

Analysis of the Geochemistry of the background sediments the Cotunguba River, Feira Nova-pe, according to parameters of the Conama Resolution 344/2004

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Abstract— *The release of untreated effluents in accordance with current legislation, as well as carrying them through rains, pesticides used in farms and agricultural areas, aims to analyze the quality of sediments and the level of toxicity with trace metals. Existing on the Cotunguba River, Feira Nova - PE, since, together with the Capibaribe River, they feed the Carpina Dam, a source of water supply for approximately 250 thousand inhabitants. The analysis of the samples of these sediments took place through collections in 4 strategically positioned points, previously treated in the Environmental Analysis Department of the University of Pernambuco and sent to the Sediment Analysis Laboratory of the University of Ontario - Canada, for cataloging the minerals as well. As for detecting trace metals with potential for pollution, using the methods FUS-ICP (Plasma Coupled by Fusion Induction), TD-ICP (Plasma Inductively Coupled by Total Digestion) and INAA (Instrumental Neutron Activation Analysis), adopted in the CONAMA parameters. At all collection points, it was observed that the level of sediment contamination, for some elements, already has levels above the recommended, in particular, mercury and lead, giving rise to mitigation actions, while, in others, the level of toxicity behaves within the parameters set by the environmental control bodies, both in Brazil and in the world. The consolidation of the results indicates that although one of the metals (Hg) is above the recommended parameters, most of them are below or within the range of acceptability for this type of contamination.*

I. INTRODUCTION

In the history of urban formation, rivers were important sources of immediate supply, both for the populations installed on its banks and for those who used it on an interim

basis. From the end of the 18th century, when urbanization occurred more intensively, in European countries and northern western countries, an imbalance in these environments was promoted, resulting in many cases of

their degradation. In Feira Nova, Agreste of Pernambuco, this process, although it occurred only from the 80s of the 20th century, was no different and the advent of urbanization has severely affected the homeostatic pattern of environmental systems in almost all of it. Above all, endangering the "life and function" of river courses in the entire urban area and part of the municipality's rural area.

This paper presents an analysis of the Cotunguba River, with the perspective of understanding the environmental dynamics of the river ecosystem from the perspective of environmental geochemistry. Being one of the main tributaries of the right bank of the Micro Bacia do Médio Capibaribe, in addition to being one of the courses that feed the dam in the municipality of Carpina, the second largest dam in the State of Pernambuco with approximately 270 million m³ (APAC, 2013). It supplies around 250 thousand inhabitants and its coverage area involves six municipalities (Carpina, Feira Nova, Lagoa do Carro, Lagoa de Itaenga, Limoeiro and Passira).

According to Köppen, the Climate the Agreste of Pernambuco is classified as As', which in itself already has low rainfall, something that varies between 600mm and 800mm per year. These climatic characteristics already position most rivers as intermittent. In addition, constructions of small dams, which serve as a water reservoir for cattle or for irregular irrigation, considerably decrease the flow of water in River. Only during the rainy season do these dams overflow, while, in the rest of the months, they serve as fetters for the natural sequence of the river, as well as for the purpose of the same.

As a consequence, practically, there was a considerable extinction of riparian forests because the owners of these localities used the trunks of trees to make fences for cattle raising or to isolate their properties, further aggravating Rivers existence. Today, they are rare. the locations where the river has an area covered by its riparian forests.

Sediment exploration, which occurs through sand and clay miners for civil construction, should also be considered. This activity has been increasing on the banks of the river under study, both in the area occupied by it and belonging to the municipality of Feira Nova, more recently, and in the municipality of Passira. In the latter, for at least two decades.

The use of the river for disposal of solid waste and domestic and industrial effluents has been another problem in the urban area of the municipality. Even though the city is being sanitized, it does not treat waste properly and this corroborates the degradation of River, because when it reaches the urban area, this environmental aggression is visible.

Another important environmental issue is the disposal of industrial waste from the flour industries, a significant economic activity in the municipality. Considered one of the largest producers in the State, culturally and officially recognized the "Terra da Farinha", according to State Decree of December 2013, n° 1730/13 (PERNAMBUCO, 2013). Other industries installed in the region also contribute to the disposal of waste on the riverbed.

II. LITERATURE REVIEW

2.1 The Improper Release of Effluents in Rivers

The advent of industrialization dating from the end of the 18th century, added to the urbanization process, aggravated by the intensification of the rural exodus, the continuous growth of cities and the search for jobs and services, marked a new phase in the way man started to relate with the environment and the resources it offers (SANTOS, 2006). Because these large centers are mostly located on the banks of important rivers and as the use and occupation of these spaces took place, their original structure was gradually being compromised (SOUZA, 2000).

One of the biggest problems faced by these rivers is the improper discharge of effluents into their waters (SOUZA, 2000). It is important to note that it is not a question of not discharging these effluents, because, in view of so many demands and the dizzying growth of the world population in the last century, it would be practically impossible not to use this instrument. However, what is being questioned is how these effluents are being discharged and where they are being discharged, according to what is determined by CONAMA Resolution 430/2011 (BRAZIL, 2011), whose content deals with the conditions and standards of effluent discharge in receiving water bodies. In practically all the resolution, it is sought to parameterize the discharge of these effluents, pointing out the ways to carry out these processes.

CONAMA aims to regulate these launches, parameterizing launch standards (CONAMA, 2011), but which in most cases is not respected. Perhaps because they perceive the fragility of the inspection process, even the perspective of impunity. The fact is that although the country has one of the most current and complete environmental legislation on the planet, what is identified in practice is very different from what is found in theory.

Studies that prove that these parameters are almost always not respected are not uncommon. In the measurements made, there is an excessively higher launch than those predetermined by CONAMA. These releases are noticeable, for example, with regard to domestic sewage, as according to the Brazilian Institute of Geography and Statistics,

practically 60% of all Brazilian cities are without basic sanitation (BRASIL, 2017).

2.2 Sediment Analysis in Rivers.

To assess the level of pollution or contamination of water slides, at least two collection instruments are usually used. The first and most common, in addition to presenting faster results, occurs in the analysis of water. The second, with more consistent and accurate results, occurs when the sediments of these bodies are analyzed (ARINE, 2000)

The record of effluents discharged into rivers is easily identified in an analysis of the water in that space, however, if the release is punctual and sporadic and depending on the quantity released and the flow of this water body, results may occur that may differ from the real situation of what you want to observe. For that, the periodicity of the water body analyzes must occur in a very short interval between one sample and another, because, as already said, there may be divergences between the results, as well as, a false result (ARINE, 2000).

On the other hand, when the analysis takes place in the sediments of these bodies of water, the chances of success in these exams are considerably greater. This is due to its ability to retain and accumulate contaminating species from the water column. Sediments have been widely used to indicate the level of pollution and environmental contamination, since they integrate all the processes that occur in the adjacent aquatic and terrestrial ecosystem (SOUZA, 2013).

In general, these effluents are transported to the sediments by leaching caused on the continents, mainly as adsorbed or co-precipitated species such as Fe/Mn oxy-hydroxide films and in organic matter. With the reduction of oxy-hydroxides, these metallic elements are deposited in aquatic systems (FORSTEN AND WITTMANN, 1983, p. 486).

The concentrations of contaminants in sediments are much higher than in waters, which makes it possible to use them as a good indicator of environmental contamination, both current and past, also enabling knowledge of the main sources of pollution, (JESUS et al., 2004).

Bryan and Langston (1992) affirm that the concentrations of metals in sediments can, in some cases, exceed the orders of magnitudes present in the waters in five times and that the transformation into organo-metallic compounds, depending on the medium, can greatly increase the its toxicity, especially in the case of lead and mercury.

The identification of these contaminants in sediments is an important step in the mapping of polluting sources, since it is possible to build a process of environmental characterization of the main polluting agents (JESUS et al., 2004). The actions that may result from the mapping of

these trace metals present in the sediments, can result in important mitigating interventions in the recovery of the environmental balance of these ecosystems (VOLPATO et. Al., 2017).

It is also important to consider that, based on the results presented in the analysis of these sediments, in finding a number above what determines the parameters of CONAMA, in its resolution 430 of 2011, both the government and the private sector can, through educational actions, mitigating and remedial actions, seek to resolve these problems.

Among the main polluting agents found in sediments and, which cause concern because they pose health risks, the most common or recurring agents, according to Arine (2000), Souza (2013) and Volpato (2017), are: cadmium, lead, arsenic, barium , mercury, sewage, hydrocarbons, POPs, among others.

The presence of these trace metals in sediments also plays a testimonial role in a polluting process (CARVALHO, 2014). It is possible to verify from which period the contamination was installed and, therefore, it is possible to map the probable sources of this pollution. With this mapping in place, actions to mitigate or eliminate these polluting sources become easier and more effective. It is true that despite the contribution of the Brazilian environmental legislation, the application, monitoring and results, almost always do not follow its contemporaneity.

The evils resulting from both water pollution and sediments are diverse and have direct and complex implications, whether in the physical environment or involving humans. This occurs through the distribution of water to the population or through the irrigation process of agriculture. The fact is that the final consumer of these services is impacted and becomes a potential victim of the harm arising from these polluting processes. The WHO already lists a series of side effects in the world population, resulting from the use and/or exposure to these agents. Pathologies that range from allergies, skin irritations, infections, to more aggressive diseases, such as, for example, cancer, malformation and mutations. (WHO, 2015).

III. MATERIALS AND METHODS

The work was initially based on cabinet studies, with bibliographic review, covering themes such as, for example, management of water resources, effluents and solid waste based on the concept of environmental diagnosis through the identification of geochemical parameters in sediments in the river bed of the Cotunguba River. In a methodological perspective, applied with the qualitative axis (insofar as it identifies the environmental forces), having in Minayo

(2008) its main theoretical and quantitative reference (when it allows the measurement of the levels of toxicity concentration of polluting elements in river sediments) , based on what Marconi and Lakatos (2010) propose.

With the obtained data, cartographic materials were processed using specific software (Q-GIS, Google Earth), based on data from SIRGAS 2000. These data made it possible to locate the study area, as well as the sediment collection sites. for laboratory analysis, in addition to the

territorial layout of the Cotunguba basin, for a better understanding of the studied space.

In the second stage of this work, sediments were collected that were removed from the riverbed in four different points, properly georeferenced, using a GPS equipment, model GARMIN, version ETREX 10, taking into account the social, economic and spatial importance of the points demarcated for collection, as can be seen in figure 1 and table 1.

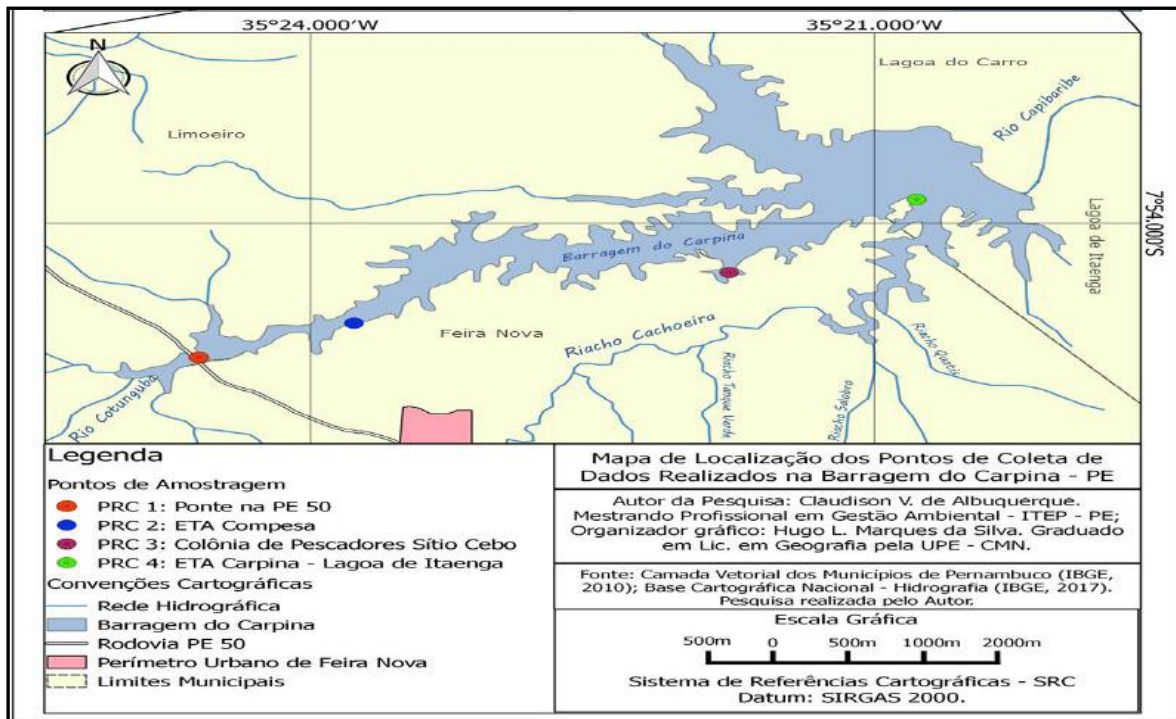


Fig.1: Map of the Cotunguba River, marking the collection points.

Source: Author / 2019.

Table 01 - Points of Collection of the Sediments Samples of the Cotunguba River.

POINT	LONGITUDE WEST	SOUTH LATITUDE
PRC 01	35°, 24' e 36,6"	7°, 55' e 17,5"
PRC 02	35°, 22' e 21,1"	7°, 54' e 22"
PRC 03	35°, 17' e 13"	7°, 52' e 48
PRC 04	35°,20' e 23"	7°,53' e 33"

Source: Author / 2019.

The choice of visit points considered the different sectors studied in order to contemplate a region of about 10km in length. Samples were also collected for laboratory analysis of the following trace metals: Cd, Cr, Hg, Ni, Pb and Zn.

The collected sedimentary material, "04 samples", was packed in plastic bags, identified with a label and transported to the Environmental Monitoring Laboratory of the University of Pernambuco, for drying in an SLL

greenhouse, model VDO9210, for 72 hours at a temperature of 35°.

After drying, the sample was sieved, then disaggregated, comminuted and homogenized in a mortar. The material was properly packed, packed in polyethylene jars, sealed, labeled and sent to the Chemical Analysis Laboratory of the University of Ontario - Canada (ACTLABS) for analysis and identification of the composition of the sediments, both

of natural components, as well as of elements introduced by the anthropic action, figure 02. A part of this treated,

disaggregated and comminuted material was kept in a dry and ventilated place to be used as a proof, if necessary.



Fig.2: Preparation of Comminution, Packaging and Labeled Sediments for laboratory analysis

Source: Author / 2019.

The other 50% of the samples were sent to the Department of Soil Sciences at CTG / UFPE for granulometric analysis. All analyzes were performed on the total sediment (ST).



Fig.3: Photo Mosaic with the preparation of the sediments for granulometric analysis.

Source: Author / 2019.

The methods used to obtain the results were those of FUS-ICP (Plasma Coupled by Fusion Induction), where an oxidized sample is dissolved in a borate flow and then diluted in aqueous nitric acid; o TD-ICP (Plasma Inductively Coupled by Total Digestion), when a sample is

digested via the sequential addition of hydrofluoric, perchloric and nitric acids. The acids are evaporated and the residue is reconstituted in aqua regia and; INAA (Instrumental Neutron Activation Analysis), whose samples are bombarded with neutrons to generate radioactive

nuclides. Measurement of energy and intensity of alpha particles generated by subsequent decay is used to quantify the various elements present in the original sample.

IV. RESULTS AND DISCUSSION

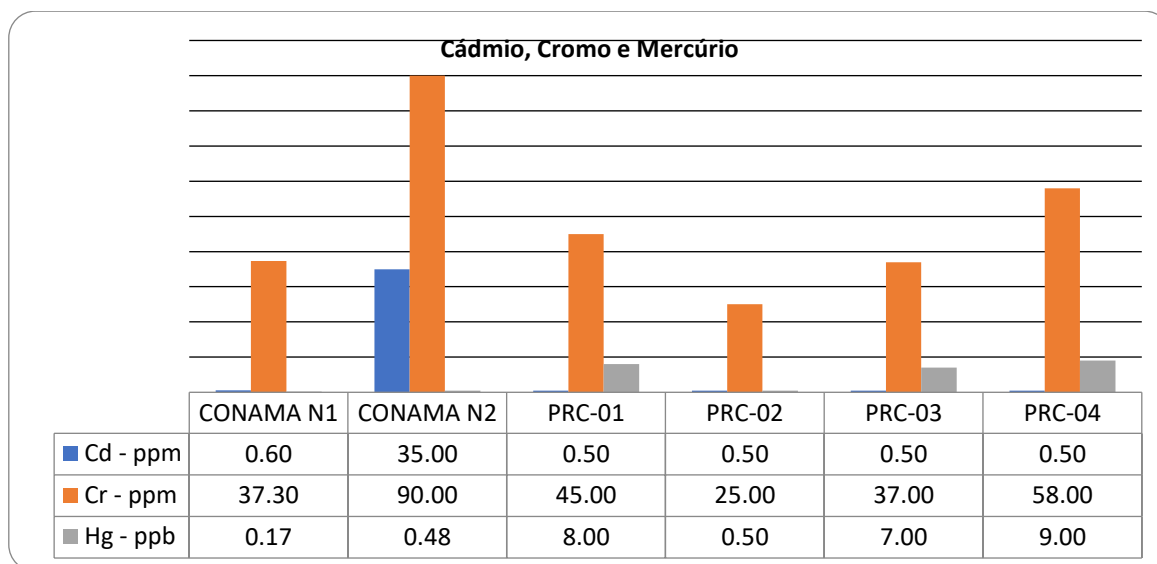
4.1 Analysis of the Cotunguba River Sediments According to the CONAMA Parameter Resolution 344/2004.

The parameter to be used for analyzing the results of this work is that of CONAMA resolution / 344 of 2004. It establishes two levels of pollution for sediments, with level 1 for the unpolluted and level 2 for the tolerable limit of pollution with medium impact. Regarding the trace metal parameter for sediments, CONAMA uses the standards referenced by USEPA and EC, whose main references are Long et al (1995/1998) and Thomas (1987). Table 2 shows how the numbers of the river under study behave.

Table 2- CONAMA / 344 parameters. Pollution degree of sediments according to concentration of metallic species. Comparison with the sediments of the Cotunguba River.

POLLUTANTS	LEVEL 1	LEVEL 1	PRC-01	PRC-02	PRC-03	PRC-04
Cd – ppm	0,6	35	<0,5	<0,5	<0,5	<0,5
Cr – ppm	37,3	90	45*	25	37	58
Hg – ppb	0,17	0,480	8	<0,5	7	9
Ni – ppm	18	35,9	18	7	7	12
Pb – ppm	35	91	34	61	28	13
Zn – ppm	123	315	64	41	48	42

Level 1 - Unpolluted; Level 2- Tolerable limit, with medium impact. * limit above the tolerable.
Source: Author / 2019.



Graph 1 - Comparative Analysis of Cd, Cr and Hg with the CONAMA parameters.

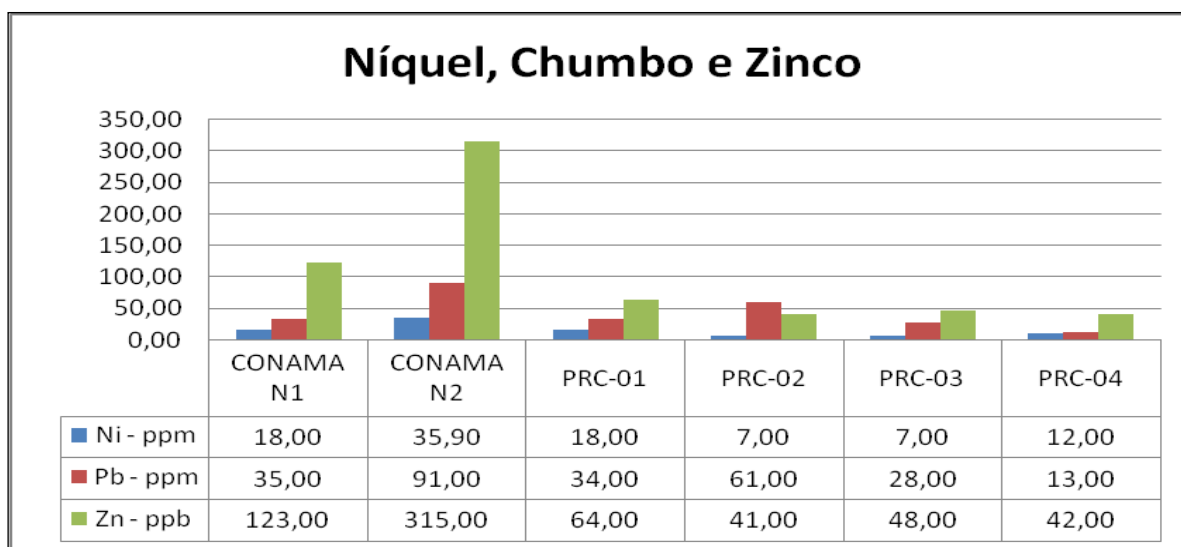
Source: Author / 2019.

The cadmium element, as well as in other parameters, appears below the recommended minimum, therefore, presenting indices that do not cause damage to the biota and fit within level 1, that is, they are considered as unpolluted

sediments. The chromium element, on the other hand, is above the minimum acceptable in points 01 and 04, while in point 03, it borders the minimum limit, except for point 02, which has a content well below the determined level.

Mercury, on the other hand, presents high rates in all analyzed points. The lowest incidence is in point 02,

however, in the others, it is practically 1,800% higher than the other samples.



Graph 2 - Comparative Analysis of Ni, Pb and Zn with the CONAMA parameters.

Source: Author / 2019.

Nickel levels show indices within the standard of uncontaminated in practically all samples, and in point 01, the toxicity content is already at the beginning of what CONAMA considers polluted, even if it is in the basic contamination pattern. As for lead, they already present some samples within level 1, with levels of pollution, but all within what it considers to be of medium impact, because in none of the cases analyzed, the numbers exceed the maximum values, however, it must be considered that point 02 is on average 50% more polluted than point 01, more than 100% in relation to point 03 and practically 400% more polluted than point 04. Finally, zinc behaves in all samples below the minimum standard pollution, with a certain stability between points 02, 03 and 04 and with an index slightly above the other samples in 01.

When analyzing the other hydrographic basins in Pernambuco and the country, using the CONAMA / 344 resolution, it can be seen that practically all of them fit into

level two, with medium impact situations, when the elements in question are Cd and Zn. When the element under study is Cr, the numbers are very considerable and appear above the maximum tolerable limit, as is the case of the Cabo Basin (ARAÚJO, 2014), with almost 90% of content above the average, São Francisco (PEREIRA, 2017), something around 70% more. This can be seen in more detail in graphs 3 and in table number 3.

3.2 Analysis of the Cotunguba River with the other Pernambuco Basins

In addition to the analysis of sediment samples collected in the Cotunguba River having been parameterized with RESOLUTION 344/2004 of the National Environment Council - CONAMA, the results of the river under study were also compared in Table 3 and Graph 3, with the results obtained with other hydrographic basins in the state of Pernambuco and Brazil.

Table 3 - Comparison of the level of sediment pollution in the main hydrographic basins in Pernambuco and Brazil.

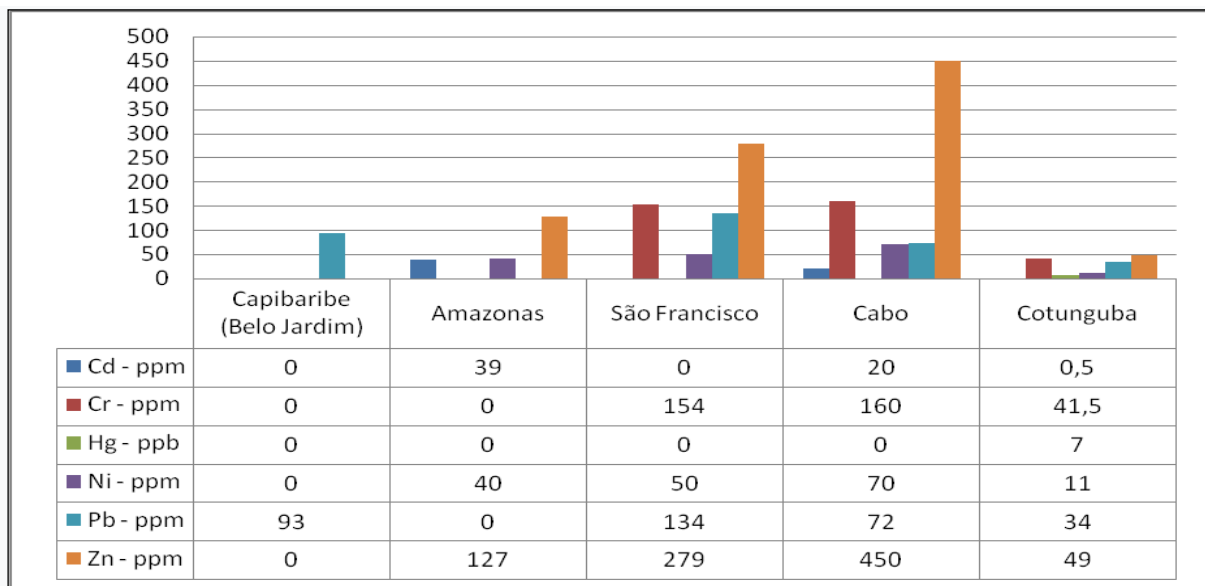
Metais Traços	Capibaribe (Belo Jardim)	Amazonas	Cabo	São Francisco	Cotunguba
Cd – PPM	SP*	39	20	SP	<0,5
Cr – ppm	SP	SP	160	154	41,5
Hg – ppb	SP	SP	SP	SP	7
Ni – ppm	SP	40	70	50	11
Pb – ppm	93	SP	72	134	34
Zn – ppm	SP	127	450	279	49

	Paiva 2005	Siqueira et al 2006	Araújo 2014	Pereira 2017	
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Source: Author / 2019. SP – No Parameters for the case study.

Only the rivers whose studies took place under the same geochemical conditions were analyzed and compared, that is, hydrographic basins versus hydrographic basins, since the processes and dynamics are similar, as there are no different geological and chemical factors. Although studies

and results from estuarine areas are cited here, the intention is not to make analogies between them, but only to demonstrate that regardless of the river segment (source, tributaries, sub-effluents, mouth, estuaries, etc.), the effluent inputs and trace metals have already reached them.



Graph 3 - Comparison of the pollution level of the sediments of the Cotunguba River with the other hydrographic basins of Pernambuco and Brazil.

Source: Author / 2019. * the number 0 represents the absence of parameters for the river under study.

When comparing the numbers obtained by the results of the sediments samples from the Cotunguba River with the other rivers already studied in the state and in the country, by parameters of institutions such as USEPA, EC, CONAMA, among others, considerable variations in content are perceived at certain times. of toxicity between rivers for similar elements, even though anthropic factors are the cause of the main inputs.

In the general picture, in practically all the elements of the other rivers in analysis are above that presented by the study in question. Some aspects point to possibilities for understanding the peculiarities of some river systems and uniqueness when analyzing these resources holistically. Therefore, some elements need to be presented:

a) Industrialization Factor: all rivers analyzed, with the exception of Cotunguba, run through at least one area with industrial concentration. As already said, the control of effluent emissions does not respect what the legislation

determines and they end up dumping their waste into these rivers, compromising the quality of their water and sediments. Undoubtedly, the most affected of them is the Capibaribe River, which from the municipality of Santa Cruz do Capibaribe, through Toritama and Caruaru, the so-called textile pole, has no control over the discharge of its effluents into the riverbed. As the river approaches the coast, the tendency is to worsen, as it also receives effluents in the city of Limoeiro, Paudalho, São Lourenço da Mata, Camaragibe until it reaches Recife. Not very different, we have the rivers that make up the Cabo Basin in the municipality of Cabo de Santo Agostinho, São Francisco Basin, in the stretch between Petrolina and Juazeiro and the Amazon River, just after the confluence between the Negro and Solimões Rivers, which ends suffering from the same problems. As Cotunguba is not exposed to this factor, part of the elements indicates numbers within the acceptable range and well below the other rivers in the State.

b) Basic Sanitation Factor: another point that must be considered is the issue of basic sanitation, since just over 40% of the country has an effective public sanitation policy, with the North / Northeast being the region with the lowest index and the Southeast and Southeast regions. South and those with the best results in this segment (BRASIL, 2015). It should be noted that the failure to effectively treat sanitation causes serious and diverse problems to health, the environment and why not affirm, also, the economy. On the other hand, the lack of environmental awareness among the population, further aggravates these aspects.

In view of all this, in several municipalities where rivers were analyzed in Pernambuco, including the study in question, it was found that practically 100% of domestic sewage is discharged directly into the river. The fact that Cotunguba is located in a sub-region, with low population density, justifies smaller launches in relation to the other rivers mentioned, which in several cases, cut municipalities with populations in the hundreds of thousands of inhabitants. Naturally, with the constancy with which this process occurs, even though some elements have a small content, their accumulation ends up being extremely harmful to the life of the river and to those who depend on it.

c) Deforestation: it is also necessary to consider that, with the expansion of agriculture, especially the monoculture of sugar cane and livestock, deforestation has accelerated in recent centuries. According to IBAMA (2011), in Pernambuco, it reached 93% of the entire Atlantic Forest. However, this problem was not restricted exclusively to the Atlantic Forest biome, much less to the Brazilian colonial period. The advance of deforestation in other ecosystems has been a recent action, especially in areas close to estuaries and marine vegetation, for the exploration of tourism. Even in regions with a lower density of vegetation cover, such as Agreste and Sertão, the advance of deforestation is real. All of this directly contributes to carrying effluents that, when decanted into rivers, intensify the process of pollution of their sediments.

c) Agriculture: another factor that must be considered in this context is the issue of agriculture. In addition to the deforestation process, which it demands, it is also associated with this, the use of agricultural pesticides (POPS), to control pests in animals, as well as the use of fertilizers and pesticides in crops aimed at feeding cattle. The indiscriminate use of these products contributes to the contamination of sediments, through the process of leaching and carrying, making most of the rivers in Pernambuco, especially those located in the Zona da Mata do Estado, be polluted. The irregularity of the rains ends up being an aggravating factor for the intensification of the pollution

process, occurring a decrease in it, when the rains are more constant, as stated by Lima (2008), when observing that in the areas where the Botafogo River was perennial the pollution content was less than the areas where the river was intermittent.

The collected samples make it possible to identify the current situation of the environmental conditions in which the region finds itself. Especially when considering the following factors: territorial dimension of the mouth of about 10 km in length, intermittent regime and uniqueness of the multiple uses of the river, based on irrigation, urban supply, mining and effluent convergence. This allows a diagnosis aimed at a qualitative analysis, identifying its main inputs. Consider also that for the analysis of bottom sediments, great diversity of samples is not necessary.

The general context of the situation of the sediments of the Cotunguba River in the section that approaches its mouth, indicates changes in the environmental balance, all of which are the result of anthropic actions. The deforestation of riparian forests and the basin's surroundings, the direct release of effluents (domestic and industrial) into the river, the indiscriminate use of fertilizers and pesticides in agriculture, those of pesticides in livestock and the disposal and storage of solid waste produced by the population of the cities that make up the river basin are the main causes for this scenario.

V. FINAL CONSIDERATIONS

Sediments are important sources for identifying the most diverse forms of pollution, especially trace metals. Corroborating with this, the study of the material of the Cotunguba River, in the municipality of Feira Nova - PE, brings valuable information and in certain points of concern regarding the level of contamination by trace metals in its sediments, resulting in serious problems to human beings. and the entire existing ecosystem in its surroundings.

Anthropic actions arising from the advancement of urbanization and industrialization, the absence of more effective public policies and the non-compliance with existing laws in the country, as is the case with the law on solid waste and the discharge of effluents, showed, through the samples, that were collected and analyzed, that practically all the analyzed points have at least one highly polluting chemical element, above the parameters acceptable by the control bodies (CONAMA).

The presence of trace metals such as chromium, mercury and lead in the PRC1, PRC3 and PRC4 samples, well above the tolerance levels and the most diverse evils caused to all biota, resulting from direct or indirect contact with these elements, give rise to urgent actions and effective in order

to mitigate the impacts caused by them and ceasing the continuity of their launches in the waters of the Cotunguba River and, consequently, in their sediments.

Appropriating this information, equips the public authorities with instruments that make it possible to act with more objectivity and effectiveness in preventing actions of this nature. In addition, it also equips civil society (control agencies, non-governmental organizations and the press), important actors in the process of collecting and inspecting actions, both from their peers and their representatives.

However, it is also important to consider that one should not expect only the actions of the public authorities. A continuous work of environmental awareness of the population that resides in the municipalities that are part of the river's hydrographic basin and that uses the waters of the dam, including mainly, the riverside, needs to be implemented urgently, because part of the contamination process that has occurred, in a systematic and continuous way, has been caused by the referred population, even if it does it without intentionality.

Despite so many problems and disastrous consequences, it cannot be said that the history and / or function of this river has come to an end, as some mitigating actions can be taken with the aim of reversing the situation and recovering its "health" and restoring environmental balance. For that, it is enough that the public power is positioned in order to fulfill its role. It should be noted that sewage, in addition to being the main polluter, according to COMPESA data, around 66% of them in the state are not treated before being discharged into rivers, a number that, here in Feira Nova, reaches 100%, since there is no sewage treatment plant, it does not inspect and prevents other agents from doing so. This directly contributes to the wasting of the river.

It is also of considerable concern that, with all this polluting action, the water that is offered to the population supplied by the dam, is not of a satisfactory quality and that meets the requirements of CONAMA legislation for use and supply. Therefore, a study of the river sediments, as well as a good job of characterizing the area, can contribute considerably for the services provided to improve, directly influencing the quality of life of people, the main object of public power, as well as reducing costs and processes in their treatment and offer.

On the other hand, it is not possible to think only about the supply of water to the population and the cost that this may incur on the supplying company. But we need, as stated by Leff (2013), to think about posterity, to treat this issue as a micro situation, but not to forget that it is part of the macro and that ecosystems are integrated, especially those of limnocyclus that are today the most susceptible to pollution processes. Therefore, taking care of the surroundings of this

river, mapping potential polluters and verifying through laboratory analysis the situation of sediments in this river, in addition to seeking public awareness and the population in general to raise awareness of care, to maintain and ensure that populations may also enjoy, as this is the real concept of sustainability.

The continuity in the research process in the river in question, deepening and broadening the discussions, is fundamental for the reestablishment of its balance. Aware that this work is just a kick-off and that there is still much to be studied, it is anxious for other studies to emerge and that, with their contributions, may point out ways and measures that aim at Cotunguba's life and sustainability.

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