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ATMOSPHERIC DISPERSION OF NITROGEN DIOXIDE EMISSIONS OF INDUSTRY INTERPRISE ON UNFAVOURABLE WEATHER CONDITIONS

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Abstract. *In this paper , the conducted researches allow to draw the following conclusions:*

1. The nitrogen dioxide impact hypothesis on pollution of the city in the conditions of the northwest and northern directions of wind causing air pollution in the city was proved.

2. It is shown that the highest pollution of city air happens in tranquility (0.04 mg/m3), pollution is slightly less than 1 m/s (0.015 - 0.25 mg/m3) in the speed of wind, and the lowest pollution (0.007 mg/m3) is observed in speed 2m/s.

Keywords: *atmospheric dispersion, nitrogen dioxid,e emission, f industry interprise, weather conditions, concentration, wind velocity, maximum permissible concentration, pollution.*

The variety of the chemical plants production, of the technologies applied, and of the raw materials used determines the wide range of the environmental pollutant [1-3]. Each day the plants emits a significant amount gaseous admixtures, nevertheless, enhanced concentrations of these substances in the air streams not permanently [4]. It is the result of the air flows impact on dispersion and removal of the emissions out of the city. However, unfavorable directions of wind result in increase of toxic substances content in the air.

Fig.1 demonstrates concentrations for nitrogen dioxide at the wind velocity of 1 and 2 m/s. Velocity increase from 1 to 2 m/s decreases the total concentration of nitrogen dioxide. For nitrogen dioxide at any direction of wind concentration in most cases exceeds the average daily maximum permissible concentration (MPC) emission (0.04 mg/m^3), and at south-west directions exceeds the (MPC) value (0.085 mg/m^3) of a maximum single emission ,which is exceeded 1.2 -1.4 times, and average daily – 2.5 -3 times.

The information on the concentration field of dispersed substances in the direction casing pollution of the residential area as well as in the direction perpendicular to the flow of removal is required for studies of polluting substances dispersion in the atmosphere.

With the aim of calculations convenience and pollution evaluation the direction of axis *x* was aligned with the wind direction prevailing in the area studied and causing pollution of air in city by the emissions of chemical enterprise.

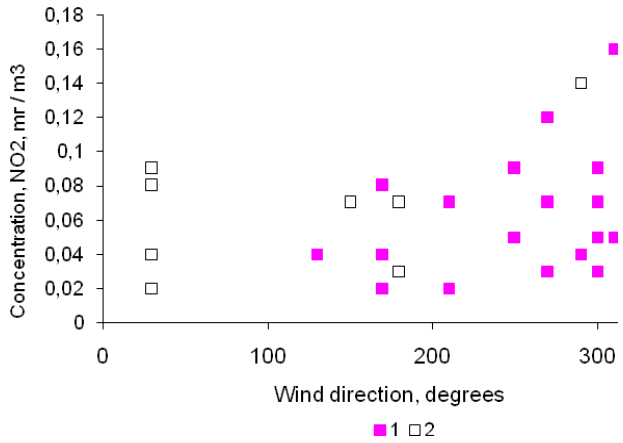

Fig.1 - NO_2 concentration in dependence on wind direction. 1- wind of velocity 1 m/s; 2 – 2 m/s.

Nitrogen dioxide distribution shown in fig.2 demonstrates, that in the area of industrial wastes storages location nitrogen dioxide concentration is 0.02 mg/m^3 at calm, and in the area at distance from a of emission source (-2.75 km) - 0.01 mg/m^3, that does not exceed average daily MPC (0.04 mg/m^3) whereas at point №1 in city it exceeds both average daily MPC 1.25 -2.5 times and maximum single MPC (0.085 mg/m^3), reaching 0.1 mg/m^3

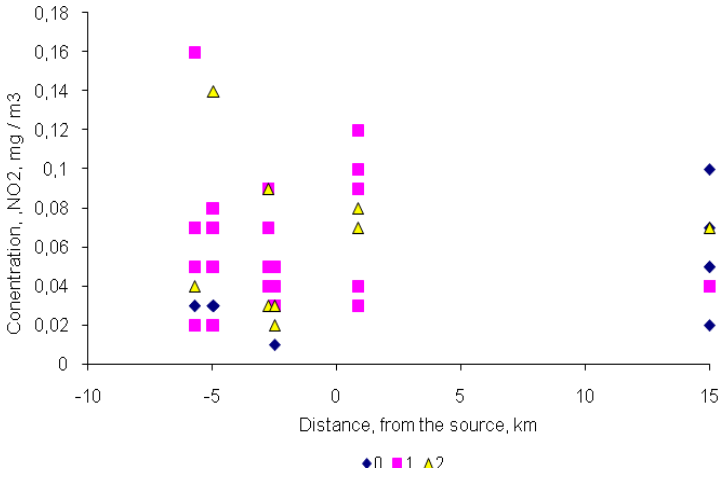

Fig 2 - Concentration of nitrogen dioxide at different distances from the source of emission at wind velocity: 0 – calm; 1 – wind velocity 1 m/s; 2 – wind velocity 2 m/s.

At wind velocity 1-2 m/s in observation point of pollution №1 (-4,95 km) nitrogen dioxide concentration also exceeds average daily emission, approaching to the single emission maximum (0,085 mg/m^3). Evaluation of the pollutants diffusion in the direction perpendicular to the flow of polluting substances drift presented an interesting task. Such information can be obtained in the course of large-scale under-torch observations, when sampling is made in the points, located perpendicular to the stream direction at various distances from the source, and thus, transverse pollutants diffusion can be evaluated.

As such information was not available for the studied area, it was interesting to evaluate polluting agents diffusion in the direction perpendicular to the stream of their spread using the data of observation stations and obtain the information on substances concentration in respect not only to the source of pollution but to the torch axis as well.

The given fig. 3 demonstrates NO_2 concentrations at different distances from the torch axis. The distribution of NO_2 is rather even, approaching to Gaussian distribution and exceeds average daily MCL (0.04 mg/m^3) in each point of observations

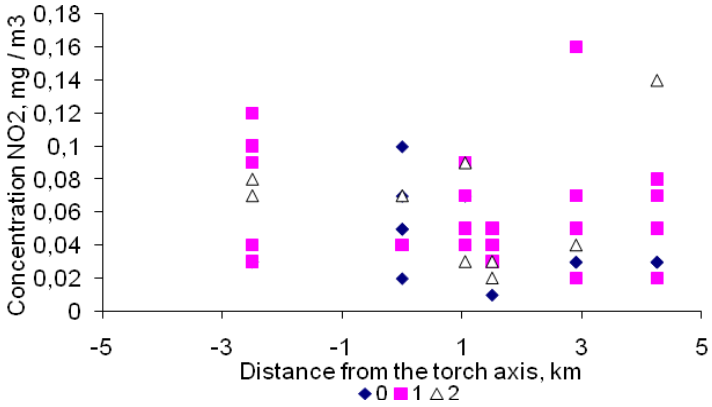

Fig.3 - Concentrations at different distances of nitrogen dioxide from the torch axis at the wind velocities: 0 – calm; 1 – wind velocity 1 m/s; 2 – wind velocity 2 m/s.

The distribution of NO_2 is rather even and approaches to Gaussian distribution. The analysis of the nitrogen dioxide dependence on the distance from the torch axis allows evaluation of the scale of transverse turbulent diffusion.

Thus, the conducted researches allow to draw the following conclusions:

1. The nitrogen dioxide impact hypothesis on pollution of the city in the conditions of the northwest and northern directions of wind causing air pollution in the city was proved.

2. It is shown that the highest pollution of city air happens in tranquility (0.04 mg/m3), pollution is slightly less than 1 m/s (0.015 - 0.25 mg/m3) in the speed of wind, and the lowest pollution (0.007 mg/m3) is observed in speed 2 m/s.

Literature:

1. Anirudhan T.S. , Sreekumari, S.S. Adsorptive removal of heavy metal ions from industrial effluents using activated carbon derived from waste coconut buttons . // Journal of Environmental Sciences. Volume 23, Issue 12 2011. P. 1989-1998.

2. Matthias Waldenmaie..Petaja, Sanna Yautala, Kari Hautala, Doug Worsnop, Markku Kulmala, Maria-Kuisa Riekkola. Changes in concentration of nitrogen-containing compounds in 10 nm particles of boreal forest atmosphere at snowmelt. //Journal of Aerosol Science.2014. V. 70. P. 1-10.

3. Petaja, Sanna Yautala, Kari Hautala, Doug Worsnop, Markku Kulmala, Maria-Kuisa Riekkola. Changes in concentration of nitrogen-containing compounds in 10 nm particles of boreal forest atmosphere at snowmelt. //Journal of Aerosol Science.2014. V. 70. P. 1-10.

4. Omarbekuly T., Sembina G. K. Modeling of air pollution at adverse weather conditions//The Messenger of KazATK of M. Tynyshpayev. - Almaty, 2005. - No. 6. – P. 158-162.