

# Physico-Chemical Analysis of Wellwater in the Area of City Seimad Located in the First Borough of Nosy be Hell-Ville (District of Nosy be)

Razafitsiferana Theophile \*, Bruno Razanamparany, Mihasina Rabesiaka,  
Mandrimanana Andrianainarivelo

Faculty of Science, Antsiranana University, Madagascar

**Abstract** The district of Nosy-Be located in the Mozambique Channel, north-west of Madagascar, between latitude 13° 11' and 13° 30' south and between 48° 8' and 48° 22' east longitude. The district of Nosy-Bese finds in the region DIANA, of the autonomous pronation of Antsiranana of the Country Madagascar. Is made up of five districts, the district of CITE SEIMAD is in the first Arrondissement. The objective of this work is to determine the concentrations of physicochemical and microbiological parameters of well water in the CITE SEIMAD neighborhood. Temperature 16.1°C per thermometer, turbidity 1.3 NTU per turbidimeter and the pH is 6.22 per pH meter. The physical parameters found are eligible for international standards (WHO, EU and EM). Dissolved oxygen is 0.3 mg / L, salinity is 0.05 mg / L, Ammonium is 0.05 mg / L, Sodium is 3.38 mg / L, Potassium is 13.5 mg / L, Calcium is 4.8 mg / L, Magnesium is 0.97 mg / L, Iron Assay 0 mg / L, Aluminum is 0 mg / L, Lead is 0 mg / L, Copper is 0.5 mg / L and Chloride is 8.87 mg / L. The chemical parameters are admissible to the standards of potability of the water in spite of the insufficiency of some found concentrations. The anions are measured by the spectrometer and the cations by atomic absorption. The microbiological: microorganisms at 36°C is 5 Ufc / ml, Bacteria coliform is 0.01Ufc / 100ml, Escherchia coli is 0.005 Ufc / 100ml, Intestinal enterococci is 0 Ufc / 100ml and Spores of microaracisms is 0 Ufc / 100ml, we use the method of H. Vicent, modified techniques of Diénert and the method of R. Buttiaux. CITE SEIMAD well water is not microbial.

**Keywords** Water, Physicochemical And microbiological parameters

## 1. Introduction

The district of Nosy-Be is composed of five districts, this study concerns in the district CITE SEIMAD on the first district. A quarter of the population in the first district is in the CITE SEIMAD neighborhood. The number of inhabitants in this district is given by the following table

Frist Arrondissement	Male	female	Abroad
CITY SEIMAD	5250	6542	150
TOTAL	11942		

The people who live on the CITY SEIMAD use a large well for drinking water. The characteristic of this Well is given in the following table

Well	Diameter (m)	Volume (m <sup>3</sup> )	Depth (m)
CITY SEIMAD	3	1500	30

This study is divided into three parts: the first by the

bibliographic synthesis, then the results of analyzes for the physicochemical and microbiological parameters, the interpretation and the discussion of these results, we will conclude with the conclusion.

## 2. Bibliographic Synthesis

Well water is groundwater: the porosity and the structure of the ground determine the type of groundwater and the mode of underground circulation of the water. Generally pollution is absence in the underground water.

Classification:

Depending on the situation of the water table: free water table, captive water table and water table.

Depending on the geological nature of the terrain: alluvial aquifer, karstic nappe and basement ply. Main Features the quality of the water depends on the land because there is a balance and an exchange of materials between the ground and the water that is there. Groundwater has: Low turbidity Temperature is one of the physical parameters.

\* Corresponding author:  
razafitsiferana78@gmail.com (Razafitsiferana Theophile)  
Published online at <http://journal.sapub.org/re>  
Copyright © 2018 Scientific & Academic Publishing. All Rights Reserved

**Table 1.** Recommendation of the WHO

Designation of the parameters		Limit acceptable	units
Parameters microbiological	Microorganism to 22°C	<100	Ufc/ml
	Microorganism to 36°C	<20	Ufc/ml
	Coliformes	0	Ufc/100ml
	Coli	0	Ufc/100ml
	Enterocoques	0	Ufc/100ml
	Spores	0	Ufc/100ml
Parameters of aesthetic	Turbidity	5	NTU
	Temperature	25	°C
	pH	6,5 to 8,5	mg/l
Parameters inorganic	Chlorides	250	-
	Magnesium	50	-
	Sodium	200	-
	Calcium	400	-
	Potassium	<12	-
	Aluminum	0,2	-
	Nitrates	44	-
	Ammonium	<0,5	-

**Table 2.** Recommendation of the EU

Designation of parameters		Limit acceptable	units
Parameters organoleptiques	Turbidity	<5	NTU
Parameters physic-chemical	Temperature	25	°C
	pH	6,5 to 9,5	
	Chlorides	250	mg/l
	Magnesium	50	-
	Sodium	200	-
	Potassium	12	-
	Aluminum	2	-
	Toughness	50	°F
Parameters concerning the substances undesirable	Nitrates	50	mg/l
Parameters toxic	Lead	<0,5	mg/l

**Table 3.** Recommendation of the EM

Designation of the parameters		Limit acceptable	unitis
Parameters organoleptiques	Turbidity	<5	NTU
Parameters physic-chemical	Temperature	25	°C
	pH	6,5 to 9	
	Chlorides	250	mg/l
	Magnesium	50	-
	Calcium	400	-
	Sodium	150	-
	Potassium	<12	-
	Aluminum	0,2	-
Parameters concerning the substances undesirable	Nitrates	50	-
	Iron	0,2	-
Parameters concerning substances toxic	Lead	0,05	-
Parameters microbiological	Coliformeses total	0	Ufc/100ml
	Streptococcifecal	0	Ufc/100ml
	Coliforme thermotolerant	<1	Ufc/100ml
	Sulfite-Reducing	<1	Ufc/20ml

Low oxygen concentration

Low contamination (bacteria, viruses ...) the source of drinking water in general is surface water and groundwater  
A free web is sensitive to the captive web.

The free layer is fed by the whole surface of the ground situated above it.

Metals can exist in water the presence of pollution in drinking water is very dangerous Quality standard: for drinking water is referenced by the recommendation of the World Health Organization (WHO), the European Union (U.E) and the Malagasy State (E.M).

**Norm of quality**

**1 - Recommendation of the WHO**

**2 - Recommendation of EU**

**3 - Recommendation of the EM**

**3. Analysis Parameters**

Temperature, turbidity to know the transparency of the water, pH to know the water is acidic, basic or neutral. Dissolved oxygen makes it possible to estimate the amount of organic matter in the water.

Salinity is the measure of the concentration of salt in water. Ammonium to know the existence of pollution in water. Calcium, magnesium, sodium and potassium are essential elements for the nutrition of human life.

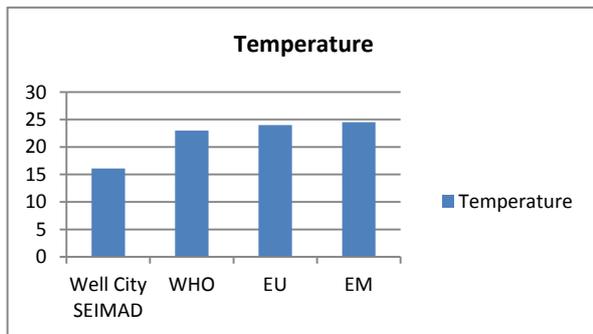
**4. Results of Measures**

**I – Physical parameters**

**1 – Temperature**

**Table 4.** Represents of the temperature

site	Temperature ( °C)
Well City SEIMAD	16,1
WHO	<25
EU	<25
EM	<25



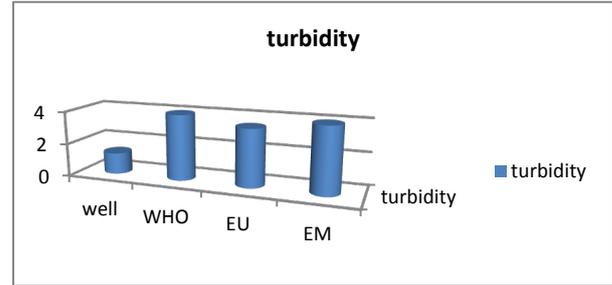
**Figure 1.** Temperature measurement

The value of the temperature found is 16.1°C so it is acceptable for the three potability standards because the value is <25°C. [3]

**2 – Turbidity**

**Table 5.** Represents the measurement of the turbidity

Site	Turbidity (NTU)
Well city seimad	1,3
WHO	<5
EU	<5
EM	<5



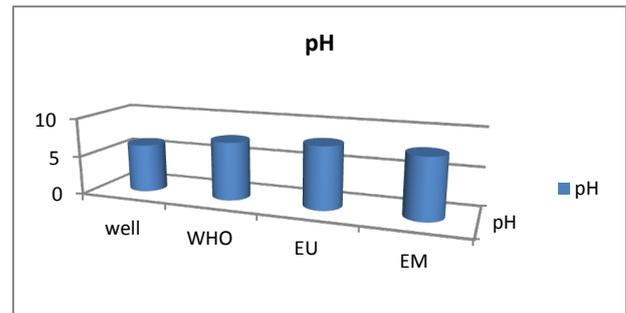
**Figure 2.** Turbidity measurement. [1]

For turbidity, the acceptable value for drinking water is 5 NTU gold for the CITY SEIMAD Well is equal to 1.3 NTU; it perfectly meets the required condition.

**3 – pH**

**Table 6.** Represents the measurement of the pH

Site	pH
Well city seimad	6,22
WHO	6,5 - 8,5
EU	6,5 - 9,5
EM	6,5 - 9



**Figure 3.** pH measurement

The pH is outside the required value because for CITY SEIMAD Well water is 6.22, while the three potability standards require this value to be 6.5 to 9, according to this results therefore the water in the vicinity of the acid. [3]

**II – CHEMICAL PARAMETERS**

**1 – Dissolved oxygen**

**Table 7.** Measurement results of dissolved oxygen concentration

Site	Dissolved oxygen (mg/L)
Well City Seimad	0,3
WHO	<2
EU	<2
EM	<2

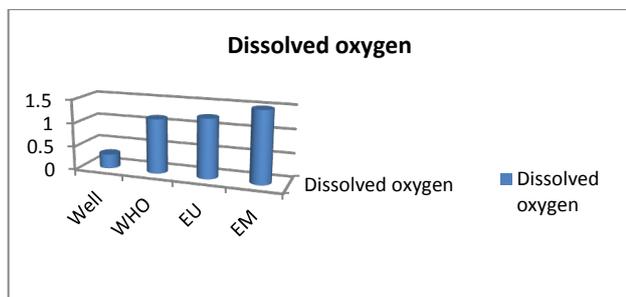


Figure 4. Dissolved oxygen

Dissolved oxygen is 0.3 mg / L less than the value requested for WHO, EU and EM. [2]

### 2 – Salinity

Table 5. Measurement results of salinity concentration

Site	Salinity (mg/L)
Well City Seimad	0,05
WHO	0
EU	0
EM	0

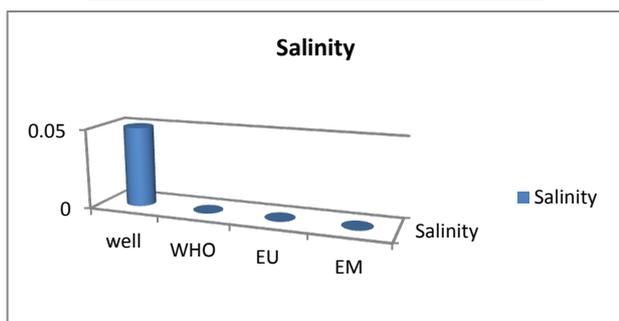


Figure 5. Results salinity

Salinity is 0 so exactly meets the required condition.

### 3 – Ammonium

Table 6. Measurement results of ammonium concentration

Site	Ammonium (mg/L)
Well City Seimad	0,05
WHO	<0,5
EU	<0,5
EM	<0,5

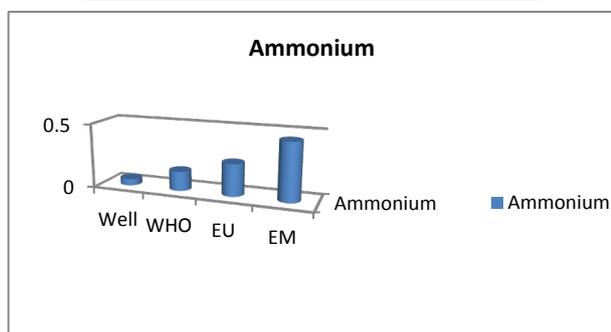


Figure 6. Results ammonium

The concentration of ammonium found is 0.05 mg / L, are lower than the three concentration values for international standards. [5]

### 4 – Sodium

Table 7. Measurement results of sodium concentration

Site	Sodium (mg/L)
Well City Seimad	3,38
WHO	200
EU	200
EM	200

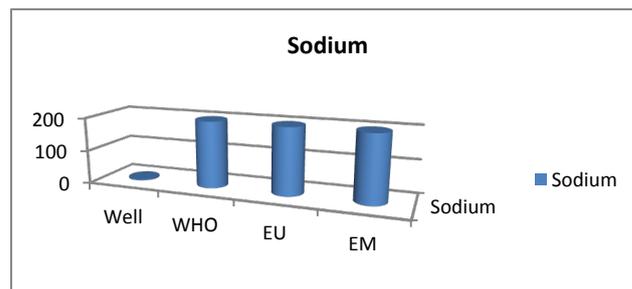


Figure 8. Results sodium concentration

The sodium concentration found is very low compared to the required values is for the Well is 3.38 mg / L, and the standard is 200mg / L.

### 5 – Potassium

Table 8. Measurement results of potassium concentration

Site	Potassium (mg/L)
Well City Seimad	13,5
WHO	<12
EU	12
EM	<12

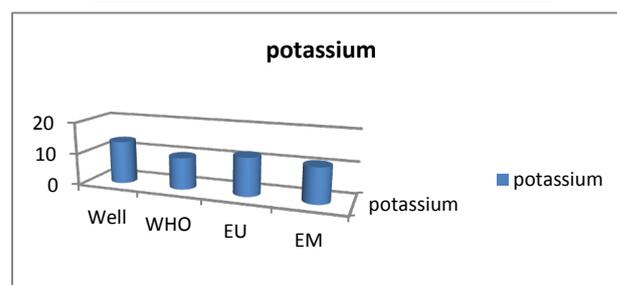


Figure 9. Results potassium concentration

The potassium concentration of CITY SEIMAD wells is in excess of the values required for drinking water standards

### 6 – Calcium

Table 9. Measurement results of calcium concentration

Site	Calcium (mg/L)
Well City Seimad	4,8
WHO	100 – 140
EU	100
EM	100

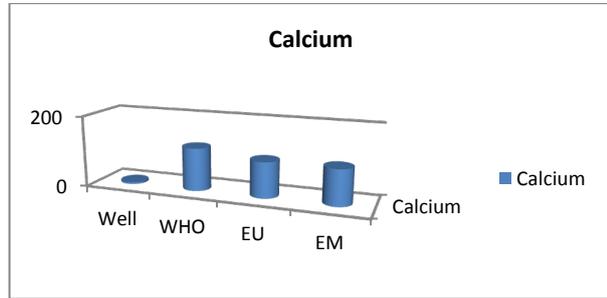


Figure 10

The concentration of calcium found is very small compared to the standards required for drinking water. So the well of City SEIMAD is not good. [6, 10]

7 – Magnesium

Table 11. Measurement results of magnesium concentration

Site	Magnesium (mg/L)
Well City Seimad	0,97
WHO	50
EU	50
EM	50

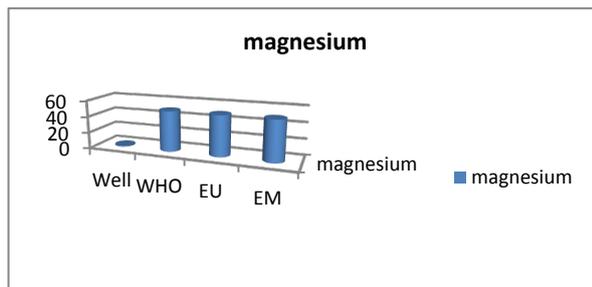


Figure 11. Results of magnesium concentration

The magnesium concentration is very low at the values required for international standards. [10]

8 – Iron dosage

Table 12. Measurement results of iron concentration

Site	Iron dosage (mg/L)
Well City Seimad	0
WHO	0,2
EU	<0,5
EM	<0,5

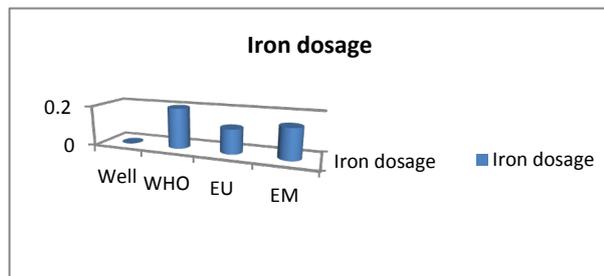


Figure 12. Results of iron concentration

Iron is only available for CITY SEIMAD well water. [9]

9 – Aluminum

Table 13. Measurement results of Aluminum concentration

Site	Aluminum (mg/L)
Well City Seimad	0
WHO	<0,2
EU	2
EM	<0,2

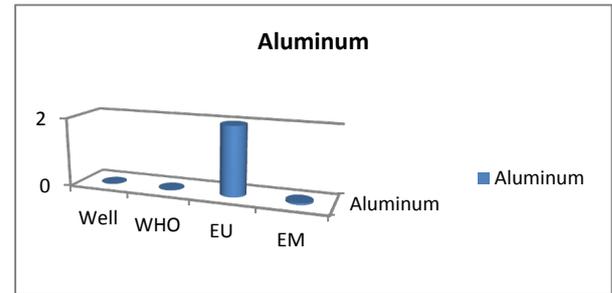


Figure 14. Results of Aluminum concentration

Aluminum is only available for CITY SEIMAD well water. [4]

10 – Copper

Table 14. Measurement results of copper concentration

Site	Copper (mg/l)
Well City Seimad	0,5
WHO	<5
EU	5
EM	5

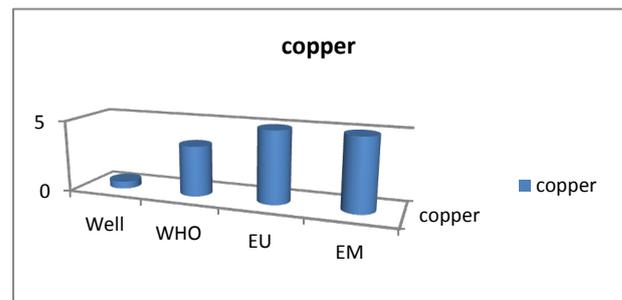


Figure 15. Results of copper concentration

Copper exists but in the form of a trace, so no problem for drinking water [8].

11 – Lead

Table 15. Measurement results of lead concentration

Site	Lead (mg/L)
Well city seimad	0
WHO	<0,5
EU	<0,5
EM	<0,5

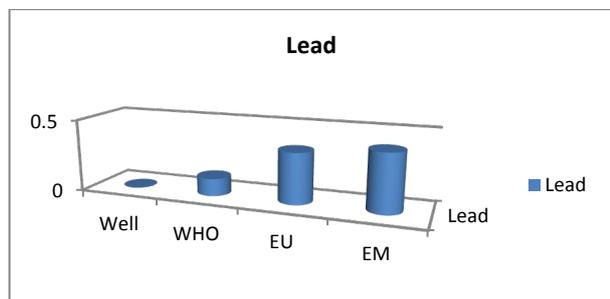


Figure 16. Results of lead concentration

Lead also does not exist for this water [11].

### 12 – Chlorides

Table 16. Measurement results of chlorides concentration

Site	Chlorides (mg/L)
Well City Seimad	8,87
WHO	<250
EU	<250
EM	250

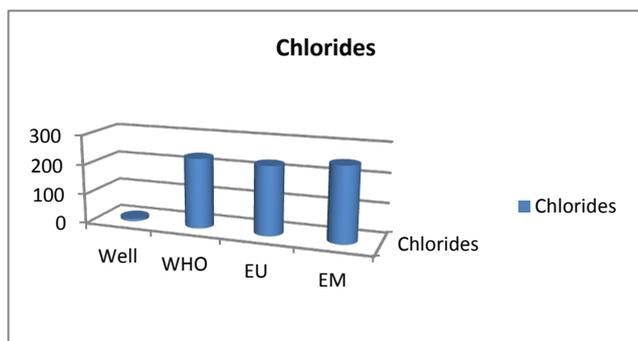


Figure 17. Results of chlorides concentration

The concentration of chloride found is very low by international standards for drinking water, so the water is not good. [7]

### III- MICROBIOLOGICAL ANALYSIS

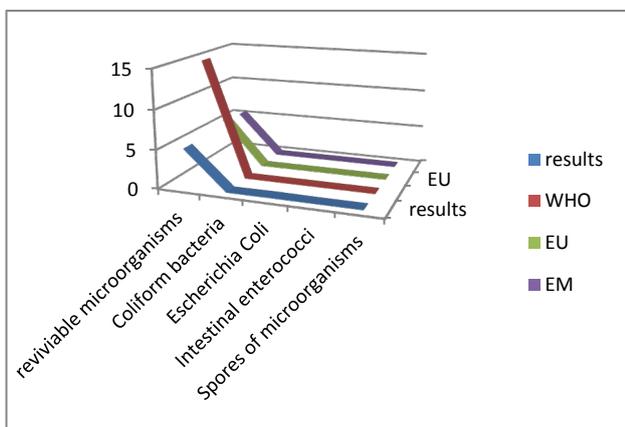


Figure 18. Results of the microbiological

Table 18. Measurement results of the microbiological

Well City Seimad	results	Unit	OMS	EU	EM
Revivable microorganisms 36°C	5	Ufc/mL	<20	<10	<10
Coliform bacteria	0,01	Ufc/100mL	0	0	0
Escherichia coli	0,05	Ufc/100mL	0	0	0
Intestinal Enterococci	0	Ufc/100mL	0	0	0
Spores of microorganisms	0	Ufc/100mL	0	0	0

The water CITY SEIMAD Well is not microbial.

## 5. Interpretation of results

### - Physical parameters

The temperature is 16.1°C, below 25°C for international standards, the turbidity 1.3 NTU less than 5 NTU for the condition of drinking water and the pH is 6.22 excluded for the standard of potability. The turbidity is 100%, the pH is 88% and the temperature is 100% for the standards required for drinking water, so from these values it can be written that the physical parameter corresponds perfectly to 96% of the values required for international standards.

### - Chemical parameters

The dissolved oxygen is 0.3 mg / L, the required concentration is <2mg / L so it is acceptable.

Salinity does not exist for the water of CITY SEIMAD.

Ammonium is 0.05 mg / L, the required value is <0.5 mg / L, so the water is less polluting.

The potassium concentration is higher than the values requested for WHO, EU and ME.

The concentration of sodium found is 3.38 mg / L, but the required values are 200 mg / L; the calcium concentration found is 4.8mg / L, their required values are 100mg / L and the magnesium is 0.97mg / L, the required value is 50mg / L.

In conclusion, according to this comparison the water is low in sodium, calcium and magnesium.

Metals like copper, aluminum, iron and lead do not exist for the water of CITY SEIMAD.

### - Microbiological analysis

from the values found have can write: Revive microorganism at 36°C, Intestinal Enterococci and Spores of microorganisms meet 100% for the standards required for drinking water, while Coliform bacteria and Eschericia coli respond to 95%, In conclusion at the bacteriological level, according to this value, it is possible to write the result that it meets 98% of the norm required for drinking water.

## 6. Conclusions

Physical parameters are eligible for the three international standards required for drinking water.

Chemical parameters: the concentrations found are almost

insufficient to drinking water standards, for which I propose the demineralization before being used. No trace of metals for this water well CITY SEIMAD.

No danger also at the level of the bacteria for the well water of CITY SEMAD.

---

## REFERENCES

- [1] C.C.HACH et al. (1995). Understanding turbidity measurement. Hach Co. Technical information Ser Booklet 11, Loveland. Colo.
- [2] S.MUANGKAEW et al. (2002). A reverse-flow injection analysis method for the determination of dissolved oxygen in fresh and marine waters, *Talanta*.58: 1285.
- [3] W.F. LANDELER. (1964). Effect of temperature on the pH natural. *J.A.W.W.A.* 38, p.179.
- [4] H.H. YEH et T.M. CHUANG (1994). The analysis of residual aluminium and its application in drinking waters treatment, *Aqua*.43: 76.
- [5] G. VAN BENEDEN (1953). Les techniques de dosage des azotes dans les eaux. *C.B.E.D.E.* 36. P. 112.
- [6] T.J. CAROWELL. Et al. (1990). Determination of calcium in waters, milk and by discontinuous-flow analysis. *Analyst*. 115:1235.
- [7] A.T. HAJ-HUSSEN (1996). Ultraviolet determination of chloride in water by flow injection analysis. *Analytical Letters*, 29: 793.
- [8] A.R. GAHLER (1954). Colorimetric determination of copper with neocuproine; *Anal. Chem.* 28 p. 174.
- [9] M.T. DOIG and D.F. MARTIN (1971). Effect of humic acids on iron analyses in natural water. *Water Res*, 5: 689.
- [10] Z. CHEN et M.A. ADAMS (1998). A metallic cobalt electrode for the indirect potentiometric determination of calcium and magnesium in natural waters using flow injection analysis. *Talanta* 47: 779.
- [11] J. RANCHET et coli. (février 1992). Essais interlaboratoires: dosage de Cd, Ct, Cu et Pb dans des solutions synthétiques par spectrométrie d'absorption atomique sans flamme. *Analisis*. 10. p. 71-77.