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Full Paper

Evaluation of Physic-chemical Parameters of Water Quality on Agricultural Fields of Western Bahia

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Abstract: For the diagnosis of the quality of water it is necessary to execute a set of analyzes (physical and chemical) of the body of water that will provide information that integrate biotic and abiotic factors that govern the functioning of the ecosystem. The objective of this study is to evaluate the quality of water from wells and rivers of Urucuia aquifer region for investigation of contamination or contamination risks. Were realize collections in nine (9) areas of western Bahia, which were collect in each area, two points of well water samples and a river, and determining the electrical conductivity, pH, dissolved ions and metals. The results were compare with the maximum permissible values (MPV) for human consumption by Ordinance No. 2914/11 of the Ministry of Health and National Environment Counsel - CONAMA (Resolution 357 and supplementary resolutions). The quantitative results of the analysis showed that the surface and well waters that are part of the aquifer Urucuia within the parameters investigated are below the values recommended by the legislation showing that the agricultural activities in the region has not affected to the evaluated parameters, the quality of water for human consumption. However, it is necessary a monitoring of surface and groundwater in the region with expansion parameters evaluated.

Keywords: agriculture; water; contamination; quality

1. INTRODUCTION

The natural resources such as water are essential to the survival of the planet and have a great economic, environmental and social value, are important to the survival of man and ecosystems on our planet, but inappropriate use causes contamination, making it unusable.

The groundwater pollution, for example, has worried the environmentalists because your users have "ignored" the serious consequences of contamination [1]. The big problem is the fact that the groundwater contaminations not be visible as surface water, in most cases identified. With this protective or interruption actions is applied late, and that when the contamination becomes noticeable, generally already reached a wide extension [2].

The Rainwater bigger replenished into the subsoil and it happens in most cases because of the infiltration of rainwater excess the soil. Soon the activities that done in this soil can threaten the groundwater quality, especially when this area is being apply or contains a type of hard degradation substance. The pollution of aquifers occurs where the contaminant load of the disposal generated by human activity (urban, industrial, agricultural, mining) is inadequately controlled and certain components exceed the attenuation capacity of the soil layers [3].

Therefore, the pollution happens slowly into aquifers and may be due to many factors. Such as: mechanical filtration action - action exerted on the particles in suspension such as sand, clay, algae, microorganisms, being very little or almost inexistent in permeable aquifers, due to the existence of great fissures or dissolution channels. Action of oxidation-

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reduction reactions - oxidation processes are important in reducing the contamination with organic and nitrogenous products predominantly occurring during infiltration in the middle unsaturated, although it can be realized in the saturated medium [2].

Most of the times in agriculture, pesticide residues that was use in plantation are the major pollutants. Water resources act as integrators of biogeochemical processes of any region. Therefore, when pesticides introduced, water resources, whether surface or underground, appear like the main final destination of pesticides. Soil and water work interactively and any action that causes adverse effect on one of these elements will affect the other[4].

The western Bahia has been standing out nationally for production of agricultural commodities, particularly in soybean, corn and cotton [5]. These activities require the application of many types of agrochemicals, in which many take a long time to be degrade naturally in the environment. Therefore, they are available with the possibility, by way of leaching be taken to the water bodies.

The region has been occupy for the intense agricultural activities, a result of plain areas and abundance of water resources, has the largest basin on the left side of the São Francisco River. Furthermore, the region is located on the Urucuia aquifer with abundant groundwater often used for the development of agriculture. The Aquifer Urucuia is the set of aquifers that take place in the area of Urucuia Group, covering Urucuia sub-basin and is defined as the northern part of the subdivision of Sanfranciscana basin, which corresponds to most of the Phanerozoic cover Craton [6].

According to Gaspar and his collaborators [7], the aquifer Urucuia is the main west of groundwater Baian. On account of its strategic importance, reference is made not only by the growing demand for water, but also by the regulatory function of the flow of the affluents of the middle left margin São Francisco river and the power of the right margin tributary headwaters of the Tocantins river, on the western edge of the Serra Geral from Goiás.

Despite the abundance of water, resources can be observed in recent years a reduction in rainfall levels in the region and, consequently, the water level of rivers becoming the worrying situation in the region, especially with regard to its quality. In this way, get to know the quality of water becomes necessary in the planning and use. In this sense, this work is to evaluate the quality of water from wells and rivers of Urucuia aquifer region for investigation of contamination or contamination risks.

2. MATERIAL AND METHODS

2.1 Characterization of the Study Area

The field activities were conducted with collection of water samples in perimeters on agricultural fields western Bahia in irrigated cultivation areas using groundwater and dry land planting in Anel da soja, Placas, Bela Vista, Novo Paraná, Panambi, Coaceral, Roda Velha, Campo Grande, Cascudeiro regions. This collection was the purpose of diagnose the quality of water to get data that will serve to alert the presence of chemical contaminants. The Figure 1 identifies the area that was conducted the study and the points where the collections were made are reported in Table 1 with their respective geographic coordinates.

The collection of samples was carry out from December 2014 to March 2015 (rainy season) in nine (9) areas of sample collection, where each area is a sample of river and two are artesian wells.

Table 1. Properties and location of collection points.

AREAS	PROPERTIES	LOCATIONS
I	COPACEL	PLACAS
	COLORADO	PLACAS
	BRANCO RIVER	PLACAS
II	SÃO MIGUEL	BELA VISTA
	SÃO VICENTE	BELA VISTA
III	SAMA	NOVO PARANA
	FAZENDA PROGRESSO	NOVO PARANA
	BORÁ RIVER	NOVO PARANA
IV	LEONATES	RODA VELHA
	HELIO KABAYASHI	RODA VELHA
	RODA VELHA RIVER	RODA VELHA
V	ALABAMA	CAMPO GRANDE
	FAZENDA TRIANGULO	CAMPO GRANDE
	NADO OF RIVER	CAMPO GRANDE
VI	PRADELLA	COACERAL
	RAMPAZZO	COACERAL
	SAPÃO RIVER	COACERAL
VII	SANTA MARIA	PANAMBI
	MINGORI	PANAMBI
	PRETO RIVER	FORMOSA
VIII	TIMM	CASCUDEIRO
	BERTOLDI	CASCUDEIRO
	TABUA STREAM	CASCUDEIRO
IX	FAZENDA MONTEKIEVI	SOJA OF ANEL
	FAZENDA BARCELONA	SOJA OF ANEL
	OURO OF RIVER	SOJA OF ANEL

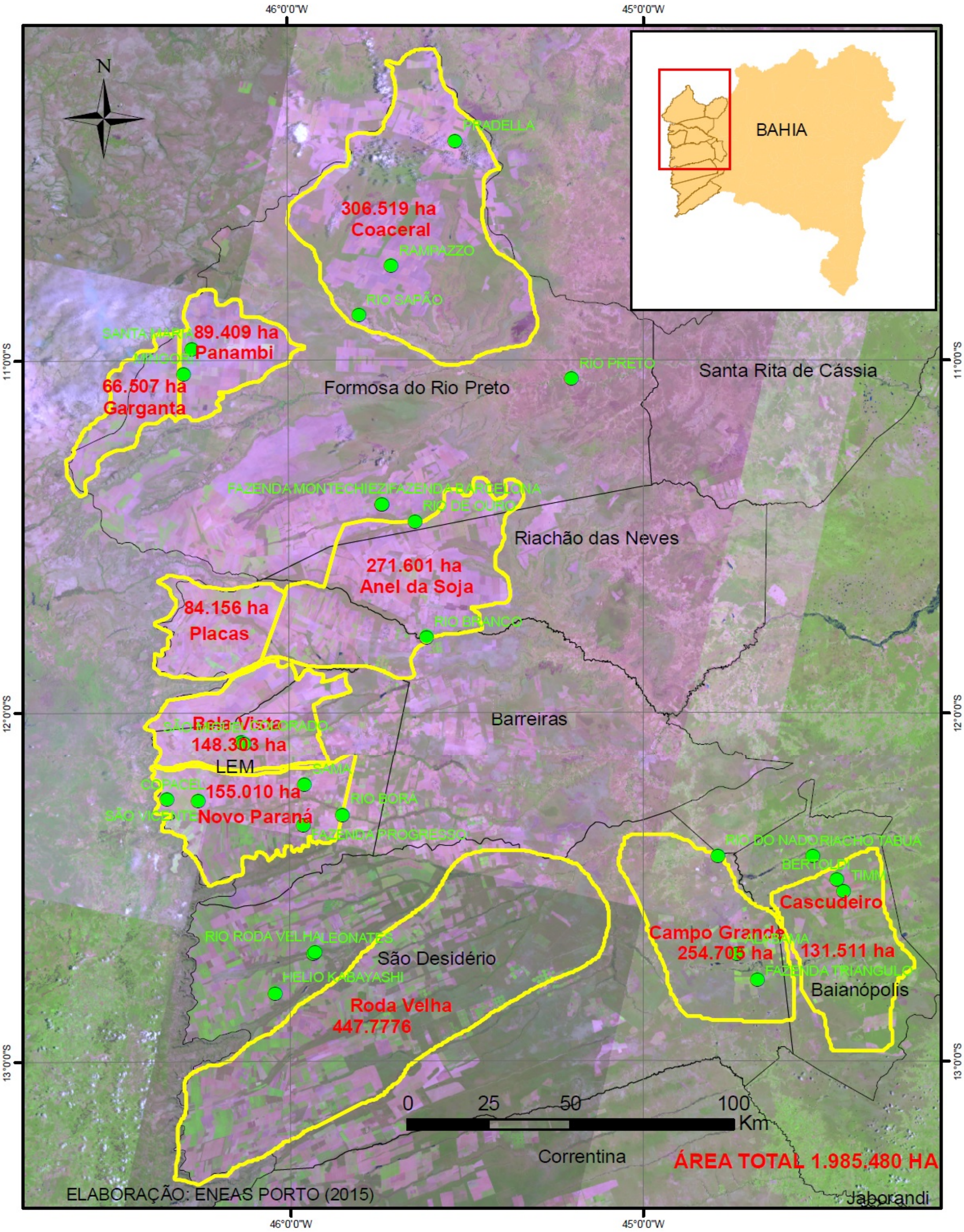

Figure 1: Strategic studies of the Rio Grande basin map. Image Adapted Landsat 8.

2.2 Analyses of Data

For each study area were collect two water samples from wells and a river. Water samples were collect in plastic flasks (PVC), inert, which were previously wash with distilled water, and packed in styrofoam box. These samples will pass by filtration on filter membrane (0.45 µM) and part of the samples preserved with nitric acid (HNO_3 diluted) to pH 1.5 for the determination of metals.

After collection water, samples were determined in the laboratory of analytical chemistry of the Federal University of the West of Bahia, the parameters: pH, temperature, electrical conductivity and salinity.

For pH measurement, where he was employed a brand name Hanna bench pH meter, model pH 21. The bench Conductivity was also used (brand Tecnopon/MB11 model) where he made measurements in $\mu S\ cm^{-1}$.

The samples were preserve with nitric acid determine Na^+, K^+, Mg^{2+} and Ca^{2+} through the use of Spectrometer Atomic Absorption (AAS), the Perkin Elmer model Analyst 200, the Geochemistry Laboratory (Lageq) at the University of Brasilia. All chemical analysis followed the protocol established in Standard Methods for Examination of Water and Wastewater [8]. The analyses were performed in triplicate, except pH and conductivity measurements.

In Table 2 are the parameters that determined and methods that have been apply to the determination the physical and chemical parameters of the water.

Table 2. Physical and chemical analysis methodologies that were used in the analysis of water from wells and rivers.

Parameters	Methods	APHA (2005) [8]
Hardness	Titration	2340 C
Electric Conductivity	Conductometric	2510 A
Chloride	Titration (Mohr)	4500-Cl^-B
pH	Electrometric	4500-H^+ B
ammonium-N-NH_4^+	Spectrophotometric (modified Berthelot)	4500-NH_4^+B
Nitrite- N-NO_2^-	Spectrophotometric (Griess)	4500-N-NO_2^-B
Total phosphorus	Spectrophotometric	4500-P
Dissolved Metals	Absorption Spectrometry and atomic emission (EAA/EEA)	311 B

The limits of quantification of metal ions Na^+, K^+, Ca^{2+} e Mg^{2+} were estimated as 10* standard deviation of the blank/slope of the calibration curve.

3. RESULTS AND DISCUSSION

The results of sampling showed in Table 3, where they exposed to some analysis parameters for the diagnosis of the water of the sampled areas.

The electrical conductivity results in the evaluation of Urucuia aquifer water got variations from 6.32 to 137.5 S / cm among all samples being obtain in the well of the Colorado Farm and Rio Campo Grande respectively. CONAMA Resolution No. 357/05, sets no limits for this parameter, but in terms of aquatic communities the amounts recorded do not compromise their survival.

The values of the potential of hydrogen ions (pH) had to acidic for all collected points. Less value 4.24 obtained in the well of Leonarte farm and greater value and 6.71 in Farm Montebnievi. The low pH, usually, makes the metals tend to solubilize and may increase the toxicity of water. For environmental legislation, it observed that the pH and are outside the limits established by CONAMA Resolution 357/05, which 6.0 to 9.0 is for class water 2. Low pH values can explained that due to decomposition of organic matter, they led by means of drainage humic and fulvic acids. These acids influence on coloration and have in their molecular structure carboxylic groups (-COOH) and hydroxyl (OH^-) when they are dissociating, release water in the H^+ ions, with a pH reduction.

Phosphate rarely found in high concentrations because of its activity for plants. Considered as an essential nutrient for plants is readily accumulating by a number of organisms. The high phosphate concentration in aquatic environments accelerates the process of eutrophication, stimulating algae growth. In analyzes, the phosphate content was below the maximum levels allowed by CONAMA 357. Still, the values found explained by phosphate loading of crops in the region, using fertilizers.

The values found for nitrite were low in all sites sampled. The concentrations are below the values of CONAMA 357/05, for class 1 and water 2 permitted the presence of up to 1.0 mg / L nitrite.

Ammonia or ammonia nitrogen is an indicator effluent entrance into the body of water, and higher concentrations can be extremely toxic. The highest concentration was find in Leonarte farm (1.9069 mg / L) distancing of the other sampled sites that are below 0.1 mg / L. However, all ammonia values are below the recommended by Resolution CONAMA 357/05, for water bodies of Classes 1 and 2, which is 3.7 mg / L to pH $\leq$ 7.5.

For metals, it is observed that the concentrations of the chemical elements are below the limit of quantitation (LOQ) for the technique used, indicating the absence of these elements from the samples. Some points were possible to quantify, but the results are below the minimum recommended values for human consumption by the health ministry.

Table 3. Physical and chemical parameters of water first collection station (rainy season).

LOCATIONS	PROPERTIES	Nitrite (mg/L)	Phosphate (mg/L)	pH	Cond. (µs/L)	Na^+ (mg/L)	K^+ (mg/L)	Ca^{2+} (mg/L)	Mg^{2+} (mg/L)	Turb.
Ordinance N° 2914/11 of the Ministry of Health (VMP) [9]		1.00	0.02*	6.0 – 9.0	-	200*	-	-	0.1	100*
PLACAS	WELL 1	0.01	0.01	6.12	34.12	<LQ	<LQ	<LQ	<LQ	0.1
	WELL 2	0.01	0.01	5.72	6.32	3.72	2.77	0.78	0.78	0
	RIVER	0.08	0.01	5.68	27.01	0.55	<LQ	<LQ	0.14	0.23
NOVO PARANÁ	WELL 1	0.09	0.01	6.09	38.05	<LQ	<LQ	0.59	<LQ	0
	WELL 2	0.09	0.01	4.52	12.29	<LQ	<LQ	<LQ	<LQ	0
	RIVER	0.09	0.01	5.97	27.59	<LQ	<LQ	6.18	<LQ	0.15
RODA VELHA	WELL 1	0.10	0.00	4.24	81.37	<LQ	<LQ	<LQ	<LQ	0.1
	WELL 2	0.09	0.01	5.87	24.76	<LQ	<LQ	3.76	<LQ	0
	RIVER	0.09	0.00	5.91	20.19	<LQ	<LQ	4.44	<LQ	0.14
CAMPO GRANDE	WELL 1	0.09	0.00	5.57	17.20	<LQ	<LQ	3.32	<LQ	0
	WELL 2	0.08	0.01	4.30	14.98	<LQ	<LQ	<LQ	<LQ	0
	RIVER	0.09	0.01	6.45	137.50	5.72	3.72	0.80	0.77	0.1
ANEL DA SOJA	WELL 1	0.01	0.00	6.71	31.92	<LQ	<LQ	0.72	<LQ	0
	WELL 2	0.07	0.01	5.66	28.03	<LQ	<LQ	0.55	<LQ	0.12
	RIVER	0.01	0.01	6.30	26.25	<LQ	<LQ	<LQ	<LQ	0.15
BELA VISTA	WELL 1	0.01	0.01	6.54	20.14	<LQ	<LQ	<LQ	<LQ	0
	WELL 2	0.01	0.01	6.41	49.87	<LQ	<LQ	<LQ	<LQ	0.1
COACERAL	WELL 1	0.01	0.00	5.22	13.30	<LQ	<LQ	0.84	<LQ	0.14
	WELL 2	0.01	0.00	5.19	3.40	0.55	<LQ	<LQ	<LQ	0.1
	RIVER	0.01	0.00	5.84	5.35	<LQ	<LQ	5.86	<LQ	0.17
PANAMBI	WELL 1	0.02	0.00	6.44	53.71	<LQ	<LQ	0.75	<LQ	0.1
	WELL 2	0.01	0.00	6.36	10.38	<LQ	<LQ	0.72	<LQ	0.1
	RIVER	0.01	0.00	7.29	4.90	<LQ	<LQ	12.33	<LQ	0.12
CASCUDEIRO	WELL 1	0.01	0.00	5.15	26.11	19.22	<LQ	<LQ	<LQ	0.01
	WELL 2	0.01	0.00	5.45	32.11	13.30	3.55	2.11	0.21	0.13
	RIVER	0.01	0.00	6.16	35.67	7.16	5.71	<LQ	0.56	0.14

*CONAMA 357/2005 [10], Limite of quantification for: Na^+ = 0.01 mg/L; K^+ = 0.01 mg/L; Ca^{2+} =0.05 mg/L and Mg^{2+} = 0.11 mg/L

4. CONCLUSION

The quantitative results of the analysis showed that surface water and wells that within the parameters investigated are part urucuia aquifer within the parameters investigated are below the values recommended by the legislation evidencing that agricultural activity in the region has not affected the quality of water for human consumption.

The concentrations of parameters determined were consistent with those found by Rego and his collaborators [11] in the Basin of Wave River, located in the region, where the results were below the recommended by the legislation. In the evaluation, in relation to the seasonal period the results of parameters determined not obtained significant differences showing no the need to carry out a new sample collection during the dry season. The work conducted by the same parameters of the concentrations was higher in the rainy season.

The characteristics of water are constantly changing because of the natural and anthropogenic changes in the environment, showing the importance of having monitoring water quality. Government investments still needed for effective monitoring of water use and the destination after use.

5. ACKNOWLEDMENTS

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