Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/14833
DOI URL: http://dx.doi.org/10.21474/IJAR01/14833

RESEARCH ARTICLE

PARTIAL PHYSICO-CHEMICAL PROFILE OF PORTO-NOVO LAGOON IN BENIN (WEST AFRICA)

Mickael Vitus Martin Kpessou Saizonou[1], Samson Ahognonhou Agossou[2], Azim Mohamed Abibou[2], Theodore Atakin[1], Bertrand Hounsemon[1] and Daouda Mama[2]

1. Unit of Research in Ecotoxicology and Quality Study. Laboratory of Study and Research in Applied Chemistry, PolytechnicalSchool of Abomey-Calavi.
2. National Institute of Water,University of Abomey, Calavi. 01 BP 2009 Cotonou- Benin.

Manuscript Info

Manuscript History
Received: 31 March 2022
Final Accepted: 30 April 2022
Published: May 2022

Key words:-
Characteristics, Physico-Chemical, Lagoon, Porto-Novo

Abstract

The lagoon of Porto-Novo is located in the south of the Republic of Benin where rainfall is appreciable. This river, has a high importance for the resident population because of itshalieutic resources providing and its use for domestic activities. This research aim to study a part of the ionic profile of the lagoon to determine what kind of chemical matters it contains. The results show globally composition matching the standards of surface waters. As examples, all of the tenorsregistred are below2000 µS/cm consideredas maximum value for conductivity. Values recorded are alsobelow standards for nitrogenreduced and oxidedforms (NH_4^+ and NO_3^-). Samely the PO_4^- contents are between (0.13 mg/L and 0.22 mg/L, those of iron,between0.31mg/L and 0.44 mg/L and allarebelow standards. These values justifywhy the lagoonprovidesuitable live conditions for halieuticsspecies.

Introduction:-

The natural watersqualityislargelyaffected by the covervegetation, agricultural practices, urbanization and more generally by the economicactivitiesdeveloped in the landscapeswherethey flow.Day after day, humanity is confronted with the scarcity of water. Indeed, water resources are not inexhaustible and we must be aware that we must protect them. Lagoon of Porto-Novo in Benin is one of the most important rivers in the south of the country, where rainfall is appreciable. This river, full of halieuticressourcesfished and consumed by a large part of the population, is also used for domestic activities such as bathing, cleaning clothes and dishes and at the same time as toilet by those of local residents. This work aims to study the physicochemical characterization of the water in this lagoon to prevent the risks of spreading water-borne diseases.

Material and Methods:-

Study area:-

Porto-Novo is atSouth East of Republic of Benin (6°28' N, 2°36 E).The lagoon (the study's area) islocated at westsouth of the city and isboarded by Aguegues and Denou, thelakeNokoue and the littoral plain.The complexlakeNokoue- Porto-Novo'slagoon (about 180 $km^2$for bothin dry season)constitute the main salted waters in the town. Porto-Novo'slagoonislessexpandedthanlakeNokoue (35 km^2 in dry season and 50 km^2in rainyseason) and

Corresponding Author:- Mickael Vitus Martin Kpessou Saizonou
Address:- Unit of Research in Ecotoxicology and Quality Study. Laboratory of Study and Research in Applied Chemistry, Polytechnical School of Abomey-Calavi.

is the outlet to Oueme river to reachAtlantic Ocean. The lagoonmeetcontinually thelakeat westvia the canal of Totche. The figure1 presents the study zone.

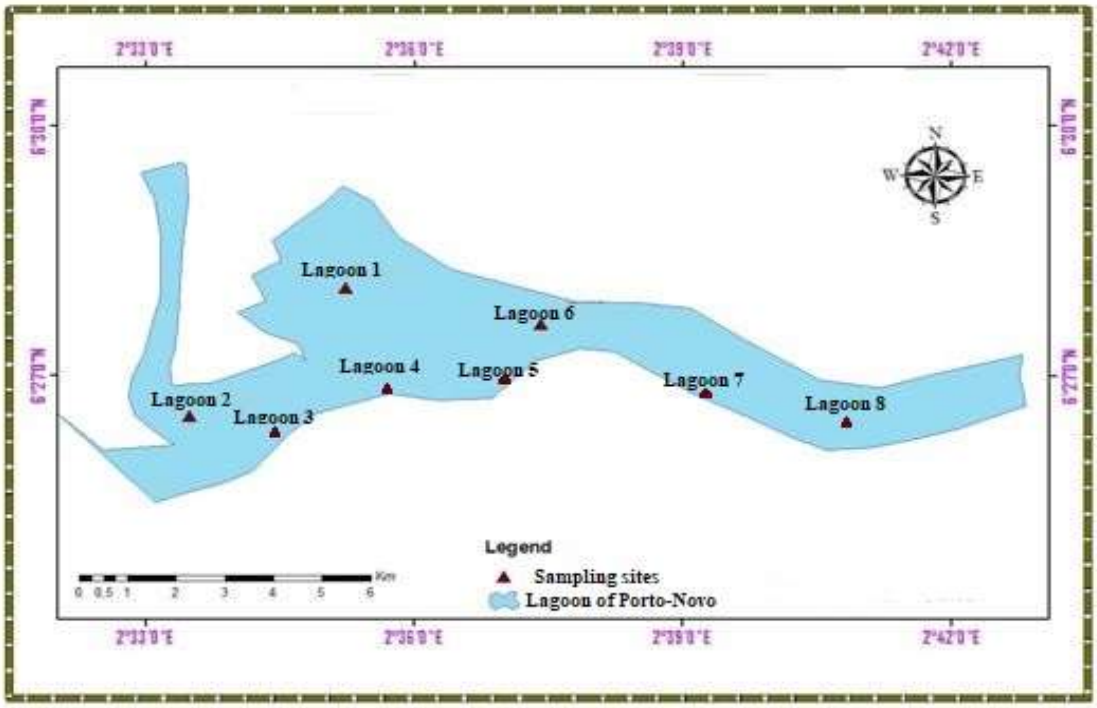

Figure 1:- Sampling sites.

Sampling:-

Samplingwascarried outat 8 sites purposelyduring the dry season to mimnimize dilution effects in order to have the best concentrations of the paramatersmeasured.Sampling pointswerechoosenon sites of important fishing, where water ismuchused byresidents and mostlynearpotential sources of contamination such as banks close to wastesdepositsand besideshomes. Waters sampleswerетaken at 3m deeplydirectlyfrom the lagoonand stored in ice box about 4°C beforebeingtaken to laboratory for analysiswichwere made according to standards analyticalmethodindicated byRodier and al (2009).

Results and Discussion:-

Temperature:-

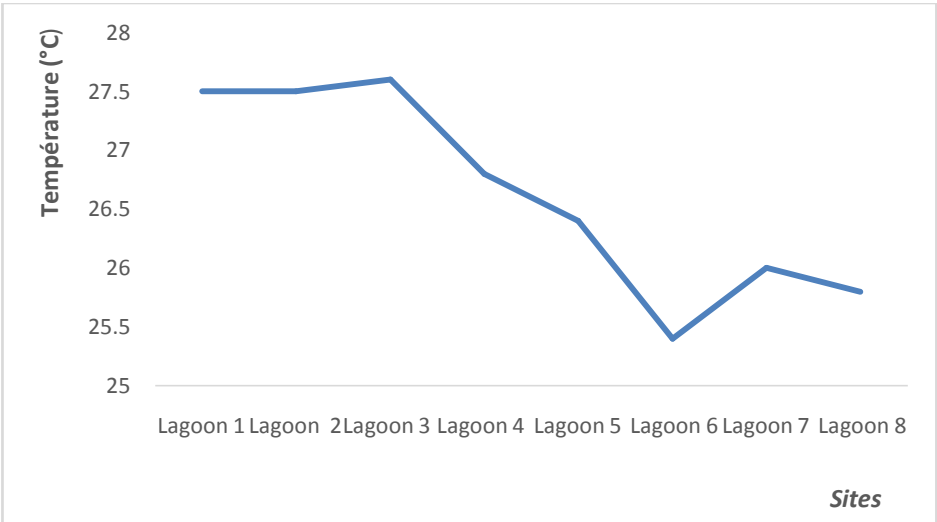

Figure 2:- Variations Oftemperature.

The temperatures of all the samplesarebetween25,8°C and 27,24°C. These values do not influence the othersparameters in priority but they are lessthanthose(27,7°C - 31,5°C) obtainedby Mehounouand al (2016) in Aplahoue (Benin) and higherthanthose (< 25°C) registred in Ngaoundere(Cameroon) by Aguizaand al (2014) andTfeiland al (2018) in Mauritusin dry seasonfor surface waters in Africa.

Color spatial variations:-

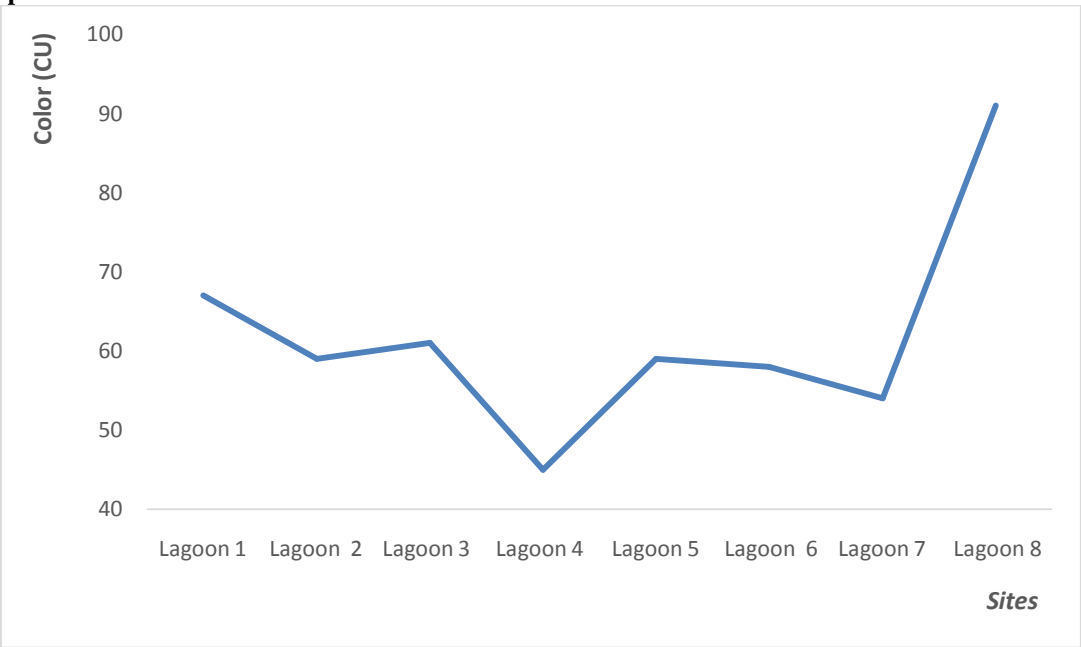

Figure 3:- Variations Of Color.

This figure,showingwater'scolor at differentssampling points, indicates a firstoverview, the water's trouble because of the important gap between the maximum value admissible (15CU)Rodier and al (2009)for surface waters and thoserecorded at the sites wich as thoughverylowthanthoseobtained by Mehounouand al (2016) in Aplahouewherecottonismuchcultived.

pH

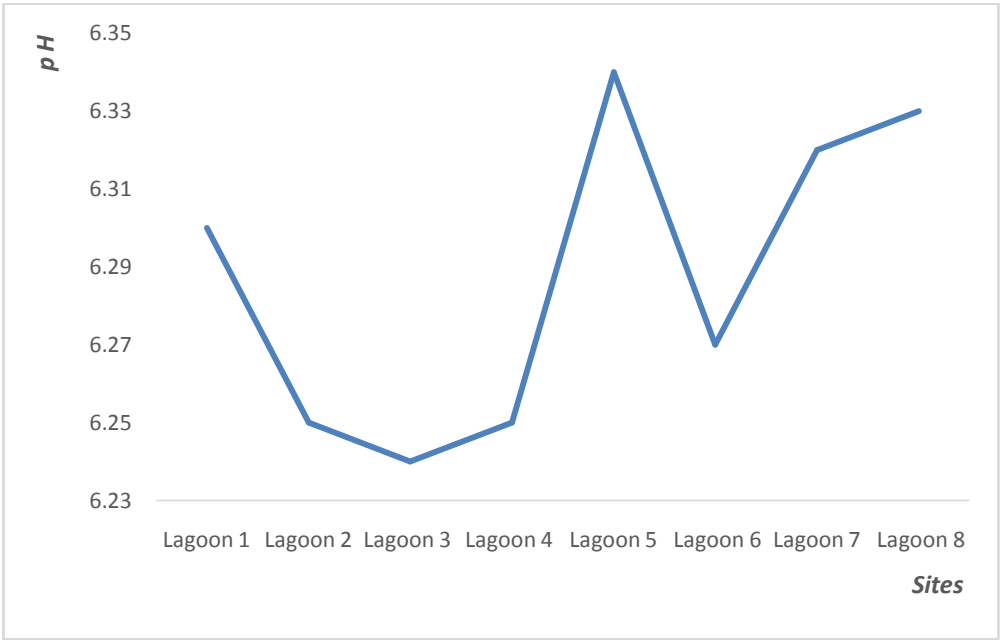

Figure 4:- Variations of pH.

Values recorded for pH are includedbetween 6.24 and 6.34. There are lessthanthoserecorded in Morocco (7.73-8.89) by Abdoudiand al(2014)in surface waters ofGuigouwatershedbassin. These values, a bit lessthanthoserecommanded by Cameroon standards (6.5 ≤ pH ≤ 8.5) (Aguiza and al, 2014) as surface water standards,indicate a slight acidification of water. This shouldbe a consequene ofthe influence of anthropogenicactivities on water quality. Itshould impact their use for domesticneeds and alsoaquatic live by restraining good conditions for wellgrowing of hallieuticspecies and vegetable in thisaquaticechosystem but observations made on sites show contrary.

Global Conductivity:-

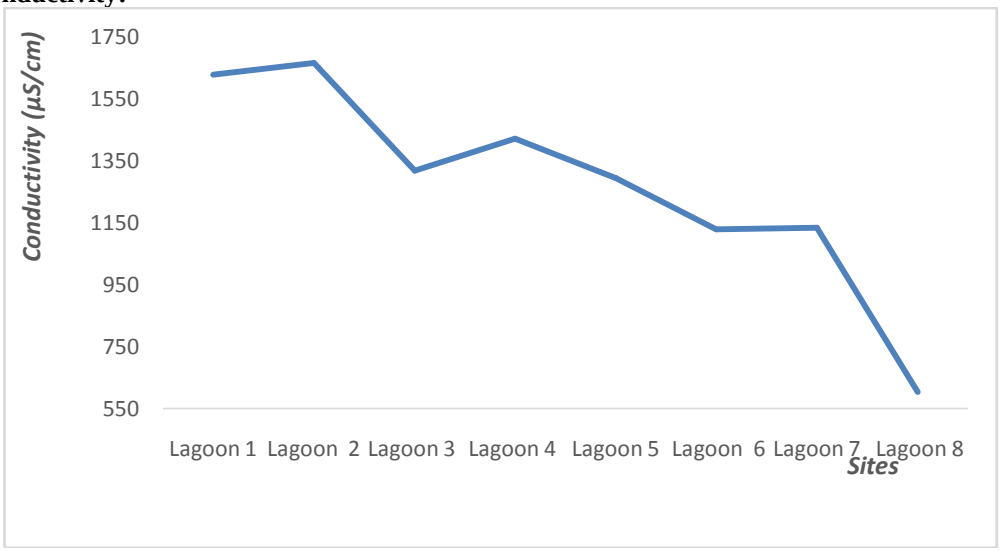

Figure 5:- Variations of conductivity.

For surface water, standardsrecommand 2000 µS/cm as the maximum value for conductivity. All of the tenorsregistredare belowthis value. The lagoondoes not presentinconvenienceregarding to global ions contents for halieuticspecies and plants. Though, values registred are high and added to the pH,showing a mineralization of the lagoon water.

Nitrogen contents:-

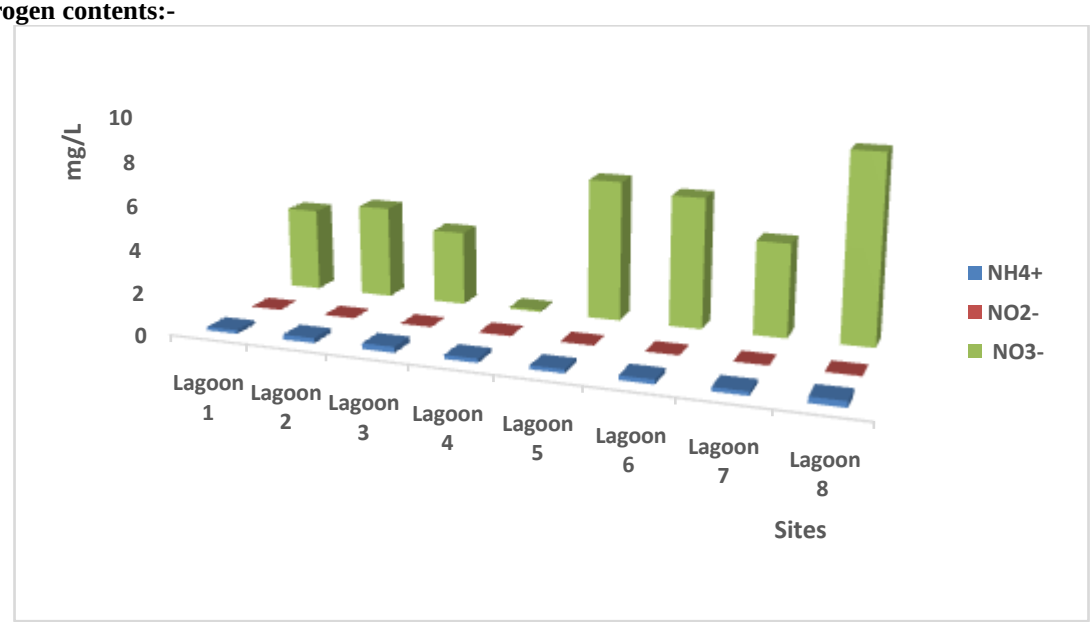

Figure 6:- nitrogen ions contents.

All of the values recorded for nitrogen ions contents are belowthoserecommended by WHO (Tfeiland al, 2018). Contrary to apprehension, the lagoon pollution by nitrogenis not remarkable. Despite the artificial pesticides and fertilizers uses in agriculture in the neighboardsvillages, worries are cancelled by dilution phenomen and lagoonoffershealvy habitats for halieuticspecies.Thesevalues are in harmonywiththoseobtained in Bruxelleswich are around6 mg/L as average for total nitrogen for surface waters of Woluwe canal (environnement.brussels, 2011).

Sulphate Contents:-

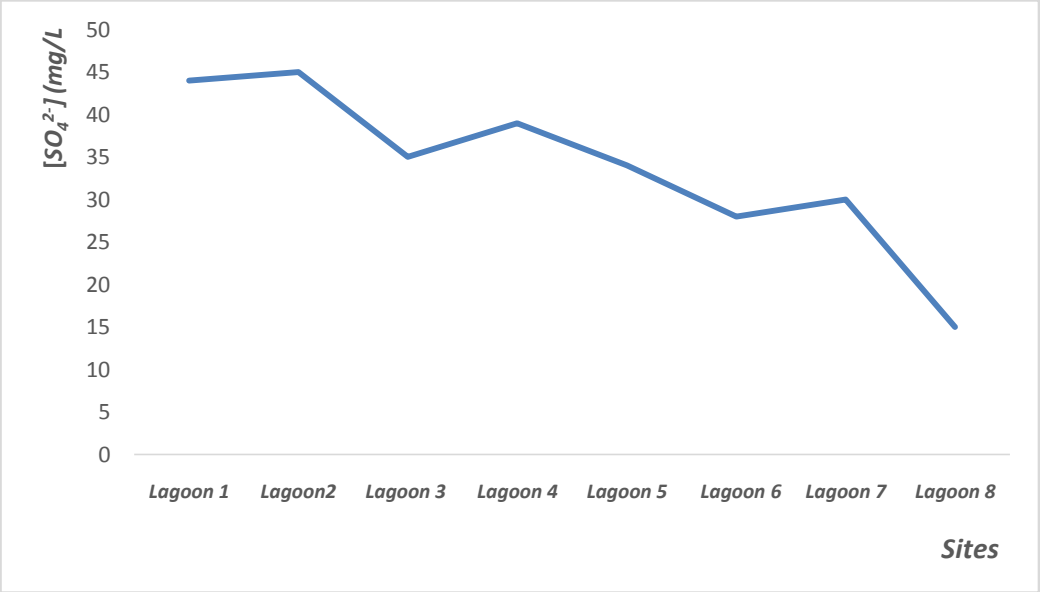

Figure 7:- Variations of sulfate contents.

Sulfate ions originatefromrainwater and the dissolution of sedimentary and evaporitic rocks, such as gypsum ($CaSO_4$) but also pyrite and veryrarelymagnetic rocks (galena, blende).Anthropogenicorigins are fertilizers, washing waters, carbon and oil combustion wichgenerate an important production of sulfurides(Barry, 1989).The reversible transformation of sulfates to sulfides occurs through the sulfur cycle (Peck, 1970).The surface waters generally sulphates contents are very variable and between 2.2 mg/L and 58 mg/L (Meybckand al, 1996). Values recorded in waters studied, are between 15.03 mg/L and 45 mg/L and lowest than those recorded in Marocco by Abdoudi (2014). The values registred in this work shouldbe due to fertilizers used in agriculture on the lagoon edges.

Phosphate contents:-

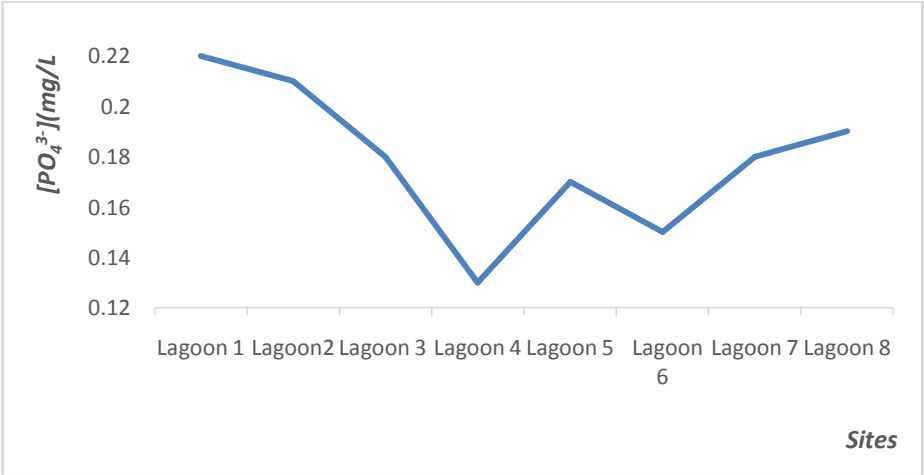

Figure 8:- Variations Of Phosphate Contents.

Phosphates come fromdetergentsthrown in surface waters throughdishwashing and bathingactivities. Despite surface waters autoepuration,itshouldbenotedthat the residuethat have resistedbiodegradationwouldbe more harmful for fishthan surfactants containingdetergents, according to certain authors(Rodier and al, 2009).Phosphates ions obtainedvalues are between 0.13mg/L and 0.22mg/L. According to AFNOR (1999) standards (0.2 mg/L), these values are acceptable. The values obtained match thoserecorded in Bruxelles wich are around 0.4 mg/L as average for total phosphorus for surface waters of Woluwe canal (environnement.brussels, 2011) butbelowthoseregistred by Aguiza (2014) in Cameroonwich are as averages, 1.73 mg/L and 3.09 mg/L, in surface waters on certain sites.Regardingthese values the lagoon of Porto-Novo does not presentriskconcerning to phosphate.

Fluorures et Iodures:-

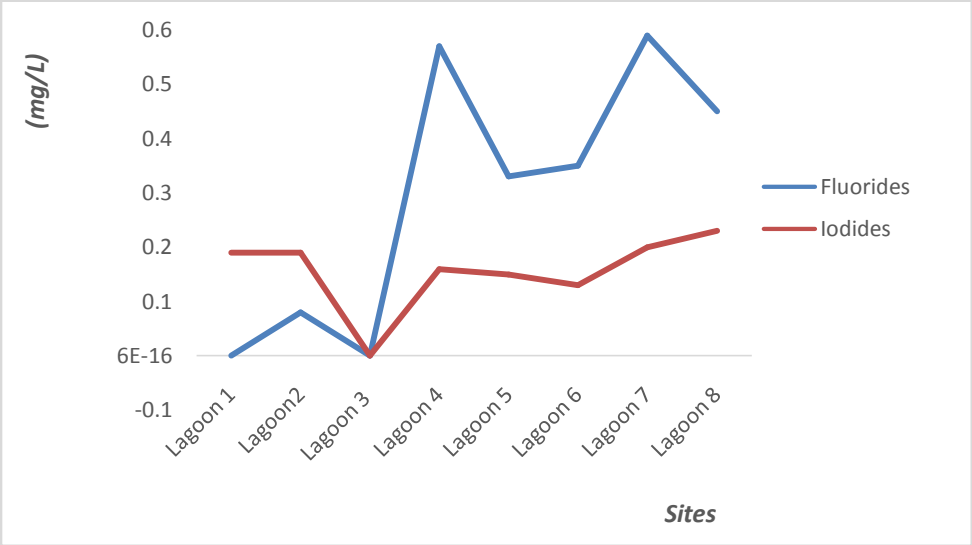

Figure 9:- Variations Of Fluorides And Iodidescontents.

All of the values recorded are below 0.6 mg/L and it'snotedthat the fulorides contents are more important thaniodides. The lowest concentrations obtainedshouldindicatethatdomesticwastesthrowninto the lagoon and fertilizers and pesticides used in agriculture, even if, from time to time, are suspiscions not being for good quality , do not containsignificantquantities of these ionsso as to negatively impact the lagoon.

Chloridescontents:-

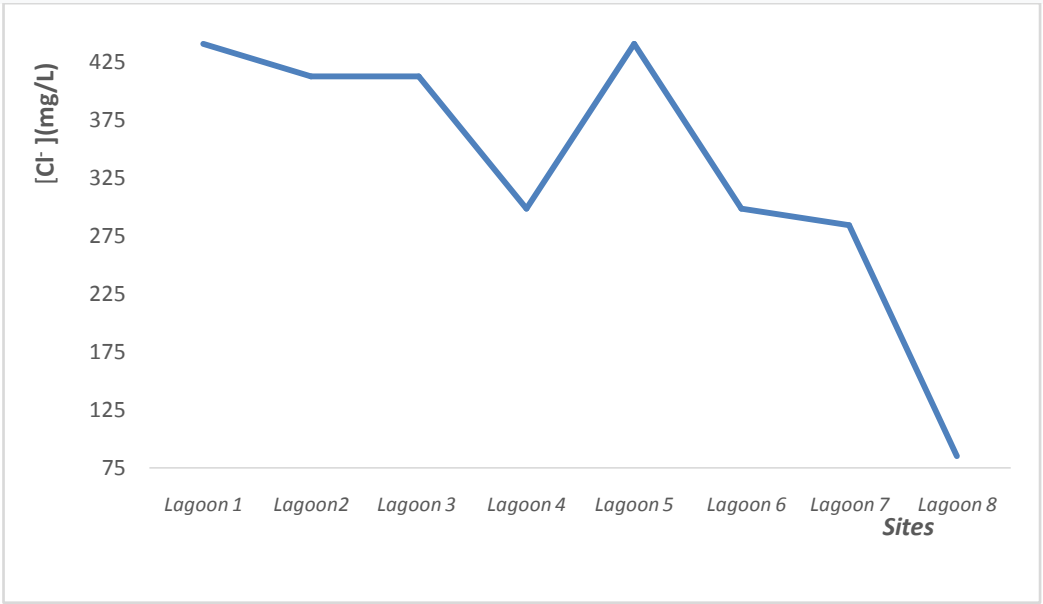

Figure 10:- Variations Of Chloride Contents.

Chloride ions are considered as pollution indicators and influence aquaticvegetation and fauna. Theyalsopreventaquaticvegetationgrowth.According to MATEE(2002),the highest value for natural waters is 750 mg/L for theseions contents.Values obtained inthisstudy are lessthanthis value and shouldbesuitable for halieuticspeciesbecausethere are evenbelow the maximum (250 mg/L) recommended for drinking water Tfeiland al (2018) at some sites and high somewhereelse.These high values are due to the connexion between the lagoonwith the Atlantic Oceanseawardstowards Lagos city in Nigeria but because of dilution effectitisnoted a balance of the values on whole the lagoon.

Total iron (Fe^{2+}/Fe^{3+}):-

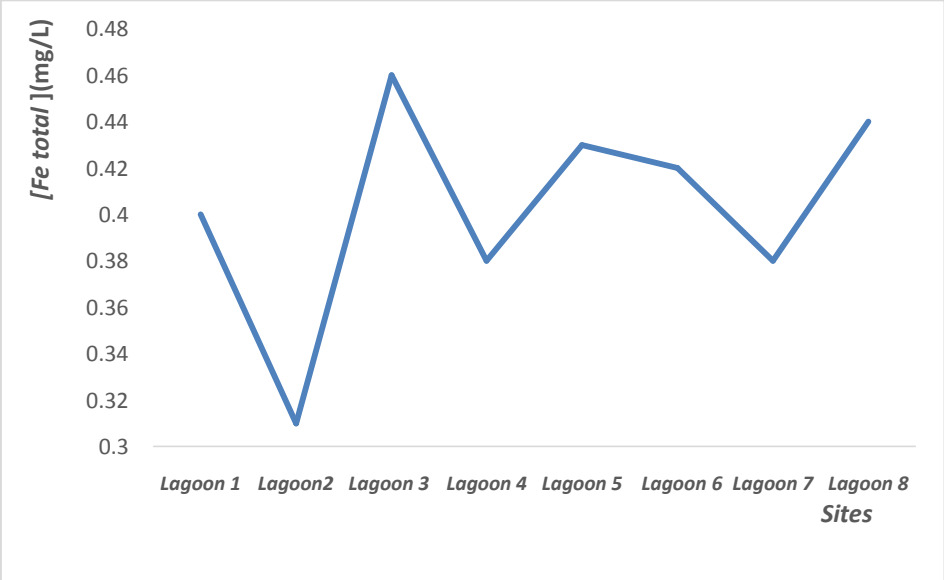

Figure 11:- Variations Of Iron Contents.

Total iron contents are between0.31mg/L and 0.43mg/L. All of these values are reallylessthanthoseobtained by Aguizaand al (2014)in Cameroon. They are alsohigherthan WHO recommandations for drinkink waters (0.3mg/L) and values obtained in Marocco by Abdoudi (2014) for metallic trace elementsincluded iron. These values are due to anthropogenicactivitiessuch as householdwastesthrown in the lagoon and do not presentany major disturbance for aquaticspecies.

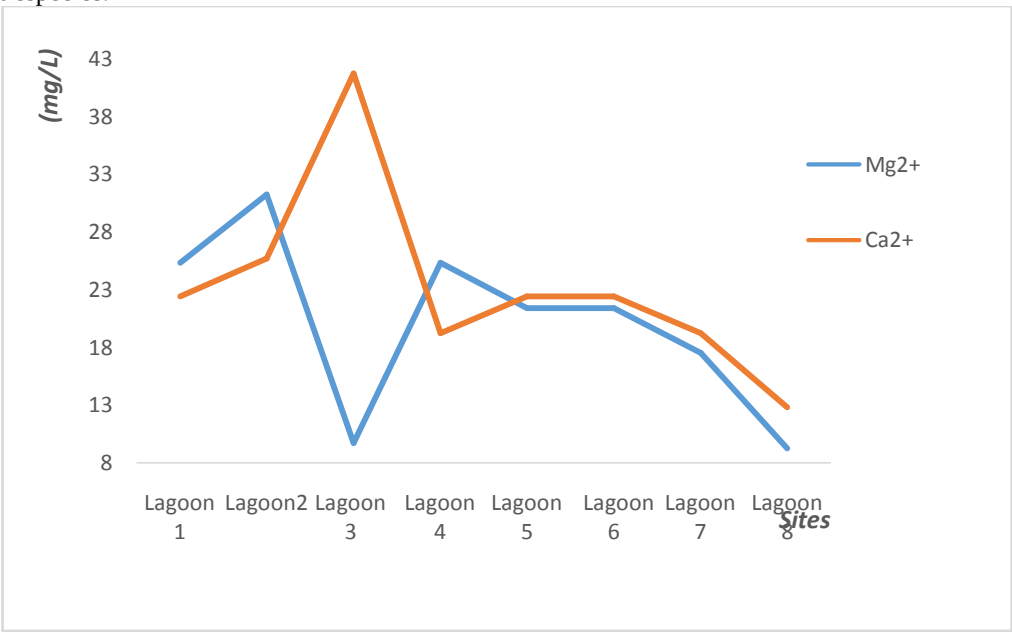

Figure 12a:- Variations Of Magnesium And Calcium Contents.

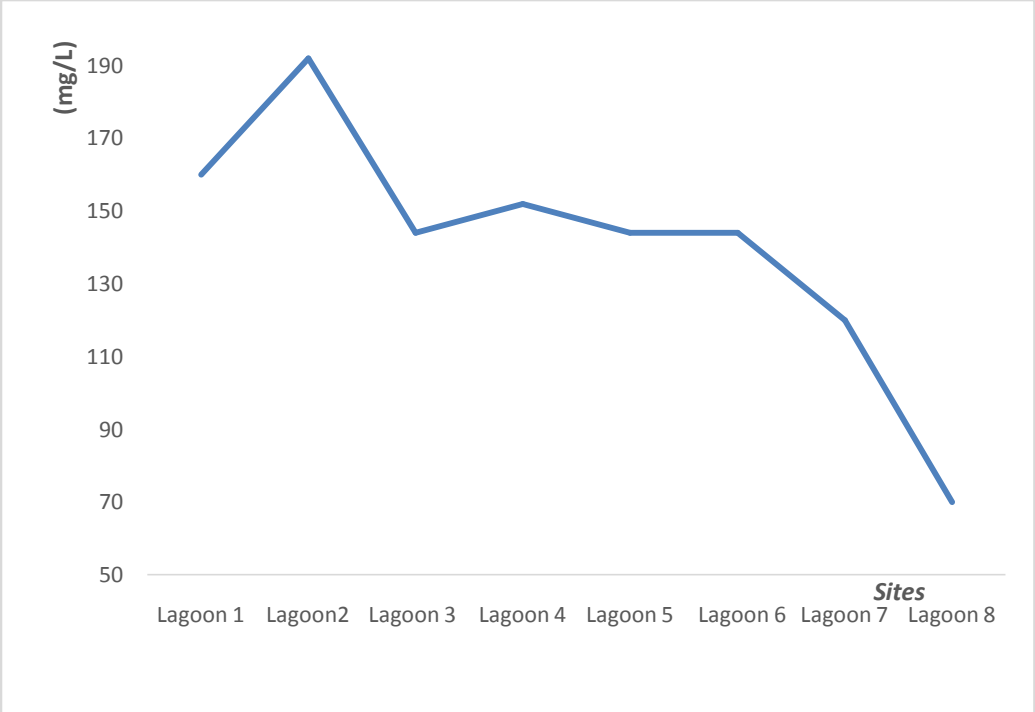

Figure 12 b:- Variations of total hardness.

Total hardness:-

Apart the value recorded at the second site, all of othersregistredagreethoseobtained by Mehounou in Aplahoue and are alsobelowthe highest (163mg/l - 266mg/l)recorded by him(Mehounouand al, 2016). But according toRodierand al (2009) , the total hardness values shouldbeincludedbetween0.3 mg/L and 1 mg/L to facilitethe soaping of water. Sothe valuesobtaineddecreasethiscapacity for thesekind of water but do not presentriskconcerning total hardness.

Conclusion:-

This study made on Lagon of Porto-Novo provide informations about certain ions thatitcontains. The values obtained for the parametersconsidered are in phase with AFNOR and WHO standards and thosevalues recorded for surface waters in otherscoutries by othersauthors in the country and elsewhere in Africa. It willbecontinuedby microbiological profile determination and the measurement of others physico-chemicalparameters values.

References:-

1. **Newspapers**
2. **Abdoudi,H. Tabyaoui, H. El Hamichi,F. Bernaabidade, L. Lahrach, A.**(2014). Surface waters of the Guigou watershed bassin in Morocco. European Scientific Journal 10 (23):84-94
3. **Aguiza, A. E. Ombolo, A. Ngassoum, M.B. Mbawala, A.** (2014).Survey of physico-chemical and bacteriologicalquality of water along the Ngaounderestream (Cameroon). Afrique SCIENCE 10(4) 135 – 145
4. **Mehounou,J. P. Josse, R. G. Dossou-Yovo, P. Senou, S. F. M .Toklo R.**(2016). Physico-chemical and microbiologicalcaracterization of groundwaters and surface waters in Aplahoue'scotton production areas. J. Appl. Biosci. 103:9841 – 9853
5. **Tfeil, H. Mahfoudh, M. Mhamed,B.A. M. Aliyen, A.Yarba,L. Hmeyada, A. M. V.** (2018). Physico-chemical characterization of water from surface and study of the chthyological diversity of some continental wetlands in Mauritania.European Scientific Journal. 14 (6): 83-101
6. **Books and websites**
7. **AFNOR** (French Association of Standards).Water quality. Tome 1. Terminology, sampling, quality control, (1999), 393 p.
8. **Barry**,**G.S.** (1989) .Sodium sulphate. Canadian mineralsyearbook – 1988. Mineral Report, n° 37. Division of mineral ressources, energy, mining and ressources. Ottawa.

9. **Ministry of Regional Planning, Water and the Environment (MATEE).** (2002).Moroccan standards for the quality of water intended for irrigation.1276-01
10. **Meybck, M. Friedrich, G. Thomas, R. Chapman**, **D.** (1996)**.**Water qualityassessments : a guide to the use of biota, sediments and water in environment monitoring, Chapman edition, 2nd ed. E & FN Spon, London, pp. 59-126.
11. **Peck**, **H.D.** (1970). Sulphurrequirements and metabolism of microorganisms. Proceedings of a symposium on sulphur in nutrium. D.H. muth& J.E. oldfields. Ari Publishing Co., Wespost, CT.
12. **Rodier,J. Legube, B.Merlet, N.** (2009).Water analysis. 9th edition, Dunod.www.dunod.com
13. https://environnement.brussels/lenvironnement-etat-des-lieux/rapports-sur-letat-de-lenvironnement/rapport-2011-2014/eau-et-4#:~:textconsulted on4th february 2022.