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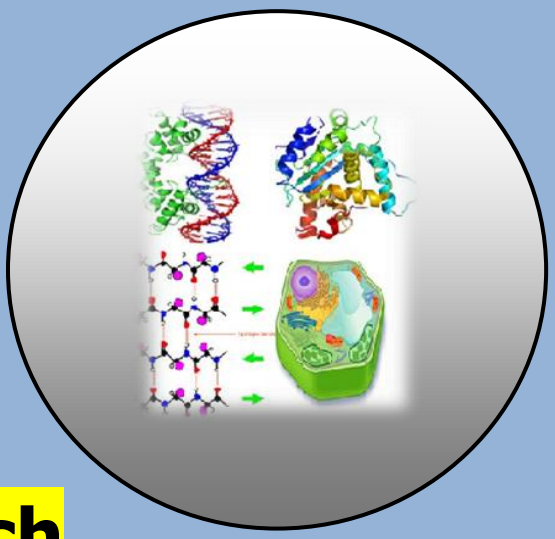

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RESEARCH PAPER

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The Evaluation of Physico-Chemical Parameters of Sefrou's Leachates (Morocco)

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ABSTRACT

The present work has as main objective the characterization of leachate generated by the uncontrolled discharge Sefrou and comparison of parameters analyzed, with those of Moroccan standards of discharges.

The physico-chemical characterization of the surveyed leachate five stations revealed that these liquid wastes are very loaded with organic matter in terms of BOD_5 (moy=3144 mg d'O_2/l) and DCO (moy=8680 mg d'O_2/l) and in mineral matter expressed in terms of electrical conductivity (moy=3216,6 µS/cm) with a salinity of (moy=1761 mg/l), and a pH of (moy=7,27) with a Under saturation in dissolved oxygen of (moy=0,23 mg/l).

The values of the report DBO_5 / DCO oscillate between 0,13 and 0,83. It shows that the studied leachates are rich in biodegradable organic matters and are situated in an intermediate state between the young and stabilized leachates. Consequently, the results of the gross leachates have shown a high degree of disturbing pollution and serious risks on the environment.

Keywords: Leachate, Physicochemical Parameters, Discharge, Sefrou and Morocco.

INTRODUCTION

In Morocco, in addition to the management of industrial and toxic waste, solid waste management in general and household waste in particular is one of the major concerns of environmental policy. The production of solid waste is increasing, following population

growth and increased economic activity (Benani 1984; Amhoud, 1997). For the vast majority of Moroccan local authorities, landfill remains the most used to get rid of solid waste method (Anonymous, 2010). Almost all of these discharges are not controlled in the open; the waste is dumped in a mixed form (household, industrial and hospital) without any treatment (El Bada et al., 2012).

More visible nuisances generated by an uncontrolled landfill such odors, fumes, fly away, etc ..., there are other harmful nesses much more dangerous. We find, in particular, leachate, these are sewage polluting power characterized by the presence of a significant number of pollutants (organic, inorganic, and dangerous). Leachate quality varies from one discharge to another, its composition depends on many factors: the composition of the waste, the water balance, the mode of operation of the landfill, climatic conditions, the thickness of the waste layer, the nature of the coverage (Clement B, 1995; Khattabi H, 2002; Mahler et *al*., 2005) and a function of time as the age of the site in particular (Farquhar., 1989; Christensen et al, 2001). In consequence, it is very difficult to make general recommendations for their effective treatment. The selection and application of a treatment method depends on the discharge characteristics under consideration.

The present work has as main objective the physicochemical characterization of leachate generated by the uncontrolled discharge of the city of Sefrou which are currently neither collected nor treated and comparison of analyzed parameters with those of Moroccan standards of discharges.

The area of study

The discharge of the town of Sefrou is a non-controlled landfill serving the entire urban area of Sefrou and the suburbs located outside the urban area (Figure 1). It is located on the right bank of the road to Lmmenzel, east of the city, less than3kmfrom the city center. To have access to the discharge is through the regional road (RR503) towards Lmenzel with a distance of 2.5 km from the downtown of Sefrou, followed by a track of 0, 6 Km.

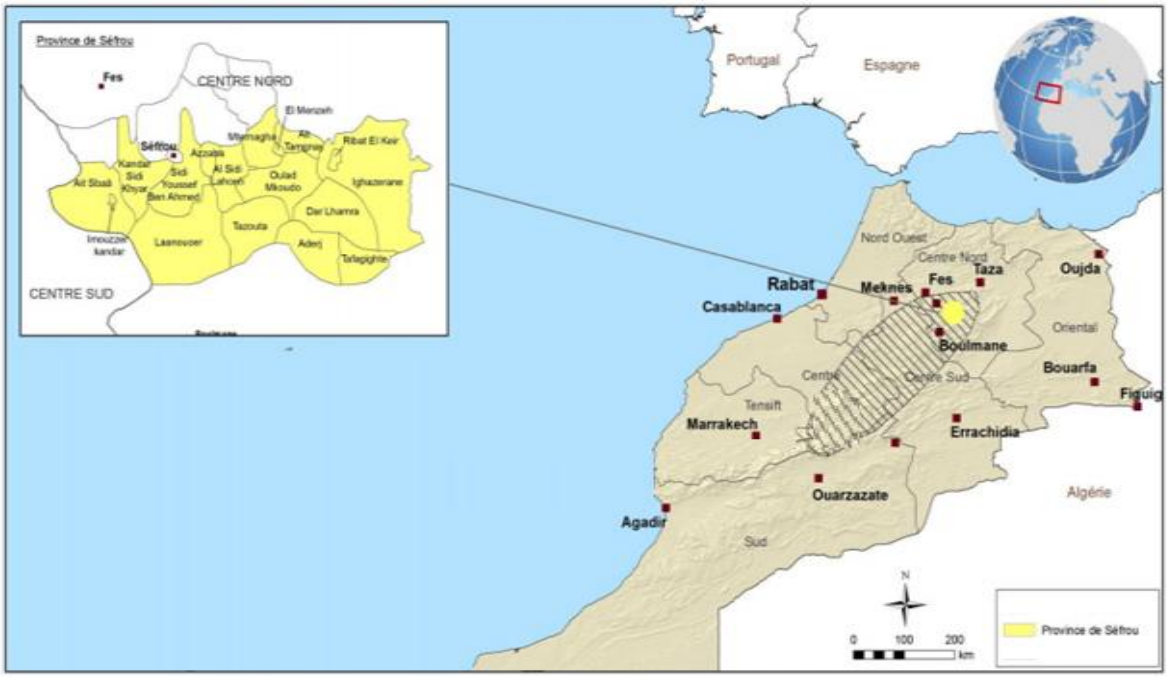

Fig 1. Map of the Province of Séfrou.

MATERIALS AND METHODS

Sites of leachate samples

The sampling sites were chosen to ensure all sides of the discharge Sefrou order to have a representative selection. We looked at five stations, whose location is shown in Fig 2. These samples were taken over a period of one year from in January to December 2013.

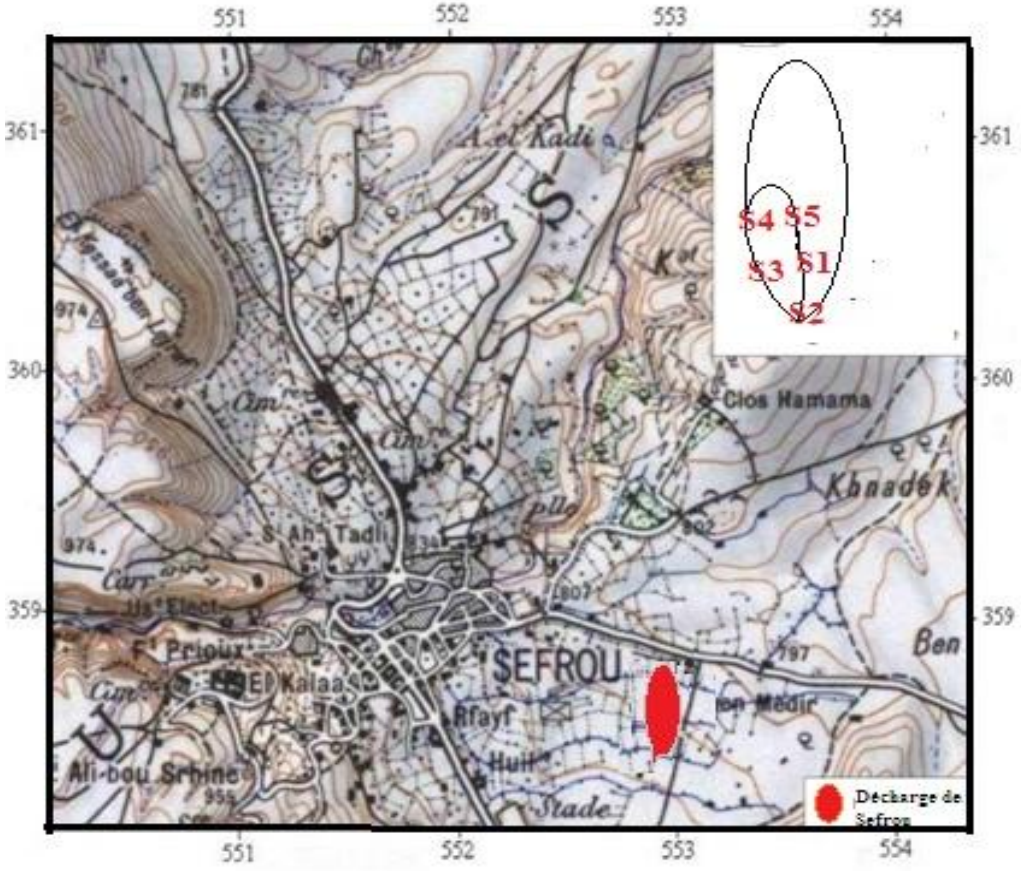

Fig. 2. Map of the sampling sites Location.

Sampling and physicochemicalanalyzes

Laboratory assay

Parameters	Unit	Device used
Temperature	° C	Thermometer mercury-based
Hydrogen Potential	------	PH -meter model HANNA instruments
Electrical Conductivity	us / cm	Multi-parameter analyzer - CONSORT C535
Salinity, hardness	mg / l	CONSORT Multi-parameter analyzer - C535
Dissolved oxygen	mg / l O_2	CONSORT analyzer Multi-parameter - C535

Field assay

Biological demand of oxygen	mg / l O_2	device OxiTop
Chemical Demand of Oxygen	mg/ l O_2	C214 (HI83214) HANNA instruments

RESULTS AND DISCUSSION

The Temperature

The temperature plays an important role in the solubility of salts and especially gases and conditions the balances of dissociation (El Maroufy, 1992). Any change in this parameter causes an imbalance in the aquatic ecosystem, as well as all the physico-chemical and biological reactions.

The values of temperature of the leachate stored in the five stations vary from 17,9 to 21,9 ° C with an average of 20,04°C (Figure 3). The maximum value is recorded at station 2. The values of the recorded leachate temperature are below 30°C which are considered as the limit value of direct discharge in the receiving environment (Anonymous, 2002). These results can be explained by that more than we approximate mass of waste, leachate temperature increases due to existing aerobic reactions which occur during the filling of the basin (Lama et al., 1999) and contrary to the sites (S3 and S4) situated a little far from the waste mass.

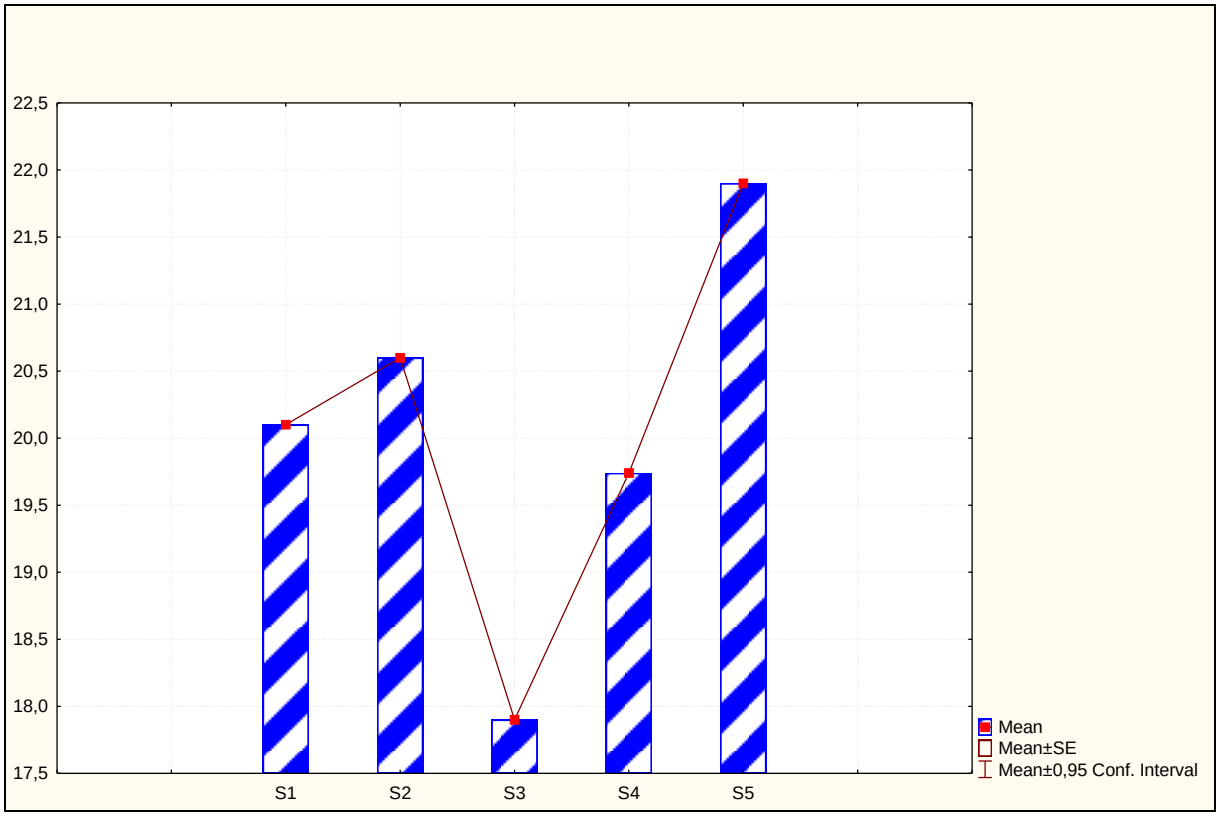

Fig 3. The values of T ° C of leachate recorded in the 5 stations.

Hydrogen's potential

The measurement of the acidity or alkalinity of a liquid is designated by the term pH. It mostly depends on the origin of water, the petro-graphic nature of the traversed terrain, the quality and quantity of waste (Bennasser., 1997; Dussart and Bouchardy., 1993). It is very sensitive to temperature, salinity, and the respiration of the organisms (Alexander and al., 2005).

The pH values of the leachate stored in the five stations vary from 6,4 to 8,18 with an average of 7,27 (Fig 4).

It is noted that the stations 2 and 5 show slightly more acidic leachate (6,5- 6,8) in relation to stations 1, 3 and 4.These values are still close to one another and lie in the interval of the limits of direct discharge (Anonymous, 2002) which is between 6.5 and 8.5 and nearly identical to that of Tangier and Kénitra landfill leachate who are also of the same order of magnitude that those obtained by El Khamlichi and al. (1997) on the discharge of Rabat.
This basic character revealed, characterizing the old landfill, is in accordance with that obtained by Kouadio et al. (2000) and Kouamé (2007).These values obtained may be related to the low concentration of volatile organic compounds. Indeed, during the acid fermentation, first phase of anaerobic decomposition of waste, the young percolas are rich in volatile organic compounds. During this phase, the pH values are generally lower than 4 (Tchobanoglous et al. , 1993). According to the ageing of the discharge, the leachate becomes impoverished of volatile organic compounds. This is then going to pull a rise of the pH to 7 or more (Kjeldsen and al., on 2002).

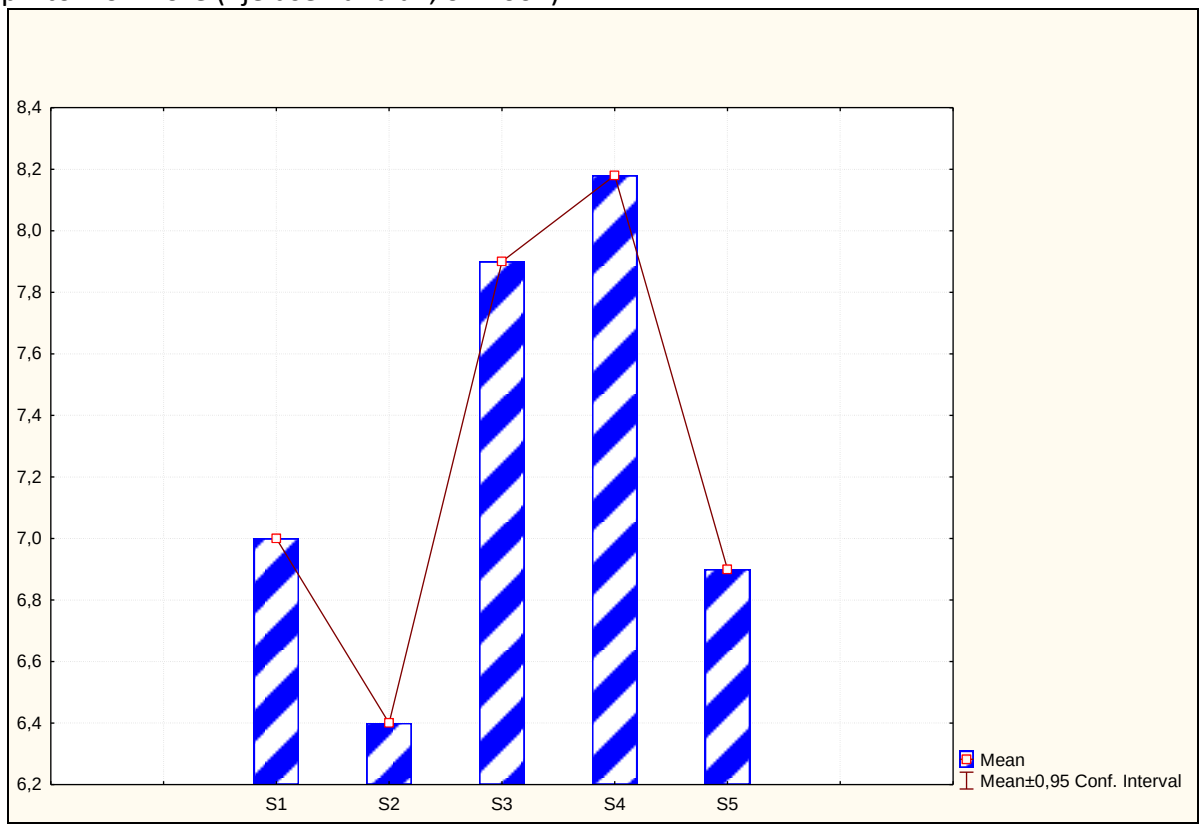

Figure 4. The value of leachates' pH in view of the five stations.

Table 1. Evolution of leachates' pH versus time (Thonart et *al.*, 2002).

Age of landfill	leachate pH
0-2 years	important Acidification and the variable
2-6 years	0,71.t pH = 4.5
After 6 years	pH Stabilization 8 to 8.5

The total hardness

This parameter represents the water content in salts of earth alkaline metals (calcium salts, magnesium, strontium and barium).

Since strontium and barium are often present in water in traces forms, the total hardness is reduced to its calcium and magnesium ion concentration which is expressed in milli moles or milligrams per liter (mmol / l or mg / l) or French degree (° F).
The analysis of the results shows that the average concentration of the total hardness is recorded at the level of about 3.7mmol/l. This removed value shows a strong mineralization of leachate.

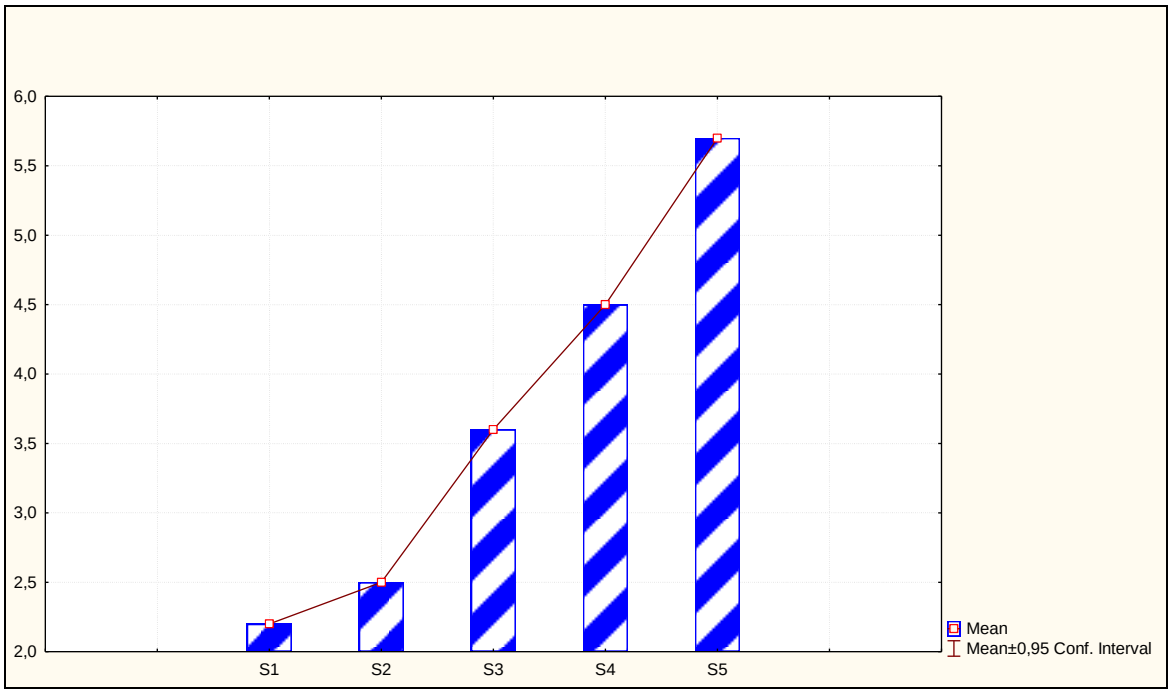

Fig. 5. The total hardness values of leachates recorded in five stations.

The Electrical Conductivity

Conductivity is the ability of a solution to conduct an electric current. This ability depends on several factors such as the presence of ions and their total concentrations.
The electrical conductivity values which are recorded in the five stations vary from 2260 µs/cm to 4332 µs /cm with an average of 3216, 6 µs/cm.This value is higher than 2700 µs/cm (considered as the limit value of the direct discharge in the receiving environment) and lower than those recorded in the discharge of Etueffont , El Jadida and Tangier
The results show a strong mineralization especially for the station 5who represents the maximum value (Fig. 6).

Salinity

Salinity of water corresponds to its concentration of dissolved salts as a whole. It is expressed either by the value of the electrical conductivity (EC) or the dry residue (DR).
Salinity present the same variation as the electrical conductivity with high values and an average of 1761 mg/l , confirming the strong mineralization of leachate with a maximum value 2450 mg / l recorded at station 5 (Figure 7) .
The measured salinity values are unacceptable according to the Moroccan standards (Decree of 09/08/2006 fixing the Moroccan discharge standards).

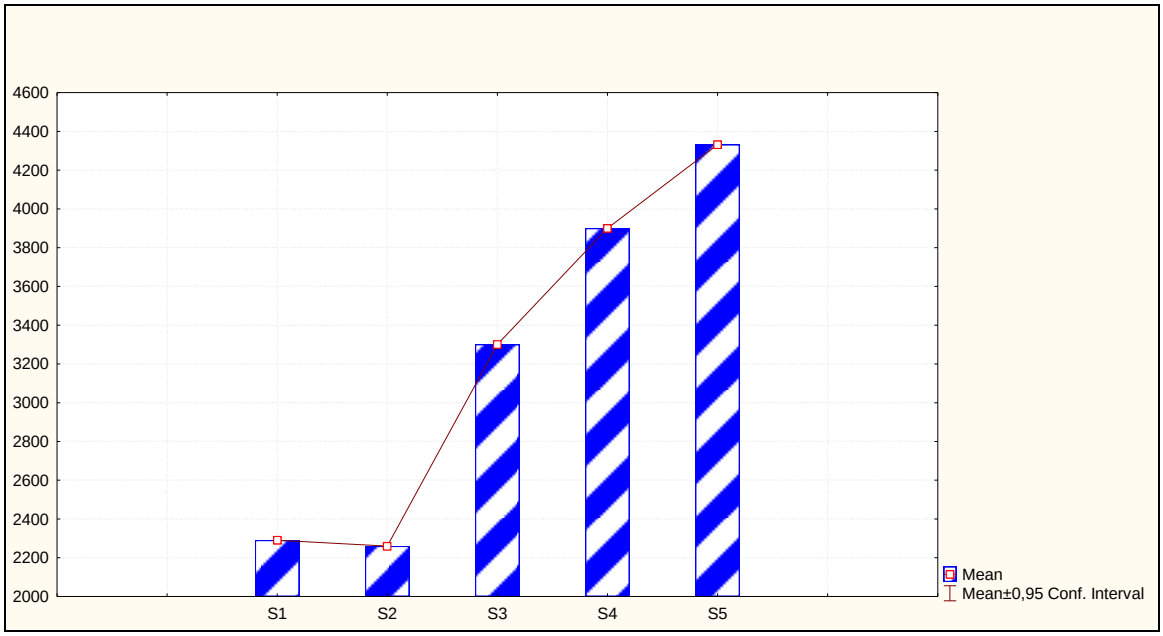

Fig. 6. The values of the electrical conductivity of the leachate stored in the 5 stations

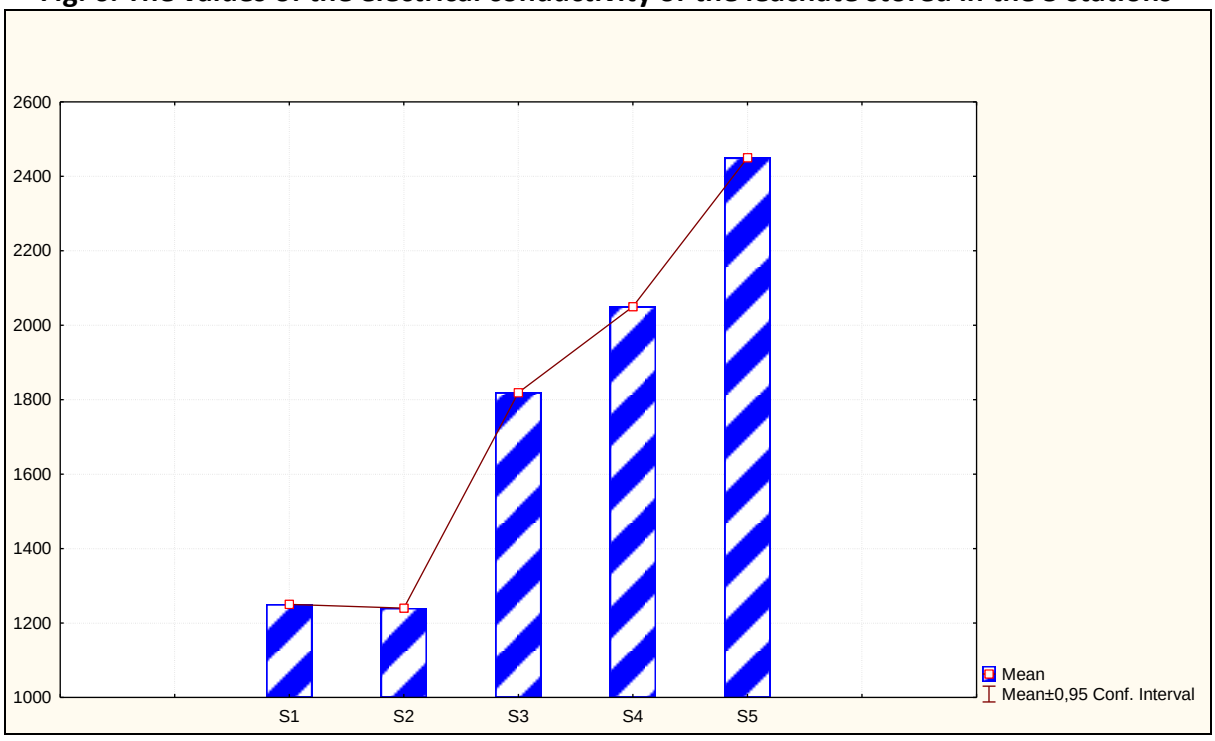

Fig.7. Variation in Salinity in the 5 stations.

The dissolved oxygen

The Dissolved Oxygen (O2 dis) is very important in that it determines the status of several minerals, degradation of organic matter. The leachate contents of the dissolved oxygen depend on the biological activity of the environment.

The state of oxygenation of the leachate shows that the dissolved oxygen concentrations oscillate between 0,1mg d'O2 / l and 0, 38 mg d'O2 / l. These values show a low oxygenation and allow deducting that these leachates have a very poor quality (1mg / l).

Biological Demand in Oxygen

The BOD_5 is a valid way to the study of natural phenomena of degradation of organic matters. It is defined as the amount of oxygen consumed by the micro-organisms for the degradation of organic matters by biological means. This measure indicates the amount of organic matter present in the leachate, hence its "concentration" in organic wastes.

The values of the content of oxidizable organic matter (BOD5) imported by the discharge vary from 1570 to 4600 mg / l. These high values reflect the abundance of organic matter and are above 100 mg / l, considered direct discharge limit value and very high compared to those found in landfills Rabat and El Jadida.

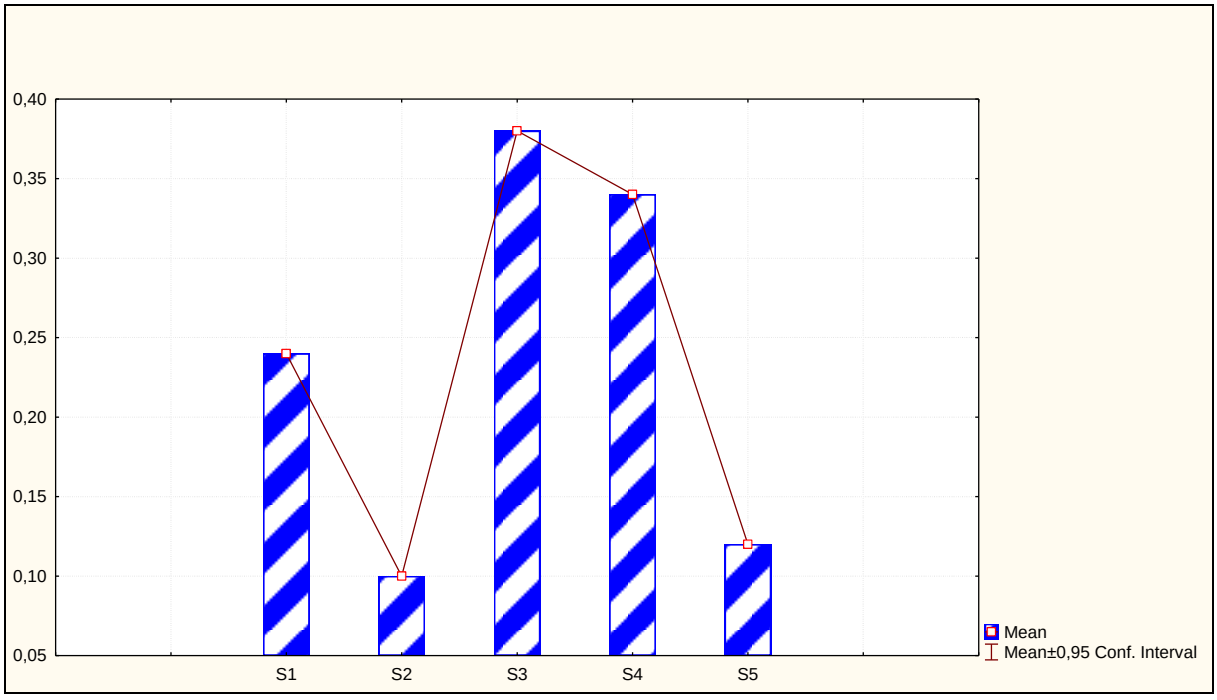

Fig.8. The contents of Dissolved Oxygen leachate recorded in the five stations.

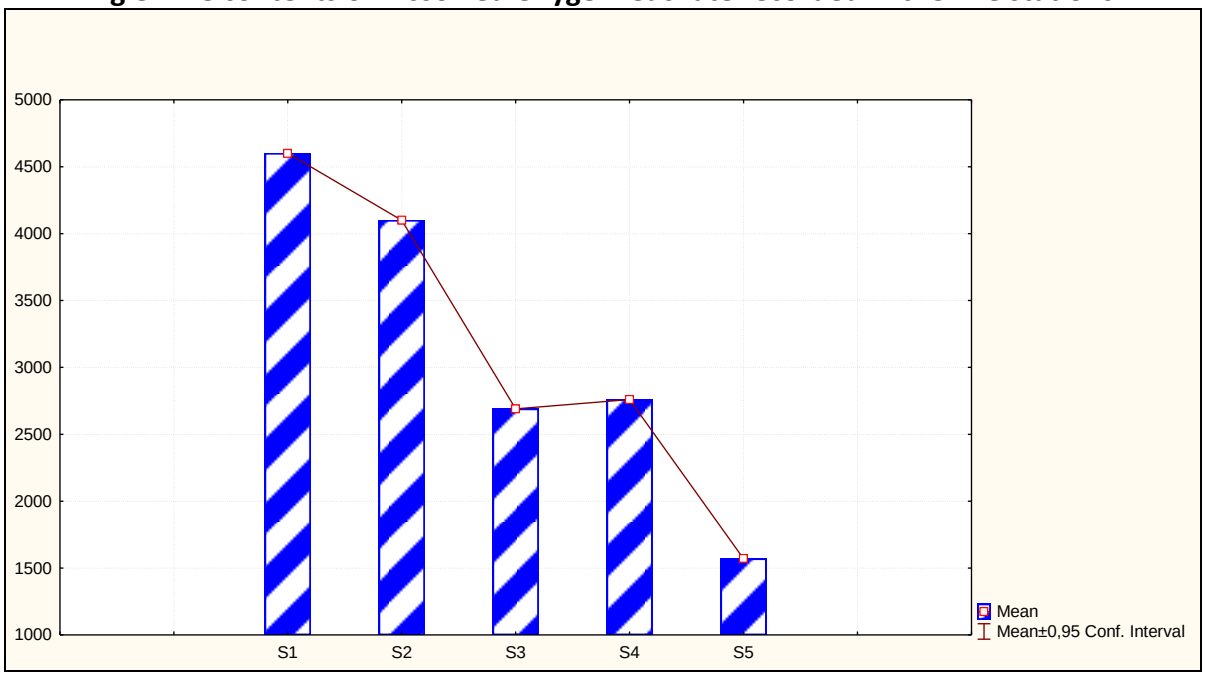

Fig.9. Changes at the level of BOD_5 measured in the five station leachate .

Chemical Demand of Oxygen (COD)

The chemical demand in oxygen is the amount of oxygen needed to oxidize the oxidizable organic compounds and inorganic salts (Makhoukh et *al*., 2001), which are contained in the sample.

The values of the DCO vary between 5500 and 12000 mg d'O_2 / l, the maximum value is recorded at the station 5 (Figure 10). These values which are clearly superior to that obtained in the discharge of Tiaret (Mokhtaria and al., 2007), confirm the important organic load revealed in these leachates.

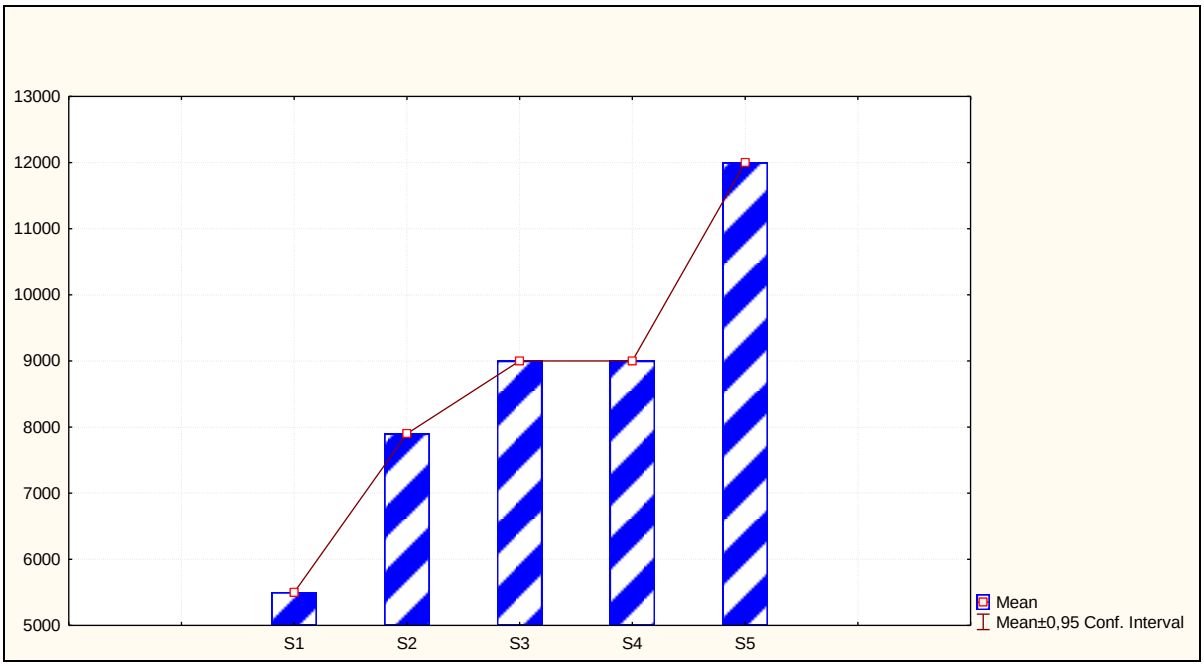

Fig. 10. The variation of the levels of COD measured in the five stations.

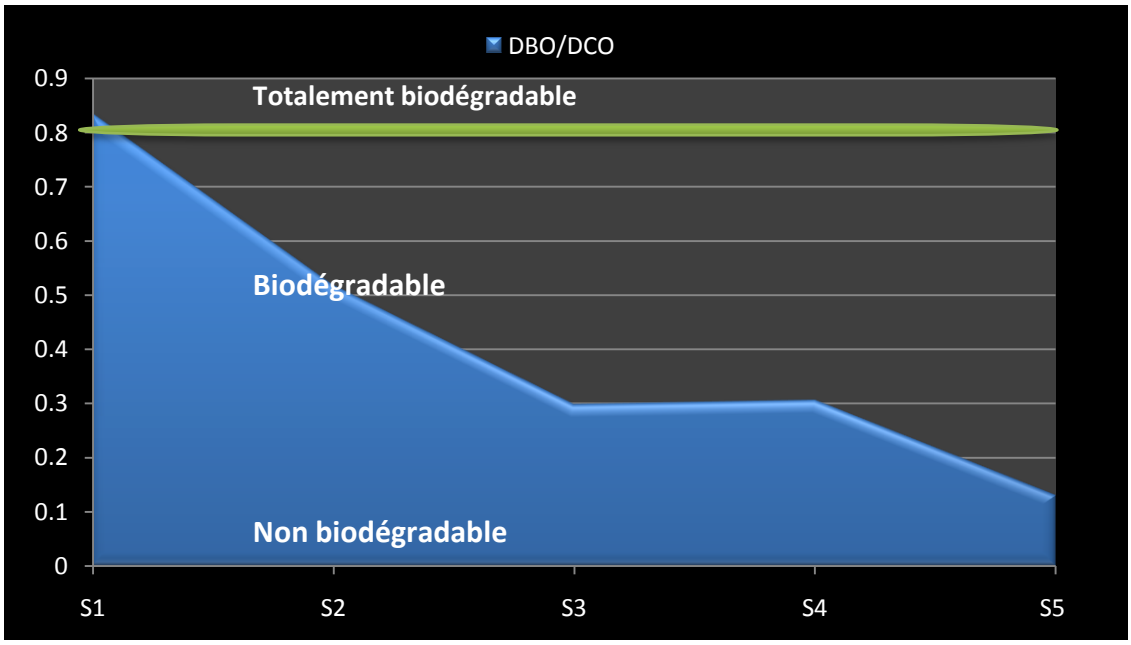

Fig. 11 Variation of the report DBO/DCO.

The report DBO/DCO

The report DBO / DCO reflects the biodegradability of the organic matter in leachates and age of the land fills, it generally varies from 0.8 for the young landfills to less than 0.1 for old landfills. It indicates that a big part of the organic matter in the leachate of the young landfill is biodegradable. On the contrary, there is a significant amount of biologically inert materials in leachates from of old landfills that are stable (for example, compounds type humic and fulvic acids) (Anonymous, 2010 *).

The values of reports BOD5/COD are between 0.13 and 0.83 with an average of 0.41. These values show that the leachates from the landfill of Sefrou are rich in biodegradable organic matters.

CONCLUSION

This work was given for objective to estimate the degree of pollution of the leachates of the discharge from the city of Sefrou. The results show that, for the majority of the analyzed parameters, the pollution is obvious and the Moroccan standards of liquid discharge are often exceeded.

Besides, the average values Found for the Potential of hydrogen potential, Conductivity, Salinity, Hardness, DBO5 and DCO allows to conclude that the levels of pollution load are essentially organic more that mineral and according to The values of reports DBO5/DCO we can conclude that the studied leachates are intermediate leachates with mediocre biodegradability

The variation of these parameters is also remarkable compared with to the location of the sampling sites is to say more than we take away from the mass of waste leachates becomes more stabilized.

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