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Control of Air quality in Oran City, ALGERIA

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ABSTRACT/RESUME

Abstract: *Air pollution is a problem which takes more and more importance in many cities in the world.*
Air pollution impacts human health, it contains pollutants like tiny airborne particles, which can be a trigger for a respiratory disease like asthma for example. According to world health organization nine out of ten people now breathe polluted air.
Several factors influence this phenomenon, the most important of which are: weather conditions, and urban activities, especially cars traffic.
The main Experimental objective of this study is the effect of pollutants NOx and CO on the air quality in the city of Oran resulting from emissions, issues of cars and from certain factories.
Also this study joins mainly in an approach of apprehension of the air quality, by determining the rate of pollution caused by the traffic in various points of the city of Oran. The data on the atmospheric pollution often require a meteorological interpretation.
Two meteorological parameters are of a first importance in the control of the level of pollution in the city.

I. Introduction

The atmospheric pollution stands out as a subject today, which worries more and more the citizens, the researchers and the government's policies, ministry of health.
This current pollution has negative effects on the environment and witch established of earth, water, plants and air which are important for our good and for a natural balance.
During the last years, the evaluation of the atmospheric pollution and exactly the domain of the pollution by dusts is considered as a real revolution having a direct impact on the human beings. It has been a long time since the presence in the atmosphere of smokes, ashes, mono carbon is recognized expensive and dangerous for health [1, 2, 3].
The relative danger presented by various gaseous pollutants and particulars for the health, varies with the concentration of these pollutants in the time and in the space, and so the effects of these pollutants on the health are varying from a country to another one. There are the continuous, well-kept and attentive surveillance of the concentrations of polluting gases as well as the distribution size grading of particles, their concentration and their composition are necessary before an acceptable estimation. The situation is even more complicated because certain combinations of pollutants have cumulative effects and sometimes synergetic [4, 5].
In this work, we are discussing mainly about automobile pollution of the city of Oran. The data are recently made in January and February, August and September 2016. We are showing, through graphs, the results of these sample taken on specify and chosen sites around and in the city of Oran [6, 7].

Objectives of the study:

The atmospheric pollution of automobile origin establishes in Oran a subject of concern which mobilizes the public opinion, in particular during every episode of strong pollution. One of the important question asked by the population is the impact of that pollution on the health of Oranian, in particular those who seem the most exposed [8, 9, 10].

This study has for objective the impact estimation witch is the asthmatic, children and elderly peoples of the pollution of automobiles on the population.

The following studies are based on individual measures of on the car exhoste mainly carbon monoxide and the nitrogen dioxide.

Definition of the air pollution:

The air pollution was the object of definition and different points of view, Certain countries and organizations defined it as the presence in the air of the contaminants which exercise effects on the human health from a defined concentration, others consider that the pollution is a change of the natural environment and which can have grave consequences leading to the disappearance of living species. Whatever the raison, the man is the first one responsible for this devastating phenomenon [11, 12].

The main air pollution:

Air pollution refers to a variety of pollutants including carbon monoxide (CO), nitrogen dioxide (NO2) [13].

The main of air pollution can be natural sources, the fires of forests, sources due to the industrial activities, the automobile sources (CO, NOx), The fixed installations of combustions the homes of combustions of the industry, The industrial installations (the industries of the nitrogenous by-products, and the cement works [14, 15].

Determination of the norms of the quality of air:

Numerous countries established quality norms of air regarding dangerous substances. These norms fix the levels of concentration considered allowable to guarantee the protection of the public health [16].

The norms of the quality of air are developed by taking into consideration different mailmen: scientists result of laboratory studies at the animals and at volunteers and of epidemiological studies, experts' judgements, and a mailman of margin of safety. (Padget, 1983) [4].

The table 1 gives the limit thresholds for the protection of human health.

Table 1. *Reference values for the protection of human health (WHO source)*

Pollutant	average hourly	Annual average
nitrogen dioxide (NOx)	200 µg/m³	40 µg/m³
carbon monoxide (CO)	10 mg/m³	/

II. Materials and methods:

II.1. Protocol of measure

II.1.1. The implement and the sites of measure

An assessment of air pollution in different districts of the city at different hours is evaluated giving an overview of the air quality.

The measures have been taken using a portable device, close to car traffic on a high 1 meter, the duration of each measurement is three minutes and the result is an average of three tries.

The measurements of two pollutants, the carbon monoxide (CO) and oxides nitrogen (NOx), were taken between 11h00-13h00 and 16h00-18h00, units being expressed ppm there (parties of million). Nine sites kept for the campaigns of measurements are reposted in the geographical card. The choice of the study area for the nine sites was determined on operational arguments as residential areas with very high traffic like downtown, traffic in roundabouts, bus stop, commercial location, ect….

II.1.2. Choice of the sites the measures of pollution:

Table 2. *Coordinated geographical of the sites of measurements*

Sites	Location	Degree of longitude (North, West)
Site 1	Rond-point USTO	35°42'49.19"N 0°34'41.05"O
Site 2	Akid Lotfi	35°43'12.42"N 0°35'39.37"O
Site 3	Rond-point Hamri	35°41'3.96"N 0°36'37.21"O
Site 4	Gambetta	35° 42.456 N 0° 37.290 O
Site 5	M'dina Djadida	35°41'37.11"N 0°38'42.68"O
Site 6	El-Charfaoui	35°40'45.01"N 0°38'34.27"O
Site 7	Place Victoire	35° 42.175 N 0° 38.233 O

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Figure 1. *The cartographic of sites measurements*

III. Results and discussions:

III.1 Seasonal obtained results:

Results obtained in January 2016:

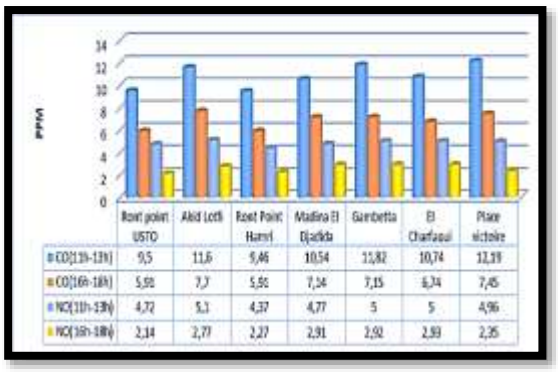

Figure 2. *Levels of the average concentrations of the time slots 11h-13h and 16h-18 in the ambient air in CO and NOx in January 2016 in Oran*

Results obtained in February 2016:

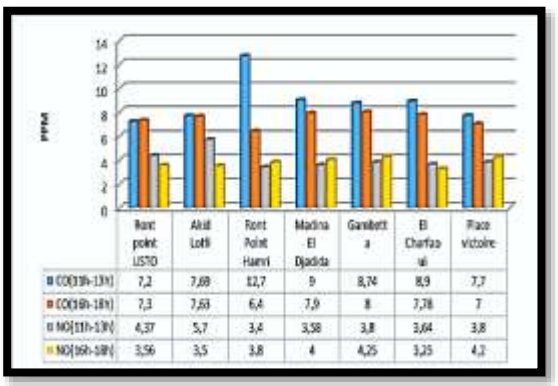

Figure 3. *Levels of the average concentrations of the time slots 11h-13h and 16h-18 in the ambient air in CO and NOx in February 2016 in Oran*

Results obtained in August 2016:

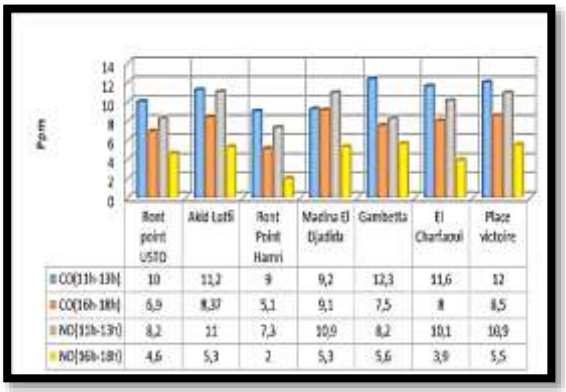

Figure 4. *Levels of the average concentrations of the time slots 11h-13h and 16h-18 in the ambient air in CO and NOx in August 2016 in Oran*

Results obtained in September 2016:

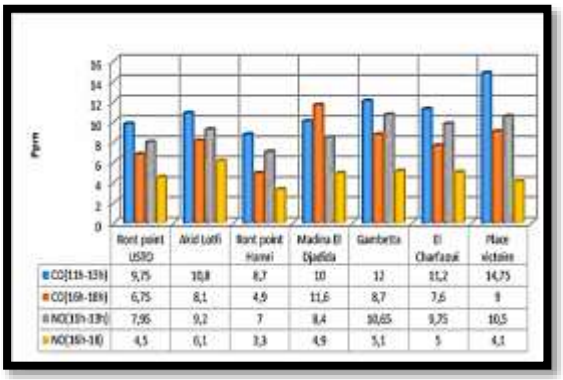

Figure 5. *Levels of the average concentrations of the time slots 11h-13h and 16h-18 in the ambient air in CO and NOx in September 2016 in Oran*

The assessment shows that the values of CO and NOx are different depending on the rushing hours, which is normal.
Moreover, the values in August and September are higher because of increase of the traffic causing by the tourists in the summer.
From it, we can say that the value of CO and NOx varies according to the season and rush hours.

Table 3. *Summary of the most polluted sites*

	Carbon monoxide (Ppm)		Oxides of nitrogen (Ppm)	
	11h-13h	16h-18h	11h-13h	16h-18h
January, 2016	Place victoire 12.19	Akid Lotfi 7.7	Akid Lotfi 5.1	El-Charfaoui 2.93
February 2016	Rond-point hamri 12.07	Gambetta 8	Akid Lotfi 5.70	Gambetta 4.25
August 2016	Gambetta 12.3	Mdina Djadida 9.1	Akid Lotfi 10.56	Gambetta 4.2
September 2016	Place victoire 14.75	Mdina Djadida 11.66	Gambetta 6.7	Akid Lotfi 6.1

III.2 Relation pollutants – speed of wind:

Polluting CO, NOx and the wind in January:

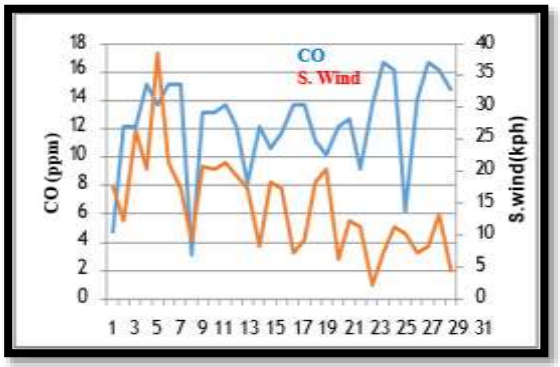

Figure 6.*Evolution of the wind and CO (11h-13h) on Place victory for January 2016*

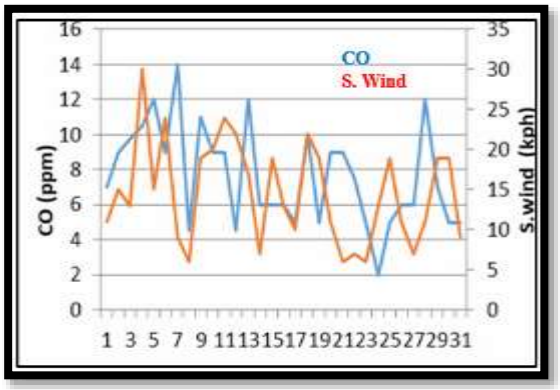

Figure 7.*Evolution of the wind and CO (16h-18h) on Akid lotfi for January 2016*

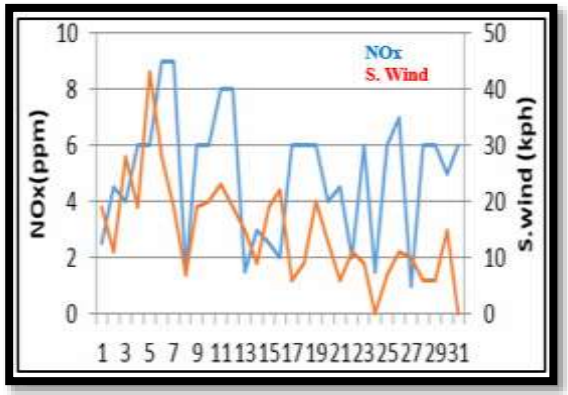

Figure 8. *Evolution of the wind and NOx (11h-13h) on Akid lotfi for January 2016*

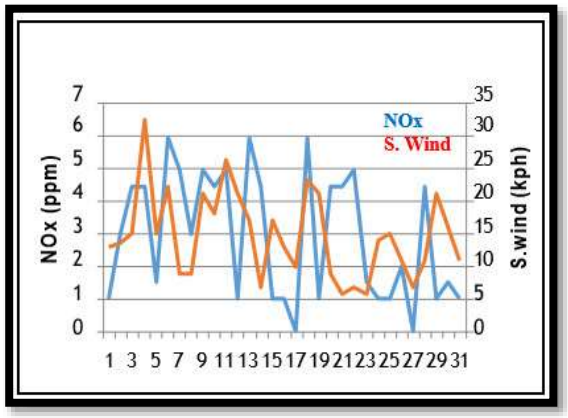

Figure 9. *Evolution of the wind and NOx (16h-18h) on El Charfaoui for January 2016*

Table 4*. Coefficients of correlation between CO and the NOx for both time slots (11h-13h, 16h-18h) in deferential sites pollute in January 2016.*

COEFFICIENT OF CORRELATION	11h-13h	16h-18h
CO(ppm)	0,015	0,189
NOX(ppm)	0,254	0,191

the largeness of relation between the speed of the wind and rates of both pollutants for the 04 site is not visible with coefficients in the order of 0.25 between the pollutant and the speed of the wind during the period (11h-13h), and the weak coefficients during the period (16h-17h).
Considering no linearity of relation between the speed of the wind and the content of the atmosphere of pollutants, they can say that the coefficients of correlation cannot give convincing explanation. They note that the positive sign of the coefficients of correlation leads us to say that the phenomenon of dispersion did not take place in this month.

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Polluting CO, NOx and the wind in February:

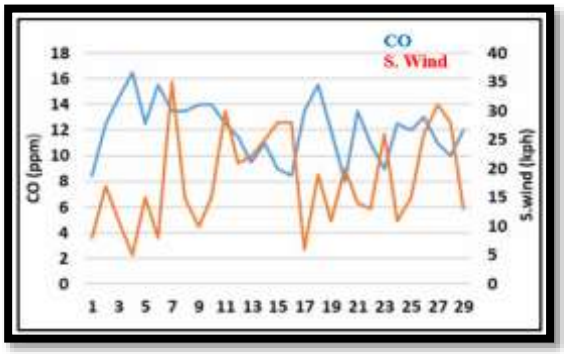

Figure 10.*Evolution of the wind and CO (11h-13h) on crossroad Hamri for February 2016*

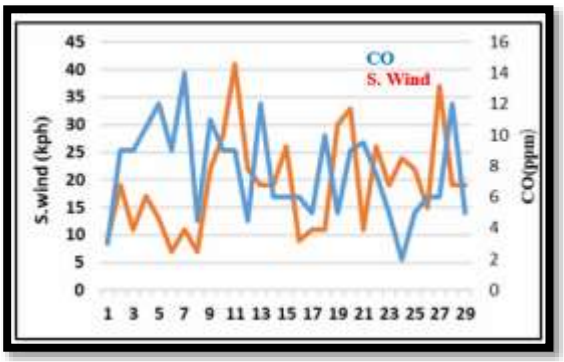

Figure 11. *Evolution of the wind and CO (16h-18h) in Gambetta for February 2016*

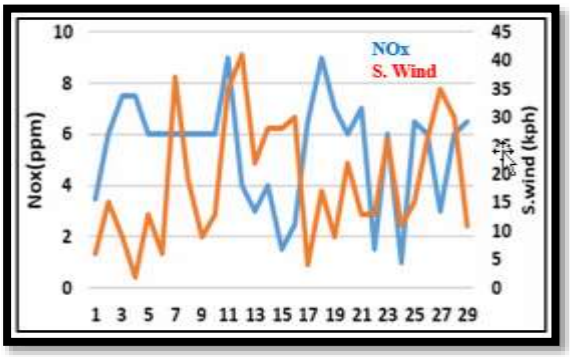

Figure 12. *Evolution of the wind and NOx (11h-13h) in Akid lotfi for February 2016*

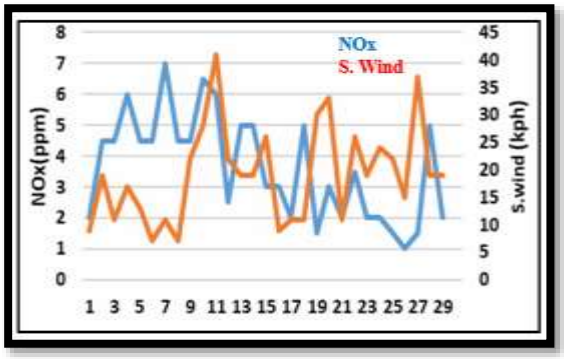

Figure 13.*Evolution of the wind and NOx (16h-18h) in Gambetta for February 2016*

Table 5. *Coefficients of correlation between CO and the NOx for both time slots (11h-13h, 16h-18h) in deferential sites pollute in February 2016.*

COEFFICIENT OF CORRELATION	11h-13h	16h-18h
CO(ppm)	-0.433	-0.08
NOX(ppm)	-0.202	-0.07

These two sites located Akid Lotfi and Gambetta in the heart of the city are closed sites and little exposure to the wind. To this, we add low values of monthly averages of wind speed for the period from 16h-18h, which induce conditions unfavorable to a good dispersion of pollutants.

When the sign of the coefficients would be negative. We notice the profiles of the wind and some pollutants vary in opposite direction. The wind speed favorable to the dispersal has to be at least 25 kph.

We notice that the positive sign of the coefficients of correlation leads us to say that the phenomenon of the dispersal did not take place in this month.

Polluting CO, NOx and the wind in August:

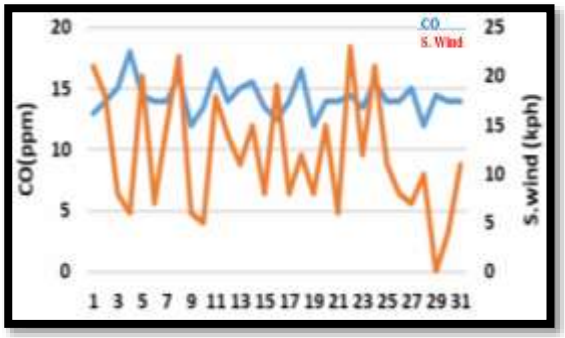

Figure 14.*Evolution of the wind and CO (11h-13h) in Gambetta for August 2016*

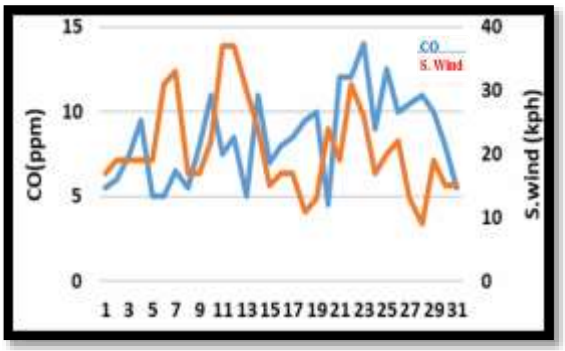

Figure 15.*Evolution of the wind and CO (16h-18h) in Mdina Djadida for August 2016*

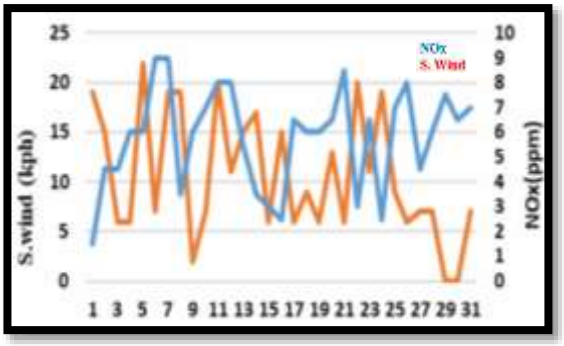

Figure 16.*Evolution of the wind and NOx (11h-13h) in Akid Lotfi for August 2016*

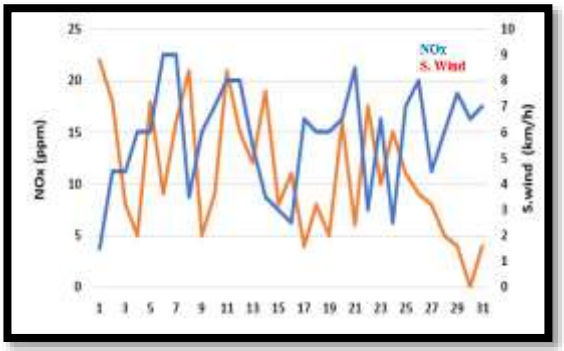

Figure 17.*Evolution of the wind and NOx (16h-18h) in Gambetta for August 2016*

***Table* 6.** *Coefficients of correlation between CO and the NOx for both time slots (11h-13h, 16h-18h) in deferential sites pollute in August 2016.*

COEFFICIENT OF CORRELATION	11h-13h	16h-18h
CO(ppm)	0.243	-0.104
NOX(ppm)	-0.381	0.275

Sequences of days with no value for the NOx were registered for all the sites during August 2016.

The coefficients of correlation any negatives prove that both series, wind speed and both pollutants, evolve opposite direction there.

We do not observe significant values to confirm the relation between the wind speed and the content in pollutants.

Polluting CO, NOx and the wind in September:

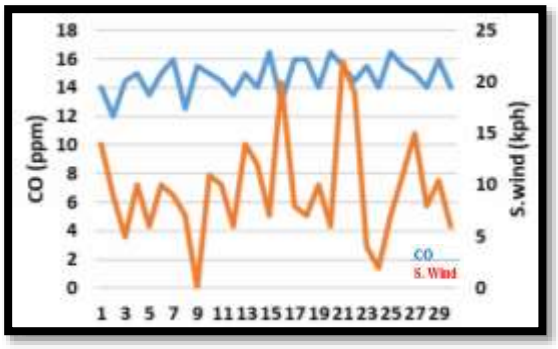

Figure 18.*Evolution of the wind and CO (11h-13h) in Place victory for September 2016*

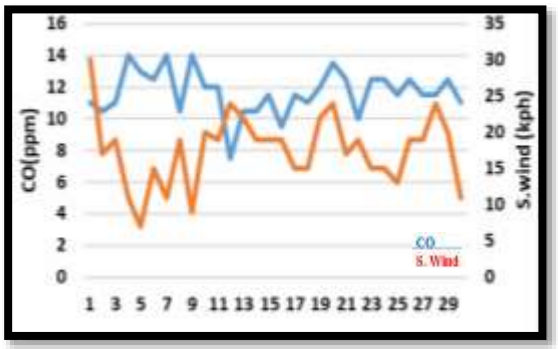

Figure 19*.Evolution of the wind and CO (16h-18h) in Mdina Djadida for September 2016*

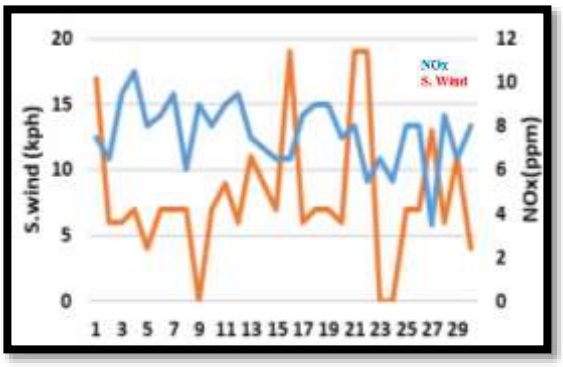

Figure 20.*Evolution of the wind and NOx (11h-13h) in Gambetta for September 2016*

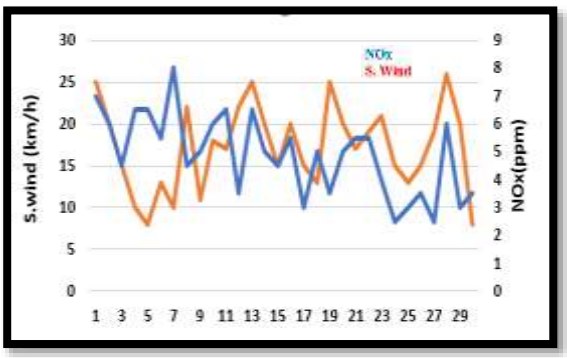

Figure 21.*Evolution of the wind and NOx (16h-18h) in Akid Lotfi for September 2016*

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***Table* 7.** *Coefficients of correlation between CO and the NOx for both time slots (11h-13h, 16h-18h) in deferential sites pollute in September 2016.*

COEFFICIENT OF CORRELATION	11h-13h	16h-18h
CO(ppm)	-0.09	-0.477
NOX(ppm)	-0.271	0.002

The contribution of wind in the issuance process of both pollutants is not clear (net) for the period of 16-17h the coefficients of correlation between the wind and the NOx are negative.

Sites present however a peculiarity. The values of the coefficients of correlation obtained show that the phenomenon of dispersal is observed for this site.

III.3 Relation pollutants – Traffics:

Polluting CO, NOx and the numbers of traffics in January:

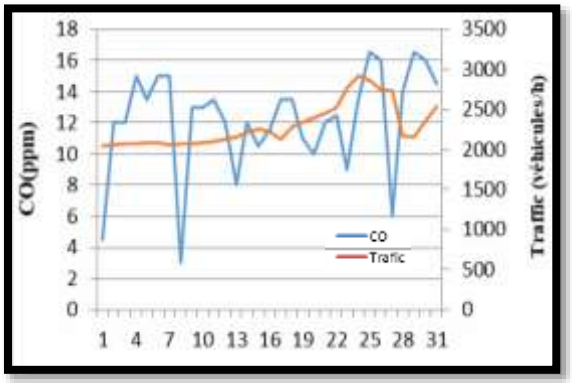

Figure 22.*Evolution of the traffic and CO (11h-13h) on Place victory for January 2016*

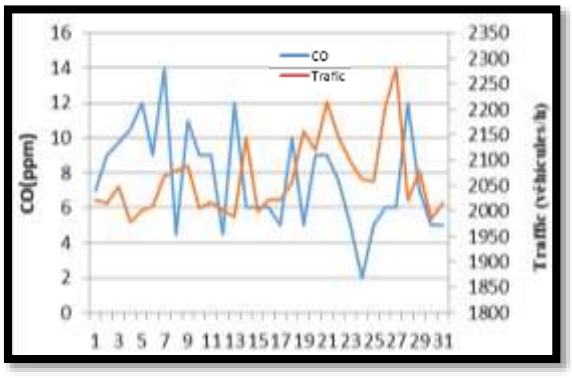

Figure 23.*Evolution of the traffic and CO (16h-18h) on Akid Lotfi for January 2016*

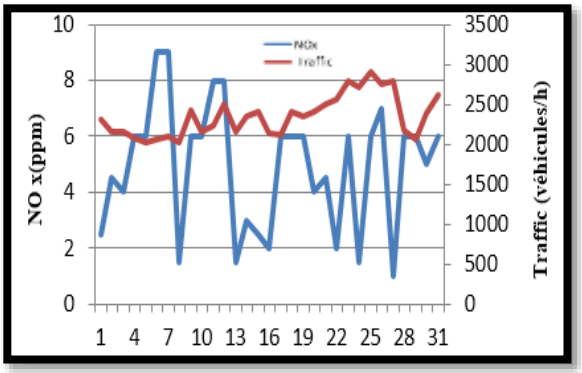

Figure 24. *Evolution of the traffic and NOx (11h-13h) on Akid Lotfi for January 2016*

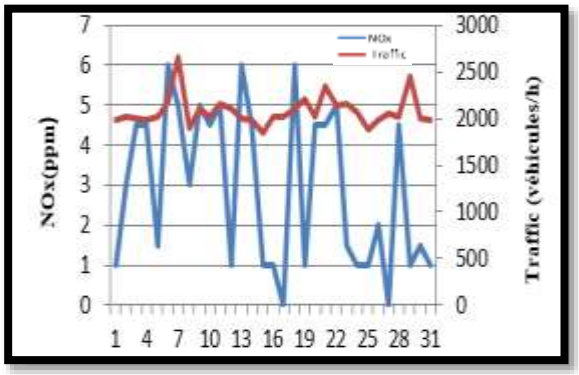

Figure 25.*Evolution of the traffic and NOx (16h-18h) on El Charfaoui for January 2016*

***Table* 8.** *Coefficients of correlation between CO and the NOx for both time slots (11h-13h, 16h-18h) in deferential sites pollute in January 2016.*

COEFFICIENT OF CORRELATION	11h-13h	16h-18h
CO(ppm)	0.09	-0.188
NOX(ppm)	-0.140	0.217

It introduces the most well brought up debit side of vehicles between 16h-18h (2900 vehicles / hour)

The contents of NOx diminish while traffic augments between 16h-18h. This is justified by the geographical position as bare site and as a result displayed in the variations of the wind.

His clear position makes that the concentration of pollutants is less than that of two other sites.

As a result, the relation between motorized traffic and rates of pollutants is not put in an obvious place.

Polluting CO, NOx and the numbers of traffics in August:

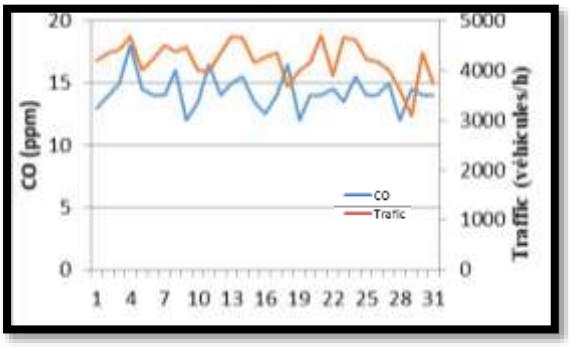

Figure 26.*Evolution of the traffic and CO (11h-13h) on Gambetta for August 2016*

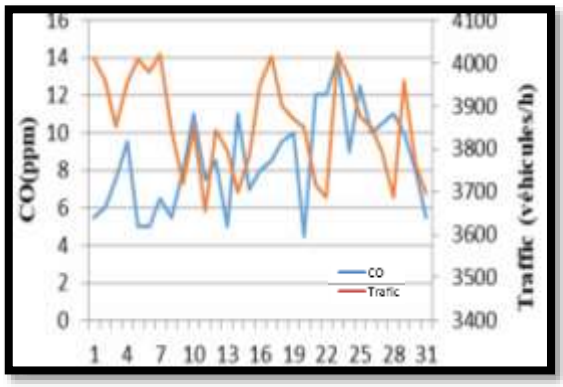

Figure 27.*Evolution of the traffic and CO (16h-18h) on Mdina Djadida for August 2016*

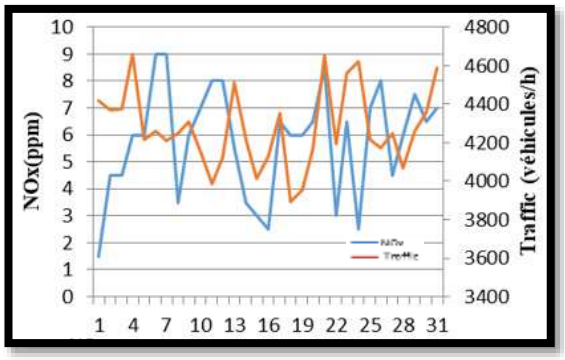

Figure 28.*Evolution of the traffic and NOx (11h-13h) on Akid Lotfi for August 2016*

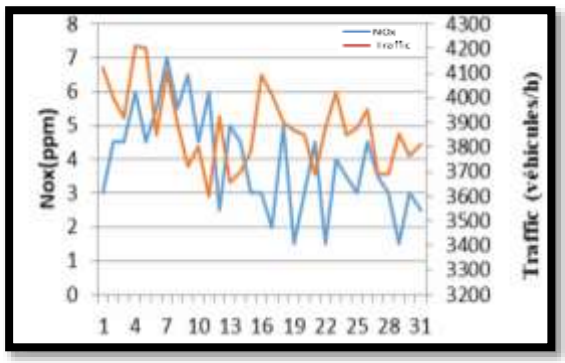

Figure 29.*Evolution of the traffic and NOx (16h-18h) on Gambetta for August 2016*

***Table* 9.** *Coefficients of correlation between CO and the NOx for both time slots (11h-13h, 16h-18h) in deferential sites pollute in August 2016.*

COEFFICIENT OF CORRELATION	11h-13h	16h-18h
CO(ppm)	0.153	-0.174
NOX(ppm)	-0.046	0.248

It introduces the most well brought up debit side of vehicles between 11h-13h (4600 vehicles / hour) in rush hours.

As a result, the relation between motorized traffic and rates of pollutants especially at midday is put in an obvious place-causing season of summer.

It can be said that several factors influence the levels of pollution recorded: the amount of traffic according to the time, the type of street (width of the road/ height of the buildings), the orientation in relation to the prevailing wind.

IV. Conclusion

Several factors intervene in the registered levels of pollution:

-The importance of the traffic according to the hour, the typology of the street, the orientation with regard to with the prevailing wind.

-The analysis of the graphs and the paintings shows that the average concentrations in winter are globally lower than those observed in the summer, justifying the hypothesis that anticyclone conditions contribute to an accumulation of pollution.

-In a general way, we also notice that streets the most exposed to the pollution are ways "canyons" of city center with a configuration very unfavorable to the dispersal of the pollution. Let us quote, as an example Medina djadida and place victory.

-We conclude for all that that Oran is a city exempt from pollution, because everybody can realize from now on nuisances caused by the pollution owed to the traffic.

-According to its geographical position, Oran benefits in the whole of weather conditions favorable to the dispersal of pollutants.

-Graphs indicates an increase of the contents in NOx during the wintry period, and a summary (the January and February; in August and September). The business resumption of September also leads an increase of the rates of NOx.

-The winter, the weather conditions are more penalizing and the human activity, in particular the road traffic, is maximal.

The city of Oran has weather conditions that help to disperse pollutants, Yes, that does not mean that it's not a polluted city, because it can be seen at midday

rush hour or at weekends that cause difficulty breathing and bad smells... Far from being a simple problem, pollution has become increasingly common.
The fewer gasoline we burn, the better we will work to reduce air pollution and the adverse effects of climate change. Therefore, it is very important that we raise awareness and convince everyone to participate in protecting the air.

Recommendations:

Developing research projects for cleaner energy such as LPG (Liquefied Petroleum Gas) namely called Sirghaz.
Applying a severe technical control on fumes emissions by using the Executive Decree 06-138 [17].
Walking, cycling or public transport.
Use gas-powered cars instead of gasoline or choose an electric car if possible.
Stop the engine during a long parking.

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