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ORIGINAL PAPER

Detection of toxic heavy metals in the water of Chott Ain el Beida (bowl of ouargla, South-east of Algeria)

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ABSTRACT

The bowl of Ouargla has several wetlands of international importance including the chott of Ain El Beida. The site is characterized by an important fauna and flora whose protection constitutes currently a major national concern. The chott has served as an outlet for all wastewater and drainage water from the bowl in order to avoiding its engorgement. This site is at this time seat of a metal pollution. The detection of heavy metals will undoubtedly have adverse consequences on the ecological characteristics of the site.

Introduction

Water is a non-renewable resource. It represents a heritage whose protection and sustainable management constitute today a global concern [1].

The bowl of Ouargla because of its geographical location contains several wetlands known in the region under the name of Sebkhas. The origins of these waters are numerous, including wadis runoff, local rainwater and especially drainage and sanitation waters [2].

The Chott de Ain El Beida is the first wetland that served as a natural outlet for all surplus water from the bowl. It is a saline depression located at 6 km east of the chief lieu of the wilaya of Ouargla near the chief lieu of the common of Ain El Beida. It covers an area of 6,853 hectares lengthened towards North - West South - East over a length of 5.3 km, its width varies from 1 to 1.5 Km and its altitude turns from 142 m to 146 m [3-4].

Ecologically, the chott is characterized by flora include 12 families, 27 genera and 30 species, whether a high genetic coefficient of 90%. With regard to fauna, 84 species of birds with all phenological statuses are distributed in 11 orders covering 27 families and 52 genera representing 24% of the total presume of the Algerian birds and more than 60% species that frequent the Algerian wetlands. The mammalian fauna of chott has 16 wild and 8 domestic species [5].

In this research, attention has been given to the study of the pollution of the waters of Chott Ain Baida by metals, in particular heavy metals, considered to be the most dangerous pollutants for man and environment because of their bioaccumulation in living organisms.

Materials and methods

Materials

The metals concentrations in the water were determined using atomic adsorption spectrophotometer (type AA860). The metals analyzed are: Lead, Silver, Cadmium, Nickel, Iron, Zinc, Potassium and Magnesium under different spectral conditions [6].

Sampling

Great importance is given to the sampling operations, so the operator must have a precise knowledge of the sampling conditions (sampling and conservation) and their importance for the quality of the analytical results.

Samples must be homogeneous, representative and obtained without modification of the physicochemical characteristics of the water because the errors likely to make the interpretation of the results difficult are most often related to an unsatisfactory sampling rather than to analytical errors [7]. In this study, samples were taken along the Chott at 11 different points as shown in Figure 1.

The sampling method varies according to the origin of the

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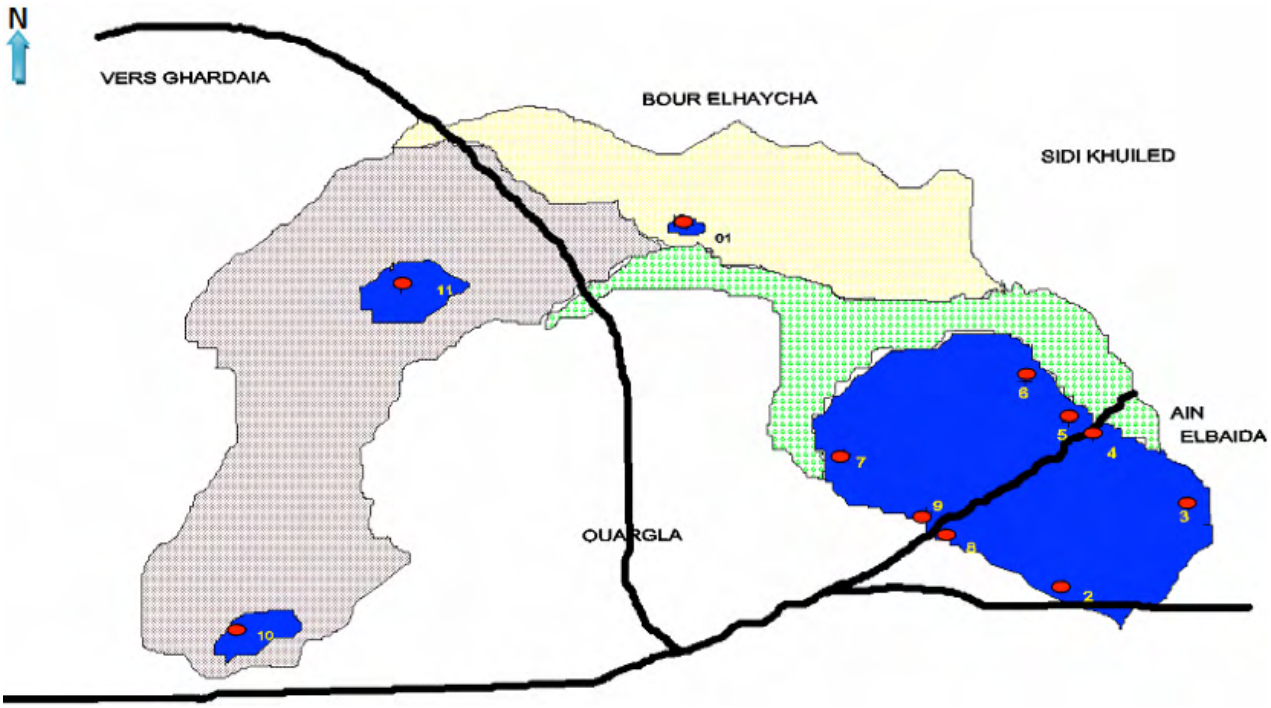

Fig. 1. Location of sampling points [8].

water. In our case, polyethylene flacons were immersed at a distance of (20 to 30 cm) from the surface, far enough from the edges to avoid resuspension of the deposits [8].

Results and discussion

Following the results obtained, we classified the analyzed metals into four groups:

Heavy metals toxic for plants and animals

Lead

Figure 2 shows that the lead level of the analyzed waters varies from 31.20 to 48.08 μg/L. The presence of this element in large quantity is probably due to the discharges of the washing stations and the finishing of the metals.

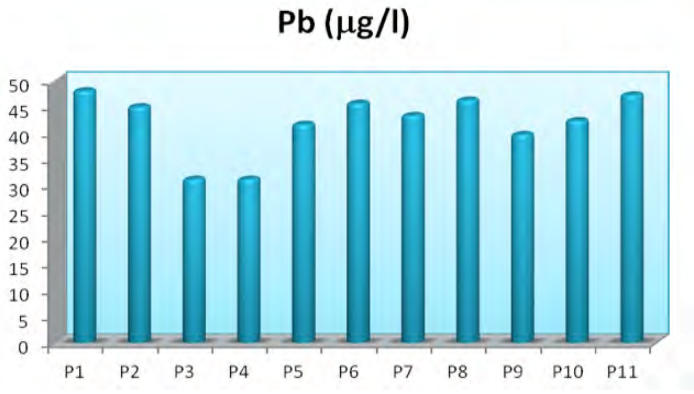

Fig 2. Spatial evolution of Lead concentration (μg/L).

Silver

Silver exists only in some samples as clearly shown in figure 3. Its concentration varies from 14.64 to 21.50 g / l. These concentrations above the structural concentration of water may be related to the presence of a source of pollution in the area between P1 and P5 that we could not determine.

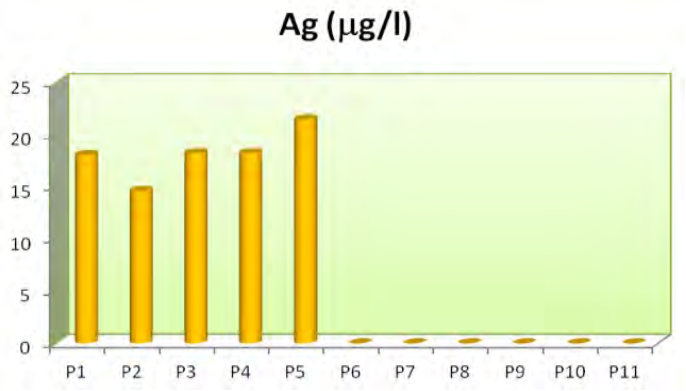

Fig. 3.Spatial evolution of Silver concentration (μg/L).

Cadmium

The content of Cadmium shown in Figure 4 varies from 0.11 to 4.32 μg/L. Its existence in the water of the chott is due to the rejections of the washing stations or the finishing of the metals.

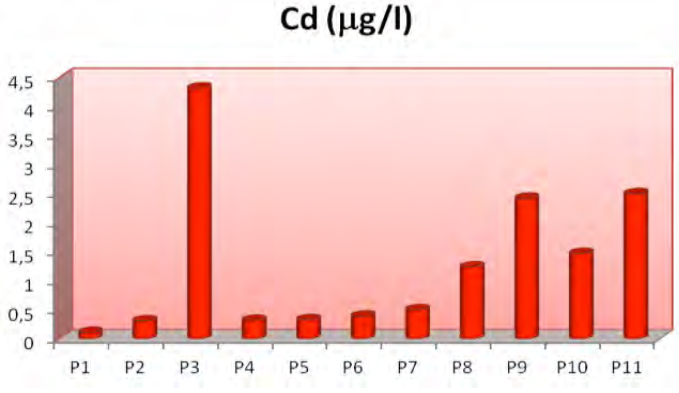

Fig. 4. Spatial evolution of Cadmium concentration (μg/L).

Heavy metals toxic for plants and essential for animals

Nickel

Having the same probable source as Cadmium, the Nickel content varies between 0.12 and 90.08 μg/L. we note that these values largely exceed the concentrations related to the natural structure of water. This confirms the presence of a source of localized pollution especially in the zone of the sample N ° 11.

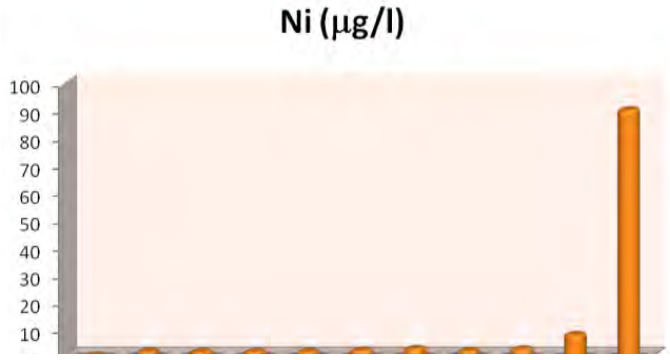

Fig. 5. Spatial evolution of Nickel concentration (μg/L).

Heavy metals essential for plants and animals

Iron

Figure 6 shows that the concentration of iron varies from 12.43 to 27.32 μg/L. The presence of this metal in the site is, in our opinion, mainly due to the corrosion of the pipes used for the irrigation of the palm groves, or that used for the evacuation of drainage water and wastewater.

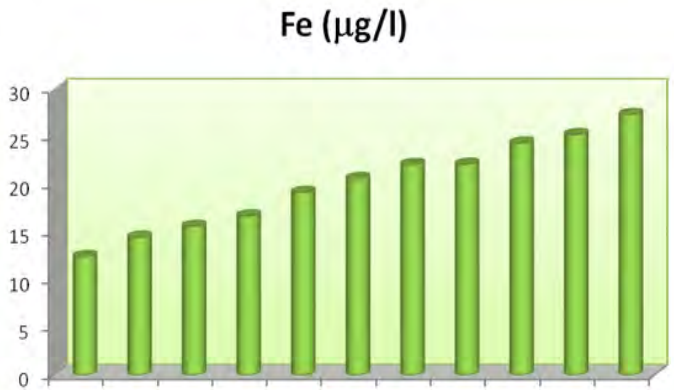

Fig. 6. Spatial evolution of Iron concentration (μg/L).

Zinc

Zinc concentration ranges from 12.58 to 22.28 μg/L. As a probable source of this element we propose: corrosion of piping used for irrigation or sanitation, industrial discharges and washing stations.

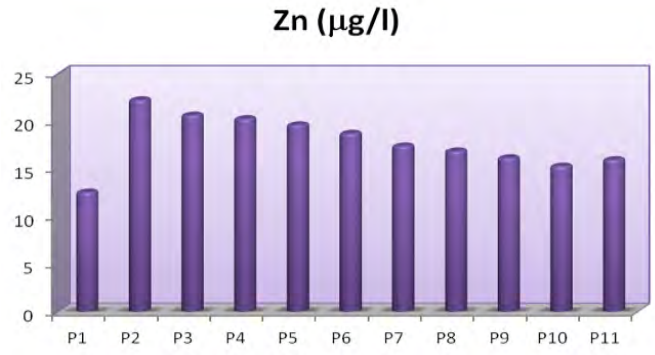

Fig. 7. Spatial evolution of Zinc concentration (μg/L).

Structural metals of water essential for plants and animals

Potassium

The potassium concentrations range from 22.27 to 46.43 mg/L, as clearly shown in Figure 8. This concentration are greatly exceeds the structural concentration of the water; this may have a direct relationship with the fertilizers used in the nearby palm groves of the site.

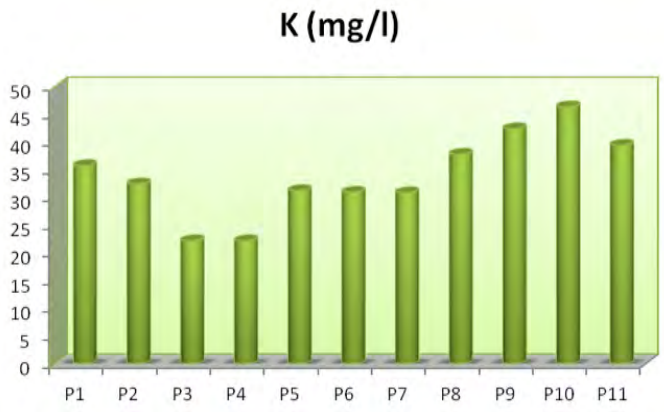

Fig. 8. Spatial evolution of Potassium concentration (mg/l).

Magnesium

The content of Magnesium (Figure 9) varies from 18.15 to 30.87 mg/L. It is noted that the waters of Chott rather present a deficiency in this metal, this is due to its fixation by the particles of the soil.

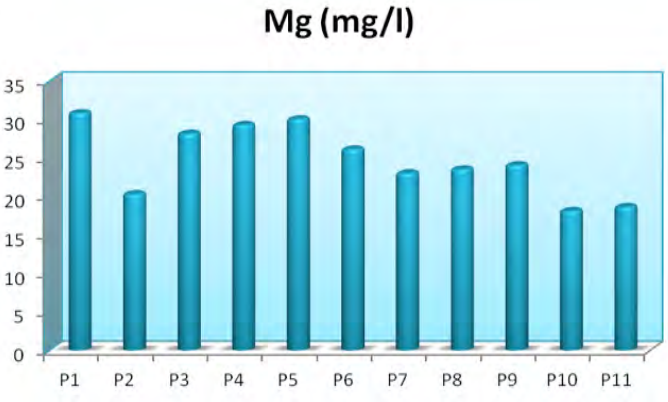

Fig. 9. Spatial evolution of Magnesium concentration (mg/l).

Conclusion

In conclusion of this work we can say that water of chott Ain Beida is composed of 8 metals presenting a spatial distribution on all the site. On the basis of their effects on plants and animals, these metals are classified into four groups, namely:

- Heavy metals toxic to plants and animals: Lead, Silver and Cadmium.

A contamination by Lead is observed in all the samples. The absence of Silver in six samples and the exceeding of the structural concentration in the other one suggest the existence of a localized source of pollution in the area between P1 and P5. The 11 points about our study are polluted with Cadmium.

- Heavy metals toxic to plants and essential for animals: Nickel.

The amount of Nickel present in our samples originates from the possibility of the presence of a source of pollution.

- Essential heavy metals for plants and animals: Iron and Zinc.

All points are not polluted in Iron but moderately polluted in Zinc
- Structural metals of water essential for plants and animals: Potassium and Magnesium.
- For potassium, all the points have a concentration higher than the structural concentration in water. This does not exclude the presence of a source of pollution. Concerning magnesium, we can say that these waters have a deficiency in this metal.

References

1. N. Chaouch, M. Chaouki. Water treatment processes applied at the deoiling stations at Hassi Messaoud (efficiency and professional risks). Materials and Biomaterials Science 01 (2018) 029–034.
2. N. Chaouch. Étude de la composition chimique et approche de la qualité des eaux souterraine destinées a l'alimentation en eau potable au niveau de la cuvette de Ouargla, Mémoire Ingénieur en Chimie industrielle, Université de Ouargla (1996) p. 60.
3. N. Chaouch. Utilisation des sous-produits du palmier dattier dans le traitement physico-chimique des eaux polluées. Thèse de Doctorat en Chimie, Université Hadj Lakhdar Batna (2014) p. 54.
4. W. Lannabi, B. Herga. Étude de l'efficacité de la bentonite de Maghnia dans le traitement de métaux lourds du chott de Ain El Beida (cas de la région de Ouargla). Mémoire Ingénieur en Génie de l'environnement, Université Kasdi Merbah Ouargla (2008) p. 67.
5. Anonyme. ATLAS IV des zones humides Algérienne d'importance internationale (2004) pp.35 - 45.
6. M . Pinta. Spectrophotométre à absorption atomique .Application à l'analyse chimique, Tome 2, 1980, pp. 306-377.
7. J. Roudier. L'analyse de l'eau édition, 8eme édition (1997) pp. 1126 -1150.
8. S. Bireche, I. Messaoudi. La contamination des eaux par les métaux cas du chott de Ain El Beida de la région de Ouargla. Mémoire Ingénieur en Génie de l'environnement, Université Kasdi Merbah Ouargla (2007) p. 55.

Conflicts of interest

Authors declare no conflict of interests.

Notes

The authors declare no competing financial interest.

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