ESTIMATION OF CONCENTRATION OF OXIDES OF SULPHUR IN FUSHE-KRUJA AND KRUJA REGION, ALBANIA

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Abstract:
The occurrence and distribution of Sulphur dioxide in ambient air of the Fushe-Kruje and Kruja region were investigated by means of their content determination in passive samplers. The samplers were distributed and collected during different seasons of the year. Monitoring took place from January 2014 until December 2014. After the first 1 year data collection it was decided to extend the monitoring period by continuing from January until July 2015 as well. 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 sulphur in ambient air, and provides difficulties in connecting the oxides of sulphur 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, 9 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 sulphur dioxide resulted to be very low. The highest concentration was identified in receptor I (Shperdhet) with a concentration in the monitoring period 18.2 µg/m³. This value compared to Albanian Legislation on Ambient air quality as well as to the EU limit value, fall within the limit, (Albanian limit for yearly SO2 concentration is 60 µg/m³ and EU limit value is 40 µg/m³ ). Apparent variations of the SO2 content in different monitoring periods were evident.

Keywords: Sulphur Dioxide, passive samplers, Fushe-Kruje, Kruje Pengile.

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 sulphur dioxide, SO2, there were selected specific points. SO2 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 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

2.1. Sampling

The ambient air SO2 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

Figure 1: Map with the locations

2.2. Principle of the samplers

The cartridge (passive sampler cartridge) is made of micro porous polyethylene material, coated with triethanolamine (TEA). Nitrogen (NO2) and sulfur (SO2) 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 (NO2 and SO2 can be analysed together by ion chromatography). Sampling is selective for gaseous molecules: any airborne nitrite, sulphite or sulphate will not cross the diffusive membrane.

SO2: The sampling rate value \( Q_{298} \) at 298 K (25°C) and 1013 hPa is \( 0.466 \pm 0.022 \) ng•ppb\(-1•min\)-1.

2.3. 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 shaken 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.

2.4. 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) ethylenediamine 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-.

2.5. Determination of the sulphite and sulphate ions

Though SO2 is converted into sulphite and sulphate ions with variable ratios, the sum of the two ion equivalents is linear with exposure to SO2. To obtain calibration curves, prepare
solutions containing both ions at concentrations ranging from 5 to 50 mg·l⁻¹.

Ion chromatography analysis of the standard solutions and the extraction solutions from the cartridges was performed in the same way according to usual laboratory practice.

### 3. RESULTS AND DISCUSSION

Concentration of SO₂ 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 µg/m³. In the figure below, the concentrations measured during the first period of monitoring are presented.

3.1. Discussion

**Figure 2:** Results of SO₂- content in ambient air

Given the rural area in the region where the monitoring took place, the concentration of ground level sulphur dioxide resulted to be very low. The highest concentration was identified in receptor I (Shperdhet) with a concentration in the monitoring period 18.2 µg/m³. This value compared to Albanian Legislation on Ambient air quality as well as to the EU limit value, fall within the limit, (Albanian limit for yearly SO₂ concentration is 60 µg/m³ and EU limit value is 40 µg/m³ ). Apparent variations of the SO₂ content in different monitoring periods were evident.

All the measured concentration, fall well within the Albanian limit value and to the EU limit value. EU limit for ambient air NO₂ concentration is 40 µg/m³ whilst the Albanian limit is 60 µg/m³ [6, 7, 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.

### 3.2. 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.

### REFERENCES


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