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Air Pollution by Fraction Particulate Matters PM10, PM2.5 in the Site of Algiers Centers

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This article concerns the quality of the air in the urban site of Algiers centre. A sampler with low air flow was used for the collection of the samples on the level of this site characterized by the presence of a strong density of circulation of cars. The mass of the ambient particles is a complex mixture which strongly depends on the characteristics of the sources and their sizes according to whether they are "fine" particles or "large" particles. The sampling procedures of the suspended particles in the air multiple and are varied among them, the PM10 and PM2.5 which are taken using a sampler of the type Gent sampler. The analysis of the collected filters was carried out by X-ray fluorescence spectrometry. Heavy metals were proportioned by this technique showing in obviousness the existence of air pollution due mainly to the human activity.

Key Words: Particulate matters (PM10, PM2.5), Gent sampler, Heavy metals, Spectrometry by x-ray fluorescence.

INTRODUCTION

Pollution constitutes by its three components, watery, terrestrial and atmospheric, a major problem of public health throughout the world. The study of the air pollution is a recent concept, appeared with the industrial development. This subject still is poorly studied in Algeria and in particular in Algiers. This city, become a megalopolis knows a growth on touts the plans, population, dwellings, road traffic, industries. All these activities occur in a restricted surface which one does not have data to evaluate the consequences on the quality of the air. In this work, one proposes to study the air pollution by the particulate aerosols in mode in occurrence the PM10 and the PM2.5[1,2], with in more the determination of the heavy metals contained in the taken aerosols[3].

EXPERIMENTAL

Area of sampling: This sampling area is an urban centre known for the density of traffic daily. Fig. 1 represents the area.

Sampler: The sampler system designed for the IAEA under the research contract with the Institute of Nuclear Sciences, University of Gent, Belgium[4,5]. The air sampler of Gent Sampler compartment: module removal, control module, sampling PM10 and PM2.5 simultaneously. The device illustrated in Fig. 2.

Fig. 1. Nuclear research centre of Algiers (CRNA) with the location of the Gent sampler

Analyses: Analysis of samples were performed with X-ray fluorescence technique[6]. The concentration of each element is given by the following expression:

$$C_x = \frac{(I_{ech} - I_{bech}) \times m_{st}}{(I_{st} - I_{bst}) \times V}$$

C_x = concentration of element in the sample (μg/m^3), I_{ech} = intensity of element, I_{bst} = intensity of element in the standard white, I_{bech} = intensity of element in the sample, I_{st} = intensity of element in the standard, m_{st} = the mass of element i in the standard (μg), V = volume of air drawn for each sample (m^3) for the duration of the sampling.

Fig. 2. Gent sampler

RESULTS AND DISCUSSION

Fig. 3 shows the content of PM10 is always greater than that of PM2.5. This high concentration of PM10 (PM10 > PM2.5) does not automatically high in PM2.5. This is explained by the fact that a significant portion of PM10 is made up of coarse particles that come from another source and which therefore has no connection with the road traffic emissions.

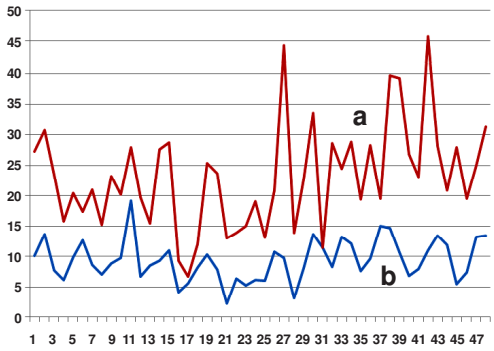

Fig. 3. Changing levels of (a) PM10 and (b) PM2.5 measured in Algiers center

Figs. 4 and 5 show that the levels of PM2.5 and PM10 do not exceed guideline values[7] "PM2.5 < 25 µg/m^3 and PM10 < 50 µg/m^3.

The concentration of PM2.5 ranges from 2.23-19.14 µg/m^3 with an average of 9.3714 µg/m^3. PM10 is a minimum value of 6.74 µg/m^3 and a maximum value of 45.77 µg/m^3 with an average of 23.08 µg/m^3.

Fig. 6 shows that the lead content varies from 1.12 ng/m^3 A124, 21 ng/m^3 in PM2.5 are below the WHO standard (500 ng/m^3) and the same case in Fig. 7 it varies between 6.19 and 143.95 ng/m^3 ng/m^3 in PM10. This suggests that there is no air pollution by lead at our study site (CRNA).

According to these results it is noted that the levels of cadmium in some samples exceed the standard of the future European directive (5 ng/m^3). So we recorded a high air pollution by cadmium with null values or not detected in some other samples (Figs. 8 and 9).

Figs. 10 and 11 show that compared with the standard of the future European directive (10 ng/m^3), a large portion of

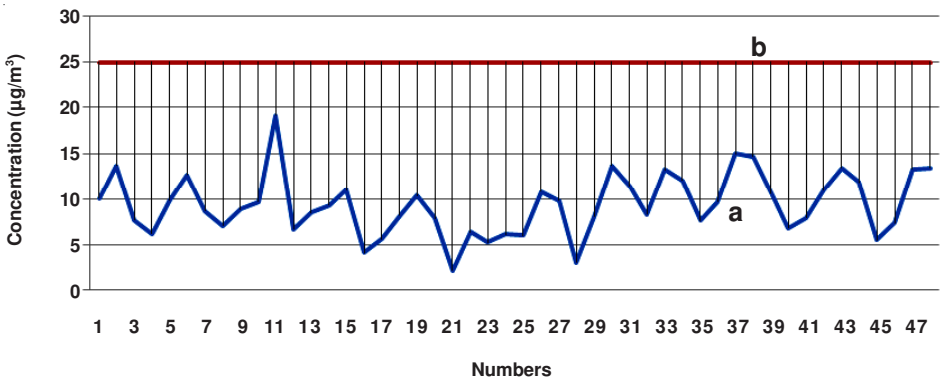

Fig. 4. Comparison of the concentration of (a) PM2.5 and (b) value guide

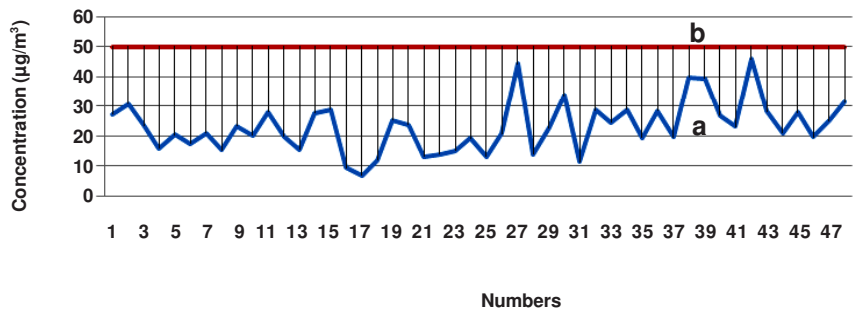

Fig. 5. Comparison of the concentration of (a) PM10 and (b) value guide

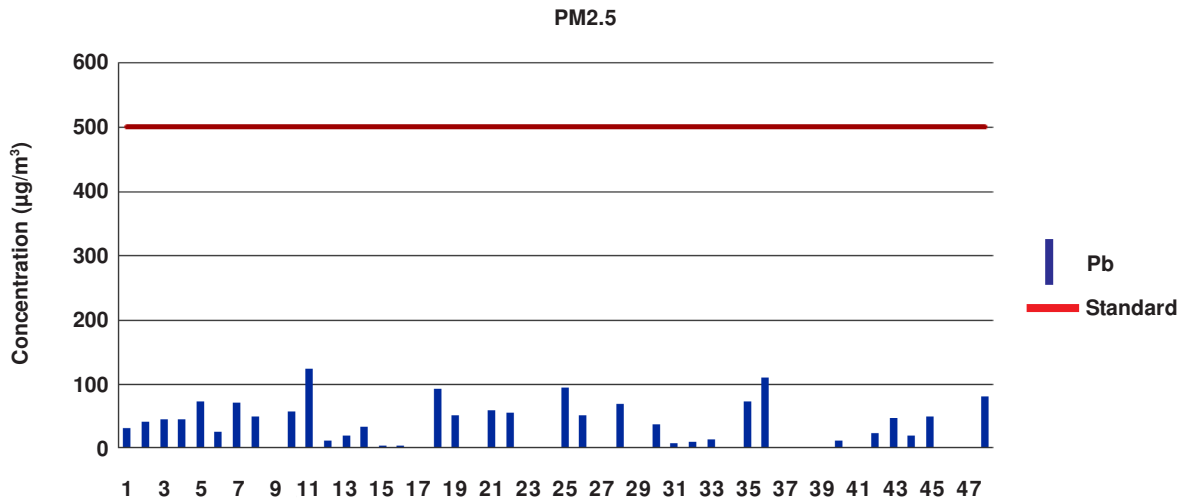

Fig. 6. Vriation of the concentration of lead in PM2.5 in the number of sampling and comparison with its standard

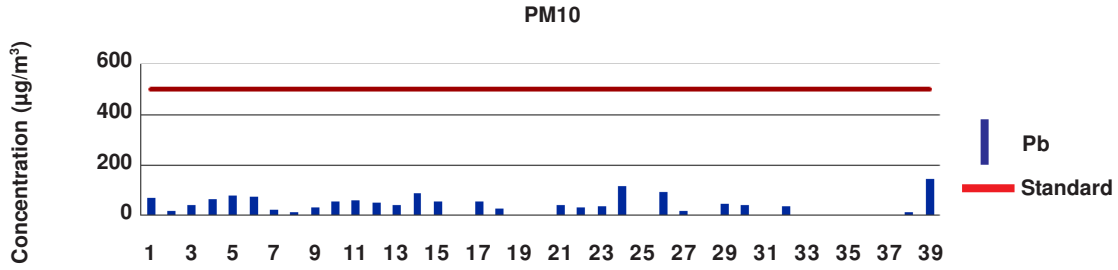

Fig. 7. Variation of the concentration of lead in PM10 in the number of sampling and comparison with its standard

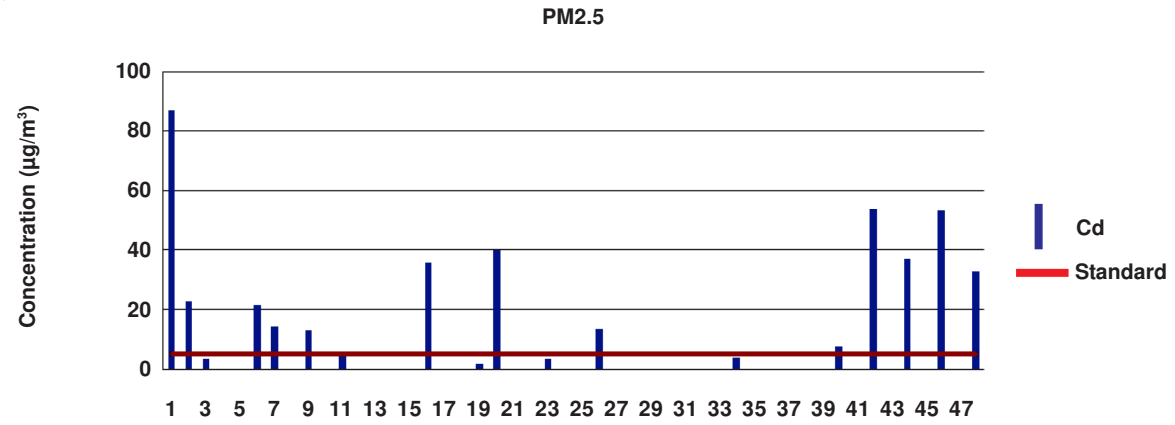

Fig. 8. Variation of the concentration of cadmium in PM2.5 in the number of sampling and compared with its standard

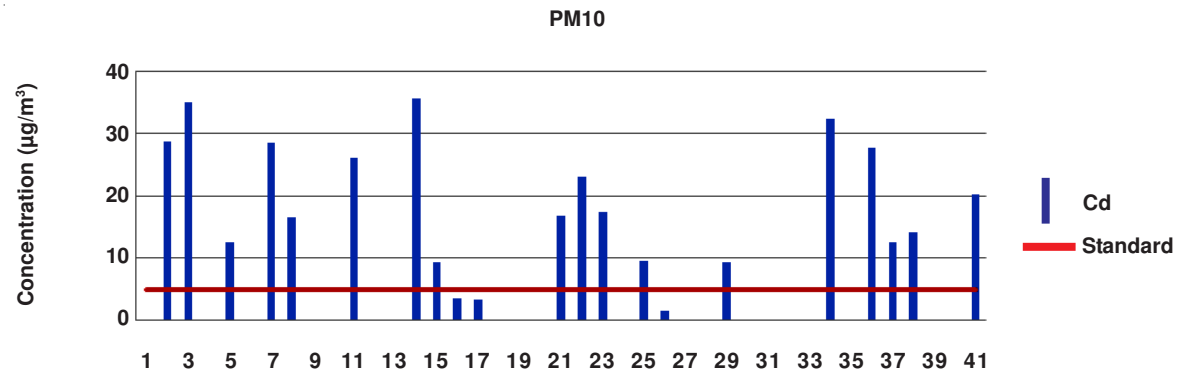

Fig. 9. Variation of the concentration of cadmium in PM10 in the number of sampling and compared with its standard

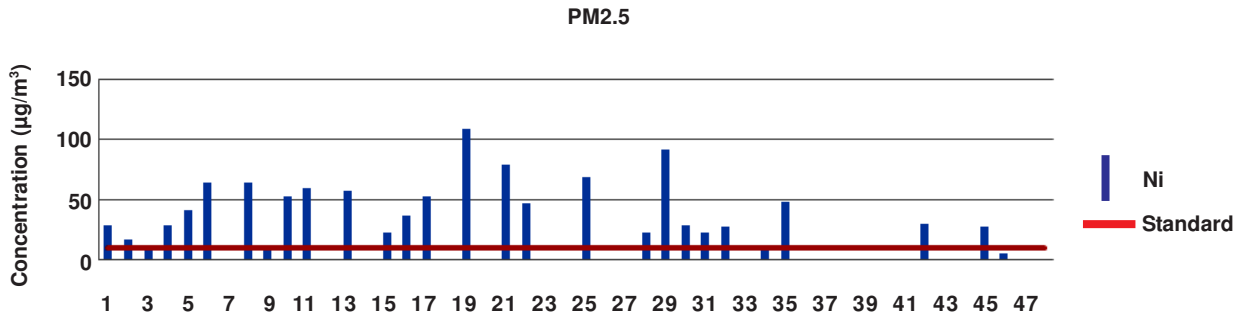

Fig. 10. Variation of the concentration of nickel in PM2.5 in the number of sampling and compared with its standard

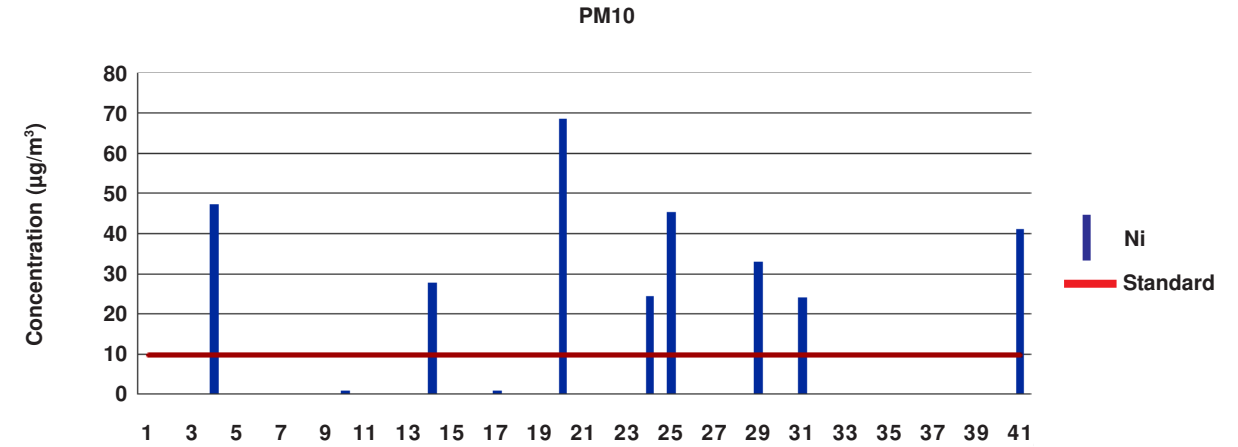

Fig. 11. Variation of the concentration of nickel in PM10 in the number of sampling and compared with its standard

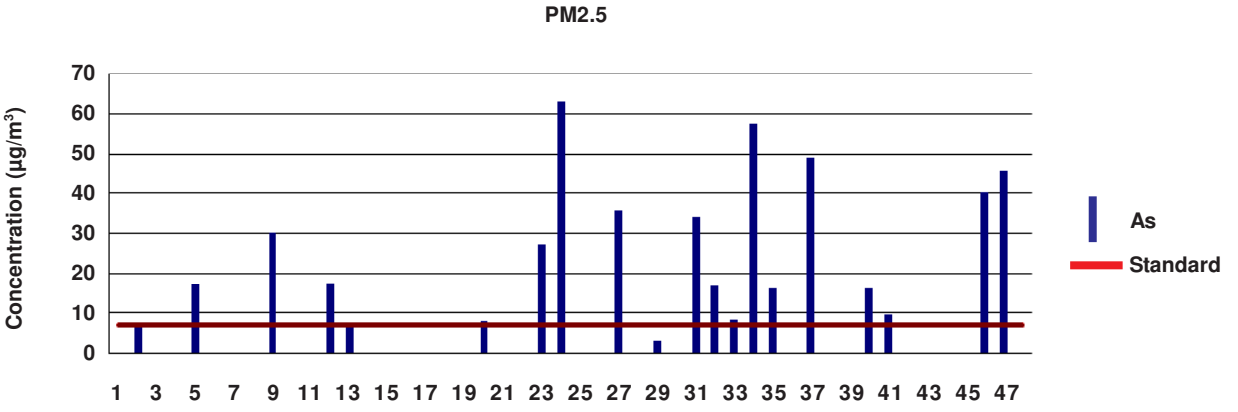

Fig. 12. Variation of the concentration of arsenic in PM2.5 in the number of sampling and compared with its standard

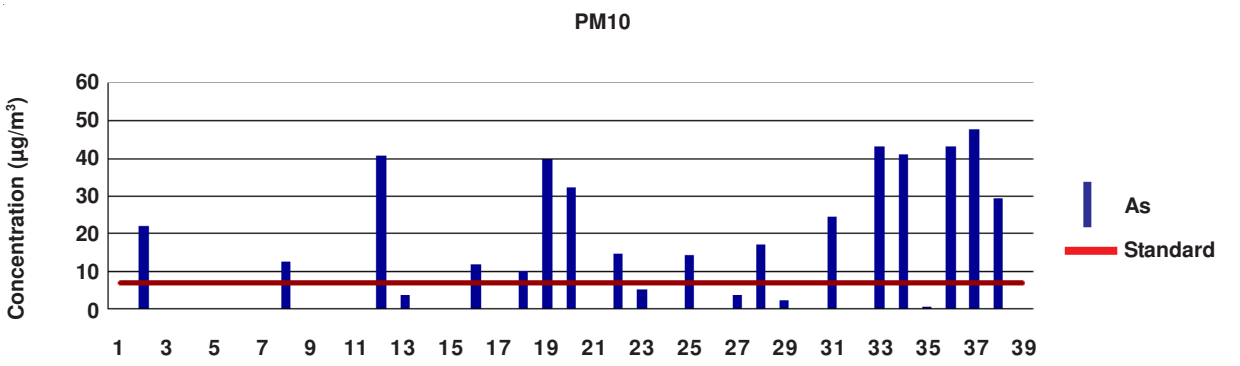

Fig. 13. Variation of the concentration of arsenic in PM10 in the number of sampling and compared with its standard

samples exhibit a concentric nickel value very high and nickel is much more in the PM2.5 as PM10.

From the Figs. 12 and 13, arsenic is very high concentrations "> 7 ng/m^3 standard of the future European directive" in the two size fractions of PM10 and PM2.5.

Conclusion

This study assessed in Algiers pollution levels affected by particulate matter. The experimental results show that atmospheric levels of PM10 and PM2.5 of our urban site selected (the Nuclear Research Centre of Algiers "CRNA"), have an average of 9.37 and 23.08 μg/m^3, respectively. Then there are values that do not exceed the WHO standards and the EU Directive 2008/50/EC. The particles in question are mainly derived from road trafficPar addition, the study has shown that the level of PM10 is always higher than that of PM2.5. Indeed, the pace of PM10 and PM2.5 follow a similar evolution almost. This similarity in trends suggests that the atmospheric particles are largely the same origin. This high concentration of PM10 does not automatically high in PM2.5. This is explained by the fact that a significant portion of PM10 is made up of coarse particles that come from another source and which therefore has no connection with the road traffic emissions. Histograms of concentration variation drawn from the results obtained and a comparison with standards of European Directive 2008/50/EC clearly show that there is pollution by cadmium, nickel and arsenic.

So these results show a certain level of pollution by heavy metals. However, it remains to intensify sampling with this device Gent sampler on multiple sites to better refine the results for details and use other analytical techniques.

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