Blood Lead Levels and Bio-markers of Lead Toxicity via the Consumption of Drinking Water in Kerou (Benin) in Watershed of the Niger

Bernadin ELEGBEDE[*1, 3], Patrick A. EDORH[2, 3], Alain K. AÏSSI[3], Luc KOUMOLOU[4], Christophe KAKI[5], Patient GUEDENON[3], Koffi KOUDOVO[4], Sabine MONTCHO[3], Michel BOKO[6]

[1, 3] State Department of Water, Oueme-Plateau, 04 BP 1412, Benin

[2, 3]Biochemistry and Cellular Biology Department, Faculty of Sciences and Techniques, University of Abomey- Calavi (UAC), 01BP 526 Cotonou, Benin

[3]Interfaculty Centre of Training and Research in Environment for Sustainable Development (CIFRED), University of Abomey (UAC), 03 BP 1463 Jericho Cotonou, Benin

[4]Departments of Physiology / Pharmacology, Faculty of Science, University of Lomé (UL), BP 1515 Lome, Togo

[5]Sciences Department of Earth, Faculty of Sciences and Techniques, University of Abomey Calavi (UAC), 01BP 526 Cotonou, Benin

[6]Laboratory Pierre Pagney: Climate, Water, Ecosystems and Development (LACEEDE), 03 BP 1122 Cotonou, Benin

*elegbedebern@yahoo.fr

Abstract- **This survey made an assessment of bio markers witnesses of a chronic poisoning to the lead via the consumption of the drinking water whose contamination has been proved in the cotton zone of Kérou. Contents of lead measured out in samples of water of boreholes and out in blood plasma by atomic absorption spectrophotometer have been compared. To check the health impact of water pollution by pesticides and toxic metals, the present study conducted the collection of blood and urine of 39 residents, following the ethical rules. Kerou in Benin is a good reference of a site to test the hypothesis of the connection between water pollution with heavy metals (Pb in the present investigation) and human health and the intensity of farming activities and cotton cultivation in the zone.**

After laboratory analyses, the calculation of the Daily Exposure Dose (DED) showed high doses of toxic substances especially the lead in the plasma. These high values can be attributed to residues of pesticides. Results also show a lead level in blood interrelation in water for boreholes F3, F5 and F7. The blood lead limit has been passed in zones of the F12 boreholes, F16 and F18. Signs of poisoning to the lead are not marked at the level of the biochemical parameters but at the level of symptoms of lead poisoning have been observed within the investigated population of the residents.

These results were confirmed by checking the poisoning of the body of consumers around the measurement of bio-markers such as urea, creatinin, transaminase, total cholesterol and urinary calcium of 39 individuals. It has been shown that chronic poisoning to lead via the consumption of drinking water occurred and bio markers witnesses were assessed.

Keywords- Cotton Culture; Boreholes Water; Blood Lead; Lead Poisoning

I. INTRODUCTION

Studies have highlighted the vulnerability of water from boreholes with manual pump type UPM or VERGNET particularly the toxic metal pollution in the cotton zone of Kérou (Elegbede, 2011), especially by lead. Dougnon et al., (2012) have shown that boreholes water used in garden-sites in Cotonou are more contaminated by lead than cadmium for example. Air emissions of lead are mainly anthropogenic (Casas, 2005). Many authors have shown an increase by a factor of 20 in relation to human activities over the last two centuries (Elegbede et al., 2012) (Murozumi et al., 1969; Boutron and Patterson, 1983). The main sources currently are still burning automotive fuels in urban areas and the use of fungicides in rural areas (Deluise et al. 1996; Bourrelier and Berthelin, 1998). This study aims to evaluate bio-markers, evidence of exposure to lead through consumption of drinking water in the Coton town of Kérou related to high values of Daily Allowed Dose (DAD).

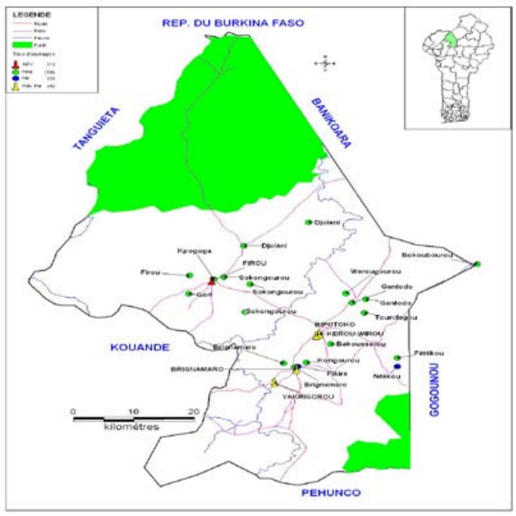

Fig. 1 Location map of the study area showing sampled boreholes

II. MATERIALS AND METHODS

A. Study Area

Fig. 1 describes study area. Kerou lies on latitude 10º 49'29'' North of the Equator and on longitude 2º06'30'' east of the Greenwich median. Kerou stands on the attitude of about 326 meters above the sea level. Kerou municipality is limited at North-West by the Municipality of Tanguieta with which it shares the Pendjari Park and at North-East by the Municipality of Banikoara which is the first producer of cotton at the national level. In the South, it shares its borders with the cotton belt of Pehonco, and Kouande Gogounou. It is divided into four Districts that are Brignamaro, Kerou, Centre Kaobagou and Firou. The climate of the region is governed by the North Sudanese regime characterized by two distinct seasons: a dry season from October to April and a rainy season from May to September. The study area is the second known producer of cotton at the national level; it is located in the watershed of the Niger which is controlled by the streams tributary of Pendjari such as the Sota and Mekrou River. Annual rainfall is around 900 to 1000 mm.

Its hydrogeology is dominated by Precambrian granitic-gneiss covered with a thick layer of clay-altered lateritic. Infiltration of rainwater is very intense due to the high density of the fracture network and the nature of the soil generally clay-lateritic with high permeability. The crystalline basement consists of igneous and metamorphic rocks and is waterproof, facilitating runoff chemicals substances in the beds of rivers. These geological formations explain the nature and properties of soils which are extremely fragile. The area is dominated by cotton cultivation with uncontrolled use of pesticides and fertilizers. They are undeniable sources of metals found in the river and in groundwater.

B. Sampling and Analysis

Thirty-nine people who were drinking water from eighteen (18) contaminated boreholes (Elegbede et al, 2012) were interviewed. Out of those people twenty five (25) bloods were taken and analyzed. The results revealed that all the 25 blood were contaminated by lead. One must notice that the level of the lead depends on closeness of the inspected person to Mekrou River or the cotton farms. People were surveyed on the basis of form attached to this document. As many samples of blood were made in the conditions of health standards and ethics. The various informations on factors which are likely to identify lead exposure were obtained by interview, and blood samples for blood lead levels were maintained in laboratory conditions. Lead was analyzed in the laboratory by flame atomic absorption spectrophotometer (Thermo Electron Corporation with Solar correction) according to the protocols suggested by Anane et al. (1995) and Vaidya et Al (1996). The data were represented by spots blots in Excel.

III. RESULTS AND DISCUSSION

Lead poisoning is defined as the level of lead that is higher or equal to 100µg/liter. The taking into account of this disease is difficult because it is about affection with no specific symptoms. It can thus easily pass unperceived. Only the proportioning of lead in blood can prove it. Previous study in this area showed the Daily exposure dose per body, weight (DED/bw) obtained for adults was 3.85µg/kg/day and 12.54µg/kg/day for children. They are largely exceeding allowed limit by WHO which is 3.6µg/kg/day of the body weight. Although the daily exposure dose per body weight exceeded WHO limit, it is however lower than those reported by Adam et al. (2011) which are 22.35µg /kg/j and 6.87µg /kg/j for children and adults respectively in another northern area at 70km from Kérou in Benin. However, to this DED/bw the amount day laborer brought by general food must be added (DEDf), since the children are exposed to this same metal via other food in the same way as population in general.

The results showed that there was lead in the blood of the inspected people and this is in connection with certain bio markers factors of toxicity. This identification crossed the data of investigations into recorded pathologies specific to metals and the level of contamination of the organism of the surveyed person. The level of contamination of the body by heavy metals and the pesticides is known by the identification through conversation, proportioning, of parameters biomarkers of toxicity (Fig. 2). The average blood lead is of 0.024mg/l. However the blood lead threshold which makes it possible to take cover from clinical signs is related to the Daily Allowed Dose (DAD) which is reached with a blood lead of 20µg/L, that is to say a DAD of 3.6µg/kg (WHO, 1986). Indeed, human consumption of contaminated food by lead which can cause a blood concentration of 10µg/dL, can involve the inhibition of the enzymes responsible for the synthesis of heme. This inhibition is complete for 90µg/dL (Landrigan and Tod, 1997). It is considered that the blood lead increases starting from contributions by 5µg/kg/day. The threshold of toxicity is defined like a lead concentration in total blood higher than 60µg/dl. The effects of lead were then considered in a simple way: or the individual showed clinical signs of poisoning. Then, the conviction came that lead could reduce the intelligence and deteriorate behavior with blood lead lower than 60µg/dl; with insufficient levels to produce obvious symptoms. Thus, was born the concept of subclinical poisoning with the lead, based on comprehension owing to the fact that lead produces a spectrum of toxicity in which clinical symptoms like encephalopathy, the renal insufficiency and anemia had their subclinical counterparts in a reduced intelligence, a faded operation of the renal tubules and high protoporphyrin rates.

Our results showed that there are signs of toxicity according to informations provided by the people surveyed in comparison, as shown in Tables Ⅰ and Ⅱ. All the known signs of lead poisoning were listed among surveyed people: weaken, abdominal pains, constipation, disturb digestive, anorexia, vomiting, behavioral problem, apathy or irritability, hyperactivity, disorders of the attention and the sleep sickness, bad psychomotor development, reduction in the cognitive performances. In the Kérou community, the recurring signs after the investigations were the digestive anorexia and disorders (lack of appetite, constipation) which are mostly the signs of the intoxication of lead without counting the nervous disorders. But one notices the catch presence of tobacco in the surveyed population. This can influence the effects of lead considerably.

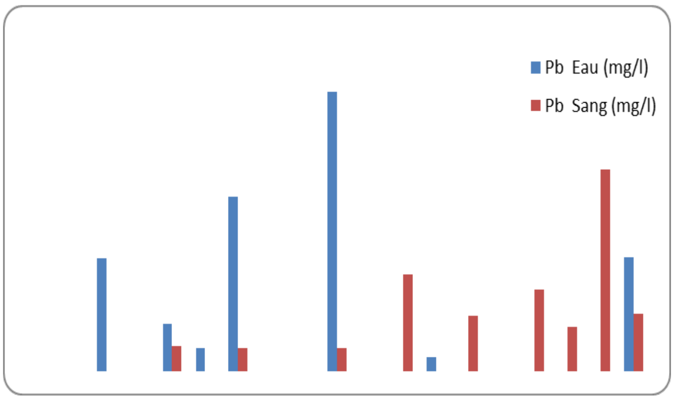

Fig. 2 Correlation between blood lead levels and lead in water

TABLE I RESULT OF BLOOD LEAD PROPORTION AND LEAD LEVELS WATER

FDrills	Villages	Locality	Pb Water (mg/l)	Pb Blood (mg/l)
F1	Firou	Firou Market	-	-0.0401C
F2		Camp Peul –EPP	-	-0.2962C
F3		Farm Manager	0,0394	-0.7316C
F4		Marékpo	-	-0.9045C
F5		Ganboré	0,0167	0.0087
F6	Kerou	Gantodo School	0,0079	-
F7		Toundagou	0,0613	0.0080
F8		Center	-	-
F9		Boni	-	-
F10		Konigourou Center	0,098	0.0080
F11	Briganmaro	Kossou-North	-	0 .045
F12		Kossou-South	-	0.0340
F13		Hospital	0,0048	-0.0279C
F14		Ouinra-Center	-	0.0192
F15		Bérékossou	-	-0.0206C
F16		Banbaba	-	0.0286
F17		Wodora	-	0.0153
F18		Boukaro	-	0.0707
F19		Mekrou-River	0,0604	-
Standards			0,04	0,002

NB. Dashes (-) means that content is null or is not determined. Values followed by the letter C are to be corrected because of detection limit of the spectrophotometer which is too high to measure very low values. The study has considered them as null contents. The average lead concentration found in water in Kérou commune was 0.0796 ppm. The ppm is the equivalent of mg/kg or mg/L. Therefore 0.0796 ppm = 79.6 µg/kg

TABLE II RESULTS OF BIOLOGICAL INDICATORS OF LEAD TOXICITY

N°	Age	Weight	Observation	Urem	Crea	Transa TGP	Chol Total	CA Urinary	Blood Lead (ppm)
NV			Signs of lead poisoning: weaken, abdominal pains, constipation, delay of growth are evocative clinical signs of an intoxication lead, disturb digestive vagueness: anorexia, vomiting, behavioral problem: apathy or irritability, hyperactivity, disorders of the attention and the sleep, bad psychomotor development: reduction in the cognitive performances.	0.15 to 0.45 g/l	6 to 14 mg/l	inf. with 49 g/l	inf. with 2 g/l	150 to 250 mg/l	0,020
1	50	63	Losses of appetite, heartburn, bilharzias	0.19	13.2	12.3	1.72	46.2	0 .045
2	20	57	Excessive perspiration at rest, headaches	0.16	12.2	19.2	1.32	29.4	0.0340
3	28	50	Excessive perspiration at rests, turbid digestive, sterility, renal disease, bleeding	0.30	15.8	21.2	1.42	99.2	-
4	24	57	A loss of appetite, constipation, excessive perspiration at rests; turbid digestive weakens anorexia, tiredness, tremor, giddiness, temporary loss of vision. Smoke much.	0.26	16.1	19.8	1.25	51.1	0.0192
5	45	66	Losses of appetite, constipation, headaches, nightmare, disturb digestive, tiredness, nervousness. His two wives have made stillborn in 2009	X	X	X	X	X	X
6	50	70	Losses of appetite, heartburn, headaches, renal insufficiency, problem of bone, tiredness, giddiness, involuntary loss of weight, sudden death of infants. Smoke much.	X	X	X	X	X	X
9	18	35	Weaken, digestive disorders, loses of appetite, constipation, anorexia	X	X	X	X	X	0.0153
10	44	65	Losses of appetite, headaches, renal insufficiency, Smokes.	X	X	X	X	X	X
11	45	53	Losses of appetite, headaches, renal insufficiency, abdominal pains, constipation, nightmare, excessive tiredness, anorexia	X	X	X	X	X	X
12	11	15	Nothing	0.42	12.0	30.2	2.39	26.2	
13	35	60	Losses of appetite, temporary headaches, Tremor, losses of vision, anorexia renal insufficiency. Gave birth to three times still-born children,	0.27	13.2	25.4	1.79	-	0.0707

14	28	54	Losses of appetite, constipation, problem of skin, insomnia, migraine, tremor of all the body. Do not smoke but chews.	0.23	10.0	20.2	2.48	21.4	
15	53	56	Losses of appetite, constipation, stops dries, digestive disorders, deafness, nervousness. Smoke much.	0,27	3,4	12,0	3.12	54,2	
16	45	60	Losses of appetite, constipation, stops dries, headaches, Fume	0.18	10.4	13.4	3.71	90.1	
17	40	54	Weaken, cold, constipation, excessive perspiration at rest, hyperactivity, insomnia. Smoke much	0.24	10.0	12.0	3.02	59.5	
18	35	48	Weaken, lost of appetite, loss of coordination, stops dries, cold, disturb digestive, hyperactivity, insomnia.	0.20	10.0	27.0	3.21	29.4	
19	22	56	Losses of appetite, colds, stops dries, cold, disturb digestive, constipation.	0.27	12.2	29.8	1.86	28.4	
20	35	53	Losses of appetite, colds, stops dries, cold, excessive perspiration at rest, renal insufficiency, hyperactivity, Trembling of the feet, nervousness, three times still-born children for the same woman, chews	0.30	13.6	22.7	1.34	30.0	
21	26	45	Losses of appetite, colds, headaches, abdominal pains, tiredness.	0.26	12.3	24.2	1.43	36.2	
22	20	65	Losses of appetite, excessive perspiration at rest, heartburn, chew much	0.21	11.8	10.0	1.56	99.2	
23	22	70	Losses of appetite, stops dries, constipation, excessive perspiration at rests, turbid digestive, abdominal pains, frequent loss of memory, hyperactivity, nervousness, Fume much	0.31	11.7	28.4	1.02	51.8	0.0087
24	30	65	Anorexia, nauseas, nightmare, Losses of appetite, stop dries, constipation, and excessive perspiration at rests, turbid digestive, abdominal pains, frequent loss of memory, hyperactivity, insomnia, nervousness, tremor of all the body. Two sudden deaths children, chews much.	0.27	14.0	30.0	1.00	26.2	0.0080
25	41	68	Losses of appetite, colds, stops dries, heartburn, excessive perspiration at rests, turbid digestive, abdominal pains, frequent loss of memory, insomnia, nervousness, problem of menstruation, sterility, renal insufficiency once made deaths born	0.20	10.4	36.2	1.89	92.2	0.0080
26	50	54	Losses of appetite, headaches, disturb digestive, eye trouble, giddiness; Pose tremor the tobacco on the language.	0.16	11.2	16.0	1.46	51.4	-
27	30	47	Losses of appetite, headaches, nauseas, giddiness, tremor, three sudden times dead of infants, one miscarriage.	0.17	13.2	12.0	1.47	26.3	-
28	37	68	Losses of appetite, stops dries, excessive perspiration at rest, colds, headaches, heartburn, one dead - born. Smoke much	0.19	13.2	49.0	1.24	91.7 -	
29	35	68	Losses of appetite, disturb digestive, abdominal pains, headaches,	0.16	13.8	34.3	0.98	56.2	-
30	27	50	Losses of appetite, colds, stops dries, heartburn, renal insufficiency, headaches, migraine. Smokes.	0.17	14.4	15.7	1.09	31.1	-
31	25	48	Losses of appetite, colds, stops dries, heartburn, renal insufficiency, headaches, migraine, gum pain, nervousness. Miscarriage only once.	0.24	11.0	17.8	1.72	31.1	-
32	28	60	Losses of appetite, colds, stops dries, disorder digestive, nauseas, giddiness.	0.22	7.6	22.3	0.99	91.1	-
33	25	44	Losses of appetite, colds, stops dries, heartburn, disturb digestive, renal insufficiency, nauseas, giddiness,	0.13	9.6	12.6	0.89	56.2	-
34	20	45	Losses of appetite, colds, nervousness, hyperactivity, giddiness, itching of skin, tires and tremor	0.37	12.2	12.3	102	31.1	-
35	43	53	Losses of appetite, colds, stops dries, constipation, excessive perspiration, hyperactivity.	0.22	13.9	40.2	1.26	76.2	-
36	20	43	Losses of appetite, colds, stops dries, nervousness, dental decays, gum pain, constipation, hyperactivity. Sterility	0.30	12.0	22.1	1.34	81.1	-

			suspected, since 7 years married without child.						
37	45	43	Losses of appetite, colds, two children dead	0.20	13.2	12.3	1.11	93.1	-
38	74	64	Losses of appetite, colds, nauseas with much of vomiting, dental decays, gum pain, sees with only one eye, hears with only one ear, he has 36 children among them one dead of inhalation of pesticide, another one fell into the Mékrou River. Chew	0.22	12.2	16.4	1.09	66.2	-
39	56	59	Losses of appetite, colds, itching of skin, loss of memory, headaches, chronic renal insufficiency, hyperactivity, gum pain, tremor	0.28	12.0	48.0	1.04	55.1	

NV= Normal value

In addition, the biochemical analyses of the blood of surveyed people concerning urea, creatinin, transaminase, total cholesterol and urinary calcium shows variability compared to the values of reference. The urea and creatinin are waste of the metabolism which informs about the purifying function of the kidney, principal target of heavy metals and the pesticides. Any nephrotoxic substance (tubular damage) even in the short run is likely to modify the blood concentrations of this two waste in the direction of an increase (they are reabsorbed in the injured tubules and return in the blood, in which increase, the results showed that the found contents were in the normal fork at knowing 0.15 to 0.45g/l for urea. Only one case has a creatinemy exceeding the standard (14.4mg/l against 14mg/l).

Concerning transaminase, the value guides (49g/l) is not exceeded; it is the same with urinary calcium. Calcium just like iron are in competition with heavy metals (Pb, Cd, Hg): any excessive presence of these traces elements in the urines (or the saddles) is a proof of the action of metals which would thus have occupied the place of these elements on the sites of the enzymes which will be thus inactive. Fortunately this situation is not yet observed but on the other hand for total cholesterol, several cases of going beyond of the limit (2g/l) were recorded. The origin of this lead is food, primarily the drink water like that was demonstrated the precedent results on the water proportioning of drillings. Water can be contaminated by passage through lead drains. Enrichment is variable according to the degree of acidity and aggressiveness of water. Our results had shown that the content of lead in the water of drilling in the Kerou Commune exceeded standard WHO (0.04mg/l) because the recorded content was of 0.07965mg/l and of 0.0604mg/l in the Mékrou river. The new European standard fixes the maximum content lead in water at 10µg/l, and the states have until 2013 being put in conformity. Water is however, not the only source of exposure of the organism to lead. Also lead is found in the air, grounds, food and dust; the individual contributions vary according to the environment and from the age (Kremp and Barbier, 2001). The food can be contaminated by water and various containers (ceramics, pottery, tins, crystals, leads of hunting). WHO has fixed an amount tolerable day of laborer to 3.5µg/kg. However, even if it is by the blood lead that we could highlight intoxication at lead in the commune of Kérou, the blood lead is used to evaluate a recent exposure but, it is only a poor indicator among the preceding exposures since lead quickly excreted or stored in the bones. The lead content of the teeth has the advantage of reflecting a cumulative exposure to lead; however, that does not make it possible to determine the age or the diagram of exposure, which can be critical factors of lead toxicity. The research must then be based on information obtained from the parents. The multiple measurements spaced in time get more valid information; this approach became besides the standard in the exploratory studies.

IV. CONCLUSIONS

This work aimed to evaluate the risks of exposure to toxic metals and pesticides in the cotton zone of Kérou. It was a question of making the physicochemical and toxicological characterization of the water of the wells and drillings of the Commune of Kérou and evaluating the medical risks of exposure to toxic metals and the pesticides via the consumption of this water by the population. The physic-chemical characterization of Mekrou River, water of well and drillings of the area of study made it possible to release the behavior of certain descriptive parameters of the physicochemical quality of water. A comparison of the contents of the principal elements measured in subsoil waters of this zone for various sites of sampling indicates a difference in concentration between the wells and drillings. This difference is characterized by high values in water of the wells than protected drillings. However the investigations wanting to go further on this level of protection made it possible to highlight the vulnerability of water of drillings pollution by toxic metals and the residues of pesticides, coming primarily from the cultivation of cotton and the domestic activities. The evaluation of exposure risks of related to the consumption of contaminated water by toxic metals and the pesticides took support on the example of lead according to the standardized step. Adam et al. (2012) showed the same conclusions. The results showed that there was risk of accumulation of lead in the organism in comparison with the daily exposure dose (DED) and calculated quotient of danger (QD).

To have a clear idea on this assumption, sampling of blood is made on exposed population and analyzed on lead contents, with the search for certain indicating biochemical parameters of toxicity. It appeared that the assumption of intoxication was not to reject being given the disorders listed within the surveyed sample, disturb identifiable with lead poisoning, characteristic disease of intoxication by lead. Moreover, the blood of surveyed contained lead is beyond the threshold of toxicity. Furthermore, biochemical parameters, even if they are not all out-limits, were enough alarmed to attest of a probable intoxication by lead in the commune of Kérou. In all the ways, at the point where there are the results, they are sufficiently worrying so that a monitoring of the water pollution of well and drillings is initiated with series of sensitizing for the medical safety of the drink water, essential to the wellbeing of the population of Kérou in particular and that of Benin in general.

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Born on the 27th of December 1977 in Bohicon, the historical capital of Benin, Patient Guedenon achieved his primary, secondary and high education in Porto-Novo. In 2009, Patient Guedenon was awarded by International Development Research Center of Canada, the only one awardee in Benin and number eight in Africa for 2009th edition. He is an active member of Central and West African Society of Eco-health practitioners, association coordinated by Canadian international research center.

Né le 29 mars 1979, de parents Béninois, AISSI K. Alain est Ingénieur d'Analyses Biomédicales. Il possède également une Maitrise en Psychologie. Fonctionnaire du Ministère de la Santé il poursuivit des études de Master en Environnement - Santé et Développement Durable et est actuellement admis en Thèse de Doctorat Unique à l'Université d'Abomey-Calavi au Bénin. Marié et père de deux enfants, il est co-auteur d'une dizaine de publications scientifiques sous l'Egide du Laboratoire de Référence du Programme National de Lutte contre le SIDA et le Laboratoire de Toxicologie de Santé Environnementale où il effectue ses recherches.

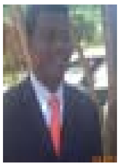
Mr Koudouvo Koffi de nationalité togolaise est né le 06 Décembre 1963 à Tométi Kondji (Préfecture de Yoyo) où il a grandi et effectué ses études des enseignements primaire et secondaire jusqu'à l'obtention du baccalauréat option ''Sciences Biologiques et Mathématiques''(Série D)en 1986. Sur **le plan professionnel**, il a enseigné dans l'enseignement secondaire (Collège et Lycée) où il a dispensé des cours des Sciences de la Vie et de la Terre avec la charge de Proviseur de 1991 à 2006 et de 2010 à 2011. De 2010 à ce jour il est engagé à l'UL comme Enseignant-Chercheur de Biologie.

Christophe KAKI est né en 1959 à Natitingou au Bénin où il a grandi et effectué ses études primaires et secondaires de 1967 à 1980. Il est Maître -Assistant des Universités depuis juillet 2004 et dispense les cours théoriques et des travaux pratiques de Sédimentologie et Pétrologie sédimentaire, de Géologie des combustibles à Université d'Abomey-Calavi. Il a à son actif une vingtaine de publications dans les trois domaines de recherche dans lesquels il travaille. Ci-dessous, les récentes publications des résultats des travaux des équipes de recherche avec lesquelles il travaille.

MONTCHO Sabine A. est née le 29 Août 1980 à Cotonou en République du Bénin. Accepted in Journal of Research in Environmental Science and Toxicology 2012;1(1):1-6, Available online http://www.interesjournals.org/JREST. Arsenic, Cadmium, Copper and Lead Accumulation in Water, Sediments and Fish Species of Oueme River in Bonou". P. Guedenon, A.P. Edorh, C. Kaki, A.P.E. Yehouenou, K. Gnandi, **S. Montcho**, A. Hounkpatin, L. Koumolou and M. Boko; British Journal of Pharmacology and Toxicology 2012; 4(1): 13-20, ISSN: 2044-2467.

EDORH A. Patrick est né le 13 janvier 1959 à Lomé en République du Togo. Après avoir décroché son baccalauréat série D à Lomé, il obtint un diplôme de Maîtrise de Biochimie en Bulgarie. Il s'envola ensuite pour la France pour y décrocher successivement un Diplôme d'Etudes Approfondies (DEA) en Toxicologie de l'Environnement et un Doctorat en Toxicologie.

BOKO MICHEL Codjo now got his Professeur Titulaire in 1998.



Bernadin Manou EELGBEDE de nationalité béninnoise, est né le 02 juillet 1966 à Kétou au Sud -Est du Bénin. Il entra à l'Ecole Catholique Romaine d'Ilara en République Fédérale du Nigéria où il obtint son diplôme de certificat primaire Anglais en 1975. Ses recherches scientifiques l'ont ensuite conduit à «Galilee Management Institut » en Israël où il obtint un diplôme sur «la Gestion de l'Eau et Sécurité Alimentaire: les Challenges de l'Agriculture en 2011 ».
Ces différents travaux de recherche ont été couronnés en 2012 par l'obtention du doctorat unique du 3èm Cycle en Ecotoxicologie avec mention très honorable et félicitation du président du Jury à l'université d'Abomey Calavi au Bénin.

Luc Koumolou est né le 16 octobre 1975 à Cotonou au Bénin où il a fait entièrement ses études scolaires. Il a grandi dans la capitale économique du Bénin où après les études secondaires il entre à l'université en 1996. Diplômé d'une maîtrise en sciences naturelles obtenue à l'université d'Abomey-Calavi en 2004, il décide de poursuivre ses études au Togo où il obtient un DEA en toxicologie de l'environnement en 2009. Ce diplôme lui a permis de se lancer dans la recherche scientifique. Il est actuellement assistant de recherche au laboratoire de toxicologie et de santé environnementale à Université d'Abomey-Calavi où il donne quelques cours de toxicologie sous la direction de son Directeur de Thèse. Il a à son actif une vingtaine de publications dont une douzaine d'articles et le reste comme des parutions dans des actes de colloques et conférences auxquels il a participé dans son pays et dans la sous-région. Ci-dessous, deux des dernières publications des résultats des travaux de l'équipe de recherche avec laquelle il travaille.
Koumolou L, Edorh A. P, Agbandji L, Hounkpatin S. A and Elégbédé B (**2012**). Threat of the health quality of garden produces linked to pollution by toxic metals on some gardening sites of Benin. Am. J. Environ. Sci., 8: 248-252. **Koumolou L**, Edorh A. P, Elégbédé B and Aklikokou A. K (**2012**). Comparison of the toxic metals pollution in soil, water and vegetables on three major gardening sites of Benin**,** Accepted for publication in J. Environ. Chem. Ecotoxicol. Under number JECE-11-035. Mr KOUMOLOU est membre d'une ONG qui travaille hâtivement dans la culture des valeurs morales au sein de la jeunesse et dans sensibilisation sur l'environnement et la santé