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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.

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Índice. Tabla de Contenido

Vol. 18, No. 3

Sección editorial. Información del número

Información legal y directorio

English abstracts

Lista de revisores 2025

Artículos completos

1. Metodologías e índices de segurança hídrica: uma revisão sistemática da aplicação em bacias e na indústria 267-285
Methodologies and indices: a systematic review of their application in basins and industry
[Jussara Ferreira-Santos, Renan Rodrigues Campos da Silva, Celso Bandeira de Melo Ribeiro](#)
2. Modelagem matemática do tratamento de dejetos bovino por biodigestão anaerobia 286-302
Mathematical modeling of bovine manure treatment by anaerobic digestion
[Vitheli de Oliveira Ocampos, Gabriela Pereira de Assis, Izabel Melz Fleck, Leandro Fleck](#)
3. Emissões de carbono e energia incorporada em projetos de edificações: empreendimento Porto Privilege em Salvador-Bahia 303-331|
Carbon emissions and embodied energy in buildings: Porto Privilege project in Salvador-Bahia
[Ângela Márcia Andrade Silva, José Célio Silveira Andrade, Isabelle Barbosa de Brito](#)
4. Spatio-temporal variability of dissolved oxygen in a large tropical semi-arid reservoir 332-352
[Tharcia Priscilla de Paiva Batista Matos, Alexandre Cunha Costa](#)
5. Alternativas de reúso de águas cinzas após tratamento químico 353-370
Alternatives for reusing gray water after chemical treatment
[Ranyere do Nascimento Lôbo, Rui Felipe de Miranda Rios, Jéssica Paula Oliveira Rodrigues, Marcelo Mendes Pedroza, Claudia da Silva Aguiar Rezende, Elaine da Cunha Silva Paz](#)

6. Evaluación de la planta de tratamiento de aguas residuales El Gavilán y su impacto sobre la percepción de olores de los habitantes de Manta, provincia de Manabí, Ecuador. 371-384

Evaluation of the El Gavilán wastewater treatment plant and its impact on the odor perception of the residents of Manta, Manabí province, Ecuador

Hugo Miguel Cobeña Navarrete, Carlos Ricardo Delgado Villafuerte, Johnny Manuel Navarrete Álava, Francisco Javier Velásquez Intriago, Nancy T. Hernández de Guerrero, Randi J. Guerrero-Ríos

7. Projeto-piloto para estruturação da rede mineira de logística reversa 385-413

Pilot project for structuring the Minas Gerais' Reverse Logistics network

Mônica de Abreu Azevedo, Nina Rosa Fernandes Diniz, João Victor Alves Gomes Silva, Diego da Silva Marques

8. Um estudo de caso sobre a percepção de servidores em uma instituição pública da área da saúde acerca de suas atitudes ambientais 414-435

A case study about perception of employees in a public health institution about their environmental behavior

Ana Carolina Teles de Aquino, Otávio Augusto Antunes Dias, Fabiana Cristina Lima Barbosa, Valdir Lamim-Guedes, Marcos Paulo Gomes Mol

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METODOLOGIAS E ÍNDICES DE SEGURANÇA HÍDRICA: UMA REVISÃO SISTEMÁTICA DA APLICAÇÃO EM BACIAS E NA INDÚSTRIA

Jussara Ferreira-Santos¹
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METHODOLOGIES AND WATER SECURITY INDICES: A SYSTEMATIC REVIEW OF THEIR APPLICATION IN BASINS AND INDUSTRY

Recibido el 23 de abril de 2024. Aceptado el 22 de abril de 2025

Abstract

Water scarcity, intensified by climate change and population growth, represents a global challenge that directly affects water security and makes the industrial sector vulnerable due to its high demand for water in operational processes. This article presents a systematic review conducted according to the PRISMA methodology and the PICO strategy, aiming to identify and analyze methodologies used for water security assessment in different territorial and sectoral contexts, with emphasis on contributions and gaps related to the industrial sector. Several approaches for assessing water security, risk, and vulnerability were identified, notably multi-criteria methods such as AHP and its variations (FAHP, BWM, Delphi, entropy), fuzzy models (FCE), conceptual frameworks such as DPSIR and PSER, grey forecasting, and decision support systems (DSS). Many of these methodologies have been applied to the construction of indices and indicators for urban and rural water security analysis, water stress assessment, and water resources sustainability. The analysis of 26 studies revealed both established and emerging methods, often combined with analytical and geospatial tools to enhance the accuracy and applicability of results. Although the literature search explicitly included the term "industry," few direct applications were found, revealing a significant gap in the use of these methodologies in the sector. Nevertheless, the identified methods provide a robust basis for future adaptations capable of supporting diagnosis, forecasting, and strategic decision-making in industrial contexts and in territories under increasing water stress.

Keywords: multicriteria analysis, water resources, industrial sector, hydrographic basin, systematic review.

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MODELAGEM MATEMÁTICA DO TRATAMENTO DE DEJETO BOVINO POR BIODIGESTÃO ANAERÓBIA

Vitheli de Oliveira Ocampos¹

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MATHEMATICAL MODELING OF BOVINE MANURE TREATMENT BY ANAEROBIC DIGESTION

Recibido el 23 de abril de 2024. Aceptado el 22 de abril de 2025

Abstract

Brazilian livestock stands out worldwide, however it generates organic waste that requires adequate treatment to avoid environmental impacts. The present study is based on the hypothesis that anaerobic digestion can be used for the efficient treatment of livestock waste. Bovine manure from beef cattle was used as substrate and sludge from an anaerobic starch biodigester was used as inoculum. The factors inoculum mixing ratio (IMR) (%) and operating time (OT) of the anaerobic biodigesters (days) were controlled, with their effects on the color, turbidity and COD parameters being evaluated using a CCRD. The highest efficiency of the system was observed for turbidity removal (96.94%). The IMR factor, quadratic term, had a significant effect on the removal of turbidity and color. Although COD removal was not high, similar results were observed in the literature. The mathematical model for turbidity was statistically significant, presenting a p-value of 0.03. The biogas produced by experimental test 08, showed 82.0% methane, 16.0% carbon dioxide and a total absence of hydrogen sulfide. The anaerobic biodigestion technique is indicated for the treatment of cattle waste using starch effluent biodigester inoculum, however it is suggested that researchers in the area carry out additional research under experimental conditions different from those tested in the present study.

Keywords: bioenergy, biogas, organic matter, livestock.

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EMISSIONS OF CARBON AND EMBODIED ENERGY IN BUILDINGS: PORTO PRIVILEGE PROJECT IN SALVADOR-BAHIA

Ângela Márcia Andrade Silva ¹

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Isabelle Barbosa de Brito ³

CARBON EMISSIONS AND EMBODIED ENERGY IN BUILDINGS: PORTO PRIVILEGE PROJECT IN SALVADOR-BAHIA

Recibido el 23 de abril de 2024. Aceptado el 22 de abril de 2025

Abstract

The general objective of this article is to analyze the inventory prepared using the energy consumption and carbon emissions calculator (CECarbon) for a building project in Salvador - Bahia. The following methodological techniques were used: bibliographic and documentary research and an illustrative case of Porto Privilege's project. The results demonstrated that 79% of carbon emissions from the project (1,134.68 tCO_{2e} or 0.22 tCO_{2e}/m²) refer to the consumption of steel, concrete, aluminum frames, mortar, and concrete blocks. The embodied energy in all materials used in the project (12,906.78 GJ or 2.55 GJ/m²) would be capable of supplying 415 homes with four people for one year. Thus, the evaluation of the structural aspect of the building, the efficiency of the construction process, allowing the reduction of losses of steel, concrete, and mortar, or possible replacement of aluminum frames and concrete blocks with other alternative materials, for example, has potential to reduce carbon emissions and embodied energy at Porto Privilege. For possible compensation actions, the project's total emissions are equivalent to the carbon content stored in 7,943 trees in the Atlantic Forest. It is concluded that Porto Privilege's results are positioned within the national average regarding carbon intensity and energy consumption of buildings. It is hoped that the article can motivate other construction companies to carry out their carbon emission inventories, contributing to improving indicators for the sector, and supporting decision-making by entrepreneurs and public agents regarding mitigation strategies and/or offsetting carbon emissions in the construction sector in Brazil.

Keywords: carbon emissions, embodied energy, CECarbon, urban building projects, Salvador - Bahia.

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Investigación, desarrollo y práctica.

SPATIO-TEMPORAL VARIABILITY OF DISSOLVED OXYGEN IN A LARGE TROPICAL SEMI-ARID RESERVOIR

*Tharcia Priscilla de Paiva Batista Matos ¹
Alexandre Cunha Costa ¹

Recibido el 5 de noviembre de 2024. Aceptado el 9 de agosto de 2025

Abstract

The monitoring of dammed waters is important for the management of watersheds, mainly in the semi-arid region due to the meteorological regime in the region. The goal of this research is to analyze the spatio-temporal variability of dissolved oxygen (DO) in the Castanhão reservoir, Brazil, highlighting its impact on fish farming. The data used refer to six sampling stations provided by the Ceará State Company of Water Resources Management. Hydrogen potential (pH), salinity (S), temperature (T), and depth (z) of the water column profile of the reservoir between January 2016, and June 2021 were analyzed. The Kruskal-Wallis test with Post-Hoc analysis and the Mann-Kendall trend test were used. In the spatial analysis on the water surface, most of the DO values observed were above 4.0 mg.L⁻¹, corresponding to the recommended standards for creating Nile romis niloticus). Spatial analysis at the bottom of the reservoir showed that the deeper stations have a lower concentration of DO. It was possible to group the analyzed stations into two groups in the surface analysis (CTN-20 and CTNs) and three groups in the bottom analysis (group A: CTN-20, CTN-24, and CTN-08, group B: CTN-23 and CTN-03, and group C: CTN-16). The seasonal analysis at the bottom showed lower DO availability in the rainy season. In the interannual analysis, cluster A deteriorated over the years concerning DO concentration.

Keywords: aquaculture, dissolved oxygen, tropical semi-arid, water quality.

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ALTERNATIVAS DE REÚSO DE ÁGUAS CINZAS APÓS TRATAMENTO QUÍMICO

ALTERNATIVES FOR REUSING GRAY WATER AFTER CHEMICAL TREATMENT

Ranyere do Nascimento Lôbo¹

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Recibido el 7 de diciembre de 2024. Aceptado el 23 de agosto de 2025

Abstract

The scarcity of water resources is an issue that is becoming increasingly worrying over time, reflecting the significant reduction in the volumes of water stored in reservoirs in various regions. The reuse of gray water is widely adopted in several countries as a sustainable alternative to reduce the demand for drinking water. However, the lack of adequate water quality standards or guidelines hinders the appropriate reuse of graywater. This research aims to simulate a graywater reuse project, derived from domestic processes such as dishwashing, laundry and bathing - excluding toilet waste. This research was carried out at the Laboratory for Innovation in Waste Utilization and Energy Sustainability (LARSEN) at the Federal Institute of Tocantins (IFTO) - Palmas Campus. The treatment used in this research was structured in two stages: (1) Coagulation, Flocculation and Decantation and (2) Filtration of the effluent from the coagulation system in a sand filter, followed by adsorption on activated carbon. To this end, coagulation tests were carried out with aluminium plichloride at a concentration of 1% in order to optimize the removal of turbidity from the liquid, and factorial planning was carried out using the Fractional Factorial Design (FFD) to verify turbidity removal. The factors studied were pH of the grey water, coagulant dosage, slow mixing time and sedimentation time. The characterization of the raw and treated greywater was carried out, showing the efficiency of removal of parameters such as COD (from 259.1 to 26 mg/L), Volatile Solids (from 487 to 20.3 mg/L), Suspended Solids (from 120 to not detected), Turbidity (from 126 to 0.1 uT) and E. coli (from 9.2 to not detected). With the results obtained, and based on the 1997 NBR 13969 standard, the treated effluent can be used for washing cars, floors and sidewalks, flushing toilets, as well as irrigating gardens, orchards, cereals and pastures.

Keywords: reuse, greywaters, chemical treatment, residual waters, environment.

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EVALUACIÓN DE LA PLANTA DE TRATAMIENTO DE AGUAS RESIDUALES EL GAVILÁN Y SU IMPACTO SOBRE LA PERCEPCIÓN DE OLORES DE LOS HABITANTES DE MANTA, PROVINCIA DE MANABÍ, ECUADOR

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EVALUATION OF THE EL GAVILÁN WASTEWATER TREATMENT PLANT AND ITS IMPACT ON THE ODOR PERCEPTION OF THE RESIDENTS OF MANTA, MANABÍ PROVINCE, ECUADOR

Recibido el 15 de enero de 2025. Aceptado el 26 de agosto de 2025

Abstract

The main objective of wastewater treatment plants (WWTP) is to contribute to the quality of life of the inhabitants by preserving the resource and the landscape. However, when these are poorly managed, they become urban stressors and affect the health of citizens. For this reason, it is desired to evaluate the impact of the El Gavilán WWTP on the adjacent population. To assess the impact, unstructured interviews and surveys were conducted with different sectors of society, in order to know the impact caused by the El Gavilán WWTP and their area of influence. It was determined that the El Gavilán WWTP is causing a negative impact on society, the main one being bad odors with a level 4 intensity and a generalized radius with a of more than 1 kilometer. Uncontrolled growth and the incorporation of industries into the drainage system, coupled with sewage system collapse due to garbage dumping, have caused complications in the management of the wastewater treatment plant, resulting in unpleasant odors and, consequently, a deterioration in the quality of life and health of residents. It is recommended that odor mitigation measures be incorporated.

Keywords: bad odors, quality life, unplanned growth

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PROJETO-PILOTO PARA ESTRUTURAÇÃO DA REDE MINEIRA DE LOGÍSTICA REVERSA

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Diego da Silva Marques ¹

PILOT PROJECT FOR STRUCTURING THE MINAS GERAIS' REVERSE LOGISTICS NETWORK

Recibido el 27 de enero de 2024. Aceptado el 5 de septiembre de 2025

Abstract

Reverse Logistics is defined in the National Solid Waste Policy (Law 12305/2010) as the "return of products after use by the consumer, independently of the public urban cleaning and solid waste management service" which must be carried out by manufacturers, importers, distributors and traders of packaging and pesticide residues; cells and batteries; tires; packaging and waste of lubricating oils; fluorescent, sodium and mercury vapor and mixed light lamps; and electronic products and their components. Minas Gerais is the fourth largest Brazilian state with the largest number of municipalities, characterized by its large size and population dispersion. Of the 853 municipalities in Minas Gerais, 80% are considered small municipalities, with a population of less than 25 thousand inhabitants, which are not regularly served by reverse logistics (IBGE, 2010). The Minas Gerais' Reverse Logistics Network is an initiative proposed for the development of a strategy for implementing reverse logistics in all municipalities, including small ones. A pilot project was developed in 17 municipalities, with the joint action of reverse logistics institutions in itinerant collection campaigns, with the centralization of waste to optimize collection and transportation logistics. This article presents the results of the surveys carried out to characterize the 42 tons of waste collected and the strategies employed for popular mobilization and participation, in order to provide information and consolidate a proposal for the implementation of Reverse Logistics in Minas Gerais, ensuring broad coverage of the state.

Keywords: Reverse Logistics, sustainability, solid waste, hazardous waste, Minas Gerais' network.

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UM ESTUDO DE CASO SOBRE A PERCEPÇÃO DE SERVIDORES EM UMA INSTITUIÇÃO PÚBLICA DA ÁREA DA SAÚDE ACERCA DE SUAS ATITUDES AMBIENTAIS

Ana Carolina Teles de Aquino ¹
Otávio Augusto Antunes Dias ²
Fabiana Cristina Lima Barbosa ²
Valdir Lamim-Guedes ³
* Marcos Paulo Gomes Mol ¹

A CASE STUDY ABOUT PERCEPTION OF EMPLOYEES IN A PUBLIC HEALTH INSTITUTION ABOUT THEIR ENVIRONMENTAL BEHAVIOR

Recibido el 14 de FEBRERO de 2025. Aceptado el 15 de septiembre de 2025

Abstract

The assessment of a group's environmental practices is fundamental for understanding the impact of Environmental Education (EE) on it. The present study diagnosed the self-declared perceptions of employees at a public health institution in Belo Horizonte regarding the internal EE Program. Using quantitative questionnaires and Principal Component Analysis in R software, variables such as recycling, waste segregation, conscious consumption, use of water and energy, motivation and satisfaction were analyzed. The results showed a greater perception of sustainable attitudes related to water, followed by energy and consumption, while selective collection was less prominent. Two correlation groups were identified: one with satisfaction, selective collection, segregation and consumption, and another with water and energy. The motivation was more associated with waste segregation. Identifying these specific insights can improve program performance, reinforcing the construction of an EA culture adapted to institutional needs.

Keywords: environmental education, perception study, public employees, awareness.

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Diógenes Antonio Hernandez Espinoza, Chile	Miriam de Fátima Carvalho Machado, Brasil
Edgar Omar Rueda Puente, México	Naiara Angelo Gomes, Brasil
Emanuel Júnior Silva Soares, Brasil	Neyson Martins Mendonça, Brasil
Erandi Amor Castillo Perez, México	Osvaldo Frutos, Paraguay
Eric Pascal Houbron, México	Quetzalcoatl Cruz Hernández Escobedo, México
Fabián Robles Martínez, México	Ranyere do Nascimento Lôbo, Brasil
Fábio Ribeiro de Oliveira, Brasil	Raphael Corrêa Medeiros, Brasil
Farith Gonzalez Martinez, Colombia	Renata Mendes Luna, Brasil
Fernando Carlos Raffo, Argentina	Ricardo Antonio Álvarez Carmona, Brasil
Franciane Andreza Veloso dos Santos Gonçalves, Brasil	Ricardo Ferreira Caros de Amorim, Brasil
Francisca Nara da Conceição Moreira, Brasil	Rinaldo dos Santos Araújo, Brasil
Francisco Humberto de Carvalho Junior, Brasil	Rodrigo Bordignon, Brasil
Francisco J. Cervantes, México	Rolando Chamy Maggi, Chile
Gabriella Laura Peixoto Botelho, Brasil	Rubén Hugo Ponce, Argentina
Girlene Figueiredo Maciel, Brasil,	Simone Rosa da Silva, Brasil
Giulliano Guimarães Silva, Brasil	Tasnim Chargui, Reino Unido
João José Hiluy Filho, Brasil	Valéria Cristina Palmeira Zago, Brasil
José Juan González Márquez, México	Virginia Montiel Corona, México
Juan Gabriel García Maldonado, México	