Caspian Journal of Environmental Sciences
Online ISSN: 1735-3866
Print ISSN: 1735-3033

# Organization of road traffic flows taking into account environmental criteria

**Ilnar Fargatovich Suleimanov, Damir Afgatovich Kharlyamov* Gennady Vitalevich Mavrin**

*Department of Chemistry and Ecology, Naberezhnye Chelny Institute, Kazan Federal University, Republic of Tatarstan, Russia*

**Corresponding Author's Email: kharlyamov@gmail.com*

## ABSTRACT

Modern scientific knowledge about the problem of environmental pollution by road transport is based on the concept of the negative impact of the entire transport complex, and not just individual transport facilities. The problem of environmental pollution by objects of the motor transport complex is aggravated by the rapid growth of the car park. Together with the insufficient development of the road network and the low level of quality management of road transport flows, this leads to a critical environmental situation in cities. Along with the progressive deterioration of the quality of atmospheric air, other environmental problems associated with the production of automotive equipment, spare parts and operating materials, operation, maintenance, storage and disposal of vehicles are aggravated. One of the most effective ways to resolve the problem situation is the establishment of quotas for emissions of pollutants from road traffic, taking into account the polluting background and the achievement of the established quotas by organizing the movement of vehicles. The proposed method predetermined the development of a system analysis methodology, which determines the sequence of analysis stages and methods for their implementation, combining mathematical modeling and programming, air sampling techniques, laboratory instrumental analysis and statistical processing of experimental results. In this regard, a method has been developed to limit emissions of pollutants from road traffic flows by introducing quotas, for the implementation of which an algorithm, special software and a calculation and instrumental method of environmental monitoring of road traffic flows are proposed.

**Keywords:** Road traffic, Environmental monitoring, Emissions of harmful substances, Industrial enterprises.

## INTRODUCTION

In cities with a developed industry, the share of the contribution of pollutants from exhaust gases of cars is more than 50% of the total harmful emissions into the air in the presence of a sufficiently high polluting background from stationary sources (industrial enterprises, thermal power plants, parking lots and garages, gas stations, etc.) (Korchagin *et al.* 2013). At the same time, in contrast to stationary sources, the emissions of which are subject to regulation, road traffic flows (with an irrational organization of traffic and a high polluting background) create surface concentrations of pollutants that are many times higher than their maximum permissible concentrations (MPC). In this situation, the limitation of emissions of pollutants from road traffic flows, taking into account the pollution of the air basin by stationary sources, has a high degree of relevance. When implementing measures in this direction, an objective current and predictive assessment of the quality of the air basin on the basis of environmental monitoring and simulation modeling of traffic flows is significant (Geneva 1990; Lozhkin *et al.* 2007; Suleimanov *et al.* 2011). In this regard, studies aimed at identifying patterns in the formation of pollutant emissions from road traffic flows in an industrial city, limiting emissions and ensuring the environmental safety of the road transport complex are relevant (Laguna & Marti 2002; Suleimanov 2013).

## MATERIALS AND METHODS

The developed methodology ensures the continuity of the environmental monitoring process due to the timing of changes in the characteristics of road traffic, which is recorded during a field survey (block 1), taken into account

Caspian J. Environ. Sci. Vol. 18 No. 5 (Special Issue: Environmental Aspects of Economic and Social Sustainable Development)
pp. 575~581 Received: April 02. 2020 Accepted: Aug. 18. 2020
DOI: Article type: Research

in the calculation assessment when compiling digital maps of the distribution of surface concentrations of pollutants (blocks 2 and 4) and the choice of control points (block 5). The continuity condition is also satisfied in the course of instrumental assessment (block 6), which is necessary to clarify the results of calculations of maximum surface concentrations (block 7), zoning of digital maps by the level of air pollution RKIZA (blocks 8 and 9) and experimental substantiation of quotas for pollutant emissions for road traffic (block 10).Thus, the developed methodology is endowed with all the features of the methodology for environmental monitoring of road traffic flows, a distinctive feature of which is taking into account the polluting background of stationary sources (block 3) when experimentally justifying quotas for pollutant emissions for mobile sources - road traffic flows (Suleimanov *et al.* 2013, 2014).

A method has been developed to limit emissions of pollutants from road traffic flows by introducing quotas, for the implementation of which an algorithm is proposed.

The algorithm uses special computer programs: 1) blocks 2, 3 - UPRZA "Ecologist" ver. 4.5., Option "Standard"; 2) Blocks 5, 12 - "Determination of the calculated integrated index of atmospheric pollution"; 3) block 6 - "Calculation of quotas for emissions of pollutants from industrial enterprises and vehicles"; 4) block 10 – "Program for the development of management decisions in the field of optimization of the parameters of sections of the road network". Certificates of state registration have been received for all programs, except for the current unified program for calculating the dispersion of air pollution "Ecolog".

Initial information on the environmental performance of the system is collected on the basis of:

1) calculation of the amount of pollutant emissions from road traffic flows;

2) inventory of emission sources and determination of maximum permissible emissions of pollutants from stationary sources.

An important condition for the implementation of the algorithm is the availability of a computational and instrumental methodology for environmental monitoring of road traffic flows, taking into account the effects of the joint presence of emissions from mobile and stationary sources in the air basin.

## RESULTS AND DISCUSSION

A summary calculation of the dispersion of 143 pollutants, forming 28 groups of summation, was performed and a digital map of the distribution of surface concentrations of pollutants in Naberezhnye Chelny was compiled.

When performing the calculations, the influence of meteorological conditions and terrain on the distribution of pollutants was taken into account. The calculations made it possible to obtain a picture of the distribution of the level of atmospheric air pollution throughout the territory of Naberezhnye Chelny. An excess of the concentration of carbon monoxide, nitrogen dioxide and the summation groups formed by these substances is predicted in the residential area of the city. For carbon monoxide, zones with maximum surface concentrations of more than 1 MPC are observed along major highways and interchanges. The excess of the MPC for nitrogen dioxide is expected in more than 70% of the territory of Naberezhnye Chelny.

For pollutants contained in emissions from stationary sources, the excess of MPC at the border with the residential area is not expected. The highest concentrations in terms of MPC are predicted for the following substances and groups of summations: manganese and its compounds 0.66 MPC; caustic soda 0.6 MPC; carbon (soot) 0.31 MPC; dimethylbenzene (xylene) 0.7 MPC; butan-1-ol 0.35 MPC; phenol 0.26 MPC; butyl acetate 0.6 MPC; acetone 0.2 MPC; triethanolamine 0.22 MPC; mineral oil 0.8 MPC; solvent naphtha 0.6 MPC; abrasive dust 0.2 MPC; summation group 6015 (acetone, furfural, formaldehyde and phenol) 0.55 MPC; summation group 6017 (aerosols of vanadium pentoxide and manganese oxides) 0.65 MPC; summation group 6038 (sulfur dioxide and phenol) 0.35 MPC; summation group 6052 (acetic acid, phenol and ethyl acetate) 0.3 MPC.

To assess the share of contributions from stationary sources to the pollution of the residential area, a calculation was carried out without taking into account traffic flows (Suleimanov *et al.* 2015, 2017). It was found that the calculated emissions of carbon monoxide and nitrogen dioxide from stationary sources in comparison with mobile sources are not so significant and create no more than 0.1 MPC. This is due to the remoteness from the residential area of most large stationary sources of air pollution and the lower total emission of these pollutants compared to vehicles. For 17 priority pollutants, there is a decrease in the content in the atmospheric air with distance from the industrial zone. For nitrogen dioxide and carbon monoxide, an increase in the calculated concentration was recorded at 2 points located in the central part of the city. For CO and NOx, an increase in content is recorded with

Caspian J. Environ. Sci. Vol. 18 No. 5 (Special Issue: Environmental Aspects of Economic and Social Sustainable Development)
pp. 575~581 Received: April 02. 2020 Accepted: Aug. 18. 2020
DOI: Article type: Research

distance from the industrial zone towards the city center, where the maximum intensity of traffic flows is observed (Khabibullin *et al.* 2013; Kajino 2003). The established patterns allow us to assert the predominantly motor transport origin of carbon monoxide and nitrogen dioxide. Based on the results of the analysis carried out on the basis of the developed digital maps for the most problematic sections of the road network in Naberezhnye Chelny, two groups of pollutants were identified:

1) contained in emissions from traffic flows and stationary sources;

2) contained only in emissions from stationary sources. The latter are not considered in further research, since their maximum surface concentrations do not exceed the MPC. Thus, the tasks of instrumental assessment and establishment of emission quotas for road traffic flows are simplified, due to the fact that the solution lies within the first group of pollutants.

Based on the results of field surveys (Block 1), the contribution of freight transport and buses (category of motor vehicles (ATS), which, in comparison with cars, is a more powerful source of pollutant emissions, to the total traffic intensity in the residential area of the city (about 11%), which is significantly less than the same indicator for an industrial zone (about 24%). With a higher level of air pollution in the industrial zone, in comparison with the residential zone (due to stationary sources), there is also a more complex ecological situation in the surveyed sections of the city's road network. The results of assessing the contribution of road traffic flows to air pollution in the city of Naberezhnye Chelny (blocks 2-3) show that road traffic flows are the priority sources of emissions into the air basin of the city (about 64%). A significant share of emissions from stationary sources (about 36%) shows the features of an industrial city, which are taken into account in the work when limiting emissions of pollutants from road traffic flows by setting quotas. Pollutants from road traffic flows in the city of Naberezhnye Chelny, in descending order of emissions, make up the following series: carbon monoxide (CO) -32854 t/year; nitrogen oxides (NOx) - 4596 t / year; total hydrocarbons (CnHm) -3296 t / year; sulfur dioxide ($SO_2$) -467 t / year; soot (C) -87 t / year. Based on the results of the instrumental assessment, the digital map of Naberezhnye Chelny is divided into zones (blocks 7-9) according to the level of atmospheric air pollution based on RKIZA (Fig. 1).

The sections of the road network with the levels “very high”, “high” and “elevated” make up 7%, 25% and 40% of the territory of Naberezhnye Chelny, respectively. Air pollution Basin in these areas is formed mainly due to traffic flows (over 70%) with a high polluting background of stationary sources (about 30%). The use of quotas while limiting emissions of pollutants from road traffic will allow achieving a low level (according to RKIZA) of air pollution. Based on the analysis of the results of the calculated and instrumental environmental monitoring of road traffic flows (Block 10, Fig. 1), quotas for pollutant emissions for road traffic flows of all ecologically unfavorable sections of the road network in Naberezhnye Chelny were established. To comply with the established quotas, the actual amount of pollutant emissions from road traffic flows must be reduced by 40 ... 67% for CO and 40 ... 59% for $NO_2$.

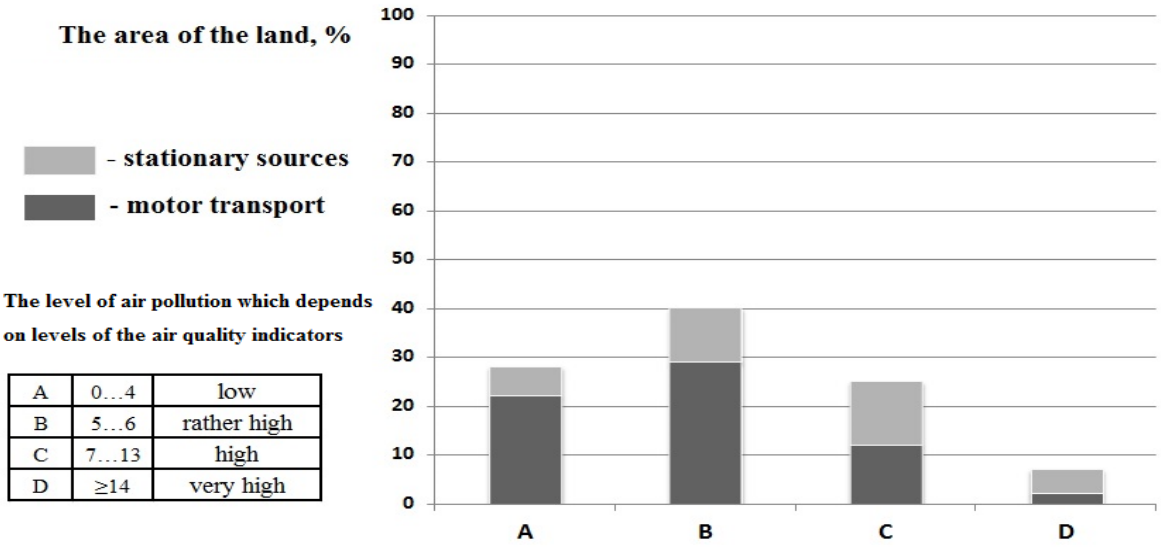


**Fig. 1.** Results of computational and instrumental environmental monitoring of road traffic flows in Naberezhnye Chelny.

Caspian J. Environ. Sci. Vol. 18 No. 5 (Special Issue: Environmental Aspects of Economic and Social Sustainable Development)
pp. 575~581 Received: April 02. 2020 Accepted: Aug. 18. 2020
DOI: Article type: Research

Based on the results of the computational and instrumental environmental monitoring of road traffic flows, the most problematic section of the road network in Naberezhnye Chelny was selected for the simulation experiment - the intersection of Mira and Druzhby Narodov avenues.

The sections of the road network with the levels "very high", "high" and "elevated" make up 7%, 25% and 40% of the territory of Naberezhnye Chelny, respectively. Air pollution in these areas is formed mainly due to traffic flows (over 70%) with a high polluting background of stationary sources (about 30%). The use of quotas while limiting emissions of pollutants from road traffic flows will make it possible to achieve a low level (according to RKIZA) of atmospheric air pollution. Based on the analysis of the results of the calculated and instrumental environmental monitoring of road traffic flows, quotas for emissions of pollutants for road traffic flows of all ecologically unfavorable sections of the road network were established

Naberezhnye Chelny (Table 1).

**Table 1.** Results of determining the pollutant emission quota for road traffic flows.

| **Name of the section of the road network** | **Actual amount of pollutant emissions, g/s** | **Pollutant emission quota, g/s** | **Reduction percentage, %** |
|---|---|---|---|
| 1 Hasan Tufan Ave. | 7.3 | 4.8 | 66 |
| 2 Raisa Belyaeva Ave. (section from Mira Ave. to Moskovsky Ave.) | 4.5 | 4.2 | 12 |
| 3 Druzhby Ave. (section from Mira Ave. to Moskovsky Ave.) | 3.8 | 3.2 | 27 |
| 4 Moskovsky Ave. (section from Hasan Tufan Ave. to Raisa Belyaev Ave.) | 3.0 | 2.3 | 22 |
| 5 Moskovsky Ave. (section from Raisa Belyaev Ave. to Druzhby Narodov Ave.) | 4.6 | 4.3 | 12 |
| 6 Mira Ave. (section from Raisa Belyaev Ave. to Druzhby Narodov Ave.) | 7.5 | 6.5 | 24 |
| 7 Mira Ave. (section from Academician Korolev St. to Druzhby Narodov Ave.) | 5,9 | 5,5 | 14 |
| 8 Syuyumbike Ave. (section from Avtozavodsky Ave. to Vakhitov Ave.) | 5.7 | 4.5 | 40 |
| 9 Syuyumbike Ave. (section from Vakhitov Ave. to Hasan Tufan Ave.) | 8.4 | 6.6 | 42 |
| 10 Naberezhnochelninsky ave. | 25.2 | 23.2 | 14 |
| 11 Musa Jalil Ave. | 4.2 | 3.3 | 21 |

To comply with the established quotas, it is required to reduce the actual amount of emissions of pollutants from road traffic by 40 ... 67% for CO and 40 ... 59% for $NO_2$. On the basis of the results of instrumental assessment by the method of correlation-regression analysis using the software product Microsoft Office Excel 2007, regularities of changes in the level of atmospheric air pollution are established depending on the parameters of the functioning of road traffic flows. The results of approximation of the dependence of RKIZA on the intensity of traffic flows are presented in the form of equations (1) for hauls and (2) for intersection nodes.

$$RKIZAp = \begin{cases} A_{П}^{1} \cdot N_{П} + F_{П}, & if \quad S_{ГА} \le 10\%, \\ A_{П}^{2} \cdot N_{П} + F_{П}, & if \quad 10\% < S_{ГА} < 25\%, \\ A_{П}^{3} \cdot N_{П} + F_{П}, & if \quad S_{ГА} \ge 25\% \end{cases} \quad \textbf{(1)}$$

Caspian J. Environ. Sci. Vol. 18 No. 5 (Special Issue: Environmental Aspects of Economic and Social Sustainable Development)
pp. 575~581 Received: April 02. 2020 Accepted: Aug. 18. 2020
DOI: Article type: Research

$$RKIZAu = \begin{cases} A_y^1 \cdot N_y + F_y, & if \quad S_{\Gamma A} \le 10\%, \\ A_y^2 \cdot N_y + F_y, & if \quad 10\% < S_{\Gamma A} < 25\%, \\ A_y^3 \cdot N_y + F_y, & if \quad S_{\Gamma A} \ge 25\% \end{cases} \quad \textbf{(2)}$$

where $A_{\ddot{I}}^{1,2,3}$ è $A_{\acute{O}}^{1,2,3}$ - regression coefficients, hour / auto.;

$N_{\ddot{I}}$ , $N_{\acute{O}}$ - the intensity of the traffic flow on the stretch and in the junction, vehicles / hour;

$F_{\ddot{I}}$ , $F_{\acute{O}}$ - background pollution level from stationary sources.

The values of the indicators are for the equation (1): $F_{\ddot{I}} = 0{,}17$ ; $A_{\ddot{I}}^1 = 0{,}005$ ; $A_{\ddot{I}}^2 = 0{,}006$ ; $R^2 = 0{,}96$ ; for the equation (2): $F_{\acute{O}} = 0{,}18$ ; $A_{\acute{O}}^1 = 0{,}002$ ; $A_{\acute{O}}^2 = 0{,}005$ ; $A_{\acute{O}}^3 = 0{,}008$ .

The value of the coefficient of determination $R^2$ is 0,96, which speaks about the adequacy of the model to the monitoring data and, accordingly, the possibility of their further use as regularities in the change in the quality of the air basin during the functioning of the system "traffic flow-street of an industrial city". The established patterns allow us to draw the following main conclusions regarding the change in the level of atmospheric pollution, expressed by RKIZA, which is growing:

- linearly the intensity of the traffic flow from a certain minimum value determined by the polluting background of stationary sources;
- with an increase in the share of trucks and buses in the traffic flow, which are more powerful sources of pollutant emissions compared to cars;
- when the conditions for the movement of vehicles change from the hauls to the intersection nodes.

Thus, the limiting factors are the composition and intensity of traffic flows, the impact of which on air pollution on the tracks and at the intersection nodes have significant differences. Limiting emissions of pollutants to the level of quotas comes down to optimizing the parameters of the functioning of road traffic flows by the method of simulation modeling based on the scientific analysis of the obtained statistical, calculated and experimental information.

**SUMMARY**

The developed methodology for calculating and instrumental environmental monitoring of road traffic flows has been tested in the city of Naberezhnye Chelny, where road traffic flows are priority sources of emissions into the air (about 64%). A significant share of emissions from stationary sources (about 36%) shows the features of an industrial city, which are taken into account in the work when limiting emissions of pollutants from road traffic flows by setting quotas. A list of pollutants has been determined that form a high level of environmental hazard of road traffic flows. Based on the results of field surveys, the motor roads of Naberezhnye Chelny were divided into groups according to the composition and intensity of traffic flows, as well as the dynamics of these indicators in the daily, weekly and annual traffic cycles. The regularities of changes in the composition of the traffic flow by groups of highways have been established. In the residential area of Naberezhnye Chelny, the contribution to the total traffic intensity of freight transport and buses (ATC category, which is a more powerful source of pollutant emissions compared to light vehicles) is about 11%, which is significantly less than the same indicator for the industrial zone (about 24%). The established fact, taking into account the higher level of air pollution in the industrial zone, in comparison with the residential zone (due to stationary sources), also explains the more complex ecological situation on the surveyed sections of the road network in Naberezhnye Chelny. (Arekhi & Jamshidi 2018). A distinctive feature of the developed computational and instrumental methodology for environmental monitoring of road traffic flows is to take into account the polluting background of stationary sources in the experimental substantiation of quotas for pollutant emissions for mobile sources. Analysis of the results of environmental monitoring of road traffic flows in Naberezhnye Chelny, carried out according to the developed methodology, showed.

Caspian J. Environ. Sci. Vol. 18 No. 5 (Special Issue: Environmental Aspects of Economic and Social Sustainable Development)
pp. 575~581 Received: April 02. 2020 Accepted: Aug. 18. 2020
DOI: Article type: Research

## CONCLUSION

The purpose of the developed computational and instrumental methodology for environmental monitoring of road traffic flows is to continuously monitor and track critical conditions, which are indicated by a high and very high degree of danger of the level of atmospheric air pollution, expressed by the calculated complex index of atmospheric pollution. A feature of the developed methodology is the refinement and addition of information obtained by calculation methods, the results of instrumental control, which are analyzed for the establishment of quotas for emissions of pollutants from road traffic, taking into account the polluting background and the achievement of established quotas due to the organization of vehicle traffic.

## ACKNOWLEDGEMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

## REFERENCES

Kajino, M 2003, Modelling liquid water content of atmospheric aerosols. IIASA IR 03-046.

Arekhi, M & Jamshidi, M 2018, Influences of inorganic binder on photocatalytic oxidation (PCO) and degradation of nano/micro $TiO_2$ containing acrylic composites. *Progress in Organic Coatings*, 115: 1-8.

Khabibullin RG, Makarova IV, Belyaev EI, Suleimanov IF, Pernebekov SS, Ussipbayev UA, Junusbekov AS, Balabekov ZA 2013, The study and management of reliability parameters for automotive equipment using simulation modeling. *Life Science Journal*, 10: 828-831.

Khabibullin RG, Makarova IV Belyaev EI, Suleimanov IF, Pernebekov SS, Ussipbayev UA, Junusbekov AS, Balabekov ZA 2013, The study and management of reliability parameters for automotive equipment using simulation modeling. *Life Science Journal*, 10: 828-831, http://www.lifesciencesite.com

Korchagin VA, Gorban MV, Rizaeva YuN, Goncharov, OYu 2013, Comparative assessment of the level of environmental hazard of vehicles, Actual issues of innovative development of the transport complex. Materials of the International Scientific Conference, Orel, pp. 261-266.

Laguna, M & Marti R 2002, The OptQuest callable library, optimization software class libraries. S, Voss & DL Woodruff (Eds.), Kluwer, Boston, pp. 193-218

Lozhkin VN, Greshnykh AA, Lozhkin OV 2007. Automobile and environment. SPb.: NPK "Atmosphere" at GGO im. AI, Voeikova, Moscow, Russia, 305 p.

Economic Commission for Europe 1990, Review of national strategies and policies for the abatement of air pollution, 8th Session, Geneva, 20-23 November, 59 p.

Suleimanov IF, Mavrin GV, Kharlyamov DA 2011. Application of computational monitoring for assessing urban air pollution. *Scientific and Technical Bulletin of the Volga Region*, 2: 107-111.

Suleimanov IF, Mavrin GV, Mavrin VG, Belyaev EI, Khabibullin RG, Makarova IV 2013, Field studies of traffic flows and the use of instrumental methods for assessing the quality of atmospheric air. *World of Transport and Technological Machines*, 4: 116-124.

Suleimanov IF, Mavrin GV, Mavrin GV 2014, Research of traffic flows and assessment of the quality of atmospheric air based on instrumental methods on city highways. *Avtotransportnoe Predpriyatie*, 1: 46-51.

Suleimanov IF, Mavrin GV, Kalimulina MR, Bondarenko EV, Kalimullin RF, Filippov AA 2017, The use of simulation modeling in traffic flow management. *Journal of Fundamental and Applied Sciences*, 1: 1840-1848. DOI:10.4314/jfas.v9ils.824 WOS:000413464300032.

Suleimanov IF, Mavrin GV, Kalimulina MR, Bondarenko EV, Kalimullin RF, Filippov AA 2017. Assessment of atmospheric pollution in the city of Naberezhnye Chelny with emissions from motor vehicles and industrial enterprises. *Journal of Fundamental and Applied Sciences*, 3: 1059-1066. DOI: 10.4314/jfas.v9i2s.80 WOS:000413464300032.

Suleimanov IF, Mavrin GV, Kharlyamov DA, Belyaev EI, Mansurova AI 2015, Pollution of the Air basin in the cities by motor transport and the industrial enterprises: Quality assessment of atmospheric air with the use of calculation methods and instrumental control. *Modern Applied Science*, 9: 12-20.

Caspian J. Environ. Sci. Vol. 18 No. 5 (Special Issue: Environmental Aspects of Economic and Social Sustainable Development)
pp. 575~581 Received: April 02. 2020 Accepted: Aug. 18. 2020
DOI: Article type: Research

# سامان‌دهی جریانات عبور و مرور جاده ای با در نظر گرفتن معیارهای زیست محیطی

**ایلنار فارگاتوویچ سلیمانوف[۱]، دامیر آفگاتوویچ خارلیاموف[۲]*، گنادی ویتالویچ ماورین[۳]**

۱- نامزد علوم فنی، دکترای علوم، گروه شیمی و اکولوژی، موسسه Naberezhnye Chelny، real7best@mail.ru، + 7-917-904-59-77 ، شناسه Scopus 55768296800، ORSID 0000-0003-0867-5574

۲- داوطلب علوم‌فنی، دکترای علوم، گروه شیمی و اکولوژی، موسسه Naberezhnye Chelny، kharlyamov@gmail.com، + 7-917-399-14-20، ID Scopus 56193220900، ORSID 0000-0002-7728-4502

۳- داوطلب علوم شیمی، دکترا ، گروه شیمی و اکولوژی، موسسه Naberezhnye Chelny، mavrin-g@rambler.ru، + 7-906-124-32-65، ID اسکوپوس ۵۶۰۹۱۳۴۹۴۰۰ ، ORSID 0000-0003-0276-4365

(تاریخ دریافت: ۹۹/۰۱/۱۴ تاریخ پذیرش: ۹۹/۰۵/۲۸)

**چکیده**

دانش علمی مدرن در مورد مشکل آلودگی محیط زیست توسط حمل و نقل جاده‌ای مبتنی بر مفهوم تأثیر منفی کل مجموعه حمل و نقل است و نه فقط امکانات حمل و نقل فردی. مشکل آلودگی محیط زیست توسط اشیا of مجتمع حمل و نقل موتور با رشد سریع پارکینگ بیشتر می‌شود. همراه با توسعه ناکافی شبکه راه و سطح پایین مدیریت کیفیت جریان حمل و نقل جاده‌ای، این امر منجر به یک وضعیت بحرانی زیست محیطی در شهرها می‌شود. همراه با وخامت تدریجی کیفیت هوای جوی، سایر مشکلات زیست محیطی مرتبط با تولید تجهیزات خودرو، قطعات یدکی و مواد عملیاتی، بهره برداری، نگهداری، ذخیره سازی و دفع وسایل نقلیه وخیم‌تر می‌شود. ایجاد سهمیه برای انتشار آلاینده‌ها از ترافیک جاده‌ای، با درنظرگرفتن پیشینه آلایندگی و دستیابی به سهمیه‌های تعیین شده از طریق سازماندهی حرکت وسایل نقلیه، یکی از موثرترین راه‌ها برای حل وضعیت مشکل است. روش پیشنهادی توسعه یک روش تجزیه و تحلیل سیستم را تعیین می‌کند، که توالی مراحل تجزیه و تحلیل و روش‌های اجرای آنها، ترکیب مدل‌سازی و برنامه‌ریزی ریاضی، روش‌های نمونه‌برداری هوا، تجزیه و تحلیل ابزار آزمایشگاهی و پردازش آماری نتایج تجربی را تعیین می‌کند. در این راستا، روشی ایجاد شده است که با معرفی سهمیه‌بندی، میزان انتشار آلاینده‌ها از جریان‌های ترافیکی جاده‌ای را محدود می‌کند، برای اجرای آن الگوریتمی، نرم افزار ویژه و محاسبه و روش ابزاری برای پایش محیطی جریان‌های ترافیکی جاده‌ای پیشنهاد می‌شود.

*مولف مسئول

***Bibliographic information of this paper for citing:***

Fargatovich Suleimanov, Il, Afgatovich Kharlyamov, D, Vitalevich Mavrin, G 2020, Organization of road traffic flows taking into account environmental criteria, Caspian Journal of Environmental Sciences, 18: 575-581



Caspian J. Environ. Sci. Vol. 18 No. 5 (Special Issue: Environmental Aspects of Economic and Social Sustainable Development)
pp. 575~581 Received: April 02. 2020 Accepted: Aug. 18. 2020
DOI: Article type: Research