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Chemical Characterization of the Atmospheric Dismissals of the Cement Factory and Survey of Their Impact on the Quality of Soil -Case of the Cement Factory of El Ma El-Abiod, Algeria

Tahar Goudjil, Meriem Aouimeur and Manel Hamiri

Department of Biology, Tebessa University, Tebessa, 12000, Algeria

Abstract: The cement industry with its atmospheric emissions of gases and dust may affect the chemical balance of the atmosphere and environment such as soil. In order to assess the impact of air pollution from Atmospheric dismissals of the cement factory of El Ma El-Abiod on soil quality, a study was done in the plain of El Ma El-Abiod the terraced the cement factory and at the town of El Ma El-Abiod. This study is based on the collection of dust generated by the factory in bins located around it along a radius of 20km, then a chemical analysis was performed to characterize the chemical dust, and a soil survey was made for assess the impact of dust on soil quality. After chemical analysis of the nine major oxides, SiO_2, Al_2O, Fe_2O, $CaCO_3$, MgO, Na_2O, K_2O, SO_3 and Cl, in air releases from cement factory and soil by fluorescence spectrometry with X-ray The study has shown that the rejected dust, compared with soil is rich in SiO_2, $CaCO_3$ and Cl.

Key words: Air pollution · Cement factory of El Ma El-Abiod · Dust · Soil · Fluorescence spectrophotometer with X-ray

INTRODUCTION

Since the beginning of the industrial age, the air pollution is enhanced. The advent of factories and companies that have waste or releases to air offers some world problems [1]. Air pollution is the presence of impurities in the air can cause a significant gene for comfort or health, is damage to property is also a chemical or physical change in environment leading to harmful effects to human [2, 3].

The cement industry is one of the main sources of pollution due to the discharge of atmospheric compounds as gas and dust. In the cement industry, the major releases to the atmosphere are sulfur dioxide, nitrogen dioxide and carbon monoxide. These gases have an important role associated with two phenomena of air pollution are the greenhouse effect and acid rain [4-6].

Dust emissions of cement can be classified into two categories, local emissions not dangerous on the environment, they only affect the internal environment of the factory, and chimneys emissions dust mainly from furnaces and grinding. Dusts dispersed into the atmosphere through stacks consist essentially from particles of limestone and clay. The particles released into the atmosphere will carry and reacted during this transport. This deposit may be due to the dry or wet weight due to leaching of pollutants by precipitation. The pollutants are deposited on plants and soil which affects the soil composition and also the degradation of surface soil layers [6, 7].

The objective of this study is to characterize the dust by cement of El Ma El Abiod; east of Algeria, to identify their chemical composition and to study the impact of dust on soil quality of the plain.

MATERIALS AND METHODS

The Cement ERCE: The company was created in the month of November 1993. The headquarters is located in Tebessa 680km south east of Algiers and 250 km from the city of Annaba in the north.

The cement plant is located 26 km south of Tebessa and 35 Km Algerian Tunisian border, is the latest achievement in the public sector cement.

The cement capacity to of 1600 tons/day clinker is 500.000 tons/year. It has a line of cooking dry. It draws its main raw materials from deposits near the quotes (calcareous clay and 500m: 10Km). The reserves of raw materials allow operation of more than 100 years.

Corresponding Author: Tahar Goudjil, Biology Department, Tebessa University, Tebessa, 12000, Algeria

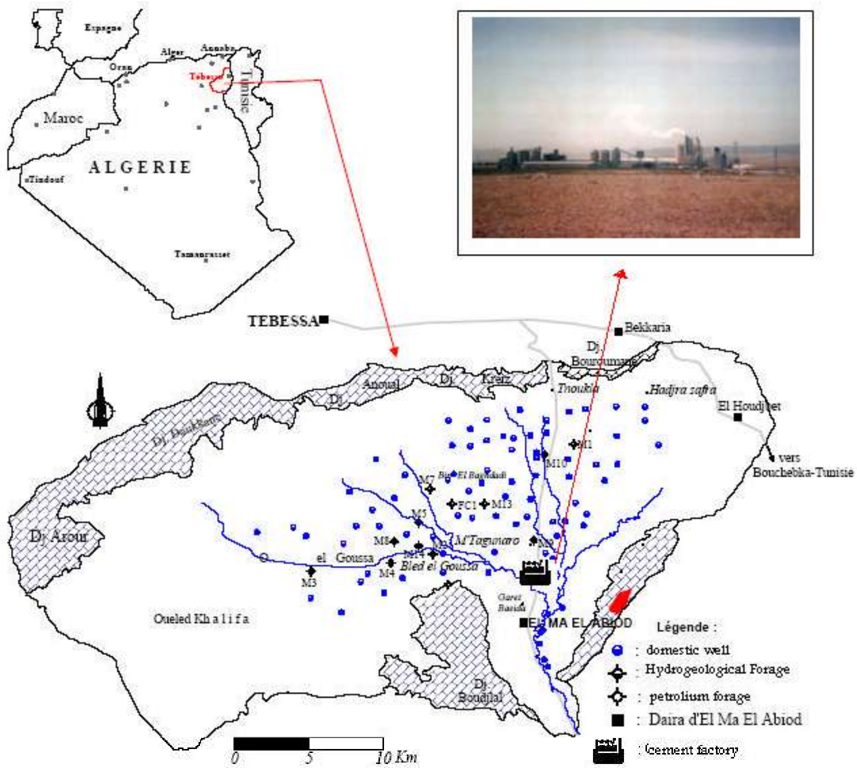

Fig. 1: Location of the plain cement factory [8]

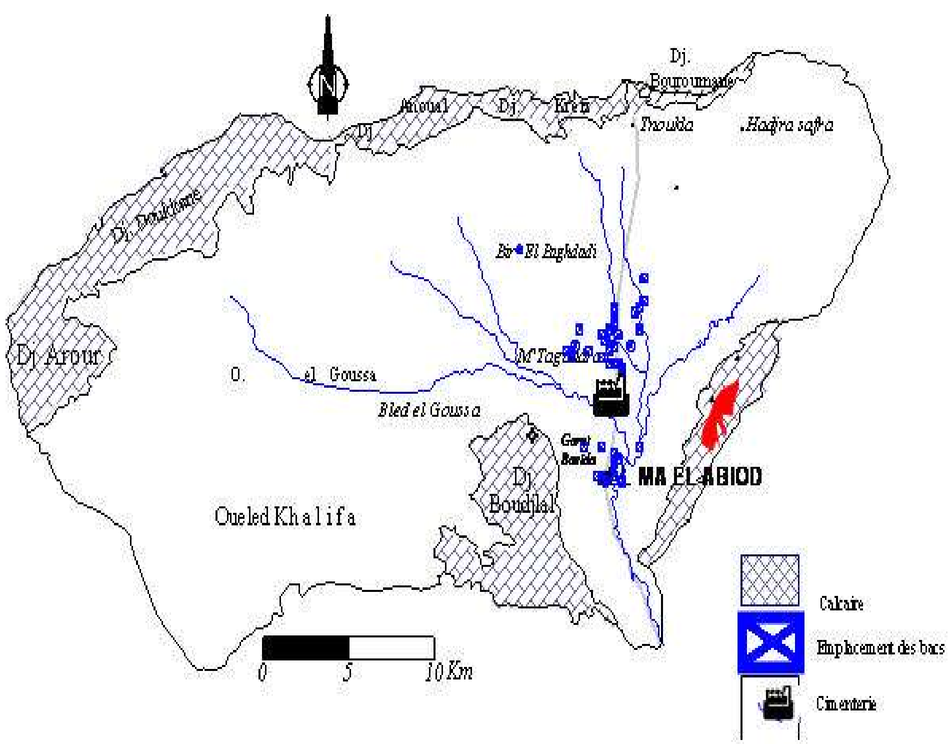

Fig. 2: Distribution of sampling dust and soil the plain

Methodology and Analytical Conditions

Characterization of Dust: The cement industry with these releases is essentially atmospheric dust has an impact on the environment and disrupts the balance of the atmosphere [9].

The objective of this study is to characterize the dust generated by the cement factory resulting from the cooking of raw materials, and thus the dispersion of these pollutants in the plain of El Ma El Abiod.

To address this problem, the study was based on the collection of dust generated by the factory; work is divided into two key stages;

Trays Site: For this study, 36 rectangular trays were used, the trays are placed around the plant, in the city of El Ma El Abiod and in the urban area. The distribution of bins has been made in all directions along an axis of 04km, the position of the bins to assess the distribution of pollutants along the wind direction and distance of the plant.

A ferry has been witnessed in the town of Tebessa which departs from the study area with 30 km, to compare the nutrient content with a region far from the pollution source, for the presence of terrain around the plain may prevent the arrival of pollutants in this region.

Sampling: During a period of 6 months (April-September 2007), 05 samples of dust were made. Sampling was done with a brush; dust is collected in dry boxes.

After the removal of dry dust, leaching tanks with water Distell, to ensure the collection of very fine particles, has been done.

The mixture recovered was put in bottles, and then evaporated in a beaker on a hotplate to recover the amount of dust stuck to the surface and sides of pan.
To determine the nature of dust generated by cement, 36 bins are distributed around the plant to collect dust.

Characterization of Soil: To evaluate the soil of the region and their impact on the dust sample, a soil sampling was conducted at all listed where bins.

The soil sampling was done by a spatula and the samples were placed in boxes.

The following map shows the distribution of bins around the plant.

Sample Preparation: Samples are prepared at the laboratory of the plant according to the following

- Drying the samples in an oven temperature of 120°C.
- Samples manual grinding using a glass mortar and sifted through a sieve of 0.125mm., Diameter asked to move from analysis to unit.
- Preparation of pellets with a pelletizer.
- Chemical analysis by XRF is to determine the percentage of different oxides in the sample. After the preparation of pellets, they are placed in the door of sample X-ray fluorescence analyzer, and then pass the sample for analysis using a computer connected to the spectrometer where the results appear.

RESULTS AND DISCUSSION

To assess the chemical composition of dust, their origins and the relationship between variables and the effect of position bins on the quality of the recovered dust, and finally the impact of waste on soil quality of the plain; a principal component analysis was performed.

The purpose of this analysis is to remove the sample points which have high levels of elements from all points. This study concerns the analysis of samples from each of 05 companies carried out between April and September 2008 in the plain of El Ma El Abiod and ACP envelope for 05 samples, aussiune ACP for sampling soil.

Characterization of Dust: The data matrix contains 09 variables SiO_2, Al_2O, Fe_2O, $CaCO_3$, MgO, Na_2O, K_2O, SO_3 and Cl and 36 individuals who are the sampling points.

***Values**

	F1	F2	F3	F4	F5	F6	F7	F8	F9
Raw Value	2.659	1.232	1.054	1.028	0.936	0.814	0.710	0.529	0.038
% Variance	29.548	13.688	11.714	11.420	10.395	9.049	7.884	5.882	0.421
% Cumulated	29.548	43.236	54.950	66.369	76.764	85.814	93.698	99.579	100.000

The first principal component has a variance (Eigen value) of 2.659 and is 29.548% of the total variance, the second principal component has a variance of 1.232 and is 13.688% of the variability of data, the third principal component has a variance (value own) of 1.054 and is 11.714% of the total variance. The first three factors account for 54.950% of total inertia.

Analysis of Circles: We will limit our observation projection variables and individuals in the circle formed by the axes F1 and F2, since it provides the maximum information (43.24%)

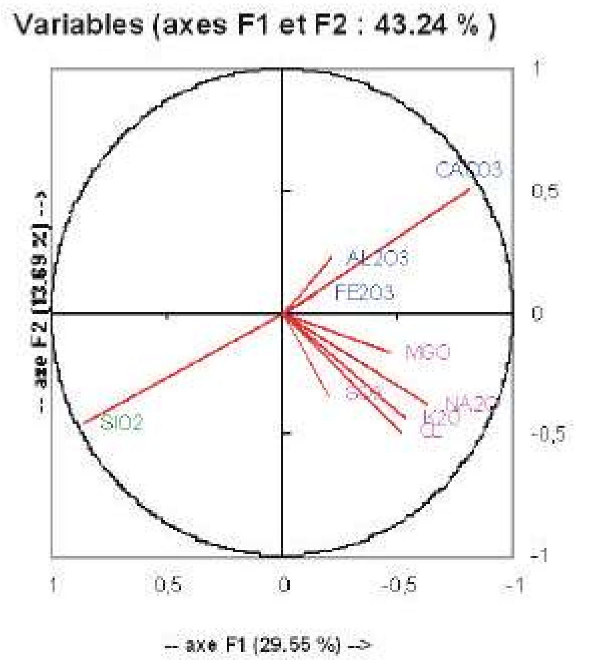

Fig. 3: Projection of the variables in the plane F1 and F2

Variables Study: The F1 axis of the overall ACP expresses 29.55% of the total variation of parameters, the second 13.69% of this information.

The overall ACP shows an association between the major elements in the clearances, the silica is presented conflicting with other variables that form two distinct groups: the first consisting of $CaCO_3$, Al_2O_3 and Fe_2O_3Et the second group, MgO, SO_3, Na_2O, K_2O and Cl.

Individuals Studies: The graph represents the projection of individuals in the plane F1 * F2, it shows the distribution of concentrations of elements in the 36 sampling points. The distribution of individuals is linked with the distance and direction of position bins in the plain. The samples near the plant as; Ind. 02, 04, 03, 08, 14, shows a higher rate of silica, which has two roots, soil and dust cleared. The sample 37 is the control; she appeared in the plan to other isolated points, which means their different nature.

Characterization of Soil

Eigen Values

	F1	F2	F3	F4	F5	F6	F7	F8	F9
Ret Value	2.569	1.977	1.327	0.852	0.788	0.688	0.539	0.257	0.003
% Variance	28.543	21.963	14.746	9.463	8.754	7.649	5.994	2.852	0.036
% Cumulated	28.543	50.506	65.252	74.715	83.469	91.117	97.112	99.964	100.000

The first principal component has a variance (Eigen value) of 2.569 and is 28,543% of the total variance, the second principal component has a variance of 1.977 and is 21.963% of the variability of data, the third principal component has a variance (value own) of 1.327 and represents 14.746 of the total variance. The first three factors account for 62.52% of total inertia

Analysis of Circles

Study of Variables: The circle PCR is represented by the correlation of two axis F1 and F2 with a performance of 50.51% of the total variation of inertia variables.

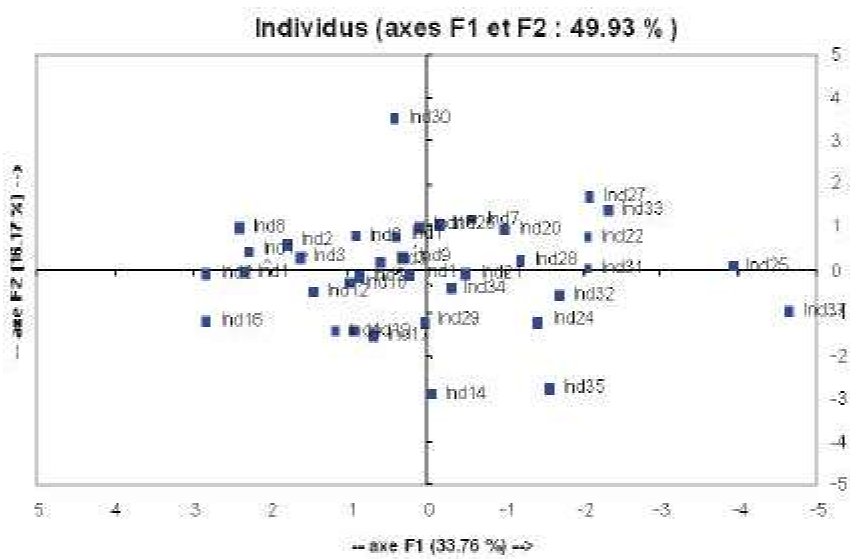

Fig. 4: Projection of individuals in terms F1 and F2

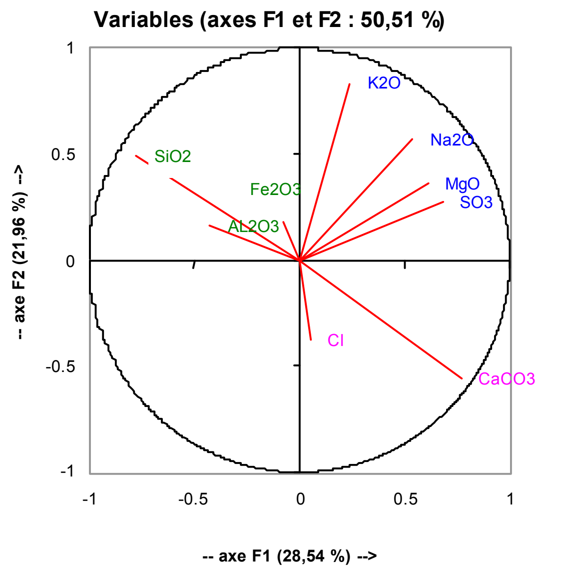

Fig. 5: Projection of the variables in the plane F1 and F2

The first axis represents 28.54% of the information; it is correlated with variables SO_3, MgO, Na_2O and K_2O. The second axis represents 21.96% of the variation. The projection of soil elements is consistent with that of dust; silica has always been isolated to other variables.

Studies of Individuals: The distribution of variables in the plan shows that the concentration of elements is divided by the sampling and removal of cement.

The sample 37 is the control; it has a different chemical composition of their position in the plane.

The distribution of 09 variable samples of dust and soil show that the elements contained in samples taken from two sources:

- The release of the cement consists mainly of dust coming from the chimney of dosing of raw materials. Thus the stone quarries near the plant.
- The soil of the region, which shows a high rate of SiO_2 due to their nature "argillaceous sand"

The combination of $CaCO_3$ with Al_2O_3 in each sample is due to their origins, careers clay and limestone that are near the study area. SO_3 and Cl are mainly derived from releases of dust.

Other types of air emissions from the plant that are not reported in this study, the gases, which consist mainly of SO_3 and Cl This composition can react in the atmosphere and made an impact, which explains their correlation the circle of correlation, these two elements are important indicators of pollution and impacts on the soil [4, 10].

The distribution of individuals in the plan expresses the effect of distance and position of bins on their distribution, the sample near the plant has high concentrations of elements and then decreased with distance from the plant.

During the work period extends from April to September 2007, two major wind directions are towards West-Northwest "WNW" from November to April. In Southbound "S" more significant from May to July.

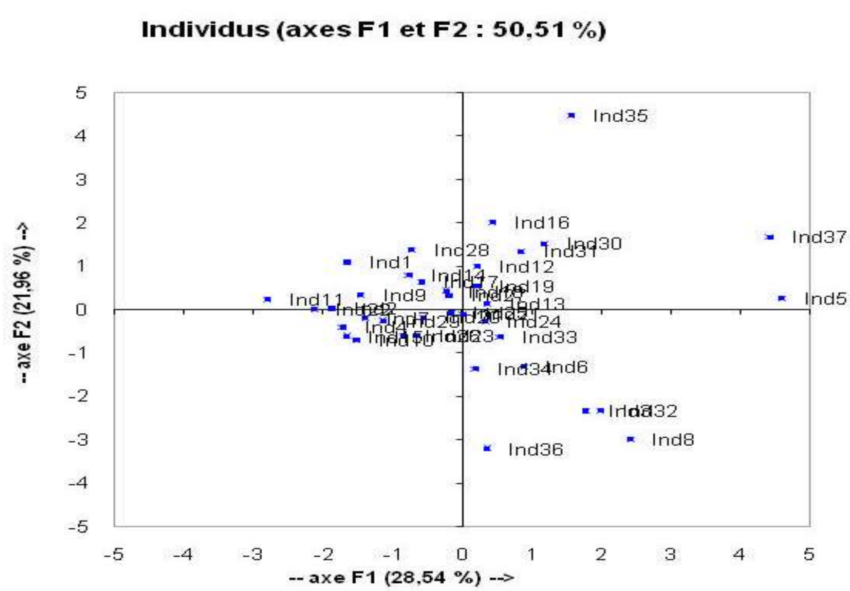

Fig. 6: Projection of individuals in terms F1 and F2

This distribution of directions thus influences the distribution of samples in the plan. Other studies have been made to characterize the dust are given results consistent with the results of this study; [11, 12] have found that dust-rich SiO2 is located near the cement and removal of sampling points affects the amount of dust and the nature of composition.

CONCLUSION

The chemical analysis of dust generated by the plant showed elevated rates of SiO_2 and $CaCO_3$, these two elements are the origin of raw materials, SiO_2 has other home is the soil of the region that is likely clayey sand. The high SiO_2 content can lead to long-term onset of severe respiratory diseases such as silicosis, and the presence of factors responsible for climate change as greenhouse gases such as SO_3 and Cl-bends, the cement influences soil quality and region of la plants and agronomy of the region.

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