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La Revista AIDIS de Ingeniería y Ciencias Ambientales: Investigación, desarrollo y práctica es una publicación electrónica cuatrimestral coeditada por AIDIS y el Instituto de Ingeniería UNAM. Publica contribuciones originales de calidad y actualidad evaluadas por pares, dentro de su área de competencia. Se presentan trabajos que abarcan aspectos relacionados con el conocimiento científico y práctico, tanto tecnológico como de gestión, dentro del área de Ingeniería y Ciencias Ambientales en Latinoamérica.

El enfoque es multidisciplinario, buscando contribuir en forma directa a la generación de conocimiento, al desarrollo de tecnologías y a un mejor desempeño profesional. Entre los temas cubiertos por la revista están los siguientes: agua potable, calidad de agua, aguas residuales, residuos sólidos, energía, contaminación, reciclaje, cambio climático, salud ambiental, nuevas tecnologías, ética, educación, legislación y política ambiental, gestión ambiental, sostenibilidad y participación social, entre otros.

Cada edición muestra los trabajos que derivan del arbitraje académico estricto de carácter internacional. También se publican números especiales de temas particulares que fueron presentados en los diversos Congresos Interamericanos realizados por la Asociación Interamericana de Ingeniería Sanitaria y Ambiental (AIDIS) y que en forma adicional fueron sometidos al proceso de revisión interno de la revista.

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OXIDATIVE DEGRADATION BY FENTON'S METHOD FOR TEN PHARMACEUTICAL DRUGS LARGELY USED IN A BRAZILIAN CITY

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Abstract

Medicines have been recently recognized as one of the emerging contaminants in the environment. These are discharged after therapeutic use through human excretion or irregular discharges. Effluent containing high concentrations of drugs discharged from production facilities is also a cause of concern to nearby aquatic bodies. There is an increased interest in their removal due to environmental and public health problems related. Some drugs are resistant to conventional methods of liquid effluent treatment, and there is a risk of negative impacts in humans and animals if exposed repeatedly to the same medicines for prolonged periods. To date, the potential human, animal, and ecological risks associated with the discharge of these compounds to the environment and the potential techniques for liquid effluent degradation demand to be well discussed. Fenton degradation process represents one possibility of pharmaceutical removal of liquid effluents, as presented by the scientific literature. Therefore, this study presents a brief summary on Fenton degradation studies of ten of the most used drugs in city of Belo Horizonte, the capital of the state of Minas Gerais, Brazil. The result of the literature search about the studies of oxidative degradation of the drugs resulted in 45 articles found, applied to 6 drugs among the 10 most frequently used in Belo Horizonte. The needs regarding removal, disposal, and treatment of drugs represent an important challenge in environmental management.

Keywords: liquid effluent, Fenton process, medicines degradation, Brazil.

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AVALIAÇÃO BIBLIOMÉTRICA PARA A REMOÇÃO DE FÓSFORO PRESENTE NO ESGOTO SANITÁRIO ATRAVÉS DA PRECIPITAÇÃO QUÍMICA UTILIZANDO A ESCÓRIA DE AÇO COMO FONTE ALTERNATIVA DE CÁLCIO E MAGNÉSIO

* Janaína Simões Lima ¹
Renata Estevam ¹
Ricardo Franci Gonçalves ²

BIBLIOMETRIC EVALUATION FOR THE REMOVAL OF PHOSPHORUS PRESENT IN SANITARY SEWAGE THROUGH CHEMICAL PRECIPITATION USING STEEL SLAG AS AN ALTERNATIVE SOURCE OF CALCIUM AND MAGNESIUM

Recibido el 1 de octubre de 2023. Aceptado el 11 de octubre de 2024

Abstract

The recovery of phosphorus present in sewage through chemical precipitation was addressed in this study. The objective was to evaluate the research trends and the correlations of academic networks related to the use of steel slag as an alternative source of Ca and Mg in the removal of phosphorus from sewage. The publications between the years 2017 and 2023 were mapped through the Biblioshiny interface, which is a bibliometrix tool. Among the results found in the panorama of publications, it was identified that China is the country that published the most during this period and it was observed that there was a gradual increase in the number of publications over the years. Among the identified gaps, the lack of crystallographic studies of the precipitates with an approach to the properties of the crystalline structures formed in the systems, as well as the use of slag with granulometries greater than 20 mm in reactive filters and systems with operating periods longer than 1 year.

Keywords: phosphorus recovery, sewage, steel slag, dephosphate and bibliometrix.

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AS CONTRIBUIÇÕES DA RECICLAGEM PARA O DESENVOLVIMENTO SUSTENTÁVEL: UMA REVISÃO BIBLIOGRÁFICA

* Janaína Aparecida Cezário ¹
Maxsuel Bezerra do Nascimento ²
Laércio Leal dos Santos ¹
William de Paiva ¹

THE CONTRIBUTIONS OF RECYCLING TO SUSTAINABLE DEVELOPMENT: A BIBLIOGRAPHIC REVIEW

Recibido el 4 de octubre de 2023. Aceptado el 8 de enero de 2024

Abstract

This paper presents a bibliographic review on the contributions of recycling to sustainable development. The contemporary scenario demands bold solutions for the harmonious coexistence of economic progress and environmental preservation. In this context, recycling emerges as a key player, orchestrating a series of significant contributions to sustainable development. Recycling is discussed as a fundamental strategy for solid waste reduction, preservation of natural resources, and promotion of more efficient materials management, as well as a source of job creation and social inclusion. Through the analysis of studies from different authors, the paper examines how recycling contributes to the reduction of environmental pollution, generation of employment and income, social inclusion, and environmental awareness. Furthermore, the implications of recycling in specific sectors, such as the construction industry, are explored. The bibliographic review demonstrates the relevance of recycling as a key tool in the pursuit of more sustainable development, emphasizing its ability to promote circular economy principles and social cohesion.

Keywords: solid waste, resource preservation, environmental awareness, social inclusion, circular economy.

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REGULAÇÃO DE SERVIÇOS DE SANEAMENTO: AVANÇOS, NECESSIDADES DE MELHORIA E OPORTUNIDADES EM MUNICÍPIOS DE PEQUENO PORTE NO ESTADO DO MARANHÃO

Joel Carlos Zukowski Junior ¹

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André Pereira Raposo ³

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REGULATION OF SANITATION SERVICES: ADVANCES, IMPROVEMENT NEEDS AND OPPORTUNITIES IN SMALL MUNICIPALITIES IN THE STATE OF MARANHÃO

Recibido el 23 de octubre de 2023. Aceptado el 21 de junio de 2024

Abstract

This study aimed to assess the current regulatory framework for sanitation applied to public water supply in small municipalities within the Southwest Maranhão Metropolitan Region. The primary objective was to propose a regulatory model for environmental sanitation in these municipalities. The methodological approach involved a systematic literature review, data collection, and analysis of the historical context of sanitation regulation in the state of Maranhão. Additionally, a regulatory exposure model was proposed for the Southwest Maranhão Metropolitan Region. The findings revealed the existence of universalization goals for basic sanitation services in the state of Maranhão, with specific targets for service coverage and quality to ensure equitable and adequate access for the entire population. However, the study also identified challenges related to water quality and solid waste management. These findings provide valuable insights for implementing regulatory exposure as a more efficient and sustainable strategy for sanitation services in this region. Regulatory exposure entails the clear and accessible dissemination of information to the public regarding the sanitation actions undertaken by the concessionaire and their corresponding outcomes.

Keywords: environmental sanitation, governance, regulation.

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AVALIAÇÃO DA APLICAÇÃO DE UM BIORREATOR A MEMBRANA EM BATELADAS SEQUENCIAIS NO TRATAMENTO DE ESGOTO DOMÉSTICO

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EVALUATION OF THE APPLICATION OF A MEMBRANE BIOREACTOR IN SEQUENTIAL BATCHES IN THE TREATMENT OF DOMESTIC SEWAGE

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Abstract

The membrane bioreactor system (MBR) has been gaining prominence in recent years compared to traditional domestic effluent treatment systems, as restrictions are increasingly greater due to its release into water bodies. Therefore, the present study aimed to evaluate the application, on a pilot scale, of a sequential batch membrane bioreactor (MBR-SB) in the treatment of domestic sewage. Reactor performance was evaluated based on the removal of parameters: soluble chemical oxygen demand (COD), biochemical oxygen demand (BOD), ammonia nitrogen, soluble phosphorus, apparent color and turbidity. At the same time, analyzes related to membrane fouling processes were evaluated in the reactor: soluble microbial products (SMP) and extracellular polymeric substances (EPS) in terms of proteins and polysaccharides, as well as transmembrane pressure (TMP). MBR-SB showed significant efficiencies in removing CODs, true color and turbidity, being 94%, 93% and 99%, respectively. The values of SMP, EPS, CODs significantly correlated with the increase in PTM, however, with a low clogging speed. In conclusion, the use of MBR-SB presents a promising approach to mitigate the environmental impacts associated with domestic sewage.

Keywords: membrane filtration, biological treatment, membrane fouling.

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THE PRACTICE OF COIL (COLLABORATIVE ONLINE INTERNATIONAL LEARNING) IN BRAZIL: A CASE STUDY ON THE PRACTICE OF SUSTAINABLE DEVELOPMENT IN THE ACADEMIC ENVIRONMENT

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Recibido el 8 de noviembre de 2023. Aceptado el 6 de mayo de 2024

Abstract

Recently, the educational system of the planet has been going through several expressive transformations. Examples include the change in the curriculum, the innovation of strategic methodologies for obtaining knowledge and especially the new remote teaching methods arising from the impacts of the COVID-19 pandemic. This study aims to present the teaching methodology of inverted class used in the discipline of Environmental Sustainability Applied to Engineering, promoted by the Federal University of Pernambuco (UFPE), at the Academic Campus of Agreste (CAA). This discipline proposes to create a collaboration network model, with national and international partnerships, for the broad teaching of environmental education. In this discipline, cultural exchanges, learning about the concept of sustainability, development of sustainable projects and understanding of the situation of environmental resources on the planet are promoted. Adopting an innovative and practical teaching methodology, with the presence of strong aggregating partnerships, it can be observed that there is a greater contribution to the dissemination of the concept of sustainability linked to environmental conservation for future generations. The entire course is based on the concept of thinking globally and acting locally.

Keywords: educational system, methodology of inverted class, environmental sustainability applied to engineering, environmental education.

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REVISTA AIDIS

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ENERGY, ENVIRONMENTAL AND FINANCIAL EVALUATION OF PROGRESSIVE CAVITY PUMPS WITH ROTORS PRODUCED FROM DIFFERENT MATERIALS

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Recibido el 15 de noviembre de 2023. Aceptado el 11 de octubre de 2024

Abstract

In industrial applications, pumps traditionally operate for thousands of hours at high pressures, often under severe conditions imposed by abrasive fluids or undergoing chemical attack. However, in tinting dispensers, a progressive cavity pump (PCP) rarely reaches one hundred hours of use, and alternative materials could be explored for its components. An energetic, environmental, and financial assessment was conducted on four distinct materials intended for the rotor of a PCP: chrome-coated steel, PA6, PEEK, and 6082 aluminum alloy. Equipment was built to obtain the characteristic curves of each pump, electrical energy consumption, wear of rotors and stators, and energy efficiency. The rotor machining process was instrumented to measure electrical energy and inputs. The Cleaner Production method was applied, and, finally, the rotors underwent financial evaluation. There was no significant wear on the stator-rotor pairs, the minimum lifetime was not a challenge for the integrity of any of the components, and the polymers studied were not incompatible with the working fluid. Maximum and minimum energy efficiency of the pumps occurred with aluminum alloy and PA6 rotors, respectively, showing a difference of 22.5% in electrical energy consumption. However, the PA6 rotor presented the best energy and environmental efficiency in the manufacturing process, in addition to being the only one capable of dry machining. Financially, all proposed materials registered a significant improvement, particularly highlighting the aluminum alloy and PA6 rotors, which exceeded a 90% cost reduction.

Keywords: progressive cavity pump, energy efficiency, cleaner production, tinting.

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SOCIAL LIFE CYCLE ASSESSMENT IN WASTE PICKERS ASSOCIATIONS USING PRIMARY AND SECONDARY DATA

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Abstract

There is a growing interest in measuring and evaluating social aspects, such as the impact of actions, activities or decisions on society and the environment. To measure these impacts, a tool called Social Life Cycle Analysis (SLCA) can be used with different types of data or inventory sources. However, the conducted bibliographic review revealed that the quality of the data was not verified in previous SLCA studies of waste pickers associations. Therefore, this study compares the results of an SLCA using the same assessment method but with primary and secondary data, motivating the analysis of relationships between data types and assessment results. This analysis focused on the social impacts on Waste Pickers Organizations located in Vitória, the capital of Espírito Santo, Brazil. The results show better impact levels in the indicators and subcategories when using secondary data instead of primary data. This shows that using secondary data leads to more uncertainties for a study with a Type I SLCA with performance benchmarks. Regarding data quality, the trend remains the same, with primary data being of better quality than secondary data.

Keywords: Social Life Cycle Assessment, municipal solid waste, Waste Pickers Organizations, indicators, subcategories, primary/secondary data.

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REVISTA AIDIS

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PERCEPÇÃO SOBRE A QUALIDADE DO SERVIÇO DE ÁGUA POTÁVEL NO MUNICÍPIO DE TUCURUÍ – PA, BRASIL: DAS CONDIÇÕES DE OFERTA

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PERCEPTION OF THE QUALITY OF DRINKING WATER SERVICE IN TUCURUÍ – PA, BRAZIL: OFFER CONDITIONS

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Abstract

The article aims to analyze the perception of the quality of drinking water supply services in the city of Tucuruí-PA. With a focus on identifying specific phenomena and discussing the relationship between water supply at the SAA km 4 and water consumption and use in the Jaqueira neighborhood, a correlation analysis was carried out only between socioeconomic variables and then between socioeconomic variables and those of water consumption and use. The study was carried out in two stages, the first addressing the capacity of the drinking water supply sector in km4 and the second focusing on the perception of services by the population of the Jaqueira neighborhood. The research indicated that by the year 2028, the km4 system may not have the capacity to meet the water demand of the population living in the area it serves. In addition, the population of the Jaqueira neighbourhood, characterized mainly by small families, low income and low level of education, evaluates the services as poor or very poor. In addition, a negative correlation was identified between the occurrence of intermittent water supply and the assessment of water quality, a positive correlation between economic class and the use of bottled water, as well as a negative correlation between the frequency of household cleaning of reservoirs and the occurrence of symptoms related to contact with poor quality water. Finally, it was not possible to accurately identify the profile of consumers based on perception

Keywords: water supply systems, consumer perception, correlation analysis, cluster analysis.

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REVISTA AIDIS

de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica.

RESÍDUOS SÓLIDOS EM UM CAMPUS UNIVERSITÁRIO DA AMAZÔNIA ORIENTAL: COMPOSIÇÃO GRAVIMÉTRICA E PERCEPÇÃO DOS DISCENTES

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SOLID WASTE ON A UNIVERSITY CAMPUS IN THE EASTERN AMAZON: GRAVIMETRIC COMPOSITION AND STUDENTS' PERCEPTION

Recibido el 10 de enero de 2024. Aceptado el 11 de octubre de 2024

Abstract

We aimed to carry out a diagnosis of the solid waste (SW) produced at a small campus of the Rural Federal University of Amazon, located in Capitão Poço, Pará State, Eastern Amazon region. We also evaluated the environmental perception of graduation students to support the practice of environmental education tools and encourage the appropriate destination of SW. We collected biweekly and analysed the SW composition of all the residues produced at the institution at the end of one day. We also assessed the environmental perception of 198 students through a questionnaire application. The results showed that the campus produced, on average, 431.8 kg month⁻¹ and 21.59 kg day⁻¹ of SW. The largest portion has recyclable potential (73.7%), such as organic waste (29%), paper (24%) and plastic (17%). The questionnaires analysis showed that 58% of the students are unaware of the 5Rs policy and only 4% do separate waste at source at homes. However, more than 70% would support environmental actions at the university. Biological Sciences students had a more engaged perception, due to the influence of the curricular components and projects developed during graduation. The institution has the potential to appropriately manage its waste in addition to implementing efficient SW management policies. The solution can come through the implementation of a Solid Waste Management Program, including educational actions.

Keywords: perception, questionnaire, selective collect, waste management.

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AVALIAÇÃO DO CICLO DE VIDA DA PRODUÇÃO DE COMBUSTÍVEL DERIVADO DE RESÍDUOS URBANOS UTILIZADOS NO COPROCESSAMENTO EM FORNOS DE CIMENTO

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ASSESSMENT OF THE LIFE CYCLE OF PRODUCTION OF REFUSE DERIVED FUEL URBAN WASTE USED IN CO-PROCESSING IN CEMENT FURNACES

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Abstract

The increase in urban solid waste generation in Brazil requires efficient solutions. Thermal treatment stands out for significantly reducing the volume of waste, and this study analyzed the environmental impact of Waste-Derived Fuel when replacing fossil fuels in the cement industry. The results show that the use of this alternative fuel can reduce greenhouse gas emissions by up to 85.98% throughout the supply chain, avoiding 1.781,46 tCO_{2-eq}.year⁻¹. This contributes to the mitigation of climate change, being an important benefit in the context of the transition to a more sustainable economy. Regarding calorific value, the variations observed between scenarios do not compromise energy efficiency, which presents an average value of 4.932 kcal.kg⁻¹, which makes it competitive in relation to conventional fuels. The greatest environmental benefits are the reduction in oil exploration and carbon emissions into the atmosphere, while the negative impacts are related to the use of fuels in transportation and the consumption of electricity during manufacturing, in addition to the ecotoxicity generated by burning in cement kilns. This study reinforces the technical and environmental feasibility of thermal waste treatment, highlighting it as an effective alternative in waste management and in replacing fossil fuels.

Keywords: thermal energy, life cycle, solid waste, fuel.

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VIGILÂNCIA DA QUALIDADE DA ÁGUA TRATADA USANDO O SISTEMA DE INFORMAÇÃO GEOGRÁFICA (SIG) NO MUNICÍPIO DE BELÉM, PARÁ, BRASIL

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SURVEILLANCE OF TREATED WATER QUALITY USING THE GEOGRAPHIC INFORMATION SYSTEM (GIS) IN THE MUNICIPALITY OF BELÉM, PARÁ, BRAZIL

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Abstract

Safe drinking water is an essential human right for all segments of society. In this sense, the water quality surveillance program for human consumption (VIGIAGUA) aims to promote the collective and preventive health of the population in order to reduce the aggravation of diseases related to water transmission, through the management of risks related to the water supply system. In this context, the present study aimed to specialize and analyze the quality data of treated water in the municipality of Belém-PA-Brazil, located in the Amazon region of the State of Pará, using the Geographic Information System (GIS) tool. The methodology was divided into three main stages: initially, data from the Water Quality Surveillance Information System (SISAGUA) were consulted; subsequently, the service goals were evaluated with the coverage of the water supply system and verification of compliance with the sampling plan required by VIGIAGUA. In addition, thematic maps were prepared comparing the results with the potability standards required by current legislation. The results for the basic parameters indicated that the turbidity was in accordance with the value of 5 uT for waters from surface water abstraction and 1 uT for groundwater as required by Ordinance n. 888, of May 4, 2021, of the Ministry of Health (MS). On the other hand, the variables of free residual chlorine, total coliforms and Escherichia coli showed "VERY POOR" performance due to the alteration of the water distributed to the population. Therefore, this scenario of vulnerability puts the health of the population at risk due to the physical, chemical and microbiological contamination of the water in the public supply system of the municipality of Belém, pointing to the need for emergency public policies so that the potability standard is met.

Keywords: public water supply, treated water, water quality, fulfillment goals, VIGIAGUA.

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ANÁLISE DA COMPOSIÇÃO GRAVIMÉTRICA DOS RESÍDUOS SÓLIDOS URBANOS DA CIDADE DE GUANAMBI-BA

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Luísa Magalhães Araújo ²

ANALYSIS OF THE GRAVIMETRIC COMPOSITION OF URBAN SOLID WASTE FROM THE CITY OF GUANAMBI-BA

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Abstract

More efficient waste management must begin with its classification and quantification, i.e. the physical characterization of waste. The aim of this study is to survey the gravimetric composition of MSW in the city of Guanambi. In addition, through a systematic review, the aim is to analyze the studies on gravimetric composition in Brazil, giving an overview of the publications and comparing the results with those obtained in the field survey. The systematic review found a difference in the classification of some materials in reject category, such as fabric and rubber, which may led to statistically significant difference in the percentage. As for organic and recyclable materials, the sample average does not differ statistically from the national average, i.e. the values found by the authors are within the confidence interval. Regarding the data found for the city of Guanambi, the results show that the fraction of organic waste is above the national average (71.78%) and recyclable waste (24.66%) and rejects (3.72%) are below average. In general, the results also showed a difference between the fraction results for different income brackets, with the lowest fraction of recyclables identified in high-income neighborhoods, mainly due to population characteristics. The results demonstrate the need to look for new alternatives for disposing of organic waste, since the current form, an open-air dump, exacerbates the negative environmental impacts of this waste.

Keywords: rejects, final destination, per capita generation, MSW, gravimetry, systematic review.

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Investigación, desarrollo y práctica.

EFEITO DA SAZONALIDADE NA QUALIDADE DA ÁGUA DO AÇUDE TAQUARA, CEARÁ, BRASIL

SEASONALITY EFFECT ON WATER QUALITY IN THE TAQUARA RESERVOIR, CEARÁ, BRAZIL

Brenda de Assis Ferreira Carvalho ¹

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Abstract

Water quality in reservoirs is a growing concern for environmental sustainability, water bodies play a vital role in providing drinking water, in agriculture and in maintaining aquatic ecosystems. It is noted that the water issue has been worsening over time, with the semi-arid region having the greatest impacts in relation to the water crisis, but today the concern about availability is notable in all regions of the world. This study assessed the impact of seasonality on the water quality of the Taquara Reservoir. The data utilized were sourced from the Water Resources Management Company (COGERH) for the period from 2016 to 2020. Parameters analyzed for water characterization included pH, dissolved oxygen, electrical conductivity, chlorophyll "a," cyanobacteria, Escherichia coli, total nitrogen, total phosphorus, chlorides, color, magnesium, potassium, sodium, total solids, and turbidity. Descriptive analyses and box-plot graph construction were employed to assess water body quality during seasonal periods, comparing concentrations of the analyzed variables with the maximum allowable values (MAVs) established by CONAMA Resolution No. 357/2005 for freshwater class 2. The concentrations obtained mostly fall within the limits permitted by CONAMA Resolution. However, parameters such as total phosphorus, dissolved oxygen, Escherichia coli, chlorophyll "a," and cyanobacteria did not comply with the legislation. The results suggest seasonal variations and anthropogenic contaminations. Emphasis is placed on the importance of understanding the influence of seasonal changes and adopting measures to reduce human interference, aiming at the preservation of the quality and sustainability of this vital resource.

Keywords: monitoring, reservoir, semiarid.

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ANÁLISE EVOLUTIVA E COMPARATIVA DO USO E COBERTURA DO SOLO PARA AUXILIAR NO CADASTRO AMBIENTAL RURAL NO MUNICÍPIO DE SÃO FÉLIX DO XINGU – PA.

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Vanessa de Nazaré Cunha Lopes ²
Flávia Sales Velasco ³
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EVOLUTIONARY AND COMPARATIVE ANALYSIS OF LAND USE AND COVER TO ASSIST IN THE RURAL ENVIRONMENTAL REGISTRATION IN THE MUNICIPALITY OF SÃO FÉLIX DO XINGU – PA.

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Abstract

The environmental changes caused by anthropic activity directly reflect the change in the landscape of a region and, in this context, the city of São Félix do Xingu - PA has gone through several changes. This work presents a land use and land cover mapping to get to know the environmental reality of the city and verify the reliability of MapBiomas data for the implementation of the Rural Environmental Registry (CAR) in order to collaborate with environmental control. To perform the multitemporal analysis, images of five-year time intervals from 1985 to 2020 were used, and to verify the reliability of the MapBiomas land cover data, a comparison was made with the land cover of small, medium and large rural properties. declared and approved in SICAR/PA through global accuracy and Cohen's kappa coefficient. The results indicate that there was a very expressive percentage of native forest reduction, giving way to the advance of agriculture and livestock activities until 2010, but later this percentage decreased with the application of policies aimed at reducing illegal suppression of vegetation. The results of the land cover comparison showed that MapBiomas reflects better responses for smaller scale analyses, that is, for rural properties greater than 4 fiscal modules. Therefore, it is concluded that the MapBiomas database is relevant to assist in the delimitation of the land cover of medium and large rural properties to be declared in the CAR, being a relevant tool to help implementation of the CAR.

Keywords: land cover, MapBiomes, rural environmental register, rural properties.

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