

Physicochemical Study of Dayet Er-Romi Lake Water, Khemisset Region

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ABSTRACT: This work has for purpose to determine the quality of the raw water of Dayet Erromi Lake in khemisset region by achievement of the physico-chemical analysis of the four samples. We have studied the effect of Some Physico-chemical parameters which are mainly: the temperature, pH, electrical conductivity, turbidity, chlorides, sulphate, calcium, magnesium and nitrates. The analytical results show that pH values are close to neutral, while the values of chlorides greatly exceeding the value guide fixed by European standards and also do not conform to the standards defined by the World Health Organization (WHO). By cons, studied waters of our stations are not subject to a risk of pollution by other physicochemical parameters.

Keywords: Lake Dayet Erromi, raw water, physical and chemical quality

I. INTRODUCTION

Throughout the world, the pressure on water resources and in particular on the groundwater resources is increasing, mainly because of the growing demand and the degradation of the water quality. Thus the demand for drinking water, irrigation, urban expansion and the industrial development are all factors that increase these pressures. The preservation of our hydraulic heritage and its sustainable management must be a major concern of our government. This management necessarily involves the implementation, at the national level, action programs against pollution of our aquatic ecosystems, whether marine or continental. Several previous studies have evaluated the physico-chemical and metallic quality of surface and deep water in the Talsint region of eastern Morocco [1-3]. Thus the lake ecosystem Dayet Er-Roumi is the only continental permanent natural lake at the Khemisset region; it is classified as a site of biological and ecological interest. As well in the previous work the evolution of the physico-chemical quality of the water in this region have been studied [4], in effect M.KHYRI and collaborators are interested in evaluating the physico chemical quality of Dayet Erromi Lake, and these authors have shown that Dayet Erromi lake has a strong mineralization [4]. A complete diagnosis of the current situation and rigorous monitoring of its evolution are needed to judge the physical and chemical quality of the water and its impact on the environment of the area: Dayet Erromi Lake.

II. MATERIALS AND METHODS

Study Area

The site Dayet Er-Roumi is located within the territory of three rural communes: Ait Ouahi; Aitlkkou and Ait Ouribel it situated 15 km from Khemisset (33 ° 45'N 06 ° 12 ') characterized by semi-arid climate with rainfall regime is Mediterranean (fig. 1). The lake is fed by groundwater and a stream from the Southeast. The Northeast, a platform corresponding to the outlet of Lake makes the junction between the lake and a permanent stream (Oued Rehhou). At the Lake north-eastern end opens a drainage channel from a marshy depression (daya of frogs) located 1-2 km north-east of the lake. Thus the lake has a climate of semi-arid, the maximum temperature is 38 ° C and the minimum temperature is 7 ° C.

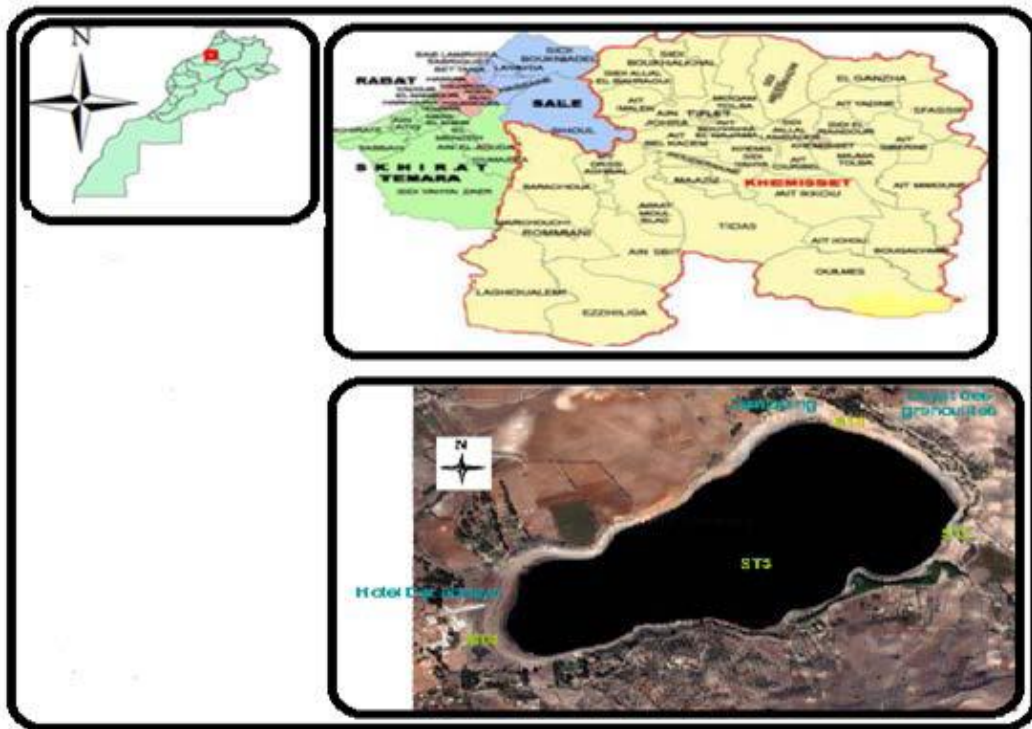


Fig. 1: Study area

Choice Of Stations

In order to determine the physical-chemical water quality of Lake Dayet Erromi, samples were taken from all four stations of March 2016. The Choice of stations has been achieved in a rational manner in order to have a good estimate of the physicochemical water quality. These stations are denoted as shown in the following table:

Table1: Stations names in Dayet Erromi Lake:

S1: Station 1	S2: Station 2	S3: Station 3	S4: Station 4
located at the north end of the lake and provides a sampling in depth to 0m	located in the center of the lake and provides a sampling in depth to 3m	located in the south west of the lake and allows a sampling in depth to 5m	located in swallows (4m) of the lake and allows a sampling in depth to 1m BV

Technical Analysis

At each station, 1.5liter of water was collected transferred to a rigid plastic bottle. The bottles are kept in a cooler at 4 ° C and transported to the laboratory as soon as possible.

III. RESULTS AND DISCUSSION

pH

PH measures the H⁺ concentration of the water; this parameter characterizes a large number of physico-chemical equilibrium and depends on multiple factors. It mostly depends on the origin of water, the petrographic nature of the land to be traversed and the quality and quantity of wastewater discharges [5]. The pH is also influenced by acid precipitation, the biological activity and some industrial releases. The values of the quality criterion of the raw water supply are located between 6.5 and 8.5 and between 6.5 and 9.0 for the Protection of Aquatic Life [6]. In our locality, the values of pH of the lake water is slightly alkaline, in effect, the higher value is saved in the station ST1 with a value of 6.70 and for the lowest value is 5.9 recorded in the station ST2 (Figure 2). As well the pH values have fluctuated between values of acids toward basic values. The results show that the values of pH are not relatively high on any part studied in the locality. This may be due to the geological context of the region. In all stations studied, these waters are favourable to irrigation (Moroccan standards). These values are also placed in the interval of potability presented by European standards (6.5 to 9). In addition, the values of the pH measured in the waters of stations surveyed place these last in the class of excellent to good, therefore the values found pH in the different stations; do not present a danger to the aquatic life in the region.

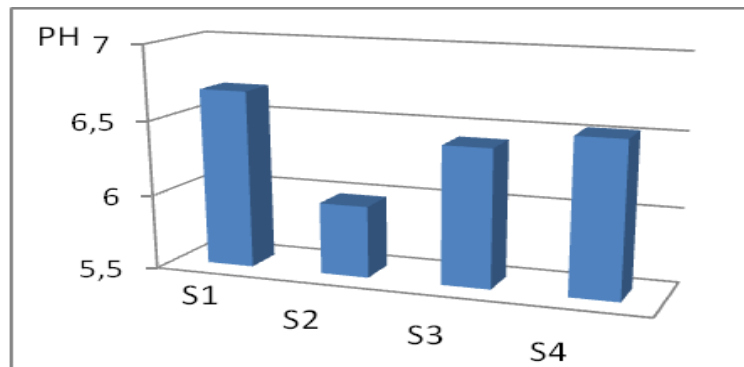


Fig.2: variation of water pH in Dayet Erroumi Lake (marsh 2016)

Temperature

The water temperature is an important factor in the aquatic environment because it governs almost all the physical, chemical and biological reactions. The water temperature plays a very important role in increasing the chemical activity, bacterial activity and evaporation of water. [7] And the temperature being a very important factor for the function of ecosystems, for surface water is due to atmospheric influences and especially the changes in air temperature. Thus the analysis of Figure 3 shows that the lake surface waters are characterized by a relative thermal stability, and the water temperature of the studied stations is relatively stable, it depends mainly on the location and the general climate. Indeed for the lake: The highest value (7°C) is noted at the station 3; the lowest (5.2°C) is noted at the station 1. We have found that this temperature has no great variation from one station to the other and remains close to the value of the average temperature the coldest month 5°C .

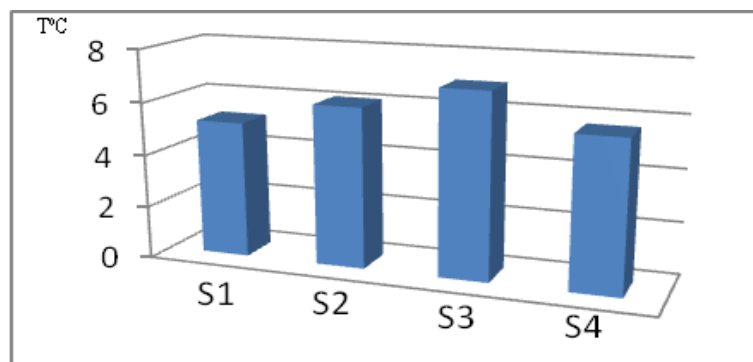


Fig. 3: Variation of the main temperature ($T^{\circ}\text{C}$) in Dayet Erroumi Lake (marsh 2016)

Electrical Conductivity

Electrical Conductivity (EC) of the waters expresses the overall mineralization; it translates the ionic charge of the water [8]. The whole of the sampled sites analyzed present values of conductivity (Figure 4), which not exceeding the guide value fixed by the Moroccan standards ($2700\ \mu\text{S}\cdot\text{cm}^{-1}$). As well these values found are generally very low and lower than the guide value set by the European standards ($100\ \mu\text{S}\cdot\text{cm}^{-1}$).

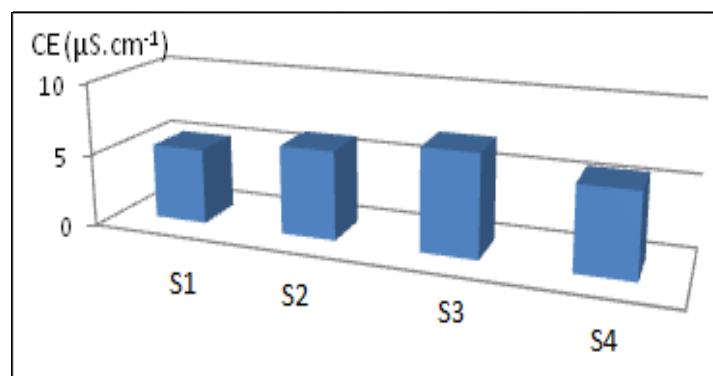


Fig.4 : variation of the Electrical Conductivity in Dayet Erroumi Lake (marsh 2016)

Chlorides

The results obtained for the water in the studied stations show that the Cl ion content varies from one station to another. According to Moroccan standards of water intended for the production of drinking water, which require up to 300 mg l-1 and 750 mg l-1 as an imperative value, the values found are very low and are consistent with Moroccan standards and that set by WHO (200 mg / l).

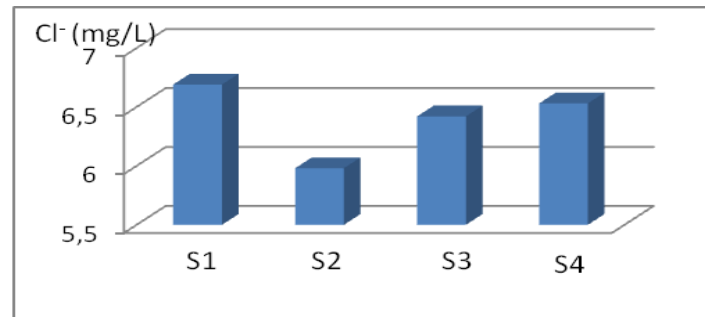


Fig.5: Variation of the mean content of chlorides ions in Dayet Erroumi Lake water (marsh 2016)

Turbidity

The turbidity of water is due to the presence of finely divided suspended matter: clay, silt, silica particles, organic matter ... the values of the turbidity found oscillates between 1.82 NTU (ST2) as minimum value to 2.65 NTU (ST1) as the maximum value (Figure6). The results show that the values of turbidity are relatively low throughout the study part of the resort, by Moroccan standards intake of water intended for the production of drinking water, which require a maximum of 5 NTU

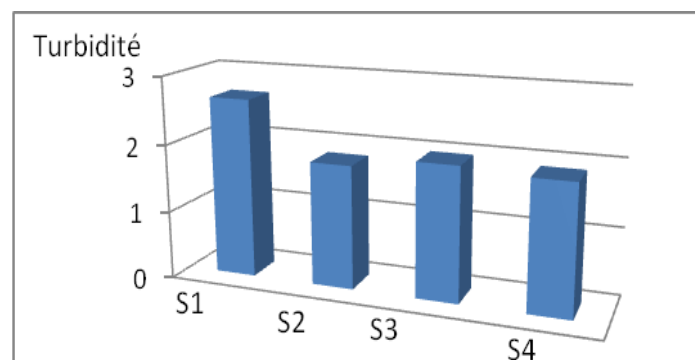


Fig. 6: Evolution of water turbidity in Dayet Erroumi Lake (marsh 2016)

Sulfates

The presence of sulfates in water can come from: the dissolution of some minerals such as gypsum or anhydrite, agricultural activity, industrial waste, etc.... It can be of human origin in connection with an industrial or urban pollution. [9] In our study, the contents of SO_4^{2-} vary from one station to another, ranging from 36.32 mg l-1 in Station 1, to 46.13 mg l-1 in the station 4 (FIG 8). According to Moroccan standards of water quality for the production of drinking water that require a 'limit value' of 400 mg l-1 of sulphates, and according to WHO standards (250mg / l) all surveyed stations respond to these values.

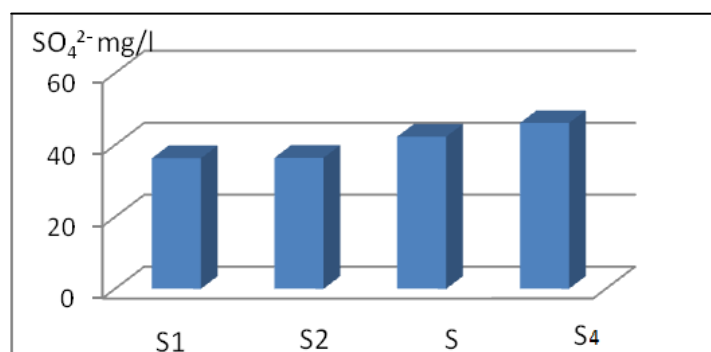


Fig.7: Evolution of the sulfates ion content in the water of Dayet Erroumi Lake (marsh 2016)

Calcium

The calcium ion concentration is directly related to the geological nature of the land crossed by water. Calcium ions resulting from the attack by water filled with carbon dioxide limestone or the simple dissolution of the sulphates such as gypsum. [9] This element plays a vital role in building skeletons and shells, and cell permeability of the phenomena; it is concentrated by organisms from water or food. [9] It can not in any case ask potability problems, the only domestic drawback is high hardness scaling. By cons, very soft water can result in corrosion problems ducts [9]. In all study sites (Figure 9), the calcium ion concentrations vary from one station to another. The content of Ca^{2+} the highest (34 mg l^{-1}) was recorded at the station 2, while the lowest level was recorded in Station 1 (29.5 mg l^{-1}).

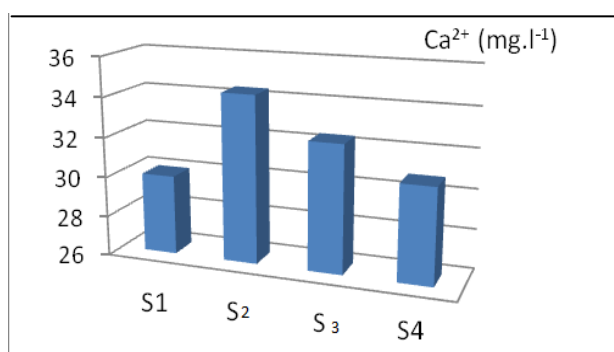


Fig.8: Evolution of the calcium ion content in the water of Dayet Erroumi Lake (marsh 2016)

Thus the measured values in the various stations are lower than the values reported in other regions of Morocco. [9] In most plants studied, the values found are lower than the guideline value set by the WHO standard (270 mg / L).

Magnesium

Magnesium is one of the most abundant elements in nature. It represents approximately 2.1% of the earth's crust. This is a significant element of the hardness of water. The Mg content in the water depends on the nature of the terrain to be traversed and may be high in the water passing through the soil rich in MgSO_4 [10]. Previous work [11] showed that the levels of Mg^{2+} are related to the presence of sedimentary magnesia rock that enriches the existing sources in the area of Bouregreg. The ions (Mg^{2+}) come as calcium ions, dissolution of carbonate formations rich in magnesium (dolomite). [12] In our area, the stations (Figure 9): the contents of Mg^{2+} between 30 mg l^{-1} (1 station) and 34.4 mg l^{-1} (Station 2), we find that the dosage levels Mg^{2+} ions are slightly smaller in all waters of the surveyed stations are lower than the value indicated by the OMS (50 mg l^{-1}). Thus these values found do not disturb the living environment studied.

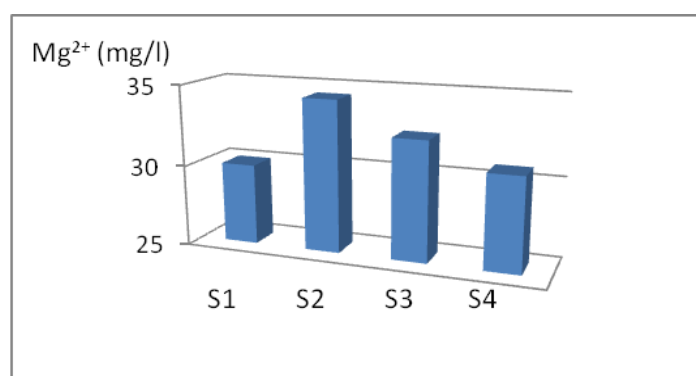


Fig.9: Evolution of the Magnesium ion content in the water of Dayet Erroumi Lake (marsh 2016)

Nitrates

Nitrate is an inorganic compound composed of a nitrogen atom (N) and three atoms of oxygen (O). Its chemical formula is NO_3 . Thus, nitrate is the most dominant form nitrogen in rivers and groundwater aquifers. They usually originate from the decomposition of organic matter by bacterial oxidation of nitrites and thus constitute the end product of nitrification. Thus nitrate is a stable natural chemical substance that plays an important role in the nitrogen cycle [13]. The maximum permissible value of this element was set at 50 mg l^{-1} by all international standards unless US standards that set 45 mg.l^{-1} as maximum permissible value. The results

in Figure 12 show that for the stations studied, the levels ranged from 0.00 mg / l (station4) as minimum and 0.06 mg / l (station 2) as the maximum value. The values found in nitrates remain well below the permissible value by Moroccan standards (50 mg / l). Thus, the studied waters of our stations are not subject to a risk of nitrate pollution.

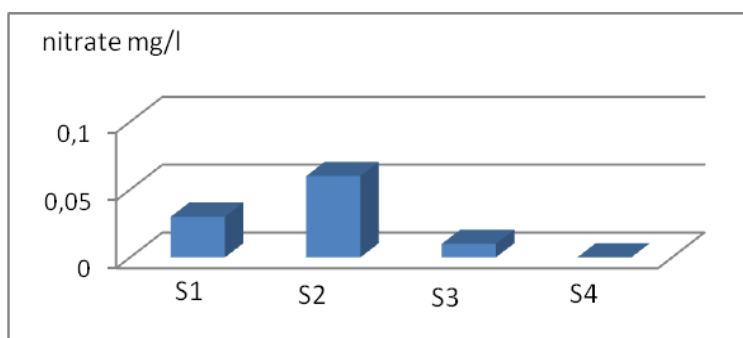


Fig.10: Evolution of the nitrate ion content in the water of Dayet Erroumi Lake (marsh 2016)

IV. CONCLUSION

The results of water testing of Dayet erroumi Lake obtained show that pH values are close to neutral, whereas values chlorides far exceeding the value fixed guide by European standards and also do not comply with standards set by the World health Organization (WHO). By cons, studied waters of our stations are not subject to the risk of pollution from other physicochemical parameters.

REFERENCES

- [1]. Hamid Taouil ; S. Ibn Ahmed; N. Hajjaji ; A. Srhiri « Evaluation de la pollution métallique : manganèse, fer, zinc, cobalt et chrome des eaux de l'oued Tislit Talsint : Maroc oriental », *ScienceLib Editions Mersenne : Volume 4, N ° 120301 I ISSN 2111470*, (2012).
- [2]. H. Taouil , S. Ibn Ahmed, A. El Assyry, N. Hajjaji, A. Srhiri «Water quality evaluation of the river Tislit-Talsint (East Morocco) » *J. Mater. Environ. Sci.*, (2013) 502-509.
- [3]. H. Taouil , S. Ibn Ahmed, A. El Assyry, N. Hajjaji, A. Srhiri « Evaluation of métal pollution: Aluminium, Zinc, Iron and Copper of Tyikomiyne well water (East Morocco) » *J. Mater. Environ. Sci.*, (2014) 5 (1) 177-182.
- [4]. KHYRI Mohammed et all « contribution a l'étude physico-chimique et bactériologique de l'écosystème lacustre dayet er roumi (khemisset) maroc » *ScienceLib Editions Mersenne : Volume 5, N ° 130412. ISSN 2111-4706*. 2013.
- [5]. Laila Bennassera, Mohamed Fekhaouib, Jean-Louis Benoit-Guyod. C and Gérard. Mohamed, 1997. Influence of tide on water quality of lower Sebou polluted by Gharb plain wastes (Morocco). April, Page 859-867 volume 31, issu 4 Science Direct.
- [6]. Painchaud J., 1997. La qualité de l'eau des rivières du Québec : État et tendances. Direction des écosystèmes aquatiques. Rapport du Ministère de l'Environnement et de la Faune du Québec. 55p.
- [7]. I.I.Alami, 2010 « Contribution a l'étude et la prédiction spatio temporelle de la pollution physicochimique des eaux souterraine cas de la nappe phréatique de m'nasra » Thèse de Doctorat, discipline : science de l'environnement, Université Ibn Tofail.
- [8]. H. Taouil, S. Ibn Ahmed, A. El Assyry, N. Hajjaji, A. Srhiri «Physicochemical of water from Tyikomiyne wells, Talssint region (Eastern Morocco) » *ScienceLib Editions Mersenne: Volume 5, N ° 130511. ISSN 2111- 4706*. 2013.
- [9]. Ali Ait Boughrous (2007). Biodiversité, écologie et qualité des eaux souterraines de deux régions arides du Maroc : le Tafilalet et la région de Marrakech. Thèse de Doctorat UFR : Sciences et Techniques des eaux. Spécialité : Hydrobiologie souterraine Université Cadi Ayyad, Fac. Sci. Semlalia, Marrakech, 46p.
- [10]. Gaujous D., 1995. La pollution des milieux aquatiques : aide-mémoire. 2ème Ed. 217p.
- [11]. Kourradi R. 2007. Evaluation du degré de la pollution anthropique de l'estuaire de Bou Regreg et impact sur la biologie et dynamique de scobicularia plana (Linné, 1758) et solen marginatus (Linné, 1767) - Thèse de Doctorat. Spécialité : écologie animale. Université Mohammed V- Agdal, faculté des sciences Rabat.
- [12]. GOUAIDIA Layachi ,2008 - Influence de la lithologie et des conditions climatiques sur la variation des parametres Physico-Chimiques des eaux d'une nappe en zone semi aride ,cas de la nappe meskiana nord-est Algerien -b Thèse de Doctorat, Université Badji Mokhtar -Annaba.
- [13]. I.I.Alami, 2010 « Contribution a l'étude et la prédiction spatio temporelle de la pollution physicochimique des eaux souterraine cas de la nappe phréatique de m'nasra » Thèse de Doctorat, discipline : science de l'environnement, université ibn tofail.