THE STUDY OF AIR QUALITY INDICES IN CRAIOVA MUNICIPALITY

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Abstract. The environmental pollution is a major concern at the individual, collective and global level. The degradation of living conditions caused by pollution justifies these concerns; thus, complex measures are necessary, especially for reducing the negative effects (DUFLO et al., 2008). In this study there were measured the main pollutants: SO_2, NO_2, NH_3 and particulates in five stations from Craiova municipality, and the pollution level was established. There was recorded a moderate pollution, except for Breasta area. Since the atmosphere is the broadest and most unpredictable vector of transmission of pollutants, it is required that the prevention of air pollution to be an issue of national and international interest. The air pollution can cause short and long term effects on the respiratory system (KYMISIS & HADJISTAVROU, 2008).

Keywords: monitoring, atmospheric pollution, chemical and physical indicators, air quality indices.

Rezumat. Studiul indicilor de calitate a aerului din Municipiul Craiova. Poluarea mediului reprezintă o preocupare majoră la nivel individual, colectiv şi global. Degradarea condiţiilor de viaţă cauzată de poluare justifică aceste preocupări şi face necesare măsuri complexe, în special pentru diminuarea efectelor negative (DUFLO et al., 2008). În lucrarea de faţă au fost determinaţi în cinci staţii din oraşul Craiova, principalii poluanţi: SO_2, NO_2, NH_3, pulberile şi a fost stabilit gradul de poluare. S-a înregistrat o poluare moderată, excepţie fiind zona Breasta. Dat fiind faptul că atmosfera este cel mai larg şi în acelaşi timp cel mai imprevizibil vector de propagare a poluanţilor se impune ca prevenirea poluării atmosferice să constituie o problemă de interes public naţional şi internaţional. Poluarea atmosferică poate produce efecte pe termen scurt şi lung asupra aparatului respirator (KYMISIS & HADJISTAVROU, 2008).

Cuvinte cheie: monitorizare, poluare atmosferică, indicatori fizici şi chimici, indici de calitate ai aerului.

INTRODUCTION

Since 2006, the air quality monitoring was done through the automatic air quality monitoring system, consisting of five automatic stations that have been placed according to the criteria set out in Ord. 592/2002. Also, there was taken into account the normative no. 756/2000 issued by the Ministry of Waters and Environmental Protection concerning the limit values, threshold values and evaluation criteria and methods of SO_2, NO_2 and NO_x, particulate matters, lead, benzene, carbon monoxide and ozone in the ambient air (POPA & RACOCEANU, 2003).

Also, there was studied the putting into practice of the national environmental policies, by: promoting the appropriate technologies for retaining the pollutants at the source, among the traders activity (POPA et al., 2008), air resource management for reducing the emissions to the lower levels possible, that do not exceed the regeneration capacity of the atmosphere (POPESCU, 2007), the use of low-sterile fuel (RACOCEANU & POPESCU, 2006), decreasing the entrainment on the deposits of slag and ash by the completion of the wetting system.

MATERIAL AND METHODS

Since 2006, the European Union has imposed on us to monitor the air quality, which is achieved by introducing an automatic air quality monitoring system, consisting of five automatic stations, which were located according to the criteria set in Ord. 592 / 2002 (Table 1, Fig. 1).

Table 1. Measuring stations. / Tabel 1. Staţiile de măsură.

Name of station	Type of station
Calea Bucureşti (DJ 1)	Traffic station
Primărie (DJ 2)	Urban station
Billa (DJ 3)	Mixed station - industrial and traffic
Işalniţa (DJ 4)	Industrial station
Breasta (DJ 5	Regional Fund

The air quality monitoring involves the tracking of pollutants in order to assess the degree of pollution of the atmosphere (POPESCU, 2007). The emissions were measured using the Oldham apparatus for determining noxae (Fig. 2).

The air quality indicators are calculated based on the data from the air quality monitoring system and are regarded as most important for assessing the full situations, in comparison with the quality targets set by the EU regulations.

The quality indices, namely the specific air quality index is a coding system of the concentrations recorded for each of the following monitored pollutants: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), particulate matters PM_{10}.

Besides these pollutants, the Oldham apparatus records also the methane, material particulates, hydrogen sulphide, volatile organic compounds, etc.

The general index is established for each of the automatic stations as being the highest from the specific indices corresponding to the monitored pollutants. The general index calculation results from at least three specific monitored indices. The general index and the specific indices are represented by integers between 1 and 6.

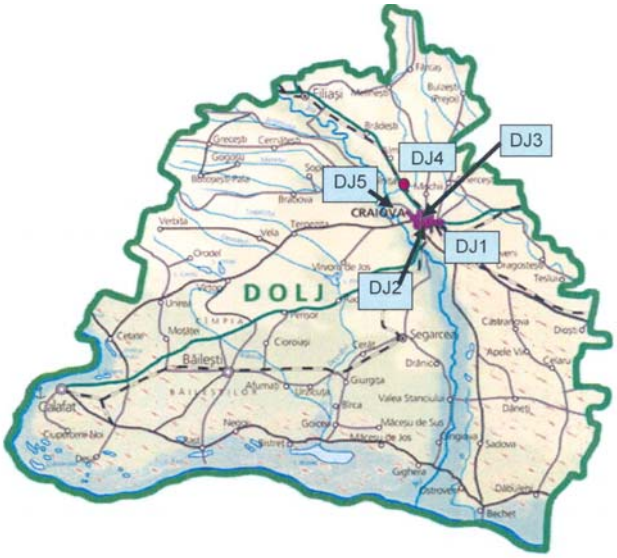

Figure 1. The location of air monitoring stations.
Figura 1. Amplasarea stațiilor de monitorizare a aerului.

Figure 2. The Oldham apparatus for determining noxae.
Figura 2. Aparat pentru determinarea noxelor Oldham.

The specific index corresponding to sulfur dioxide is determined by the classification of the hourly average concentrations in one of the areas of concentrations listed as follows: 0-49.9 μg/m^3 → 1; 50-74.9 μg/m^3 → 2; 75-124.9 μg/m^3 → 3; 125-249.9 μg/m^3 → 4; 350-499.9 μg/m^3 → 5; >500 μg/m^3 → 6. (according to the National Network for Air Quality Monitoring).

RESULTS AND DISCUSSIONS

The increased use of fossil energy since the industrial revolution, and especially since 1950, has been the major cause of increased emissions of air pollutants and, correspondingly, many environmental problems. Emissions due to the use of energy are major sources of sulfur dioxide, nitrogen oxides, carbon dioxide, and soot and constitute a large contribution of methane, non-methane volatile organic compounds and heavy metals. Depending on conversion due to atmospheric chemical reactions, on meteorological transport, and on deposition processes, air pollution can be transported from hundreds of kilometres (ammonia) to several thousands kilometres (aerosols) on a truly global scale (CO_2 and CFCs). The adverse effects of emissions due to use of energy range from very local to regional and global. In cities, traffic can cause very high concentrations of nitrogen oxides and carbon monoxide, but also secondary products such as ozone and aerosols, especially under conditions of stagnant air (SLANINA, 2004).

Air quality in cities is the result of a complex interaction between natural and anthropogenic environmental conditions. Air pollution in cities is a serious environmental problem – especially in the developing countries. The air pollution path of the urban atmosphere consists of emission and transmission of air pollutants resulting in the ambient air pollution. Each part of the path is influenced by different factors. Emissions from motor traffic are a very important source group throughout the world. During transmission, air pollutants are dispersed, diluted and subjected to photochemical reactions (MAYER, 1999).

In the study conducted between 2009 and 2010, there were recorded lower values on Calea Bucuresti Street (DJ 1) during the winter months, due to the precipitation, which have cleaned up the air. The highest values were recorded in June and December at Billa (DJ 4) – which is polluted by industry and traffic. For the City Hall (DJ 2) there is a SO_2 significant average value of 22.7 μg/m^3, due to heavy traffic from the centre of Craiova. The specific index for SO_2 has the value 1 (since any recorded average value does not exceed 49.9 μg/m^3) (Fig. 1).

The NO_2 pollutant has recorded values above the permissible limits, at the monitoring station in Calea București Street (DJ 1), in February and December, due to snow, which purified air. The average value is 29.9 μg/m^3. In the station located at the City Hall there is observed only one exceeding of 53 μg/m^3 in December. The average value is 36.8 μg/m^3. The lowest values were recorded in Breasta area (DJ 5), the annual average value being of 23 μg/m^3. This area has no industry and traffic is reduced, the atmosphere being unpolluted. The general indices from Billa area have value 2 in June, September-October (Fig. 2).

In the case of particulate matters there are observed higher values in March (DJ 2), due to the traffic, and in February (DJ 3), due to the industry. The general indices range between 3 and 4, respectively good and average (Fig. 3).

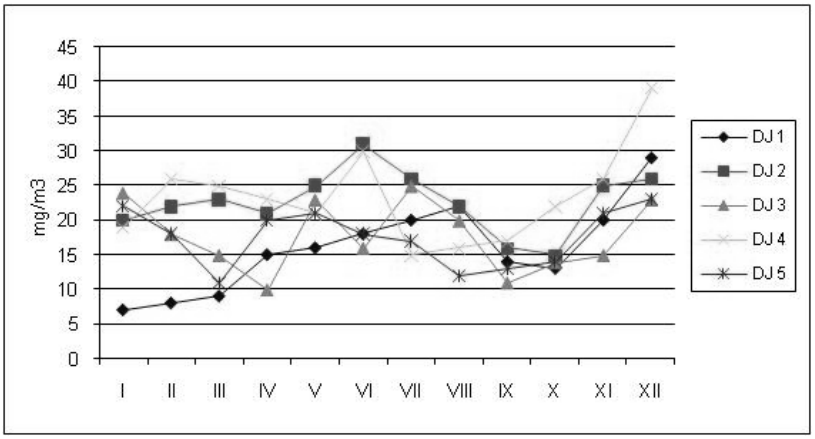

Figure 1. The evolution of SO_2 concentration in 2009-2010 (average values).
Figura 1. Evoluţia concentraţiei de SO_2 în anii 2009-2010 (valori medii).

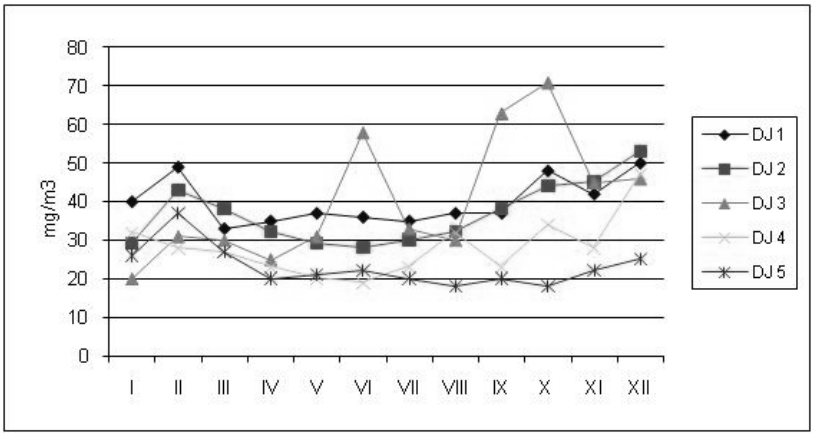

Figure 2. The evolution of NO_2 concentration in 2009-2010 (average values).
Figura 2. Evoluţia concentraţiei de NO_2 în anii 2009-2010 (valori medii).

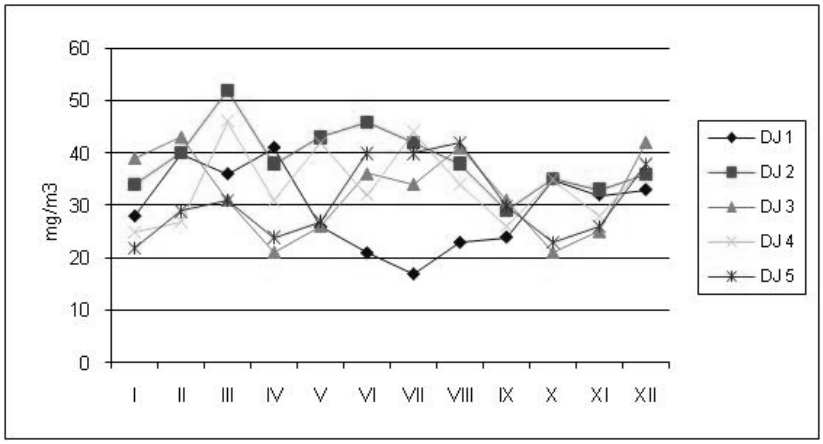

Figure 3. The evolution of particulate matters concentrations in 2009-2010 (average values).
Figura 3. Evoluţia concentraţiei pulberilor în suspensie în anii 2009-2010 (valori medii).

After the conducted study, in order to prevent, limit or reduce and even eliminate where possible the environmental pollution, in order to reduce the influence degree to people, flora and fauna, etc., the following measures and actions are required:

- replacement of raw materials, combustibles, fuels and lubricants with a high content of elements and pollutants, with raw materials and materials less polluting;
- additions and upgrades in the production facilities and technical equipment in order to increase their efficiency;
- improving the technological performances of pre-purification, purification, retention, treatment, neutralization and dispersion facilities and equipment of pollutants or building new facilities with appropriate technologies;
- elimination of dangerous and priority dangerous toxic substances usage, with materials and substances less dangerous;

- operation and appropriate and adequate maintenance of technological facilities of manufacturing and of depollution, in compliance with the designed parameters;

- systematization of road and rail traffic and infrastructure improvements in the area of these transport activities;

- the delivery, distribution, commercialization and use of combustibles and fuels low in sulfur, nitrogen, lead and heavy metals;

- installation and use of capture and conversion facilities of noxae resulting from fuel combustion in internal combustion engines;

- compliance with the existing legal regulations on the prevention and limitation of accidental pollution;

- applying drastically the coercive principles and the "polluter pays" principle for the situations of noncompliance with environmental, water and health legislation in force;

- development of plans, strategies and programs to protect the environment and to ensure the financial resources needed for works on short, medium and long term;

- development and implementation (adoption) of plans and programs for the progressive reduction of emissions of pollutants in the environment;

- achievement of objectives and new activities only by adopting the best available techniques, without involving excessive costs in the context of the transposition and implementation of European Community regulations.

CONCLUSIONS

1. The data and information reveal that the general quality indices of monitored parameters - sulfur dioxide, nitrogen dioxide, particulate matter - in the five monitoring stations from Craiova municipality present an environment characterized by moderate pollution.

2. The atmospheric pollution is due to the fact that the facilities of processing, capture, retention, depollution, dilution and dispersion of pollutants in the atmosphere have a low efficiency.

3. The main human activities that generate solid, liquid and gaseous pollutants, that have affected, affect and / or may still affect directly or indirectly in the short, medium and long term the quality parameters of environmental factors (water, air, soil, vegetation etc.), which also affected the health of humans, animals and plants, are represented by:

- production activities of nitrogen fertilizers (ammonia, nitric acid, nitrate and urea) and organic synthesis products (acetylene, acetaldehyde, methanol, etc.);

- electricity and heat production based on fossil fuels (coal, lignite in the lower basin of the Jiu Valley, oil, natural gases);

- drilling, extraction and primary processing of crude oil and natural gas;

- agro-alimentary production activities (beer, oil, tobacco, margarine, alcoholic beverages and soft drinks, meat and meat products, milk and milk products, etc.).

4. To the pollution generated by socio-economic activities (industrial, agricultural activities and services, etc.) it is added also the air pollution due to exhaust emissions from fuel combustion in internal combustion engines (petrol, diesel) and rail, road and air traffic.

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