

# Degradation indices of chotts and sebkhas brines in the Algerian Low Sahara

Bellaoueur Abdelaziz<sup>(1)</sup>, Hacini Messaoud<sup>(2)</sup>

<sup>(1) (2)</sup> *Laboratoire Géologie du Sahara - Université Ouargla, Ouargla 30000, Algérie.*

*E-Mail: bellaoueuraz@gmail.com*

**Abstract**— This study aims to highlight the impact of urban discharges on chotts and sebkhas brines in the Algerian Low Sahara. The physicochemical analysis revealed that these discharges are heavily loaded with mineral and organic matter expressed in terms of : nitrates (0.5 to 1356 mg/l), phosphates (62 mg/l), COD (82 to 710 mg/l), BOD<sub>5</sub> (20 to 123 mg/l) and SM (67 to 149 mg/l). Due of the still widespread practice of "everything in the sewer", and the review of these results, emphasize very well the terrible degradation of these receiving environments by urban discharges.

**Key-Words**— Brines, Chotts, Sebkhass, Low Sahara, Releases, Degradation.

## I. INTRODUCTION

Water is one of the essential elements in our life. After being used, the largest part is returned to the environment. As this water is usually loaded with organic matter, it causes an increase in phosphorus and nitrogen concentrations, promotes eutrophication of the aquatic system and therefore becomes an important source of pollution for the receiving environment [1]. In the Algerian Low Sahara, urban discharges in the chotts and sebkhas, constitute a serious factor of pollution favored by certain climatic conditions like the temperature and the sun. For this purpose, we try in this study, to determine the global parameters of pollen and to highlight the impact of these urban discharges on the receiving environment chott and sebkha.

## II. STUDY SITE

The Algerian Low Sahara is a vast depression (-37 to 300m above sea level), partly occupied by

the Grand Erg Oriental. It is limited by: the Saharan Atlas Mountains in the North, the Saharan Dorsal and the Great Western Erg in the West and the Tademaït Plateau and Tassilis N'Ajers in the South. This depression opens to the North-East on the Gulf of Gabes and the Mediterranean, and covers an area of 720,000 km<sup>2</sup> between 35° and 28° North latitude and 3° to 11° East longitude. It is a region of shallow valleys and low plateaus [2] (Fig. 1).

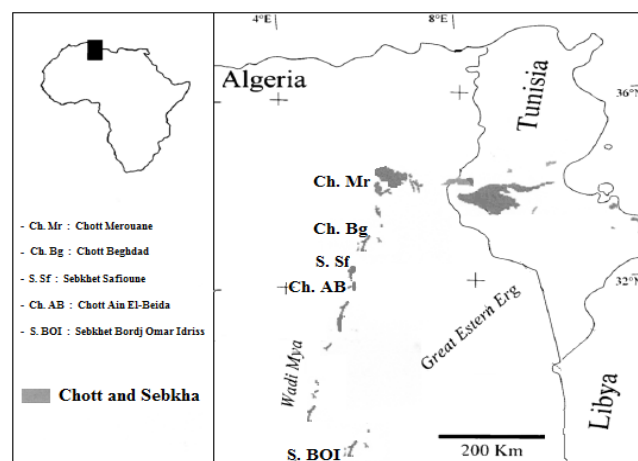


Figure 1. Location of the study site

## III. MEANS AND METHODS

From 2009 to 2016:

- 67 samples were taken and analyzed in accordance with the protocol developed at the transfer geochemistry laboratory at CNRS Toulouse France (LMTG UMR 5055);
- 107 samples were collected and analyzed according to the protocol developed by [3].

The elements NO<sub>3</sub> and PO<sub>4</sub> were determined by the HPLC method (ionic chromatography in liquid phase under pressure).

COD (Chemical Oxygen Demand), BOD<sub>5</sub> (Biochemical Oxygen Demand) and SM

(Suspended Matter) were determined according to [3].

pH (Potential of Hydrogen), electrical conductivity, temperature and dissolved oxygen are measured in situ after each sampling using handheld devices (HI-9829, Multi-3430).

#### IV. RESULTS AND DISCUSSION

To predict the impact of the discharges on our receiving environment chotts and sebkhas, and to evaluate the index of degradation of the brines, it is necessary to determine certain physico-chemical parameters.

The results of physico-chemical analyzes (Table I), allow to note that :

- The temperature of the brines follows the ambient temperature. The minimum values (14°C) are recorded in January and February and the maximum values (31°C) in July and August. The average is varied between 18 and 23°C (Fig. 2).

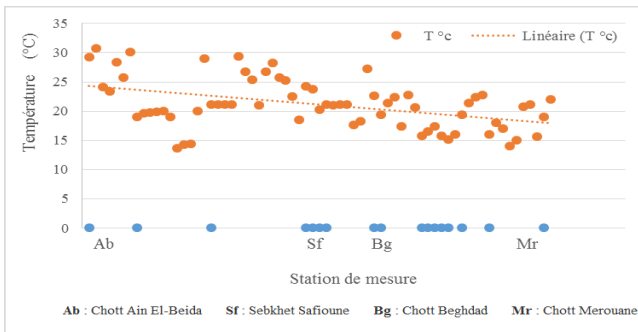


Figure 2. Temperature of brines

- The pH indicates the basicity or the acidity of the brines. The minimum and maximum extreme values measured are between 6.5 and 9.4 (Fig. 3) for brines in contact with or out of contact with urban discharges. Its role is crucial in the growth of microorganisms; when it is less than 5 or greater than 8.5 the growth of microorganisms is directly affected.

Electrical conductivity is one of the simplest and most important parameters used to control brine quality. It tells us about the salinity and degree of

mineralization. It is a numerical expression of the capacity of the brines to conduct an electric current measured in mS/cm. The results obtained show a significant variation of the mineralization expressed in mean conductivity. These results could be explained by the contact or not with the urban discharges.

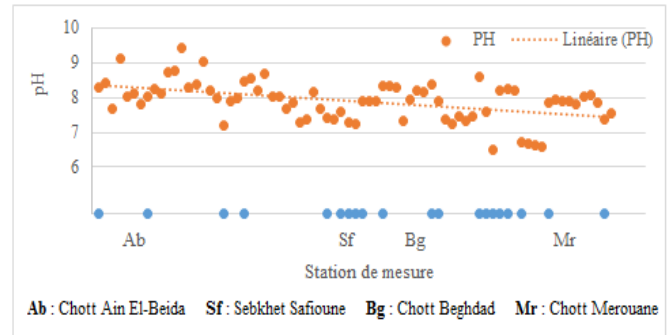


Figure 3. Hydrogen potential of brines

- The values below 50 mS/cm recorded at Chott Aïn El Beida and Sebkheth Safioune, show the contact of these environments with wastewater discharges. Maximum values (above 150 mS/cm) are recorded in the case where the brines are out of contact with urban discharges: the case of Chott Beghdad and Chott Merouane (Fig. 4).

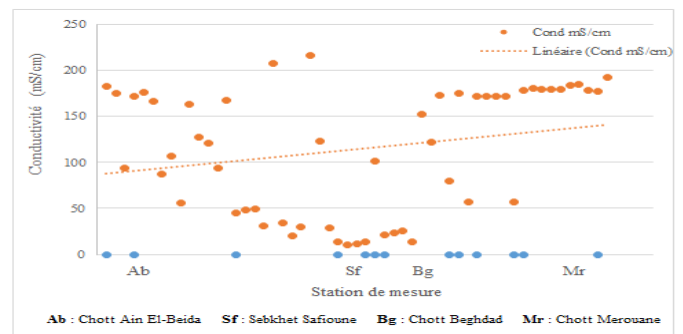


Figure 4. Electrical Conductivity of brines

- The presence of dissolved oxygen conditions the degradation reactions of organic matter and the biological equilibrium of lacustrine environments. The state of oxygenation of our samples shows extreme minimum and maximum values of 1.6 to 7.6 mg/l respectively for Sebkheth Safioune and Chott Beghdad (El-Bheir). These values make it

possible to deduce that these samples are very degraded.

- The SM varied from 67 to 149 mg/l.

- The organic pollution expressed by the BOD<sub>5</sub>, presents significant concentrations between the sites in contact and the sites out of contact with the urban discharges. The average values recorded vary from 20 to 123 mg/l. These values could be explained by the abundance of organic matter essentially in dissolved form.

- The pollutant load expressed by the COD is one of the most important criteria used in the design of a wastewater treatment. The average value recorded is varied between 82 and 340 mg/l.

Nitrates, like other forms of nitrogen, evolve very rapidly in the natural environment according to the nitrogen cycle. Its presence is generally associated with agriculture; it is a better sign of pollution of agricultural origin. But in our case, nitrates originate from untreated wastewater :

- The maximum extreme values are recorded at Sebkheth Safioune (1.3 g/l). The 126 mg/l value recorded at Chott Beghdad is certainly associated with the excess of nitrogen inputs by manure spreading and agricultural activities. At Chott Ain El-Beida the concentration is of the order of 49 mg/l. Low levels are recorded at Sebkheth Safioune and Chott Aïn El-Beida;

- Similarly, the recorded levels of phosphates (PO<sub>4</sub>) are important at Sebkheth Safioune (62 mg/l). Total phosphorus (Pt) assumes values of 0.1 to 3.7 mg/l in Chott Beghdad and Chott Aïn El-Beida, respectively. The presence of phosphate is an indicator of eutrophication that is clearly related to an excess of mineral nutrients directly derived from the mineralization of organic matter from wastewater.

On the basis of nitrate and phosphate contents, it can be deduced that these two indices clearly identify the degradation and eutrophication of these lacustrine environments. As we have said, the highest grades are recorded at Chott Ain El-Beida and Sebkheth Safioune where the pollution is the strongest and the most obvious. In addition, it

is more marked where is observed easily in the field: organic matter, smells, etc.

Table 1. Physico-chemical parameters of brines

Station	T °C	pH	Cond (mS/cm)	O <sub>2</sub>	BOD <sub>5</sub> (mg/L)	COD	SM	NO <sub>3</sub>	PO <sub>4</sub>	Pt
Chott Ain El-Beida	14-31	7-9,4	10-216	3	28-123	82-340	74-149	0,5-49	/	3,7
Sebkheth Safioune	17-27	7,3-8,3	14-173	1,6	20-101	104-710	/	3-1356	62	/
Chott Beghdad	16-23	6,5-7,9	173	7	29	109	67	5-126	/	0,1-3
Lac El-Bheir	16	8,2-8,6	57	7,6	27-43	167	70	15-20	/	0,2
Standard	25 [4]	7,0-8,7 [5]	/	4 [6]	3,0 [7]	25 [8]	/	3,6 [9]	2,68 [10]	0,03 [11]

Given all these data, we can say that Chott Ain El-Beida and Sebkheth Safioune are terribly

polluted, and it is impossible to maintain them as brine preserved environments. What confirms this point of view are the practices and decisions of local and national authorities through the classification of these places as potential release zones. Chott Beghdad for example, is a natural environment requires preservation and development on the mining plan like that of Chott Merouane. Sadly ; in recent years this chott is threatened by the non-responsible orientations of the local authorities of the considered as area of discharges of sewage.

The elimination of discharges of raw water, organic matter and pollutants is one of the positive actions to enhance and conserve these natural environments. It will contribute to:

- Limit pollution pressure in nitrates and phosphorus and improve the chemical quality of brines, biological environment and ambient air;
- Limit the return of polluted water to the surface water table.

#### V. CONCLUSION

The chemical analysis of the brines shows high concentrations of: COD, BOD<sub>5</sub>, NO<sub>3</sub> and PO<sub>4</sub>. This reflects a certain and dangerous pollution of chotts and sebkhas in the Algerian Low Sahara. It is certain that these lacustrine environments are influenced by discharges of wastewater typically domestic. The high organic load estimated by the measurement of BOD<sub>5</sub> and COD suggests significant organic pollution. According to the standards, the waters in these environments are almost ten (10) times more loaded with organic matter.

If nothing is done to protect these environments, the impact of human activities could have irremediable consequences.

So, what to do?

- It is obliged to suppress discharges of raw water into these environments;
- Check the efficiency of wastewater treatment at already established treatment plants;
- Reuse treated water in agricultural needs, etc.

It is also necessary for the state to impose its authority on the different sectors to comply with the regulations in force regarding the protection and respect of the environment.

#### REFERENCES

- [1] El Guamri Y., Belghyti D., El Kharrim Kh., Raweh S., Sylla I. and Benyakhef M. (2008). Physicochemical study of raw wastewaters of Kenitra municipal slaughterhouse (Morocco) for the implementation of a suitable treatment. *Sud Sciences et Technologies*. N° 16 Juin 2008. ISSN 0796-5419
- [2] Dubief J. (1963). *Le climat du Sahara*. Institut des recherches sahariennes. Mémoire hors-série, tome 1 et 2. Alger, 275p.
- [3] Rodier J. (2005). *Analyse de l'eau naturelle et des eaux résiduaires et eaux de mers*. 8. ed. Édition Paris : DUNOD.
- [4] IBGE (1987). *Water in Brussels*, Ministry of Public Health and the Environment. "Royal Decree of 4 November 1987 laying down basic quality standards for the waters of the public water system and adapting the Royal Decree of 3 August 1976 laying down general regulations for discharges of wastewater into ordinary surface waters, public sewers, and in artificial ways of rainwater drainage ", MB of 21.11.87.
- [5] CCME, 2002. *Recommandations canadiennes pour la qualité de l'environnement*, mise à jour 2, novembre 2002, Winnipeg, le Conseil.
- [6] OMOE, 1984a. *Water Management-Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment*, Revised edition, 70 p.
- [7] Inhaber, H., 1975. *An Approach to a Water Quality Index for Canada*, Water Research, vol. 9, p. 821-833.
- [8] ISO EN NBN 90-101: Brussels North wastewater treatment plant. Documentary \ LABW in Conformity N1 LAB 00 KTR 002.

- [9] CCME, 2003. Recommandations canadiennes pour la qualité de l'environnement, mise à jour 3.2, décembre 2005, Winnipeg, le Conseil.
- [10] Guideline value of surface water corresponds to the mandatory values A1 of the decree of 3 January 1989 in Management of potentially polluted sites - version 1 BRGM Edition - June 1997.
- [11] OMOEE, 1994. Water Management. Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy, Toronto, 32 p.