

REVISTA AIDIS



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

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

DOI: <http://dx.doi.org/10.22201/iingen.0718378xe.2019.12.2>

Vol. 12, No. 2
6 de agosto de 2019

ISSN 0718-378X

Editado por:



Autor: Thales Bruno Rodrigues Lima

Foto: Produção de agregados reciclados. Usina de Reciclagem de Resíduos Sólidos Inertes (USIFORT) - Cidade de Fortaleza/Ceará, Brasil



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 de la revista

Dr. Germán Buitrón Méndez
Investigador Instituto de Ingeniería-UNAM

ISSN

0718-378X

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

Coordinadora editorial y Secretaría técnica

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

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.

Administrador de la plataforma (OJS)

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

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

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

Dr. Germán Buitrón Méndez
Editor en jefe

MSc. Ing. Nery Martín Méndez y Méndez
Presidente de AIDIS

Dr. Luis A. Álvarez Icaza Longoria
Director del Instituto de Ingeniería, UNAM

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,
ISAE/FGV, Brasil.

Dr. Darci Campani
Universidade Federal do Rio Grande do Sul, Brasil.

Dr. David Jeison Núñez
Universidad de la Frontera, Chile.

Dr. Eric Houbron
Universidad Veracruzana, México.

Prof. Eugenio Foresti
Universidade de São Paulo, Brasil.

Dr. Francisco Cervantes Carrillo
Instituto Potosino de Investigación Científica y
Tecnológica, México

Dra. Gabriela Moeller Chávez
Universidad Politécnica de Morelos

Dr. Germán Buitrón Méndez
Instituto de Ingeniería, UNAM, México

Prof. Leo Heller
Universidade Federal de Minas Gerais, Brasil.

Dr. Manuel Salvador Rodríguez Susa
Facultad de Ingeniería,
Universidad de los Andes, Bogotá, Colombia.

Dr. Marcel Szanto Narea
Pontificia Universidad Católica de Valparaíso,
Chile.

Prof. Marcelo Zaiat
Escola de Engenharia de Sao Carlos, Brasil.

Prof. Marcos von Sperling
Universidade Federal de Minas Gerais, Brasil.

Dra. Mirna Argueta Iria
Servicio Autónomo Nacional de Acueductos y
Alcantarillados, Honduras.

Prof. Rafael Bastos
Universidade Federal de Visosa, Brasil.

Dr. Rolando Chamy Maggi
Universidad Católica de Valparaíso, Chile.



Universidad Nacional
Autónoma de México

Portal de revistas
científicas y arbitradas
de la UNAM

Tabla de Contenido

Vol. 12, No 2

O GERENCIAMENTO DE RESÍDUOS DA CONSTRUÇÃO CIVIL ORIUNDOS DA ARQUITETURA DE INTERIORES NA ÓTICA DE ARQUITETOS E URBANISTAS DE UM MUNICÍPIO BRASILEIRO <i>THE MANAGEMENT OF CONSTRUCTION AND DEMOLITION WASTE FROM INTERIOR ARCHITECTURE IN THE VIEW OF THE ARCHITECTS AND URBAN PLANNERS FROM A BRAZILIAN CITY</i> Nadime Saraiva Rissi, Juliano Rodrigues Gimenez, Vania Elisabete Schneider	181 - 194
APLICACIÓN DEL PROCESO DE ANÁLISIS JERÁRQUICO PARA LA UBICACIÓN DE SITIOS DE DISPOSICIÓN FINAL DE RESIDUOS DE LA CONSTRUCCIÓN Y DEMOLICIÓN: CASO ESTUDIO CIUDAD DE MÉXICO <i>APPLICATION OF THE ANALYTIC HIERARCHY PROCESS FOR THE LOCATION OF CONSTRUCTION AND DEMOLITION WASTES DISPOSAL SITES: CASE STUDY OF MEXICO CITY</i> Eduardo Hernández Malva, Juan Pablo Moreno Ordaz, Constantino Gutiérrez Palacios	195 - 208
RENDIMIENTO DE UN REACTOR AEROBIO DE LECHO FLUIDIZADO CON TERCERA CÁMARA EN LA REMOCIÓN DE NITRÓGENO <i>PERFORMANCE OF A BIOFILM AIRLIFT SUSPENSION REACTOR WITH THIRD CHAMBER IN NITROGEN REMOVAL</i> Paula Andrea Montenegro Chaucanes, Tsunao Matsumoto, Milton Dall’Aglío Sobrinho	209 - 217
EFEITO DA TAXA DE APLICAÇÃO SUPERFICIAL NA REMOÇÃO DE MATÉRIA ORGÂNICA EM FILTROS DE AREIA <i>EFFECT OF RATE OF SURFACE APPLICATION ON THE REMOVAL OF ORGANIC MATTER IN SAND FILTERS</i> Robson Arruda dos Santos, Gilson Barbosa Athayde Junior, Natália de Souza Guedes	218 - 233
APRIMORAMENTO DA QUALIDADE DE EFLUENTE DE REATORES ANAERÓBIOS POR COAGULAÇÃO COM TANINO VEGETAL <i>IMPROVEMENT OF ANAEROBIC REACTORS EFFLUENT QUALITY BY COAGULATION USING TANNIN COAGULANT</i> Mirelly Manica, Carlos Magno de Sousa Vidal, Jeanette Beber de Souza, Daniel Bartiko, Ludmila Carvalho Neves, Ana Cé	234 - 248
A PERCEPÇÃO DO SANEAMENTO NA ILHA MAMANGAL, MUNICÍPIO DE IGARAPÉ – MIRI, PARÁ <i>THE SANITATION OF PERCEPTION ON THE ISLAND MAMANGAL, IGARAPÉ - MIRI, PARÁ</i> Francisca Nara da Conceição Moreira, Márcia Valéria Porto de Oliveira Cunha, Adiel José Passos da Cunha Júnior	249 - 265
DIAGRAMA DE PARETO E RISCO FUZZY NA AVALIAÇÃO DE EFLUENTE DE LAGOAS DE ESTABILIZAÇÃO <i>PARETO DIAGRAM AND FUZZY RISK IN THE EVALUATION OF EFFLUENT OF STABILIZATION PONDS</i> João Igor da Rocha Leitão, Fernando José Araújo da Silva, Valquíria Melo Souza Correia, João Roberto Façanha de Almeida, André Luís Calado Araújo	266 - 279

- CARACTERIZAÇÃO PLUVIOMÉTRICA DA BACIA HIDROGRÁFICA DO RIO NEGRO EM TERRITÓRIO BRASILEIRO** 280 - 294
RAINFALL CHARACTERIZATION OF THE NEGRO RIVER BASIN IN BRAZILIAN TERRITORY
Raisa Rodrigues Neves, Edkeyse Dias Gonçalves, Jairo dos Passos Correa, Francisco Carlos Lira Pessoa, Lindemberg Lima Fernandes
- ESTUDO DO REGIME PLUVIOMÉTRICO DA MICRORREGIÃO DO SALGADO NO ESTADO DO PARÁ** 295 - 312
PLUVIOMETRIC REGIME STUDY OF THE SALGADO MICRO-REGION IN THE STATE OF PARÁ
Ana Beatriz Bastos Gomes, Lindemberg Lima Fernandes
- PROPUESTA DE METODOLOGÍA PARA LA ELABORACIÓN DE UN MAPA DE ORDENACIÓN MINERO AMBIENTAL** 313 - 327
PROPOSAL OF METHODOLOGY FOR THE DEVELOPMENT OF A MAP OF ENVIRONMENTAL MINING ORDINATION
Adrián Hernández Zúñiga, Francisco Estrada Godoy, Rodrigo Mondragón Guzmán, José María Ramos Rodríguez
- EFEITO DA ENTRADA E DA RAZÃO PROFUNDIDADE/DIÂMETRO NA QUALIDADE DA ÁGUA EM RESERVATÓRIOS DE SISTEMAS DE ÁGUA** 328 - 338
EFFECT OF THE INLET AND THE DEPTH-TO-DIAMETER RATIO UPON THE WATER QUALITY OF STORAGE TANKS OF WATER SYSTEMS
Harrison Cesar de Souza Coltre, Johannes Gerson Janzen
- AVALIAÇÃO AMBIENTAL DE UNIDADE DE PEQUENO PORTE DE RECICLAGEM DE RESÍDUOS DE CONSTRUÇÃO CIVIL** 339 - 352
ENVIRONMENTAL PERFORMANCE OF A SMALL SCALE CONSTRUCTION AND DEMOLITION WASTE RECYCLING FACILITY
Laís Carlos Boaventura Santos, Luciano Matos Queiroz, Viviana Maria Zanta
- AVALIAÇÃO HIDRODINÂMICA DE UM WETLAND CONSTRUÍDO DE FLUXO HORIZONTAL** 353 - 369
HYDRODYNAMIC EVALUATION OF A HORIZONTAL FLOW CONSTRUCTED WETLAND
Monique Nunes de Freitas, Catiane Pelissari, Benny Zuse Rousso, Víctor Ybarzo Fechinie, Mayara Oliveira dos Santos, Pablo Heleno Sezerino
- O IMPACTO DA COLETA SELETIVA NOS CUSTOS DOS SERVIÇOS DE COLETA DOS RESÍDUOS SÓLIDOS DA REGIÃO NORTE DO BRASIL** 370 - 382
THE IMPACT OF SELECTED COLLECTION ON THE COSTS OF SOLID WASTE COLLECTION SERVICES IN THE NORTHERN REGION OF BRAZIL
Laila Rover Santana, Roberto dos Santos Correa, Laila Rebeca da Silva Nunes, Luiza Girard Teixeira

REVISTA AIDIS

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

O GERENCIAMENTO DE RESÍDUOS DA CONSTRUÇÃO CIVIL ORIUNDOS DA ARQUITETURA DE INTERIORES NA ÓTICA DE ARQUITETOS E URBANISTAS DE UM MUNICÍPIO BRASILEIRO

*Nadime Saraiva Rissi¹
Juliano Rodrigues Gimenez¹
*Vania Elisabete Schneider²

THE MANAGEMENT OF CONSTRUCTION AND DEMOLITION WASTE FROM INTERIOR ARCHITECTURE IN THE VIEW OF THE ARCHITECTS AND URBAN PLANNERS FROM A BRAZILIAN CITY

Recibido el 14 de julio de 2017; Aceptado el 21 de mayo de 2019

Abstract

The rapid urbanization and intensification of medium and large-size cities has been contributed to the increase of Construction and Demolition Waste (CDW) in Brazilian cities. This issue is not only rising due to the large amount of waste produced by cities, but also for the imprudence or lack of knowledge by professionals responsible for monitoring the construction works. This irregular disposal is one of the reasons for the environmental degradation with well-recognized potential to affect the population's quality of life and endanger the natural resources and ecosystems. This study aims to investigate how wastes are being managed by professional working with interior architecture in a city located at south of Brazil. The method used to achieve the qualitative and quantitative data was the development of surveys. Hence, was performed an in-depth interview and, subsequently, was developed a survey research to a sample of architects and urban planners. The findings suggest that professionals recognize the importance of the environment to the well-being of society as a whole and adopt practices on behalf of the environment in their personal life, however, they lack understanding of the management, administration and legal responsibilities related to the CDW.

Keywords: *construction and demolition waste, interior architecture, waste management.*

¹ Programa de Pós-Graduação em Engenharia e Ciências Ambientais, Universidade de Caxias do Sul, Brasil

² Instituto de Saneamento Ambiental (ISAM), Universidade de Caxias do Sul, Brasil.

*Autor correspondente: PPGE CAM - Programa de Pós-graduação em Engenharia e Ciências Ambientais - Universidade de Caxias do Sul - Rua Francisco Getúlio Vargas, 1130 CEP 95070-560 - Caxias do Sul. Email: nadikoff@hotmail.com

REVISTA AIDIS

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

APLICACIÓN DEL PROCESO DE ANÁLISIS JERÁRQUICO PARA LA UBICACIÓN DE SITIOS DE DISPOSICIÓN FINAL DE RESIDUOS DE LA CONSTRUCCIÓN Y DEMOLICIÓN: CASO ESTUDIO CIUDAD DE MÉXICO

Eduardo Hernández Malva¹
Juan Pablo Moreno Ordaz¹
*Constantino Gutiérrez Palacios¹

APPLICATION OF THE ANALYTIC HIERARCHY PROCESS FOR THE LOCATION OF CONSTRUCTION AND DEMOLITION WASTES DISPOSAL SITES: CASE STUDY OF MEXICO CITY

Recibido el 8 de septiembre de 2017; Aceptado el 14 de marzo de 2018

Abstract

The search for final disposal sites (FDS) for Construction and Demolition Waste (C&DW) in Mexico City has been complicated by the scarcity of this type of infrastructure. In order to define a methodology for its location, this work focuses on the evaluation of 12 sites in Mexico City, located at South and East of the city. Some of these sites are located within Protected Natural Areas (PNA), and an evaluation was necessary to compare them with those located outside these areas. The Analytical Hierarchy Process technique was used for the classification of the lands, which was based on variables chosen by an interdisciplinary panel of experts, divided into three criteria: environmental, technical and socioeconomic. The analysis resulted in four feasible sites: one is located in the Tlalpan delegation and the rest in the Tláhuac delegation. Subsequent to the definition of the best qualified lands, a second analysis was carried out, based on additional characteristics of the sites, such as the proximity to the generation sources of C&DW, ease of access, their area, among others. The best evaluated site was in Tláhuac delegation, next to the road Eje 10 Sur to Santa Catarina, near the limits with the State of Mexico, and it has an area of 213 ha.

Keywords: analytical hierarchy process, construction and demolition waste, final disposal site.

¹ División de Ingeniería Civil y Geomática, Facultad de Ingeniería, Universidad Nacional Autónoma de México (UNAM), México.

*Autor correspondiente: División de Ingeniería Civil y Geomática, Facultad de Ingeniería, Universidad Nacional Autónoma de México. Av. Universidad No. 3000, Ciudad Universitaria, México CDMX. CP 04510. México. Email: cgping@yahoo.com

REVISTA AIDIS

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

RENDIMIENTO DE UN REACTOR AEROBIO DE LECHO FLUIDIZADO CON TERCERA CÁMARA EN LA REMOCIÓN DE NITRÓGENO

*Paula Andrea Montenegro Chaucanes'
Tsunao Matsumoto'
Milton Dall'Aglio Sobrinho'

PERFORMANCE OF A BIOFILM AIRLIFT SUSPENSION REACTOR WITH THIRD CHAMBER IN NITROGEN REMOVAL

Recibido el 20 de septiembre de 2017; Aceptado el 16 de octubre de 2018

Abstract

This paper shows the operation of a Biofilm Airlift Suspension – BAS reactor, with concentric pipes adding a third chamber (an additional concentric pipe), to generate two reaction zones, an aerobic zone for the chambers 1 and 2, the chamber 1 being fully aerobic by the action of the gas injector, and the chamber 2 moderately aerobic by the action of recirculating air bubbles; and an anoxic zone for the chamber 3, due to the non-recirculation of air bubbles towards this chamber. This configuration is intended of facilitate the process of nitrification and denitrification. The results obtained to removal COD were $3.69 \pm 1.44 \text{ Kg COD m}^{-3}\text{d}^{-1}$ with a removal efficiency of $80.5 \pm 9.6\%$, and an average total nitrogen removal of $0.18 \pm 0.07 \text{ kg N m}^{-3} \text{ d}^{-1}$, with a removal efficiency of $42.27 \pm 17\%$, with a HRT of 3 hours and the application of two flow rates.

Keywords: nitrification, denitrification, biofilm airlift suspension reactor, simultaneous nitrification denitrification.

¹Departamento de Ingeniería Civil, Universidade Estadual Paulista “Júlio de Mesquita Filho”, Campus Ilha Solteira, Brasil.

*Autor correspondente: Departamento de Ingeniería Civil, Universidade Estadual Paulista “Júlio de Mesquita Filho”, Campus Ilha Solteira, Brasil. Email: paula_andrea_mon@hotmail.com

REVISTA AIDIS

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

EFEITO DA TAXA DE APLICAÇÃO SUPERFICIAL NA REMOÇÃO DE MATÉRIA ORGÂNICA EM FILTROS DE AREIA

*Robson Arruda dos Santos¹
Gilson Barbosa Athayde Junior¹
Natália de Souza Guedes¹

EFFECT OF RATE OF SURFACE APPLICATION ON THE REMOVAL OF ORGANIC MATTER IN SAND FILTERS

Recibido el 21 de septiembre de 2017; Aceptado el 16 de octubre de 2018

Abstract

This research consists of a study of the rate of surface application for sand filter sizing, with septic tank effluents and anaerobic filter. We evaluated the effect of rate of application in the removal of organic matter by sand filters as well as the relevance of the anaerobic filter interposed between the septic tank and the sand filter. The research was conducted on two wastewater treatment systems, both mounted in the University Residence of UFPB: (1) Septic Tank + Anaerobic Filter + Sand Filter and (2) Septic Tank + Sand Filter, in order to get the rate of surface application to be adopted in projects for the conditions of the study area (northeastern Brazil), for both options. The rates of application were analyzed in values of 200, 300, 500 and 600 L/m².d. Analyses of BOD₅, COD and NO₃ were held in Pastel UV equipment. The results of this research show the feasibility of using sand filters in an individual treatment system of sewage, whether for residential units, condominiums or small communities, since the high efficiency values reached on the removal of organic matter. It was obtained a good performance on the nitrification of effluents from the septic tank and the anaerobic filter in the sand filters. Finally, with the analysis of the behavior of the filters results to changes in the applied rates, it reached an "excellent" value of 300 L / m².d, for both systems studied.

Keywords: sewage treatment, sand filter, rate of surface application.

¹ Departamento de Engenharia Civil e Ambiental, Universidade Federal da Paraíba, Brasil.

*Autor correspondente: Programa de Pós-Graduação em Engenharia Civil e Ambiental, Universidade Federal da Paraíba – UFPB. Cidade Universitária, s/n, João Pessoa, Paraíba. CEP: 58051-900, Brasil. Email: robson.santos@ifpb.edu.br

REVISTA AIDIS

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

APRIMORAMENTO DA QUALIDADE DE EFLUENTE DE REATORES ANAERÓBIOS POR COAGULAÇÃO COM TANINO VEGETAL

IMPROVEMENT OF ANAEROBIC REACTORS EFFLUENT QUALITY BY COAGULATION USING TANNIN COAGULANT

Recibido el 8 de octubre de 2017; Aceptado el 21 de marzo de 2018

Abstract

*Upflow anaerobic sludge blanket (UASB) reactors present low efficiency regarding to the removal of nutrients, organic matter and pathogenic microorganisms. Therefore, it is necessary to use a post-treatment to improve the quality of the final effluent. In this respect, it was collected UASB reactor effluent samples for performing coagulation/flocculation/sedimentation tests on a bench scale (jar-test) using a natural tannin-based coagulant. It also investigated the potential of a subsequent rapid filtration through sand filters. The operating conditions used in the tests were: coagulation velocity gradient of 600s^{-1} and rapid mixing time equal to 10 seconds; flocculation velocity gradient of 40s^{-1} and slow mixing time equal to 15 minutes; it was tested three settling velocities, which was 0.6 ; 0.3 e $0.2\text{ cm}\cdot\text{min}^{-1}$, and coagulant dosages ranging from 10.0 to $50.0\text{ mg}\cdot\text{L}^{-1}$. The analysis of variance and Tukey's multiple comparison test resulted in the optimum coagulant dosage of $15\text{ mg}\cdot\text{L}^{-1}$ and the settling velocity of $0.6\text{ cm}\cdot\text{min}^{-1}$, which showed good results in terms of turbidity, apparent color, true color and COD of the effluent from UASB. It was not observed removal of total phosphorus in the studied effluent. Concerning to the removal of pathogenic microorganisms, it was achieved a 95.4 % removal efficiency for total coliforms (TC) and *E. Coli*. The Student's t-test showed that the use of sand filters was potentially viable for the removal of turbidity, apparent color and *E. Coli*.*

Keywords: coagulation, natural coagulant, sand filtration, UASB, wastewater.

¹ Departamento de Engenharia Ambiental, Universidade Estadual do Centro-Oeste, Brasil.

² Departamento de Engenharia Sanitária e Ambiental, Universidade Federal de Santa Catarina, Brasil.

³ Departamento de Ciências Florestais, Universidade Estadual do Centro-Oeste, Brasil.

⁴ Departamento de Engenharia Ambiental, Universidade Tecnológica Federal do Paraná, Brasil.

*Autor correspondente: Departamento de Engenharia Ambiental, Universidade Estadual do Centro-Oeste, PR 153, Km 7, s/n – Riozinho, Irati, Paraná. 84500000. Brasil. Email: mirellymanica@hotmail.com

REVISTA AIDIS

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

**A PERCEÇÃO DO SANEAMENTO NA ILHA
MAMANGAL, MUNICÍPIO DE IGARAPÉ – MIRI,
PARÁ**

**Francisca Nara da Conceição Moreira'
Márcia Valéria Porto de Oliveira Cunha'
Adiel José Passos da Cunha Júnior'*

**THE SANITATION OF PERCEPTION ON THE ISLAND
MAMANGAL, IGARAPÉ - MIRI, PARÁ**

Recibido el 8 de octubre de 2017; Aceptado el 21 de agosto de 2018

Abstract

This paper aims to analyse the Mamangal Island population's perception of sanitation access, in the Igarape Miri district. A semi-structured interview was carried out on 215 households along five communities on the Mamangal Island to establish the population profile and the local sanitation condition. The observations during the interviews revealed the lack of access of sanitation facilities on the island. Despite the low education level, all the interviewees could identify problems caused by lack of sanitation and its impact on public health. Therefore, this paper recommended improvement actions that should be undertaken by the local government at those communities. The local communities were provided with the findings of this research for referral at future sanitation facilities improvement deliberations.

Keywords: *water supply, sewage system, solid waste, public health.*

¹ Instituto Federal de Educação, Ciência e Tecnologia do Pará, (IFPA) Brasil.

**Autor correspondente:* Divisão de Saneamento Ambiental, Instituto Federal de Educação, Ciência e Tecnologia do Pará, (IFPA), Belém, Pará, Av. Alm. Barroso, 115, Marco. CEP: 66093-020, Brasil. Email: namoreira2012@gmail.com



REVISTA AIDIS

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

DIAGRAMA DE PARETO E RISCO FUZZY NA AVALIAÇÃO DE EFLUENTE DE LAGOAS DE ESTABILIZAÇÃO

*João Igor da Rocha Leitão¹
Fernando José Araújo da Silva¹
Valquíria Melo Souza Correia¹
João Roberto Façanha de Almeida²
André Luís Calado Araújo³

PARETO DIAGRAM AND FUZZY RISK IN THE EVALUATION OF EFFLUENT OF STABILIZATION PONDS

Recibido el 9 de octubre de 2017; Aceptado el 21 de marzo de 2018

Abstract

The evaluation of the performance of sewage treatment plants and the quality of effluent discharged is fundamental to the management of environmental quality. Limitations of means such as financial, technical, intellectual and even logistics restrict the monitoring programs. This study proposes the application of the Pareto diagram and the fuzzy risk concept for evaluating the performance of sewage treatment systems and the compliance to environmental standards for effluent disposal. This approach was applied to monitoring data from full-scale stabilization pond series, which is one of the most widespread treatment technologies in Brazil. The results show that the effluent from pond systems require post-treatment and both Pareto diagram and the fuzzy risk approach are effective for the evaluation and management control of effluent disposal.

Keywords: environmental quality, performance of treatment plants, effluent monitoring.

¹ Departamento de Engenharia Hidráulica e Ambiental (DEHA) da Universidade Federal do Ceará, Fortaleza, Brasil.

² Instituto Federal de Ciência e Tecnologia do Ceará (IFCE), Fortaleza, Brasil.

³ Instituto Federal de Ciência e Tecnologia do Rio Grande do Norte (IFRN), Mossoró, Brasil

Autor correspondente: Departamento de Engenharia Hidráulica e Ambiental, DEHA. Av. Mister Hull, s/n, Pici, Fortaleza, Ceará, CEP 60455-760. Brasil. Email: i_leitao@hotmail.com



REVISTA AIDIS

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

CARACTERIZAÇÃO PLUVIOMÉTRICA DA BACIA HIDROGRÁFICA DO RIO NEGRO EM TERRITÓRIO BRASILEIRO

*Raisa Rodrigues Neves'
Edkeyse Dias Gonçalves'
Jairo dos Passos Correa'
Francisco Carlos Lira Pessoa'
Lindemberg Lima Fernandes'

RAINFALL CHARACTERIZATION OF THE NEGRO RIVER BASIN IN BRAZILIAN TERRITORY

Recibido el 10 de octubre de 2017; Aceptado el 21 de marzo de 2018

Abstract

The rainfall characterization of the Negro River basin was done by using of 31 years of pluviometric data (1984-2014). To obtain this data, information from HidroWeb and from the software ArcGis 10.1 were utilized. After the acquisition of this information, isohyetal maps were drawn by the interpolator of Linear Ordinary Kriging, which made possible to calculate water blades and precipitate volume in the area. The temporal variation of the rainfall was analyzed annually, being possible to verify that the El Niño–Southern Oscillation (ENSO) phenomenon is related to the rainfall behavior of the basin studied, occurring an increase of rainfall index in years of La Niña and decrease in years of El Niño. To the trend analysis in time series, Mann-Kendall and Spearman tests were used to the 31 years of data, considering a level of significance of 5%, in which the absence of tendency or low rainfall variability were noticed.

Keywords: river basin, rainfall characterization, ENSO phenomenon.

¹ Programa de Pós-Graduação em Engenharia Civil, Universidade Federal do Pará (UFPA), Campus Belém, Brasil.

*Autor correspondente: Laboratorio de Ingeniería Sanitaria y Ambiental (LAESA), Universidad Federal de Pará. Calle Augusto Corrêa, 01, Guamá, Campus Belém. Belém, Pará, Brasil. CEP 66075-110. Email: raisanevesufpa@gmail.com



REVISTA AIDIS

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

ESTUDO DO REGIME PLUVIOMÉTRICO DA MICRORREGIÃO DO SALGADO NO ESTADO DO PARÁ

*Ana Beatriz Bastos Gomes¹
Lindemberg Lima Fernandes¹

PLUVIOMETRIC REGIME STUDY OF THE SALGADO MICRO-REGION IN THE STATE OF PARÁ

Recibido el 10 de octubre de 2017; Aceptado el 21 de marzo de 2018

Abstract

The present study aims to analyze pluviometric regime of the Salgado Paraense Micro-region statistically, with an emphasis on the homogeneous clusters analysis of the monthly pluviometric behavior, as well as verify trends and influences of the El Niño South Oscillation (ENSO) and Atlantic Dipole climatic phenomena in the dynamics rainfall from the locality. Was used data of six pluviometric stations from this region during 1978 to 2016, which was submitted statistical tests like as Ward's hierarchical grouping method to define of stations and similar monthly precipitation periods, Kolmogorov-Smirnov and Shapiro-Wilk tests to verify series normality, and tests of Mann-Kendall and Spearman's Correlation Coefficient for trends identification. The three-order moving average technique was applied to determine the dry and wet periods of the series, which were correlated with the occurrence years of the ENOS and Dipole Atlantic climatic phenomena. According to the analyzes results, can be defined statistically three homogenous stations groups and monthly precipitation periods, the series follows a normal distribution and none significative trend was detected. Can be inferred that climatic phenomena have an influence on the Salgado Micro-region rainfall behavior.

Keywords: climatic phenomena, precipitation, statistics tests, Salgado Paraense.

¹ Faculdade de Engenharia Sanitária e Ambiental, Universidade Federal do Pará (UFPA), Campus Belém, Brasil.

*Autor correspondente: Laboratorio de Ingeniería Sanitaria y Ambiental (LAESA), Universidad Federal de Pará. Calle Augusto Corrêa, 01, Guamá, Campus Belém, Belém, Pará. CEP 66075-110. Brasil. Email: abeatrizbgomes@gmail.com

REVISTA AIDIS

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

PROPUESTA DE METODOLOGÍA PARA LA ELABORACIÓN DE UN MAPA DE ORDENACIÓN MINERO AMBIENTAL

*Adrián Hernández Zúñiga¹
Francisco Estrada Godoy²
Rodrigo Mondragón Guzmán²
José María Ramos Rodríguez^{1,2}

PROPOSAL OF METHODOLOGY FOR THE DEVELOPMENT OF A MAP OF ENVIRONMENTAL MINING ORDINATION

Recibido el 12 de octubre de 2017; Aceptado el 3 de mayo de 2018

Abstract

The Methodology is proposed for the development of small projects that are in the planning or reactivation phase. The method can also serve as a tool in the preliminary selection of sites to expand new activities in active mining operations. The methodology seeks to propose solutions for the categorization and microzonification of mining lots, for the optimal planning and design of mining projects, based on geomorphological, hydrogeological criteria and with the conservation of vegetation. Taking as one of the main bases of the analysis of the environmental parameters through the Hierarchical Analytical Process (AHP). The sum of the established parameters, is oriented to generate the Map of Mining-Environmental Management. Arranz González (2008) conceives of this map, as the fundamental cartographic tool for the integration of mining activities in territorial planning, representing a zoning of the territory according to the feasibility of exploitation according to minimum and environmental criteria.

Keywords: *geographic information system, map of environmental mining, mining-environmental units, policies and criteria for ecological regulation.*

¹ Geohidrología y Geología Ambiental, Servicio Geológico Mexicano, México.

² Escuela Superior de ingeniería y Arquitectura, Ciencias de la Tierra, Unidad Ticoman, Instituto Politécnico Nacional, México.

³ Instituto Federal de Ciência e Tecnologia do Rio Grande do Norte (IFRN), Mossoró, Brasil

Autor correspondencia: Gerencia de Geohidrología y Geología Ambiental, Servicio Geológico Mexicano. Boulevard Felipe Ángeles Km. 93.50-4, Col. Venta Prieta, Pachuca, Hidalgo, C. P.: 42083, México. Teléfono: 01 771 711 0845, Ext. 1216. Email: adrianhernandez@sgm.gob.mx



REVISTA AIDIS

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

EFEITO DA ENTRADA E DA RAZÃO PROFUNDIDADE/DIÂMETRO NA QUALIDADE DA ÁGUA EM RESERVATÓRIOS DE SISTEMAS DE ÁGUA

Harrison Cesar de Souza Coltre¹

*Johannes Gerson Janzen²

EFFECT OF THE INLET AND THE DEPTH-TO-DIAMETER RATIO UPON THE WATER QUALITY OF STORAGE TANKS OF WATER SYSTEMS

Recibido el 14 de octubre de 2017; Aceptado el 16 de octubre de 2018

Abstract

The influence of inlet orientation and depth-to-diameter ratio on water quality of cylindrical water storage tanks were investigated using Computational Fluid Dynamics (CFD). The CFD model calculated the flow and chlorine concentration fields for a transient flow regime. The increase of ratio depth-to-diameter diminished the outlet chlorine concentration. The configuration with one vertical or horizontal inlet, near wall, presented the highest outlet chlorine concentration.

Keywords: *chlorine concentration, computational fluid dynamics, water quality, water storage tank.*

¹Engenheiro Ambiental, Universidade Federal de Rondônia, Brasil

²Faculdade de Engenharias, Arquitetura e Urbanismo e Geografia, Universidade Federal de Mato Grosso do Sul, Brasil. E-mail: johannesjanzen@gmail.com

Autor correspondente: Faculdade de Engenharias, Arquitetura e Urbanismo e Geografia, Universidade Federal de Mato Grosso do Sul, Brasil. Email: johannesjanzen@gmail.com

REVISTA AIDIS

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

AVALIAÇÃO AMBIENTAL DE UNIDADE DE PEQUENO PORTE DE RECICLAGEM DE RESÍDUOS DE CONSTRUÇÃO CIVIL

Laís Carlos Boaventura Santos¹
Luciano Matos Queiroz¹
*Viviana Maria Zanta¹

ENVIRONMENTAL PERFORMANCE OF A SMALL SCALE CONSTRUCTION AND DEMOLITION WASTE RECYCLING FACILITY

Recibido el 14 de noviembre de 2017; Aceptado el 23 de agosto de 2018

Abstract

Small recycling facilities is one of the most attractive alternatives for valorization of construction and demolition waste (C&DW), mainly due to its size that makes possible the installation very close to the generating sources. The objective of this work was to evaluate the environmental performance of a small C&DW recycling unit installed in Feira de Santana city, Bahia state, Brazil. Environmental performance indicators were selected in the scientific literature and validated by groups of experts for the aspects of noise emission, particulate matter emission, water consumption, energy consumption, segregation and productivity of recycled material. The raw material consumption showed that the process allows the recovery of C&DW class A (concrete, mortar and ceramic materials) of 92 %. The segregation of C&DW class A was adequate and also important since losses were minimal (0.05%). Water consumption was insignificant and energy consumption was less than 1% of total energy consumption of the construction site. The values of noise emission met the legal standard of environmental noise emission of the surrounding area provided by the Brazilian Law. The emission of Total Suspended Particles (TSP) in one day of observation was 1,460 $\mu\text{g}\cdot\text{m}^{-3}$. The results allow concluding that it is recommended the use of safety and personal protection equipment and other measures that minimize the emission of particulate matter.

Keywords: construction waste, environmental impacts, indicators, recycling.

¹ Departamento de Engenharia Ambiental, Escola Politécnica, Universidade Federal da Bahia, Brasil.

Autor correspondente: Departamento de Engenharia Ambiental, Escola Politécnica, Universidade Federal da Bahia. Rua Aristidis Novis, 2 – Federação, Salvador, Bahia. 40210-630. Brasil. Email: zanta@ufba.br

REVISTA AIDIS

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

AVALIAÇÃO HIDRODINÂMICA DE UM WETLAND CONSTRUÍDO DE FLUXO HORIZONTAL

HYDRODYNAMIC EVALUATION OF A HORIZONTAL FLOW CONSTRUCTED WETLAND

Monique Nunes de Freitas¹
Catiane Pelissari¹
Benny Zuse Rousso¹
Victor Ybarzo Fechinie¹
Mayara Oliveira dos Santos¹
*Pablo Heleno Sezerino¹

Recibido el 23 de noviembre de 2017; Aceptado el 29 de marzo de 2019

Abstract

*This paper's goal consisted on the evaluation of the hydrodynamic performance of a horizontal flow constructed wetland (HCW) component of a hybrid system employed in urban wastewater treatment, located in Florianópolis - south of Brazil. The hybrid system (composed by a downward vertical constructed wetland – DVCW, followed by the HCW) was operated under an average organic loading rate (OLR) of 40 g COD m⁻².d⁻¹, whereas the WCH module was operated under an OLR of 4.4 g COD m⁻².d⁻¹ (considering the surface area). The HCW achieved load removals of 1.5 g COD m⁻².d⁻¹ (or 71% influent load removal), 0.3 g SST m⁻².d⁻¹ (or 73% influent load removal), 0.3 g P-PO₄³⁻ m⁻².d⁻¹ (or 91% influent load removal), 1 g N-NH₄⁺ m⁻².d⁻¹ (or 81% influent load removal) and 1.6 g NT m⁻².d⁻¹ (or 70% influent load removal). The average WCH evapotranspiration was 2.2 mm.d⁻¹ or 8% of the hydraulic loading rate (HLR). The hydrodynamic indicators revealed that the HCW, under the smallest rainfall contribution (11 mm), showed a behavior close to the piston flow. By contrast, while under the highest rainfall contribution (57 mm), the reactor did not present a defined behavior, which resulted in a higher dispersion number and in a smaller tracer mass recovery (63.7%). The mean hydraulic detention time (HDTm) obtained was 6 days. Furthermore, two models of kinetic hydraulic were evaluated, the piston flow (PF) and the piston flow with residual concentration (PF k-C *). The PF-C* was the model that best represented the COD decay with a decay coefficient (k_d) of 0.33 d⁻¹.*

Keywords: hybrid system, hydrodynamics monitoring, urban wastewater.

¹Grupo de Estudos em Saneamento Descentralizado, Departamento de Engenharia Sanitária e Ambiental – ENS, Universidade Federal de Santa Catarina (UFSC), Brasil

Autor correspondente: Departamento de Engenharia Sanitária e Ambiental, Universidade Federal de Santa Catarina, bairro Trindade, Florianópolis, Santa Catarina, CEP 88040-900, Brasil, Email: pablo.sezerino@ufsc.br

REVISTA AIDIS

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

O IMPACTO DA COLETA SELETIVA NOS CUSTOS DOS SERVIÇOS DE COLETA DOS RESÍDUOS SÓLIDOS DA REGIÃO NORTE DO BRASIL

*Laila Rover Santana¹
Roberto dos Santos Correa²
Laila Rebeca da Silva Nunes¹
Luiza Girard Teixeira¹

THE IMPACT OF SELECTED COLLECTION ON THE COSTS OF SOLID WASTE COLLECTION SERVICES IN THE NORTHERN REGION OF BRAZIL

Recibido el 28 de diciembre de 2017; Aceptado el 16 de octubre de 2018

Abstract

Urban Solid Waste Management (USWM) is one of the most important points to be implemented within the dynamics of cities. The Northern Region of Brazil presents the worst indexes related to USWM in the country and was chosen as study area of this paper that aims to analyze the impact of selective collection on the costs of solid waste collection services. For this, it was necessary to quantify the generation and collection of solid waste in each State, as well as the recyclable fraction of that waste. The costs of waste collection services with and without the recyclable fraction were also quantified, thus identifying the impact that selective collection would have on each state in the region. For this study, secondary data were obtained from Brazilian Institute of Geography and Statistics (IBGE), the Brazilian Association of Public Cleaning and Special Remediation Companies (ABRELPE), the Business Commitment for Recycling (CEMPRE) and the Diagnosis of Urban Solid Waste Management of the National Sanitation Information System (SNIS). The results showed that the Northern Region of Brazil spends more than R\$ 1800000.00 / day on urban cleaning services (US\$ 7308000.00 / day – SET/2018). With the recycling of the entire recyclable fraction, this value would reduce to approximately R\$ 1224000.00 / day, highlighting the positive impact of the selective collection on the costs of the USW collection services. It can also be observed that if the States invest more in the selective collection systems, the expenses with the services of urban cleaning could have an average reduction of 95% of the overall value.

Keywords: selective collection, costs of solid waste collection, Brazil Northern Region, solid waste.

¹ Universidade Federal do Pará (UFPA), Campus Belém, Brasil.

² Instituto Federal do Pará (IFPA), Campus Paragominas, Brasil.

Autor correspondente: Rua Augusto Côrrea 01, Guamá, Belém, Pará, CEP: 66075-110, Brasil. Email: lailasrover@gmail.com