

# Management of Technology Focused on the Water Analysis Results in Artesians Wells

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**Abstract**— *The water is an universal soluble, fundamental to every living being. The main component to the human body and indispensable for any form of life, however, there is an increasing preoccupation within the quality of their providers, which are the rivers, strands and springs, but as the time passes by are threatened by anthropogenic activities, main causer of the contamination and destruction of the local fauna and habitat. The principal objective of this research was to generate necessary information to further make use of this water, specifically located in Porto Velho, Rondônia, in Jamari's River's hidrographic basin sided with Green River's, one affluent and one subfluent of Madeira's River, which is one of the most important hidrographic basins of Amazon's River, yet, lots of physical, chemicals and microbiological parameters were effected, like pH, turbidity, overall alkalinity, overall toughness, iron, chloride, color, fecal coliforms, that are capable of identify the contamination by anthropic action, obtaining the characteristics of the*

*containing waters in the studied area, which in turn had favorable results, following the collected results we could confirm that all them were under acceptable and expectable parameters required by legislation in force of bathing, aquatic community preservation and human consumption, being the last one dependable of a simple threatment (chlorination).*

**Keywords**— *Water Quality, Physical Parameters, Chemistry and Environment.*

## I. INTRODUCTION

The water is the most important natural resource for the life in earth, having its place as an abundant substance in the whole planet, available in different places and in different quantities making itself irreplaceable. The water domain allowed the human to learn skills such as botanic, animal creation and breeding for its own survival, how to generate energy from it with hydroelectric, and one of the simple habits that shows it

clearly is that the man itself always aimed to live close to rivers and places with rivers to settle in. (Translated from DANTAS, 2002).

To characterize water, some parameters are determined; they represent its physical, chemical and biological characteristics. These parameters indicate the quality of the water and constitute its impurity when it reaches superior value then determined for usage. (Translated from FRACARO, 2005).

As for the importance of the underground waters and the fact that they are virtually the main public supply, related studies regarding its physical, chemical and microbiological parameters turn out to be extremely necessary for these waters. Like this, through analysis, take the right measures to threat the water before the presence of the detected harmful substances.

## II. OBJECTIVES

This research main objective is to study the chemical. Physical and microbiological characteristics of three wells located in one specific countryside of Porto Velho, capital of Rondônia, in Brazil. And for the results the task at hand brings objectives like obtaining samples from which well to obtain characteristics like depth, temperature, color, turbidity (a), compare themselves among other samples to check their pH, alkalinity, toughness, chloride, free chlorine and ammoniacal nitrogen (b), evaluate the contamination of each sample based on the microbiological parameters of fecal coliforms and total coliforms (c) and at last, but not least, correlate the results of each parameter, physical-chemical and microbiological of each studied area with intent to obtain the true quality of the underground water of the area (d).

## III. LITERATURE REVIEW

The quality of water for human consumption is directly linked to the way the present soil was occupied, or by the high deforestation of its riparian forest and the disorderly use of its natural resources, such as livestock and agrochemicals used for agriculture practiced by the present inhabitants and use this water to supply their homes for the consumption of their families.

The main sources of water pollution are liquid and solid discharges from human agglomerations and industrialized regions. Domestic sewage usually consists of a mixture of organic substances and some nutrients, such as detergents and soaps. Industrial sewage generally has a greater diversity of composition, including acids, bases and toxins. However, food industry sewage presents a more heterogeneous mixture due to the type of production and product, usually with a high content of

organic substances (SCHÄFER, 1985; STAMOU et al., 1999).

According to a study carried out by the Water and Sewage Company of Rio Grande do Norte (CAERN) in partnership with the Federal University of Rio Grande do Norte (UFRN), it was possible to identify the main sources of contamination of our surface and underground water sources. They are:

- The cesspools and sinks (consequences of lack of basic sanitation throughout the city).
- Infiltration ponds (resulting from clandestine sewage connections in the rainwater network).
- Old cacimbons transformed into cesspits (directly contaminate groundwater sheets).
- Poorly constructed wells (prepared without adequate technical criteria).
- Dumps (built on the dunes, which are very permeable soils).
- Industrial sewers (transferred to infiltration ponds or dumped directly into the Potengi, Jiqui and Jundiá rivers).
- Gas stations (fuel leaks from tanks buried in the ground and not treatment of wastewater).
- Creations of animals (cattle, pigs and birds) along riverbanks and lagoons.

Waste generated by industries, cities and agricultural activities is solid or liquid, with a very large potential for pollution. Waste generated by cities, such as "garbage", debris and toxic products are carried to the rivers with the help of rains. Liquid waste carries organic pollutants (which are easier to control than inorganic ones, when in small amounts). The industries produce large amounts of waste in their processes, one part being retained by the industry's own treatment facilities, which retain both solid and liquid waste, and the other part dumped into the environment.

In the process of treatment of organic waste is also produced another residue called "slurry", liquid that again needs treatment and control. Finally, water pollution can appear in various ways, including thermal pollution, which is the discharge of effluents at high temperatures, physical pollution, which is the discharge of suspended solid material, biological pollution, which is the discharge of pathogenic microorganisms and viruses, and chemical pollution, which can occur due to oxygen deficiency, toxicity and eutrophication. This is caused by processes of erosion and decomposition that increase nutrient content, increasing biological productivity, allowing periodic proliferation of algae, which in the present study, it was found that the presence of oxygen-deficient water was associated with increased oxygen uptake and increased toxicity to the organisms that live there, such as fish that

appear dead with toxic foams. (ZAMPIERON & VIEIRA, 2006).

It is worth mentioning that the current environmental legislation CONAMA Resolution (National Environmental Council), nº 357/2005 - classifies the waters of the Brazilian territory according to its salinity, as for example; the world water classification, based on its natural characteristics, refers to "fresh water" with a total dissolved solids content (STD) of less than 0,5% mg / l. Waters with STD between 1,000 and 10,000 mg / l are classified as "brackish" and those with more than 10,000 mg / l are considered "salty".

**IV. METHODOLOGY**

**4.1 Characterization of the Area**

The experiment will be in 3 (three) points of different situations and activity: 1 (one) industrial area well, 1 (one) well in the commercial area and 1 (one) well in a residential area. All points located in a rural area in the municipality of Porto Velho - Rondônia - Brazil. The points between them have a distance as shown below:

The collections and analyzes were carried out in April 2015, along with the geographical coordinates. After the collections, the tests were carried out in the laboratory of Waters from Rondônia's University (FARO), and were composed of 3 (three) glass bottles, where each flask had an average of 300 ml of sample, the time elapsed between sample collection and the reception for physical - chemical analysis was from 15 to 16 hours, on constant refrigeration. Receipt for physical - chemical analysis was 15 to 16 hours, on constant cooling.

The points studied were identified as follows:

- WELL 1: Commercial area
- WELL 2: Residential area
- WELL 3: Industrial Area

**4.2 Collection of Samples**

The marking of the points for collecting the samples was obtained by a portable GPS of the Garmin brand, model Gpsmap 76CSx, the geographical coordinates of each point are expressed in the table below number 01:

*Table.1: Geographical Coordinates*

Sample Collection Points	Geographical Coordinates	
W1	8°47'52.08" S	63°49'47.21" O
W2	8°48'37.10" S	63°48'24.46" O
W3	8°47'42.64" S	63°46'1.76" O

**4.3 Colorimetric Tests**

The use of colorimetry and the method of quantitative analysis which is based on the comparison of the color produced by a chemical reaction with a standard color according to the intensity of the color produced, infer the concentration of a certain analyte (substance to be analyzed). The safest method to check the color of a reaction is through the use of titrator techniques and an indicator, which compares color intensity to a standard color, called "white". It is the most widely used method in laboratory analysis of the AlfaKit's 2011 potability instruction manual.

**4.4 Alkalinity**

To perform the alkalinity test, 50 ml of sample with plastic beaker was measured and transferred to the wide mouth flask. Then added 3 (three) drops of Phenolphthalein shaking in circular motions.

After the sample was pink, the total alkalinity reagent was added to the burette and dripped until the color disappeared and then the volume (Vg) as AP was recorded.

In another sample were added 5 drops of mixed and stirred indicator, continuing to drip to the total alkalinity reagent changing from blue to salmon, always stirred in circular motions after the addition of each drop. At the end of this process, the volume spent (Vg) as AT was recorded.

Formula:

$AP \text{ (mg L}^{-1}\text{ CaCO}_3\text{)} = Vg \times 20$ $AT \text{ (mg L}^{-1}\text{ CaCO}_3\text{)} = Vg \times 20$
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- AP: Partial Alkalinity
- AT: Total Alkalinity
- Vg: Volume Spent

The alkalinity occurs due to the presence of Hydroxides, Carbonates and Bicarbonates. Table 2 shows the relationship between them:

Ex: If AP is equal to zero the Alkalinity will be due only to Bicarbonates.

*Table.2: Reading of Alkalinities*

Readings	Alkalinity		
	Hydroxide	Carbonates	Bicarbonates
AP = 0	ND	ND	AT
AP = AT	AT	ND	ND
AP Smaller 1/2 AT	ND	2 AP	AT - (2 AP)
AP = 1/2 AT	ND	2AP	ND
AP Bigger 1/2 AT	2 AP - AT	2 (AT-AP)	ND

#### 4.5 Hardness

To define the hardness, 50 ml of sample was measured with the plastic beaker; and transferred to the wide mouth flask. Added 1.0ml of Buffer Solution and shaker. After this procedure, 02 measurements of Black E.T and stirred were added. Then EDTA was added to the burette and dripped into the sample, shaken with each drop added until the appearance of pure blue color. At the end of this process, the volume spent (Vg) in the titration was recorded.

Formula II:

$$\text{Total Hardness (mg L}^{-1}\text{ CaCO}_3) = Vg \times 20$$

Observations: If the sample shows blue color with E.T. Black before titration, there is no hardness in the sample.

#### 4.6 Iron

The sample was transferred to the cuvette until the 5 ml mark was added, 2 drops of the Tiofer Reagent, closed, shaken and waited 10 minutes. Then open the bucket, positioned on the cartouche and made color comparison.

Formula III:

$$\text{mg L}^{-1}\text{Fe} = \text{Card Read Result}$$

#### 4.7 Turbidity

The sample was placed in the large bucket, to the brim, without spilling. Inserted the turbidimeter into the cuvette and press the "on" button and start the analysis. After the end of this procedure, noting the result that was expressed in UNT.

#### 4.8 Color

A total of 50 ml of sample was transferred to the glass beaker, the lower plastic holder was removed from the beaker and the beaker was placed on the card to make the color comparison, and the colors were visualized above the beaker.

$$\text{mg L}^{-1}\text{Fe} = \text{Card Read Result}$$

#### 4.9 Chloride

After measuring 50 ml of sample with the plastic beaker, transfer to the wide-mouth flask, then add 1 ml of Potassium Chromate and shaken with circular motions. As a result, the sample turned yellow.

Afterwards, the burette was filled with Silver Nitrate. Subsequently, the reagent was dripped into the sample (holder), shaken with each drop added until the

sample turned yellow brick. At the end of this process, the volume spent (Vg) was recorded.

Formula IV:

$$(\text{mg L}^{-1}\text{ Cl}^{-}) = Vg \times 35$$

Vg: Volume spent in titration.

### V. MICROBIOLOGICAL TESTS

To carry out the microbiological tests, the Colipaper Kit of the Alpha Kit was used, using the following technique:

It was removed to the microbiological carton and touching just above the pick, then immersed the carton in the sample to be analyzed and waiting to be dampened. After damp, the sample tray and the excess water were removed, replacing the carton in the plastic package and removing the part of the bundle without the rest being touched. Then it was brought to the oven for 15 hours at a temperature of 36-37 ° C.

After 15 hours of incubation, the colonies were counted, always considering the two sides of the chart.

### VI. RESULTS AND DISCUSSIONS

With the collection of the local samples, it was possible to carry out the analyzes and with the results, execute the elaboration of several graphs that will be furtherly discussed during the work, the results of the parameters are represented in the graphs below:

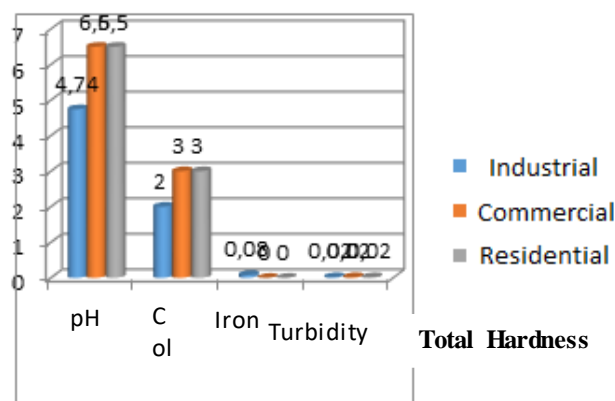


Fig.1: Results of the analysis of Ph, Color, Iron and Turbidity parameters.

According to the results shown in figure 4, we can observe that the pH of the sample related to the industry well is considered to be acid (pH 4.7) and it is necessary to correct the pH in the range of 6.0-9, 0. The other samples presented satisfactory results for these parameters. In contrast, the results of the tests of color, iron and turbidity are very low than the current legislation, as shown in table 01.

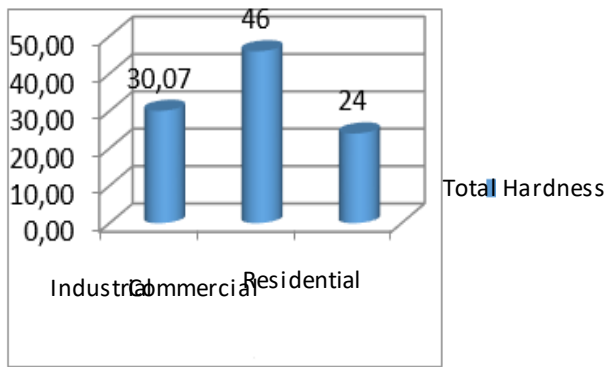


Fig.2: Result of the Total Hardness Analysis

Total hardness is directly related to total alkalinity, both in water and soil. Hardness levels are represented by the amount of CaCo3 in water and influence on the pH of water. Thus, the water sample in the industrial area presented a lower total hardness index (3.07 mg / l CaCo3) in relation to the commercial water sample (46 mg / l CaCo3), justifying the pH of 4.5 and 6.5 of the industrial area and commercial area respectively. The sample of the residence, the CaCo3 index in the water does not follow the same logic, being able to indicate that the sample belongs to a different underground source.

### 6.1 Ammonia and Chloride

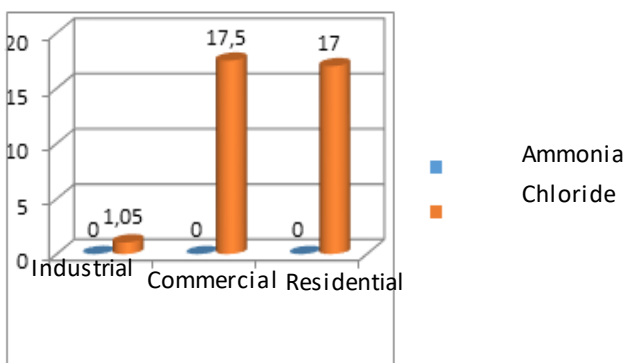


Fig.3: Results of Ammonia and Chloride Analysis

### 6.2 Escherichia, coliforms and bacteria

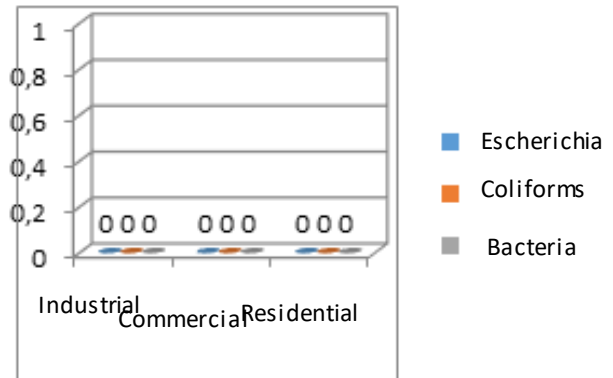


Fig.4: Results of Escherichia, Coliforms and Bacteria Analysis.

### 6.3 Results x Legislation

Table2: Results compared with in force legislation

Parameters	Unity	Well 1	Well 2	Well 3	Ministry of Health Ordinance No. 2914
pH	-	6,5	6,5	4,74	6,0 - 9,5
Turbidity	NTU	0,02	0,02	0,02	5
Color	UH	>3	>3	2	15
Iron	Mg/L	Absent	Absent	0,08	0,3
Fluorine	Mg/L	1,52	1,17	0,04	1,5
Total Hardness	Mg/L	46	24	30,07	≤500
Partial alkalinity	CaCO3	Absent	Absent	Absent	-
Total alkalinity	Mg/L	50	26	34	-
Chloride	Mg/L	17,5	17	1,05	≤250
Ammonium nitrogen	Mg/L	0,25	0,10	0	1,5

### VII CONCLUSION

It is possible to conclude with this research, that according to the results obtained for the studied area, all obtained a final result of respectively favorable analyzes, possessing a good physical - chemical and microbiological quality, for the fauna and flora present in the analyzed rural area, it is important to remember that the results apply to the site studied, both the collection points of the 3 wells, can be an alternative source of supply for the activities present in the areas and without being detrimental to the community in the vicinity. In addition, groundwater is increasingly being contaminated by anthropogenic activities, causing great concern for water quality, so it is important to know that all the results of the analyzes for pH, turbidity, iron, total hardness, alkalinity total, chloride and color of the samples studied here are within the level permitted by Ministry of Health Ordinance No. 2914 and CONAMA Resolution No. 357, which defines the maximum value allowed for human



consumption and protection of aquatic communities, however, only of a chlorination application so that the water is fit for consumption, being aware of such parameters and knowing the quality of the water, to be able to avoid several types of diseases and future complications for the health and well-being of the population.

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