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Microbiological Analysis of Surface Waters in the "Igarapé Esperança" water Resources in Benjamin Constant-Am

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***Abstract*— *One concern that plagues the contemporary population is the pollution of water sources. When a water ecosystem is degraded and modified by anthropic actions, environmental and human survival is a risk. The release of freshwater effluents into water resources results in several socio-environmental problems, significant impacts on aquatic life and the environment as a whole. In this way, this work presents results of the analysis of the surface waters using Microbiological Parameters in 06 points of the Igarapé in the city of Benjamin Constant-AM, in order to know the levels of water pollution from microbiological agents such as the presence and quantity of Thermotolerant Bacteria, Total and Heterotrophic Coliforms. It was verified that in one of the Parameters analyzed the value exceeded the limit allowed by the Ministry of Health (2011) and Conama Resolution nº 357 of 03/17/2005 (CONAMA, 2011), returning the concern to some residents who still use the surface waters for domestic purposes, allowing the appearance of diseases characteristic of impacted water ecosystems. It is necessary to encourage and carry out actions aimed at the preservation and conservation of the Igarapé, enabling the formation of work centers to study ways of reversing and minimizing the Environmental Degradation framework.*
***Keywords*— Analyzes. Water Resource. Microbiological Parameters.**

I. INTRODUCTION

The Amazon Rainforest has the largest biodiversity, sociodiversity, and morphoclimatic and phytogeographic holder of the world, in an area of 6.3 million km2, being approximately 5 million only in Brazilian territory, covering most of the countries of South America, as Bolivia, Colombia, Ecuador and Peru "(HAFFER et al, 2002).

It has the largest drainage basin in the world, with about 700,000km² (URSZTYN, 2004). It is formed by a diversity of water bodies, not only large rivers and lakes, but also numerous small streams that constitute one of the densest water networks in the world (JUNK, 1983).

Water in this extensive forest is essential for the life and dynamics of living ecosystems and local populations. In the Amazon, the mainland streams, mostly, present acidic waters, due to the presence of humic and fulvic acids. They are one of the natural resources that most directly suffer from the impacts of urban growth. Until recently used abundantly, water resources in many regions of the Amazon have become increasingly scarce as population expansion occurs (FARIA, 2010).

According to the National Water Agency (ANA, 2012), the main causes of the poor quality of raw water are due to the lack of control of population growth in the surroundings of water bodies, accompanied by lack of investments in basic sanitation, contamination by domestic sources, industrial , agricultural activities and mining.

With the discharge of several pollutants in the water bodies, changes and modifications in their physical, chemical and biological characteristics occur. According to CONAMA Resolution 357 (Brazil, 2011), it establishes acceptable values for the different types of parameters in the raw waters, classifying these water resources according to their use. The classification standardizes the bodies of water and allows the establishment of goals to reach the level of quality desired (BRASIL, 2006).

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Detection of certain metals in surface waters according to IUPAC (2008) is of considerable importance because it establishes the levels of influences for natural ecosystems as well as monitor and control the critical sources through which they reach the hydrosphere.

Microbiological analysis is also considered relevant for monitoring studies of natural waters, as it is possible to verify the influence of some microorganisms on water quality. An example is the presence of bacteria typical of degraded sites such as the Coliformes group, formed by bacteria which include the genera Klebsiella, Escherichia, Serratia, Erwinia and Enterobacteria.

II. METHODOLOGY

The survey was carried out in Igarapé Esperança, a water body of greater scope, present in the urban area of the city of Benjamin Constant (1,116 km from Manaus), a city belonging to the sub-region of the Amazon Basin called the micro-region of Alto Solimões in the southwest of the state of Amazonas, between the coordinates: 4 ° 23'19.56 "S - 70 ° 1'31.99" W, in a triple border area razil, Colombia and Peru (IBGE, 2010), shown in figure 01.

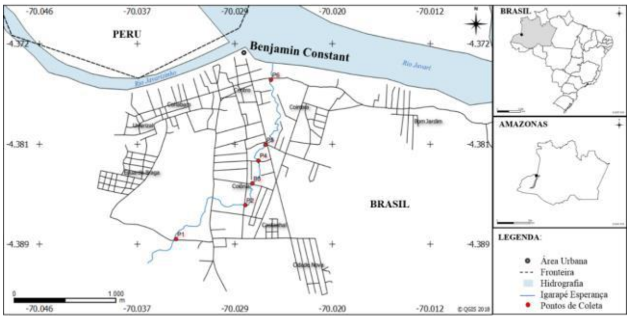

Fig. 01. Location of Collection points in the Municipality of Benjamin Constant-AM.

The research consisted in the sampling of surface waters and sediments at 06 points along the Igarapé Esperança, in the smaller and larger urbanization sections of the municipal district of Benjamin Constant-AM, distancing approximately 500 meters from each point. Surface water samples were collected against the stream in 500 mL polyethylene pots, approximately 10 cm from the surface, previously decontaminated after vigorous rinsing with distilled water.

The analysis was performed after the conclusion of the samples, as a way of minimizing and delaying the processes of chemical and biological changes of the water from the moment of withdrawal of the sample from the environment. The microbiological parameters analyzed were Heterotrophic Bacteria and Thermotolerant Bacteria and Total Coliforms.

For analyzes of Thermotolerant and Total Bacteria, the Collext reagent was added to the polyethylene pot containing the samples, shaking until the solution was diluted. The solution was poured into the analysis plate, taking it to the sealer to prevent spillage and external contamination in the sample. After this procedure, the 06 analysis plates corresponding to the collection points were taken to the Greenhouse for 24 hours of incubation.

The procedure for the analysis of the presence of Heterotrophic Bacteria is similar to that of Thermotolerant and Totals, but another reagent is used. 1 ml of the water sample was applied to the test dish and 5 ml of the Simplate for HPC reagent. Samples were taken to the greenhouse for 48 hours, as shown in figures 02 and 03.

III. INDENTATIONS AND EQUATIONS

The first paragraph under each heading or subheading should be flush left, and subsequent paragraphs should have a five-space indentation. A colon is inserted before an equation is presented, but there is no punctuation following the equation. All equations are numbered and referred to in the text solely by a number enclosed in a round bracket (i.e., (3) reads as "equation 3"). Ensure that any miscellaneous numbering system you use in your paper cannot be confused with a reference [4] or an equation (3) designation.

Fig. 02. Solutions poured into

Fig. 03. Plates with samples taken to

The analysis and reading of the bacteria occurred with the aid of the lantern of emission of ultraviolet radiation and with the data of references obtained from the Resolution Conama nº 357 of 03/17/2011 (CONAMA, 2011) and Reference Patterns: ordinance nº 2914 / 2011 of the Ministry of Health.

Data analysis was performed using quantitative and qualitative treatments, tabulated with the use of electronic spreadsheets for better quantification and interpretation of graphs and tables later submitted to statistical treatment using Microsoft Excel, version 2016.

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The dispersion charts used to demonstrate the relationship between sets of values obtained in the two collections, referring to the samples collected in the Amazon Summer and those collected in the winter, were used to explain the results. These procedures are performed upon receipt corresponding to all collections.

IV. RESULTS AND DISCUSSIONS

The determination of microorganisms indicative of water pollution is essential for the verification and monitoring of the level of environmental impact of a given object of study. The analysis of the thermotolerant coliforms, "organisms belonging to the subgroups of bacteria of the species Escherichia coli, made it possible to verify the presence in all points of this type of prokaryotic that originates mainly from human feces (BRASIL, 2011), indicating contamination in the water resource.

According to Figure 4, the quantity of thermotolerant coliforms at 4 collection points (points: P2, P3, P4 and P5) exceeded the value determined according to ordinance no. 2914/2011 of the Ministry of Health (Funasa, 2011), which establishes the measurement of drinking water for human use. In this evaluation it is possible to verify the presence of total and thermotolerant coliforms, preferably Escherichia coli. This same rule "establishes that the standard bacterial count should not exceed 500 colony forming units per 1 milliliter of sample (500 / CFU / ml)" (BRASIL, 2006).

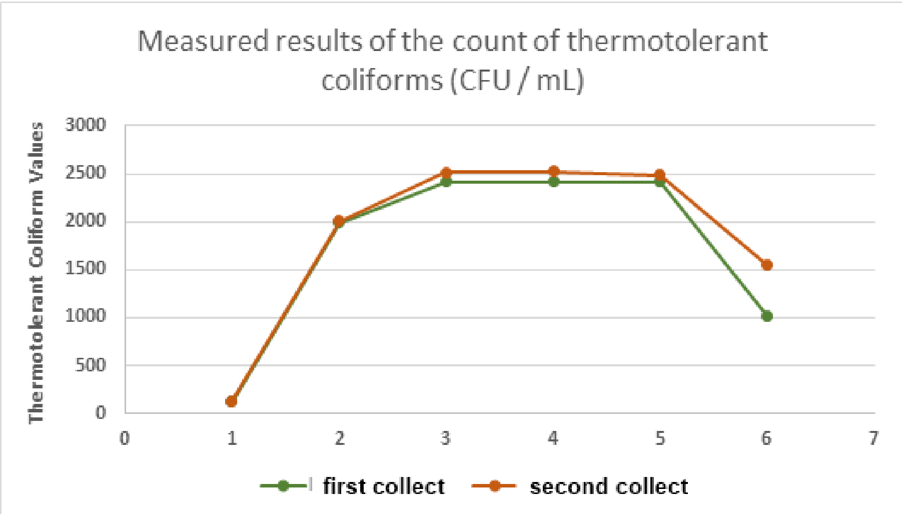

Fig. 04. Quantity of thermotolerant coliforms in the samples collected.

The indicated values of thermotolerant bacteria that reached 2,419.6 in 3 points, demonstrate the very high concentration of Escherichia coli in these areas. In a second collection, there was a slight increase in the measured values highlighting the point P4 (2,525 CFU / m), an increase caused by the beginning of the period of higher precipitations. The highest values would be due to the higher concentration of housing nuclei and consequently domestic discharges directly to Igarapé, causing problems related to public health, which are reflected in inadequate or almost nonexistent sanitation.

According to Brazil (2011), "the fecal origin of E. coli is unquestionable and its ubiquitous nature unlikely, which validates its more precise role as an organism indicating contamination in both natural and treated waters."

Another analysis was the determination of the total amount of Heterotrophic Bacteria. These bacteria are essences in water ecosystems because they "participate in the cycling of many inorganic substances used by other living beings, besides decomposing cellulose, lignin, keratin and other natural molecules difficult to decompose" (COSTERTON et al, 1995). high concentrations can affect water quality.

To determine the presence or absence of Heterotrophic Bacteria, we used the Ultraviolet emission Flashlight, observing the existence of blue fluorescence in the wells of the plates. Such staining indicates the possible presence of colonies of certain bacteria. Figure 05 shows the values determined by the most probable number (MPN) method in a sample.

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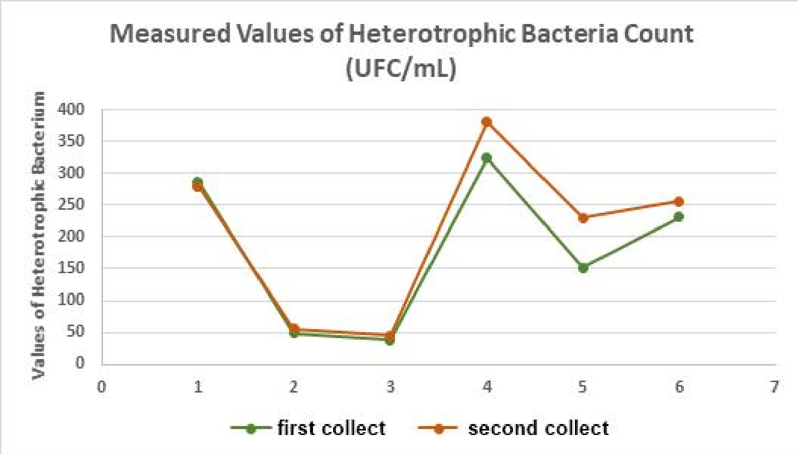

Fig. 05. Quantity of Heterotrophic Bacterium from the lake sample.

The highest concentration that presented an expressive value in relation to the other points was P4 (324 bacteria in a 10 mL sample of water), but did not exceed the allowed value of 500 CFU / mL indicated by ordinance 2914/2011. In the second collection, the points P4 (380 CFU / mL) and P5 (256 CFU / mL) were the most discharged sites.

Although this species of bacteria is not considered pathogenic, its excess may present risks to human health, deteriorating water quality, causing unpleasant odors and flavors (BRASIL, 2012).

Sabioni and Silva (2006) emphasize the importance of controlling their density, since in higher numbers they may present a certain risk to health and especially to the environment, and may act as secondary pathogens. According to Opas (1999), some of the major diseases caused by water pollution by pathogenic bacterial microorganisms.

Another microbiological parameter used was the measurement of total coliforms. Most of the bacteria in this group belong to the coliform genera Escherichia, Citrobacter, Klebsiella and Enterobacter, although there are other genera and species included in this group (BRASIL, 2011). The analysis found that the point with the highest incidence of total Coliforms was P5, with the result reaching the most probable number of 65 and the P4 with 45 units of this group in the first collection. In the second collection there was a change in the values corresponding to the points P5 (70) and P6 (42) units of total coliforms.

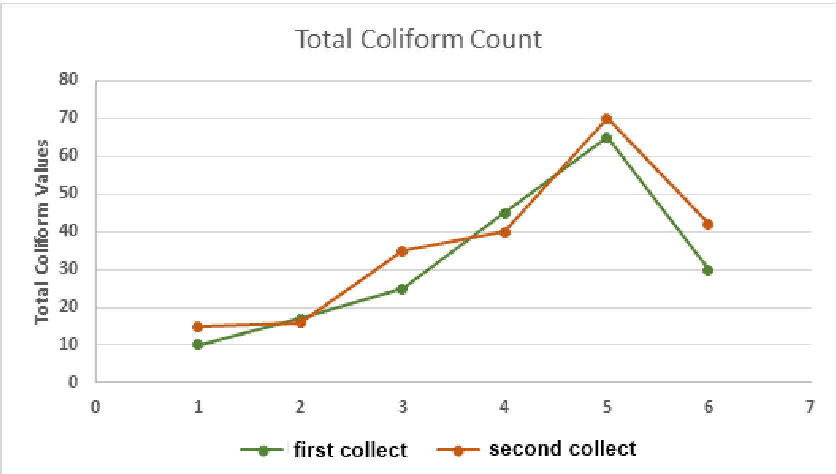

Fig. 06. Total Coliform values corresponding to the collection points of the lake.

Figure 6 shows a rise, which starts from P1, with the lowest number of total Coliforms, and as the water body enters the neighborhoods, the values increase, which can be explained by the greater influence of urbanization and lack of infra - structure and greater superficial flow of fecal material in the stretches, data shown in points P4 and P5.

This is explained by the fact that there are higher numbers of residences that discharge all kinds of matter (animal, vegetable, oils and greases) in their beds, representing a great indication that the waters of Igarapé are being contaminated by human feces, rendering it unusable for consumption. Effluents are released directly into water bodies, and there is no sewage treatment plant (STUDART, 2003).

According to the National Water Agency (ANA, 2012), the main causes of the poor quality of raw water occur due to the lack of control in the population growth around the bodies of water, accompanied by lack of investments in basic sanitation, contamination by domestic sources, industrial , agricultural activities and mining.

With the discharge of several pollutants in the water bodies, changes and modifications in their physical, chemical and biological characteristics occur. According to CONAMA Resolution 357 (Brazil, 2005), it establishes acceptable values for the different types of parameters in the raw waters, classifying these water resources according to their use. The classification standardizes the bodies of water and allows the establishment of goals to reach the level of quality desired (BRASIL, 2006).

The presence of this group of bacteria in the water resources of developing countries, according to the World Health Organization (WHO) 80% of diseases caused by contaminated water. Microbial contamination of urban systems has the potential to cause large outbreaks of waterborne diseases, so ensuring the quality of such systems is a priority (WHO, 2008). According to the report of the Pan American Conference on Health and Sustainable Human Environment, about 30% of the Brazilian population consumes water from unsafe sources, most of which are served by public water supply and do not always receive adequate quality and quantity of water (COPASAD , 1995).

V. CONCLUSION

The analysis of the microbiological parameters of the surface water of the analyzed water body made possible the analysis of the water quality of one of the main water ecosystems of the urban area of the city of Benjamin Constant-AM, being possible to correlate the results obtained with the anthropogenic activities visualized at the time of collection, demonstrating and confirming that the increase of housing centers around the body of water causes environmental degradation, a strong threat to the health of the local population and biota.

It was possible to classify according to the norms, that the analyzed water ecosystem was evaluated in Class III, because they presented values, standards and microbiological conditions qualifiable by resolution of CONAMA No. 357 of 2011,

The results suggest that the Igarapé needs an intervention for supposed recoveries in its physical structures, reallocations of domiciles located around the water body that periodically release household waste, organic residues and solids that allow the proliferation of microorganisms that directly affect the local population.

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