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Assessment of Water quality For Balneability of Francisquinha Stream - Porto Nacional – TO

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Abstract*—The search for areas for recreation, directs people to subject themselves to bathing places with probable contamination, caused by sewage residues, concentrations of garbage among countless others that cause, the appearance of bacteria such as total coliforms and Escherichia coli (E. coli). Microbiological analyzes were performed using indicators of total coliforms and Escherichia coli (E. coli), according to the method described by APHA (2005). The study sought to assess the water conditions of the Francisquinha stream hydrographic basin in the municipality of Porto Nacional - TO, for bathing purposes, according to CONAMA Resolution 274/2000. Using the parameters to detect and identify the presence of total coliforms and Escherichia coli, the Colilert technique was used. The results presented Escherichia coli were low, adapting in the classification of own bathing, according to CONAMA Resolution 274/2000. With the data presented in the study, during the analyzed period of six weeks, the results were satisfactory for recreation of primary use of the Francisquinha stream watershed.*

I. INTRODUCTION

Water is indispensable for human existence. Water is of great importance to the economic and social sectors, since it is used for various activities. It generates a demand for good quality water, which is able to meet demands, such as domestic use, irrigation, animal and plant care, industrial supply, species breeding, power generation, navigation, landscaping, waste dilution, recreation and leisure (NETO, 2006).

Due to the use of water for recreation, it is of utmost importance for individuals due to the growing increase in bathers, and thus can generate certain risks and damage to health. It may contain some types of contamination by various types of waste, such as sewage or garbage that are carried by rain or that are dumped directly into the river (BENETTI & BIDONE, 2001).

According to Silva et al. (2013), there are numerous other pollutants such as in the atmosphere or in the soil. There is also the application of toxic products in agriculture, which can reach the water, and end up depositing pathogenic microorganisms and toxic elements. These factors can cause unbalance in the aquatic environment, which consequently generates various health risks for the users.

The use of water for recreation is significant for people, since there is a great use of bathers, so it can generate health risks, because it can contain some kind of contamination by sewage or garbage that ends up being carried by rain or that is dumped in the river. There are pollutants that exist in the atmosphere or in the soil, from the application of toxic products in agriculture, which, when brought near the water, deposit pathogenic micro-organisms and toxic elements. Thus, they generate unbalance in the aquatic environment, posing risks to the health of users, according to the CONAMA Resolution 274/00.

With the construction of the Luís Eduardo Magalhães Hydroelectric Power Station, in the municipality of Lajeado - TO, on the Tocantins River. It generated a lake, damming water and thus raising the water level, thus submerging the riparian forest, beaches and buildings located on the banks of the lake. As a result, the quality of the water for recreational use has deteriorated.

According to CONAMA Resolution 274/00, fresh, brackish, and salt waters will have their quality levels evaluated by specific assessments, so as to certify bathing conditions (primary contact recreation such as diving, swimming, water skiing, and sport fishing). Through this study, the Probable Number (MPN/100ml of water) of the fecal coliform group (thermotolerant) and Escherichia coli (E. Coli) present in the waters of the Tocantins River basin, Francisquinha stream, were determined.

This study aimed to evaluate the water conditions of the Francisquinha stream watershed in the municipality of Porto Nacional - TO, for bathing purposes, according to CONAMA Resolution 274/2000.

II. MATERIALS AND METHODS

STUDY AREA

With the help of a GPS - Global Positioning System, the point of collection was determined where it was easily accessible and could be checked in order to obtain an accurate analysis of the location.

The Francisquinha Stream Basin area is located in the state of Tocantins, in the municipality of Porto Nacional, which is located in the geographical center of the state, in the eastern mesoregion, with an average altitude of 212 meters above sea level, with a surface area of 4,449.9 km² and coordinates 10°42'29" latitude and 48°25'02" west longitude.

Two types of tests were performed, the fecal coliform and the pH test. The fecal coliform test confirms the presence and number of bacteria originating from waste in the water sample. Because bacteria can cause transmission of diseases such as hepatitis or cause intestinal gastric problems (INMETRO, 2018).

The research was not conducted during the beach period, which is from June to July, when there is a high concentration of people, which could hinder the course of the study, the samples collected, thus hindering the final results.

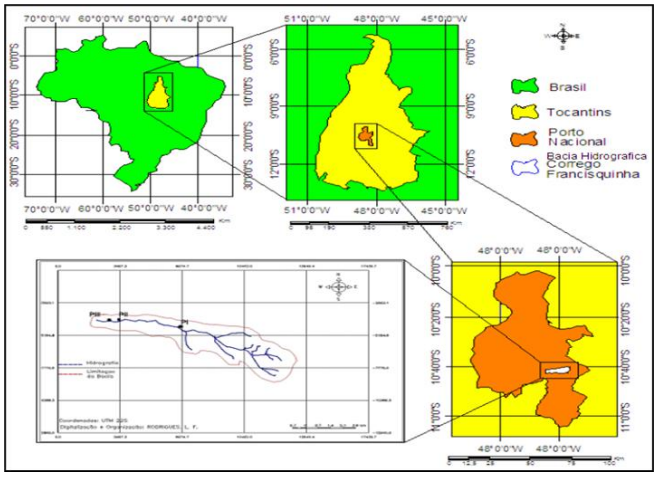

Fig.1: Map of Francisquinha Stream location

Fonte: RODRIGUES (2016)

The COLILERT technique was used to determine the Most Probable Number (MPN/100ml) of fecal coliform bacteria in 100 ml of water, in accordance with the methodology of the Standard Methods for the Examination of Water and Wastewater - APHA, 2005/American Public Health Association.

In this context, laboratory results were found in accordance with the parameters for water quality according to CONAMA Resolution No. 274/00, which establishes the conditions for bathing, which are classified as suitable or unsuitable for primary contact recreation. The confirmation of high fecal coliform values will indicate fecal contamination of the water, which can cause risk to the bather's health.

Therefore, the analysis of the water of the Francisquinha stream was guided by sample collection, laboratory analysis, correlation with legislation and other parameters pertinent to the evaluation of water for recreational use.

III. METHODOLOGICAL PROCEDURES

For the research, the procedures of "on-site" sample collection and laboratory analysis were used.

Sample Collection

The sampling took place in the period between February and March 2021, after the selection of some main points. The water was collected about 25 cm below the water surface, using sterilized and identified bottles with a capacity of 100 ml, a considerable quantity for the analysis. As stated in article 5 of the single clause of Conama Resolution 274/2000, the collection site was determined where there would be a greater accumulation of bathers.

After the collection of the bottles, they were sealed and stored in an isothermal box properly refrigerated and taken to the Physical-Chemical Laboratory of the IFTO - Federal Institute of Tocantins in Porto Nacional - TO, where several analyses were performed to define the absolute concentration of total coliforms and E. coli, according to the method described by APHA (2005). It was also used the parameter of physical and chemical analysis of the pH of the water.

Microbiological analysis

Through the use of the Coliert method, microbiological analyses were performed in the waters of the Francisquinha stream, analyzing them according to the method described by Standard Methods (APHA, 2005). The method is related to the recognition of bacteria from the group of total coliforms and E. coli considering a 24-hour period.

The use of the Colilert method considers the Colilert enzyme in the amount sufficient for the evaluation of 100 ml of water; each enzyme was added to 100ml in the bottle of the sample in question collected and stirred until the granules were fully diluted. Soon after, the solution was incubated in a laboratory oven at 35ºC for 24 hours.

To define the analysis results, it is noteworthy that if the medium remains colorless, it indicates that there are no total coliforms and Escherichia coli bacteria in the samples. If the medium turns light yellow and fluorescent under ultraviolet light, it indicates the presence of bacteria of the total coliform group in the samples being analyzed, according to Marquezi (2010).

After obtaining the laboratory results, they were compared with the values established in CONAMA Resolution 274/00, in order to classify the bathing water as suitable (excellent, very good and satisfactory) or unsuitable, according to the density of E. coli bacteria.

IV. RESULTS AND DISCUSSION

According to the monitoring that occurred during the months of February and March 2021, which is the rainy period in the state, the volume of the stream ended up increasing, which caused the water in the study to have a dark coloration, due to the solids carried to the riverbed.

Several bacteria can be found in rainy periods, since the water suffers a great movement among the soil, which ends up carrying several impurities to the riverbed, and solid waste can be found, such as animal feces or even toxic matter, which compromises the quality and safety of the water for bathers (GOULART and CALLISTO, 2003).

According to Smith et al. (1995), it is important to inform bathers that the quality of water is not based on its color, since water with a transparent color can have a risk factor, because it may be contaminated with pathogenic microorganisms from fecal pollution sources.

During the execution of the Total Coliforms and pH test to assess the presence and number of bacteria originating from waste, the samples from the six weeks of the study showed an average pH of 6.87, and total coliforms per 100 ml a value of 79.4, i.e., what fits the waters of the Francisquinha stream as suitable for bathing purposes of primary contact.

According to SILVA, LIMA, and BALDUINO (2019), reports in a study conducted under the same conditions at the Beira Rio Beach in Porto Nacional, presented an average pH similar to that found in this study, which can be explained by the fact that the collection of samples was done in a rainy period, thus with the runoff of rainwater possibly contaminated by waste and animal feces or the presence of nearby sewage.

According to Vieira (2015), the processes corresponding to the supply and treatment of wastewater, pH can affect several of the chemical and biological processes of water. It can influence several factors, such as dissolved gases and solids, alkalinity and hardness, temperature and biotic factors. The pH can vary between 0 and 14 (very acid to very alkaline), as there is a factor of interference in the metabolism of species.

CONAMA states that through resolution 274/00 where the values found should remain between 6 and 9 (ANA, 2020). In the studies, an average of 6.87 was obtained, fitting the range stipulated by CONAMA Resolution 274/00. Throughout the period, the pH obtained some oscillations, but remained within the existing range according to Resolution CONAMA 274/00, which indicates pH values around 6.0 to 9.0 for springs. The average value indicated is slightly acidic.

With the results obtained, it was noted that the water from Francisquinha stream is safe according to the parameters, thus making it fit as a category suitable for primary contact bathing purposes.

As the point evaluated by the study does not contain any type of basic devices to inform bathers about the quality of the water, this study may arouse the interest of public agencies to adapt and carry out frequent monitoring at the site, as the bathing conditions vary with time and use, making its evaluation indispensable.

V. CONCLUSION

According to the CONAMA Resolution 274/00 (BRASIL, 2000) states, bathing can be defined as: the condition of saline, fresh and brackish waters, which are used for primary contact recreation, known as by direct and prolonged contact with water (diving, swimming, water sports, etc.), where there may be the possibility of ingesting large quantities of water.

The study carried out in the Francisquinha Stream is of great relevance, since it gives information about the real state of the water. The classification of the water was given as suitable for primary contact recreation, presenting excellent qualities, since in all the samples analyzed, none obtained values for E. Coli above 200 NMP/100 ml and did not present pH values outside the standards.

According to the results, it is expected to awaken an interest for a frequent monitoring by the public organs and the population, thus ensuring an adequate control for bathing, stimulating the use of the stream throughout the year as a place dedicated to the practice of recreation and leisure, according to the criteria established by CONAMA Resolution 274/2000.

Attention is needed from the population and from the agencies, because of the residues that are common to be found, such as bottles, cans, human hair, cardboard boxes, bags, cigarette butts, food waste, discarded clothes, human and animal excrement, and paper. To ensure that it provides a clean and contamination-free environment for local users.

Due to this fact, periodic inspection is necessary, a good job of cleaning the river banks and the residues, to keep them away from being carried to the water during the rainy season. Also the supervision of commercial establishments, residences and others, requiring an adequate treatment of domestic wastewater.

REFERENCES

[1] ANA - National Water Agency (Brazil). Caring for the Waters: Solutions to improve the quality of water resources - 2nd Edition. Brasília - DF, 2013.Perfect, T. J., & Schwartz, B. L. (Eds.) (2002). Applied metacognition Retrieved from http://www.questia.com/read/107598848

[2] NATIONAL WATER AGENCY (ANA). Evolution of the organization and implementation of watershed management in Brazil. Brasília: ANA. 2002.

[3] NATIONAL WATER AGENCY (ANA). Management Report 2003.Brasília: ANA, 2004.

[4] NATIONAL WATER AGENCY (ANA). List of terms for the National Water Agency's water resources thesaurus.Brasília: ANA, 2014.

[5] APHA – American Public Health Association. Standard methods for the examination of water and wastewater. 21ª edição. American Public Health Association. Washington: APHA, 2005.

[6] BENETTI, A.; BIDONE. F. The environment and water resources. In: TUCCI, C.E.M. (Org.). Hidrologia:ciência e aplicação. Porto Alegre: Federal University of Rio Grande do Sul, 2001. p.849-876.

[7] BRAZIL. CONAMA Resolution. Resolution No. 274, of November 29, 2000. Section 1, pages 70 – 71. Defines criteria for bathing Brazilian waters Published in Official Federal Gazette, nº 18 de 25 de January de 2001.

[8] BERG, C. H.; GUERCIO, M. J.; ULBRICHT, V. R. Indicadores de Balneabilidade: The Brazilian situation and the recommendations of the World Health Organization. International Journal of Knowledge Engineering and Management. Florianópolis, v. 2, n. 3, p. 83-101, jul./out, 2013.

[9] BOLLMANN, Harry Alberto; CARNEIRO, C.; PERGORINI, E. S. Water Quality and Nutrient Dynamics. In: ANDREOLI, C.V.; CARNEIRO, C. Integrated Management of Eutrophicated Water Supplies. Curitiba: Capital Printing Plant, LTDA, 2005. 500p. cap. 7, p. 213-270.

[10] CARVALHO, A. P., BALDUINO A. R., MACIEL, G. F., A. P. PICANÇO. Assessment of pollution in rivers using water quality indices: a case study in Ribeirão São João in Porto Nacional -TO. In: São Paulo. UNESP, Geociências, V. 35, N.5, P.394-407, 2016.

[11] Denvironmental Sanitation technology company -CETESB. 2012. Report on the quality of the coastal beaches in the state of São Paulo. 2011. São Paulo.

[12] CETESB. Environmental Sanitation Technology Company. Report on the Quality of Coastal Waters in the State of São Paulo - Bathing Beaches. São Paulo: 142 p, 2004

[13] CONAMA - National Environment Council. Resolution 357, 2005.

[14] DETONI, Terezinha Lucia; DONDONI, Paulo Cezar. The scarcity of water: a global look at sustainability and academic awareness. Rev. Ciênc. Admin., Fortaleza, v. 14, n. 2, p.191-204, dez. 2008.

[15] FAPTO, Tocantins Research Support Foundation. Lake Surrounding Watershed Plan. Phase Report B. Watershed Diagnosis, 2015.

[16] GOULART, M.; CALLISTO, M. Bioindicators of water quality as a tool in environmental impact studies. Magazine of FAPAM, ano 2, nº 1, 2003.

[17] MELO, M. C. Water Security in Urban Areas: a case study of the Rio das Velhas Basin. Doctoral Thesis. PhD in Civil Engineering - Federal University of Rio de Janeiro, Rio de Janeiro. 2016.

[18] MINISTRY OF ENVIRONMENT. National water resources plan: overview and status of water resources in Brazil: volume 1. Brasília, DF: MMA, 2006.

[19] NETO, V. P. Evaluation of the water quality of dams used to supply livestock at Embrapa Pecuária Sudeste. 2006. 40p. Dissertation (Master in Ecology), Center for Water

Resources and Applied Ecology, University of São Paulo, São Carlos. 2006.

[20] PEREIRA, D.S.P.; FORMIGA-JOHNSSON, R. M. Governance of water resources in Brazil: the implementation of management instruments in the Paraíba do Sul river basin. Brasília, DF: National Water Agency, 2003. 82 p.

[21] RODRIGUES, L.F. EVALUATION OF THE WATER QUALITY INDEX OF THE FRANCISQUINHA STREAM WATERSHED IN THE MUNICIPALITY OF PORTO NACIONAL - TOCANTINS; 2016

[22] SILVA, A. P.; LIMA, D. P.; BALDUINO, A. R. Diagnosis of bathing conditions at Beira Rio Beach in the city of Porto Nacional (TO). Engineering Sciences, v.7, n.2, p.53-59, 2019.

[23] Silva, V. de P. R da; Aleixo, D de O.; Neto, J. D.; Maracajá, K. F. B.; Araújo L. E. de. A measure of environmental sustainability: the water footprint.Revista Brasileira de Engenharia Agrícola e Ambiental, v.17, n.1, p.100–10.2013.

[24] SMITH, D. G. et. al. Human perception of water appearance1. Clarity and colour for bathing and aesthetics. Navy Newspaper of Nova Zelândia. Wellington, v. 29. 1995.