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Drafting method of atmospheric air condition monitoring

Currently, in the existing methodological recommendations covered issues of ranging areas based on quantitative and qualitative analysis criteria, using air-route and under torch samples. In modern conditions for the control of air pollution are necessary techniques to provide an adequate assessment of the degree of air pollution with minimal physical, technical and financial costs. Evaluation of air pollution with the help of maximum permissible concentration is carried out with the mandatory condition of coincidence of their temporal characteristics with the timing of the actual pollutant concentrations in the atmospheric air. For assessing the degree of air pollution.

Key words: atmospheric air, the maximum permissible concentration, chemicals, dust, heavy metals, ecology, monitoring.

Great importance for the air protection sanitary is to identify new sources of the air pollution, taking into account projected, constructed and reconstructed facilities, polluting the atmosphere [1–3]. The Environmental Safety Concept of Kazakhstan for 2014–2015., approved by the Presidential Decree № 1241 from 03.12.2003 year, provided the requirements of the establishment of standards for industrial emissions of pollutants into the Kazakhstan environment [3]. These standards are defined so that the total emissions from all area industrial enterprises did not exceed the standards for maximum allowable concentrations of pollutants in ambient air. For each stationary source set emission limit values (ELVs) only on the basis of maximum permissible concentrations (MPC) [4–8].

Air monitoring — a multipurpose information system, which has primary goals — observation, evaluation and forecasting of air quality under the anthropogenic impact influence [5]. Many countries have set up special stations for monitoring [1, 3, 4, 6].

Comprehensive ecological assessments of the ambient air needed for comparison with each other industrial regions, however, with dozens of indicators MPC describing various adverse environmental factors. Comprehensive assessment of the industrial area air environment adverse factors, can use the classes of substances that are normally given in Tables MAC. There are: the first class of danger: benzopyrene; the second class of danger: nitrogen dioxide, hydrogen cyanide; the third class of danger: sulfur dioxide and phenol; the fourth class of danger: benzene, acetone [2]. For detailed assessment and prediction of the air state in the cities take extra: carbon monoxide, hydrogen sulfide, sulfur dioxide, formaldehyde. In addition, dust and soot are recorded [2]. For a complex environmental assessment are used bioindication methods. Plants and their advantage is that they respond immediately to the entire amount of impurities [2, 9]. Bioindication methods are cheap and require relatively little time. Sharing their use allows to improve the estimation and air quality forecast accuracy, reasonable estimate about the state of the environmental area.

There is a quite clear correlation between the proliferation of lichen degree and the sulfur dioxide concentration in the air. Lichen complete absence means that the concentration of sulfur dioxide in the air exceeds 0.3 mg/m^3 [9].

The intensive air pollution is characteristic for large and medium-sized industrial cities, where on a person at the same time affect from 30 to 100 or more harmful chemical substances in quantities exceeding the maximum permissible levels, and their combined effect is even more significant [10]. Therefore, in many European countries and the United States to ensure the monitoring of air basin created an automated system of air pollution control [11–13]. The control system includes an automatic monitoring of the industrial emissions; check of the pollutants concentrations; analysis of the received information; determination of the actual state air pollution; measuring one or more ingredients concentration of the following series: SO, CJ, NO, O, CH, HS, NH, suspended solids; determination of moisture, temperature, wind direction and speed; the adoption of measures to reduce emissions; prognosis and assessment of the pollution level; development of recommendations for environmental improvement; checking the calculations of impurities dispersion [13–15]. At the air monitoring is used high-tech electrochemical, amperometric, semiconductor, quartz crystal, photometric sensors using fiber optics and detector tubes, biosensors, sensors on the surface-active fibers, and others.

Monitoring of the atmospheric air on the industrial region territory operates with a frequency of fixing the measurements results — 3 times a day up to 60 times per hour. Air monitoring stations operate automatically, the development of the monitoring is done by increasing the number of fixed stations and mobile observation posts application. Further an observing systems improvement is carried out through the use of more modern technology, combining the individual control systems in stationary, routing, mobile (undertorch) or in a comprehensive observation posts [15–18]. Fixed post is intended for continuous pollutants registration or regular air sampling for analysis. Highlighted stationary support posts — to identify long-term changes in the content of the basic and most common contaminants [16, 17]. Routing post is intended for the regular air sampling at a fixed point of the area observations, which is carried out by using a specially equipped vehicle laboratory [16, 17]. Roll (undertorch) post is intended for sampling under the plume to identify source influence zones [17, 18]. Laboratories, mounted in the car, make observations under the torch. Undertorch posts are arranged at the certain points on a fixed distance from the source. They move according to the direction of the surveyed emission source torch. Stationary and route posts are placed at the locations selected on the basis of a preliminary air pollution study, firstly in the most contaminated areas, adjacent to the most traffic highways, and also in the recreation areas [15–17].

The most contaminated areas include the largest maximum single (Ms) areas and the average concentrations (A) produced by the enterprises industrial emissions (within a radius of 2 km from low sources and from 2 to 3 km from high). Undertorch posts are placed considering the most expected concentrations at 0.5; 12; 3; 10 km distance from the sanitary protection zone (SPZ) border or the air pollution source downwind from it. The direction of the torch is determined by visual observation of the smoke clouds contours and the wind direction, if there is no smoke cloud [15–18]. Each observation post should be placed on an open, all sides ventilated with a non-dusting floor surface (asphalt, hard ground, turf) to prevent measurement results distortion because of the green spaces presence, buildings and other facilities. The observation posts quantity is established depending on the city population, so that, up to 50 thousand residents — 1 post; up to 100 thousand — 2 post; up to 200 thousand — 2–3 post; from 200 to 500 thousand up to 5 positions; more than 500 thousand to 10 posts; more than 1 million inhabitants up to 20 stationary and routing posts. The distance between the stationary posts is from 0.5 to 5 km. The number of monitoring stations for ambient air also depends on the settlement area, the terrain, the the placement characteristics and the level of industrial enterprises development, the location of roads with heavy traffic, the recreation and resort areas location, climate-weather conditions [15–19].

The level of air pollution is estimated according the year observations. To account the fluctuations in weather conditions and to obtain more reliable information about the contamination level are used observational materials for the period of 2–5 years. The total number of observations during the period under consideration should be not less than 800. In a mandatory list of controlled substances are included: benzo(a)pyrene, soluble sulfates — in cities with a population over 100 thousand residents; formaldehyde and lead compounds — in cities with a population over 500 thousand residents; metals — in cities with ferrous and non-ferrous metallurgy manufactures; pesticides — in the cities located near agricultural areas. The list of controlled substances is reviewed at least once every 3 years. It should be pointed out, that, at the undertorch supervision is carried out monitoring of specific pollutants, which are characteristic for this enterprise emissions [18, 19].

Thus, the analysis of quantitative indicators in the air gets improved in the criteria development and methods for quantitative assessment of chemicals in the air basin, which, in our opinion, is the scientific basis for recognizing the feasibility of the air quality monitoring. However, despite the significant number of the environmental objects studies, such as ambient air, individual questions on comprehensive assessment aspects of the anthropogenic and natural factors, affecting the level of air pollution in industrial regions, is still insufficiently developed.

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Атмосфералық ауа күйінің мониторингін құрастыру әдістемесі

Бүгінгі таңда қолданыста бар әдістік ұсыныстарда территориялық орынға ие сұрақтар жарық көрді, олар ауаның сапалық және сандық талдау көрсеткіштері негізінде сапарлық және факеластылық сынамалар көмегімен жасалған. Заман шарттарына сай атмосфералық ауаның ластануын бақылау үшін, оған минималды физикалық, техникалық және қаржылық шығындарда, ауаның ластануына жеткілікті дәрежеде баға бере алатын әдістер қажет. Ауаның ластануын бағалау шекті рұқсат етілген концентрацияның көмегімен жүзеге асады, бірақ міндетті шарт негізінде оның уақытша сипаттамалары атмосфералық ауаны ластайтын заттардың фактілік концентрациясының уақытша сипаттамасымен сәйкес болуы тиіс.

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Методика составления мониторинга состояния атмосферного воздуха

В настоящее время в существующих методических рекомендациях освещены вопросы ранжирования территорий на основе количественных и качественных критериев анализа воздуха с использованием маршрутных и подфакельных проб. Отмечено, что в современных условиях для контроля загрязнения атмосферного воздуха необходимы методики, позволяющие дать адекватную оценку степени загрязнения воздуха при минимальных физических, технических и финансовых затратах. Оценка загрязнения воздушной среды с помощью предельно допустимых концентраций осуществляется при обязательном условии совпадения их временных характеристик с временными характеристиками фактических концентраций загрязняющих веществ в атмосферном воздухе.

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