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CONTENT ANALYSIS ON THE PROCESS OF EUTROPHIZATION OF WATER BODIES TO UNDERSTAND WATER BREAKING DISEASES

CONTENT ANALYSIS ON THE PROCESS OF EUTROPHIZATION OF WATER BODIES FOR THE UNDERSTANDING ABOUT WATER TRANSMITTED DISEASES

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Summary
Eutrophication is a process resulting from the bioaccumulation of organic matter that leads to an uncontrolled increase in macrophytes, causing changes in the color and aging of the water body. Analyze the eutrophication process in water bodies to understand waterborne diseases through qualitative content analysis. This is a qualitative content analysis of the documentary type proposed by Bardin (2011), which is based on organizing data into categories. The study was based on research by Silva and Fonseca (2016), organized into three categories that involve: urban occupation, the problem of eutrophication, aspects of water quality and the need for quality and quantity sewage treatment, over a period of five years. It was observed that urbanization, lack of environmental sanitation, high concentrations of phosphorus and nitrogen favor water eutrophication. When classified as hypereutrophic, attention must be paid to the possibility of gradual disappearance of the water resource. These problems cause the death of fish and crustaceans, socioeconomic problems in the fish market and tourism. Microbiological and physicochemical analyzes are essential for control. It is concluded that there are several parameters that are associated with water quality and can become a reservoir for waterborne diseases in public health. Furthermore, producing drinking water is not easy and requires high investments, however good and constant water and sewage treatment is essential.
Key words: Eutrophication. Water quality. Waterborne Diseases. Content analysis.

Abstract
Eutrophication is a process resulting from the bioaccumulation of organic matter that promotes the increase of macrophytes in an uncontrolled manner, causing changes in the color and aging of the water body. To analyze the eutrophication process in water bodies for the understanding about waterborne diseases through a qualitative content analysis. This is a qualitative content analysis of the documentary type proposed by Bardin (2011), which is based on the organization of data by categories. The study was based on the research of Silva and Fonseca (2016), organized into three categories involving: urban occupation, the eutrophication problem, water quality aspects, and the need for quality and quantity sewage treatment over a five-year period. It was observed that urbanization, lack of environmental sanitation, high concentrations of phosphorus and nitrogen favor the eutrophication of waters. When these waters are classified as hypereutrophic, attention should be paid to the possibility of the gradual disappearance of the water resource. These problems cause the death of fish and crustaceans, socioeconomic problems in the fish market and tourism. Microbiological and physical-chemical analyzes are indispensable for control. The conclusion is that there are several parameters that are associated with the quality of the water, which can become a reservoir for waterborne diseases. Furthermore, producing drinking water is not easy and demands high investments, however, a good and constant treatment of water and sewage is essential.
Keywords: Eutrophication. Water Quality. Water-Borne Diseases. Content Analysis.

1. Introduction

Eutrophication is the process in which the accumulation of organic matter promotes the excessive growth of various algae and plants in water resources, consequently generating a greenish color. The greenish color is generated as a result of the alpha chlorophyll pigment, produced by algae and plants in imbalance in the location, for this reason, the greater

is the amount of alpha chlorophyll in the water, the greater the amount of algae in the area and possibly the greater the probability that the environment is undergoing a eutrophication process. However, color is just a consequence of the eutrophication process, making it necessary to evaluate the Trophic State Index (TEI) of the water (SILVA, 2019; BRASIL, 2013).

The IET calculation is carried out by the nutrient levels at the site and the relationship with total phosphorus, for lentic (still waters and no current) and lotic (water with constant flow) environments. In this sense, the IET will be responsible for identifying the level of trophic state of the water, that is, quantifying the percentage of organic matter and nutrients in the location. In this way, water resources can be classified by trophic levels, that is, oligotrophic, mesotrophic and eutrophic.

The importance of waters classified as eutrophic or super eutrophic is also highlighted, as eutrophication may not only influence aquatic life, but also human health, considering that the favoring and accumulation of organic matter may be a reservoir for the spread of diseases. of water transport (BRASIL, 2013). Contaminated and eutrophicated waters favor the accumulation of organic matter and other pathogenic microorganisms, such as total fecal coliforms,*Escherichia coli*and viruses, which can cause various diseases such as typhoid and paratyphoid fever, bacillary dysentery, cholera, acute gastroenteritis and diarrhea, hepatitis A, poliomyelitis, amoebic dysentery and gastroenteritis. Another important factor is the lack of basic sanitation, as inadequate dumping of untreated waste into water favors the appearance of these organisms and their imbalance, making this a cycle that negatively influences human health and aquatic ecosystems (STIMAMILIO, 2016 ; BRAZIL, 2013).

The lack of basic sanitation is a big problem when it comes to water. This is due to the large amount of untreated organic matter that is dumped into the water and the risks that this waste can cause on site, which in turn comes from a specific type known as anthropogenic eutrophication. This process could cause the river to age due to untreated toxic compounds that are dumped directly into the waters, such as: waste, detergents, domestic, agricultural and industrial effluents, where the main consequences are to directly influence the lives of fish and humans (MACEDO; SIPAÚBA-TAVARES, 2018; VON SPERLING, 2014).

Other compounds such as nitrogen and phosphorus are of great relevance to the eutrophication process. This is because both compounds arising from domestic and industrial activities can influence the increase in the production of algae, plants and cyanobacteria, leading to the eutrophication process. The lack of basic sanitation, the accumulation of organic matter, and untreated domestic waste are the main risks for the eutrophication process of a water body, however, with the increased production of nutrients generated by plants and bacteria in the area, there is It is also possible to reduce the penetration of light, which provides greater turbidity and will consequently influence the levels of oxygen dissolved in the water (MACEDO; SIPAÚBA-TAVARES, 2018).

Important in the water treatment process, water turbidity occurs in the presence of solid materials in suspension, which reduce its transparency. The high concentration of these materials can form heavy flakes that settle more quickly when compared to water with less concentration of these compounds (less turbidity) (BRASIL, 2013).

Numerous organic and non-organic compounds increase the index to this magnitude; For example: algae, plankton, zinc, iron, manganese and even sand resulting from the natural process of erosion or waste from homes and industries. On the other hand, there are some disadvantages when there is high turbidity in the water, as well as in disinfection, as it can be made difficult by the protection given to microorganisms in direct contact with disinfectants (BRASIL, 2013).

2 METHODOLOGY

According to Marconi and Lakatos (2003), qualitative research is the "*source of data collection is restricted to documents, written or not, constituting what are called primary sources*." The theme was related to water quality, the eutrophication process and diseases linked to water resources issues. Thus, the document selected for documentary analysis was the scientific article by Silva and Fonseca (2016) entitled "Eutrophication of water resources as a tool for understanding waterborne diseases".

The delimitation of the theme that addresses the eutrophication process in water bodies was intended to encompass these contents, with regard to the quality, management and conservation of water resources. Eutrophication creates problems, as viruses and pathogenic bacteria proliferate. Furthermore, zooplankton infestation occurs and release of toxins into the water.

Thus, according to Bardin (2011), content analysis is first carried out by organizing the data, in order to make a selection of what is important for the existing problem. In a second step, coding is carried out, using the concepts of recording unit, which is the part that will be analyzed in the research, but also the context unit, which is the location of the recording unit. Finally, there is categorization which consists of a planned grouping, so that it is possible to create a pattern for analysis to take place. Therefore, the author develops a structure that consists of three stages, the first in a pre-analysis of the document, the second

refers to the exploration of the material and the third stage would be the treatment of the results, which enable inference and interpretation of the data.

The development of research contains the investigation method, an activity that presents some steps as a way to obtain the objectives and results of the research problem. The deductive method is applied in this article, which uses an approach whose concepts and theories predict the emergence of particular phenomena. The concepts would be deductive, as the information is qualitative and the data generated that allowed the results to be achieved are the quantification part.

It is worth pointing out that information related to the research problem was identified for the research, as there was a high level of use of the data. An investigation of the information provided on the topic was carried out and topics of great relevance to the subject that include water quality and the eutrophication process were observed.

3 Theoretical framework

3.1 Urban occupation and the problem of eutrophication

Eutrophication means the aging of the water body, thus, it is a process that causes environmental pollution by substances that alter the natural conditions of water bodies. Therefore, the use of this water resource is harmed. Therefore, the environmental quality affected by degradation can facilitate problems related to the health of populations. Nutrients are a source of water pollution, in the case of eutrophication there are nitrogen (N) and phosphorus (P) which can have the polluting effect of being responsible for waterborne diseases. Regarding water contamination by nutrients, the article studied presents the following findings:

> Waters are classified in this way when they are significantly affected by the high concentration of organic matter and nutrients, resulting from urbanization and the lack of adequate environmental sanitation. (SILVA; FONSECA, 2016. p.255).

Thus, it is clear that eutrophication occurs due to excess organic matter, nutrients, among other factors. The information contained in the quote is related to the trophic state, which can be manifested as the state of eutrophication and the most critical reality of water quality, which is the hypereutrophic condition (SILVA; FONSECA, 2016).

For Von Sperling (2014), it is noted that the level of eutrophication is linked to the type of land occupation predominant in the river basin, therefore, in urban occupations the evolution of this process is faster. Sewage contains a high load of nutrients (N and P), which results in a high concentration of algae, siltation and the presence of macrophytes. The author in his work makes it possible to gather information about the undesirable problems of eutrophication. The following are mentioned:

- Aesthetic and recreation problems, tourism due to possible bad odors and others: There is a reduction in the use of water for recreational purposes, for bathing and tourism is harmed, as there is excessive vegetation growth.
- High concentration of bacteria and the aquatic environment becomes anaerobic and with an absence of light: at the bottom of the water body, conditions become anaerobic, that is, oxygen is consumed in the liquid medium and consequently the availability of dissolved oxygen is reduced. greatly reduced at depth. The absence of light is observed, due to the lack of photosynthesis and there are several factors that trigger the deterioration of the important quality of water.
- The mortality of fish in that body of water: It is known that in the environment of the river basin in a state of eutrophication, the oxygen resource is found in smaller quantities, it begins to have anaerobic conditions and other changes that turn the environment into a toxic condition.
- Higher cost and greater difficulty in treatment: The water resource deteriorated by eutrophication presents many changes in the parameters that make up the water quality index, such as color and turbidity. In situations of environmental pollution, the eutrophicated water body requires treatment with more steps and processes, the cost of which is higher due to greater complexity.
- Problems in supplying industrial water: excessive deposits of algae are a problem in supplying water for industrial purposes.
- Algae toxicity: The presence of toxins in the water makes this water unsuitable for human and animal supply, due to the presence of cyanotoxins.
- Change in the quality and quantity of fish of commercial value: With fishing activity compromised, with less use of fish due to them being contaminated in the environment that suffers from eutrophication, there is a decrease in the quantity of fish, but also in quality.
- Reduction in navigation activity and transport use: Macrophytes (algae) interfere with navigation and transport use. The harm to other uses is high.

- The gradual disappearance of the water resource as a whole: many phenomena are triggered after pollution. The silting events, the visualization of a lot of vegetation, means that there is a projection of the disappearance of that water resource to be an environment predominantly of vegetation.

According to Quevedo and Paganini (2018), eutrophication, in addition to causing a reduction in water availability, also results in a greater risk of the occurrence of cyanophyte blooms, a phenomenon that makes the use of important sources that are responsible for supplying a population unfeasible. , which causes impacts on the natural water resource and consequently on public health.
Ramos (2016), in his master's thesis, reports that information about the phenomenon of blooms consists of the growth of cyanobacteria, which is generated by many factors, including the concentration of nutrients, including N and P. For the scholar, the The unpredictable emergence of this impact could be explained by uncontrolled discharges of anthropogenic origin. Another discovery made in the work of Ramos (2016) was the fact that toxins are capable of bioaccumulating in the tissues of organisms that live in the aquatic environment, for example, fish and crustaceans. In other words, the major problem with the existence of cyanobacteria in water sources results from microorganisms, which are compounds with taste and smell, called cyanotoxins.

3.2 Water quality aspects

According to the authors, Silva and Fonseca (2016), they based the study on "data*water quality (concentration of nutrients, dissolved oxygen and phytoplanton biomass) and water trophic level*", however, these characteristics are not the only ones to understand about water quality, there are several parameters to understand it, since with the naked eye it is not possible to see microorganisms, bacteria, among others.
The importance of understanding water quality is because it is essential for human life. Therefore, it is essential to understand the potability of water, as clear, clear and odorless water does not mean that there are no contaminants, however, "*These characteristics alone do not guarantee the good quality of this liquid, so precious for life.*" (BRK, 2018).
In relation to water quality, there is the Water Quality Index (WQI) and the parameters to be analyzed, as attention must be paid to physical parameters: temperature, taste and odor, color, solids (in suspension, sedimentable, unsedimented, dissolved), electrical conductivity. Chemical parameters: pH, alkalinity, hardness, chlorides, Iron (Fe), Manganese (Mn), Nitrogen (N), Phosphorus (P), fluorides, Dissolved Oxygen (DO), chemical matter (Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), inorganic components, organic components: Total Coliforms (TC) and algae (VON SPERLING, 2014).

Despite all these parameters, according to the National Water and Basic Sanitation Agency (ANA), to calculate the AQI, the main parameters are: water temperature, pH, dissolved oxygen, total residue, biochemical oxygen demand, thermotolerant coliforms, nitrogen total, total phosphorus and turbidity. Furthermore, in 2013, ANA created the National Water Quality Monitoring Network (RNQA), "*which seeks to establish national standardization and encourage cooperation between monitoring network operators*" (ANA, 2013; BRK, 2018).
In order for it to be consumed without presenting health risks, that is, to become drinkable, the water must be treated, clean and decontaminated. Water treatment is a set of physical and chemical procedures that are applied to water so that it is in suitable conditions for consumption, that is, so that the water becomes drinkable. The water treatment process rids it of any type of contamination, preventing the transmission of diseases. (SANESUL, 2019).
Contamination by viruses, bacteria and microscopic toxic substances are imperceptible to the naked eye and can harm our health. Therefore, in addition to having no taste, smell or color, consumable water must meet more specific quality parameters, which are determined by the Ministry of Health (BRK, 2018).
Therefore, according to Sanesul (2019), to obtain quality water it is necessary to pass through the Water Treatment Station (ETA), such as: coagulation, flocculation, decantation, filtration, disinfection, fluoridation, PH correction. When water is collected from underground sources, through wells, it is not necessary for it to be treated in an ETA. It only receives dosages of chlorine and fluorine in the reservoirs. Producing drinking water is not easy. Requires large investments to build treatment plants and purchase the necessary inputs to purify it, in addition to constant analysis laboratories to ensure that quality standards are being met. In Sanesul's 11 laboratories, there are analyzes of 5,100 monthly samples were carried out. Regional Laboratories perform 5,000 samples per month in (Color, pH, Turbidity, E. coli and Heterotrophic Bac). In other words, approximately 25,000 parameters are analyzed per month. (5000 samples x 5 parameters) (SANESUL, 2019).

3.3 The need for quality and quantity sewage treatment

Water plays an important role in the economic and social development of society, in addition to being directly

linked to human health and well-being (VIEIRA, 2018). The quantity and quality of water are important factors for establishing health benefits, such as reducing the incidence and prevalence of various diseases, particularly diarrheal disease (QUEIROZ, et al., 2009).

According to Trata Brasil (2018), the lack of investment in treated water, sewage collection and treatment has a direct effect on labor market activities and economic activities that depend on good environmental conditions for their full exercise. Even knowing that Brazil has the largest water production 48,314 (m^3) of water per inhabitant, the majority of the population does not have access to water to drink in their homes and we still have 50% of the water used for irrigation being wasted, the country has a large inequality when it comes to distribution (VICTORINO, 2007). Only 41.6% of Brazilian municipalities have a sewage collection system, 66.2% of which do not treat sanitary sewage, combined with the lack of quality of drinking water, it is becoming decadent throughout the world, making it necessary to use water more effectively. . (BRASIL, et al., 2005).

> Waters are classified in this way when they are significantly affected by the high concentration of organic matter and nutrients, resulting from urbanization and the lack of adequate environmental sanitation. (SILVA; FONSECA, 2016. p.259).

This lack of investment in basic sanitation leads to several situations where the loss of water quality affects everything from expenses related to the need for treated water services, sewage collection and treatment to the quality of life of Brazilians, to compromising water availability.

In view of the above, these environmental issues contribute to the degradation of water resources mainly due to precarious conditions of basic sanitation, low socioeconomic level, culture, lack of guidance and hygiene, causing contamination of intestinal parasites. Especially the dumping of untreated effluents in inappropriate locations close to tourist sites and/or concentrations of people (AGUIAR, 2017).

3.4 Waterborne diseases

According to the Brazilian Society of Pediatrics, the main etiological agents that cause water-related diseases are: *Bacillus cereus, Staphylococcus aureus, Campylobacter, Escherichia coli*enterotoxigenic (ETEC), enteropathogenic E. coli, enteroinvasive E. coli, enterohemorrhagic E. coli,*Salmonella*not typhoid, S*higella*,*Yersinia enterocolitica*, Vibrio cholerae, Astrovirus, Calicivirus, Enteric adenovirus, Norwalk, Rotavirus group A, Rotavirus group B, Rotavirus group C,*Balantidium coli, Cryptosporidium, Entamoeba histolytica, Giardia lamblia, Cystoisospora belli*(SDP, 2017).

When studying the quality of water, sanitation and sewage treatment, it is impossible not to link such issues to health problems, since when such services are carried out incorrectly, they can cause great damage, thus causing waterborne diseases. The article is based on the following information:

> Information regarding the incidence of waterborne diseases (diarrhea, gastroenteritis, conjunctivitis and mycoses), for the years 2013 and 2014, was made available by the Municipal Health Department of Florianópolis. Data from the Health Centers were grouped into reports and were obtained by the INFOSAUDE software, version 4.0.0.7, in the Municipal Health System. (SILVA; FONSECA, 2016. p.254).

By relying on this data, they were able to clearly understand water issues, such as water-borne diseases. Contaminated waters from water courses flow onto beaches and aquaculture parks, thus compromising environmental and human health. (SILVA; FONSECA, 2016).

Water is a vector of diseases that are transmitted by lack of personal and domestic hygiene, poor supply, contact with contaminated water and aquatic vectors (animals and fish). (SILVA; FONSECA, 2016).

The main water-related diseases are: diarrhea*Escherichia coli*(E. coli), amoebiasis, cholera, leptospirosis, bacterial dysentery, hepatitis A, schistosomiasis, typhoid fever, ascariasis, dengue, rotavirus. Therefore, adequate treatment of water before reaching the population is essential (COSTA, et al., 2002).

When water comes from unsafe sources, it should be boiled before drinking. However, adequate treatment of

Water and sewage stand out as the main prevention actions against waterborne diseases. That because basic sanitation considerably reduces the chances of water being contaminated by microorganisms harmful substances to be consumed by the population (BRK, 2019).

For years we have been living with the absence of sanitation. We rarely notice how impactful the lack of basic services is for Brazilian municipalities. Many places are in very precarious situations, especially in the North and Northeast regions, which have been the most precarious for years. The indices are still worrying, even more so when we address the issue of sewage, this is what the Brazilian Sanitation panel points out, a platform with the main socioeconomic and environmental indicators recently released by Instituto Trata Brasil (TRATA BRASIL, 2018).

According to data collected by Trata Brasil during the years 2010-2017, the main diseases transmitted

that most affected the population were: infectious gastrointestinal diseases, yellow fever, dengue fever, leptospirosis, malaria and schistosomiasis. Dengue being the main one, during this study period it was noticed that there was a drop in death cases, that is, there was an improvement in sanitation in several regions of the country (TRATA BRASIL, 2019).

Final considerations

In view of what was exposed in the study, there was a perception of several parameters that may be associated with water quality, as well as urbanization, lack of basic sanitation and high concentrations of phosphorus and nitrogen. These favor the process called eutrophication, in which they enable the spread of waterborne diseases, the main ones being: diarrhea caused by*Escherichia coli*(E. coli), amoebiasis, cholera, leptospirosis, bacterial dysentery, hepatitis A, schistosomiasis, typhoid fever, ascariasis, dengue, rotavirus. Waters classified as hypereutrophic represent a warning as they can gradually disappear and even be considered unusable.
Problems arising from eutrophication and pollution of water bodies cause the death of fish and crustaceans, increased turbidity and decreased dissolved oxygen in the water, bioaccumulation of organic matter, increased flowering, excessive deposition of algae, plants and macrophytes and the appearance of cyanobacteria that generate cyanotoxins, such as cyanobacteria. Furthermore, it is essential to forget that socioeconomic factors linked to the fish market and tourism are also affected, as pollution affects aquatic life and, sometimes, tourists are unable to visit these places and fish become prohibited in the area. consumption.
Therefore, the importance of water treatment through microbiological, physical-chemical analyzes and other water quality indices stands out, which attest to the suitability of the water resource for consumption and human contact. Pay attention to analyzes at Water Treatment Stations, responsible for capturing water for distribution and consumption. Taking into account the aspects analyzed, to achieve better water quality levels, constant analysis and treatment is necessary, together with health security and the Ministry of Health.

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