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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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IDENTIFICAÇÃO DE TENDÊNCIAS NAS SÉRIES TEMPORAIS DE PRECIPITAÇÃO NA MICRORREGIÃO DO ALTO SERTÃO PARAIBANO

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IDENTIFICAÇÃO DE TENDÊNCIAS NAS SÉRIES TEMPORAIS DE PRECIPITAÇÃO NA MICRORREGIÃO DO ALTO SERTÃO PARAIBANO

Recibido el 27 de febrero de 2018; Aceptado el 11 de enero de 2019

Abstract

The development of the semi-arid region of Northeast Brazil (NEB) is strongly dependent on rainfall, and its variations cause economic and social losses to the population, such as the difficulty of maintaining subsistence agricultural activities or even meeting the demand for human supply. This reseach aims to investigate the circumstantial changes in the distribution of precipitation in the Alto Sertão Paraibano, from the exploration of the characteristics of the pluviometric time series. For the identification of trends in precipitation time series, daily data from 20 years (1996 to 2015) of 15 pluviometric stations of the Executive Water Management Agency of the State of Paraíba were used, applying the non-parametric methods of Mann-Kendall and Pettitt and the parametric method of Linear Regression. It was possible to notice that the rainy season of the microregion corresponds to the months of February to May, being responsible for more than 70% of the total annual precipitation, having an oscillation consistent with the average distribution of annual precipitation. The trend identification methods proved to be efficient and comprehensively applied to analyzes of rainfall time series. The analysis of annual precipitation and the rainy season, although with signs of trends, did not become significant. In turn, the dry season shows a negative trend in the first decade, but with no evidence of a recent trend.

Keywords: *trend, Least Squares, Mann-Kendall, Pettitt, daily rain.*

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AVALIAÇÃO DA OPERAÇÃO DO PROCESSO OXIDATIVO AVANÇADO DO TIPO FOTO-FENTON COM LÂMPADA GERMICIDA COMO FONTE UV

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EVALUATION OF THE OPERATION OF THE ADVANCED OXIDATIVE PROCESS OF THE PHOTO-FENTON TYPE WITH GERMICID LAMP AS A UV SOURCE

Recibido el 17 de mayo de 2018; Aceptado el 12 de enero de 2021

Abstract

The present paper objective was to evaluate the application of alternative sources of UV radiation for the application of photo-Fenton type AOP. The use of a germicidal lamp against to the mercury vapor lamp conventionally used for industrial wastewater treatment. For this, the chosen parameters to attest the efficiency of the lamps were apparent color, turbidity and phenols. The parameters presented average reduction values of approximately 95%, 90% and 72%, for germicidal lamps and 97%, 86% and 81% for mercury vapor lamps. The applicability was confirmed by means test, t test, with 5% of significance, corroborated by the reduction of the spectral area in the UV-Vis region (200 nm – 800 nm), concluding with the confirmation of possibility of applying the germicidal lamp to the effluent degradation with possible reduction of operating costs.

Keywords: *radiation, alternative source, Photo-Fenton, textile wastewater.*

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INVESTIGAÇÃO DA CONDIÇÃO TRÓFICA DO RESERVATÓRIO DE ABASTECIMENTO DE ÁGUA BOLONHA

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INVESTIGATION OF THE TROPICAL CONDITION OF THE BOLONHA WATER SUPPLY RESERVOIR

Recibido el 25 de octubre de 2018; Aceptado el 12 de enero de 2021

Abstract

The problems related to water quality involve a very broad spectrum in the determination of human activities that have been causing a series of impacts on the quality of this element, with emphasis on the water euphoria. Due to the excessive supply of nutrients mainly from agricultural activities of the discharge of effluents, changes in the water regime, pollution by heavy metals and pesticides. This study focused on water monitoring in order to evaluate the Trophic State Index of the Bologna reservoir in the municipality of Belém-PA, based on the quantification of the variables total phosphorus and transparency over the rainy and less rainy period, which allowed the classification of the Bologna reservoir as an eutrophic environment, both in the rainy and less rainy periods of the year 2017.

Keywords: *Bolonha, phosphor, Trophic State Index.*

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A DINÂMICA DA VEGETAÇÃO E SUAS INFLUÊNCIAS HIDROCLIMÁTICAS NO MUNICÍPIO DE PARAGOMINAS-PA

* David Figueiredo Ferreira Filho [1]
Paulo Eduardo Silva Bezerra [1]
Francisco Carlos Lira Pessoa [1]

THE DYNAMICS OF VEGETATION AND THEIR HYDROCLIMACTIC INFLUENCES IN COUNTY OF PARAGOMINAS-PA

Recibido el 30 de mayo de 2019; Aceptado el 12 de enero de 2021

Abstract

Using remote sensing and geoprocessing techniques that provide opportunities to map the changes in large-scale vegetation coverage caused by the advancement of land use, we sought to correlate precipitation data with the advance of vegetation cover change, using data from (NDVI) and soil surface temperature (TST) with the aid of Landsat satellite images in 1987, 1997, 2007 and 2017 in Paragominas, Pará State, Brazil. A non-parametric test of Mann-Kendall, Spearman and Sen's was used to correlate with the changes in the areas. The results showed that changes in vegetation cover resulted in hydrological, climatological influences, variations in the index of reflectivity (Albedo) and an increase in the average surface temperature in the municipality, condemning the practice of the advance to the degradation of vegetation. Therefore, the deforestation of vegetation was evidenced by the agricultural practices and human occupations in the region, emphasizing that although the municipality has been titled "green municipality", it needs more in-depth studies on the subject matter that the change of vegetal cover causes in the region.

Keywords: *precipitation, surface temperature, Vegetable Cover Index (NDVI).*

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ANÁLISE DA GERAÇÃO DE RESÍDUOS SÓLIDOS EM UM HOTEL NO BRASIL: QUANTIFICAÇÃO, COMPOSIÇÃO E ESTRATÉGIAS PARA MINIMIZAÇÃO DO FLUXO A SER DISPOSTO EM ATERRO SANITÁRIO

* Igor do Nascimento Quaresma [1]
Gilson Barbosa Athayde Junior [1]
João Evangelista do Nascimento Filho [2]

ANALYSIS OF SOLID WASTE GENERATION IN A HOSPITALITY IN BRAZIL: QUANTIFICATION, COMPOSITION AND MINIMIZATION STRATEGIES FOR THE AMOUNT TO BE DISPOSED OF IN LANDFILL

Recibido el 11 de junio de 2019; Aceptado el 4 de abril de 2020

Abstract

Brazilian Policy for solid wastes classifies these items according to their source into eleven classes and among which, those from the commercial enterprises can be found. In this class, the hotels are recognised as one of the major wastes generators. In this context, the objective of this article was to analyse solid waste generation in a hotel, focusing in its quantification, composition and minimization strategies for the waste to be disposed of in landfill. Quantification and composition of the wastes were determined in order to calculate the generation rate of the waste and used for the minimization strategies implementation. Results showed that the hotel generated 35.6 tons of solid wastes in a six months period, resulting in a generation rate of 1.321 kg/person.day. The minimization strategies adopted presented a potential to reduce the generation rate to 0.195 kg/person.day, showing to be an efficient to reduce the amount of solid waste to be disposed of in landfill.

Keywords: *composting, environmental management, hospitality industry, solid waste.*

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DESTINAÇÃO FINAL DE LODO DE ESGOTO: PROPOSIÇÃO PARA AUXÍLIO EM TOMADAS DE DECISÃO A PARTIR DE UMA REVISÃO DE LITERATURA

Dayane Batista Gonçalves [1]
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FINAL DESTINATION OF BIOSOLIDS: PROPOSITION FOR SUPPORT IN DECISION MAKES FROM A LITERATURE REVIEW

Recibido el 11 de junio de 2019; Aceptado el 4 de abril de 2020

Abstract

The choice of good alternatives for the final disposal for life cycle in wastewater treatment plants (WWTP) is a complex and conflicting decision. It involves technical, economic, environmental and leisure modalities, which are the boundaries of the treatment plant and which knowledge is of extreme importance for an appropriate and feasible decision. The objective of this work is to present a proposal of questionnaire that aims to diagnose the situation of WWTP, from a literature review, as well as approach the main criteria for evaluating alternatives for the final disposal of biosolids. It is expected to enable a previous analysis of more appropriate solutions, compatible with the expectations and objectives of managers of public or private sanitation companies, assisting them in decision making. The questionnaire was submitted to three sanitation technical professionals to test its comprehension, to test its explicitness and functionality. According to the analysis done by the professionals, improvements were implemented in the questionnaire, making it more appropriate to meet the proposed objective.

Keywords: *sewage sludge, final destination, decision-making, evaluation of alternatives.*

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MODELAGEM DE RECALQUES DE LONGO PRAZO DE UM ATERRO SANITÁRIO EXPERIMENTAL – ANÁLISE CRÍTICA DE TRÊS MODELOS EMPÍRICOS

* Michelle Granha Giorgini [1]
Cícero Antônio Antunes Catapreta [2]
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MODELING OF LONG-TERM SETTLEMENTS OF AN EXPERIMENTAL SANITARY LANDFILL – CRITICAL ANALYSIS OF THREE EMPIRICAL MODELS

Recibido el 12 de junio de 2019; Aceptado el 4 de mayo de 2020

Abstract

One of the tools used for the estimation of long-term settlements of landfills is the use prediction models. Estimation of settlements and their rates are relevant to determine the landfill lifespan, since municipal solid wastes present large settlements. Settlement prediction is extremely complex, due to material heterogeneity and the various mechanisms involved in the process. This paper presents a continuation of the study by Simões and Catapreta (2013), in which data of 6 years of settlement monitoring of the experimental landfill of Belo Horizonte were used to predict long term settlements with three models (rheological, hyperbolic and composite), comparing the results with actual field data of 13 years. In addition, a new calibration of the models was performed with data of 13 years. The parameters obtained in the calibration were used to predict the settlements of another 20 years. The results confirmed the need of using long periods of monitoring records to predict values closer to those observed in field. The results for the long-term settlement prediction obtained by the hyperbolic and rheological models significantly underestimate the settlements, regardless the period of data used in the calibration. The best fits were obtained with the composite model.

Keywords: *landfill, monitoring, municipal solid waste, settlements, settlements model.*

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DESEMPENHO AMBIENTAL DE SISTEMA DE REÚSO DE ÁGUA CINZA EM RESIDÊNCIA DE INTERESSE SOCIAL

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Eduardo Borges Cohim [1]

ENVIRONMENTAL PERFORMANCE OF GRAY WATER REUSE SYSTEM IN SOCIAL INTEREST RESIDENCE

Recibido el 14 de junio de 2019; Aceptado el 18 de septiembre de 2020

Abstract

The decentralized reuse of domestic sewage, especially in urban centers, has become popular in recent years. Among the solutions that stand out, both because the reduction in water use and the volume of sewage generated, the reuse of gray water (GW) is increasingly viewed as an outlet in terms of minimizing environmental impacts. In this sense, this work had the objective of quantifying and evaluating the environmental impacts of GW reuse implementation in a social interest residence located in the city of Feira de Santana (Bahia; Brazil). The study-case was conducted for a residence from the My Home My Life Brazilian Program, using the Life Cycle Analysis tool. The impact categories used in the assessment were Cumulative Energy Demand and IPCC 100. The calculated environmental impact for the GW was 0.84 kWh·m^{-3} and 0.11 kg·CO_2eq·m^{-3}, respectively, disregarding positive impacts on sewage collection and treatment. When compared to the Integrated Water Supply System of Feira de Santana (WSS-FSA), the system proposed in this study shows a reduction of approximately 75% of the impacts, both in accumulated energy demand and in equivalent CO_2 emissions per m³ of water delivered. For every 4.2 houses with GW reuse studied, the volume of water saved would be enough to fuel another similar residence. The reuse of GW has shown to be feasible when compared to the drinking water provided by the WSS-FSA, mainly considering the reduction in the volume of sewage generated.

Keywords: *environmental impact, greywater reuse; houses, Life cycle assessment, management of water resources.*

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ANÁLISE DA VIABILIDADE AMBIENTAL E ECONÔMICA DA SUBSTITUIÇÃO DE LÂMPADAS CONVENCIONAIS POR LÂMPADAS LED NO TERMINAL PETROQUÍMICO DE MIRAMAR DA COMPANHIA DOCAS DO PARÁ– CDP

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ANALYSIS OF THE ENVIRONMENTAL AND ECONOMIC VIABILITY OF THE REPLACEMENT OF CONVENTIONAL BULBS BY LEDS AT THE PETROCHEMICAL TERMINAL OF MIRAMAR OF THE COMPANHIA DOCAS DO PARÁ – CDP

Recibido el 17 de junio de 2019; Aceptado el 21 de enero de 2021

Abstract

At the Brazilian port sector, the economic growth and the expansion of foreign trade determines the increase of solid waste generation, which demands a different management because it endangers the public health and the balance of the local ecosystem. This essay analyzes the viability of substitution between conventional bulbs and LED technology, while highlighting the differences on the environmental effects and economic sustainability of the illumination system. The methodology was divided into four stages: interview and documentary survey; field research; diagnosis and data analysis and proposal of an LED system. The essay analyzed the costs of acquiring, maintaining, affordability and managing services of disposing the bulbs between the use of conventional bulbs and LED. The estimated used cost resulting from LEDs have shown savings of 58% over conventional bulbs. The electrical efficiency was the milestone advantage between them. Results demonstrated greater benefits with LEDs in mitigating environment pollution over conventional bulbs; its chemical composition is less harmful, it is more durable, and it has a reduce disposal footprint.

Keywords: *disposing light bulbs, port sector, sustainability, LED technology.*

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DESENVOLVIMENTO DE LODO GRANULAR AERÓBIO E AVALIAÇÃO DO DESEMPENHO DE REATOR EM BATELADAS SEQUENCIAIS (RBS) A PARTIR DE DOIS INÓCULOS DISTINTOS

* Ana Clara Rezende Gomes [1]
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DEVELOPMENT OF AEROBIC GRANULAR SLUDGE AND EVALUATION OF THE PERFORMANCE OF SEQUENCING BATCH REACTOR (SBR) USING TWO DIFFERENT TYPES OF INOCULA

Recibido el 25 de junio de 2019; Aceptado el 13 de enero de 2021

Abstract

This work aimed at monitoring the formation of aerobic granular sludge in a SBR prototype and at evaluating its performance. The SBR was operated in two different phases (A and B), both fed with real domestic sewage and operated with 6-h cycles, but using different types of inocula: biological sludge from an extended aeration activated sludge system (in Phase A) and biological sludge from a conventional activated sludge system (in Phase B). During Phase A, the SBR was operated over 21 consecutive days, and presented the following mean removal efficiencies: 73% for turbidity; 85% for COD; 88% for TSS; and 42% for ammoniacal nitrogen. During Phase B, the SBR was operated over 20 consecutive days and presented the following mean removal efficiencies: 86% for turbidity; 80% for COD; and 88% for TSS. No removal of ammoniacal nitrogen was observed in Phase B. In both Phases, granules with sizes between 1 and 2 mm were formed, although maturity of granules was not achieved. In Phase A, sedimentation velocities ≥ 5.8 m/h were observed, whereas in Phase B, with higher amount of granules, settling velocities of approximately 17.4 m/h were noted. Results indicate that biological sludge from both conventional activated sludge and extended aeration activated sludge systems may be good inocula options for the formation of granular sludge in SBR systems.

Keywords: *biological treatment, domestic wastewater, granule, removal efficiency.*

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FEASIBILITY STUDY OF CONSTRUCTED WETLANDS FOR THE TREATMENT OF DAIRY EFFLUENTS

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Recibido el 22 de julio de 2019; Aceptado el 4 de mayo de 2020

Abstract

This work aimed at characterizing the effluent of a small dairy in terms of flow and physical-chemical composition and at assessing constructed wetland for its treatment. The dairy produced an effluent with an average flow of 2.81 $m^3.d^{-1}$ and the following characteristics: 574-4155 $mg.L^{-1}$ of BDO; 1531-7912 $mg.L^{-1}$ of TSS; and 23-173 $mg.L^{-1}$ of TKN. Using median values of BOD, three treatment systems were designed: batch activated sludge (BAS) and waste stabilisation ponds (WSP), commonly applied for the treatment of dairy effluents; and constructed wetlands (CW) as an alternative system. In terms of area requirements based on the removal of BOD, the BAS system (2.1 m^2) was more advantageous than CW (15.0 m^2) and WSP (46.5 m^2). However, considering the removal of TKN and TSS, the WC system showed to be an attractive option for the treatment of the effluent studied. Next, a new CW system was designed aiming at removing BOD, TSS and TKN. In this case, the limiting parameter was the TKN, and not the BOD as expected. The designed CW system presented satisfactory hydraulic retention time (HRT) when compared to ranges reported in the literature, even when minimum, mean and maximum concentrations of NTK were considered for the design, corroborating the robustness of CW systems. The findings of this study confirm, therefore, the wide variation of the characteristics of dairy effluents as well as the ability of CW systems to absorb such variations without compromising the efficiency of the treatment system.

Keywords: *constructed wetlands; dairy effluent; wastewater treatment.*

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REVISTA AIDIS

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MODIFICACIÓN DE UNA MEZCLA ASFÁLTICA TIPO III ADICIONANDO POLVO DE CAUCHO DE NEUMÁTICOS USADOS, MEDIANTE UN PROCESO HÚMEDO

Carlos Ortiz [1]

MODIFICATION OF A TYPE III ASPHALTIC MIXTURE BY ADDING RUBBER POWDER OF USED TIRES THROOGH A HUMID PROCESS

Recibido el 16 de julio de 2019; Aceptado el 11 de mayo de 2020

Abstract

A type III asphaltic mixture was analyzed by adding rubber powder of used tires, through a humid process, in order to know the influence of recycled rubber powder, in the deformations of an asphalt mixture that can be used in the paving of roads, using layers or briquettes. In order to achieve this goal, rubber powder was characterized by a granulometric analysis using the normal distribution statistical method; the dynamic behavior of the asphalt-rubber mixture was analyzed by the Marshall method stated in the Covenin 2000-87 norm for roads; by determining the adequate percentage of rubber in the modified mixture; for this, rubber percentages of 5, 10 and 15 % w, respectively, were established at 150°C and 170°C. Granulometry obtained was 1,6mm diameter, and it was used for the analyses included in the norm; this determined that 5% of rubber addition at 170°C temperature results a mixture with better properties, such as: flexibility increase, fissure appearance delay and impermeability increase.

Keywords: *humid process, modified asphalts, powder rubber.*

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COST ASSESSMENT OF THE BRAZILIAN CONSTRUCTION AND DEMOLITION WASTE RECYCLING PLANT: A CASE STUDY OF PORTO ALEGRE

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Recibido el 23 de julio de 2019; Aceptado el 6 de febrero de 2020

Abstract

The construction activities generate representative amount of Construction and Demolition Waste (CDW) around the world. Brazilian City Halls collected about 45 million tons/year. CDW recycling plants needs to be economically viable. The characteristics of recycling plants and future expectations vary around the world. Thus, the cost analysis needs to be adapted to the local reality and future scenarios should be evaluated. In this context, the objective of this paper is to evaluate the CDW recycling plant costs in Brazil. Two scenarios are tested, actual Scenario (1) and future Scenario (2), with air jig. Four steps are performed: literature review, inventory of the inputs, economic indicators analysis, and sensitivity analysis of alternative solutions. The results suggest that both scenarios do not reach positive economic indicators (IRR, NPV and Payback). The Fixed Costs are the main influence on the results, mainly due to the acquisition of Equipment. The Variable Costs represent, in Scenario 1 and 2, 18% and 10% of their Total Fixed Costs, respectively. Scenario 1, however, has possible conversion into positive IRR easier than for Scenario 2, once the Air Jig influence significantly in the increment of costs. A Government subsidy tested would not make the CDW Recycling Scenarios economically attractive. Only Scenario 1 can achieve positive results, however without the acquisition costs of Land, Equipment and Vehicles. Counterparts with the City Hall, in exchange for the supply of these inputs, would not influence the positive results. The use of new technologies maybe will be possible after the recycled aggregate market is consolidated in Brazil.

Keywords: *cost analysis, CDW recycling plant, brazilian construction and demolition waste, waste management.*

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OCORRÊNCIA DE ESPÉCIES INORGÂNICAS EM ÁGUAS DO BRASIL

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Renata de Oliveira Pereira [1]
Samuel Rodrigues Castro [1]
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OCCURRENCE OF INORGANIC CHEMICALS IN WATER BODIES OF BRAZIL

Recibido el 31 de julio de 2019; Aceptado el 7 de mayo de 2020

Abstract

In this work, the occurrence of inorganic chemicals in Brazilian surface and groundwater was evaluated by means of a literature review. In order to access the available knowledge associated with the risk of human exposure via water intake, the target chemicals were those found in Brazilian drinking water standards. Two approaches to descriptive statistics analysis of the literature data was used and compared: (i) the shifting of non-detected data by the half of their respective limits; (ii) the estimation of non-detected data based on distribution of quantified data. To verify the accuracy of extracting information from other countries to update Brazilian drinking water standard, the data from Brazilian studies were compared to the international occurrence. For chemicals that were found to be in disagreement with Brazilian normative, possible adverse effects on human health were assessed. In addition, statistically significant differences between the occurrence of the chemicals in surface and groundwater sources at 95% confidence level were evaluated. Similar ranges of occurrence were found between Brazil and other countries. However, for some chemicals the average Brazilian concentrations could be bigger than international one. In some cases, the method of estimating non-detected data based on their distributions resulted in slightly higher percentiles, differing by no more than 0.03 mg.L^{-1}. Cadmium and lead presented a number of samples of surface water in high concentrations.

Keywords: *drinking water standard, groundwater, health, surface water.*

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CO2 EMISSION ASSESSMENT FOR RICE HUSK ASH IN CONCRETE ON ENVIRONMENTAL APPROACH

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Recibido el 6 de agosto de 2019; Aceptado el 14 de septiembre de 2020

Abstract

The construction industry causes significant negative environmental impact, partly due to the vast amounts of building materials used, and rice husk ash (RHA) is a solid waste produced in thermal power stations with potential applications as a partial replacement to Portland cement. Due to the increasing demand for research on environmental issues, the life-cycle approach emerges as an important tool in such investigations. This study evaluates the environmental performance of RHA as a replacement material for cement during the life-cycle of concrete. Environmental aspects and impacts associated with the combustion of rice husk biomass in a grate furnace and in a fluidized bed reactor, the transportation of the RHA produced, and its use in concrete production were evaluated. The most significant environmental impact caused by RHA production processes was global warming potential. The replacement of 20% Portland cement by RHA produced by combustion on fluidized bed reduced CO_{2eq} emissions by 24%. Even though this ash type had to be transported for 400 km to its destination, its use remained environmentally advantageous. But the replacement of 20% Portland cement by RHA produced by combustion on a grate furnace led to a reduction of only 7.7% in CO_{2eq} emissions.

Keywords: *cement replacement, concrete, life-cycle assessment, rice husk ash.*

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EVALUATION OF COMBINED TREATMENT OF LEACHATE FROM SANITARY LANDFILL AND SANITARY SEWAGE USING OZONE ON UP FLOW OXIDATION REACTOR

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Recibido el 13 de agosto de 2019; Aceptado el 18 de septiembre de 2020

Abstract

This work aimed at monitoring the formation of aerobic granular sludge in a SBR prototype and at evaluating its performance. The SBR was operated in two different phases (A and B), both fed with real domestic sewage and operated with 6-h cycles, but using different types of inocula: biological sludge from an extended aeration activated sludge system (in Phase A) and biological sludge from a conventional activated sludge system (in Phase B). During This study aimed to evaluate the combined treatment of leachate from landfill and sanitary sewage using ozone on upward flow oxidation reactor. The tests were conducted in batches, taking five and two hours of ozonation with 8.9; 9.6 and 10.5 g $O_3.h^{-1}$, applied to the mixture of 2% of leachate from sanitary landfill and 98% of sanitary sewage (v/v). The test was performed in triplicate with monitoring of COD, BOD, color, turbidity and pH. The results showed that ozone is a viable alternative for the pre-treatment of the mixture containing landfill leachate and sewage, facilitating the post-treatment in a biological process. It was observed removals of COD, BOD, apparent and true color and turbidity of 46%, 51%, 86%, 86% and 81% respectively in 5 hours of test, and average removals of 23%, 48%, 78%, 76% and 58% respectively for 2 hours of test.

Keywords: *advanced oxidation, landfill leachate, ozone, oxidation reactor, sewage.*

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Investigación, desarrollo y práctica.

USO DE MATRIZ PEDIGREE MODIFICADA NA ESCOLHA DE DADOS DE COMPOSIÇÃO ELEMENTAR DE RESÍDUOS SÓLIDOS URBANOS

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[1]

APPLICATION OF A MODIFIED PEDIGREE MATRIX FOR CHOOSING ELEMENTARY COMPOSITION DATA OF MUNICIPAL SOLID WASTE

Recibido el 17 de agosto de 2019; Aceptado el 7 de mayo de 2020

Abstract

The Municipal Solid Waste (MSW) elemental composition is important to determine its empirical chemical formula and so predict landfill gas generation. However, the determination of composition involves much work and high costs. This is a problem when resources are limited, as in the case of developing countries. In addition, data generation at later times makes direct analysis impossible because of the lack of a sample. Due to these difficulties, it is necessary to use secondary data which are carefully chosen to ensure greater robustness. This work aimed to propose a methodology for the choice of elementary composition data of MSW. The methodology originates from a tool used in life cycle assessment, the Pedigree Matrix. The Pedigree Matrix is used to evaluate data quality under the aspects of reliability, completeness and the temporal, geographic and technological correlations. Some modifications in the original Matrix were proposed in order to choose more robust secondary data of the elemental composition for MSW generated in Porto Alegre, RS. Temporal, geographic and technological correlations were removed from the original matrix. The qualitative correlation was added, while reliability and completeness were maintained. The modification of the Pedigree Matrix made it possible to choose more appropriate data. Using the composition of carbon, hydrogen, oxygen, and nitrogen the empirical chemical formulas were determined for the wastes generated in 1997 and 2010. The formula determined for organic matter in 2010, $C_{28.27}H_{43.44}O_{15.93}N$, was similar to that obtained analytically $C_{33.3}H_{57.6}O_{17}N$ demonstrating the viability of the proposed methodology.

Keywords: *chemical composition of waste, chemical formula of waste, municipal solid waste; pedigree matrix, qualitative correlation.*

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QUALIDADE DA ÁGUA COMO RETRATO DA VULNERABILIDADE SOCIOAMBIENTAL: O CASO DO RIO COCÓ - FORTALEZA/CE

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Fernando José Araújo da Silva [1]
Carlos de Araújo Farrapeira Neto [2]
Gabriella de Lima Souza Albuquerque [3]
Ingrid Fernandes de Oliveira Alencar [3]
Raquel Jucá de Moraes Sales [3]
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WATER QUALITY AS A PORTRAIT OF SOCIO-ENVIRONMENTAL VULNERABILITY: THE CASE OF COCÓ RIVER - FORTALEZA / CE

Recibido el 27 de agosto de 2019; Aceptado el 7 de mayo de 2020

Abstract

Multiple factors influence the change in the quality of water resources. Industrialization, geographical conditions, demographic explosion, disordered land use and occupation are among the main factors. Thus, the objective is to analyze the water quality of the Cocó River from the perspective of the social and environmental vulnerability of its urban banks. The qualitative-quantitative methodology was based on the monitoring of 07 (seven) points of the river carried out by the State Superintendence of the Environment. One of them was chosen for analysis, due to the intense population density. Using the IQA (Water Quality Index) method, the parameters were: thermotolerant coliform (CTT), biochemical oxygen demand (BOD) and dissolved oxygen (DO). The data provided for Brazilian conditions (Companhia de Tecnologia e Saneamento Ambiental (CETESB)) was calibrated and systematized in Excel spreadsheets and charts. As results, there is a scenario of local socio-environmental and sanitary commitment. All the numbers observed in the BOD, OD, CTT, IQA averages, in addition to the HDI, are lower than the sanitary, environmental and social quality standards, evidencing multiple anthropic and negative natural impacts - contamination of soil and groundwater, fauna and flora, besides being an increment of vectors and contaminating agents that have as vehicle of transmission the water. It is concluded that there is a growing need to ascertain and understand the factors influencing water quality, as well as to anticipate future impacts, in order to seek social well-being and environmental quality.

Keywords: *contamination, environmental vulnerability, quality of water.*

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Investigación, desarrollo y práctica.

PRODUÇÃO DE HIDROGÊNIO A PARTIR DE CASCAS DE BANANA EM REATOR ANAERÓBIO EM BATELADA

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Fernanda Santana Peiter [1]
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HYDROGEN PRODUCTION FROM BANANA PEEL IN ANAEROBIC BATCH REACTOR

Recibido el 12 de septiembre de 2019; Aceptado el 13 de enero de 2021

Abstract

The global energy matrix largely gears towards the use of fossil fuels that cause significant environmental impacts. Alternative sources of energy, including biohydrogen, appear as a substitute for these non-renewable fuels. For hydrogen production, anaerobic digestion stands out for the degradation of organic matter without the need for light and for being able to be conducted at low temperatures. Thus, this study aimed to evaluate the efficiency of an anaerobic reactor to produce hydrogen using banana peel as a substrate. The tests were carried out in batch with controlled temperature (35 ± 1 ºC) and with agitation at 120 rpm, using the sludge from an effluent treatment plant as inoculum. The amounts of inoculum (0.139 g and 0.209 g of volatile solids (SV) per batch) and substrate (0.695 g and 2.78 g SV per batch) were varied, as were the initial pH values (5.5 and 6). In addition, the effect of substrate pretreatment for all reaction conditions was evaluated. The best results for carbohydrate consumption and hydrogen production occurred in reactors with the alkaline treatment of the substrate. Reactor R3 (with 209 g of SV per batch of inoculum, initial pH 6 and 0.695 g of SV per substrate batch) presented the best result for the specific rate of hydrogen production, reaching 309.82 mL.g-1SV when subjected to the pretreatment of the substrate.

Keywords: *alkaline treatment, biohydrogen, fermentative process, experimental planning, agro-industrial waste.*

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SELECTIVE COLLECTION IN PALMAS/TO: ANALYSIS OF THE FIRST MUNICIPAL RECYCLING PROGRAM

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Abstract

Selective collection aiming the recycling of municipal solid waste is worldwide an alternative to reduce the final disposal in landfills, besides reducing natural resources consumption. This paper aimed to analyze the system of selective collection of recyclable materials proposed by the municipal government of Palmas through the Program "Coleta Palmas", through data collection in the institutions involved, intending to contribute for the improvement of the system adopted. A survey was carried out with the main stakeholders of the Program, with the purpose of knowing the institutional arrangement, the types of partnerships, the objectives and targets set, the actions and strategies planning, the monitoring and results achieved so far. Results showed difficulties involving the coordination unit, and it was noticed that the general view of the operating units on the Program is positive, although for two of them, to date, the participation has not represented financial gains. It was concluded that changes in the management of the Program are necessary, including improvement of social communication and continuous environmental education. Lastly, recommendations made by the operating units were collected in three perspectives: institutional, operational, and environmental education.

Keywords: *municipal solid waste management, selective collection, solid waste pickers.*

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AVALIAÇÃO DO TRATAMENTO DE LODO CONTAMINADO POR HIDROCARBONETOS POLICÍCLICOS AROMÁTICOS POR PROCESSOS DE BIORREMEDIAÇÃO E REAÇÃO FENTON

Ariel Ullmann Geanezini [1]
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EVALUATION OF TREATMENT OF SLUDGE CONTAMINATED BY POLYCYCLIC AROMATIC HYDROCARBONS BY BIOREMEDIATION AND REACTION FENTON PROCESSES

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Abstract

Several human activities, such as industries and service provision, result in the generation of effluents and solid wastes that require treatment or an appropriate final disposal. The sludge generated in the effluent treatment of a vehicle and parts trading company, as well as car wash services is considered solid waste. It is classified as class I waste (hazardous), according to NBR 10004, due to presence of Polycyclic Aromatic Hydrocarbons (PAH), coming from diesel oil, gasoline, lubricating oils and various greases. This work evaluates two distinct sludge treatment methods, bioremediation and Fenton reaction, as well as their respective efficiencies. For both treatments, three tests were performed with different retention times. For bioremediation, were obtained PAH degradation percentages from 76.03 ± 8.83% to 92.88 ± 3.48%. The treatments by Fenton reaction obtained PAH degradation percentage above 99.9%. The high degradation values were obtained with Fenton reaction, in 3 days of test.

Keywords: *bioremediation, bioaccumulation, Fenton reaction, PAH, sludge.*

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UTILIZAÇÃO DO CACTO MANDACARU (*Cereus jamacaru DC*) COMBINADO À RADIAÇÃO SOLAR COMO ALTERNATIVA PARA TRATAMENTO DE ÁGUA

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Elaine Costa Almeida [1]
Riuzuani M. B. P. Lopes [1]
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APPLICATION OF Cereus jamacaru DC CACTUS COMBINED TO SOLAR RADIATION AS AN ALTERNATIVE FOR WATER TREATMENT

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Abstract

Water is a limited resource and indispensable for human survival, but also increasingly scarce, especially in the semiarid regions of Brazil. In this sense, the present work seeks to analyze the effectiveness of a simplified water treatment using *Cereus jamacaru* DC cactus combined with solar disinfection (SODIS). For that, a differentiated methodology was developed where the variables studied were the amount of cactus fragments used and the time of exposure to solar radiation, obtaining results in terms of turbidity, thermotolerant coliforms and pH of the sample. It was observed that the *Cereus jamacaru* DC was efficient in the treatment of water, reducing turbidity and biological contamination, with the application of SODIS potentializing the performance of the treatment. Better results were obtained for the treatment in which a greater amount of the cactus was used combined with 18 hours of SODIS. The findings allow us to conclude that the use of the *Cereus jamacaru* DC cactus for water treatment is possible and must be explored and better studied in order to standardize methodologies and optimize results.

Keywords: water treatment, *Cereus jamacaru* DC, SODIS, semiarid.

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UTLIZAÇÃO DA CASCA DE CASTANHA DE CAJU POR PROCESSO DE PIRÓLISE COMO ALTERNATIVA SUSTENTÁVEL PARA GERAÇÃO DE NOVOS PRODUTOS

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THE USE OF CASHEW NUT PEEL BY PYROLYSIS PROCESS AS A SUSTAINABLE ALTERNATIVE FOR THE GENERATION OF NEW PRODUCTS

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Abstract

The use of biomass generated in the processing of some fruits is now seen as a sustainable alternative for the production of renewable energy and the environmentally safe disposal of agroindustrial solid waste. The main residue of biomass generated in large quantities in the process of the nut processing is the cashew nut shell, which has as its main problem its final disposal, since a considerable quantity has as final destination the sanitary landfills. The present study aims to present the skin of cashew nut, agroindustrial residue, as raw material alternative for the production of activated carbon obtained through the pyrolysis process, and its appropriate use in the tertiary stage of treatment and purification of effluents industries. The data obtained showed that the studies of the use of the skin of cashew nuts were positive, resulting in a sustainable alternative to the problem of final disposal of the skin of cashew nuts in sanitary landfills and the generation of new products with added value.

Keywords: *biomass, activated carbon, cashews, pyrolysis.*

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CARACTERIZAÇÃO MORFOMÉTRICA DA BACIA HIDROGRÁFICA DO RIBEIRÃO DAS PEDRAS NO MUNICÍPIO DE PALMAS – TO

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Girlene Figueiredo Maciel [1]
Juan Carlos Valdés Serra [1]
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MORPHOMETRIC CHARACTERIZATION OF THE RIBEIRÃO DAS PEDRAS WATERSHED IN PALMAS – TO

Recibido el 2 de octubre de 2019; Aceptado el 24 de septiembre de 2020

Abstract

The watershed, also understood as the contribution basin of a watercourse, is the geographic area that collects rainwater, which, flowing through the soil surface, reaches the section considered. All events occurring in the drainage basin have a direct or indirect impact on rivers. Climatic conditions, vegetation cover and lithology are factors that control the morphogenesis of the slopes and, in turn, the type of detrital charge to be supplied to the rivers. Thus, the present study aims to characterize the morphometric parameters, using georeferenced data in GIS environment (Geographic Information System) of the watershed of Ribeirão das Pedras. For the delimitation of the topographic divider was used an MDE derived from the SRTM image obtained by the project Embrapa Satellite Monitoring and with this delimitation the morphometric parameters were calculated. The Ribeirão das Pedras basin is of the 3rd order, indicating that it is sparsely branched, although it is considered a large basin with an area of 478 km² and a perimeter of 112 km. In this sense, after the application of calculation and classification methods based on the methodology proposed by several authors, the Ribeirão das Pedras basin has a low drainage capacity, is little susceptible to erosion, low flood risk, high altimetric amplitude and low risk. Also considering the large extent of area covered by the watershed.

Keywords: *environment, geoprocessing, management, morphometry, water resources.*

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AVALIAÇÃO DO ESTABELECIMENTO DE ESPÉCIES VEGETAIS LEGUMINOSAS EM SUBSTRATO DEGRADADO DE UM ATERRO SANITÁRIO

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ASSESSMENT OF LEGUMINOUS PLANT SPECIES ESTABLISHMENT IN DEGRADED SUBSTRATE OF A LANDFILL

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Abstract

The study of particularities of plant species in degraded substrate of landfills can improve the development of methods to evaluate the success of environmental remediation of final covers of landfills, especially in the case of plants establishment through the root system. The study assessed the performance of *Cajanus cajan* (*C. cajan),* *Crotalaria brefiflora* (*C. brefiflora*), *Crotalaria juncea* (*C. juncea*) and *Crotalaria ochroleuca* (*C. ochroleuca*) in a degraded substrate of a landfill. The experiment was conducted at Belo Horizonte Landfill, MG, Brazil. After 30 days the density of plants was measured, and individual size of aerial part (length and wet/dry biomass) and root (dry/wet biomass and root density) were determined after 12 months. The moisture content and soil density of plots were determined and monitored monthly. *C. cajan, C. ochroleuca and C. juncea* obtained uniformity and early growth after 60 days. *C. juncea, C. ochroleuca* and *C. brefiflora* reached all phenological stages until the fifth month. *C. ochroleuca* and *C. juncea* presented higher shoot length (193.17 cm and 177.56 cm). The higher dry matter accumulated was obtained in *C. cajan*, 14.35 $g.ind^{-1}$, in shoots, and 38.18 $g.dm^{-3}$, in roots. *C. cajan* and *C. brefiflora* obtained the highest values of plant density, 81 and 61 $ind.m^{-2}$. Concerning the stablishment of the species, the best performance was obtained with *C. brefiflora*, which accumulated 30.70 $g.dm^{-3}$ of root biomass in 1.2 $g.cm^{-3}$ soil density, and *C. juncea*, with the second largest biomass production in shoots, 64 $g.ind^{-1}$, with just 11% soil moisture.

Keywords: landfill, final cover, environmental remediation, plant-soil relationship, degraded area.

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VIABILIDADE EM PROJETOS DE MELHORIAS AMBIENTAIS EM UMA REDE DE POSTOS DE COMBUSTÍVEIS

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FEASIBILITY ANALYSIS OF PROPOSALS FOR ENVIRONMENTAL IMPROVEMENTS IN A NETWORK OF GAS STATIONS

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Abstract

The consumption of fossil fuels, electric power and drinking water, has increased considerably in recent years, followed by an increase in the number of fuel trade facilities in large and small cities in Brazil. This kind of commercial activity is potentially hazardous to the environment due to the amount of hazardous substances stored and marketed in these locations. In this work, the proposals of environmental improvements was analyzed with the focus on promoting the sustainability of these projects and contributing to the reduction of the environmental impacts of these activities, involving the management of solid waste, use of rainwater and photovoltaic energy. It was verified that the implementation of all improvements would result in an increase in the cost of installing a fuel station by around 13%, but with a return on investment of around 4 years and several intangible benefits for the enterprise and for the environment.

Keywords: *environmental feasibility analysis, environmental projects, sustainability at gas stations.*

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MÉTODOS MULTICRITÉRIOS PARA SELEÇÃO DE ÁREAS DESTINADAS A ATERROS SANITÁRIOS

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MULTICRITERIA METHODS FOR SELECTION OF AREAS INTENDED FOR LANDFILLS

Recibido el 7 de octubre de 2019; Aceptado el 7 de mayo de 2020

Abstract

The Urban Solid Waste Management (USWM) has become a complex issue due to the rapid socio-economic development of several countries and its consequent increase in waste production. The correct management of solid waste presupposes its reduction, as well as its correct final destination, the most conventional being the landfill. Given social, economic, environmental and technical criteria and restrictions for determining the ideal location for the implementation of a landfill, this work carried out fitness assessments in areas of the city of Toritama-PE, Brazil. For that, the Analytical Hierarchy Process (AHP) multicriteria method integrated with a Geographic Information System (GIS) was used to systematize the criteria. The results showed several areas with a high aptitude for landfill allocation in the municipality. Allied to this, the methodology can be easily applied in other municipalities, to obtain a preliminary study of favorable and unfavorable areas to the implantation of landfills. Thus, it can assist in the development of studies with the theme in question and the universalization of the National Solid Waste Policy in Brazil, reducing operating costs and impacts on the environment.

Keywords: *AHP, geoprocessing, urban solid waste, area selection.*

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BACTERIAL ESTABLISHMENT DURING THE FIRST YEAR OF OPERATION OF AN UNSATURATED AND A PARTIALLY SATURATED VERTICAL FLOW CONSTRUCTED WETLANDS

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Abstract

Based on seven sampling campaigns during the first year of operation of an unsaturated (UVF) and a partially saturated vertical (SVF) subsurface flow constructed wetland the dynamics of nitrogen transforming bacteria were unravelled. Ammonia oxidizing populations (*Nitrosomonas* and *Nitrosospira*) showed large variations throughout the study, especially in the top layer of both wetlands, whereas in the bottom layers lower abundance and no temporal variation was found. Nitrite oxidizing bacteria (*Nitrobacter* and *Nitrospira*) displayed little fluctuations and were identified in higher abundance in the bottom of the UVF wetland, and the top of the SVF wetland. Denitrifying bacteria exhibited no significant changes over time in both wetlands. In addition, the saturation of the bottom part of the SVF caused denitrification to occur over time in greater magnitude in the SVF wetland than in the UVF wetland, coinciding with the greater abundance of denitrifiers in this wetland configuration.

Keywords: constructed wetlands, bacterial temporal dynamics, start-up period, nitrifying-denitrifying biofilm development.

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MÉTODO DE DECISÃO MULTICRITÉRIO APLICADO À SELEÇÃO DE MATERIAIS ESTRUTURAIS CONSIDERANDO O IMPACTO AMBIENTAL

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MULTICRITERIA DECISION METHOD APPLIED TO THE SELECTION OF STRUCTURAL MATERIALS CONSIDERING THE ENVIRONMENTAL IMPACT

Recibido el 13 de octubre de 2019; Aceptado el 4 de mayo de 2020

Abstract

When designing a building, the selection of the most appropriate structural material may be based on several factors such as cost, performance, availability, and, more recently, the possible environmental impacts produced. One way to select the best alternative based on several criteria may be the use of decision-making techniques. Multicriteria decision analysis standardizes the decision-making process through mathematical modeling, helping the decision maker to solve problems in which there are several objectives to be achieved simultaneously. Among the existing methods, one of the most widely used is the Analytic Hierarchy Process (AHP), which is based on the division of the decision problem into hierarchical levels and the paired comparison. The present work had as objective to present a methodology employed to compare three types of structural materials, concrete, steel and wood, according to both objective and subjective criteria. Among the results obtained, it was found that, despite the lower environmental impact attributed to the wood, as well as the better strength of steel, concrete was the material that presented the best total score, mainly due to its lower cost and to cultural aspects.

Keywords: *structural materials, structures, Analytic Hierarchy Process, decision-making, construction.*

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APLICAÇÃO DO ÍNDICE DE QUALIDADE DA ÁGUA IQA_C EM BACIAS HIDROGRÁFICAS PARANAENSES

Alana Deduck Cicilinski [1]
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APPLICATION OF THE WATER QUALITY INDEX IQA_C IN PARANA STATE WATERSHEDS

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Abstract

The main objective of this research was to analyze water quality in the watershed of Tibagi river and Cinzas river, located in the State of Parana, Brazil by applying the CONAMA Water Quality Index (IQAc). Ponderations were made from a viewpoint of more and less rainy annual periods, as well as a seasonal perspective. Georeferenced maps were elaborated using the Inverse Distance Weighted (IDW) interpolation method, in order to obtain the spatial distribution of the estimated values. With the view to compare the results obtained by rainfall periods and seasons, statistical analyzes were carried out at a significance level of 1%. From the results obtained in this study, it can be concluded that the water quality in the evaluated area complies with the minimum water quality requirements in Brazilian legislation for Class 2 rivers. It was observed that the seasonal factor had no significant influence in water quality.

Keywords: IQAc, surface water quality, water quality monitoring.

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UTILIZAÇÃO DE *Trametes versicolor* NO PROCESSO DE DEGRADAÇÃO DE CORANTE ÍNDIGO CARMIM

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USE OF Trametes versicolor IN THE PROCESS OF DEGRADATION OF INDIGO CARMINE DYE

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Abstract

Among the industrial sectors with polluting potential, the textile industry stands out for the large amount of effluents containing dyes, recalcitrant substances with high toxicity. In the search for innovative treatments, the biological treatment stands out for achieving promising results, so this work had the objective of evaluating the degradation of synthetic effluent containing indigo carmine with concentration 20 $mg.L^{-1}$ from the application of fungus *Trametes versicolor* using glucose as carbon source. A study involved the application of glucose at the concentration of 1.0 $g.L^{-1}$ at the beginning of the reaction time (0h) and reapplication of 0.7 $g.L^{-1}$ after 24 hours (24h') in 13 cycles lasting 48 hours, each. Chemical oxygen demand (COD) and glucose were monitored at four times: cycle start (0h), half cycle before addition to glucose (24h) and after addition (24h) and at the end of the cycle (48h). The concentrations of dye and enzyme laccase were taken at 3h, 5h, 10h, 24h, 30h, 34h and 48h. The results of the medium intensity test were 40.6% in the initial 24 hours and 54.4% at the end of the cycle. A COD, on average, 85 ± 4.2% of removal. The low laccase activity may have been attributed to other enzymes, not evaluated in this work. Therefore, our results signals positively for a use of the *Trametes versicolor* in the degradation of indigo carmine.

Keywords: bioremediation, glucose, laccase, *Trametes versicolor*.

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