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# Estimation of Concentration of Oxides of Nitrogen in Fushe-Kruja and Kruja Region, Albania

Stela I. Pepa and Alma Shehu

*Department of Chemistry, Faculty of Natural Sciences, University of Tirana, Albania*

**Abstract:** The occurrence and distribution of Nitrogen dioxide in ambient air of the Fushe-Kruje and Kruja region were investigated by means of their content determination in passive samplers. Due to the light dependent nature of the reactions they undertake in ambient air, the samplers were distributed and collected during different seasons of the year. Monitoring took place from January 2014 until June 2014 and from July 2014 to December 2014. The region where the measurements took place is loaded with industrial activities, both licensed and not, which contribute to the natural concentration of oxides of nitrogen in ambient air, and provides difficulties in connecting the oxides of nitrogen increment with a specific activity. Due to the lack of an existing database of pollutants concentration from State Authorities as well as due to the lack of background pollutant concentration in the monitored area, a new database is created in order to enable the evaluation of the increment in pollutant concentration during the year. For this reason, 15 monitoring points were selected. Aiming to reduce the measurements bias, the samplers were duplicated at each point. Given the rural area in the region where the monitoring took place, the concentration of ground level nitrogen dioxide resulted to be very low. The highest concentration was identified in receptor E (Kruja, Pengile) with a concentration in the monitoring period 48.6 μg/m3. This value compared to Albanian Legislation on Ambient air quality fall within the limit, although not to the EU limit value (only for 1 point one single measurement) , (Albanian limit for yearly NO2 concentration is 60 μg/m3 and EU limit value is 40 μg/m3 ). Apparent variations of the NO2 content in different monitoring periods were evident as the NO2 formation in ambient air is highly dependent on daylight, atmospheric conditions as well as on the concentration of ground level ozone.

**Key words:** Nitrogen Dioxide, passive samplers, Fushe-Kruje, Kruje Gjuraj

## 1. Introduction

Ambient air monitoring of Fushe-Kruja and Kruja region was monitored during a period of one year. Aiming to evaluate the ambient air concentration of nitrogen dioxide, NO2, there were selected specific points. NO2 concentration in ground level is highly depended on the seasonal and atmospheric conditions [1, 3, 4].

The area where the study took place has been designated to be an industrial region from the local authorities, due to the last year activities. Several industrial sites are located nearby this area, being so target for ambient air monitoring. Illegal activities are also operating (although the last period, a lot of efforts are being done to close them), which do have a significant contribution to the ambient air quality of the region.

The sampling of ambient air was carried out by using passive diffusive samplers, which were distributed in different stations of the region and collected on a monthly frequency. Passive samplers are small, silent, and reliable; do not need electricity; and are less expensive. They can be used for indoors and outdoors monitoring in rural, urban, arctic, and tropical environments where they can provide exposure profiles with high quality [2, 4]. Samplers do not need field calibration, air volume measurements, and technical demands at the sampling site. They are

**Corresponding author:** Stela I. Pepa, Ph.D. Candidate, Department of Chemistry, Faculty of Natural Sciences, University of Tirana, research areas/interests: Environment
E-mail: stelapepa@yahoo.com.

suitable for determining spatial distribution of gases and establishing atmospheric monitoring networks.

The results were calculated based on the atmospheric conditions of the monitored period like, temperature, humidity, pressure, etc.

Due to the lack of an existing database of pollutants concentration from State Authorities as well as due to the lack of background pollutant concentration in the monitored area, a new database is created in order to enable the evaluation of the increment in pollutant concentration during the year. For this reason, 9 monitoring points were selected.

## 2. Materials and Methods

The ambient air $NO_2$ concentration in ground level was measured via the use of passive diffusive samplers, which were duplicated at each location in order to reduce the measurement bias. Measurements took place in 9 points as per the below location:

Picrraga (Popaji) **A**
Picrraga **B**
Picrraga (Broti) **C**
Kruja (Gjuraj) **D**
Kruja (Pengile) **E**
Kruja **F**
Borizana **G**
Borizana North **H**
Shperdhet **I**

### *2.1 Principle of the Samplers*

The cartridge (passive sampler cartridge) is made of micro porous polyethylene material, coated with triethanolamine (TEA). Nitrogen ($NO_2$) and sulfur ($SO_2$) dioxide are chemically adsorbed onto TEA as nitrite and sulphite or sulphate ions respectively. Nitrite is quantified by visible spectrophotometry while sulphite and sulphate can be analysed by ion chromatography ($NO_2$ and $SO_2$ can be analysed together by ion chromatography).

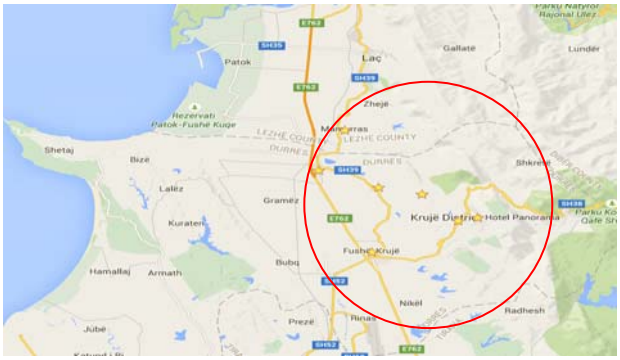


**Fig. 1 Map of the Location**

Sampling is selective for gaseous molecules: any airborne nitrite, sulphite or sulphate will not cross the diffusive membrane.

$NO_2$: The sampling rate value Q 298 at 298 K (25°C) and 1013 hPa is 0.141 ± 0.007 ng•ppb-1•min-1.

### *2.2 Sample Treatment*

Samplers exposed to ambient air were collected; its filters were taken out using clean forceps and then immersed into 5-ml water, placed in clean plastic vials. The vials were then closed and shacked vigorously using a vortex for 1 minute to extract the ions from the filters. The same is procedure was also applied for three unexposed cartridges, aiming to use them as blanks.

## 3. Colorimetric Determination of Nitrite Ion

Nitrogen dioxide was quantitatively converted to nitrite ion than determined by SF UV-VIS method, using the complex that nitrites form with sulphanilamide and NED (N-(1-naphthyl) ethylendiamine dihydrochloride). The complex has an optimum absorption at 537 nm. The calibration curve was prepared with standard solutions having concentration of from 0.1 to 20 mg•l-1, expressed as NO2-.

## 4. Results and Discussion

Concentration of $NO_2$ in ambient air of selected site was determined by using the linear regression method. Results are the average values of two repeated measurements and expressed in $g/m^3$. In Fig. 2, the

concentrations measured during the first period of monitoring are presented.

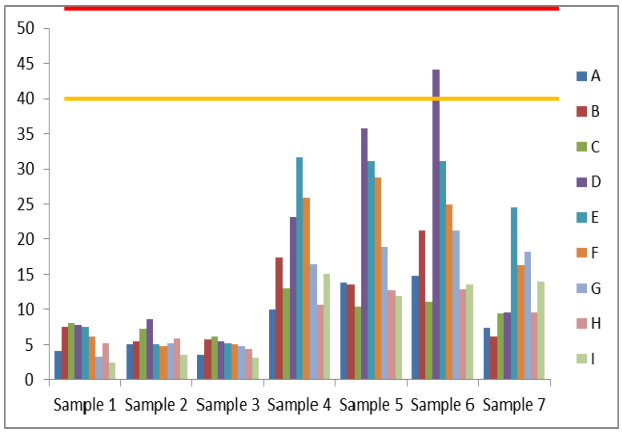


**Fig. 2 Results of NO2-Cntent in Ambient Air**

## 5. Discussion

Given the rural area in the region where the monitoring took place, the concentration of ground level nitrogen dioxide resulted to be very low. The highest concentration was identified in receptor E (Kruja, Pengile *) with a concentration in the monitoring period 48.6 μg/m$^3$. This value compared to Albanian Legislation on Ambient air quality fall within the limit although not within to the EU limit value, (Albanian limit for yearly $NO_2$ concentration is 60 μg/m$^3$ and EU limit value is 40 μg/m$^3$). Apparent variations of the $NO_2$ content in different monitoring periods were evident as the $NO_2$ formation in ambient air is highly dependent on daylight, atmospheric conditions as well as on the concentration of ground level ozone.

All the measured concentration (except of *), fall well within the Albanian limit value although a higher value compared to the EU limit value in the receptor D was registered. EU limit for ambient air $NO_2$ concentration is 40 μg/m$^3$ whilst the Albanian limit is 60 μg/m$^3$ [6-8].

As seen from the above graph, it was observed an increment tendency from spring to summer & autumn samples, and in the end of autumn beginning of winter the concentrations measured showed decreasing tendency, which was something that was expected because of the light depended reactions that Nitrogen oxides undertake.

## 6. Conclusions

The overall ambient air quality in the monitored locations showed to be good and to not exceed the ambient air limits, as regard to yearly concentrations. Although the last sets of measurements are not yet completed, there is no expectation that the same trends will not be observed again.

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