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Using Principal component analysis (PCA) to interpret geochemical composition of toxics waste

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Abstract

The Ivorian Antipollution Center discovered the toxics Waste from Probo Koala boat in 21 August, 2006. This boat had been used to refine oil named naphta of cokéfaction by Trafigura firm in the sea. The process of refine consist to caustic sodium carbonate washing and produced toxics waste. These toxic wastes have been unloading in 13 zones of the Abidjan district: Akouédo, Abobo, Abobo Alépé road (DJIBIvillage), civile prison road (MACA), industrial zone of Koumassi, Port-Bouët - Vridi CAP Logistic (Rue Saint-Sylvestre) … This situation caused a socio-political crisis and generated the death of many people. The first analyses showed that the substances coumpound of toxic waste are a petroleum factory origin. In the aim to know the environmental impact of these pollutes in Abidjan district (IvoryCoast) the samples of these toxic wastes have been sent to analyses in Wesling laboratory in France. These experiences showed thatthe toxic waste contain the Polycyclics Aromatics Hydrocarbons (PAH), the Volatile Aromatics Compound (VAC), the Mercaptans and sulphur molecules Aliphatic hydrocarbons, Linear hydrocarbons, Total Petroleum Hydrocarbons (TPH), Mercaptans, sulphur and also heavy metals.

Keywords: Toxics Waste; Trafigura; Probo Koala; Polycyclics Aromatics Hydrocarbons (PAH); Volatile Aromatics Compound (VAC); Aliphatic Hydrocarbons; Linear Hydrocarbons; Total Petroleum Hydrocarbons (TPH); Mercaptans; Sulphur; Heavy Metals;Principal Component Analysis (PCA)

1. Introduction

In 21 Auguste 2006, 540 m^3 of toxic waste have been discovered in 13 zones of Abidjan district in Ivory Coast. The pollutes compounds toxic waste were discharge in Abidjan districmade 30 000 cases of intoxication and the death of one hundred people [1]. Even if many PAH-contaminated sites have been inherited from the end of industrial activities during the last century (1960s and 1980s principaly) around the world, in the country of our study, the toxic waste become a principal source of these pollutes because they made the death of people. Coal related activities, such as coking and gas production, were particularly responsible for the PAH contamination in industrials oils [2]. As these compounds present carcinogenic, toxic, and mutagenic properties, some of them were classified as priority pollutants by the US-EPA [3]. In environment, the PAH cause the contamination of sols, water, air around the world [4]. To study the environmental impact of these in Ivory Coast in generaly and Abidjan district particullary, the samples of toxic waste

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have been sent to analyses to France in Wes linglaboratory for analyses. Until todays, the Ivory Coast authority, the people want to know the real coumpound of toxics waste. So the problématique of our survey concerns the determination of the chemical composition of toxic waste. To be in phase with international classsification of waste, we use in this study the Europens commission waste classification to found the code of our toxic waste. and than, we use Principale Coumpound Analyseas to show the realationship betwenn ours chemical anlalyses results coumpound. But firsly it important for us to know the orignin of these toxics waste.

2. Materials and methods

2.1. Samples

This study concerns the 13toxics waste contaminated zones in "south" of IvoryCoast, which are located in the Abidjan district. The samples selected have been collected in these zones. These geographic positions are given in Table 1.

Table 1 The geographic position of 13 contaminated toxic waste zones

Zone	Unloading geographic position
Cocody: Akouédo	-Akouédo I: N 05°21.429' - W 03°56.095' -Akouédo II: N 05°21.077' - W 03°56.206' -Akouédo III: N 05°21.425' - W 03°56.028'
Abobo	-Abobo (Coco services) : N 05°24.092' - W 04°01.167' -Abobo Sagbé : N 05°24.409' - W 04°01.593' -Plateau Dodui I : N 05°23.403' - W 04°00.367'
Abobo Alépé Road (DJIBI Village)	-Alépé 1 : N 05°27.373' - W 03°58.344' -Alépé 2 : N 05°27.572' - W 03°58.280'
Yopougon: Civile Prison Road (MACA)	-MACA I : N 05°23.354' - W 04°04.710' -MACA II : N 05°24.811' - W 04°04.674' -MACA III : N 05°25.309' - W 04°04.405'
Koumassi	-Koumassi Industrial Zone : N 05°17.547' - W 03°56.783'
Port-Bouet	-Vridi CAP Logistic : N 05°15.832' - W 03°59.980'

Soils have been sampled in these 13 zones. Extractible Organic Matter was recovered by extracting parts of the soils in Soxhlet apparatus (CHCl3, 24 h), it contains PAH, VAC, Mercaptan and sulphur, hight metals and other organics of various size, from macromolecules (asphaltenes) to mono-aromatic units.These analyses were carried out with a photometer-equipped microscope and indicate the proportion of the volume occupied by the different mineral and organic particles.Soil samples were freeze-dried, sieved at 2 mm, and crushed at 500 μm to homogenize the samples. To obtain the EOM, parts of the soils were extracted in Soxhlet apparatus with chloroform for 24 h.

2.2. Analytical

2.2.1. Extraction-fractionation

The toxic waste fraction wasrecovered by soxhlet extraction in chloroform for 48 h. The aliphatic, aromatic and polar fractions wereisolated by liquid chromatography on a silicacolumnwith successive elution by pentane and by a mixture of pentane and dichloromethane. Polar compound wasrecoveredwithmethanol/dichloromethane. Aftereachstep, the recovered fractions wereweighed and their mass differencewascalculated.

2.2.2. Gas chromatography-massspectrometry

Aliphatic and aromatichydrocarbons as well as polarcompounds wereanalyzed by gas chromatography–mass spectrometry (GC–MS) (HP 5890 Series II GC coupled to a HP 5971 mass spectrometer), using an on-columninjector, a 60 m DB-5 J and W, 0.25 mm i.d. and a 0.1 mm film fusedsilicacolumn. The temperature program was 40–3008C at 38C/min followed by an isothermal stage at 3008 °C for 15 min (constant helium flow of 1 ml/min). Because of the presence of carboxylicacids in the polar fractions, silylation using BSTFA 1 TMCS (99/1) wascarried out in order to improve the chromatographic resolution (40,41) [5]. A small aliquot of sample was dissolved with the derivative solution at a 4 mg/ml concentration and was treated for 15 min at 508 °C. One microliter of the solution was then directly injected into the gaschromatograph [6].

We also used geochemical analytic technical like GC-FID, ICPMS in this study. The detail of all of analyses methods are shown in table 2.

Table 2 Parameters and analyticals methods

Parameters	Norme	Technical	Laboratory
Benzene and aromatics (VAC -BTEX)	NF ISO 11423-1(#)	GC-MS	Wessling Lyon (F)
Volatile Halogenated Hydrocarbons Compounds (VHOC) on water	NF EN ISO 10301(#)	GC-MS	Wessling Lyon (F)
Polycyclics Aromatics Hydrocarbons (HAP)	Internal method HAP-PCB adapted de NF T90-115(#)	GC-MS GC-FID	Wessling Lyon (F)
Hydrocarbons Idication (GC) on water / leached (HCT)	NF EN ISO 9377-2(A)	GC-FID	Wessling Lyon (F)
Metals / Elements on water / leached	DIN EN ISO 11885 / DIN EN ISO 17294-2(A)	(ICP-MS)	Wessling Altenberge (D)
Metals on water / leached	NF EN ISO 17294-2(#)	(ICP-MS)	Wessling Lyon (F)
Metals on water / leached (ICP-MS)	NF EN ISO 17294-2(#)	(ICP-MS)	Wessling Lyon (F)
Mercaptans on water	WEX 100	(ICP-MS)	Partner Laboratory

3. Statistical methods

For expore our result we use the statistical methode, Principal component Analysis (PAC).

3.1. Principal component Analysis

Principal component analysis (PCA) is an exploratory statistical method forgraphical description of the information present in large datasets. In most applications, PCA consists of studying p variables measured on n individuals. When n and parelarge, the aim is to synthesize the huge quantity of information into an easy and understandable [7].

Unidimensional or bidimensional studies can be performed on variables usinggraphical tools (histograms, box plots) or numerical summaries (mean, variance,correlation). However, these simple preliminary studies in amultidimensional contextare insufficient since they do not take into account the eventual relationships between variables, which is often the most important point [8].

Principal component analysis is often considered as the basic method of factoranalysis, which aims to find linear combinations of the p variables called componentsused to visualize the observations in a simple way. Because it transforms a largenumber of correlated variables into a few uncorrelated principal components, PCA is a dimension reduction method. However, PCA can also be used as a multivariateoutlier detection method, especially by studying the last principal components. Thisproperty is useful in multidimensional quality control [9].

3.2. Principal component Analysis interpretation

PCA results are obtained from variables and individuals called active elements, incontrast to supplementary elements which do not participate directly in the analysis.Active variables and individuals are used to compute principal axes; supplementaryvariables and individuals are then projected onto these axes [10].

Active variables (numerical) are those with interesting intercorrelations: they arethe main variables of the study. Supplementary variables provide useful informationfor characterizing the individuals but are not directly used in the analysis [11]. We are only interested by the correlations of supplementary variables and active variables via principal components, and not by the correlations between supplementary variables [12].

Interpretation consists of analyzing the results using active variables andindividuals. Supplementary elements study is carried out in the external interpretationphase [13].

3.2.1. Variables

PCA yields principal components, which are new artificial variables defined bylinear combinations of original variables [14]. We must be able to interpret these principal components (according to original variables). This is done simply through the computations of linear correlation coefficients r(c, xj) between principal components and original variables [15].In standard PCA, we use standardized data and the computation of r(c, xj) is particularly simple. It may be shown that r(c, xj) = √λuj [16].

Usually, the correlation between the variables for a couple of principal componentsis synthesized on a graph called the 'correlation display' on which each variable xjis positioned by abscissa r(c1, xj) and ordinate r(c2, xj). Analyzing the correlationdisplay allows detection of possible groups of similar variables or opposite groups ofvariables having different behavior, giving a sense of principal axes [17].

3.2.2. Observation

Interpreting observations consists of examining their coordinates and especiallytheir resulting graphical representations referred to as principal planes. The aim is to see how the observations are scattered, which observations aresimilar and which observations differ from the others. In case of non-anonymousobservations, they can then help to interpret principal axes; for example, we willlook for opposite individuals along an axis [18].

Conversely, using results of variables analysis allows observations interpretation.When, for example, the first component is highly correlated with an original variable, it means that individuals with large positive coordinates alongaxis 1 are characterizedby this variable of value much larger than average (the origin of the axes represents the centroid of data cloud) [19].

4. Results

The results of this study concerne sample of contaminated soils and water which are in the zone of contaminated soils of Abidjan district. The samples of the toxic waste contaminated soils have been sent to France in Wesling labolatory to analyses. The results of these show that Polycyclics Aromatics Hydrocarbons (PAH), Volatile Aromatics Compound (VAC), Mercaptans and sulfurs molecules and also Heavy metal are the principals pollutes of these contaminated soils.

4.1. Polycyclics Aromatics Hydrocarbons (PAH)

Principal component analysis (PCA) of Polycyclics Aromatics Hydrocarbons (PAH) (figure 1)shows that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 90,29 %. Factor 1 respresente 80,67 % of the total variability of PAH contamination in samples of our toxics waste contaminated zone. The coefficients α=0,9 had found for Chrysène and Fluorantène which show a very hight correlation around of axe Factor 1. Factor 2 represente 9,62 % of the total variability of PAH contamination in samples of our toxics waste contaminated zone. The coefficients α=-1 had found for some of PAH which are very hight correlation around of axe Factor 2, Naphtalène is an exemple. So, we can note that, 2 of our PAH are correlate around Factor 1 and 14 of them are very correlate around Factor 2.

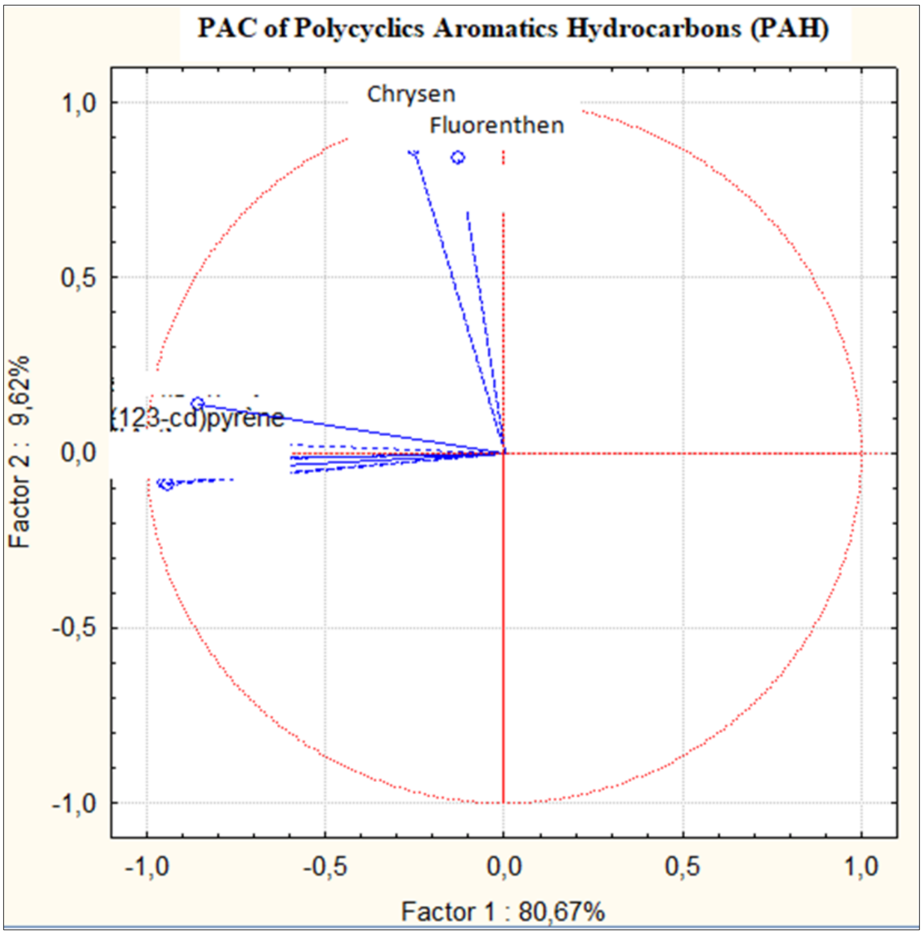

Figure 1 Principal component analysis (PCA) of Polycyclics Aromatics Hydrocarbons (PAH)

4.2. Volatile Aromatics Compound (VAC)

Principal component analysis (PCA) of Volatile Aromatics Compound (VAC) (figure 2)show that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 93,47 %. Factor 1 respresente 83,54 % of the total variability of VAC contamination in samples of our toxics waste contaminated zone. Any correlation had found around axe Factor 1. Factor 2 represente 9,93 % of the total variability of VAC contamination in samples of our toxics waste contaminated zone. The coefficients α=-1 had found for o-xylène. We can note that, all of our VAC correlate around Factor 2.

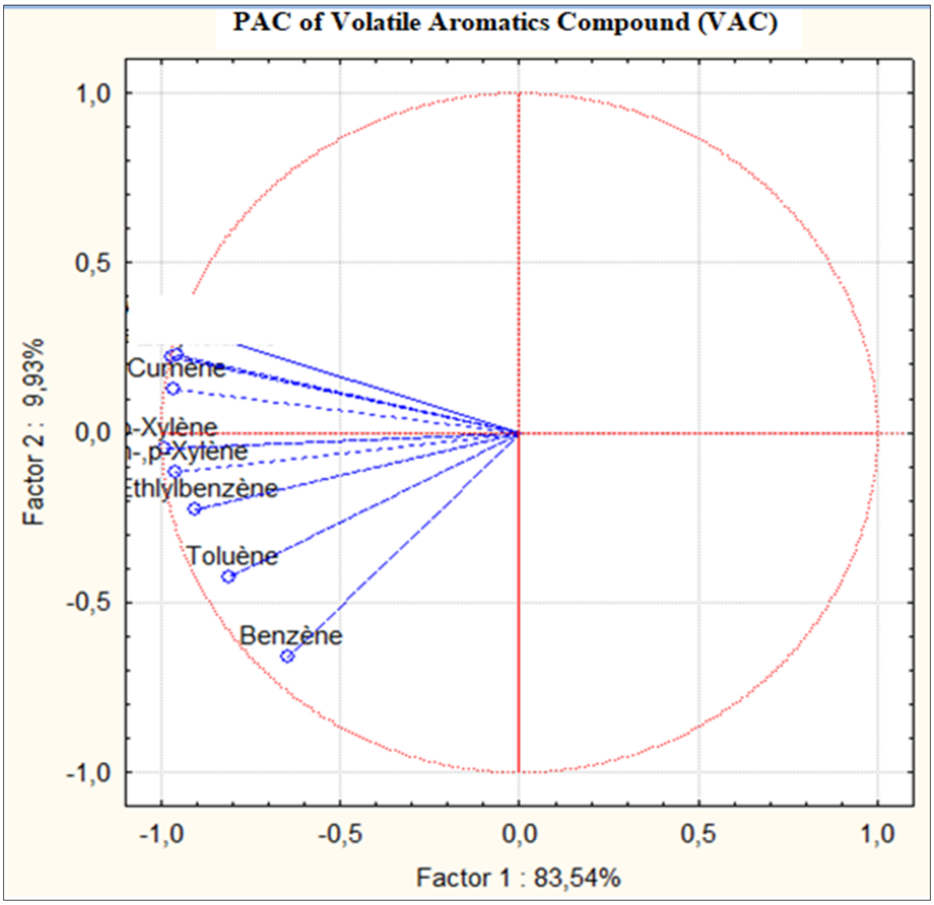

Figure 2 Principal component analysis (PCA) of Volatile Aromatics Compound (VAC)

4.3. Mercaptans and sulfurs molecules

Principal component analysis (PCA) of Mercaptans and sulfurs molecules (figure 3)show that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 55,59 %. Factor 1 respresente 37,86 % of the total variability of Mercaptans and sulfurs molecules contamination in samples of our toxics waste contaminated zone. The coefficients α=1 had found for some of Mercaptans and sulfurs molecules which are very hight correlation around of axe Factor 1, (tert) Butylmercaptan is an exemple. Factor 2 represente 17,73 % of the total variability of Mercaptans and sulfurs molecules contamination in samples of our toxics waste contaminated zone. The coefficients α=-1 had found for some of Mercaptans and sulfurs molecules which are very hight correlation around of axe Factor 2. We also remark that some of Mercaptans and sulfurs molecules are anticorrelated without Factor 1 and Factor 2, the stay in the center of our figure.

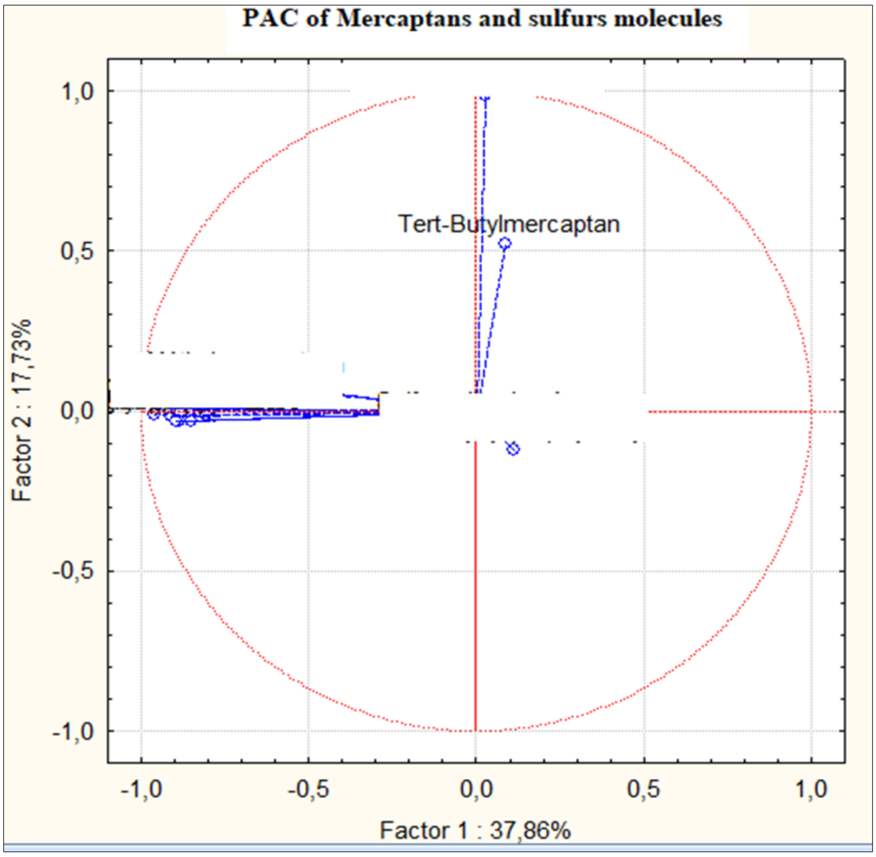

Figure 3 Principal component analysis (PCA) of Mercaptans and sulfurs molecules

4.4. Heavy metal

Principal component analysis (PCA) of Heavy metal(figure 4a) shows that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 53,90 %. Factor 1 respresente 42,74 % of the total variability of Heavy metal contamination in samples of our toxics waste contaminated zone. The coefficients α=0,7 had found for antimony around axe Factor 1 which show an anticorrelation with others métal compounds. Factor 2 represente 11,16 % of the total variability of Heavy metal contamination in samples of our toxics waste contaminated zone. The coefficients α=0,8 had found for cadmium (Cd). We can note that all of our compound is correlate arround axe Factor 2 without antimony (Sb).

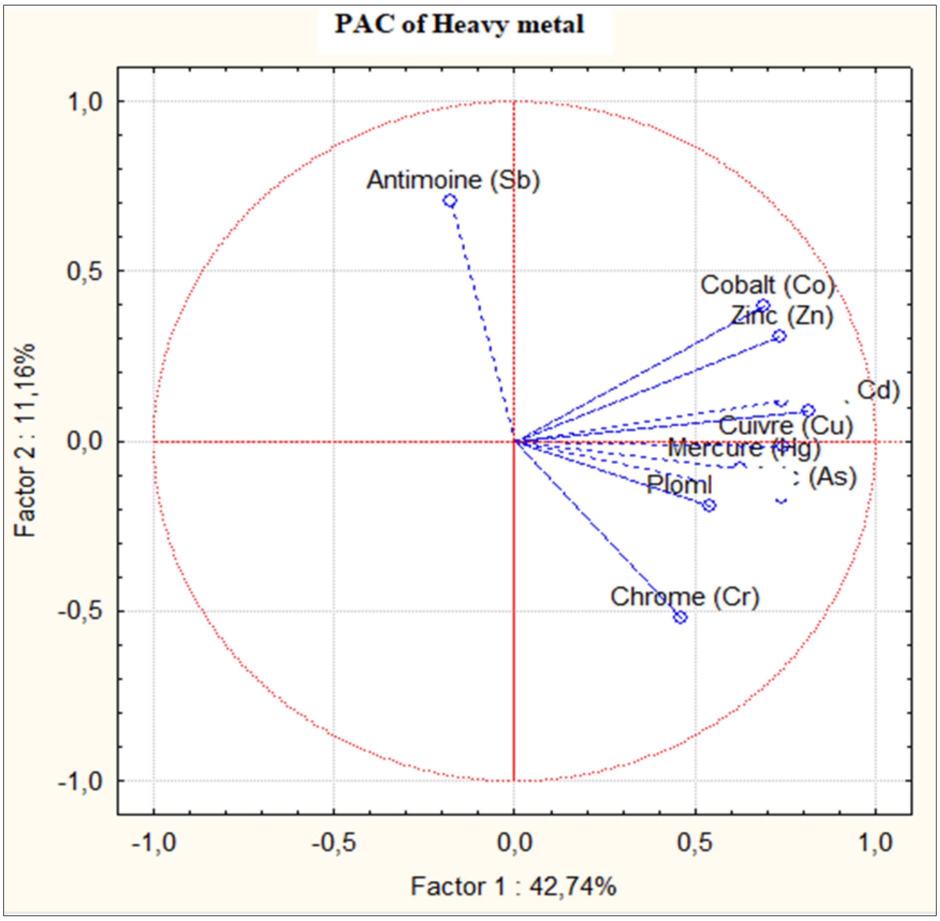

Figure 4a Principal component analysis (PCA) of Heavy metal

If we considered the sulfur in this case, the principal component analysis (PCA) of Heavy metal and sulfur(figure 4b) show that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 49,07 %. Factor 1 resprsente 38,85 % of the total variability of Heavy metal and sulfur contamination in samples of our toxics waste contaminated zone. The coefficients α=0,7 had found for antimony (Sb) around axe Factor 1 which show an anticorrelation with others métal compounds. Factor 2 represente 10,22 % of the total variability of Heavy metal and sulfur contamination in samples of our toxics waste contaminated zone. The coefficients α=0,8 had found for cadmium (Cd). We can note that all of our compound are correlate arround axe Factor 2 without antimony (Sb). The sulfur also anticorrelated with other havy metal, α=-0,35 had found for it.

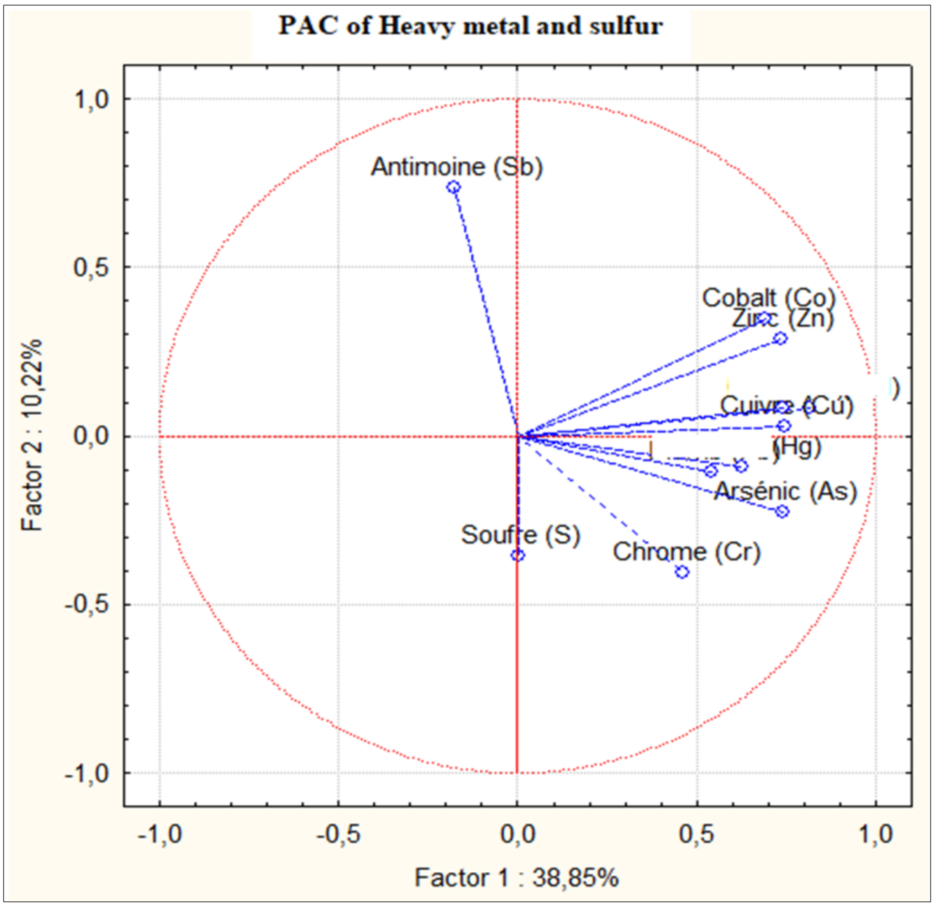

Figure 4b Principal component analysis (PCA) of Heavy metal and sulfur

5. Aliphatic Hydrocarbons

Principal component analysis (PCA) ofAliphatic Hydrocarbons compound(figure 5)shows that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 92,87 %. Factor 1 respresente 68,62 % of the total variability of Aliphatic Hydrocarbons compound contamination in samples of our toxics waste contaminated zone. The coefficients α=0,9 had found for Aliphatic compound C10-C12 around of axe Factor 1 which show an anticorrelation with another compound. Factor 2 represente 24,25 % of the total variability of Aliphatic Hydrocarbonscompound contamination in samples of our toxics waste contaminated zone. The coefficients α=1 had found for Aliphatic compound C8-C10 which is hight correlation around of axe Factor 2 without Aliphatic compound C10-C12.

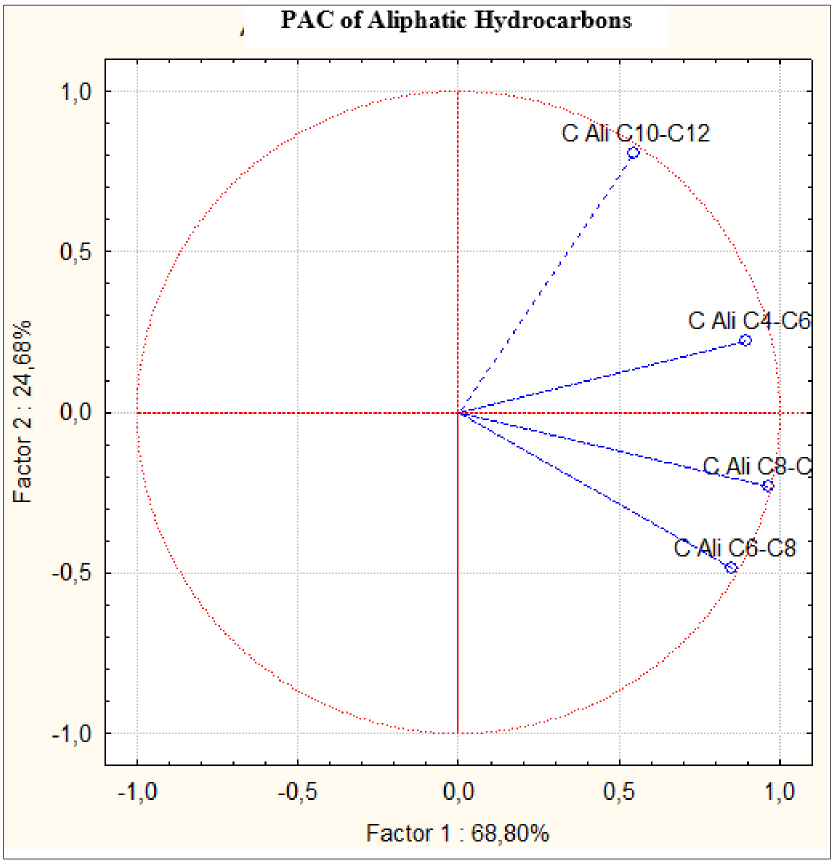

Figure 5 Principal component analysis (PCA) of Aliphatic Hydrocarbons compound

6. Linear hydrocarbons

Principal component analysis (PCA) of Linear hydrocarbons (figure 6)show that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 71,26 %. Factor 1 respresente 49,88 % of the total variability of Linear hydrocarbonsin samples of our toxics waste contaminated zone. Any Linear hydrocarbons compound were found around Factor 1. Factor 2 represente 21,38 % of the total variability of Linear hydrocarbons contamination in samples of our toxics waste contaminated zone. The coefficients α=-1 had found for Linear hydrocarbons C10-C12, Linear hydrocarbons C12-C16Linear hydrocarbons C16-C21 and Linear hydrocarbons C35-C40.

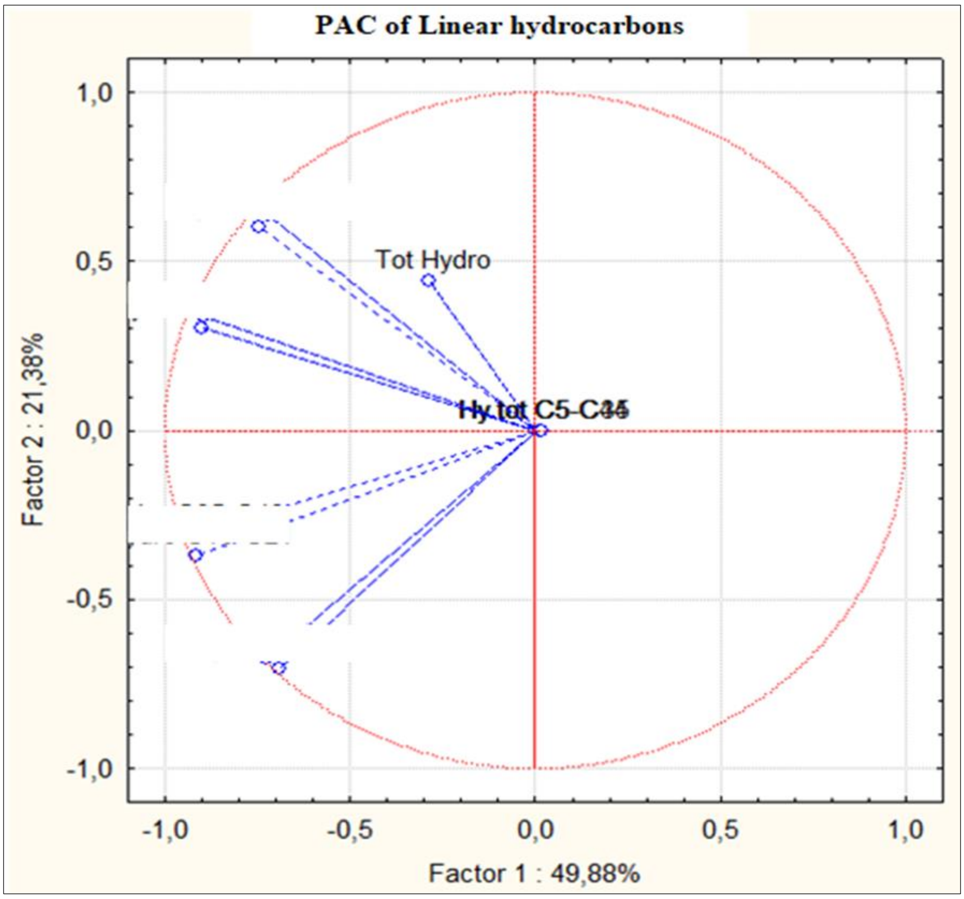

Figure 6 Principal component analysis (PCA) of Linear hydrocarbons

7. Total petroleum hydrocarbons (tph)

Principal component analysis (PCA) of Total Petroleum Hydrocarbons (TPH) (figure 7) show that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 68,74 %. Factor 1 respresente 50,58 % of the total variability of Total Petroleum Hydrocarbons (TPH)in samples of our toxics waste contaminated zone. Any Total Petroleum Hydrocarbons (TPH)compound were found around Factor 1. Factor 2 represente 18,16 % of the total variability of Total Petroleum Hydrocarbons (TPH) contamination in samples of our toxics waste contaminated zone. The coefficients α=-1 had found for Total Petroleum Hydrocarbons (TPH) C8-C10.

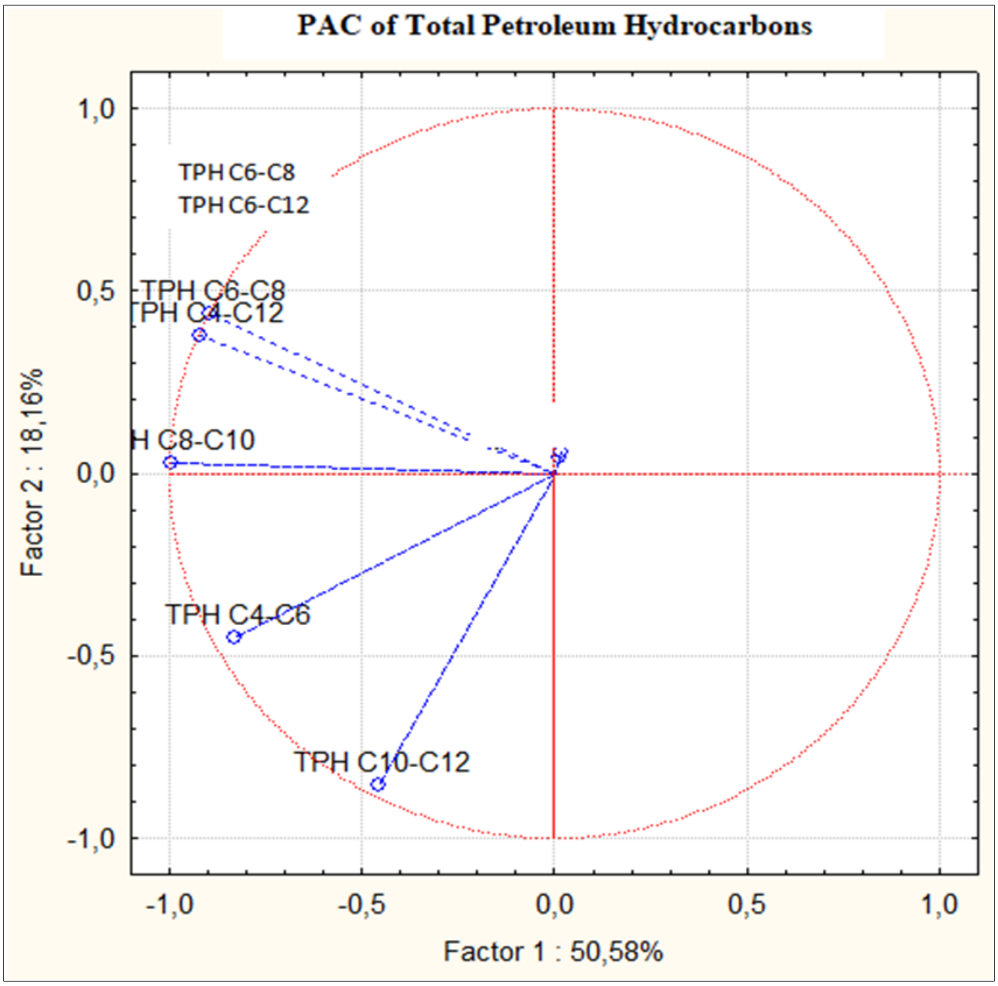

Figure 7 Principal component analysis (PCA) of Total Petroleum Hydrocarbons (TPH)

8. All chemical coumpound of toxics waste

Principal component analysis (PCA) of all chemical coumpound of toxics waste show that the two first axes (Factor 1 and Factor 2) had been extracted whith a total contribution of 49,7 %. Factor 1 respresente 33,92 % of the total variability of all chemical coumpound of toxics waste contamination in samples of our toxics waste contaminated zone. The coefficients α=-0,9 had found for some of these compound. Butylmercaptan is an exemple on these. We can also note that many haevy metal are correlated around this axe Factor 1. Factor 2 represente 15,78 % of the total variability of all chemical coumpound of toxics waste contaminated zone. The coefficients α=-1 had found for some of All chemical coumpound of toxics waste which are very hight correlation around of axe Factor 2, o-Xylène is an exemple on it.

9. Discussion

When considering the different parameters followed in this study, we can note that there are many methode to determine the geochemical composition of waste in generaly and toxics waste in particulare. According to Europeans Commission, the guideline centers déchets, modified lately by the regulation (EU) n°1357/2014, and the decision 2000/532/CE, lately modified by the decision,2014/955/UE8 constitute the communal authorized setting of the assessment of the hazard of the waste. The objective of the recent modifications concerning the properties of hazard of the waste weretaken into account the new communal authorized setting onthe classification and the labeling of the substances and miscellanies coming of the application of the regulation n°1272/2008 says CLP regulation" (Classification, Labelling, Packaging), in order to make converge, as much that possible, the two approaches, and notably to adopt the new system of classification, integrating the mentions of Hxxx hazard instead of the sentences of Rxx risks [20].To the date of writing of the present document, a project of decree transposing these texts in French right in the Code of the environment are under adoption as he leans essentially on the European references. According to European

List of the waste, the Code of the toxic waste in Abidjan after analyses can be write like that : 050407*, and call : containing waste of the hazardous substances coming from the transformation of petroleum and combustion origin.

The naphta of cokéfaction proposed to the sale by PMI firm had a strong content in sulfur mercaptan;The executives of the firm had found two means to refine the naphta of cokéfaction: the oxidization of the mercaptans (or Merox process), and washing to the caustic sodium carbonate. In the two cases, when the naphta of cokéfaction is mixed to the caustic sodium carbonate in order to capture the mercaptans on it generates toxic residues. The Merox process contains a second essential step that transforms these residues in disulfures, more stable and less harmful, by oxidization. This step normally takes place in a specialized factory. Trafigura decided to buld an installation to be able to use the Merox process. A executive of Trafigura has notice that this option" would be expensive, but would function ".However, without one knows really reason, Trafigura decided to abandon the idea of the proceeded Merox and preferred him to the washing of the caustic sodium carbonate. Trafigura perfectly knew that this process would produce toxic waste. The electronic mail interns to the society clearly show it. For example, one of them mentions explicitly that" the terminals of the United States, Singapore and Europe refuse washings to the caustic sodium carbonate because the local agencies for the protection of the environment forbid the residue of the toxic waste that results of these chemical process. Jorge Marrero, superior executive of Trafigura, sent an electronic mail in his subsidiary compagny of the Ivory Coast, Puma Energy, to warn it, of the imminent arrival of the ship and to inform it that it would have 528 m^3 of residues to unload.In this electronic mail, Trafigura informed its subsidiary compagny that because of a chemical demand some oxygen (DCO) superior to 2 000 mg/l, the toxics waste" [had to] not to be considered as MARPOL residues" but as "chemical residues" ". Jorge Marreroof Trafigura describedalso the residues like" a mixture of oil and caustic sodium carbonate, with a strong,concentration in sulfur mercaptan".

According to our geogemical anlyses which are done in weslling laboratory in France, the essential composition of toxics waste are Polycyclics Aromatics Hydrocarbons (PAH), Volatile Aromatics Compound (VAC),Mercaptans and sulfurs molecules, Heavy metal, sulfure, Aliphatic compound Hydrocarbons, Linear hydrocarbons, Total Petroleum Hydrocarbons (TPH). We use Principal component Analysis to describe theme in this study.The results of the laboratory analyses that weredone on the samples of soil, of water, of air, ofsediments, of mollusks, and of fruits and vegetablesdeducted on the affected sites.

We intend to make the recommendation in order to warn the attacks to the rights and to the environment committed by the firm and factory around the world. All States must look after what their legal setting gives the possibility to hire the penal responsibility of the firm and factory (as legal entities). They also must to grant sufficient means to permit the investigations and the satisfactory attack to the firm and factory.All States must review their legal setting to insure that it contains thesuitable measures have imposing to the enterprises to respect the human rights andthe environment on the whole of their activities and allowing the state to lead the investigations and of the attack on the acts criminal of the firm and factory committed abroad or having abroad consequences. This assessment of the legal setting must be returned public.The firm and foctory must be held legally to give reasonable diligence proofconcerning human rights in their activities everywhere in the world, and to return public their balance in this domain.All enterprises must have the legal obligation to provide some informationexhaustive on all material or substance having had some consequences on the environment or the public health whereas it was in their possession or under their control.

10. Conclusion

This article present the environnemental impact of PAH-contaminatedsoil in Abidjan district of Ivory Coast. Even if many PAH-contaminated sites have been inheritedfrom the end of industrialactivitiesduring the last century (1960s and 1980s principaly) around the world, in Ivory Coast the country of our study, The toxics waste became a principal of pollutant because it cause the death of one hundred people and made 30 000 cases of intoxication. The GC-MS analyses in Wesling laboratory from France of soil and water sample from 13 [Akouédo, Abobo, Abobo Alépé road (DJIBIvillage), civile prison road (MACA), industrial zone of Koumassi, Port-Bouët - Vridi CAP Logistic (Rue Saint-Sylvestre)] zones of the Abidjan distric had been impact by toxic waste show that they are heterogenious origine. Our reacherch show that toxics waste came from naphta of cokéfactionwashing to the caustic sodium carbonate by Trafigura in the Probo Koala boad. The terminals of the United States, Singapore and Europe refuse washings to the caustic sodium carbonate because the local agencies for the protection of the environment forbid the residue of the toxic waste that results of this chemical process. The executives of trafigura describedalso the residues like" a mixture of oil and caustic sodium carbonate, with a strong,concentration in sulfur mercaptan". Accordind to European List of the waste, the Code of the toxic waste in Abidjan after analyses can be write : 050407*: Containing waste of the hasardous substances coming from the transformation of petroleum and combustion origin.The Probo Koala arrived in the port of Abidjan the Saturday August 19, 2006. The trucks and their drivers engaged by the Tommy company waited for it to unload the waste and work began the afternoon. In reality it was never possible to establish a complete cartography of the totality of the places of toxics waste unloading. The fact that the drivers poured the toxics waste in many places andleft to hide then contributed to make difficult the identification of all sites touched. A card taking data the most commonly accepted, established by the UNOSAT (Fully tested program of the United Nations for the satellite applications) to leave from information of the authorities of the Ivory Coast, the European union and the Office of the coordination of the humanitarian business of the United Nations (BCAH) watch 18 points of tunloading.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors have no conflict of interests about the content of this article.

Statement of ethical approval

All of authors approved the ethical content of this article and they accepted to participate.

Statement of informed consent

All of authors declare that they have been informed and consent for the work submitted for publication. All authors have read and approved the final version manuscript.

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