

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

<http://www.journals.unam.mx/index.php/aidis>

DOI: <http://dx.doi.org/10.22201/iingen.0718378xe.2025.18.1>

Vol. 18, No. 1
Abril 2025

ISSN 0718-378X

Editado por:





ISSN 0718-378X

REVISTA AIDIS

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

Temática y alcance

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.

Editor en Jefe

Dr. Germán Buitrón Méndez,
Instituto de Ingeniería, UNAM

Entidad editora

Instituto de Ingeniería, UNAM
Ciudad Universitaria, Coyoacán, México D.F., C.P. 04360
Teléfono: (52) (55) 56-23-36-00; Fax: (52) (55)
56-16-28-94

Información Legal

La Revista AIDIS de Ingeniería y Ciencias Ambientales: Investigación, desarrollo y práctica es una publicación electrónica cuatrimestral, editada en el Instituto de Ingeniería, UNAM.

Reservas de derechos al uso exclusivo:
04-2011-011413271800-203

ISSN

0718-378X

Coordinadora editorial y Secretaría técnica

Biól. Blanca P. Gamboa Rocha
Instituto de Ingeniería, UNAM, México

Administrador de la plataforma (OJS)

Biól. Blanca P. Gamboa Rocha
Instituto de Ingeniería, UNAM, México

Contacto

revista_aidis@pumas.iingen.unam.mx (Principal)
revista.aidis@gmail.com



ISSN 0718-378X

REVISTA AIDIS

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

Directorio

Junta editorial

Dra. Rosa María Ramírez Zamora

Directora del Instituto de Ingeniería, UNAM. México

Dr. Germán Buitrón Méndez

Editor en Jefe, Instituto de Ingeniería, UNAM. México

Dr. Rolando Chamy Maggi

Presidente de AIDIS. Chile

Consejo editorial

Dr. Adalberto Noyola Robles

Instituto de Ingeniería, UNAM, México.

Prof. André Bezerra dos Santos

Universidade Federal do Ceará, Brasil.

Prof. Cleverson V. Andreoli

Instituto Superior de Administração e Economia, FGV, Brasil.

Dr. Darci Campani

Universidade Federal do Rio Grande do Sul, Brasil.

Dr. David Jeison Núñez

Universidad de la Frontera, Chile.

Dr. Diógenes Hernández Espinoza

Universidad de Talca, Chile.

Dr. Eric Houbron

Universidad Veracruzana, México.

Prof. Eugenio Foresti

Universidade de São Paulo, Brasil.

Dra. Fabiana Passos

Universidade Federal de Minas Gerais, Brasil.

Dr. Francisco Cervantes Carrillo

Instituto de Ingeniería, UNAM, México.

Dra. Gabriela Moeller Chávez

Universidad Politécnica de Morelos, México.

Dr. Germán Buitrón Méndez

Instituto de Ingeniería, UNAM, México.

Dr. Iván Moreno Andrade

Instituto de Ingeniería, UNAM, México.

Prof. Léo Heller

Fundação Oswaldo Cruz, Brasil.

Dr. Manuel Salvador Rodríguez Susa

Universidad de los Andes, Bogotá, Colombia.

Dr. Marcel Szanto Narea

Pontificia Universidad Católica de Valparaíso, Chile.

Prof. Marcelo Zaiat

Escola de Engenharia de São Carlos, Brasil.

Dra. Mirna Argueta Iria

Servicio Autónomo Nacional de Acueductos y Alcantarillados, Honduras.

Dr. Quetzalcoatl Hernández Escobedo

Escuela Nacional de Estudios Superiores Juriquilla, UNAM, México.

Prof. Rafael Bastos

Universidade Federal de Viçosa, Brasil.

Dr. Raúl Muñoz

Universidad de Valladolid, España.

Dr. Rolando Chamy Maggi

Pontificia Universidad Católica de Valparaíso, Chile.

Dra. Sonia Arriaga

Instituto Potosino de Investigación Científica y Tecnológica, México.



Universidad Nacional
Autónoma de México

Portal de revistas
científicas y arbitradas
de la UNAM

Índice. Tabla de Contenido

Vol. 18, No. 1

Sección editorial. Información del número

Información legal y directorio

English abstracts

Artículos completos

1. **Perspectivas de conversão de óleo residual em fontes de energia: uma revisão bibliográfica narrativa sobre características, produção, pirólise e bio-óleo**
Perspectives on conversion of waste oil into energy sources: a narrative bibliographical review on characteristics, production, pyrolysis and bio-oil
Gabriela Aguiar Rezende, Marcelo Mendes Pedroza, Cláudia da Silva Aguiar Rezende, Germário Marcos Araújo, Joel Carlos Zukowski Junior 1-20
2. **Geoprocessamento aplicado na identificação de áreas para implantação de aterro sanitário no Município de Tucuruí – PA**
Geoprocessing applied in the identification of areas for implementation of sanitary landfill in the Municipality of Tucuruí – PA
Arthur Vilena Petronilio, Isabela de Aviz Lisboa, Thayson Assunção da Silva de Freitas, Raísa Rodrigues Neves 21-42
3. **Uso do diagrama de coagulação como ferramenta para o estudo da remoção de *Cryptosporidium* spp. E *Giardia* spp. Em água para abastecimento**
*Use of the coagulation diagrams as a tool for studying the removal of *Cryptosporidium* sp.p e *Giardia* spp. in public water supply*
Danielle Segóvia C. A. Pereira, Elizabeth R. Halfeld da Costa, Regina de Pinho Keller, Edumar Ramos 43-60
4. **Índices de vulnerabilidade hídrica georreferenciados: uma revisão sistemática**
Georeferenced water vulnerability indexes: a systematic review
Renan Rodrigues Campos da Silva, Jussara Ferreira-Santos, Celso Bandeira de Melo Ribeiro 61-77
5. **Simulación del comportamiento de PM_{2.5} como efecto de actividades no esenciales dentro de espacios con poca ventilación**
Simulation of PM_{2.5} behavior in low-ventilation spaces due to non-essential activities
José Antonio Martínez de Dios, Jesús Manuel Carrera Velueta, Elizabeth Magaña Villegas 78-93
6. **Uso de polímeros orgánicos a base de mucilago de tuna (*Opuntia ficus indica*) para la remoción de tensoactivos en aguas residuales domésticas**
*Use of organic polymers based on tuna mucilage (*Opuntia ficus indica*) for the removal of surfactants in domestic wastewater*
Anthony Jara, Diego Paredes, Carlos Enríquez 94-110

7. **Phosphate adsorption study employing a synthesized activated carbon derived from banana pseudostem**
Moisés de Souza Luz Faria, Rayra Millene Ribeiro Lima, Rita de Cássia Superbi de Sousa,
Alisson Carraro Borges 111-124
8. **Methane production from vivarium waste using ruminal fluid as inoculum**
Elvan Nascimento dos Santos Filho, Nadjane Leite dos Santos Telles,
Fernanda Santana Peiter, Eduardo Lucena Cavalcante de Amorim 125-137

REVISTA AIDIS

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

PERSPECTIVAS DE CONVERSÃO DE ÓLEO RESIDUAL EM FONTES DE ENERGIA: UMA REVISÃO BIBLIOGRÁFICA NARRATIVA SOBRE CARACTERÍSTICAS, PRODUÇÃO, PIROLÍSE E BIO-ÓLEO

Gabriela Aguiar Rezende ¹
*Marcelo Mendes Pedroza ²
Cláudia da Silva Aguiar Rezende ³
Germário Marcos Araújo ³
Joel Carlos Zukowski Junior ⁴

PERSPECTIVES ON CONVERSION OF WASTE OIL INTO ENERGY SOURCES: A NARRATIVE BIBLIOGRAPHICAL REVIEW ON CHARACTERISTICS, PRODUCTION, PYROLYSIS AND BIO-OIL

Recibido el 3 de febrero de 2024. Aceptado el 11 de octubre de 2024

Abstract

Seeking to reduce the environmental impacts caused by residual frying oil, various strategies are being investigated to convert this waste into a usable form of energy. The present work seeks to carry out a narrative bibliographic review on possibilities for converting waste oil into energy sources, emphasizing the study of its characteristics, production processes, the application of pyrolysis in this context and the subsequent use of bio-oil as a raw material renewable. For this study, the search keywords "residual frying oil", "pyrolysis" and "bio-oil" were used in search bases such as Science direct and google academic. The literature review offers a comprehensive and critical view of these topics, consolidating relevant information on the conversion of this waste into some type of energy source, from obtaining residual oil to the practical applications of bio-oil resulting from pyrolysis. Through this study and bibliographical survey, it is possible to verify the importance of correctly disposing of waste oil, in addition to the potential of the approaches discussed for the energy recovery of waste oil, as well as future directions for research in this promising field.

Keywords: sustainability, reuse, biofuel.

¹ Universidade Federal do Tocantins, Campus Palmas, Brasil.

² Instituto Federal de Ciência, Educação e Tecnologia do Tocantins, Brasil.

³ Departamento de Engenharia Hidráulica e Ambiental, Universidade Federal do Ceará, Brasil.

⁴ Programa de Pós-Graduação em Engenharia Ambiental, Universidade Federal do Tocantins, Brasil.

*Autor correspondente: Laboratório de Inovação em Aproveitamento de Resíduos Sustentabilidade Energética, Instituto Federal de Ciência, Educação e Tecnologia do Tocantins, Palmas –Tocantins, Brasil. 310 Sul, Av. LO 5, s/n -Plano Diretor Sul, Palmas –TO.

CEP: 77021-090.Email: mendes@iftto.edu.br

REVISTA AIDIS

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

GEOPROCESSAMENTO APLICADO NA IDENTIFICAÇÃO DE ÁREAS PARA IMPLANTAÇÃO DE ATERRO SANITÁRIO NO MUNICÍPIO DE TUCURUÍ – PA

Arthur Vilena Petronilio ¹

Isabela de Aviz Lisboa ¹

Thayson Assunção da Silva de Freitas ¹

* Raísa Rodrigues Neves ¹

GEOPROCESSING APPLIED IN THE IDENTIFICATION OF AREAS FOR IMPLEMENTATION OF SANITARY LANDFILL IN THE MUNICIPALITY OF TUCURUÍ – PA

Recibido el 6 de marzo de 2024. Aceptado el 11 de diciembre de 2024

Abstract

Although the municipality of Tucuruí is considered large, it still faces many challenges in meeting the mandatory National Solid Waste Policy related to the deactivation of the areas unsuitable for solid waste disposal and the implementation of a sanitary landfill, considered, in this Law, the environmentally appropriate form of disposal. This research was carried out to provide support to municipal managers regarding the selection of suitable areas for the installation of this project. In this sense, this work consisted of carrying out a selection of areas in the territory of the municipality of Tucuruí in the State of Pará, which are suitable, according to the criteria established in this research, for the implementation of a landfill project for urban solid waste. The methodology used was based on obtaining information through literature review, study of relief, topography, hydrology and proximity to the urban core, and data processing through geoprocessing programs, divided into two stages: surveys of potential areas for the implementation of the landfill in the municipality and evaluation of all areas within the zone of greatest potential, enabling the choice of the best area for the implementation of a sanitary landfill.

Keywords: geographic information system, urban solid waste, landfill.

¹ Faculdade de Engenharia Civil, Universidade Federal do Pará, Brasil.

*Autor correspondente: Universidade Federal do Pará, Brasil. Campus Universitário de Tucuruí – PA, Faculdade de Engenharia Civil, Rodovia BR 422 km 13 – Canteiro de Obras UHE - Vila Permanente, Tucuruí - PA, 68464-000. Email: raisaneves@ufpa.br

REVISTA AIDIS

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

USO DO DIAGRAMA DE COAGULAÇÃO COMO FERRAMENTA PARA O ESTUDO DA REMOÇÃO DE *Cryptosporidium* spp. E *Giardia* spp. EM ÁGUA PARA ABASTECIMENTO

* Danielle Segóvia C. A. Pereira ¹
Elizabeth R. Halfeld da Costa ²
Regina de Pinho Keller ³
Edumar Ramos Cabral Coelho ³

USE OF THE COAGULATION DIAGRAMS AS A TOOL FOR STUDYING THE REMOVAL OF *Cryptosporidium* spp. AND *Giardia* spp. IN PUBLIC WATER SUPPLY

Recibido el 11 de marzo de 2024. Aceptado el 14 de febrero de 2025

Abstract

Protozoa of the genera *Cryptosporidium* and *Giardia* are responsible for outbreaks of waterborne diseases, including in developed countries, which reveals the difficulty of their removal through the water treatment normally used. In Brazil, the most used water treatment technology is the complete cycle type, which consists of the sequential stages of coagulation, flocculation, decantation, filtration and disinfection. The study evaluated the removal of *Cryptosporidium* spp. oocysts and *Giardia* spp. cysts in waters from the Jucu River, a station that supplies a full cycle station, based on the coagulation diagram. The research consisted of physical-chemical and biological characterization using three types of water collected from the Jucu River. For each type of water, a coagulation diagram was constructed using aluminum sulfate as a coagulant in the scanning mechanism. To carry out studies with inoculum of *Cryptosporidium* and *Giardia* (oo) cysts, two points were strategically selected, determined by the "coagulant dosage x coagulation pH", one within the optimal scanning region and the other outside. The studies showed that in the optimal scanning region, the removal of turbidity from the decant walter was greater than 80% and that the recovery of *Cryptosporidium* and *Giardia* (oo) cysts in the sludge was greater than 70% and 40%, respectively. These results indicated that the removal of turbidity influenced the removal of these protozoa and that the construction of the coagulation diagram constitutes an important tool in the study of their removal in water treatment plants.

Keywords: coagulation diagram, *Cryptosporidium*, *Giardia*, public water supply.

¹ Laboratório de Dinâmica de Transmissão e Complexidade em Helminthiasis, Núcleo de Doenças Infecciosas, Universidade Federal do Espírito Santo, Brasil.

² Departamento de Ciência e Tecnologia Ambiental, Centro Federal de Educação Tecnológica de Minas Gerais, Brasil.

³ Departamento de Engenharia Ambiental, Universidade Federal do Espírito Santo, Brasil.

* Autor correspondente: Laboratório de Dinâmica de Transmissão e Complexidade em Helminthiasis, Núcleo de Doenças Infecciosas, CCS, Universidade Federal do Espírito Santo. Avenida Marechal Campos 1468, UFES-Campus de Maruípe, Térreo do Prédio do CCS, Núcleo de Doenças Infecciosas (NDI), 29043-910 Vitória ES. Email: daniscapbcp@gmail.com

REVISTA AIDIS

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

ÍNDICES DE VULNERABILIDADE HÍDRICA GEORREFERENCIADOS: UMA REVISÃO SISTEMÁTICA

Renan Rodrigues Campos da Silva ¹

Jussara Ferreira-Santos ¹

* Celso Bandeira de Melo Ribeiro ¹

GEOREFERENCED WATER VULNERABILITY INDEXES: A SYSTEMATIC REVIEW

Recibido el 13 de marzo de 2024. Aceptado el 11 de octubre de 2024

Abstract

The water resource is indispensable, used in almost all productive sectors, and linked to the metabolic maintenance of all living beings. However, due to climate change and population growth, the demand for this resource has indicated a substantial increase in overexploitation and worsening situations such as drought. Given this, water vulnerability indices emerge as a vanguard in global research, helping to understand the pressures exerted, and encouraging the creation of projects and strategies to overcome this problem. Therefore, it is essential to identify the main factors that actively contribute to this vulnerability typology, and the methodologies applied to quantify them. Given this, the main objective of this systematic review was to select and analyze studies related to georeferenced water vulnerability index systems at the river basin level, identifying the main factors that actively contribute to water vulnerability. The results showed, through the creation of bibliometric maps, a strong correlation between the chosen articles, highlighting keywords such as China, vulnerability, drought, and fuzzy mathematics. Furthermore, the presence of methodologies such as Fuzzy logic and Hierarchical Analysis of Fuzzy Processes (FAHP), and the use of natural and socioeconomic factors to calculate water vulnerability was notable.

Keywords: water resources, hydrographic basin, water vulnerability, geoprocessing, systematic review.

¹ Departamento de Engenharia Sanitária e Ambiental, Universidade Federal de Juiz de Fora, Brasil.

* Autor correspondente: Departamento de Engenharia Sanitária e Ambiental, Universidade Federal de Juiz de Fora. Rua José Lourenço Kelmer, s/n – Martelos, Juiz de Fora, Minas Gerais. 36036-330. Brasil. Email: celso.bandeira@ufjf.edu.br

REVISTA AIDIS

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

SIMULACIÓN DEL COMPORTAMIENTO DE $PM_{2.5}$ COMO EFECTO DE ACTIVIDADES NO ESENCIALES DENTRO DE ESPACIOS CON POCA VENTILACIÓN

* José Antonio Martínez de Dios ¹
Jesús Manuel Carrera Velueta ¹
Elizabeth Magaña Villegas ¹

SIMULATION OF $PM_{2.5}$ BEHAVIOR IN LOW-VENTILATION SPACES DUE TO NON-ESSENTIAL ACTIVITIES

Recibido el 23 de marzo de 2024. Aceptado el 11 de diciembre de 2024

Abstract

Indoor air quality has gained importance due to significant time people spend in these spaces unaware of the air they're exposed to. $PM_{2.5}$ is a major indoor pollutant. Thus, this study aimed to analyze $PM_{2.5}$ scenarios during activities like burning candles, incense, and mosquito coils, using mass balance models. Sparkler candles and spiral mosquito coils were the highest emission sources, with $PM_{2.5}$ emission factors up to 12,124 $\mu\text{g}/\text{sparkler candle}$ and 775 $\mu\text{g}/\text{min}$. Notably, a 30 m^3 room burning a mosquito coil for 53 minutes led to poor air quality for 116 minutes. Similarly, a 60 m^3 room with a sparkler candle generated poor air quality for 65 minutes. These findings reveal short-term emission sources can still compromise health due to high $PM_{2.5}$ concentrations. Wind speed and room dimensions also mattered. This research informs individuals to engage in these activities more health-consciously.

Keywords: emission rates, $PM_{2.5}$, indoor air quality.

¹ Universidad Juárez Autónoma de Tabasco, México.

*Autor correspondal: Calle/Av. Carlos Pellicer Cámara, 287, ISSET, 86270, Centro, Tabasco, México. Email: jose.amdd@gmail.com

REVISTA AIDIS

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

USO DE POLÍMEROS ORGÁNICOS A BASE DE MUCÍLAGO DE TUNA (*Opuntia ficus indica*) PARA LA REMOCIÓN DE TENSOACTIVOS EN AGUAS RESIDUALES DOMÉSTICAS

Anthony Jara ¹
Diego Paredes ¹
*Carlos Enríquez ¹

USE OF ORGANIC POLYMERS BASED ON TUNA MUCILAGE (*Opuntia ficus indica*) FOR THE REMOVAL OF SURFACTANTS IN DOMESTIC WASTEWATER

Recibido el 25 de marzo de 2024. Aceptado el 2 de octubre de 2024

Abstract

In this research an analysis was conducted on the removal of surfactants in domestic wastewater through the addition of an organic polymer derived from prickly pear cactus mucilage (*Opuntia ficus indica*). Surfactants are challenging contaminants to remove, as they alter the original characteristics of water bodies, leading to environmental imbalances. In this study, an organic polymer was created using cactus mucilage, and standard samples with specific concentrations of anionic surfactants were developed. Different doses of the organic polymer were applied to these samples to evaluate its efficacy in surfactant removal, using jar tests. This process allowed the determination of the optimal polymer dose for each surfactant concentration. The amount of surfactant removed was measured through the methylene blue active substances (MBAS) method, also known as the SAAM method, providing a quantitative evaluation of surfactant removal. Once the polymer's efficacy was confirmed, the process was replicated on domestic wastewater samples collected from the Katta Cassale residential complex in Quito to test its effectiveness in surfactant removal. Surfactant removal rates of over 90% were achieved in standard samples, and over 95% in domestic wastewater samples, enabling the treated samples to meet, in most cases, the limits established by Ecuador's current regulations. This research project is expected to pave the way for future studies in wastewater treatment using low-impact environmental compounds

Keywords: civil engineering, wastewater treatment, water quality, surfactants, polymer.

¹ Facultad de Ingeniería y Ciencias Aplicadas, Universidad Central del Ecuador, Ecuador.

* Autor correspondiente: Laboratorio de Ingeniería Sanitaria, Facultad de Ingeniería y Ciencias Aplicadas, Universidad Central del Ecuador. Av. America y Mercadillo, Ciudadela Universitaria, Quito, Ecuador. Email: cgenriquez@uce.edu.ec

REVISTA AIDIS

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

PHOSPHATE ADSORPTION STUDY EMPLOYING A SYNTHESIZED ACTIVATED CARBON DERIVED FROM BANANA PSEUDOSTEM

Moisés de Souza Luz Faria ¹
Rayra Millene Ribeiro Lima ¹
Rita de Cássia Superbi de Sousa ¹
* Alisson Carraro Borges ²

Recibido el 7 de junio de 2024. Aceptado el 11 de octubre de 2024

Abstract

In recent years, the application of biomass sources as precursors for various materials has been employed as an alternative for waste reuse. The banana pseudostem, being a lignocellulosic residue generated in huge quantities, has been studied for its reuse possibilities. The use of this biomaterial as a pyrolyzed and activated adsorbent compound is a promising application in wastewater treatment. Phosphorus (P), as a macronutrient, must have its concentration controlled in water bodies, as it contributes to the eutrophication process and causes environmental impact, demanding effective control of its release and removal in wastewater. Although some studies have already applied the banana pseudostem in wastewater treatment, its use for phosphorus removal is still scarce. Therefore, this work aimed to produce and characterize the banana pseudostem activated carbon (BPAC) under specific conditions at 600°C for 90 minutes, through chemical activation with zinc chloride at a ratio of 3:1. The results showed a surface area of 996 m² g⁻¹, and the kinetic and adsorption isotherm tests revealed an equilibrium time of 16 hours and a maximum P adsorption capacity of 11.82 mg L⁻¹, respectively. The pseudo-first order kinetics model were better fitted to experimental results, and for the isotherm at 18°C, the Langmuir was better fitted. The pH at the point of zero charge resulted in a value of 7.20, indicating that phosphorus adsorption is better favored below neutrality.

Keywords: biomass, isotherm, kinetics, zinc chloride, superficial area.

¹ Departamento de Química, Universidade Federal de Viçosa, Brasil.

² Departamento de Engenharia Agrícola, Universidade Federal de Viçosa, Brasil.

* Autor correspondal: Departamento de Engenharia Agrícola, Universidade Federal de Viçosa. Campus Universitário, Viçosa, Minas Gerais, 36570-900, Brasil. Email: borges@ufv.br

REVISTA AIDIS

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

METHANE PRODUCTION FROM VIVARIUM WASTE USING RUMINAL FLUID AS INOCULUM

Elvan Nascimento dos Santos Filho ¹

* Nadjane Leite dos Santos Telles ²

Fernanda Santana Peiter ²

Eduardo Lucena Cavalcante de Amorim ²

Recibido el 22 de agosto de 2024. Aceptado el 24 de enero de 2025

Abstract

This study aimed to evaluate the efficiency of anaerobic biodigesters in processing vivarium residues as substrates, using ruminal fluid as an inoculum for methane production and organic matter reduction, thereby mitigating the environmental impacts associated with the improper disposal of these wastes. The experiment utilized 2L Duran® flasks, operated in duplicate as batch reactors, fed with pine bedding (R1), corn cob bedding (R2), and sugarcane bedding (R3). The reactors were maintained under static conditions at approximately 37 °C. The highest accumulated methane production was observed in reactor R1, fed with pine bedding, yielding 12.56 L-CH₄, with a maximum daily production of 0.0067 L-CH₄/g-VS/d and a methane yield of 256 mL-CH₄/g-VS. In comparison, reactors R2 and R3 produced 5.24 L-CH₄ and 6.83 L-CH₄, with methane yields of 70 mL-CH₄/g-VS and 120 mL-CH₄/g-VS, respectively. Statistical analysis confirmed the superior performance of R1 (p-value < 0.05). Additionally, the consumption of volatile acids in R1, along with a final pH of 7.2, created favorable conditions for methanogenic microorganisms. In contrast, reactors R2 and R3 experienced medium acidification, which likely inhibited methane production. These findings demonstrate that waste generated at laboratory animal breeding facilities holds potential as a substrate for methane production when processed using anaerobic digestion technologies.

Keywords: cage bedding waste, batch reactor, waste treatment, environment pollution.

¹ Vivarium, Federal University of Alagoas, Maceió, Brasil.

² Tecnology Center, Federal University of Alagoas, Maceió, Brasil.

* Autor correspondiente: Laboratório de Saneamento Ambiental (LSA), Av. Lourival Melo Mota, S/N, Tabuleiro do Martins, Maceió - AL, Cep: 57072-970. Email: nadjane.santos@ctec.ufal.br