

# Analysis of the Parameters: Physical, Chemical and Microbiological Water of Farihy Soldier in the District of Nosy-Be

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**Abstract** The island of Nosy-Be is exceptional in Madagascar, because of its reliefs. The objective of my work is the determination of the physical parameters, chemical parameters and the microbiological parameters so that the water of the Farihy Soldat is drinkable for the population of Nosy-Be. Physical parameters in general are good because the temperature is 16°C, the standard <25°C, the turbidity is 1.82 NTU the norm is <5NTU, the pH is 7.1 the norm is between 6.5 to 8.5 and the conductivity is 219µS / cm the standard is between 180 to 1000µS / cm. The chemical parameters is admissible for drinking water without the insufficiency of some concentrations, the dissolved oxygen 1.1 mg / L the norm is <2mg / L, the salinity is 0mg / L the norm is 0mg / L, the TAC is 10°f the standard is <11°f, the nitrate is 0.7mg / L the standard is 44mg / L, the TH is 19,28mg / L the standard is 50mg / L, the iron is 0mg / L the standard is <0.2mg / L, Ammonium is 0.05mg / L standard is <0.5mg / L, sodium is 6.9mg / L standard is 200mg / L, potassium is 11mg / L the standard is <12mg / L, the calcium is 29.4mg / L the standard is 100mg / L, the magnesium is 29.16mg / L the standard is 50mg / L, the aluminum is 0mg / L the standard is <0, 2mg / L, the copper is 0.09mg / L the standard is <5mg / L, the lead is 0mg / L the standard is <0.5mg / L and the chlorides is 10.65mg / L the standard is 250mg / L. The microbiological parameters, the concentrations found are excluded to the values required for drinking water, so the water of the Farihy Soldat is microbial. Microorganisms that can be revived at 22°C and at 36°C with 145 cfu / ml, 23 cfu / ml Coliforms 1Ufc / 100mL standard is 0, Coli is <1 Ufc / 100mL, Enterococci is 42Ufc / 100mL the norm is 0. According to these results the water is microbial, so it is necessary to treat before being used, in my work disinfection is carried out by sodium hypochlorite.

**Keywords** Water physical, Chemical and microbiological parameters

## 1. Introduction

The island of Nosy-Be is located in the North-West of Madagascar, it measures 35 km from north to south and 19 km from east to west. There are 12 great sacred lakes, the Farihy Soldiers among the 12 Great Lakes.

The characteristics of the Farihy Soldier are given in the following table N°1.

Sites	Area (ha)	Volume (m <sup>3</sup> )	Mean Depth (m)	Maximum Depth (m)
Farihy Soldats	54	32.10 <sup>6</sup>	28	43



Pictures represents the soldats Farihy

## 2. Bibliographic Synthesis

The structure of the water is either liquid, solid and gaseous, with the chemical formula being H<sub>2</sub>O.

The water dissociates in OH<sup>-</sup> and H<sup>+</sup> ion, the potential of hydrogen which is shielded the two ions.

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Oxygen base dissolved gas indicates the chemical composition of the water.

Water may contain organic matter. It also contains the metals as a trace. Pollutions exist in water, their excess concentration causes or indicates the existence of the microbe in water.

The drinking water standard is recommended by WHO and the EU. [1]

### 3. Analysis Parameters

The pH to know that the water is acidic, is basic and neutral, turbidity is the transparency of a water, the conductivity allows to appreciate the quality of salt dissolved in water.

The organic matter allows to estimate the quality of organic matter in the water, the salinity is the measurement of the concentration of the salt in the water, the TAC it is the basic salt content that is to say to know the concentration of ion bicarbonate in water. The total hardness (TH) determination the calcium and magnesium content that exist in the water. Ammonium indicates an existence of pollution in water. The existence of iron in water in trace form, the upper levels of the limit values indicate that the water is not good.

Baseline parameters for drinking water ie calcium, magnesium and sodium limit values for drinking water standards are respected.

Aluminum, lead and copper are metals lords their existence in the water are very dangerous. Chloride is a major element in drinking water.

Microbial analysis plays a very important role for drinking water.

#### Norm of quality

##### 1. Recommendation of the WHO

##### 2. Recommendation of EU

##### 3. Recommendation of the EM

**Table 2.** 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 3.** Recommendation of the EU

Designation of parameters		Limit acceptable	units
Parameters organoleptiques	Turbidity	<5	NTU
Parameters physico-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 4.** Recommendation of the EM

Designation of the parameters		Limit acceptable	unitis
Parameters organoleptiques	Turbidity	<5	NTU
Parameters physico-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 undesiranle	Nitrates	50	-
	Iron	0,2	-
Parameters concerning substances toxic	Lead	0,05	-
Parameters microbiological	Coliformes total	0	Ufc/100ml
	Streptococcifecal	0	Ufc/100ml
	Coliforme thermotolerant	<1	Ufc/100ml
	Sulfite-Reducing	<1	Ufc/20ml

## 4. Results of Measures

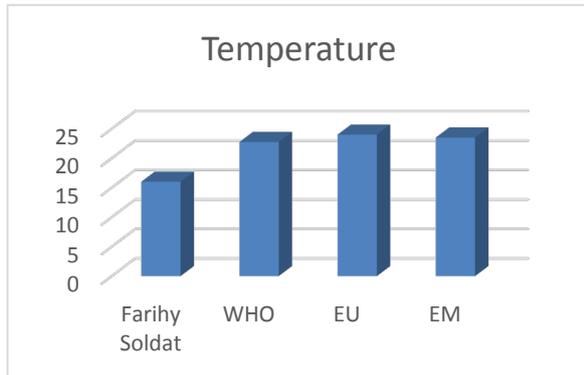
### I – Physical parameters

**1)- Temperature: [9]**

The value of the found temperature of the water of the Soldats Farihy is given by the table following.

**Table 5.** Represents of the temperature

Site	Temperature (°C)
Farihy Soldat	16
WHO	<25
EU	<25
EM	<25



**Figure 1.** Shows the water temperature value of the Farihy Soldats

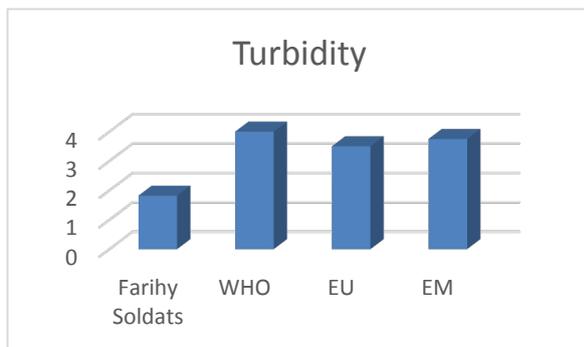
The value of the tempered temperature is 16°C, the required standard is <25°C, so this value perfectly meets the standard.

**2)- Turbidity: [7]**

The following table gives the value of the water turbidity of the Farihy Soldats.

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

Site	Turbidity (NTU)
Farihy Soldat	1,82
WHO	<5
EU	<5
EM	<5



**Figure 2.** Shows the curve of the value of turbidity

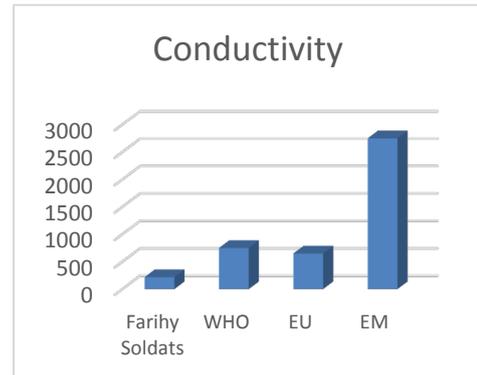
This value is 1.82 NTU, the limit value is <5NTU, so it is eligible for international standards. This value found indicates that the soldat farihy water is cloudy ie it is good for consumption.

**3)- Conductivity:**

The conductivity of the Farihy Soldiers' water is given in the following table

**Table 7.** Represents of the conductivity

Site	Conductivity (µS/cm)
Farihy Soldat	219
WHO	180 – 1000
EU	180 – 1000
EM	<3000



**Figure 3.** Shows the conductivity curve of the water

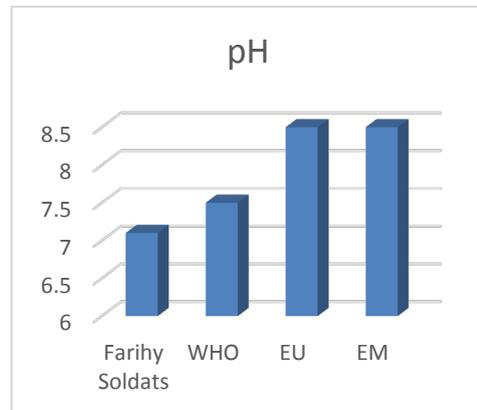
This found value is 219µS / cm, the value required between 180 to 1000 µS / cm, it is admissible for the standard of drinking water.

**4)- pH: [10] [9]**

The pH of the Farihy Soldats' water is given in the following table

**Table 8.** Represents the measurement of the pH

Site	pH
Farihy Soldat	7,1
WHO	6,5 – 8,5
EU	6,5 – 9,5
EM	6,5 – 9



**Figure 4.** Shows the water pH curve of Farihy Soldats

This found value is 7.1, the required standard is between 6.5 to 8.5, acceptable in international standards. The pH is

equal to 7.1 almost neutral so water is classified among the good quality for drinking water.

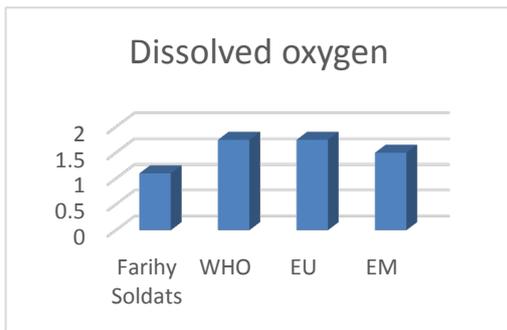
**II- Chemical parameters**

**1)- Dissolved oxygen: [8]**

The following table gives the concentration of dissolved oxygen

**Table 9.** Measurement results of dissolved oxygen concentration

Site	Dissolved oxygen (mg/L)
Farihy Soldat	1,1
WHO	<2
EU	<2
EM	<2



**Figure 5.** The figure gives the curve of the concentration of dissolved oxygen

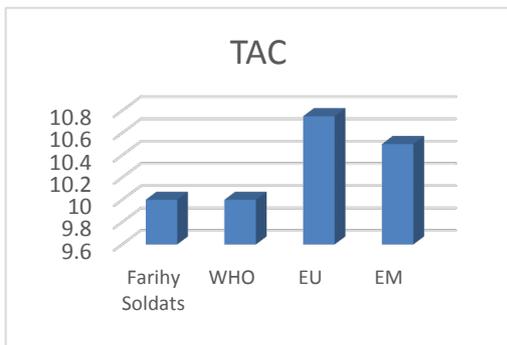
The concentration of dissolved oxygen is 1.1mg / L, the limit value is <2mg / L, this concentration found is standard for drinking water. The concentration found for dissolved oxygen is 1,1mg / L, represents that the organic matter can exist in the water, this existence leads that the water of the Farihy Soldier is polluted.

**2)- T.A.C:**

The following table gives the results of TAC.

**Table 10.** Measurement results of TAC

Site	TAC (°f)
Farihy Soldat	10
WHO	<11
EU	<11
EM	<11



**Figure 6.** The figure shows the curve of the TAC

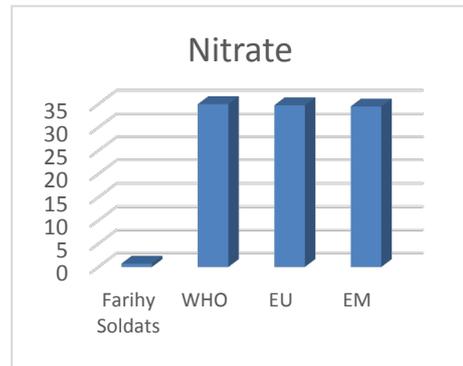
The value of the TAC is 10°f, the required value is <11°f, so the value of the TAC found is in norm. The concentration of TAC is 10°f, the alkaline levels in the water this Farihy is high, we can say that the quality of the water is pretty good.

**3)- Nitrate: [13]**

The following table shows the concentration of nitrate.

**Table 11.** Measurement results of nitrate concentration

Site	Nitrate (mg/L)
Farihy Soldat	0,7
WHO	<40
EU	<40
EM	<40



**Figure 7.** The following figure shows the curve for the nitrate concentration

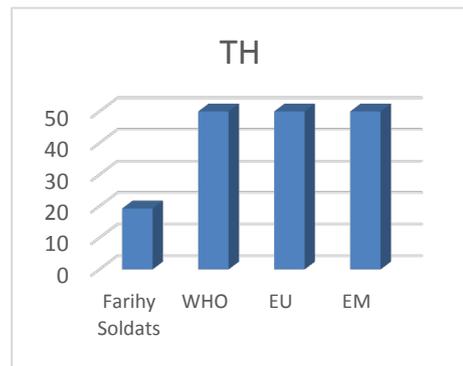
The concentration found is 0.7mg / L, the concentration limit is 40mg / L, so this concentration is acceptable. The nitrate concentration is 0.7mg / L cella indicates the water has no pollution, we can say that the water quality is good.

**4)- TH: [14] [11]**

The following table gives the concentration of hydrotimetric titer or TH

**Table 12.** Measurement results of TH concentration

Site	T H (mg/L)
Farihy Soldat	19,28
WHO	<50
EU	<50
EM	<50



**Figure 8.** The following curve gives the concentration of hydrotymetry TH

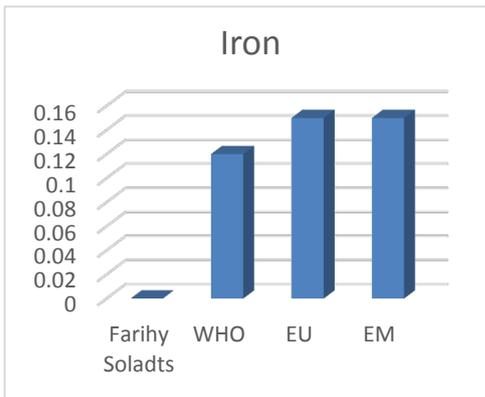
The value found 19,28mg / L, the required value is 50mg / L, so the water is good at the TH level. We can say that the water is not hard, so the quality rating is pretty good.

**5)- Iron: [16]**

The following table gives the concentration of iron.

**Table 13.** Measurement results of Iron concentration

Site	Iron (mg/L)
Farihy Soldat	0
WHO	<0,2
EU	<0,2
EM	<0,2



**Figure 9.** The following figure shows the curve of iron concentration.

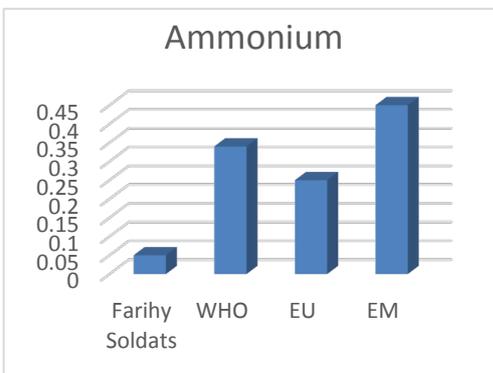
The concentration of iron found is 0, it is acceptable for the international standard for drinking water.

**6)- Ammonium: [13]**

The ammonium concentration is given in the following table

**Table 14.** Measurement results of ammonium concentration

Site	Ammonium (mg/L)
Farihy Soldat	0,05
WHO	<0,5
EU	<0,5
EM	<0,5



**Figure 10.** This figure indicates the concentration of ammonium

The concentration of ammonium found is 0.05mg / L, the limit concentration is <0.5mg / L, so this concentration is

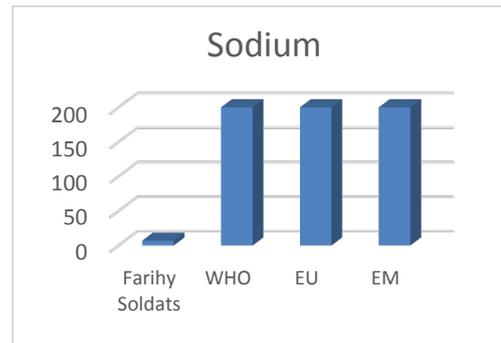
acceptable for the recommendation by WHO, EU and MS for drinking water.

**7)- Sodium: [14]**

The following table gives the measurement of the sodium concentration.

**Table 15.** Measurement results of sodium concentration

Site	Sodium (mg/L)
Farihy Soldat	6,9
WHO	200
EU	200
EM	200



**Figure 11.** This figure represents the curve of the sodium concentration

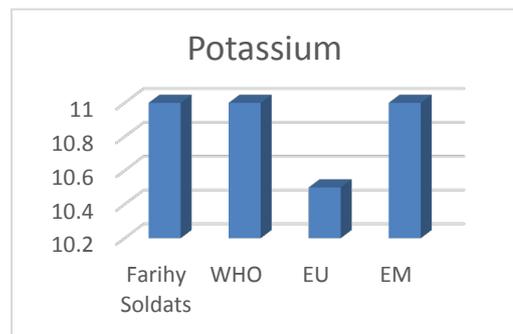
The concentration found is 6.9mg / L, the limit concentration for drinking water is 200mg / L, the value is acceptable for the standard if not their insufficiency.

**8)- Potassium: [14]**

The table below gives the concentration of potassium.

**Table 16.** Measurement results of potassium concentration

Site	Potassium (mg/L)
Farihy Soldat	11
WHO	<12
EU	<12
EM	<12



**Figure 12.** This figure shows the curve of the concentration for potassium

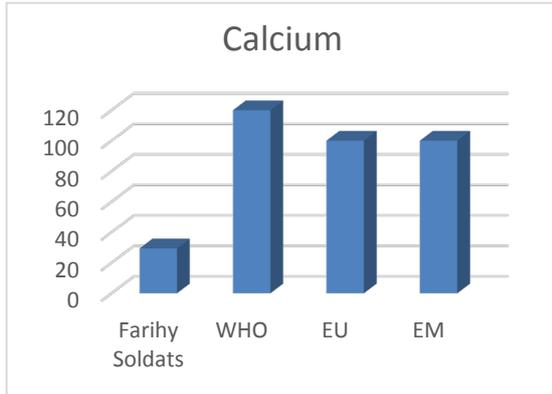
The concentration found for potassium is 11mg / L, the limit value is 12mg / L, so the potassium concentration perfectly meets this requirement. The water quality is good for water intended for human consumption.

**9)- Calcium: [14], [5]**

The table below gives the concentration of calcium

**Table 17.** Measurement results of calcium concentration

Site	Calcium (mg/L)
Farihy Soldat	29,4
WHO	100 – 140
EU	100
EM	100



**Figure 13.** This curve indicates the measurement result for the calcium concentration

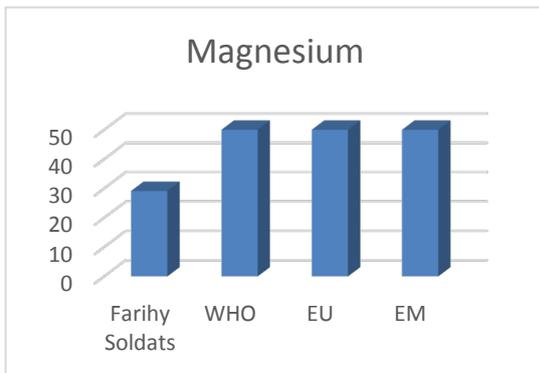
The value found is 29.4mg / L, the limit value is 100mg / L, this concentration is acceptable, but it is insufficient. The value of calcium is low may be because of this Farihy lack of limestone soil that causes calcium concentration.

**10)- Magnesium: [14]**

The table below gives the magnesium concentration.

**Table 18.** Measurement results of magnesium concentration

Site	Magnesium (mg/L)
Farihy Soldat	29,16
WHO	50
EU	50
EM	50



**Figure 14.** This figure shows the curve of magnesium concentration

The concentration found is 29.16mg / L, the limit value for drinking water is 50mg / L, so this found value is acceptable. The magnesium concentration is on average if we classify

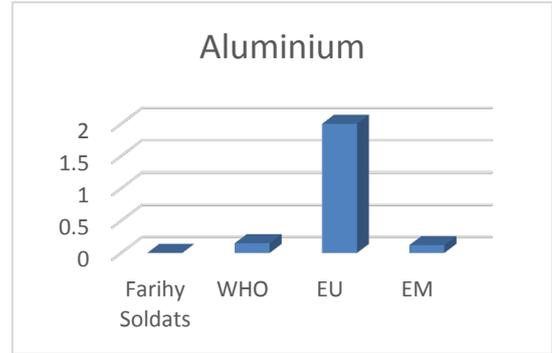
the quality of this water Farihy.

**11)- Aluminium: [12]**

The following table gives the aluminum concentration.

**Table 19.** Measurement results of Aluminium concentration

Site	Aluminium (mg/L)
Farihy Soldat	0
WHO	<0,2
EU	2
EM	<0,2



**Figure 15.** This figure indicates the concentration of aluminum in the water of the soldats Farihy

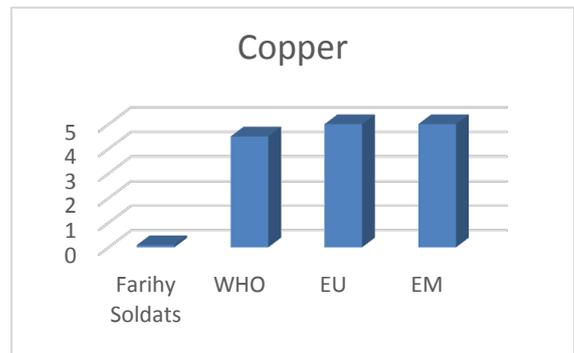
According to these analyzes, the water of Farihy Soldiers aluminum does not exist.

**12)- Copper: [3]**

The table below gives the measurement of the copper concentration.

**Table 20.** Measurement results of copper concentration

Site	Copper (mg/L)
Farihy Soldat	0,09
WHO	<5
EU	5
EM	5



**Figure 16.** The curve represents the concentration of copper that exists in the water of Farihy Soldiers

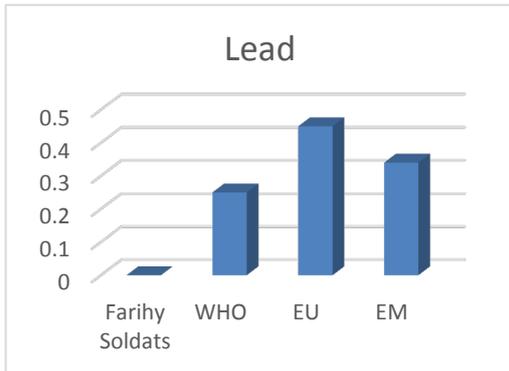
The concentration found is 0.09mg / L, the concentration limit is <5mg / L, so the concentration found is standard. The quality of the water is good and without risk of toxic for the consumers.

**13)- Lead: [3]**

The following table gives the concentration of lead.

**Table 21.** Measurement results of Lead concentration

Site	Lead (mg/L)
Farihy Soldat	0
WHO	<0,5
EU	<0,5
EM	<0,5



**Figure 17.** This curve represents the concentration of lead

The water of the Farihy Soldiers the lead does not exist.

**14)- Chlorides: [15]**

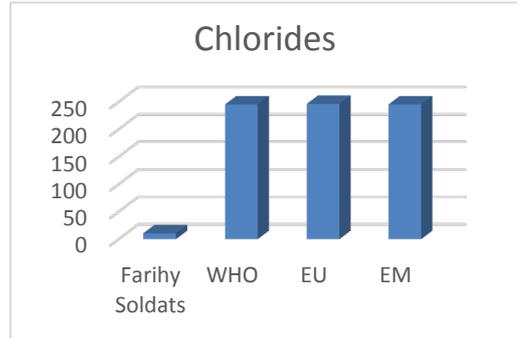
The table below gives the concentration of chloride.

**Table 22.** Measurement results of Chlorides concentration

Site	Chlorides (mg/L)
Farihy Soldat	10,65
WHO	<250
EU	<250
EM	250

The concentration found is 10.65mg / L, the limit value is 250mg / L for drinking water, so this value found is standard,

but insufficient. The concentration is low may be because of natural sources is low at the level of Natural Chloride.



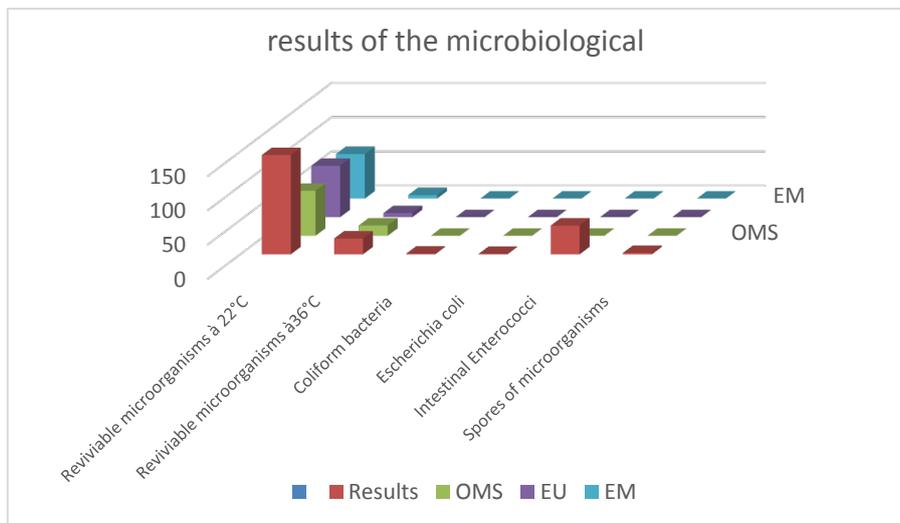
**Figure 18.** This curve represents the chloride concentration

**5. Microbiological Analysis: [6]**

The measurement results for the microbiological parameters for the Farihy Soldats water is given by the table below.

**Table 23.** Measurement results of the microbiological

Farihy Soldats	Results	Unit	OMS	EU	EM
Revivable microorganisms à 22°C	145	Ufc/mL	<100	<100	<100
Revivable microorganisms à 36°C	23	Ufc/mL	<20	<10	<10
Coliform bacteria	1	Ufc/100mL	0	0	0
Escherichia coli	<1	Ufc/100mL	0	0	0
Intestinal Enterococci	42	Ufc/100mL	0	0	0
Spores of microorganisms	2	Ufc/100mL	0	0	0



**Figure 19.** This curve indicates the measurement result for the concentration of each microbiological parameter

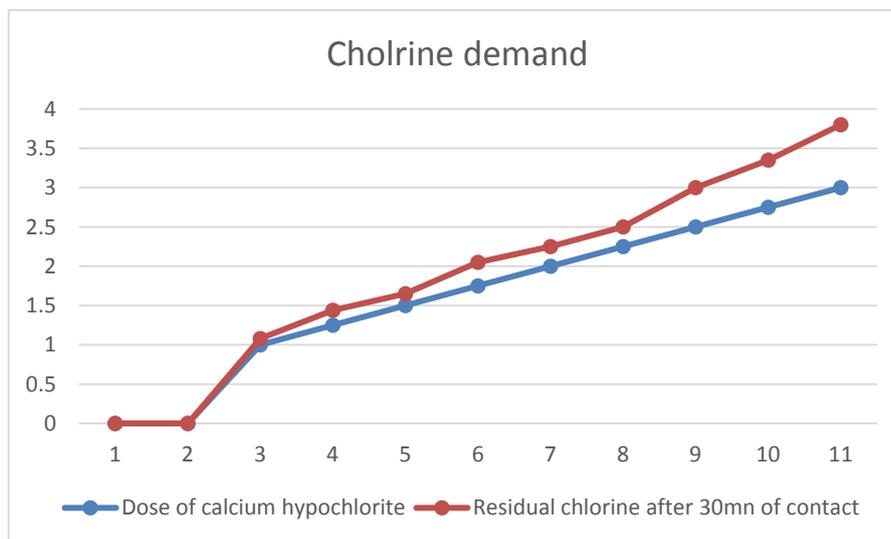
According to these results the water of the soldiers Farihy is microbial.

## 6. Treatment with Disinfection by Calcium Hypochlorite: [4]

The following table shows the measurement result for the chlorine demand.

**Table 24.** Result for the chlorine demand

Dose of calcium hypochlorite (mg/L)	1	1,25	1,5	1,75	2	2,25	2,5	2,75	3
Residual chlorine after 30mn of contact (mg/L)	0,08	0,19	0,15	0,3	0,25	0,25	0,5	0,6	0,8



**Figure 20.** This curve represents the result of the demand for chlorine, to disinfect the water of the Farihy Soldats

## 7. Results Interpretation

### ◀ For the physical parameters:

The water quality of the Farihy Soldiers responds exactly to the recommendation by WHO, EU and MS in water intended for human consumption.

### ◀ For the chemical parameters:

For the chemical parameters, such as oxygen, nitrate and ammonium, the concentrations found are low, the low content of these parameters indicates that the water does not have any pollution.

For the abortive elements like calcium, potassium, magnesium and sodium; In general, the concentrations are low, the water can be used for human consumption, but the parameters are very important for drinking water.

For lord metals, water from Farihy Soldiers no danger for metal toxicity.

The concentrations for the chemical parameters found are increasing or decreasing due to natural sources and also the populations use this water of the farihy for the supply of drinking water, used for several cultures and finally several animals that drink in this Farihy.

### ◀ For microbiological parameters:

The results found shows that the water of the Farihy Soldats is microbial.

It must be treated before being used.

My research concerning the method of disinfection by chlorination, using the dose of calcium hypochlorite after 30 minutes of contact for the disinfected.

According to this curve we find that the optimal dose to disinfect the water of Farihy Soldats is determined by the "critical point" or "break point".

So we take for disinfection the dose of calcium hypochlorite of 3mg / L.

This value is used so that the population of Nosy-Be drink water without risk of contamination.

## 8. General Conclusions

For physical parameters, the water quality of Farihy Soldats perfectly meets the international recommendation for water intended for human consumption.

For chemical parameters, the concentration of each parameter is permissible for the standard of drinking water, but the concentration found is low. So we can say that the quality of the water is not good.

Lords do not exist in the Farihy Soldiers, no risk of toxicity.

The water of Farihy Soldiers is microbial, it must be treated before being used.

The demand for chlorine can disinfect these microbes with

the optimal dose of 3mg / L.

After this treatment the population of Nosy-Be drink water without risk of contamination.

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