



Organic Pollution Indication as Tracer for the pollution of Well Water: The example of the District of Abomey-Calavi (Benin)

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Abstract

The organic pollution represents a serious problem for the environment; the worn-out waters domesticated and non-purified represent the main source of organic pollution of waters. Followed it of analysis in the different points of observation made the object of a treatment of data by the establishment of a card of organic pollution of 20 traditional well water, 1 deep boring and 4 surface water of the region, that informs us on the influence of the dismissals and the quality of waters by the slant of an organic pollution indication that himself calculation according to the method of Leclercq, Maquet (1987) whose principle is to distribute the values of the polluting elements in 05 classes, to determine from his own measures, the number class correspondent for every parameter to make the average of it. The interpretation of the card representing the different parameters of organic pollution of the 20 traditional well water, the boring water and the 4 surface water gives some results on the contamination or not of the naturel waters. The card shows that the different traditional well water in the district of Abomey-Calavi pass from a quality to another but they are more polluted than the deep boring water.

Keywords: Pollution, Abomey-Calavi, organic pollution indication, card of pollution.

Introduction

Water is essential to all plant, animal life and in particular to the life of human beings. The human body consists essentially of water. In vital organisms, water plays the role of supporting exchanges without which there is no life¹⁻². Freshwater resource is groundwater, surface water and rainwater. These water reserves are renewable but several studies worldwide have shown that these waters are more or less polluted. The pollution is a serious environmental problem because of dumped waste into rivers and the sewage was untreated represent the main source of organic pollution of waters³⁻⁴. The worn-out waters domesticate non purified represent the main source of organic pollution of waters⁴⁻⁵. They generate a deterioration of the quality of the surface and underground waters. The district of Abomey-Calavi doesn't have a system of treatment of the worn-out waters. The load of these dismissals is more and more increasing with the socioeconomic development of the region. The present survey aims to determine the assessment of the organic pollution indication in well water of the district of Abomey-Calavi.

The Region: The township of Abomey-Calavi is situated in the South part of Republic of Benin in the department of the Atlantic, between the latitudes 6°20'23.4 " and 6°42'6.6 " North and the longitudes 2°14'13.8 " and 2°25'7.8 " East. The township of Abomey-Calavi counts 70 villages and districts of cities distributed on nine (09) precincts that are: Calavi-Center, Godomey, Akassato, Zinvié, Ouèdo, Togba, Hèvié, Kpanroun

and Golo-Djigbé. The township of Abomey-Calavi, situated in the South part of Republic of Benin and the Department of the Atlantic, is limited at the North by the township of Zè, to the South by the Atlantic Ocean, to the East by the townships of Sô-Ava and Cotonou and to the west by the townships of Tori-Bossito and Ouidah (figure-1). It is the vast township of the department of the Atlantic of which it occupies more than 20% of the surface. It spreads on a surface of 536 km² representative 0.48% of the national surface of Benin. The township of Abomey-Calavi is very close to the biggest lagoon plan of water in Benin: The Nokouélake. Indeed, Long of 20 km (East-west) and large of 11km (North-South), the Nokoué lake has a surface of law water of 160 km² and represent the largest plan of water Beninese and most important lagoon to the point of view of its planning because of its proximity with the city of Cotonou⁶. The Nokouélake influences the underground water pollution considerably close to him⁷.

Material and Methods

Material: We analyzed the waters of the Nokouélake (surface water), traditional wellwater and deep boring water in the township of Abomey-Calavi from January to March 2013. We achieved analyzes them at the Laboratory of Applied hydrology (LHA) of the University of Abomey-Calavi (BENIN). We measured the ions nitrates, ammonium and phosphate by ionic chromatography. The DBO₅ is measured by a DB0-Meter.

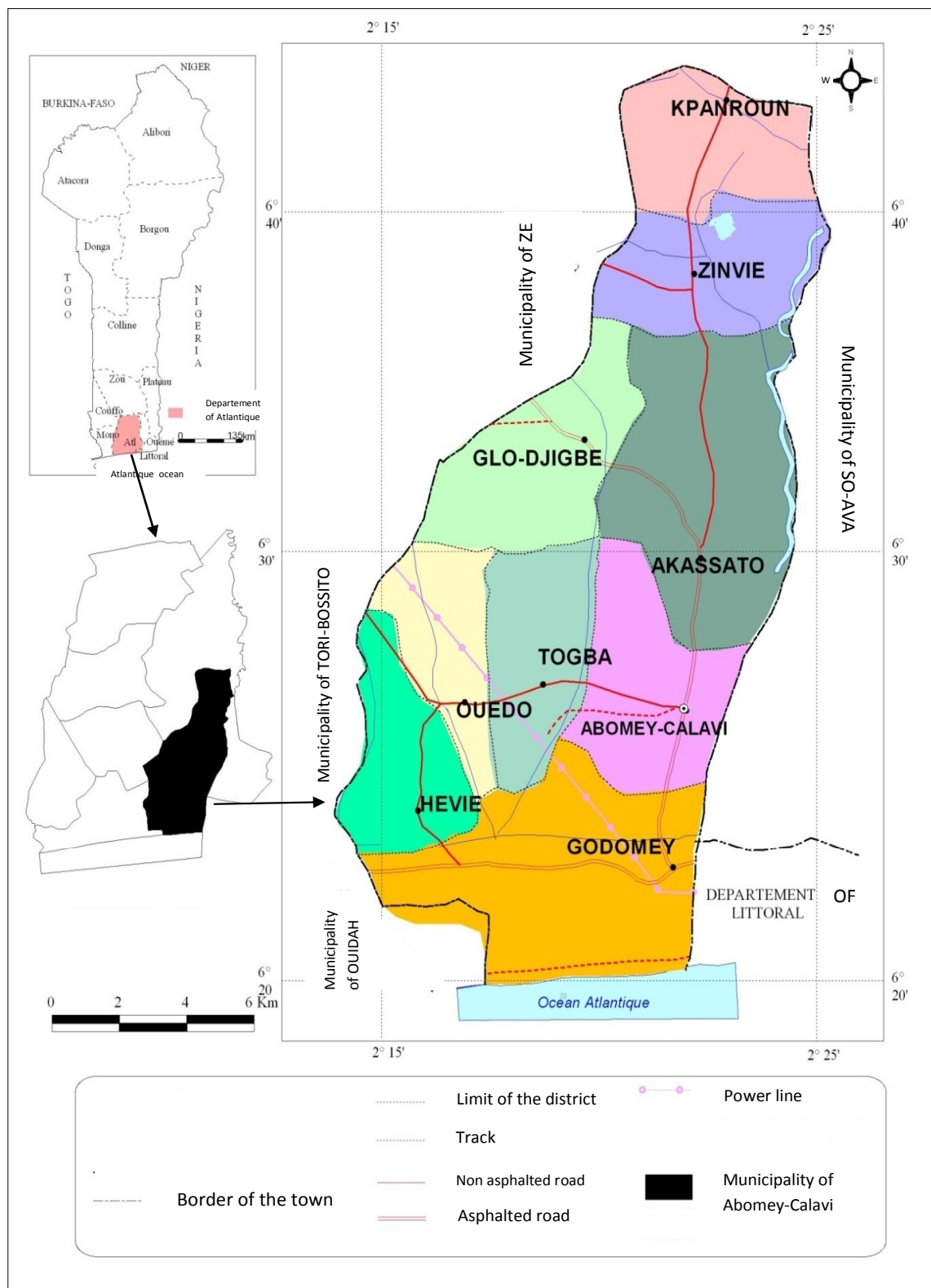


Figure-1
Location of the municipality of Abomey-Calavi

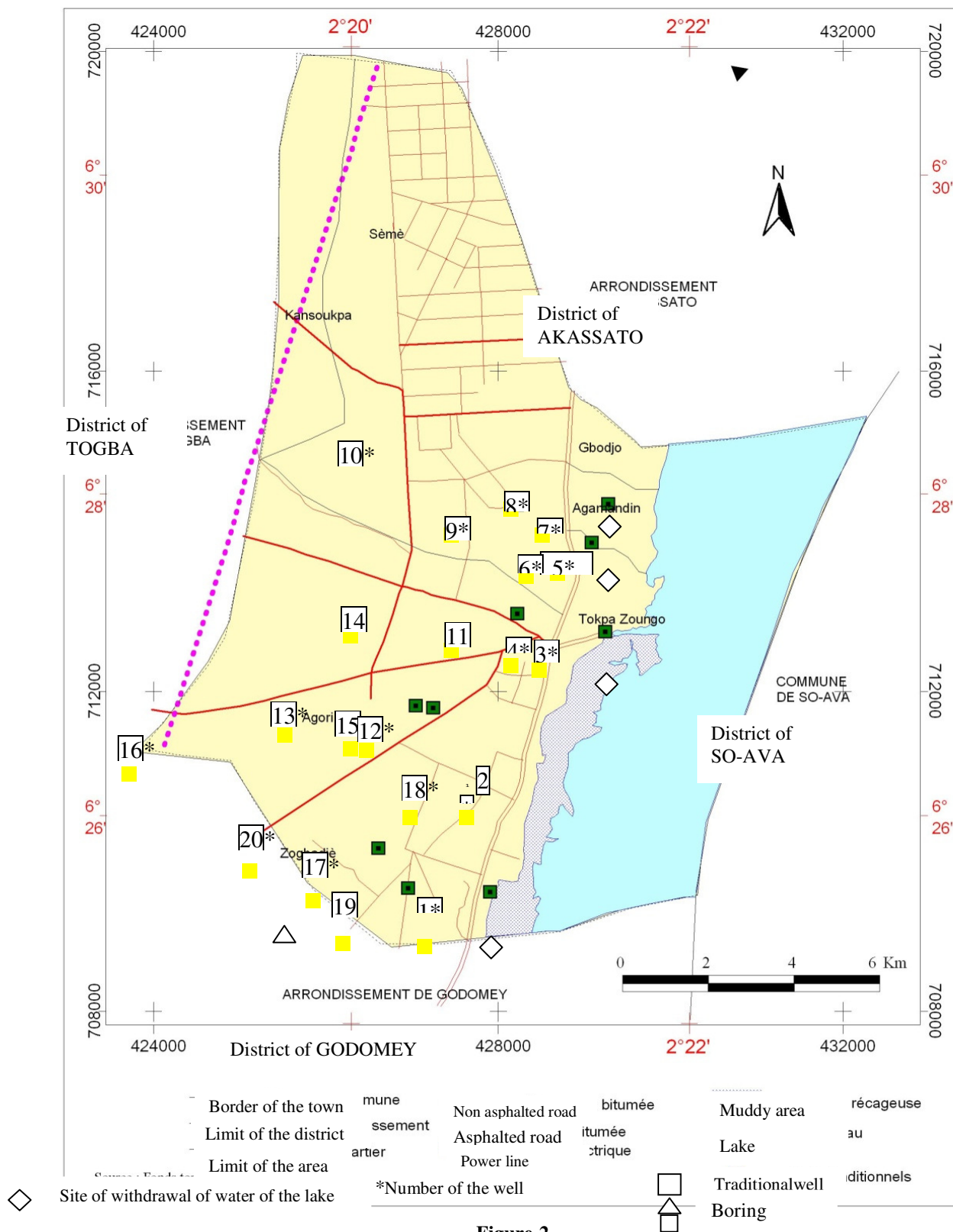


Figure-2
Water sampling sites

The approach of interpretation of the data on the organic pollution is based on the calculation of the Organic Pollution indication (IPO). The IPO depends on contents of water in ions ammonium, in nitrite and in orthophosphate and the DBO_5 . One definite 5 classes of contents for each of these parameters. The IPO is the average of the numbers of the classes of every parameter. The values of the IPO permit to distribute the organic pollutions of waters in 5 levels.

Table-1
Classes of contents for each of these parameters

	DBO_5 (mg O_2/L)	NH_4^+ (mg N/L)	NO_2^- ($\mu\text{g O}_2/\text{L}$)	PO_4^{3-} ($\mu\text{g P/L}$)
Class 5	<2	<0.1	<5	<15
Class 4	2-5	0.1-0.9	6-10	16-75
Class 3	5.1-10	1.0-2.4	11-50	76-250
Class 2	10.1-15	2.5-6.0	51-150	251-900
Class 1	>15	>6	>150	>900

The classification of the organic parameters makes itself according to five classes of quality corresponding to the generally admitted colors⁸.

Table-2
Level of organic pollution of waters according to the Organic Pollution indication

IPO	IPO Level of organic pollution
5.0 à 4.6	Very weak organic pollution (hopeless)
4.5 to 4.0	Weak organic pollution.
3.9 to 3.0	Organic pollution curbed
2.9 to 2.0	Strong organic pollution.
1.9 to 1.0	Very strong organic pollution.

Hopeless pollution in blue
Weak pollution in green
Pollution curbed in yellow
Strong pollution in orange
Very strong pollution in red

Figure-2
Color according to the classes of quality

Results and Discussion

Followed it of analysis following the different points of withdrawal permitted to calculate the natural indications of organic pollution of waters of the district of Abomey-Calavi. The interpretation of the card of indication of organic pollution of the natural waters indicates the degree of change of the waters of the survey region. All the samples of water of the Nokoué lake analyzed have a very strong level of organic pollution (IPO = 1).

Table 3
Organic pollution indication (IPO) of the sampled water

Nature of water sample	Points of withdrawals	Organic pollution indication (IPO) average
Water of Surface (Lake Nokoué)	L_1	1
	L_2	1
	L_3	1
	L_4	1
Water of traditional well	P_1	3.25
	P_2	2.9
	P_3	2.3
	P_4	2.6
	P_5	2.5
	P_6	2.7
	P_7	2.65
	P_8	2.9
	P_9	3
	P_{10}	3.2
	P_{11}	3.25
	P_{12}	3.75
	P_{13}	3.8
	P_{14}	3.75
	P_{15}	3.5
	P_{16}	3.9
	P_{17}	3.65
	P_{18}	3.5
	P_{19}	3.75
	P_{20}	3.8
Water of deepboring	F	4.25

The gotten results show that the IPO of the traditional well water vary, with a minimum of 2.3 and a maximum of 3.9. 35% of traditional well water studied have a strong organic pollution. 65% of the studied traditional well have a curbed organic pollution. The deep boring have a level of weak organic pollution (IPO=4.25).

The traditional well water are more polluted than the deep boring water. The assessment of the pollution of the underground waters by the IPO shows a contamination by the waters of surface polluted. However the degree of pollution remains least by contribution to the waters of surface.

Conclusion

The degree of the organic pollution varies from a zone to the other with contents that sometimes pass those that recommends the WHO. Water, by its elevated solvent power, dissolves the substances rejected by the human activity.

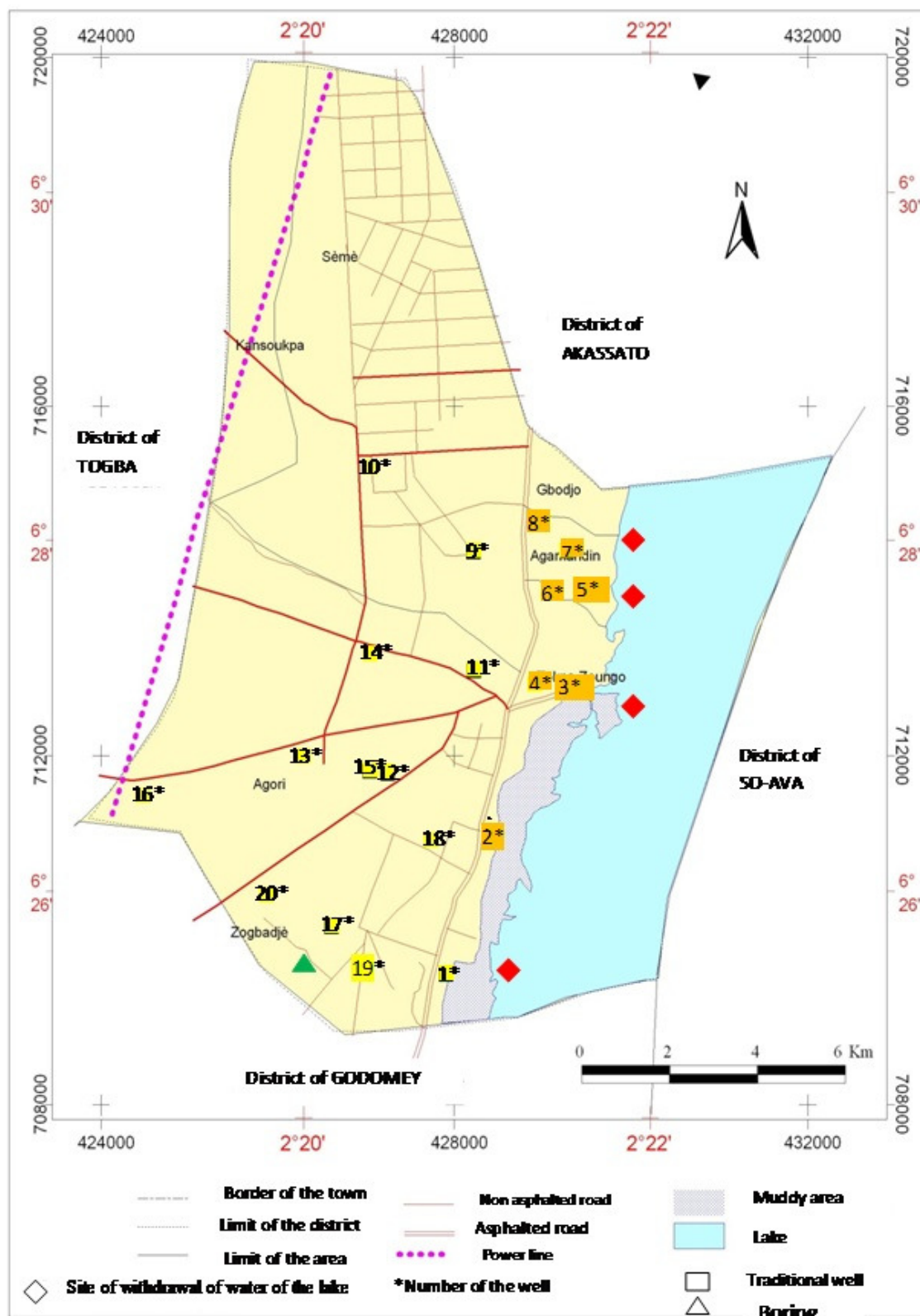


Figure-3
Organic pollution indication card (IPO) of the natural waters in the district of the survey zone

The chemical pollutants are numerous, various and most harmful origins are the compounds of nitrogen as the nitrites, provoking serious unrests at the young vertebrates by deterioration of the blood hemoglobin. They can provoke hypertension and can be the precursors of carcinogenic nitrosamines⁹. The assessment of the pollution of the underground waters by the IPO shows a contamination by the waters of surface polluted. However the degree of pollution remains least by contribution to the waters of surface. The origin of the excessive quantities of the nitrites, phosphates, DBO₅ and ammonium in the waters natural of the township of Abomey-Calavi, seem to be essentially of urban origin. The worn-out waters contain big nourishing substance quantities in particular as the organic matters encouraging, by their tipping, the fast and continuous growth of seaweed and aquatic plants (case of the NOKOUÉ lake). Indeed, we notes an eutrophication of the NOKOUÉ lake¹⁰.

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