Groundwater of the Tanoubart Water Table in the Region of Rabat-Salé-Kenitra

Hamdan Abderrahim, Tiskar Malik, Aouane el Mahjoub, Benahmad Chaimaa, Chaouch Abdelaziz

Abstract: Environmental concern presupposes a certain fundamental dynamism aimed at protecting ecosystems from all types of pollution and improving environmental management. The objective of our work is to determine the degree of pollution of the water table of Tanoubart of Rabat -Salé -Kenitra region (Morocco). During the period March 2017 / June 2018, two companions of groundwater sampling were carried out at the level of the wells located in rural areas, these samples were analyzed according to the water quality assessment techniques described by Rodier (1978, 2009) and the recommendations of the World Health Organization (WHO). The physicochemical analysis has shown that the wells studied have high concentrations to the standards recommended by WHO (1994) and by Morocco (Moroccan Standard, 1991) and poses a serious problem of direct consumption.

Index Terms: Groundwater, Quality, Wells, Physico-chemistry, Pollution

I. INTRODUCTION

The water resource is without doubt the one that most directly conditions the development of the country. It is about this vulnerable resource that drastic choices must be made to deal with immediate and future challenges, including issues of availability, access and quality. However, quantifying the risk of pollution remains a problem that is difficult to grasp. The word risk has always been associated with the word "randomness" (probability) among other parameters and this is how risk is opposed to certainty [1]. For concepts relating to environmental risks, different methods have been proposed as the case study [2,3]. And the risk was considered a cross between two dimensions: the hazard and vulnerability [4]. Groundwater is an important part of Morocco's water resource. They have the advantage of their regularity, their low mobilization costs and their good spatial distribution. It is also a resource less vulnerable to climate hazards and pollution. In certain southern regions, this resource is unique, which gives it exceptional value.

On the national territory, there are 32 deep layers and more than 48 surface layers. The former are difficult to access with a relatively high cost of mobilization and exploitation; but they can be richer and more durable; the latter are more accessible but also more vulnerable to pollution and drought [5].

II. MATERIAL AND METHOD

II.1. Sample Rate

A monthly sampling frequency was conducted at the well during two study companions, 2017-2018

II.2. Study Method

The samples collected in polyethylene bottles were transported as quickly as possible to the ONEP Kenitra laboratory to undertake the analyzes, where we studied the following parameters: Wastewater samples for other physico-chemical analyzes

And also the heavy metals were carried out in the laboratory: The Office national drinking water, in Kenitra. These Samples were kept according to the general guide for the preservation and handling of samples according to ISO 5667/3 (1994).

III. RESULTS OF PHYSICOCHEMICAL PARAMETERS WATER WELLS OF THE SLICK TANOUBART

II.1. Temperature

The results obtained from the temperature analyzes carried out are illustrated in the figure 1:

Figure 1: Variation of the temperature according to the wells of the Tanoubart aquifer

The extreme value is lower than 30°C. The values obtained are of average value of 20.61 mg / l, then by referring to Moroccan norms for drinking water.
In fact, the groundwater of the Tanoubart aquifer does not require a temperature correction that could be a human overload.

I.2. Potential hydrogen

The results obtained from the analyzes carried out are illustrated in the figure 2. Typically, pH values range from 6 to 8.5 in natural waters [7,8]. It decreases in the presence of high levels of organic matter and increases during periods of low water, when evaporation is important [9]. The values obtained are close to neutrality, while referring to Moroccan standards (pH between 6.5 and 8.5) for drinking water.

In fact, the groundwater of the Tanoubart aquifer does not require a pH correction which could be a human overload.

![Figure 2: Variation of hydrogen potential versus wells the tablecloth Tanoubart](image)

I.3. Conductivity

The results of analyzes are shown in Figure 3:

![Figure 3: Variation of the conductivity versus wells of the tablecloth of Tanoubart](image)

Electrical conductivity refers to the ability of the water to conduct a current. During our study the values of the conductivity vary between 407 to 3380 μS/cm. The maximum allowable value (VMA) is set at 2700 μS/cm according to Moroccan standards of potability.

According to this study, these values are always stable and lower than the maximum admissible value, so the high content of this parameter is explained by the high content of chloride ions (Cl−), and the high mineralization due to the contact of these underground waters with rock formations [10]. It is also noted that the values of the raw water are generally confused with those of the treated water, so it can be said that the treatment by oxidation followed by filtration does not influence the conductivity.

II.4. Calcium (Ca2+)

The results obtained from the analyzes carried out are illustrated in the figure 4:

![Figure 4: Calcium variation according to the wells of the Tanoubart aquifer](image)

In our study the calcium hardness values ranged from 52.2 to 204.8 mg/l with an average of 111 ± 4.54 mg/l. This high content of Ca 2+ can be explained by the high total hardness (TH).

II.5. Magnesium (Mg 2+)

The results obtained from the analyzes carried out are illustrated in the figure 5. During our study the magnesian hardness values vary from 16.52 at 85.66 mg/l. This strong in Mg 2+ can be justified by the total hardness (TH) that elevated [11,12].

![Figure 5: Variation Magnesium based on web wells of the web Tanoubart](image)

II.6. Hardness : (Ca2+) + (Mg2+)

The results obtained during our study are shown in Figure 6. The stationary variation in the hardness of the well water in the Tanoubart aquifer, averages 156.345 ± 83.33 mg/l with a minimum value of 67.97 ± 83.33 mg/l and a maximum value of 350.77 ± 83.33 mg/l with a variance (n-1) equals 69.44.45 ± 83.33 mg/l.
II.7. Sodium (Na⁺)

The mean annual value of sodium shown at the well level is 200 mg/l, the maximum concentration (310 mg/l) is recorded in Tanoubart 2 wells (Figure 7).

II.8. Ammonium (NH₄⁺)

Ammonium is the product of the final reduction of nitrogenous organic substances and inorganic matter in water and soil. It also comes from the excretion of living organisms and the reduction and biodegradation of waste, without neglecting domestic, industrial and agricultural inputs. This element exists in a small proportion of less than 0.1 mg/l of ammoniacal nitrogen in natural waters. In the superficial waters, it comes from nitrogenous organic matter, and gaseous exchanges between water and the atmosphere [14, 15, 16]. During our study the values in ammonium remains fixed and equal to 0 mg/l, its normal rate is fixed at 0.5 mg/l according to Moroccan standards of potability, so these values remain always lower than the maximum admissible value, that can be justified by the presence of a sufficient quantity of oxygen which favor the operation of nitrification (transformation of ammonium into nitrites then nitrates).

II.9. Chloride (Cl⁻)

The results obtained from the analyzes carried out are illustrated in the figure 9.

II.10. Nitrates (NO₃⁻)

The results of analyzes are shown in Figure 10.

II.11. Sulfate (SO₄²⁻)

The results obtained from the analyzes carried out are illustrated in the figure 11.
During our study the sulphate concentration values range from 14 to 223 mg/l with an average of 104.58 mg/l. The normal rate is fixed at 400 mg/l according to the Moroccan standards of potability, these s values remain always sands and lower than the maximum admissible value except for the well M9, so this water at this parameter is recommended to the feeding human poses no risk to the health of consumers [22,23].

Table 1 : Statistics descriptive of the web Tanoubart

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
<th>Ecart-type</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>20</td>
<td>21.8</td>
<td>20.61</td>
<td>0.611</td>
</tr>
<tr>
<td>pH</td>
<td>7.05</td>
<td>7.98</td>
<td>7.541</td>
<td>0.285</td>
</tr>
<tr>
<td>C.E</td>
<td>407</td>
<td>2380</td>
<td>1407.111</td>
<td>636.1</td>
</tr>
<tr>
<td>O2</td>
<td>0.7</td>
<td>0.76</td>
<td>0.730</td>
<td>0.019</td>
</tr>
<tr>
<td>Ca2+</td>
<td>52.8</td>
<td>144</td>
<td>104,511</td>
<td>30,476</td>
</tr>
<tr>
<td>Mg2+</td>
<td>16,520</td>
<td>85,66</td>
<td>53,666</td>
<td>20,176</td>
</tr>
<tr>
<td>Ca2++Mg2+</td>
<td>69,32</td>
<td>211,07</td>
<td>158,177</td>
<td>44,153</td>
</tr>
<tr>
<td>Na+</td>
<td>200</td>
<td>310</td>
<td>279,944</td>
<td>38,961</td>
</tr>
<tr>
<td>K+</td>
<td>4,096</td>
<td>21,95</td>
<td>13,038</td>
<td>5,548</td>
</tr>
</tbody>
</table>

The results of the study parameters presented in Table 20. We statically studied the physicochemical data of the wells of the Tanoubart aquifer by principal components analysis (PCA). The criterion of Kaiser led us to remember the first two components, since they alone absorb 74.94% of the total inertia. The axis F1 with an inertia percentage 55.19, the axis F2 with a percentage inertia 18.19 (Table 1).

III.2. Projection of the physicochemical variables on the two axes F1-F2

According to the component diagram in the space after rotation, the two groups of opposite variables (Figure 13) C that they contribute positively to the axis 1 Ca2+, Cl-, Mg2+, Cond rod uc tiv is strongly positively correlated with axis F1. On the other hand, the potential of hydrogen and iron are strongly positively correlated with F2 axis. On the other hand, NO3-, TA, SO42- and turbidity are correlated with the two axes F1 and F2.

Table 2 : Matrix of components after rotation

<table>
<thead>
<tr>
<th>Variable</th>
<th>F1</th>
<th>F2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCO3-</td>
<td>4.39</td>
<td>15.02</td>
</tr>
<tr>
<td>Cl-</td>
<td>85.2</td>
<td>685</td>
</tr>
<tr>
<td>SO42-</td>
<td>14</td>
<td>223</td>
</tr>
<tr>
<td>NO2-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NO3-</td>
<td>4,820</td>
<td>56,8</td>
</tr>
<tr>
<td>SiO2</td>
<td>0</td>
<td>6,616</td>
</tr>
<tr>
<td>NH4+</td>
<td>0</td>
<td>0,12</td>
</tr>
<tr>
<td>TAC</td>
<td>6,05</td>
<td>6,8</td>
</tr>
</tbody>
</table>

The cloud of individuals (wells) that contribute most to defining two axes 1 and 2. According to the factorial map of physico-chemical parameters on 'found two group 1 formed by M9 and M6 and the 2nd group consisting of s remains s wells except the M8 well. The projection of the wells according to the annual average of the wells makes it possible to classify these wells in three groups, group 1 is composed of wells M1, M7 and M10; Group 2 composed of M2, M3, M4, M5 and M8 wells and the third group composed of M6 and M9.
REFERENCES


2. BALKWILL, D. L. Reeves, HR, DRAKE, g., REEVES, JY, CROCKER, FH, BALDWIN, and KM BOONE, DR (1997) phylogenetic characterization of bacteria in the subsurface microbial culture collection. FEMS Microbiology Reviews, 20, 201-216.


AUTHORS PROFILE

- Hamdan Abderrahim: Ibn Tofail Faculty of Science, Laboratory of Agro-physiology, Biotechnology, Environment and Quality:Kenitra, Morocco.

-Tiskar Malik, Ibn Tofail Faculty of Science, Laboratory of Agro-physiology, Biotechnology, Environment and Quality:Kenitra, Morocco.

-Aouane el Mahjoub, Ibn Tofail Faculty of Science, Laboratory of Agro-physiology, Biotechnology, Environment and Quality:Kenitra, Morocco.

-Benahmad Chaimaa Ibn Tofail Faculty of Science, Laboratory of Agro-physiology, Biotechnology, Environment and Quality:Kenitra, Morocco

-Chaouch Abdelaziz, Ibn Tofail Faculty of Science, Laboratory of Agro-physiology, Biotechnology, Environment and Quality:Kenitra, Morocco.

Published By: Blue Eyes Intelligence Engineering & Sciences Publication