

Conclusion. In the considered areas, it is necessary to take measures to protect the population from road traffic pollution. In these measures, special attention was paid to creating favourable conditions for people to live in a cleaner environment.

Key words: transport means, soils cover, atmosphere, automobile roads, technogenic pollution.

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INTRODUCTION

The announcement of “Ecological year” in 2010 in Azerbaijan had stimulated some work recently. Some projects have been realized for prevention of the factors which negatively affect the environment and improvement of the ecological state. The renovation and landscaping work has been realized in Sumgait and surrounding areas. A special attention was paid to the creation of the good environment.

The transport is necessary for the activity of the modern industrial society. Its fast development negatively affects the environment. It especially influences the atmosphere, soils and plant cover [1]. It causes transformation, soil-formation and change of the soil structure and pollution with the heavy metals. This pollution is felt in the big cities and highways.

According to the World Health Organization’s (WHO) calculations, more than 70% of noxious substances is thrown to the atmosphere by the transport means. A weight of the pollutants realized is 965,9 million tons, but a weight per capita is a 101,3 kg, but it is 1 km 11153 kg for 1 km². Some factors, including their technical state, the fuel quality, a structure of the automobile roads and so on affect the transport waste which is higher than norm [3, 4]. Straightness and smoothness of the automobile roads are a reason for decrease of the lorries waste is 13%, but the cars waste 9%. But a main part of these effects are happened at the expense of toxic components of gases in the internal combustion engines of the transport means, unburned hydrocarbons, lubricating oils, metal and rubber dust and so on. There are three sour-

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es: the exhaust gases of the chimney, crankcase gases and fuel vapors.

According to the researchers' ideas the contamination of the separate transport means is distributed in the following order: cars-85%, sea and rivers - 5,3%, air - 3,7%, railways-3,5%, agricultural-2,5%. More than 260 chemical combinations are thrown to the biosphere by the internal combustion engines of the cars. They are: carbon oxide - 0,5-10%, nitrogen oxides - 0,8-2,5%, carbohydrate - 3%, aldehyde - 0,2% [4].

MATERIALS AND METHODS

The noxious effects of the transport means are observed not only in the big cities and also in the highways where the transport is intensive. The constant and dynamical development negatively effects on all the components of the landscape, firstly air, water and soil layer [2]. The object of our research is Sumgait. It is situated on the border way of Baku-Guba and Russia (M1) of which general lengths is approximately 200 km.

The road construction in the city began after the 30th years of the XIX century. A main reason was construction of the factories and getting a city sta-

tus of Sumgait region by the order of the Presidium of the Supreme Soviet of the USSR. The first roads were from soil, but then the soil road was replaced by gravel, gravel asphalt and recently asphalt was replaced by asphalt-concrete.

The GIC (Geographical Information Systems) technologies, historical-geographical, mathematic-statistical, comparison, observation, systematic analysis and other methods have been used for research.

RESULTS AND DISCUSSION

A total length of the automobile road is 195,8 km in Sumgait. The asphalt-concrete is 41,6 km, black coated way is 68,6 km, gravel and street roads are 85,6 km.

According to the information of 2018 the total number of the transport means is 16324. 89,4% of these transport means is cars, 6,4% of them lorries, but 4,2% of the transport means is buses. In general a quantity of the transport means increased 21,1% in 2014. This increase is observed in buses. So, 23% increase is observed in cars, but 12% reduction is noted in buses (fig. 1).

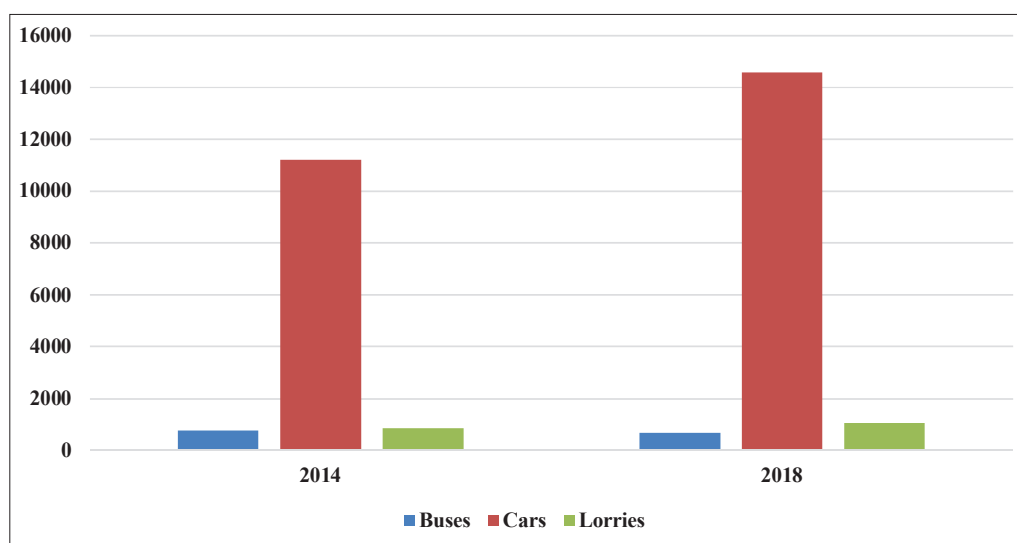


Fig. 1. Dynamics of vehicles in the city of Sumgait
[Рис. 1. Динамика транспортных средств в городе Сумгаит]

As it is seen from diagram one, the number of the transport means grew for 4 years. Increase of the transport means was a reason for waste growth in the atmosphere. This indication got separate values in every transport means. A main reason is diversity of the fuel. There are cars which use gas-line, diesel and methane gases here. We investigated an influence of the cars which work with petrol. The fuel use by the lorries was 32,7 tons, by the buses 16,3 tons but by the cars 233,4 tons in 2014. The waste by the automobiles increased 23%, but the bus waste was 12,8%

and the waste of the lorries was 17,4% in comparison with 2018. But the fuel consumption grew 20,2% in general (fig. 2).

As it is seen from picture 2 and 3, increase of the number of the transport means is resulted in growth of their fuel consumption. This process caused growth of the waste number thrown to the environment. It was determined that carbon dioxide grew 20%, nitrogen oxides 18,8%, sulfur oxide 20,3%, hydrocarbons 20,1%, aldehyde 24,6%, organic acids and soil particles 24,6% (fig. 3, 4)

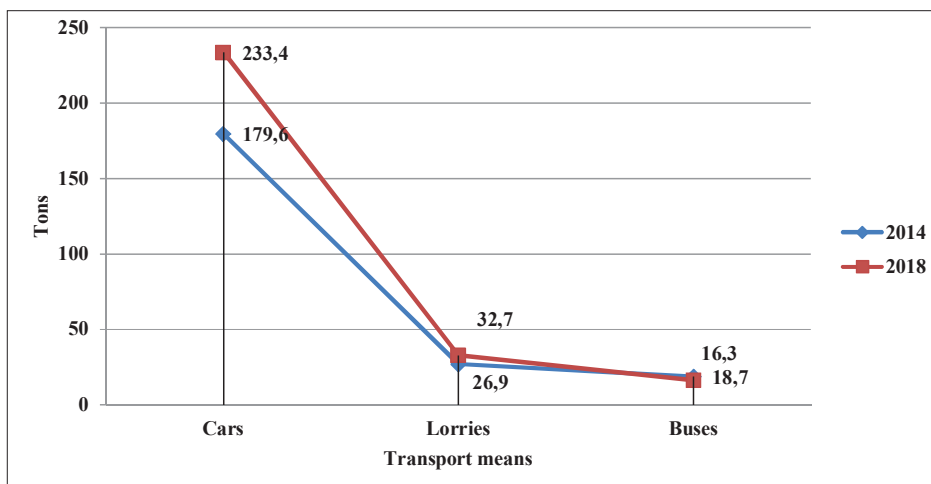


Fig. 2. Quantity of fuel used by vehicles in the city of Sumgayit in 2014-2018. (thousand tons)
 [Рис. 2. Количество топлива, используемого транспортными средствами в городе Сумгаит в 2014-2018 гг. (тыс. тонн)]

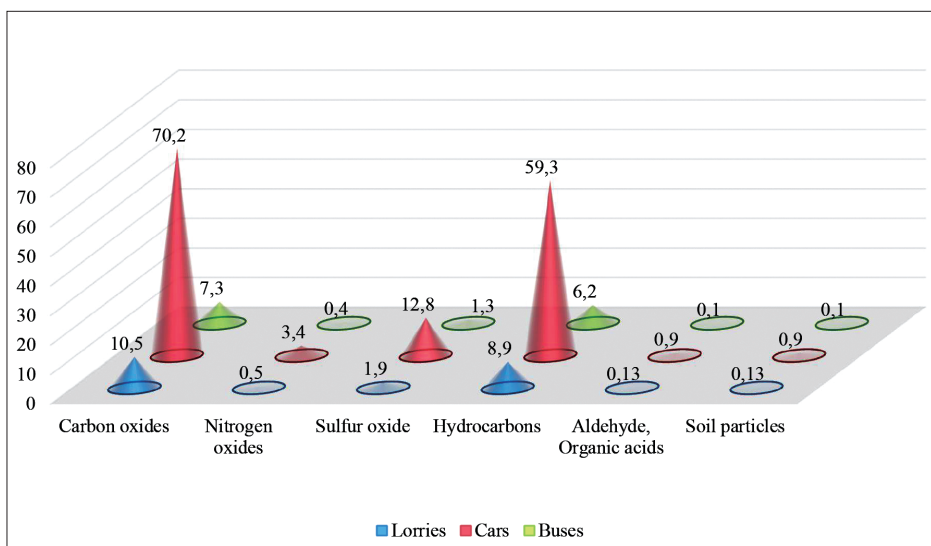


Fig. 3. Waste emitted by vehicles in the city of Sumgayit in 2014. (thousand tons)
 [Рис. 3. Отходы, выбрасываемые автотранспортом в городе Сумгаит в 2014 г. (тыс. тонн)]

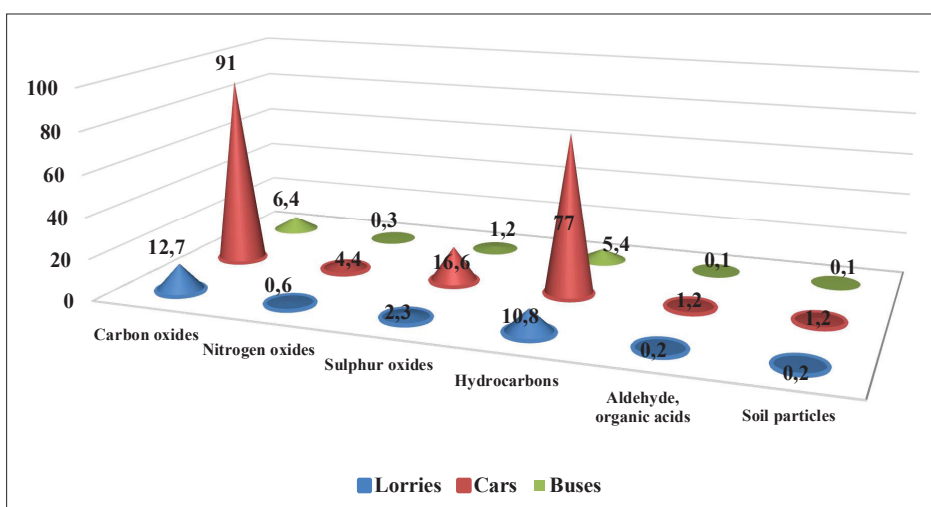


Fig. 4. Waste emitted by motor vehicles in the city of Sumgayit in 2018. (thousand tons)
 [Рис. 4. Отходы, выбрасываемые автотранспортом в городе Сумгаит в 2018 г. (тыс. тонн)]

Carbon monoxide CO_2 , carbon oxides CH_x , nitrogen oxides NO_x , soot which are used by the car are very noxious. A volume of the waste and their noxiousness rates depends on some factors: constructive, technological, organizational and technical (urban construction, organizations of movement, technical exploitation of the transport means) characters, natural-climate condition and work regime of the transport means.

Sulphur dioxide can be emphasized. This gas possesses strong unpleasant odor. It damages the central

nervous system. It causes occurrence of cardio-vascular and respiratory diseases.

Carbon gas quickly passes into the human's blood. It causes an increase of carboxy hemoglobin quantity and change of the mental movement reaction.

According to the analysis of the soil samples of the research zone, these chemical elements have been identified; as Sr (strontium), Zr (zirconium), Y (yttrium), Rb (rubidium), Fe (ferrium), Ag (silver) and Sb (stibium-surme). These elements contaminate different degree. This disturbed the biological activity of soils.

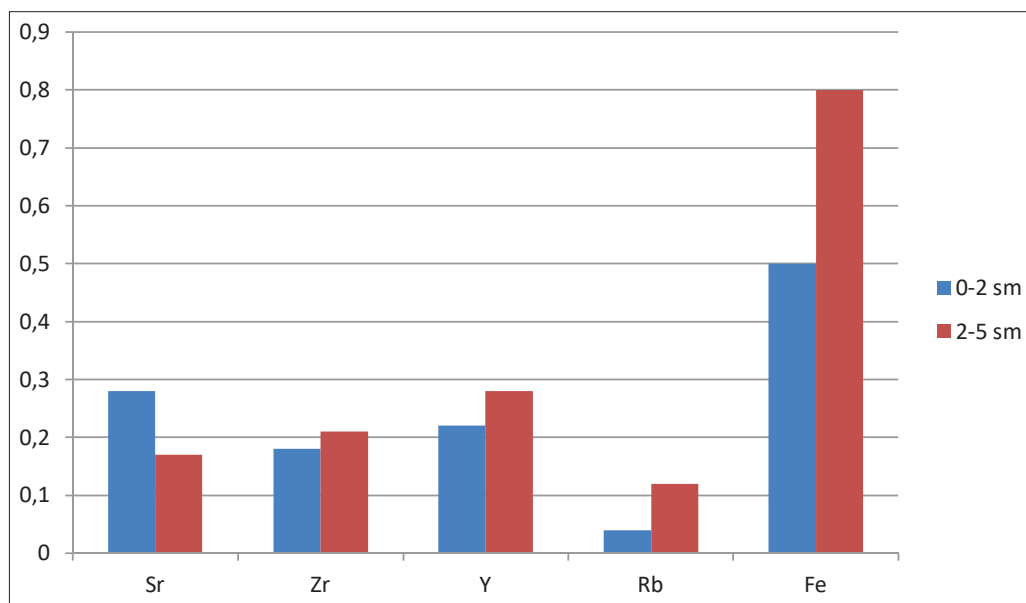


Fig. 5. The amount of pollutants from vehicles in the soils around the city of Sumgait

[Рис. 5. Количество загрязняющих веществ от транспортных средств в почвах вокруг города Сумгаит]

As it is seen from Figure 5 pollution is more at 2-5 sm of the soil depth. A quantity of Ag (argentium) is 100 m, but Sb (stibium surme) is 27,4 in these layers. Due to disruption of soil self-cleaning processes, accumulation of toxicants in the soil in proportion to the duration of population, the risk of their impact on the health of the population increase, the destruction of soil saprophytic increases, the epidemiological danger of the soil for the population.

Reduction of exhaust emissions from internal combustion engines used in vehicles and being the main source of pollution is carried out in two ways, reduction of waste noxiousness and volume of thrown noxious substances [5, 6].

Decrease of waste noxiousness. The noxious waste of the transport means is reduced in four ways.

1. Change of construction, worker processes, production technology, regulation of the combustion process system:

2. Using of other types of fuel or change of the physicochemical composition of fuel.

3. Regulation of noxious components in the waste by the special devices

4. Reduction of the waste volume.

Maximum fuel combustion reduces noxious emissions

It was determined that noxious components in the waste are significantly reduced when the ignition contact is made with an induction and capacitive transistor. In electronically controlled carburetors (where air and fuel mixtures are quickly opened and closed), forkamer method or layered mixture, measures such as recirculation of the exhaust gases, reshaping the combustion chamber and spraying water into the combustion chamber reduce emissions from the exhaust gases.

CONCLUSIONS

As a result of the researches we can say that growth of the population in Sumgait and development of the urbanization process caused the increase of transport means quantity. So, their number grew 21,1% in 2014-2018.

And this caused the increase in the number of the wastes. As a result of our investigations an increase of chemical elements as NO₂ in the atmosphere Sr (strontium) in soil cover. Zr (zirconium), Y (iodine), Rb (rubidium), Fe (ferrium), Ag (argentum) and Sb (stibium surme) are observed. The constant development of this process is resulted in ecological state of the city. For prevention of the negative processes first of all, it is necessary to control the launch of cars that meet Euro-2 standards and the ban on the use of technically unfit cars [7].

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Экологические проблемы, вызванные автотранспортом в городе Сумгаит и его окрестностях

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Аннотация: Цель – изучить влияние проезжающих по городу транспортных средств на здоровье человека и окружающую среду, разработать план действий по предотвращению негативных процессов в городе Сумгаит.

Методы исследования. С помощью технологий GIS, историко-географическими, математико-статистическими, сравнения, наблюдения, систематического анализа и другими методами изучено негативное влияние автотранспорта на окружающую среду.

Результаты и обсуждение. В статье рассчитаны протяженность существующих дорог в Сумгаите, количество транспортных средств (легковых, грузовых и автобусных), проезжающих по городу в течение года, количество отходов, выбрасываемых каждым из них в прилегающие районы, особенно в атмосферу. Кроме того, изучено их воздействие на почву и растительность, а также на здоровье человека. Проведен анализ полученных результатов и их сравнение с установленными санитарными нормативами на предмет их превышения. Осуществлен расчет статистических характеристик уровня загрязнения. Анализ данных, полученных в результате проведенных измерений, позволил сделать выводы о недостаточной эффективности сооружений, снижающих уровень загрязнения только на расстоянии 100 и 150 м от источников.

Заключение. На рассмотренных территориях необходимо проводить мероприятия по защите населения от автотранспортного загрязнения. В рамках этих мер особое внимание было уделено созданию благоприятных условий для жизни людей в более чистой окружающей среде.

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Ключевые слова: транспортные средства, растительный покров, атмосфера, дороги, техногенное загрязнение.

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