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Environmental Risks of Man-Made Air Pollution in Grand Algiers

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Abstract

The rapid economic growth and development in Algeria especially in Algiers which is the main metropolis in the country take place last decades. Uncontrolled urbanization and industrialization are contributing to deteriorate the environment. All these activities lead to an increase in the number of vehicles in the Grand Algiers, which adversely affect the air quality. Air quality in urban areas constitutes a major concern, taking in consideration the impact of pollution on environment and inhabitant's health. The main important urban air contaminants in terms of emissions and effect on environment and human health which could be taken into account are: carbon monoxide, nitrogen dioxide and particulate matter PM. The aim of our research is to assess the risks of man-made emissions into the atmosphere of Grand Algiers as a result of impact from stationary and mobile sources of pollution. GIS maps of air pollution with PM 1.0; 2.5; 10 microns in Grand Algiers were carried out. Based on the obtained results, it was revealed a tendency of increased content with nitrogen dioxide in the atmosphere of Algiers which demonstrates the existence of the risk of falling out of nitric acid rain not only within the city limits but also in the scale of grand Algiers. According to the GIS mapping revealed features of the propagation of man-made dust particles size 1.0; 2.5 and 10 microns. Further investigations should be focused on the establishment of a sufficient number of monitoring stations and planning ways to reduce the negative impact on the environment.

***Key words*:** Air pollution, particulate matter PM 1.0; 2.5; 10 microns.

Introduction

Industrial objects growth in the cities of Algeria are followed by a series of negative phenomena and, first of all, extra accumulation of different contaminating gases and vaporized pollutants. Mainly, emissions take place in the cities of Algiers, Annaba, Oran and Skikda because of the high concentration of harmful industries located in these cities.

The development of urbanization, the increase in the number of industrial facilities, the constant improvement of the density of urban transport in the Grand Algiers accompanied by a number of negative phenomena, and, above all, excessive accumulation in the atmosphere of various gas and vapor contaminants. The main components of harmful substances into the atmosphere are emissions from high-temperature fuel combustion products (exhaust gases of vehicles, aircraft, industrial emissions) [1-6]. Industrial activities in Algiers associated with engineering, chemical and petrochemical industry. Significant impact on the state of atmosphere of the metropolis due to the heavy vehicular traffic. Aerotechnogenic pollution of

the environment is the cause of most problems related to the presence of atmospheric dust particles of various sizes, which differ in size into three types (1; 2.5 and 10 μm). The potential adverse effects associated with these particles by their sizes (they are easily and deeply penetrate into the alveoli of the lungs) and the presence of toxic heavy metals (iron, lead, cadmium). The fine particles and, particularly diesel emissions are nowadays in all cities around the world, the problem for the public health. Moreover, national report on the state of environment demonstrated that 30% of consultations are for respiratory diseases, 40% of infant mortality (children under 1 year) is caused by respiratory diseases and 600 000 asthmatics suffer permanently [7-9].

The purpose of our research is to assess the risks of man-made emissions into the atmosphere of Grand Algiers as a result of stationary and mobile sources of pollution.

Material and method.

Regular grid satellite measurements were interpolated into ground observation points and regression is built on these relationships. The satellite measurements are recalculated for the whole study area by regression equations obtained. The monthly-averaged concentrations of the atmospheric contaminants are processed under time series analysis algorithm, interpreted and mapped. The data of CO remote atmospheric sensing in 4 cities of Algeria have been obtained within the different periods for the last decade.

Specialized optical or microwave sensors, mounted on the remote sensing satellites were used to analyze the Earth's atmosphere. Now the atmospheric remote sensing satellites Envisat (equipped with GOMOS, MIPAS and SCIAMACHY spectrometers), MetOp (equipped with IASI, GOME-2 and HIRS/4 spectrometers), EOS (equipped with MOPITT, AIRS, OMI and TES infrared spectrometers as well as HIRDLS and MLS microwave radiometers) and NPOESS (equipped with OMPS ultraviolet/visible spectrometer) are operated. Assessment of the atmospheric pollution with inorganic gases is carried out by satellite measurements using ground truth data. As the source the level 3 data products from NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) are used. Spatial segment of interest and required data layers selection and monthly averaging produced by Giovanni web-service (http://disc.sci.gsfc.nasa.gov/giovanni/).

Automatic selection of air samples in Algiers held since 2002 [7]. Monitoring posts have been set up in four areas: 1er Mai, Ben Aknoun, Bab El Oued and El Hamma. Additional studies were conducted during the first decade of the 21st century, and in other parts of the Grand Algiers [10].Among them, three urban areas with high population density: U1- district of Bab-Ezzouar; U2-center of Algiers; The U3-region Bach-djerrah, S - National Polytechnic University, and two suburbs (PU1- Dely-Brahim and PU2- Bouzaréah). The resulting average daily, monthly and annual averages data of background monitoring of test substances in the air compared to the maximum permissible concentration (MPC). According to WHO standards, the MPC for NO_2 is 0.03 mg / m^3 [11]. SAMASAFIA [1, 15, 17] Networks analyzers are equipped with size of 10 microns. In a further series of investigations was assessed not only by the size of 10 microns, but also other dangerous for breathing (2.5 microns), as well as emitted by diesel engines (less than 1 micron). The two classes of PM10 and PM2.5-particles are strictly regulated by the WHO in developed countries [10]. In accordance with WHO and EU limit values for PM10 standards of technological dust are 0.02 and 0.04 mg / m^3, but in Algeria, they were raised to 0.08 mg / m^3. MPC according to the WHO standards for man-made dust particles PM 2.5 is 0.02 mg / m^3 [10].

Results and discussion.

The data on remote sensing of CO concentration in the troposphere during last decade and its distribution in the north of Algeria are shown in the fig. 1.

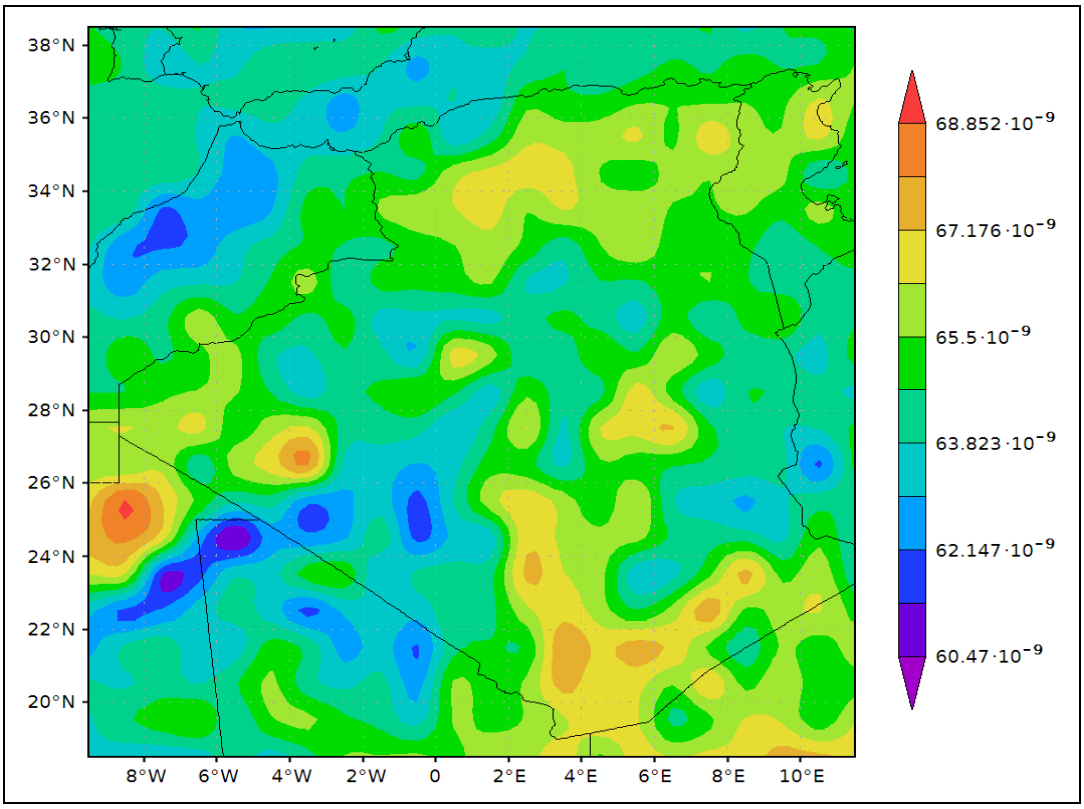

Fig.1. Giovanni web-service processing results: Aura/AIRS CO monthly volume mixing ratio AIRX3STM.005 data product, Algeria, September 2006

The data on annual monitoring of CO concentration in the urban agglomerations of Algiers are shown in the fig. 2.

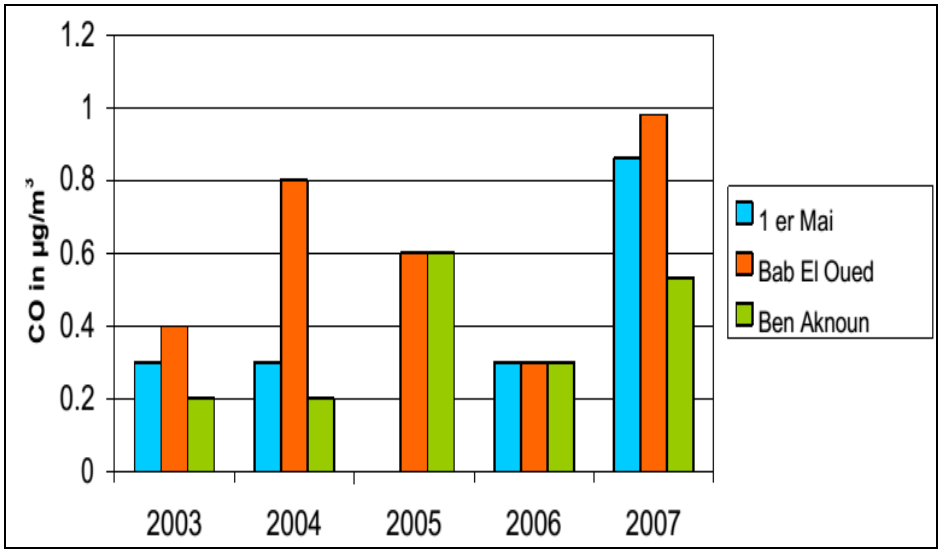

Fig. 2. Annual evolution of carbon monoxide concentration in Grand Algiers [7].

Carbon monoxide results from incomplete combustion of fuels and fuels. In the ambient air, it occurs mainly in the vicinity of the tract of traffic. A decrease of the annual values in 2007 from 0.98 mg/m^3 at Bab El Oued to 0.53 mg/m^3 at Ben Aknoun because of the traffic more disturbed and less rapid. At the level of the urban agglomeration of Algiers, the carbon monoxide is essentially the automotive traffic. Gasoline vehicles are the main sources of emission of the pollutant.

The dynamics of air pollution nitrogen dioxide in Algiers from 2003 to 2009 is shown in fig. 3.

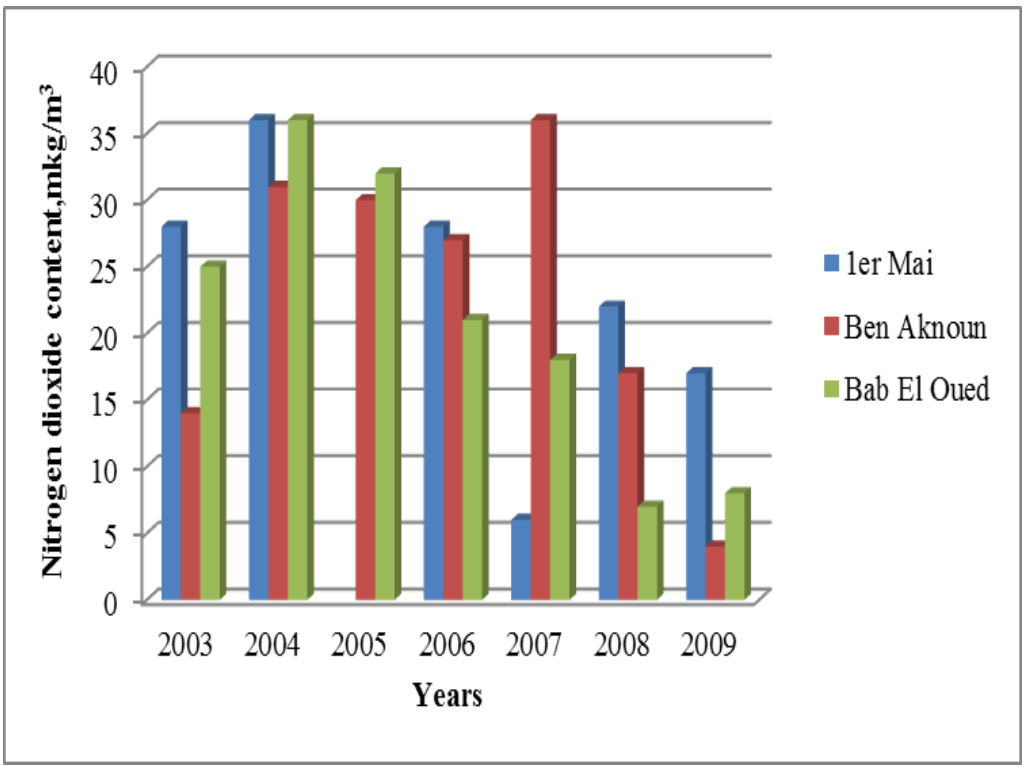

Fig. 3. The dynamics of air pollution with nitrogen dioxide in Grand Algiers

It could be argued that the average concentration of nitrogen dioxide from 2003 to 2007 in the city territory was close to 1 MPC. The annual average levels in NO_2 at the stations of Ben Aknoun and Bab El Oued are very contrasting depending on the environments considered.

The highest contents are recorded on sites in the vicinity of the axes busy in the case of Ben Aknoun (37 µg/m^3), followed by the urban site of Bab El Oued (17 µg/m^3). All sites do not exceed the quality objective, annual (40 µg/m^3).

It is known that nitrogen dioxide entering into a chemical reaction with water vapors converted to nitric acid [11]. In this regard, there is a risk of precipitation of nitric acid rains over Algiers. Necessary to consider that continuous acidification of soils due to the precipitation leads to increased migration of heavy metals in the links: soil - plant, soil - groundwater. Significant environmental risks are also associated with the increase in frequencies of respiratory human disease [12] anthropogenic degradation of soil biocoenosis, reduced crop yield in areas of acid rain [13]. Results of air pollution with dust particles during the years 2003 and 2004 in megapolis are shown in fig. 4.

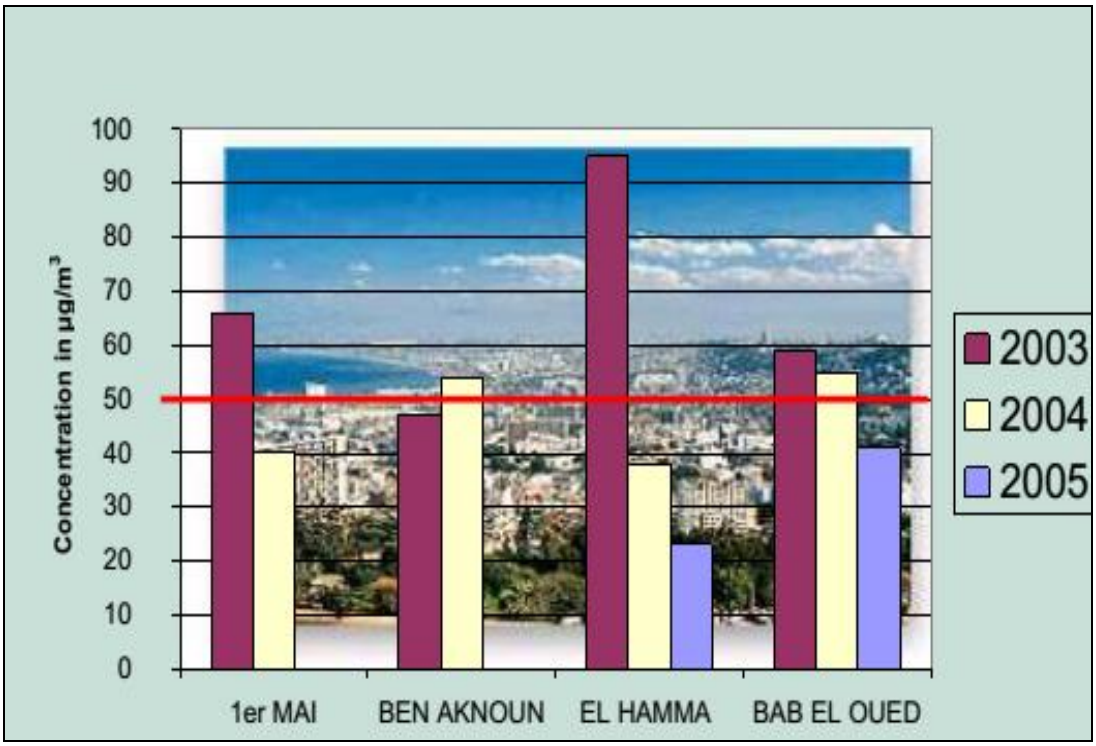

Fig. 4. Annual evolution of dust concentrations in the urban area of Algiers [15]

Comparing the obtained data demonstrates that the content of PM10 dust particles in Algiers is 1.5-4 times higher than the WHO standards. Atmospheric pollution with technogenic dust is associated with fallout of lead and other heavy metals. Data on the content of heavy metals of man-made dusts, selected in two posts of SAMASAFIA are shown in Table 1.

Table 1

Content of heavy metals in the atmosphere of two districts of Grand Algiers, µg / m^3

Element	Station of Bab El Oued		Station of Ben Aknoun	
	14.08.05	12.09.05	14.08.05	12.09.05
Lead	0.38	0.80	0.05	0.08
Cadmium	0.001	n.d	n.d	n.d
Nickel	1.56	1.67	0.37	0.38

Been recorded a greater pollution with lead, nickel and cadmium in the district of Bab El Oued compared to Ben Aknoun district. Exceeding the European standard (0.2 mg / m^3) reaches up to 4 times. Unfortunately, until now the preferential refueling of vehicles in Algeria used gasoline as an antiknock additive of tetraethyl lead (0.4-0.8 g / l) [16]. However, the presence of such additives leads to the fact that more than half of lead pollution of soil and plants accounted for the share of road transport.

Additional monitoring of technogenic pollution with PM10 was organized in the large settlements of Algiers, where the population is exposed to particles of about 60-70 µg / m^3. GIS maps of air pollution with PM 1.0; 2.5; 10 microns in Grand Algiers are shown in fig. 5-7.

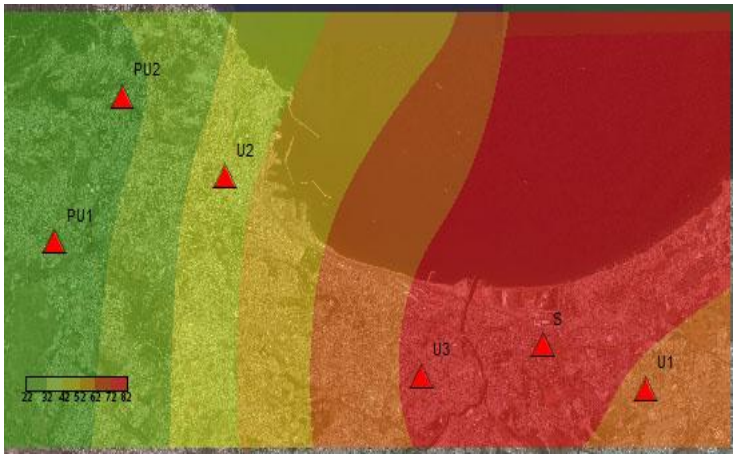

Fig. 5. Air pollution with PM10 in Grand Algiers

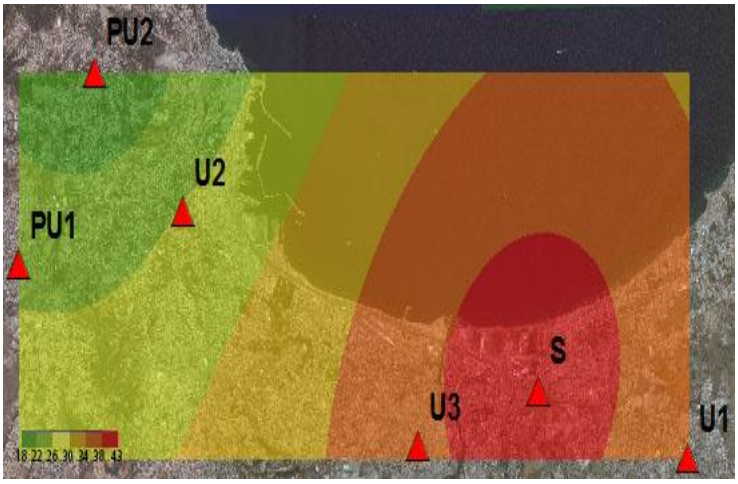

Fig. 6. Air pollution with PM2.5 in Grand Algiers

Pollution levels of ground layer air in the area of Bab-Ezzouar, in the center of Algiers, district Bach-djerrah (point U1, U2 and U3); near the Polytechnic University (S) concentrations of PM-10 and PM-2.5 exceed the international standards. In suburban areas pollution levels was twice less.

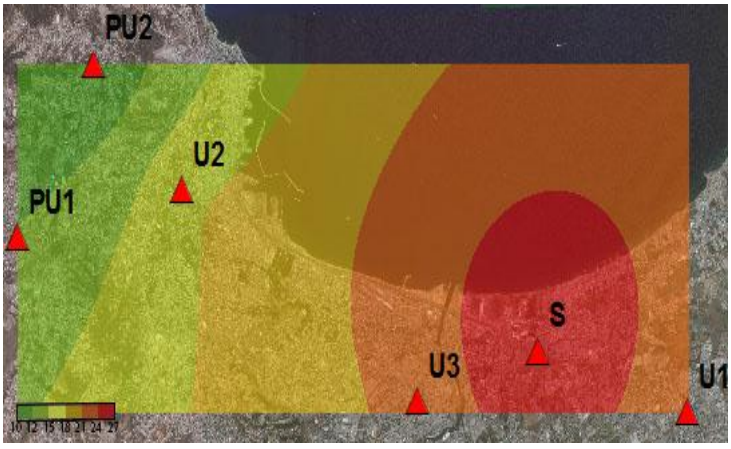

Fig. 7. Air pollution with PM1.0 in Grand Algiers

The highest level of air pollution in the area S is associated with an enormous cluster of cars around the Polytechnic University.

The weak or total absence of vegetation along the streets and in residential areas contributes to a high level of air pollution with dust particles.

Decrease in pollution growth compared to the current level can be expected in the nearest future after the introduction of ecological management measures Cement works companies Meftah and Rais-Hamidou, displacement and disposing of some animal waste repositories in the locality of Oued-Smar. It is possible to wait for better, if develop the measures to reduce the emissions from road transport. One of alternatives is the application of environmentally friendly anti-knock additives. It is known that effective additives based on metal complex compounds for diesel engines [14]. A further measure is to increase the efficiency of automobile engines.

Conclusions.

The obtained results allowed us to draw the following conclusions:

1. At the level of the urban agglomeration of Algiers, the carbon monoxide is essentially the automotive traffic.
2. Revealed the tendency of increased content of nitrogen dioxide in the atmosphere of Algiers which demonstrates the existence of the risk of falling out of nitric acid rain not only within the city limits but also in the scale of grand Algiers.
3. According to GIS mapping, it was found a features of man-made propagation of dust particles size 1.0; 2.5 and 10 microns.
4. Further investigations should be focused on the establishment of a sufficient number of monitoring stations and planning ways to reduce the negative impact on the environment.

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ჰაერის ტექნოლოგიური დაბინძურების ეკოლოგიური რისკი დიდ ალჟირში

ა. ბენსელჰოუბ, მ. ხარიტონოვი, ა. ზაიჩენკო, ს. სტანკევიჩი

რეზიუმე

ბოლო ათწლეულებში დაიმზირება ალჟირის განვითარებისა და ეკონომიკის სწრაფი ზრდა, განსაკუთრებით მისი დედაქალაქის – დიდი ალჟირის, რომელიც წარმოადგენს მთავარ მეგაპოლისს ქვეყანაში. უკონტროლო ურბანიზაცია და ინდუსტრიალიზაცია ხელს უწყობს გარემო პირობების გაუარესებას. სატრანსპორტო საშუალებების რაოდენობის ზრდა დიდ ალჟირში უარყოფითად

ზემოქმედებს ჰაერის ხარისხზე. ჰაერის ხარისხი ქალაქის სხვადასხვა რაიონში დიდ შეშფოთებას იწვევს, რადგანაც დაბინძურება გავლენას ახდენს არამარტო გარემოზე, არამედ მოსახლეობის ჯანმრთელობაზე. ქალაქის ჰაერის ძირითადი გამაჭუჭყიანებელი გამონაბოლქვისა და გარემოსა და ადამიანის ჯანმრთელობაზე ზემოქმედების თვალსაზრისით არის: ნახშირბადის ოქსიდი, აზოტის დიოქსიდი და მტვრის ნაწილაკები. ჩვენი კვლევის მიზანი მდგომარეობს რისკების შეფასებაში, რომლებიც დაკავშირებულია დიდი ალჟირის ატმოსფეროში ტექნოლოგიურ გამონადენებთან დაბინძურების სტაციონარული და მოძრავი წყაროებიდან. აგებულია მტვრის ნაწილაკებით დაბინძურების გის-რუქები 1.0; 2.5 და 10 მკმ დიდ ალჟირში. მიღებული შედეგების საფუძველზე გამოვლენილ იქნა ალჟირის ატმოსფეროში აზოტის დიოქსიდის შემცველობის ზრდის ტენდენცია, რომელმაც შესაძლოა ხელი შეუწყოს აზოტოვან წვიმას არამარტო ქალაქში, არამედ დიდი ალჟირის მასშტაბით. გის – კარტოგრაფიის მიხედვით გამოვლენილია მტვრის ტექნოგენური ნაწილაკების ზომით 1.0; 2.5 და 10 მკმ გავრცელების თავისებურებები. შემდგომი კვლევები მიმართული უნდა იქნას საკმარისი რაოდენობის მონიტორინგის სადგურების შექმნისკენ და გარემოსა და ადამიანის ჯანმრთელობაზე ნეგატიური გავლენის შემცირების გზების დაგეგმარებისკენ.

Экологические риски техногенного загрязнения воздуха в Большом Алжире

А. Бензелхоуб, М.М. Харитонов, А.О. Зайченко, С.А. Станкевич

Резюме

В последние десятилетия наблюдается быстрый экономический рост и развитие Алжира, и особенно его столицы – Большого Алжира, который является главным мегаполисом страны. Неконтролируемая урбанизация и индустриализация способствуют ухудшению окружающей среды. Увеличение количества транспортных средств в Большом Алжире негативно влияет на качество воздуха. Качество воздуха в городских районах представляет собой серьезную озабоченность, принимая во внимание влияние загрязнения на не только на окружающую среду, но и на здоровье жителей. Основными загрязнителями городского воздуха с точки зрения выбросов и воздействия на окружающую среду и здоровье человека являются: окись углерода, двуокись азота и пылевые частицы (ПЧ). Цель нашего исследования заключалась в оценке рисков, связанных с техногенными выбросами в атмосферу Большого Алжира от стационарных и передвижных источников загрязнения. Построены ГИС-карты загрязнения воздуха ПЧ 1.0; 2.5 и 10 микрон в Большом Алжире. На основании полученных результатов была установлена тенденция увеличения содержания диоксида азота в атмосфере Алжира, который может способствовать повышению риска выпадения азотнокислых дождей не только в пределах города, но и в масштабе Большого Алжира. Согласно ГИС-картографирования выявлены особенности распространения техногенных частиц пыли размером 1.0; 2.5 и 10 мкм. Дальнейшие исследования должны быть направлены на обоснование создания достаточного количества станций мониторинга и планирования путей снижения негативного влияния на окружающую среду и здоровье человека.