THE MONITORING OF PM2.5 AND PM10 IN THE AIR IN DURRES, ALBANIA

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Abstract

Particulate matter such as PM10 and PM2.5 are defined as the fraction of particles with an aerodynamic diameter smaller than respectively 10 and 2.5 µm. PM originates from natural sources and anthropogenic emissions, with the latter being the focus of environmental protection since it can be controlled by emission reduction measures. Fine PM carries unexpectedly high numbers of microorganisms, some of which might be pathogens or opportunistic pathogens that cause respiratory diseases. In this study we have made the measurements in 12 areas of Durres, during February 2019-October 2019. In each area PM2.5 and PM10 values were measured at 10-14 different points. Regarding the EU standard for PM10 which is 0.03 mg / m3 and the Albanian standard which is 0.06 mg / m3., our study shows that in Durres, the average value of PM10 in the air is 0.035 mg / m3 which is within the Albanian standard, but a bit higher compared to the EU standard. Regarding the EU standard for PM2.5 which is 0.025 mg / m3 and the Albanian standard which is 0.06 mg / m3., our study shows that in Durres, the average value of PM10 in the air is 0.035 mg / m3 which is within the Albanian standard, but higher compared to the EU standard.

Keywords: *PM10, PM2.5, Air quality, Albanian standards, EU standards*

1. INTRODUCTION

The air can be polluted by very small particles. These particles have a divergent composition and size. They are often catalogued as 'floating dust', but are best known as particulate matter (PM). They are most often categorized based on their aerodynamic diameter. The aerodynamic diameter of a dust particle is the diameter of a sphere-shaped particle that shows the same behavior in the air as a dust particle. In the framework of air quality problems, particulate matter is the most important. Particulate matter such as PM10 and PM2.5 are defined as the fraction of particles with an aerodynamic diameter smaller than respectively 10 and 2.5 µm.[9] The aim of this study is to determine the amount of PM2.5 and PM10 particles as two important air pollutants. Air pollution directly affects the quality of life and public health in our cities. The issue of urban air quality, in particular particulate matter (PM) concentration is receiving more attention as an increasing share of the world's population lives in urban centers.[10] The traffic–generated emissions are accounting for more than 50% of the total PM emissions in the urban areas.[8] PM originates from natural sources and anthropogenic emissions[2], and the latter is the focus of environmental protection because it can be controlled by emission reduction measures. The anthropogenic emissions can be divided into stationary source and mobile source; besides, they are emitted directly in the atmosphere (primary particles) or transformed into secondary organic particles by gaseous pollutants such as SO_2 (sulfur dioxide) and NO_x (nitrogen oxides) [11] Fine PM carries unexpectedly high numbers of microorganisms, some of which might be pathogens or opportunistic pathogens that cause respiratory diseases. Using 16S rRNA sequence-based technology, Cao et al. reported that bacteria were the most abundant prokaryotic microorganisms in PM2.5 and PM10 pollutants sampled during severe smog episodes in Beijing, China in 2013. Up to 1315 bacterial and archaeal species were identified. Over 85% of the bacteria carried by PM2.5 and PM10 possibly originated from fecal and terrestrial sources, and the remaining 15% of bacteria came from freshwater and marine sources. Pathogens and opportunistic pathogens were also detected, such as *Streptococcus pneumoniae* and *Aspergillus fumigates* [3]. In the present study, we report that people could inhale the

bacteria or pathogens carried by PM2.5 or PM10 through the respiratory route, as evidenced by the increased diversity of microbiota in pharyngeal swabs, which may lead to an increase in respiratory diseases [7]

2. MATERIALS AND METHODS

The monitoring of PM2.5 and PM 10 has been done between February 2019 - October 2019. The monitoring has been done in 12 areas of Durres, which include important areas such as: near the Town Hall, the main promenade, the area near the Train Station, the area near the Martyrs Museum, the area near the City Post etc. The areas selected are the ones with the heaviest traffic, among the most frequented and central areas of Durres City. In each area these two particles were measured at 10-14 different points.



Fig. 1. The monitoring map

A1	A part of the area near the City Hall and the Central Polyclinic
A2	A part of the area near the Port, the Music School, a part of the area near the City Hall
A3	A part of the area near the Train Station, a part of the area near the Port and a part of the area near Blue Star shopping center
A4	A part of the area near the Train Station, the intersection near the Post Office
A5	The area near the Martyrs Museum
A6	A part of the area near the Train Station, part of the area near the Port
A8	The area near the City Post Office

A10	A the main part of the Central Boulevard
A11	The area near the Court
A12	A part of the Central Boulevard area, part of the area near the Blue Star shopping center
A15	The area near the Mosque, the Amphitheater area
A17	The area near Venetian Tower

Table 1. The monitoring areas

In table 1 are presented the monitoring areas and their location. The sampling duration was up to 2 weeks. This time is thought to be enough to introduce the trend. Regarding the technique used for sampling, the sampling points were taken at an altitude between 1.5 meters and 4 meters above the ground. The equipment in traffic areas was taken about 25 meters from the major intersections and no more than 10 m from the sidewalk. The sampling stations are selected in order to avoid measuring very small micro-surfaces near them, i.e. in a road segment not less than 100 m long with a considerable amount of car traffic and with an area at least 250 m × 250 m in the industrial areas. The urban areas are selected so that the level of pollution is affected by the integrated contribution of all sources that are in opposite direction to the wind relative to the station. In the areas where no concentration was known, an additional sampling point was set according to the main wind direction. A sensor-based device called "aeroqual" was used to measure these two particles. This device can collect real-time information about the surrounding air. It is a flexible air quality monitoring solution that can be configured with 27 different gas sensors and particle sensors for a variety of uses in environmental monitoring. The monitoring was performed during periods of dry climate with wind speed of less than 5 m/s. The instrument at each measurement is properly calibrated, both before and after measuring the level of air pollution. The monitoring was carried out in the period of time 06.00-22.00 during the day and 22.00-06.00 during the night, for 5 to 7 hours.

3. RESULTS

The obtained results from the analysis of PM10 and PM2.5 particles in the main areas of Durres, were compared with both Albanian and EU standards. The unit used for PM10 and PM2.5 values is mg/m3. In Fig. 2 are presented the minimum and maximum of PM2.5 values of each area and the average of PM2.5 in each area.

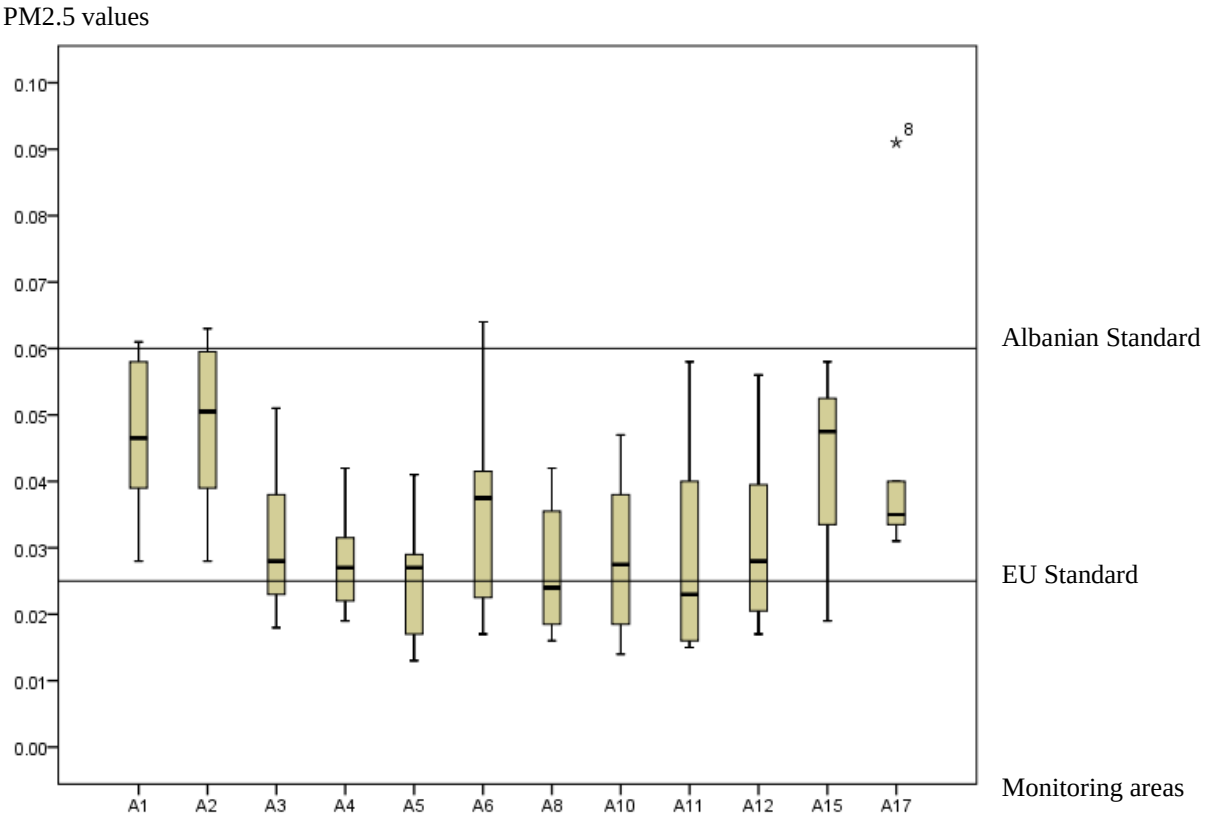

Fig. 2. PM2.5 values in each area (mg/m3)

The standard of PM2.5 in the EU is 0.025 mg / m3, while in Albania it is 0.06 mg / m3. The chart 3.1 shows that only 3 out of the 12 areas we have studied, respectively A1, A2 and A6, have points where PM2.5 values are higher than the Albanian standards. But, if we refer the average values of PM2.5 measured in each area, it has resulted that in all areas taken in the study the average of PM2.5 values taken were within the Albanian standards, but 10 out of the 12 areas, respectively A1, A2, A3, A4, A5, A6, A10, A12, A15, A15 and A17, it resulted that PM2.5 values in the air is above the EU standards

In Fig. 3. are presented the minimum and maximum of PM2.5 values in Durres and the average of PM2.5 in Durres. The study shows that in Durres the values of PM2.5 in the air is at an average value within the Albanian standard, which is 0.06 mg / m3, but higher in comparison to the EU standard, which is 0.025 mg / m3.

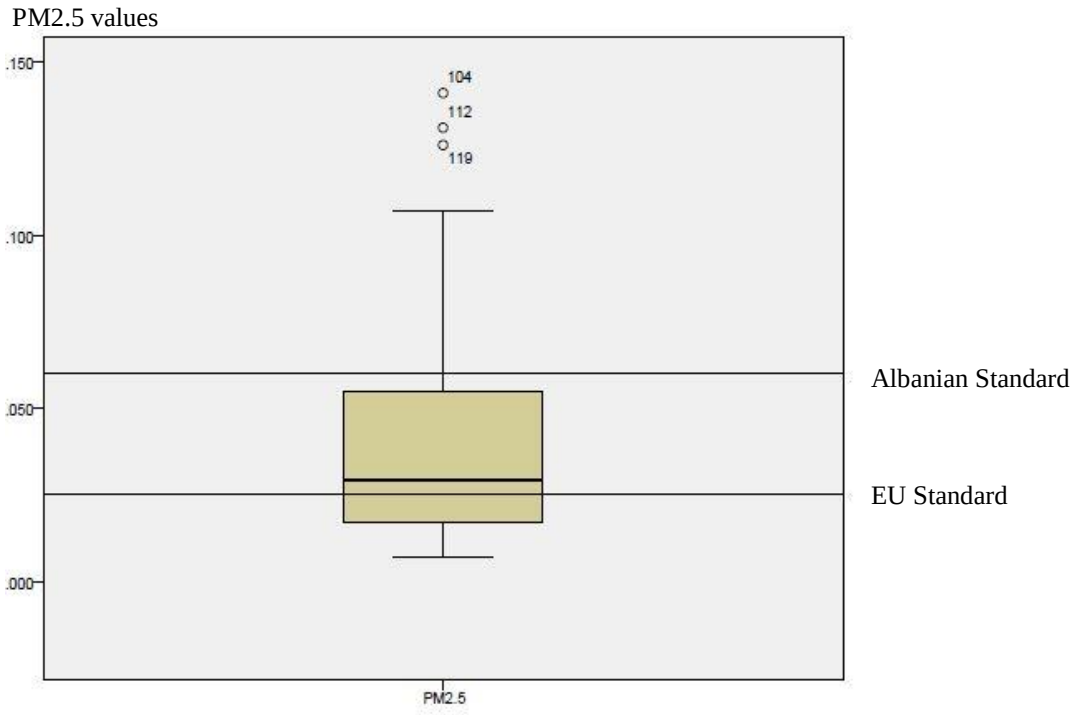

Fig. 3. The presentation of all the group areas for PM2.5(mg/m3)

In Fig. 4. are presented the minimum and maximum of PM10 values of each area and the average of PM10 in each area.

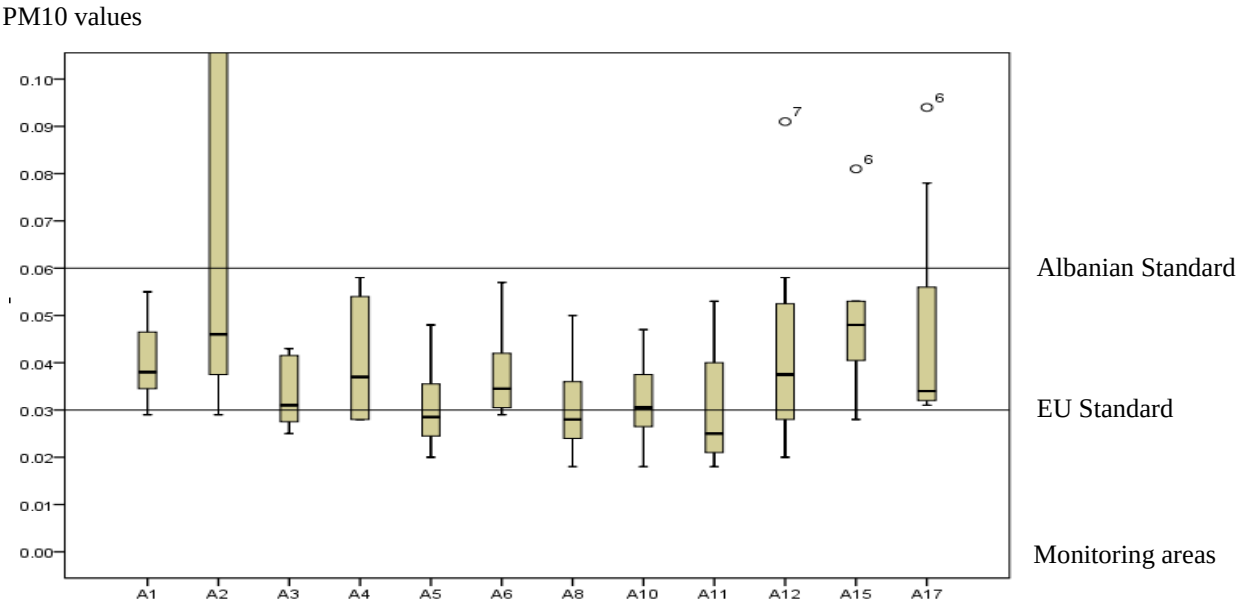

Fig. 4. PM10 values in each area (mg/m3)

The EU standard for PM10 is 0.03 mg / m3, while the Albanian standard is 0.06 mg / m3. From the data of the Chart 3.3 we see that only in 2 of all the 12 areas taken in the study there are points where PM10 values in the air has resulted higher than the Albanian standard. These areas are A2 and A17. If we refer to the average values of PM10 measured in each area, it results that in all areas studied the

value of PM10 in the air is within the Albanian standard. While if we refer to the EU standard of PM10, is seen that in 4 of all the 12 areas taken in the study, this value is as much as this standard or below it. Respectively these areas are A5, A8, A10 and A11.

In Fig. 5. are presented the minimum and maximum of PM10 values in Durres and the average of PM2.5 in Durres.

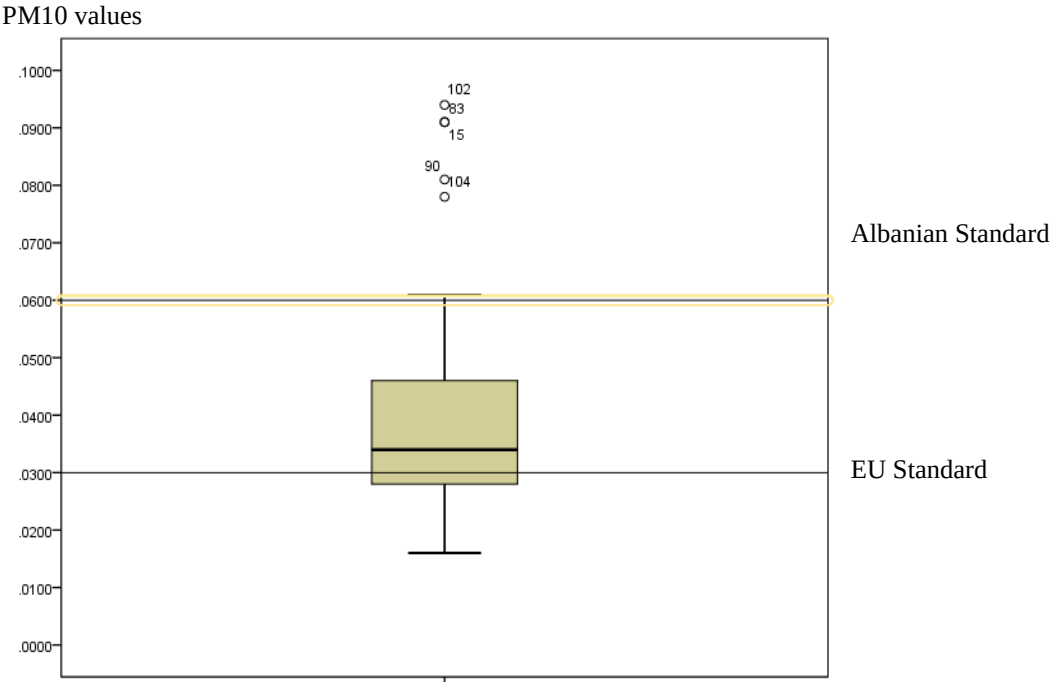

Fig. 5. The presentation of all the group areas for PM10 (mg/m3)

From the processing of all values obtained from all areas taken in the study, it results that in Durres PM10 value is on average within the Albanian standard, which is 0.06 mg / m3, but higher compared to the EU standard, which is 0.03 mg / m3.

Note: out-of-graph values represent PM2.5 and PM10 values which have resulted in very high, unlike all the measurements performed. Therefore, we think they are not real values, reliable, but artificially increased by factors such as: works in the area near the measurements, a car that may have passed quickly or that may have emitted polluting gas into the air.

4. DISCUSSION

The trend of particulate matters in the air in Durres is presented in table 2.

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2017	2019
PM10	0.124	0.109	0.095	0.091	0.093	0.1	0.057	0.121	0.091	0.104	0.025	0.033

Table 2. The trend of PM10 values in Durres during years

The values measured during years show that in 2002 and 2009 the air in Durres was more polluted by dust particles than in other years. 2017 and 2019 are the years when the air is cleaner from dust particles.[1,5,6] The Air purification from the dust particles may have come as a result of several legal

initiatives taken during 2014-2015. They relate to ambient air quality and tax system for combustibles. DCM no. 594, dated 10.09.2014, approved the National Strategy for Environmental Quality and Law no. 162/2014, dated 04.12.2014 "On the protection of the quality of the environment". This law constitutes the framework for the protection of quality and is based on Directive 2008/50 / EC and 2004/107 / EC. The law was effective in December 2017. DCM no. 352/2015 "On the assessment of the quality of the environment and the requirements for some pollutants in relation to it", was approved on 29.04.2015.[4] However, the data we have obtained shows that there is still needed an improvement, because the values of PM10 and PM2.5 are both higher than EU standards.

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