J. Mater. Environ. Sci. 3 (4) (2012) 662-669
ISSN : 2028-2508
CODEN: JMESCN

Impact of the exploitation of the quarries on the environment and their rehabilitations (Casablanca-Mohammedia, Morocco)

Nawal Ezzirari [*a], Lahcen Bahi, [a] Nadia Barhoun [b]
[a] *Laboratory of geophysics, geotechnical engineering, engineering geology and environmental, School Engineers' Mohammedia, Rabat, Morocco*
[b] *Laboratory of Geology and Paleontology, Faculty of Science Ben M' sik, Casablanca, Morocco.*

Received in 19 June 2011, Revised 19 Sept 2011, Accepted 19 Sept 2011.
*Corresponding Author: - Email: nayroubi2007@gmail. Com , Tel: +212 610 345 708

Abstract
We describe the problem and the negative impact engendered by the activity of exploitation of the quarries of the region of Casablanca-Mohammedia on the environment, most of which of these last ones were exploited to extract building materials, while most part of the exploited rocks are dolomites and limestones which constitute the reservoirs of the groundwaters of the region. The mismanagement of these quarries, and the bad choice to make of these quarries of the garbage dumps, which became the sources of pollution of the region, so putting in danger groundwaters and the environment surround. We shall take within the framework of this study as example the Mediouna landfill. The presents publication makes obvious a new technique for the treatment of the leachate of Mediouna landfill by the Diatomite. This last one was the object of a preceding study and that showed his usefulness in the filtration of worn waters.

Keywords: Quarries, impact, dump, city of Casablanca, exploitation, rehabilitation, diatomite.

1. Introduction
The opening and the exploitation of the quarries of the zone of Casablanca -Mohammedia began with the construction of the port of this economic city of Morocco in 1907. The demographic development and the urban expansion of the metropolis of Casablanca required an enormous need in building materials. Some of these quarries are at present given up, the others are transformed into uncontrolled dump sites unchecked case of the quarries of Sidi Moumen, Mediouna, Mesbahiat and Jouamia is at present in outer-urban environment or in full towns, the others are in the course of exploitation and the others of these quarries contain a scientific valuable exceptional prehistoric heritage, as shows of it the presence of vestiges hominids and of vertebrates. That's why; they must be protected for future generations. Among these quarries, we can quote the quarry of Sidi Abderrahmane, the quarry of Oulad Hamida and Ahl Al Oughlam's quarry. But not rehabilitation of some of these last ones engendered a negative impact on the natural environment which does not stop deteriorating.
It is obligatory to identify projects of fittings and rehabilitation combining environmental protection and the needs of the surrounding population.

2. Materials and methods (Example of a solution of refitting case of Mediouna landfill)
With the previous works made by Fekri and al, on 2007, we just content with making a synthesis of the studies and the data to estimate the quantity of leachate produced by the Mediouna landfill which constitutes one of our fixed objectives.

2.1. Quantity of waste produced at the level of the city of Casablanca

According to the various specialized institutions (Urban Agency of Accommodated, Ministry of the Environment, the urban community, etc.). It emerges that this tonnage evolves in a more or less parallel way with the increase of the population of the city [5].

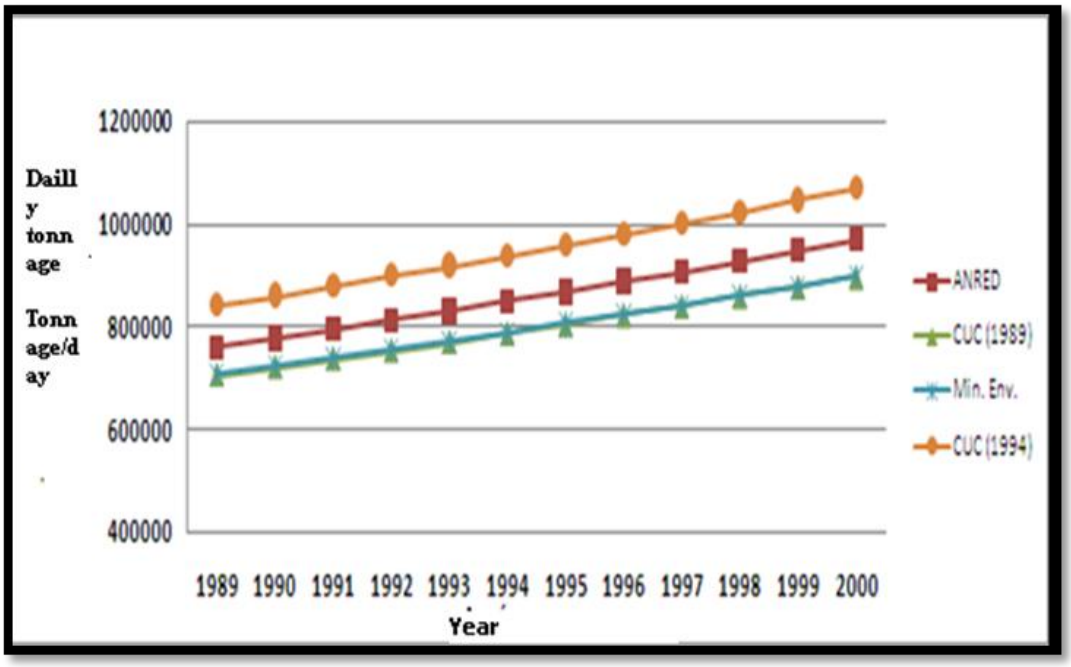

Figure 1. Estimations of the annual tonnage of the domestic losses of Casablanca (in tons / year) by various bodies for several years.

The quantities of domestic losses produced by the city of Casablanca do not stop increasing; they are at present of the order of 3500 t/j as shown in Fig 1. The composition of the produced waste knows a change due to the economic boom and to the change of the lifestyle. Indeed, the parts of plastic and some metals do not stop being growing. These two constituents limit the choice of sector of treatment.

2.2. Produced of leachate

Definition:

The leachate is the residual liquid which results from the percolation of waters through a material (case of losses, the leachate takes care of organic, mineral pollutants and metallic by lixiviation of the soluble compounds) was observed in Figure 2.

The quantification of the production of these effluents for the Mediouna landfill by the method of the hydric balance assessment gave a value of 1 277 m3 / day equivalent to a continuous fictitious flow of 1 478 l/s. This quantity which we consider high can soil and pollute the environment and damage the stability of the site [5].

The figure 3 presents the distribution of wells according to the degree of pollution:

- The group 1: characterized by a low rate of sodisation and a moderate risk of salinisation, groups includes wells P5, P8, P9, P11, P12, P13, P14 and P15. They are situated in the zone not affected by the pollution by lixiviats and remind wells situated in the upstream.
- Well P6 and P16 belongs to the group 2, they are characterized by an average risk of salinisation and a rate of moderated of sodisation. These two water sources have the peculiarity of credit note of the important depths.
- Some wells are affected by leachate and which are just situated downstream to the landfill have waters which present a risk of salinisation very hardly has extremely hardly, with a risk of sodisation means with fort. Case of wells P1, P2, P3, P4 and P7.

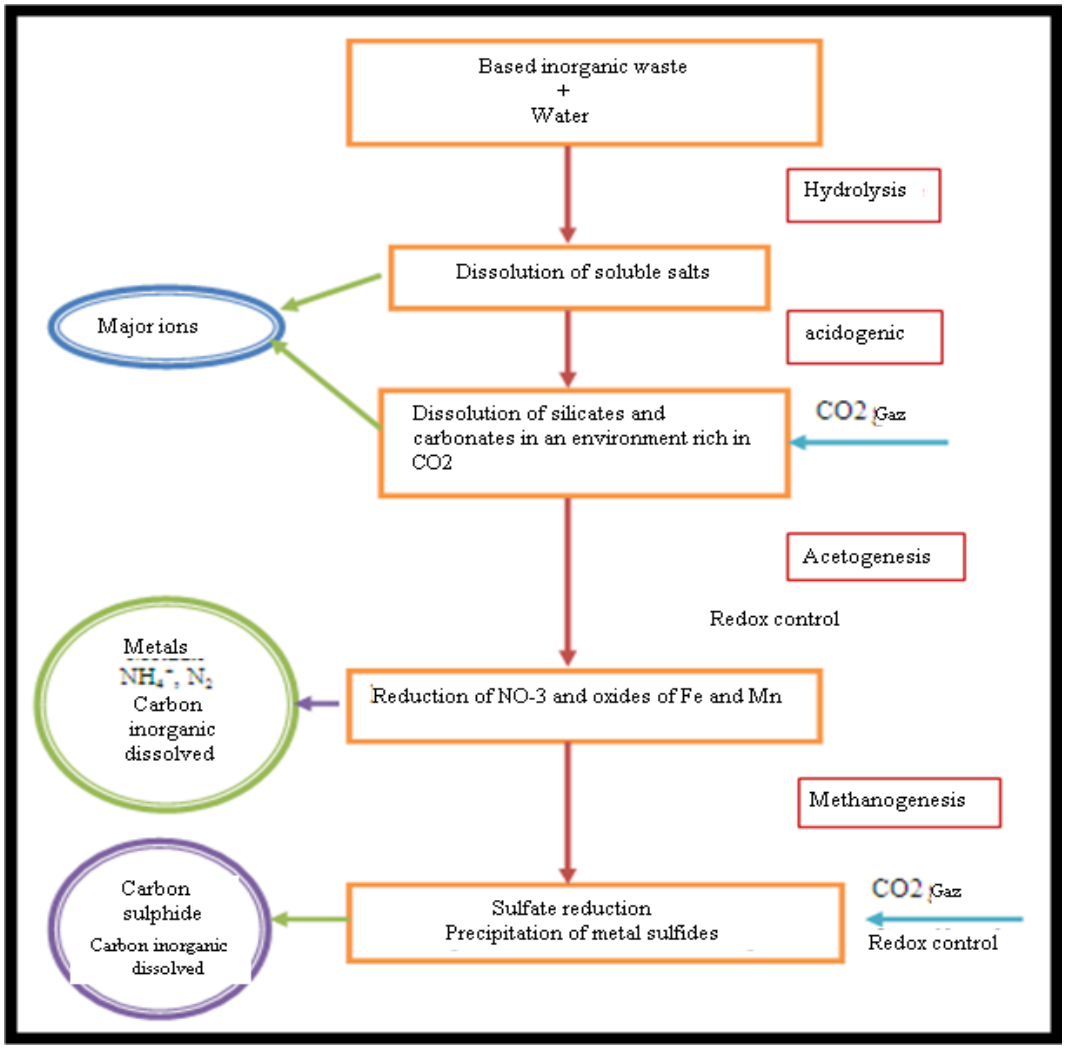

Figure 2. Principal stages of the biodegradation of the inorganic material of the waste in a controlled dump [9].

According to this figure, we see that the zone affected geographically by the leachate of the landfill remains restricted in front of big potential of nuisance which constitutes a landfill of the size of Mediouna and it since about twenty years.
This situation is due to the presence of numerous wells equipped in means of exhaure, situated downstream to the dump at the level of the conductive faults of leachate [5].

2.3. Treatment of leachate
Techniques used for the treatment of leachate are the ones applied for the waste water treatment. There are various types of treatments quoted in the literature, namely the biological treatments and the physic-chemical treatments. And we can add treatments by using of Diatomite.

2.3.1. Treatment using of Moroccan Diatomite
Definition:
The diatomite: a light siliceous sedimentary rock of greenish or yellowish white, grey color, biogenic origin is:
Constituted by the accumulation (sedimentation) of the strongly porous shells of diatoms, which is in abundance, in the region of Melilla Nador and Al Hoceima as shown in Photo 1.

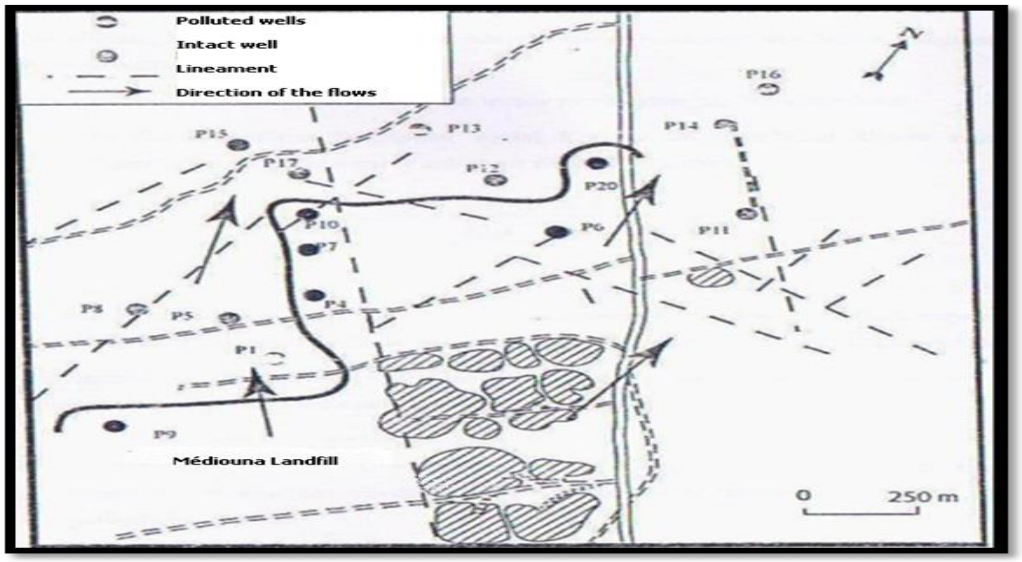

Figure 3. Delimitation of the front of pollution according to isotopiques analyses [4].

Photo 1. The deposits of Diatomite in the region of Nador.

This material presents several uses such as: purification and clarification of food liquids, construction and heat insulation, absorbing pesticides in porous circles, manufacturing of antibiotics, some pharmaceutical syrups. It qualified as friendly material towards the environment.

2.3.2. Physical and chemical characteristics of Diatomite.

The physic-chemical study of the diatomite of the region of Nador (Morocco the North - Oriental) was realized by means of very advanced techniques (DRX, MEB) and allowed to determine the chemical composition of this rock [10].

Figure 4 shows that the chemical composition obtained later analyzes by the X-rays show the ascendancy of the silica as well as the Al le Ca and the Fe and allows concluding that the diatomite is essentially constituted by silicates, by calcites and by clays.

Figure 5 shows that the spectrum of quantitative and qualitative analysis, obtained by MEB shows that the diatomite is largely constituted by Si, O, Al and Fe and in low party of Cl, Mg, K and Na.

The perusal of the diffractogram shows the presence of the characteristic lines of carbonates; calcite and silicates; quartz, Almandin, Aluminum Iron Phosphate.

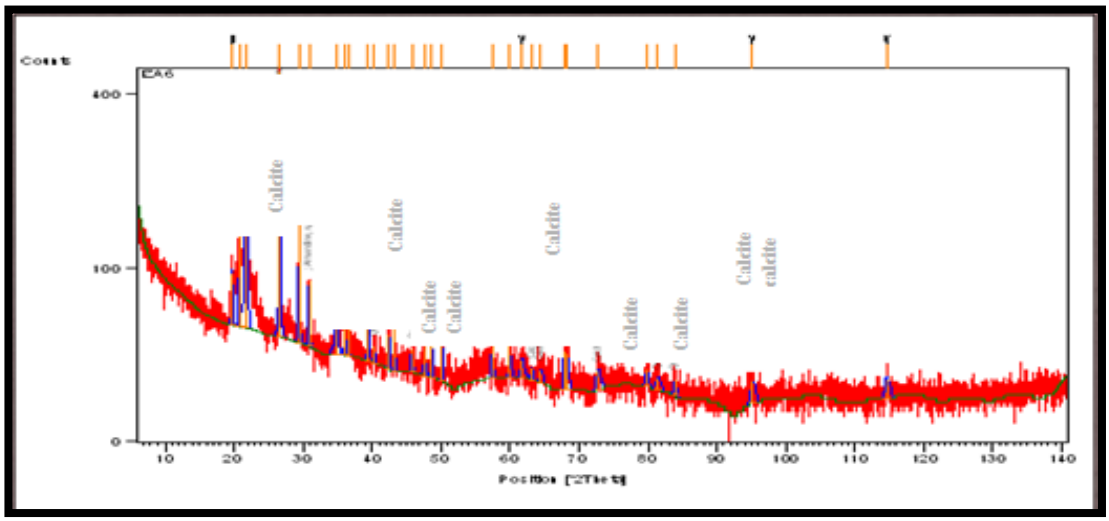

Figure 4. Diffraction of the X-rays [10].

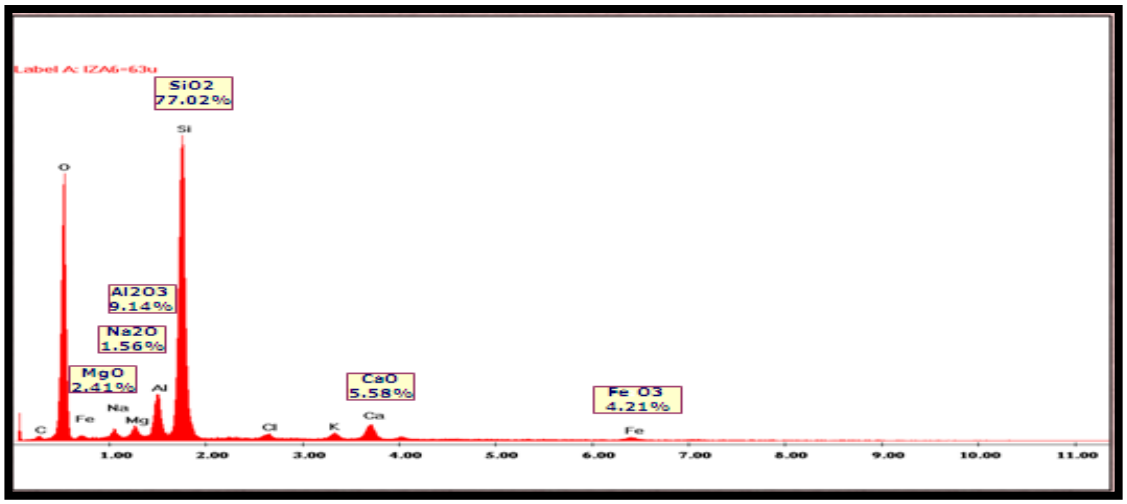

Figure 5. Technique of electronic microscopy with sweeping [10].

2.3.3. Apparatus

The used material of filtration is the raw diatomite of a size grading of 63µm. The crushed diatomite shows a low density, a big porosity and a high specific surface. We developed a simple device (see experimental Protocol attached in Diagram 1).

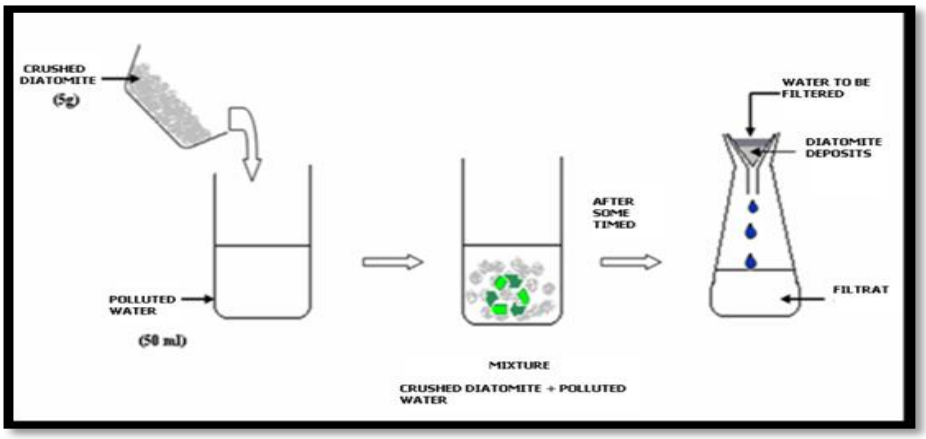

Diagram 1. Protocol experimental of the filtration by diatomite.

The used support is an industrial filter paper 150 mm in diameter pores being from 20 to 25 µm. For 50 ml of polluted water we put in suspension 5g of crushed diatomite (size grading of 63µm) that we let act a little of time with the water. Then we pass in the filtration.
The totality of the load settles uniformly, the water to be treated crosses this coat and gets rid of impurities which it contains [3-10].

3. Results and discussion

The analysis of waste water purified by diatomites brings to light the elimination, in important quantities, of the suspension material, the materials nitrogenous and phosphated, organic matters, heavy metals and bacteria as represented in Figures (6;7;8) and photos (2;3).

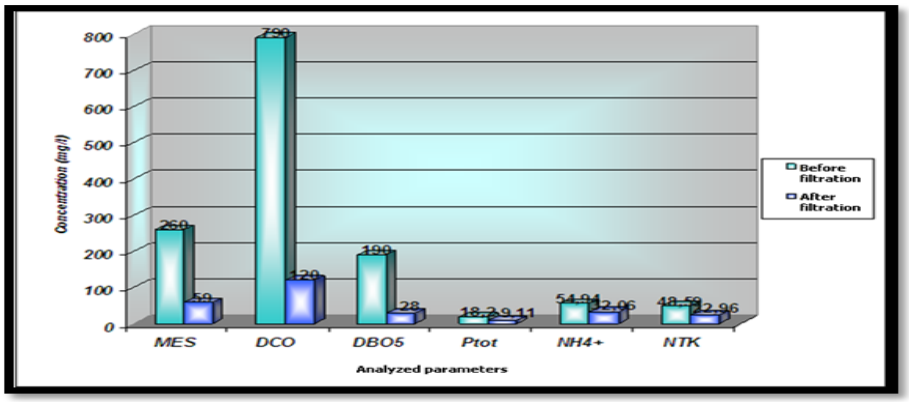

Figure 6. Analysis of the industrial water [10].

Photo 2. Aspect of the industrial water of refusal before and after filtration [3].

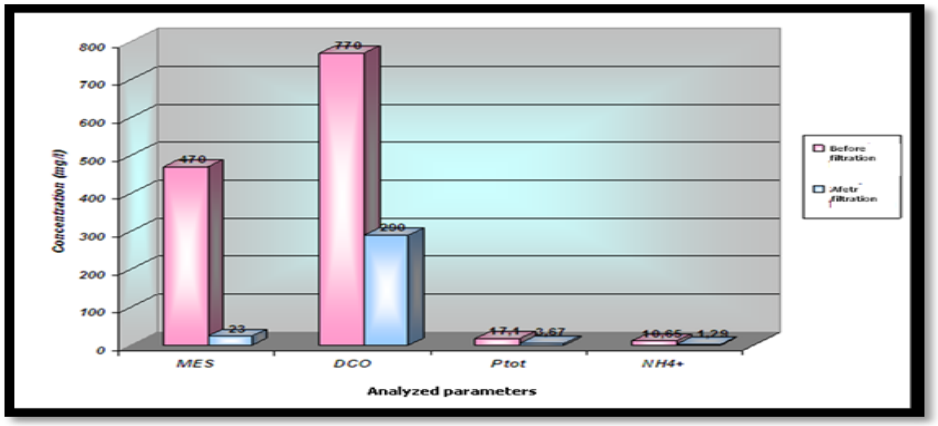

Figure 7. Analysis of urban waste water [10].

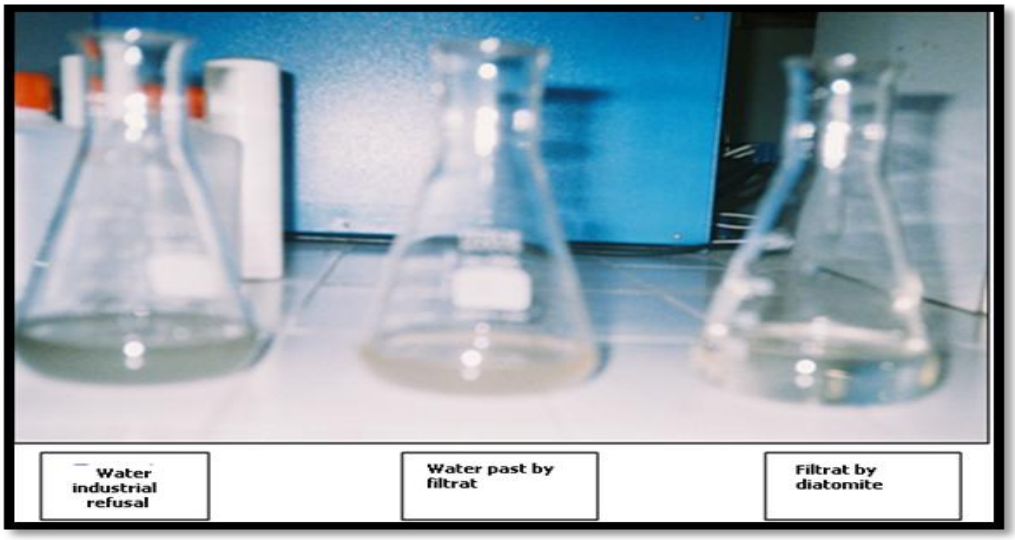

Photo 3. Aspect of the water of the urban refusal before and after filtration [10].

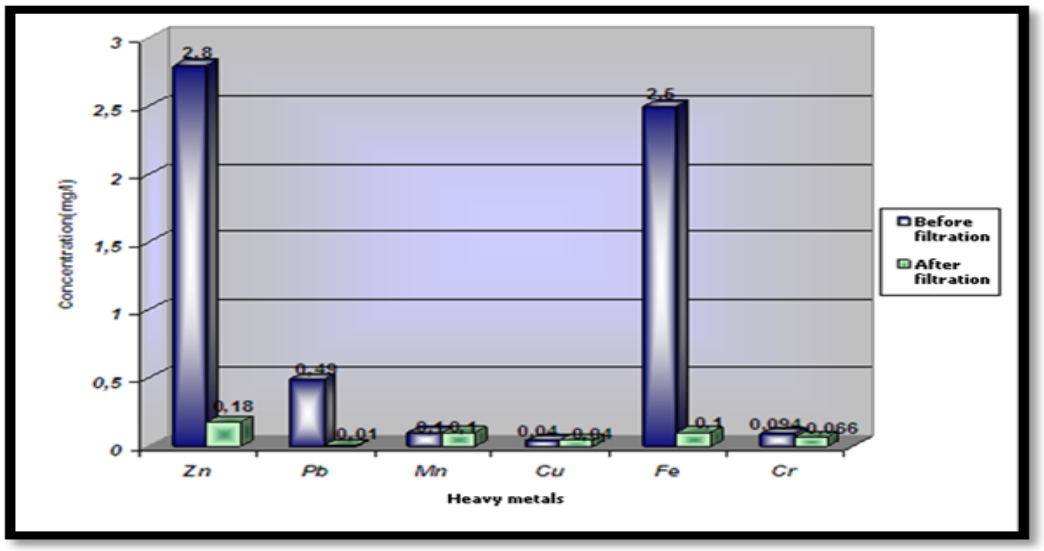

Figure 8. Analysis of the heavy metals of the industrial water of refusal [3].

The environmental problem of the activity career in the zone of Casablanca-Mohammedia does not stop deteriorating. It is obligatory to identify plans of rehabilitation and refitting adaptable to every type of careers to end this problem which harms the current life.
The results of the physic-chemical characterization of the diatomite showed that this rock is essentially constituted by silicates, by calcites and by clays. The spectrum of quantitative and qualitative analysis, obtained by MEB shows that the diatomite is largely constituted by Si, O, Al and Fe and in low party of Cl, Mg, K and Na.
The results of the various analyses (organoleptic, chemical, toxic and microbiological) waste water in the state brute and after filtration by the diatomite allowed to bring to light that this material is an adsorbing voucher and allows the elimination, in important quantities, of the suspension material, the materials nitrogenous and phosphated, organic matters, heavy metals and bacteria.
The results which we obtained are very important and we can envisage this solution for the treatment of the Mediouna landfill leachate.

Acknowledgements
I wish to express my deep gratitude and appreciation to everyone who has contributed in making this work. I also thank of Prof. Bahi Lahcen for his cooperation and assistance.

References

1. Biberson, P., Essai de classification du Quaternaire du Maroc atlantique. Comptes rendus sommaires des Séances de la Société Géologique de France, (1961) 70.
2. Destomes, J., & Jeannette, A., Mémoire explicatif de la carte géotechnique de la méséta côtière à l'Est de Casablanca au 1/50000. *Notes & Mém. Serv. géol. Maroc*, 180 bis, (1966) 104.
3. Ezzirari, N., Use of diatomite in the filtration of industrial waters rich in heavy metals. Memory study, Ben M'sik Faculty of Science, Casablanca-Morocco, (2006) 26.
4. Fekri, A., Benbouziane, M., Marrakechi, M., and Wahbim, Impact of the Casablanca municipal landfill on groundwater resource (Morocco). Publication (Ben M'sik Faculty of Science, Casablanca and Technical Faculty of Science, Gueliz -Marrakech), Morocco (2008).
5. Fekri, A., Impact of the dump of Mediouna on the resources in subterranean waters. Memory of Doctorate (Ben M'sik Faculty of Science, Casablanca: hydrogeology), (2007) 4-25.
6. Hichours, Y., Hourimche, A., Benbouziane, M., Tahiri, O., and Ejjaouani, H., Interests and environmental impacts of the quarries of exploitation of the region of Casablanca. *Moroccan magazine of the civil engineering*, N 120, (2007) 8.
7. Lefèvre, D., Raynal, J.P., Les formations plio-pléistocènes de Casablanca et la chronostratigraphie du Quaternaire marin du Maroc revisitées, de Casablanca. Stratigraphie et préhistoire ancienne au Maroc atlantique. *Quaternaire* 13 (1), (2002) 21.
8. Noury, A., Impact of the human activities on the wet zones case of the swampy zone of the city Mohammedia. Memory of Desa (School Engineers' Mohammedia of Rabat: Department of Mineral Engineering), (2000) 25.
9. Nicholson, R. V., Cherry, J. A. and Reardon, E. J., Migration of contaminations in groundwater at a landfill, a case study. *Journal of Hydrology* 63, (1983) 131 -176.
10. Khairi, I., Physic-chemical characterization and valuation of the diatomites of the pond of Melilla-Nador, Morocco. Memory of Diploma of detailed superior study. Hassan II-Mohammedia-Morocco. (2005) 110.
11. Sbihi, A., f, Raynal, JP and Mohib, H., Hunters and vultures: upper and average Acheuléen of the sites of careers (quarries) Oulad hamida 1, Thomas1 and Sidi Abderrahmane, catalog of Cathedral Crowned Heart of Casablanca, (2007) 46-55.