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Apresentações

do

Dia 30 de maio de 2019

SELECTION AND TEST OF PHASE CHANGING ABSORPTION SOLVENTS FOR ENERGY EFFICIENT CO_2 CAPTURE FROM FLUE GASES

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ABSTRACT

The major technical hindrance to the industrial use of post-combustion carbon capture by chemical absorption is the inherent energy penalty of this technology. Solvent regeneration is considered the main source of energy consumption. Advanced solvents have been developed to mitigate this issue. Phase-changing absorption solvents emerged as a class of solvents with high potential of energy saving. CO_2 absorption induces a liquid-liquid phase split, with only one CO_2-rich phase requiring regeneration. As a result, energy savings and reduced stripper footprint are achieved. Based on a systematic review and economic, process and energy related criteria four solvents (A, B, C and D) were chosen for further experimental investigation. The objective is subject the solvents to pilot tests, to move from lab to industrial scale, contributing with the global warming mitigation. Preliminary tests were performed to confirm the results reported on the literature. Solvent A (monoethanolamine/1-propanol) presented a 26% reduction on the volume of the CO_2-rich liquid phase, with relation to volume of fresh solvent. Monoethanolamine is a traditional chemical absorbent for CO_2 capture applications and 1-propanol is also considered a standard chemical, what is an advantage in terms of cost. The CO_2-rich phase of solvent A has a viscosity of 10 mPa.s at 25ºC, the lowest compared to other evaluated solvents. Solvent B, based on diethylene-triamine and N,N,N',N'',N''-pentamethyldiethylenetriamine, presented only 10% of volume reduction on CO_2 rich phase and a prohibitively high viscosity (360 mPa.s at 40ºC). Furthermore, chemical components of this solvent are considered specialty (high cost). Therefore, B was disregarded for further evaluations. Solvent C, based on N-methylcyclohexylamine and N,N-dimethylcyclohexylamine, was also considered inappropriate to be used as a phase change absorbent. Although its potential low cost and acceptable viscosity after loaded in CO_2 (58 mPa.s at 25ºC), this blend showed an undesired characteristic, solids precipitation on the CO_2 rich phase. It is a potential source of operational problems on industrial application. Solvent D, composed of triethylenetetramine and N,N-dimethylcyclohexylamine presented two immiscible phases even before CO_2 absorption, what is not acceptable for a phase change solvent. Solvent A was the only one selected and tested on the screening plant. This blend presented a CO_2 loading of 2.8 mol/kg on the lower phase, outperforming the benchmark (MEA 30%) on 76%. It is an opportunity to reduce energy penalty of carbon capture of CO_2 by chemical absorption. The solvent A was selected to further evaluation on a continuous mode pilot-plant (under construction).

KEY WORDS: Post-combustion carbon capture; phase change absorption solvents; flue gases.

IDENTIFICATION OF SUSTAINABILITY INDICATORS FOR EVALUATING THE MANEGEMENT OF ELECTRO-ELECTRONIC WASTES WITH FOCUS ON RECYCLING

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ABSTRACT

It is important to use electrical and electronic equipment (EEEs), since they bring facilities to people's lives, acting and benefiting in several areas, such as communication, entertainment, education and, culture. In this sense, waste electro-electronic equipment electronic (WEEE) presents high growth rates in the world due to high industry performance, technological innovation and products with short lifespan or obsolescence very quickly, as well as changing the consumption pattern of the population. In the case of developing countries, Brazil occupies a prominent place, especially the southeast region. The estimate is that each inhabitant produces 3.4 kg of WEEE, considering that each residence has only one unit of each appliance (refrigerator, television, cell phone and fixed). It can use sustainability indicators to manage better these wastes, with subsequent environmentally appropriate disposal, which can cover several sectors, such as economic, environmental, social and institutional. Social indicators are measures used to operationalize an abstract concept or a request for programmatic interest and that they give a direction, translating in real terms, the social dimensions of interest from previously made choices. This work has the general objective of identifying indicators (environmental, economic, social and technical) of sustainability for evaluation of the management of electrical and electronic waste with a focus on recycling. The sources used in the survey will be: 1) to research in scientific articles on management of electronic and electronic waste. It will also be applied the methodology Delphi that consists of three phases, elaboration of a questionnaire, selection of specialists and evaluation of the importance of variables in the system. The elaboration of indicators can help in the management of WEEEs and reduction of possible negative impacts in health and the environment; thus, it became relevant for decision makers. One of the main problems encountered in the elaboration of indicators is the so-called commensurability or valuation, a characteristic that is not found in indicator systems, whose best example is Pressure-State-Response (PSR) - the model describes a current situation, which changes the state of the environment, demanding action from governments or private agents (Answer). Most of the sustainability indicators cover only the state share and this type of indicator has weaknesses as it has no theoretical basis, is restricted to the specific areas of its researchers and therefore dense in some areas and empty in others, leaving aside the constant changes of the system as a whole. The disposal of WEEE in landfills and recycling can create significant risks for the environment as they may emit pollution during their reprocessing. Thus, published studies have sought to identify the nature of e-waste components, their existence in the environment, but a limited number of studies aimed at human health. As the work is still under development it was not possible to list the main indicators for the management of e-waste but one of findings are the indicators of recycling WEEEs: weight-based recycling target, recycled of scarce materials, closure of material cycles and avoid environmental burdens that are used in UE.

KEY WORDS: Sustainability indicators; e-waste; recycling;

HISTORICAL EVALUATION OF THE SANITARY SEWAGE SYSTEM AND THE INFLUENCE OF MUNICIPAL SANITATION PLANS IN THE PARAÍBA DO SUL RIVER BASIN

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ABSTRACT

In Brazil, the sanitary sewage service is regulated by the National Basic Sanitation Law, established in 2007, which has as one of the most significant obligations that each Brazilian municipality should draw up its Municipal Sanitation Basic Plan. The Plan provides a diagnosis of the basic sanitation of the municipality, detects deficiencies and needs of the sector and allows planning short, medium and long term goals and targets, serving as a strategic management tool for municipalities and service providers. Despite its importance, in January 2017 - a decade after the enactment of the Law - only 30% of the Brazilian municipalities had published their Plans and 38% declared to be with the Plans in progress. Like Municipal Sanitation Basic Plans, the management of sanitary sewage is characterized by difficulties in the delivery of services. In 2018, only 51.9% of the Brazilian population had sewage collected and only 44,9% of the total sewage generated received treatment. The National Basic Sanitation Law also establishes that the river basin should be adopted as a planning and management unit, which aims to facilitate the compatibility between water resources and sanitation managements, that is, of the basin plans with the sanitation plans. Among the Brazilian hydrographic basins, the Paraíba do Sul River Basin stands out not only for its large population, but also because it is a source of supply for several industries, as it is the main supplier of water in the Paraíba Valley and provider of electricity through several hydroelectric plants located in its extension. It extends through the states of Rio de Janeiro, São Paulo and Minas Gerais, covering 184 municipalities. Despite its importance, it still suffers from the release of untreated sewage and the lack of planning related to basic sanitation. This research intends to perform an analysis of the conditions of the sanitary sewage systems of the Paraíba do Sul River Basis over time, its influence on the environmental conditions of the basis and the relationship between the Municipal Sanitation Basic Plans and the quality of the sewage discharged into this region. To this end, a large bibliographical research is being carried out on the topics of sanitary sewage and municipal sanitation management, as well as the investigation of spatial, political, economic and environmental data of the basis. To characterize sanitary sewage systems, historical series of indicators present in the National Sanitation Information System (SNIS) and population data of the Brazilian Institute of Geography and Statistics (IBGE), both referring to all municipalities of the basin, is being used from 2010 to 2017 period. This period was chosen because of the more robust data reporting available in the SNIS. An analysis of the population's basic geographic information was done through Arcgis and a statistical analysis is being made based on indicators and population data, taking as a geographical reference not only the states and municipalities, but also the division of the basin into its eight sub-basins. In this way, the units responsible for the administrative and political-economic management of the regions will be considered. In addition, the Plans of the municipalities of the basis will be analyzed, relating the effectiveness of the existing strategic planning to the development of the sewage systems. It will be possible to highlight the municipalities with the most deficiencies over time and to evaluate their participation in basin pollution and possible corrective measures. The research is still in progress and data are being analyzed, but it is believed that it will be feasible to evaluate the influence of Plans on the study area, reflecting its effectiveness in the strategic planning changes of the sewage system. The study will highlight the importance not only of investments, but also of the implementation of actions related to the treatment and adequate disposal of sewage. It is also expected that the results provide meaningful information on the subject for managers and others involved with Paraiba do Sul River Basin studies, users and service providers.

KEY WORDS: sanitary sewage; Municipal Sanitation Basic Plan; Paraíba do Sul River Basin.

EVALUATION OF THE ENVIRONMENTAL IMPACTS OF THE USE OF RESPONSE STRATEGIES TO COMBAT AN "OIL SPILL"

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ABSTRACT

The oil-spill risk arising from the offshore oil and gas exploration and production activities is evaluated through the analysis of hydrodynamic and oil dispersion models presented by the companies, which use databases that take account of environmental information, oil typology and combat infrastructure, distance from shore, depth, relief, roughness of the sea floor, environmental sensitivity of the region, coast touch time, oil type, ocean circulation, support infrastructure and combat " oil-spill ", among others. The occurrence of an "oil-spill" implies the immediate application of methodologies to combat the already established leakage, such as containment, collection, mechanical and chemical dispersion and "insitu" burning. Each of these methodologies generates different volumes and types of waste and their corresponding environmental impacts. The central problem of this issue is the fact that in many cases the typology and volume of waste generated by the application of response strategies can often be greater than the leaked volume itself, making the environmental impacts of the waste generated is greater than the environmental impacts of the leak itself. The issue of minimizing environmental impacts is complex insofar as there is no methodology that qualifies and quantifies the specific environmental impacts resulting from the implementation of each selected response strategy, leaving the environmental impact assessment limited to the volume of leaked oil and its possibility of touch the coast. The thesis currently under development proposes the development of a modeling system based on the System Dynamics, which in the face of a concrete case of oil-spill, inform which methodologies would be more adequate and effective in the fight against leakage, at the same time as the lower volumes of waste and the lower environmental impacts are generated, with the inclusion of the variable "cost" in the decision-making process. The System Dynamics is a modeling methodology that allows the understanding of how the variables of a certain "complex" system interact, allowing the perception of its dynamic nature and the possibilities of improvement in its performance. It is based on a structure of flows and stocks that allows the modeling of complex systems with large number of variables, which can have their individual role in front of the system as a whole properly dimensioned and understood. In order for a given system to be considered "complex", a "feedback" process must take place among its variables, so that the action on a variable feedbacks the system, changing the conditions on which the initial decisions were based. The approach to the problem to be modeled by the System Dynamics should follow a sequence of steps that allows the choice of actions ranging from the definition and understanding of the problem, to the decision making regarding changes that the generated model has indicated as necessary. Thus, the use of System Dynamics in the modeling of the use of response strategies to combat oil-spill allows the manipulation of all variables individually or collectively, generating numerous output information that will identify the importance of each variable or set of variables, so that decision-making can be adopted with greater quality and effectiveness. The construction of the model will take into account the need to be segmented into distinct compartments, each of which relates to each of the available combat techniques, presenting their response capacities, positive and negative impacts generated, costs, volumes and types of waste generated, etc. Given the large number of variables involved in the system, the determination of cause and effect relationships will systematically understand the problem, allowing more robust decisions can be made regarding technological or procedural changes that contribute significantly to the maximization of responsiveness and minimization of related environmental impacts.

KEY WORDS: oil-spill, system dynamics, environmental impacts.

ANALYSIS OF P REMOVAL TROUGH THE ADDICTION OF MG IN THE SUPERNATANT OF AN ANAEROBIC SLUDGE DIGESTER

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ABSTRACT

Phosphorus is an essential element for all living organisms. It's a component of DNA and it plays an important role in the energy supplier ATP. Due to the increase of global population there is an escalation in the need of food production, which requires P, a non-substitutable fertilizer. The decrease on global P stock highlights the indispensability of sustainable P management. In addition to that, phosphorus compounds are discharged through animal, human and industrial wastes, contributing with the occurrence of eutrophication and the decrease on water quality in receiving waters. Therefore, controlling the amount of phosphorous is a key aspect of wastewater treatment. Traditional techniques of phosphorus removal aim on the biological fixation or chemical precipitation of phosphorus which leads to the production of sludge rich in nutrients such as phosphorus, nitrogen and magnesium or in the increase in sludge volumes. Raw sludge must be stabilized before final disposal and anaerobic digestion is the most applied method to promote sludge stabilization. It is a complex biochemical process in which organisms assimilate the organic matter in an environment without dissolved oxygen, and phosphorous is transferred from the solid phase (sludge) into the liquid phase (supernatant). Precipitation/crystallization is a strategy broadly used to recover phosphorus, presenting high recovery rates and significant economic efficiency. Most processes take place from the crystallization of calcium phosphates (Ca-P) or struvite (MgNH4PO4.6H2O-MAP). These precipitates are formed in a complex process under different conditions such as pH, temperature, supersaturation level and the presence of other ions in solution. In that scenario, struvite crystallization can be considered a sustainable method for recovering phosphorous and nitrogen from wastewater, mainly because struvite can be used as a slow release fertilizer, which contributes to the increase in crop productivity. This study aims to evaluate the recover of phosphorous through the addiction of a magnesium source in an alkaline environment and to evaluate the role of other ions such as calcium, iron and carbonates in phosphorous precipitation. The phosphorous recovery will be made from the supernatant of pilot scale anaerobic sludge digesters. The units will be operated and monitored according to different substrates: sewage sludge and a mixture of sewage sludge and food waste. In addition to that, it aims the determination of the influence of the ions added with the food waste in the formation of crystals like struvite. This work will be conducted in four stages: characterization of the supernatant from the anaerobic sludge digestion with and without the addition of food waste; addition of a magnesium source in order to cause chemical precipitation; removal of carbonate and characterization of the formed precipitate. The sludge used in this study comes from a pilot scale wastewater treatment plant and the food waste comes from the university restaurant. In order to characterize the supernatant tests will be performed in laboratory scale, evaluating ammonium, phosphate and metal concentrations. Magnesium chloride will be utilized because it dissociates quicker than other magnesium sources. Pumping air into the solution will do the removal of carbonates that way aeration will expulse carbon dioxide. Finally, X-ray diffraction analysis will be performed to determine which crystals were formed in the process. It is expected that the addition of food waste in the anaerobic digestion of sludge will promote an increase in nutrients, which benefits the removal of phosphorus by chemical precipitation.

KEY WORDS: struvite; phosphorous recovery; anaerobic digestion

A MATLAB & RSTUDIO-BASED MODELING PROGRAM FOR DISPERSION OF PM10 EMISSIONS FROM A STEEL INDUSTRY USING GAUSSIAN PLUME EQUATION

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ABSTRACT

The dispersion of air pollution emissions can be estimated through mathematical or air quality models. These models allow evaluating the air pollutants effects to the environment under several conditions, becoming a relevant and low-cost tool for planning and regulatory purposes. Recent studies have shown the effects of particulate matter on environment and human health, specially cardiovascular and respiratory diseases. This study aims to assess the effect on air quality of particulate matter (PM10) emissions from stationary sources of a steel industry located in the city of Volta Redonda, Brazil, with the aid of meteorological data (wind speed, wind direction, cloud covering and insolation) from monitoring stations set at the complex nearby. A mathematical model was developed linking MATLAB® and RSTUDIO® platforms, using the Gaussian Dispersion equation to perform the simulations and Google Maps API to visualize the results. Observed data revealed SE, NW and N prevailing winds of 1.0 m/s and 2.5 m/s average speed that were used to simulate stable and unstable atmosphere conditions according Pasquill-Guifford classification. The results have exposed elevated concentrations of PM10 at the complex surrounding area using different input wind data, showing high contribution of steel industry emissions to the air quality of Volta Redonda city. The national air quality standards recently updated were partially met however numerous violations were indicated, particularly in Santa Cecilia proximity. Further work is required to adjust the dispersion coefficients of Gaussian equation, evaluate the model using monitoring data, and apply for other pollutants also related to steel processes emissions.

KEY WORDS: dispersion models, pollutants dispersion, particulate matter.

CURRENT POLICIES OF FOREST RESTORATION IN BRAZIL

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ABSTRACT

The science and practice of ecological restoration are increasingly being called upon to compensate for the loss of biodiversity caused by the expansion of human activities. The environmental offsetting is a response which includes the compromise to restore a forest as a compensation for a deforested or degradation area. The necessity of an analytic framework for calculating offset ratios, which guarantee a conservation value in the restored areas is highly demanded to avoid a loss of biodiversity in the long run. In this sense the demand of decision making tools is urgent, and is essential to use science on environmental licensing in order to provide methodological prescription with defined goals and thresholds. In this paper, we provide an update on the ongoing legislation, and the most recently regulation, regarding ecological restoration in Brazil, with a clipping of the existence of monitoring protocols. We focus on the existence of regulation of forest restoration legislation regarding its drivers as environmental offsetting or the Law of Protection of Native Vegetation, analyzing the content of the legislation and discussing the existence of protocols, indicators and reference values, in order of evaluation the restoration efforts. The data used in this study was obtained in cooperation with the Brazilian Network for Ecological Restoration. For this study there were surveyed two main drivers of forest restoration in Brazil: the Brazilian Federal Law 12.651/2012 so-called Law of Protection of Native Vegetation (LPNV), and local regulations of environmental offsetting, in a perspective of existence of the regulations and the prevision of monitoring, and an indication of protocols to follow up the projects. Considering the practice of forest restoration and more indeed monitoring practice, both are a novelty for governments and its environmental agencies. Since the launch of the Federal Decree nº 7.830 in 2012 which regulates the Environmental Rural Registry (CAR) this study found a positive correlation ($R^2=0,968$) in the number of local legislation in a context were forest restoration is mandatory to the Environmental Regularization Program (PRA). In this perspective, the current paradigm is to increase the forest cover, where few legislation refer to indication of vegetation structure or even functionality, were only 4 states indicates a protocol which consider ecological criteria as measurement of success. Despite the increase of legislation dedicated to forest restoration, only 5 states have attended to the evaluated indicator forest restoration interface with environmental offsetting programs. This indicates that 80% of the applicable legislation nowadays has the CAR as main driver. This difference has implications on financing and on the forest landscape restoration approach and should be part of a longer-term policy shift emphasizing large-scale, collaborative, and adaptive planning. The necessity of develop strategies of implementation with financial and technical support is highly demanded for the success of this policies. The existence of a specific legislation for forest restoration may enhance restoration effectiveness by clarifying restoration process and rules to all stakeholders involved on implementing projects. Moreover it's necessary for the legislations to be opened for diverse technical approaches, given the opportunity and making possible the development of new techniques and solutions adjusted for local possibilities and conditions.

KEY WORDS: forest policy, monitoring protocols, offsetting

SUSTAINABLE ENERGY EFFICIENCY IN BUILDINGS VIA THE INTEGRATION OF BUILDING INFORMATION MODELING AND LIFE CYCLE ASSESSMENT

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ABSTRACT

Buildings demand a significant amount of energy during their life cycles, hence, moving towards energy efficient buildings is a key factor to achieve sustainability. This study aims to integrate Building Information Modeling (BIM) with Life Cycle Assessment (LCA) in the construction sector to enable decision-makers utilizing standard procedures to empower the process of sustainable energy efficiency in buildings and evaluate the environmental impacts of building materials. This work incorporates a mathematical optimization and a parametric analysis with the BIM-LCA integration to enhance the sustainable energy efficiency of the resulting building designs adopted, along with reducing the difficulties associated with the construction of the building. Various alternatives for building components that make up the envelope of buildings are undertaken in different climate classifications. Insights that can be gleaned from this study include that all components of building envelopes influence the energy consumption in buildings, particularly, exterior walls and windows; the impact of space area, exterior openings and material thickness and choice for the envelope components of the building in all climate classifications, aiding in the design of low-energy buildings. This work indicates that sustainable energy efficiency decisions in buildings (i.e. annual energy use intensity reduction, life cycle energy use and cost enhancement, and environmental impacts evaluation) can be achieved by optimizing the material selection and assessment of environmental impacts via BIM and LCA integration.

KEY WORDS: Building information modeling; Life cycle assessment; Energy consumption; Sustainable construction; Environmental impacts; Experimental Design; Mathematical optimization.

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THE SUSTAINABLE, RESILIENT AND SMART URBAN LAND USE DISTRIBUTION IN THE CITY OF THE FUTURE: A PROSPECTIVE ANALYSIS METHODOLOGY PROPOSITION

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ABSTRACT

Considering the technological evolution observed in recent decades and its expected exponential growth, in a short time, citizens all over the world will experience the benefits of a new generation of cities that will arise. Cities with more effective transport, energy and sanitation solutions, more productive work relationships, better quality of life and more accurate natural phenomena forecasts. The future cities will should be sustainable, resilient and smart to provide social, economic and health balance of the population. The perfect synergy between sustainability, resilience and urban intelligence is essential for the city of the future. Technological changes influence the way people live and relate themselves, including work, education, services, commerce, leisure, housing, health, mobility, among others. The concept of intelligence, ability to be smart or "smart ability" ("*smartainability*") allows estimating with qualitative and quantitative indicators the sustainability and resilience of cities, whether in the economic, energy or social field, due to innovative technologies. The strategic connection between these three concepts: sustainability, resilience and urban intelligence as the main pillars for the cities of the future is the major motivation for this study. The core discussion is how the cities, the organizations and even the people will react to this disruptive technological development process. Certainly, the urban planning of future cities will be mostly impacted, in particular, related to the different types of land use and the spatial distribution of them: residential, leisure, trade, educational institutions, health equipment, industry, services and circulation. Planning the city of the future based on a static photograph of the present seems to be an urban planning paradox. The city of the future does not exist yet, certainly it will face a totally different scenario from the current one. New forms of professional, educational, commercial and industrial relationships will be present on this new scenario. In this hypothesis, professions that do not yet exist, vehicles with still embryonic or non-existent technologies, purposes not yet glimpsed for current technologies applications, spaces formerly occupied by disabled facilities being reprogrammed to other uses, are examples of risks still unknown (unknown-unknowns) in the current urban scenario. The city of the future will need a different model of sustainable urban management, in order to consider new human relations, new technologies and management intelligence, acting in balance to the environment. This paper therefore presents a set of guidelines, based on the prospective analysis of future scenarios methodology proposed by Michel Godet to support decision making on the strategic planning of cities of the future in order to meet their Sustainability, resilience and urban intelligence objectives. The main study objective, then, is to present a methodology for prospecting future scenarios for future cities, offering strategic planning guidelines focusing on sustainability, resilience and urban intelligence and considering disruptive changes and environmental risks observed. The scenarios prospective analysis method to be presented is based on exploratory scenarios elaboration method proposed by Godet and can be structured in phases, as follows: Prospective Workshops – System delimitation; Structural Analysis (MICMAC®) – key variables determination and analysis; Strategies of Actors Analysis (MACTOR®) – identification and analysis of the game of actors and their strategic objectives; Morphologic Analysis (MORPHOL®) – Constraints and Possibilities identification; Expert Method (SMIC PROB-EXPET®) – Hypotheses and Probabilities Game of Future Key Issues; Scenario Analysis – Scenarios and Forecasts (trends or disruptions) Narrative Construction; Multicriteria Method (MULTIPOL®) – Strategic Guidelines Options Formulation. Thus, in summary, a bibliographical and documentary survey related to the theme in question was initially proposed. A laboratory at the Rio de Janeiro operations Center was used as a reference for the realization of a first exercise of the methodology proposed here. The preliminary results presented will serve as a reference for the research to be performed. The next step is to promote interviews with specialists in urban development seeking to identify, in their opinion, what are the influencing

factors for the city of the future as well as constraints to draw hypotheses and scenarios. Then, from the information collection from the sources, the influence factors that characterize the studied system will be identified. With this research with specialists and the use of appropriate computerized tools as described, a set of guidelines for strategic guidelines will be proposed.

KEY WORDS: Smart City; Urban Resilience; Urban Sustainability

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THE EFFECTIVENESS OF THE ENVIRONMENTAL IMPACT ASSESSMENT ON MINING OF THE FERRO CARAJÁS PROJECT S11D, PARÁ, BRAZIL

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ABSTRACT

Although the purpose of Environmental Impact Assessment (EIA) can take a range of interpretations depending on the point of view and perspective observed, in all its possible nuances it is expected that the EIA will play its role effectively. For this reason, it is justified to assessment the effectiveness of the EIA of the Project Ferro Carajás S11D, since it is one of the most significant mining projects in terms of mineral production ever planned in Brazil and due to its expressive dimensions. This project is part of the Carajás Mining Complex, located in the southeast of the state of Pará, northern Brazil. The objective of this research is to analyze the effectiveness of the EIA of Project Ferro Carajás S11D. The methodology was based initially on obtaining the EIA of said project at IBAMA website, the federal environmental agency responsible for the licensing of projects of this size. With the EIA, the process of evaluating the effectiveness of the EIA was started based on the Agra-Filho (1993)'s methodology, plus new criteria. Altogether, the study considered twenty evaluation criteria. Each criterion received a qualitative evaluation with scale from "a" to "d", where "a" corresponds to the worst result and "d" to the best result possible for the item under analysis. Of all the criteria evaluated, 65% were adequately attended, 20% were median attended, and 15% were either very generically attended or not attended. Therefore, although the evaluated EIA presents opportunities for improvement, it satisfied 85% or all of the criteria analyzed. Thus, it is possible to affirm that the study evaluated was effective in its purpose of being an instrument of environmental planning and management.

KEY WORDS: mining; environmental impacts; environmental report.

GEOSPATIAL ANALYSIS OF SEDIMENT-PRODUCING AREAS IN URBAN AREAS AND STUDY OF CONTROL ALTERNATIVES IN THE PORTO MARAVILHA-RJ.

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ABSTRACT

Urban basins are almost universally subject to degradation, largely due to changes in surface runoff and sediment transport. However, the impact of urbanization on the production of urban basin sediments is poorly understood. The sediments deposited on the surfaces are washed during the most intense precipitation events, being transported to the drainage system and finally released into water bodies where they can still cause significant environmental pollution. Often sediment deposits in drainage systems create barriers to flow, clogging manholes, and loopholes, reducing the useful space of some flood control devices as holding reservoirs and in many cases causing persistent flooding. The Porto Maravilha Consortium Urban Operation (OUCPM) is a municipal project that aims to requalify and redevelop five million square meters of the port region of the city of Rio de Janeiro. It is important to emphasize that the territory is home to the oldest community in the municipality of Morro da Providência, besides Morros do Livramento, Saúde and Pinto, which did not undergo urban renewal works, keeping its original characteristics. From the field studies in the region, it was possible to detect areas in the lower part of the hills with a significant accumulation of sediments, which often obstruct the existing runoff boxes, causing operational and visual impact in the circulation ways. In this work, we intend to use techniques that may allow the preparation of a deterministic cause-effect model to estimate sediment production based on the hydrological and physiographic characteristics of the region. This model can be used as a support for territorial management for water resources of urban river basins similar to the one studied in the present research. The present work has as general objective to develop a simplified model for the prediction of sediment / waste accumulation zones in a low topography region located in the base of residential occupations (communities) in the port region of Rio de Janeiro. The methodology will consist of a The methodology of the present work consists of the field recognition, the physiographic and hydrological characterization of Morro da Providência, the elaboration of hypotheses for the analysis of production, transport and sediment accumulation behavior, and finally the parameterization of a linear model regression analysis. As a result, it is expected that the different types indicate which are the other points of the region with the need to be implanted a new drainage system or adapted to avoid that the sediment reaches the base of the hill or that can be concentrated in boxes of sediment in order not to obstruct the boxes thin and impact the roads.In addition, alternatives and engineering solutions will be indicated, such as the construction of sediment-box type devices for flow concentration and collection of sediments carried from the top of the hills to the base during floods, reducing operational impacts and also the costs of cleaning (scraping) the roads.

KEY WORDS: : sediment accumulation, geospatial analysis, Porto Maravilha/RJ

PHYSICAL CHARACTERIZATION OF THE URBAN SOLID WASTE GENERATED IN DIFFERENT CITIES OF RIO DE JANEIRO STATE, BRAZIL

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ABSTRACT

In Brazil, landfill is the most common form of waste disposal. One of the goals of the National Policy for Solid Waste (Brazil, 2010) is to reduce the amount of waste landfilled by encouraging the development and utilization of material and energy recovery technologies. As the composition of Urban Solid Waste (USW) changes and is closely correlated with population growth, socio-economic standards and technological developments, knowledge of the waste composition is of vital importance for its integrated management in modern cities. In this work, a two-year survey of the physical composition of the USW will be conducted in three landfills and one waste transfer station, located in different cities of Rio de Janeiro State (São Gonçalo, Duque de Caxias, Nova Iguaçu and Barra Mansa). This study, divided into two stages, aim to identify the best technological route for the recovery of materials and energy, according to local waste characteristics. The first stage is the sampling plan for each city considering how the population is distributed within its boundaries. For a most reliable representation, sampling dispersion was calculated proportionally to the resident population in the different political-administrative subdivisions of the municipalities, based on data from the latest Brazilian Population Census. The sample sizes were predetermined by the number of bimestrial visits programed for each landfill, which is of 10 visits over a period of 24 months, and the operational capacity for the field characterization analysis, which is of four 240L containers per day. Therefore, 9.6m³ of USW will be characterized per unit studied. The second stage is the physical characterization assay, which consists in a gravimetric analysis of different fractions of the USW, differentiating them into 6 components (organic, paper, glass, metal, plastic and miscellanea. Furthermore, the components are subdivided in 37 subcomponents. Waste samples will be further analyzed in laboratory assays to determine the specific weight and water content as well as the granulometric pattern. The first stage of this work is completed and the sampling plan for each local are ready. The second is undergoing, in situ, on the sanitary landfills of Nova Iguaçu (CTR Nova Iguaçu), São Gonçalo (CTR São Gonçalo), Barra Mansa (CTR Barra Mansa) and in the Waste Transfer Station of Duque de Caxias (ETR Duque de Caxias). After the first sampling day, preliminary results shows the composition of the USW generated in the City of Duque de Caxias. Notably, organic waste is the largest portion of the waste stream, averaging 42.12% of the weight, followed by miscellanea (20.80%), paper (17.50%), plastic (15.43), glass (3.00%) and metal (1.16%). Characterization effort is still in early stages. Results for the other areas will be available and as the study develops.

KEY WORDS: WASTE, CHARACTERIZATION, LANDFILLS

EVALUATION OF THE BIOMETHANIZATION TECHNIQUE FOR THE FINAL DISPOSITION OF URBAN SOLID WASTE FROM RIO DE JANEIRO

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ABSTRACT

One of the major challenges nowadays is the adequate disposal of solid waste. According to data from ABRELPE's 2017 Solid Waste Survey, 71.6 million tons of urban solid waste (USW) are collected annually in Brazil, and of these, 51.4% corresponds to organic solid waste. In landfills, organic matter undergoes an anaerobic degradation process, generating a leachate with high polluting potential and methane, one of the greenhouse gases. In order to remedy the gaps in the solid waste management sector, Law 12,305 of 2010, which instituted the National Solid Waste Policy (PNRS), was created. Among other things, PNRS extends the possibilities of using waste as raw material in other productive processes. Therefore, with respect to the organic fraction of the residues, several technologies are being investigated, and the anaerobic digestion, or biomethanization, has been gaining importance. In light of this, the general objective of this project is to evaluate the ecotoxicity of the urban solid waste digestate originated from the Dry Tunneling Biomethanization process. In turn, the specific objectives are: determine the most appropriate composition of the residues for the process; monitor the influence of physical-chemical parameters; and evaluate the quality of the digestate as a fertilizer or soil conditioner considering the relevant legislation. As it was previously mentioned, the final disposal of solid waste is one of the major problems faced nowadays, and with the PNRS, municipalities must implement organic solid waste composting systems, in addition to being able to dispose in landfills only wastes that cannot be treated or recovered. Thus, biomethanization of the organic fraction of residues appears as a promising alternative considering that: it eliminates or reduces the organic fraction that is disposed in landfills (reducing leachate generation); increases the useful life of landfills; promotes the energetic use of biogas; and returns nutrients to the soil (using the digestate as a fertilizer or as a soil conditioner). For this project, the work will be carried out in the dry biomethanization plant in tunnels of the Caju Composting Plant. The project is a partnership between the Federal University of Minas Gerais (UFMG), the Methanum Company: Waste and Energy and the Municipal Urban Cleaning Company (COMLURB), with financing from the National Development Bank (BNDES). This is the first urban solid waste methanization plant in Latin America and it has the capacity to treat 50 tons per day, serving approximately 100,000 inhabitants. The residues will be collected at the entrance and exit of the tunnels. After the final stabilization in the composting line, the material will also be analyzed. Samples will be collected according to the Brazilian standard for solid waste sampling and during the laboratory analysis the following physical-chemical parameters will be evaluated: temperature, moisture, metals, total carbon and nitrogen, ammonia, nitrite and nitrate, conductivity, humic and fulvic acids. The following ecotoxicity tests will also be performed: acute toxicity test on Lepidiumsativum (Zucconi 1981b), chronic toxicity test on Lemnagibba (US EPA 712-c-008), acute and chronic toxicity test on Enseniafoetida (ASTM E 1676). In light of this, with this project it is intended to: contribute to urban solid waste biomethanization studies; assist in the search for an appropriate environmentally method of treatment and disposal of the organic fraction of the USW; and find in the USW digestate originated from the dry biomethanization tunnels a good fertilizer or soil conditioner, considering the relevant legislation.

KEY WORDS: biomethanization; urban solid waste; organic matter.

DENSIFICATION OF CYANOBACTERIA BIOMASS BY COAGULATION/FLOCCULATION WITH CHITOSAN FOR BIOGAS PRODUCTION

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ABSTRACT

The concern of the world population with the increase of atmospheric emissions is a recurring subject nowadays. In this context, the adoption of renewable energy source as substitutes for traditional fossil fuels is an interesting alternative. Third-generation biofuels, such as those derived from cyanobacteria and microalgae, represent a potential source for energy generation, and several studies are currently being conducted to evaluate their viability. Particularly, in order to enable the production of methane via anaerobic digestion from microalgae and/or cyanobacteria biomass, it is essential that an efficient and low-cost method of cell concentration be employed. In this sense, the use of processes involving coagulation/sedimentation is very promising. In addition to efficiency and low cost, for use of the concentrate in anaerobic digestion, it is crucial that the compound used in the concentration it is not toxic or inhibitory on anaerobic microorganisms. Studies on conventional and non-conventional coagulants for the concentration of biomass suspensions should be conducted. Thus, this study aims to evaluate the densification of a suspension of cyanobacteria *Synechococcus subsalsus* by coagulation/flocculation with chitosan followed of sedimentation and anaerobic digestion of the concentrated biomass. The cyanobacteria will be grown in 500 mL Erlenmeyer flasks containing 300 mL of sterile medium, kept in rotating shaker with temperature control (23 °C) and photoperiod (12:12)h. Jar Tests will be performed with the aim of obtaining the best coagulation/flocculation conditions, which include the best pH, as well as the best concentration of the coagulants ferric chlorid (conventional coagulant) and chitosan. For each sampling, the mixture will be kept under rapid stirring at a speed of 100 rpm for 1 minute. After this interval, the stirring speed is decreased to 40 rpm for 15 minutes. Sedimentation of the formed flakes occurs for 45 minutes at rest. After this time, the supernatant is drained and the concentrate will be collected for further analysis. The anaerobic digestion will be conducted in batch mode in 100 mL penicillin-type vials with 90% of the useful volume. Brewing industry sludge will be used as inoculum, whose concentration of volatile solids (VS) will be determined, being kept under refrigeration (4ºC) until the moment of its use. The amount of sludge and concentrated biomass (with or without coagulant) used in penicillin flasks will be calculated to maintain different inoculum/substrate ratios (g/g in VS). The flasks will be sealed with rubber seals and incubated at 30 °C until stabilization of biogas production. For the evaluation of the anaerobic biodegradability the monitored parameters are: efficiency of VS removal, production and composition of biogas. Production of biogas will be monitored by displacing the plunger from 60 mL graduated plastic syringes connected to the vials by means of scalps. The biogas composition will be measured by gas chromatography. At the end of the experiment, it is expected to have developed a method of concentration of the cyanobacteria biomass of low cost and efficient and that allows to obtain high yield of methane in the anaerobic digestion of the concentrated biomass.

KEY WORDS: *Synechococcus subsalsus*; Densification; Chitosan.

USE OF WASTEWATER INDEXES FOR BENCHMARKING AMONG WASTEWATER SERVICES COMPANIES IN RIO DE JANEIRO

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ABSTRACT

Synthetically, it is possible to divide sanitation companies into three types: local companies, state companies and private companies. In the state of Rio de Janeiro, area of the present study, 43% of the municipalities that have information in the National Sanitation Information System (SNIS) have their sewage services provided by municipal companies; 36% have their services provided by a state company, Cedae (State Water and Sewage Company of Rio de Janeiro), and 16% by private companies. Therefore, Rio de Janeiro has its sewage services mostly provided by public companies, whether local or state. This study aims to define the most efficient companies operationally, through benchmarking among all companies providing wastewater service in the state of Rio de Janeiro. The term "benchmarking" can be understood as an evaluation reference based on previously established criteria. The methodology, still under development and without definitive results, was divided into three stages. The first one included the selection of the most appropriated indicators for benchmarking. Data from SNIS were analyzed over an interval of 10 years (2008 to 2017). The indicators selected were those with a consistency greater than or equal to 75% and those that could better express the operational efficiency of the companies, namely: wastewater treatment index (IN016); index of urban wastewater service referred to municipalities served with water (IN024); productivity index: active customers per employee (IN002); and index of electricity consumption in wastewater systems (IN059). The second stage established the criteria for benchmarking. The 25% percentile was adopted for all indicators. Service providers were divided into groups with different population stratum for more assertive comparison. Population range were based on the usual stratum of Brazilian Institute of Geography and Statistics: up to 20,000 inhabitants; between 20,001 and 100,000 inhabitants; between 100,001 and 500,000 inhabitants; more than 500,001 inhabitants. The third, and last stage, consisted of grouping the companies that attended benchmarking and those that did not attended it. In order to the companies be included in the first group, they should have attended, concurrently, the benchmarking of all indicators. With the results to be obtained, it is expected that the most efficient business models for wastewater services in Rio de Janeiro, for each population stratum, will be discussed in order to subsidize the decision-making of local and state managers.

KEY WORDS: wastewater indicators; benchmarking; wastewater services companies; SNIS.

LIFE CYCLE ASSESSMENT OF BIOENERGY GENERATION BASED ON CATTLE AND PIG MANURE

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ABSTRACT

The main environmental problem associated with livestock breeding is high rates of methane emissions. The large volume of manure generated needs adequate disposal or use, making Brazil a potential producer of bioenergy. This article reports a comparative life cycle assessment of bioenergy production from pig and cattle manure biogas to estimate their respective contributions to greenhouse gas emissions. The boundaries included the finishing, manure management, anaerobic digestion (AD) and combined heat and power (CHP) phases. The method included consultation of Intergovernmental Panel on Climate Change reports and application of SimaPro 8.0 software. The results show that bioenergy generation from pig manure biogas has higher emissions than from cattle manure, which can be explained by the different allocation factors considered, related to: manure's low market value, which reduces enteric fermentation emissions; and the different amount of solid digestate produced by cattle and pig systems. By using manure as a substrate for biogas production, it ceases to be a livestock residue and becomes a product, whose use reduces greenhouse gas emissions.

KEY WORDS: Life cycle assessment (LCA); Manure Biogas; Bioenergy production Livestock;

DOES FIRST FLUSH REALLY WORKS AS A SANITARY BARRIER?

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ABSTRACT

Water scarcity has been a problem in many places world around. The increase in water demand due to population growth and consumption, associated with constraints on water availability and quality require actions, especially in a climate change scenario. Alternative water sources need to be assessed and wisely managed in order to ensure water supply. Although rainwater is considered a source of clean water, air pollution and lack of sanitation can negatively change water quality in developing countries cities incurring health risks. This study aims to detect enteric viruses from roof-harvested rainwater (RHRW) in a densely urbanized region at the Greater Metropolitan Region of Rio de Janeiro characterized by lack of adequate sanitary conditions, in order to evaluate the feasibility of its use as an alternative source for human consumption. A sampler for collecting rainwater was fixed at the roof of a building in the campus of Fiocruz and the first 10 mm of 10 rainfall events were collected from April 2015 through March 2017. The Roof Harvested Rainwater (RHRW) samples were concentrated by skimmed flocculation method and tested for Rotavirus (RV), Norovirus (NoV), Human Adenovirus (HAdV) and JC. All the samples were quantified by using quantitative polymerase chain reaction TaqMan assays. All samples were inoculated with PP7 bacteriophage as internal process control. A hundred percent success rate of the spiked internal control was obtained in raw and/or in diluted (1/10) samples. The tests have shown all samples were contaminated by at least one virus. The concentrations ranged from $1,11 \times 10°$ to $9,67 \times 107$ for Adenovirus; $2,46 \times 10^2$ to $2,58 \times 10^3$ for Norovirus; $2,05 \times 10^1$ to $8,00 \times 10^1$ for Rotavirus. This preliminary study has concluded the first flush does not work well at least for viruses.

KEY WORDS: RHRW, Virus, Health risks.

EVALUATION OF ZNIBU AS A REGENERATIVE REAGENT FOR WASTED RUBBERS

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ABSTRACT

The Brazilian Solid Waste Policy aims to join different measures that corroborate with adequate solid waste management. The principles are based with "non generation, reduction, reutilization, recycling and correct treatment" in this order of priorities. Polymers are known as an important solid waste due to their wide different uses and persistency on environment. Polymers can be divided in two different classes: thermoplastic and thermosetting polymers. Thermoplastic polymers can be recycling by heating, in a process that allows a new molding of the heated material. Thermosetting polymers, like rubbers, cannot be recycled by heating only since they present crosslinks that are formed during the vulcanization process. To recycle rubbers it is necessary the use of reagents that allows the breakage of crosslinks, in a process known as regeneration. Most of the reagents used in regeneration processes generate by-products which are harmful to environment and human health. Recent studies indicated that the reagent TETRABUTYLAMMONIUM BIS(4-METHYLPHENYLSULFONYLDITHIOCARBIMATO) ZINCATE II (ZNIBU) did not generate such by-products which makes it a potentially friendly regenerating reagent. The objective of this study was the evaluation of ZNIBU, in different concentrations, as a regenerating reagent for a rubber waste. Rheometric analysis was carried out on a Rubber Processing Analyzer (RPA) and the mechanical properties considered were tensile strength, tear resistance and hardness. Results showed that by increasing ZNIBU amounts, crosslink breakage is favored as it reduces the viscosity of the regenerated rubber. Mechanical properties indicated that there is a limit of ZNIBU content that can be used for the regeneration, as concentrations beyond this limit would lead to mechanical properties losses. So, this preliminary study indicated that it is possible to use ZNIBU as a regenerating reagent but there is an optimum concentration that needs to be considered. Next steps will be the comparison between the performances of ZNIBU and a commercially available reagent, at their optimum concentrations, concerning rheometric and mechanical properties after the respective regeneration processes.

KEY WORDS: solid waste management, rubber regeneration, rheometry

DEVELOPMENT OF THE HEALTH AND SAFETY CULTURE IN THE IRON ORE EXPLORATION AT VALE S.A.

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Vale is a mining company, based on market capitalization. The headquarters is located in Brazil, in the city of Rio de Janeiro. With over 130,000 employees in more than 30 countries, it operates in the areas of mining, logistics, steel industry and energy. It is one of the largest producers of iron ore in the world, generating iron lumps, sinter feed, pellet feed and pellets. It also produces copper, nickel, coal, fertilizers, manganese, gold, silver, cobalt and ferroalloys. The VALE Iron Ore Exploration tasks are complex in terms of their territorial diffusion, since their activities in Carajás (PA), Quadrilátero Ferrífero (MG) and Corumbá (MS) are mostly developed in remote areas, which makes it difficult to act in case of accidents. In this context, 1200 workers who carry out their activities distributed in these regions of Brazil and linked to the research and exploration processes that are divided into seven processes in the mineral exploration management. Within the iron ore sector at VALE is the ferrous and coal planning and development board, responsible for the acquisition of mining areas and rights, geological exploration, resource modeling, mine planning, reserve estimation and other objectives. This board of directors has approximately 500 own employees and 1,700 service providers and, from 2008 to 2017, presented an annual average of 10 occupational accidents, being in total, 6 accidents with medical leave and 1 fatality.

Thus, the objective of this work is to map all the risks of the iron ore exploration activities, especially at the geological drilling process, where there is the greatest exposure to the risk of personal and material accidents, applying all stages of risk management (identification, analysis, evaluation and treatment). As specific objectives, this dissertation seeks: (1) develop a preventive education process, with a training schedule in the management of risks; (2) map the critical factors to the teaching-learning process in the prevention of accidents and injuries to the health of its workers; (3) evaluate and analyze the stage of health and safety maturity of the iron ore exploration; (4) obtain a better understanding of the basic causes and beginnings of anomalies occurring in field activities; (5) subsidize preventive action, generating ways for management decision that will reduce the frequency and severity of accidents, providing a better performance of the continuity of the iron ore exploration business; (6) promote the evolution of the iron ore exploitation in relation to work safety with the internalization of the value of life first of all. As methodology, will be used the data and experiences acquired from VALE HSE work, master's and doctoral theses, scientific articles and available technical reports. Facing the theoretical reference obtained in the bibliographic research, a critical analysis of the data and reports obtained in VALE will be done for the presentation of a framework proposal for the implementation of a policy that leads to a robust security culture, taking into account everything that was researched and evaluated. Also, will be analyzed the impact of the current organizational climate in relation to work safety in the process of building a socially responsible culture - reinforcing and inhibiting aspects of safe and pro-environmental behaviors. It will be structured actions (convergent with company policies) to continuously improve the internalization of the values of the results assessed and evaluated, in order to improve the level of development of health and environmental aspects in all areas and hierarchies of mineral exploration management. The results obtained at the end of the proposed activities will be the mapping of the risks of the iron ore exploration activities in a structured way and the presentation of a proposal of prevention and mitigation of the risks mapped in the area.

KEY WORDS: SAFETY, MANAGEMENT, RISK, ORE EXPLORATION

AN ANALYSIS OF THE ENVIRONMENTAL STANDARDS USED IN THE OIL & GAS AREA IN BRAZIL

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ABSTRACT

One of the main characteristics of oil&gas area is that its projects are very intensive in capital, usually spending billions of dollars. With this in mind, it is easy to understand that risks must be carefully studied and prevented. Other important preoccupation regards pollution and other potential damages to environment. In this scenario, environmental standards play an important role, orientating all phases of the project, since basic design until the start-up of the plant, either in upstream or downstream. The problem begins when we have rules that often changes during the project, or that are poorly defined at the design phase. Also we have many players in the government area, that sometimes present conflicting legislation, or different interpretations of the standards. All this leads to great losses of time and money, reducing considerably the Net Present Value of the project. Our objective here will be to understand how things occur now and what could be done in order to reduce conflicts and optimize the project cycle but, at the same time, keeping a high level of security regarding environmental risks.

KEY WORDS: Standards, Project, Oil&gas

COMPARATIVE STUDY OF PESTICIDES CONCENTRATIONS IN SOIL IN DIFFERENT TOMATO PLANTATION METHODS

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ABSTRACT

Population growth and increased demand for food means that world agricultural production is moving fast to meet market demands. However, the pests and diseases that affect the plantations are the greater adversaries of the farmer, generating losses in the field and causing reduction of the production. Pesticides are still used today to serve large areas for planting effectively; however, the indiscriminate use of these products in crops can cause problems to food safety, human health, and contaminate soils, surface water and groundwater. Tomato is one of the main products planted and marketed by the world's agriculture and whose planting needs application of pesticides. Within this scenario, it is of fundamental importance that planting methods be introduced that prioritize good cropping techniques and the reduction, at the zero limit, of pesticide contamination. This work was based on the following assumptions: soil is the final destination of residues from the application of pesticides; there is probable contamination of soils by the application of pesticides in agricultural plantations. Organic agriculture does not have the installed capacity to meet the world demand for food; there is no validated and reliable method for determination and quantification of pesticides in soil, according to maximum residue limits (MRLs) specified by Anvisa. Based on these premises, the objective of the research was to monitor and compare the concentration of the main pesticides used in tomato planting in the soil, in order to break the paradigm that only the organic production of this fruit is environmentally friendly and demonstrate that, if applied using good techniques, pesticides can still be an efficient alternative to fighting pests and diseases in agriculture. The objective of this study was to compare the level of soil contamination by pesticide residues based on the 35 pesticides approved by ANVISA for use in planting tomatoes in their main cultivation methods (conventional, sustainable and organic). The specific objectives of the work are: to quantify pesticide residues that are carried through soil analysis in three depth horizons; to verify the accumulation of pesticides in the soil by the sum of residues of daily application in agriculture; to compare the amount of pesticide residues in the soil from different forms of tomato cultivation; validate a method for laboratory analysis of pesticide multi-residues in soils; to apply the method developed and validated to the analysis of soil samples in several cultivars, besides extending the use of the method developed and validated for other 300 pesticides authorized by Anvisa for use in Brazil in the various crops. The methodology involved the following steps: I - collection of soil samples where the tomato is planted in the following types of cultivation: conventional staking; organic and guided by the sustainable cultivation method proposed by EMBRAPA (in covered and open plantation); collection of the Reference White samples - Samples of the soils referred that were not submitted to any treatment with the pesticides of interest in this work; II- Characterization of the soil in terms of fertility and chemical composition - this stage will be carried out in partnership with EMBRAPA SOLOS; III- Preparation of samples for extraction - Samples must be 30 mesh (fine earth), suitable for chemical extraction - this step was carried out in partnership with EMBRAPA SOLOS; IV- Clean up of the samples and suitability of the QuEChERS Method for analysis through high resolution liquid and gas chromatography; V- Determination of multi-residues of pesticides by gas and liquid chromatography - stages IV and V performed in INCQS / FIOCRUZ laboratories; Validate the analytical method developed analyzing the main figures of merit, according to the guide Sante; Apply the method developed and validated in the analysis of different soil samples from tomato plantation. The samples were collected in the municipalities of Tanguá, Monjolos, Trajano de Moraes and Nova Friburgo, located in the northern part of Rio de Janeiro state, according to the sampling method proposed by EMBRAPA. After the collection of the samples, soil characterization was performed regarding fertility and physical characteristics in EMBRAPA laboratories. The samples were then reduced to the fine grade quality (30 mesh granulometry) and sent to the INCQS laboratory (FIO CRUZ), where the pesticides were characterized by high resolution gas chromatographic methods with electron

capture detector and liquid chromatography (HPLC) coupled to the mass spectrometer. The results of this work are still under analysis.

Keywords: Tomate, pesticide, soil

BUILDING A CORRELATION OF CRITICAL SUCCESS SUSTAINABLE FACTORS AND SUCCESSFUL RESULTS IN PROJECTS – DEA – DATA ENVELOPMENT ANALYSIS

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ABSTRACT
As the years progressed the impact of industrialization growth on the planet increased, turning the eyes of the scientific community to the fact that a new model of doing business would be necessary to support the existence of our planet. The United Nations created in 1972 the World Commission on Environmental and Development (WCED) to care about the environmental issues, the development, and the solutions. In 1987 the WECD launched the report "Our Common Future" and defined the term sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." In 1997 Elkington proposed that the business aspects could not be separated from the social and environmental aspects launching the Triple Bottom Line. After these events, the published articles related to sustainability increased. As it is through projects that the industrial world exists, progresses and develops itself, it is natural to seek projects to implement sustainable development. During the last decades, researchers published many articles that studied the integration of sustainability and project management, trying to propose frameworks to address sustainability through project management. There is also a seek to succeed in the projects, achieving the planned goals with successful results in the KPI's – key performance indicators. After analyzing a set of papers, it can be observed that many authors indicated very similar aspects that should be taken into consideration to bring sustainability to project management processes. This evidence is an encouraging finding because it shows that guidelines around the world are converging to the same target. Conversely, when the various authors analyzed the practical day-to-day of the projects, they found pieces of evidence that companies did not consider the most sustainable aspects in the projects. So, why are the companies not being capable of considering sustainability aspects in their projects? A couple of reasons may play a role in this scenario, such as the belief that sustainable solutions are expensive, and it is not worth to discuss it, lack of knowledge of the project team to propose innovative approaches and plan for them in the earlier project phases, lack of a practical framework to guide the decisions, and so on. On the other hand, the meaning of a successful project is a significant question mark, but authors acknowledge that only addressing time, cost and quality is not enough anymore. So, proving by research that sustainability contributes to the success of the projects could be a turning point in the decision makers' behavior, who would turn their eyes to apply sustainable factors in their projects. The objective of this study is to build a comprehensive list of critical success sustainable factors and the processes below them and to create a correlation between the existence of these processes and the successful results achieved in the projects using DEA - Data Envelopment Analysis, in the business area of mining, infrastructure, oil & gas, and energy. Additionally, analyze the differences of what critical success sustainable factors and their processes each business area considers and what the successful results are. The methodology is still being defined but primarily based on the academic research and the author's professional experience, a list indicating the critical success sustainable factors of a project and the processes below them will be defined correlating them to successful results aimed. This list will be sent to professional project experts (consultants and companies) to indicate if they agree with the indicated factors and their processes and if they suggest other factors and processes. Based on the answers a final list of critical success sustainable factors and their processes will be generated. Another survey with experts and companies will indicate, for specific projects, which factors/processes exist and what the results achieved are. A correlation between the factors/processes and the successful results will be build using DEA. - Data Envelopment Analysis. Then an analysis will be carried out and comparison between the results for each business area will be done.

KEY WORDS: sustainable, project, data envelopment analysis, success

DEVELOPMENT OF METHOD FOR LEACHATE AND METHANE BIOCHEMICAL QUANTIFICATION USING SYSTEMS DYNAMICS AND GEOTECHNOLOGY

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ABSTRACT

The demand for consumer goods and services coupled with population growth force the increase of manufacturing and production processes at all stages of the life cycle, leading to the generation of larger quantities of Municipal Solid Waste (MSW) that must be properly managed to avoid negative environmental impacts. Disposal in the soil of MSW is still considered the most economical way of management adopted in most countries. In Brazil there are 3326 units of MSW irregular disposal. They are environmental liabilities that need to be properly managed, however due to the scarcity of fund to solve the problem of contamination and pollution this work proposes a new method to support decision-making related to MSW management based on cause and effect relationships so that it can improve the way environmental liabilities are planned, executed and evaluated in order they comply with the legal requirements and the wishes of the society. The first methodological approach was to systematize the mental structures through diagrams and identify the intervening variables in the processes to determine the fundamental units that were used in the effluent quantification models establishing the limits of the systems and the subsystems. The second methodological approach was the use of the concepts, methodological sequences and empirical tools of the established methods to estimate biogas and leachate using Systems Dynamics (SD). The partial results obtained were: six Causal Loop Diagrams using the models for theoretical biogas generation; one Causal Loop Diagram to determine the leachate flow; identification of the main parameters in the process; integration between geotechnology and SD to determine the amount of waste disposed in the soil in an area without operational control; identification of the positive reinforcement loop and the negative reinforcement loop for all developed diagrams.

The simulation model will be elaborated when the definitive structures was chosen by comparison with the data obtained in the field.

KEY WORDS: system dynamics ; municipal solid waste ; geotechnology.

AEROBIC GRANULAR SLUDGE IN A PILOT-SCALE SEQUENCING BATH REACTOR TREATING REAL WASTEWATER

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ABSTRACT

Ammoniacal nitrogen in free ammonia form has potential toxic effects for aquatic life, when it oxidizes to nitrite, and then to nitrate. Nitrate affects the oxygen demand in water bodies, and it is a nutritional source for phytoplankton and vegetal biomass growth. On the other hand, phosphorus is also a fundamental element for eutrophication process in water bodies, which it is the excessive growth of phytoplankton (algae) or vegetal (macrophytes) biomass. As a result of eutrophication, the oxygen molecular diffusion is impacted due to aquatic plants proliferation along water body surface. In addition, organic matter decomposition confers taste and odor in water bodies, prejudicing the multiple use for this water. In this way, in addition to organic matter removal, guidelines for river basin management may also ask the need to remove nitrogenous and phosphorus compounds. In this context, new technologies have been created in order to meet these removal requirements, aerobic granular sludge technology is one of them. Biogranulation is a physical, biological and chemical process, which involves interactions between cells. The authors also explain that biogranulation can be classified as aerobic and anaerobic. These biogranules are formed by the microorganism's self-immobilization, which creates a dense microbial pack, forming different layers, which are aerobic, anaerobic, and anoxic layers. The presence of these distinct layers allows the presence of different bacteria (nitrifying, denitrifying phosphate accumulating organisms, and anaerobic organisms). In consequence, AGS can simultaneously remove organic matter, nitrogen, and phosphorus. Aerobic granular sludge has been the focus of different researches over the last years, but still has gaps to analyze, mainly regarding the granules formation and stabilization. In this way, the aim of this research is to provide information concerning the granules structure and its treatment efficiency to treat real domestic wastewater. In order to do that, two sequencing bath reactors were constructed to treat real wastewater. Both reactors are constructed at Centro Experimental de Saneamento Ambiental (CESA), located at Universidade Federal do Rio de Janeiro (UFRJ). The reactors were designed to work in sequencing bath operation, removing nutrients and organic matter. The main parameters such as sedimentation time, and oxygen flow rate are following older previous studies, but will be adjusted over the reactors operation.

KEY WORDS: removal; nutrients; organic matter.

EVALUATION OF MUNICIPAL WATER SUPPLY INDICATORS IN THE PARAÍBA DO SUL RIVER BASIN

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ABSTRACT

According to the National Sanitation Information System report of 2017, 16,5% of the Brazilian population still had no access to water supply network and 38,3% of treated water was lost during its distribution. These and other numbers exemplify the great challenge that Brazil has to face concerning water management. The Paraíba do Sul River Basin is one of the most populated and strategic in the country, serving as water source to multiple uses in the states of Rio de Janeiro, São Paulo and Minas Gerais, including municipal water supply, energy generation, industrial and agricultural use. However, it has been facing serious water shortage over the last years, despite having eight Basin Committees responsible to support water management in the area. In this context, a better understanding of water supply systems weaknesses is essential to help reverting this scenario. This study aims to evaluate several indicators available at the National Sanitation Information System over the last 11 years for all the 184 municipalities that are located in the basin. Eight indicators were chosen to evaluate the quality of the system and service and 14 municipalities were removed from the analysis, as just a small part of their urban population (<25%) is inside the limits of the basin. Due to considerable lack of data in earlier years (>25%), the study will take into account the period of 2010 to 2017 (the most recent year available data). The historical trajectory of each indicator will be assessed in a general view, as well as by using the administrative units and demographic information to deepen the discussion. The ongoing work's intended main contributions are: (i) identify the key weaknesses in water supply systems management for each state and each basin committee; (ii) correlate initiatives and legal instruments with the improvement or worsening of indicators; (iii) understand the influence of system sizes on water system performance.

KEY WORDS: water supply; indicators; Paraíba do Sul River Basin.

USE OF LIFE CYCLE ASSESSMENT IN DOMESTIC WASTEWATER TREATMENT PLANTS IN BRAZIL

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ABSTRACT

Domestic wastewater treatment plants (WWTPs) are designed and implemented to minimize and avoid environmental degradation, but they also generate environmental impacts, from construction to dismantle. Thus, instruments that evaluate the environmental performance of WWTPs are necessary, in which the life cycle assessment (LCA) is highlighted. In this context, the thesis aims to apply the LCA in several scenarios of WWTPs. For the first step, the use of the life cycle assessment methodology in domestic wastewater treatment plants in Brazil was analyzed. For this, Brazilian studies that apply the LCA in domestic wastewater treatment plants were selected. The studies were researched in national and international databases through the combination of several keywords, only studies in which the main author had Brazilian affiliation were selected. Once the studies were selected, their characteristics were evaluated. Only 2 articles were found, which present similarities and differences. It's concluded that: (i) the use of the LCA methodology in WWTPs is still very incipient in Brazil, which does not contribute to the development of sustainable WWTPs in the country; (ii) NBRs ISO 14040 and 14044 have not yet motivated the application of LCA in WWTPs in Brazil; (iii) uncertainty analysis is relevant and should be considered in LCA studies; and, (iv) the choice of lifespan should be carried out with criticality.

KEYWORDS: Life Cycle Assessment; Substantiality; Wastewater Treatment.

EVALUATION OF REMOVAL OF NONYLPHENOL FROM PUBLIC SUPPLY WATER

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ABSTRACT

The way in which society lives has been changing and impacting the nature, generating, as a consequence, contamination of soil, air and water resources all around the world. After World War II, water contamination intensified due to the manufacture and introduction of new xenobiotic compounds (chemical compounds extraneous to an organism) into the environment resulting from unrestrained and unsustainable development, causing negative impacts on human and animal health. Among the compounds that are increasingly present in the various environmental compartments, endocrine disrupters have been receiving great scientific interest due to their great use and ability to persist in the environment, being able to impact environmental health for a relatively long period of time. Endocrine disrupters are micropollutants capable of interfering or deregulating the natural functioning of the endocrine system of living beings and thereby producing adverse effects on human and animal health. The diverse group of chemicals classified as endocrine disrupters include pesticides, metals, bisphenol A, phthalates, alkylphenols, polychlorinated biphenyls (PCBs), parabens, as well as natural and synthetic hormones. These substances presents persistence in the environment and are detected in sanitary sewers, effluents from sewage treatment plants, public water supply, surface and underground water. Alkylphenols are substances formed by a phenolic group attached to a carbonic chain. From these compounds are generated the ethoxylated alkylphenols, substances widely used in industrial and household detergents, lubricants, emulsifiers, wetting agents, dispersants manufactures of plastics such as polystyrene and PVC (polyvinyl chloride) and are present in formulations of pesticides, paints and products (make-up, creams and hair and bath products). The ethoxylated nonylphenol is considered the most toxic, and it generates nonylphenol after its degradation. Human exposure occurs through different types of pathways and their dispersion can occur through domestic sewage, effluents from Sewage Treatment Plants (STP) and drainage of agricultural areas. The present work has as general objective to investigate the adsorption removal using activated carbon of the nonylphenol compound, as well as to emphasize the importance of the study of this micropollutant. The research will be developed at LabTare / EQ / UFRJ (Laboratory of Effluent Treatment and Reuse of Water / School of Chemistry). The methodology will consist of a systematic review aiming to acquire theoretical knowledge about the subject under study; in addition to characterizing some types of activated carbon in synthetic solutions with nonylphenol, to evaluate the adsorptive capacity of activated carbon in the removal of nonylphenol, to carry out tests to define adsorption equilibrium time and tests to adjust adsorption isotherms, to evaluate the adsorption efficiency for the removal of nonylphenol in public water supply. As a result, it is expected that the different types of activated carbon have been characterized; and that the emerging nonylphenol compound has been satisfactorily removed by the advanced activated carbon adsorption process. As well, it is possible to suggest the creation of Brazilian Legislation applied to endocrine disrupters in order to ensure human and environmental health.

KEY WORDS: nonylphenol; activated charcoal; water supply.

COGNITIVE ERGONOMY APPLIED IN THE ANALYSIS OF WORK ON OFFSHORE PLATFORMS

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ABSTRACT

Ergonomics, a Greek's origin word that links ergo (work) with nomos (standards) is a science that deals with the organization of the working environment aiming man's safety and health (https://www.significadosbr.com.br/ergonomia). However, the ergonomics concepts in the actual Brazilian scenario follow basically the Standard n° 17 of the Ministry of Labor and cover, mainly, anthropometric aspects (postures, furniture, equipment, cargo transportation) and environmental conditions (temperature and enlightenment, for example), and are still very weak from a cognitive point of view, which covers mental processes such as perception, memory and reasoning. According to the Brazilian Association of Ergonomics (Abergo), this topic of study should also assess mental workload, decision-making, performance, man-machine interaction and stress, among other factors.

These concepts are fundamental, specifically in complex working environments and, therefore, the case chosen for study was the offshore labor. Marcelo Figueiredo, in his book " A Face Oculta do Ouro Negro – Trabalho, Saúde e Segurança na Indústria Petrolífera Offshore da Bacia de Campos" describes in a such good way the mainly specialties of this kind of work: danger, complexity, continuous character and collective dimension. The risk of serious accidents is inherent for workers in the entire boarding season and they live their time-off under confinement and isolation conditions, as it is not possible to go home after work, either to be in touch with family and friends. In addition, there is an idea that in case of accident, even with the actual modern rescue systems, assistance cannot arrive in time, as, to the usual impasses for this type of situation, there are others that may hinder access to appropriate treatment, such as weather problems, for example.

As Cognitive Ergonomics is still embryonic in this field, the need of an approach improvement has been seen as a way to encourage offshore companies to undertake studies on this subject.

This research goal is the implementation of new tools in the platform's safety studies, aiming for greater safety and comfort in the accomplishment of the labor activities, being no longer the worker seen as a "problem" in the complex system, since it is the one that usually goes wrong and always fails, which is normally seen in accident investigations, where most of the causes are attributed to human unsafe acts.

Working almost eleven years in a public agency that carries out health and safety inspections in the most diverse environments, the Public Labor Ministry, we have observed that there is a need for a more specific approach in the analysis of the worker's cognitive aspects in the offshore industry. Generally, this analysis is ignored in practically all branches, which can make the work environment a weak point of human life, especially considering that work occupies most of man's time. Mainly in the case of offshore environment, when work is present 24 hours/day during the shipping period, and this should be treated and considered in the production risk assessment. Therefore, this branch was chosen for study.

It is known that the advance of the cognitive approach, there must be a boost than can be the market need, the creation of specific standards and laws, or even the inspection approach. And this is the aspect that will be worked out in this research.

Companies will be evaluated through a new system and will have to consider other factors in their working environment verification. It is hoped that, in the medium time, the journey of platforms workers will be more comfortable, healthy and safe, as all life shall be.

KEY WORDS: Cognitive Ergonomy; Offshore Labour; Inspection.

EMERGENCY EVACUATION PLAN WITH FOCUS ON HUMAN RELIABILITY: A CASE STUDY IN A LABORATORY OF A FEDERAL INSTITUTION OF HIGHER EDUCATION.

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ABSTRACT

The population of a building must have enough knowledge and training to enable its immediate evacuation from the industrial installation safely without disturbance in the event of fire, leak or explosion. The importance of this topic can be exemplified by the attention Japan gives to the subject, a country with a history of major natural disasters, such as the 1923 fire in Tokyo, earthquakes, tsunamis and possible technological accidents as the one at Fukushima nuclear power plant in 2011. With its preventive culture, Japan prioritizes training for emergencies and one of the compulsory trainings, is the emergency evacuation simulation of educational buildings, from primary school to universities, which occurs regularly in that country. According to Pontes Junior (2014), in addition to procedures, strategies, escape routes, it is necessary to take into account the importance of human factors in safety projects. They must be capable to eliminate project functions and create new ones to solve disturbances in case of emergency.

In addition to the importance of the operational readiness of the fire protection system, the emergency response plan is part unequivocal concerning actions that will be taken in emergency situations, to minimize the consequences in case of events. One of the basic procedures for the safe removal of the local population is the adoption of an evacuation plan prepared and integrated by the unit, through training and simulation exercises. According to Duarte (2002), in emergency situations, decision making under strong influence of psychological pressure, life-threaten of the team members and the responsibility for the lives of others, are particular aspects in relation the other regular procedures.The objective of this study is to develop an emergency evacuation plan focusing on human reliability in a unit of the Federal Institution of Higher Education, which will serve as an instrument for consultation and research. The specific objectives are centered on collecting, analyzing, and understanding data related to the likelihood of human failure during the emergency evacuation process, having a better understanding of evacuation plans in Federal Public Education Institutions, in order to improve behavior and the performance of the target population in case of evacuation of the facility in emergency situation.The research methodology applied in this work will be divided into stages:Stage 1: Bibliographical research carried out through publications, scientific journals, dissertations, theses, books, national technical norms, in order to compile as many authors as possible and specific works in this area of study;Stage 2: Field research, information / data collection together with the administration of the unit and its population;Stage 3: Documentary research, studies and analysis of documents furnished by the unit, such as: low plant, escape route, building population list, emergency communication system, supervision and deactivation of fire alarms, technical information;Stage 4: Elaboration of the Evacuation Plan;Stage 5: Studies using Pathfinder software;Stage 6: Application of human reliability technique to identify diverse factors that can influence people during emergency evacuation;Stage 7: Disseminate the study in the academic community and in the studied sector, as well as suggest its application.

The organization can implement the study and results of the human reliability analysis, which can provide an improvement in the response time to emergencies, generate improvement recommendations and identifying other possible escape routes.

KEY WORDS: Emergency; Human behaviour in fire; Evacuation modelling

APPLICATION OF FIRE RISK MANAGEMENT TECHNOLOGIES AND TOOLS IN MUSEUMS AND HISTORICAL HERITAGES

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ABSTRACT

The occurrence of fires in museums and historical heritages in Brazil has become recurrent. The most recent event, regarding the National Museum, in the year 2018, in the city of Rio de Janeiro, caused irreparable losses to the cultural and historical heritage. In recent years, the theme of security of Brazilian cultural heritage has been highlighted in the country scenario, due to the increase in damages caused to cultural assets. The fire is among the main agents of deterioration, which cause losses and damage to a collection. The security measures usually adopted in the case of fires in Brazilian museums and historical heritages are protective, and basically consist of fire-fighting and therefore, they are still limited and do not guarantee total protection of their original values. In theory these measures are necessary, if the preventive ones fail, and the fire originates. Preventive measures aimed at controlling the initial risk of fire and thus preventing the occurrence of fire are rarely practiced in Brazil, since they require creativity and flexibility for the development of a protection system that adds interventions constructs, technologies, equipment, habits, behaviors and adequate use of facilities In order to safeguard Brazilian historical and cultural heritage, it is essential to study new forms of prevention, application of risk management tools and technologies that control the occurrence of fires and avoid irreparable losses to the country. In this way, the objective of this work is to define the most appropriate risk management technologies and tools in the prevention and mitigation of fires in museums and historical heritages. The methodology to be developed involves a bibliographical review about the risk management technologies and tools applied to the prevention of fires in museums and historical heritages, as well as the definition of a sample and analysis of the situation of the museums and historical heritages located in the city of Rio de Janeiro, regarding to the existence of preventive and protective fire-fighting measures. With this study we hope to identify vulnerability areas, regarding fire risks, present in the museums and historical heritages of this city. In addition to proposing a framework for the analysis of fire risk in museums and historical heritages, with the establishment of preventive and mitigation measures for the treatment of them.

KEY WORDS: Risk management; Fire protection; Cultural Heritage; Museum.

SUSTAINABLE DECOMMISSIONING GUIDELINES

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ABSTRACT

In Brazil, environmental studies are mandatory to obtain authorization to operate projects that use natural resources or that have the potential to cause significant environmental impact. Such authorization, known as an environmental license, has a preventive character since its use is aimed at avoiding the occurrence of present and future environmental demages.The criterion of classification by type of enterprise for the presentation of studies of environmental impact is given by a positive list, recommended in art. 2 of CONAMA Resolution 1/86 and in resolution CONAMA 237/97. It should be emphasized that all projects subject to the obligation to submit an environmental impact study have their life cycle defined by sequential phases over time, namely: planning, implementation, operation, decommissioning and closure. However for closure to occur there is decommissioning, which is a transitional stage between closure and release for future use of the area. The importance of this stage lies in the fact that well planned, the return to society of the area will be returned, identically restored to its original conditions, avoiding environmental liabilities and ending their life cycle. The research of the guidelines on sustainable decommissioning is characterized by the need to offer an environmental planning and management methodology for the future stage of decommissioning with measurable indicators and with the identification of the environmental impacts arising in the future decommissioning, in order to reduce them and allow decommissioning in line with the Brazilian legal-environmental framework. In the research the hierarchy process analysis method (AHP) will be used, generating weights of the objective functions, for three basic principles, the first one in the construction of hierarchies with the pretension to identify the main objective, criteria, subcriteria and alternatives The second concerns the collection of data from judgments of value issued by specialists and the third must calculate the priority of each alternative, analyzing its logical consistency or quality of the solution obtained, with focus on the decommissioning stage. Among the expected results is the use of a multicriteria evaluation tool, with a sustainable quotient hierarchized in the decommissioning stage, to be formally incorporated into the process management throughout the life cycle of an enterprise.

KEY WORDS: Sustainability; Decommissioning; Environmental Liability

STAKEHOLDER DYNAMICS IN PUBLIC SUSTAINABILITY PROJECTS

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ABSTRACT

Public projects, developed by governments and/or private organizations with the main goal of benefitting the development and the welfare of communities, have been experimenting challenges in the recent past. From one side the paradigm of Sustainability and from another the speed up of the technological advancement both put a great pressure on the management of those projects, directly and indirectly. The indirect pressure is exerted though the project stakeholders, since their number, diversity, qualifications and interactions increase and become far more complicated than in traditional, top-bottom managed projects developed in technologically stable scenarios. That augmented social complexity is a central element in the project dynamics and a key success factor. Empirical observations and professional surveys point out that social complexity is often misunderstood or underestimated by managers, particularly in public projects, ant this may be one root cause of project failures. Assuming the hypothesis that an increase in social complexity leads to an increase in a project's managerial complexity, thus contributing to a decrease in the project's success probability, this study has the objective of proposing an assessment model that can help public project managers to better understand and deal with the social complexity of their projects. The final goal is to create a better chance of success for the project by better managing its core dynamics. The study uses a qualitative/quantitative approach and focuses in the Brazilian public sustainability projects. The output is a workable method for mapping, interpreting, risk assessing and engaging the stakeholders of a public project in order to turn them into a force rather than a threat.

KEY WORDS: STAKEHOLDER. PUBLIC PROJECT, SUSTAINABILITY

THE CIRCULAR ECONOMY ALIGNED TO THE DECOMMISSIONING OF *OFFSHORE* PLATFORMS

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ABSTRACT

The need for regulatory adequacy, expansion of technical capacity and development of the service chain with specific solutions, make the decommissioning of installations a challenge for the oil and natural gas industry. The decommissioning of offshore platforms encompasses the engineering services of planning, uninstallation, disassembly, removal and transportation of equipment and metal structures, as well as treatment, storage and final disposal of waste. This process demands an analysis of the reuse of materials from dismantling, logistics and equipment mobility. The National Solid waste Policy (*Política Nacional de Resíduos Sólidos -* PNRS) establishes the concept of shared responsibility of the waste generators, being those responsible for the reuse and proper disposal, aiming to prevent and reduce their training. Therefore, it is important to carry out studies aimed at implementing solutions for the management of waste generated in various industrial operations.

The Circular Economy emerges as a new way of thinking solutions that preserve the competitiveness of companies, with reduced production costs and increased efficiency, representing a breakdown of paradigms. The economy in question is characterized by mimicking natural systems, considering new types of business transactions and influencing the change of responsibilities and profits. It is presented as a model focused on the creation of values and growth based on the restoration of natural and social capital. It defends the treatment of waste as a valuable resource, covering routine actions for the collection, sorting and recycling of discarded materials; development of new products for possible reuse and the use of transforming products into new raw materials or other better quality products.

In line with the Circular Economy model, this work proposal aims to reuse the polyester fibers (PET) form anchoring cables of decommissioned offshore platforms. These materials will be processed with polyolefin residues from the packaging industry in TeckTril twin-screw co-rotating extruder and the new materials will be characterized by mechanical, thermal and rheological analysis. It is hoped that new products obtained from waste generated by different industry sectors present differentiated properties with higher added value.

KEY WORDS: DECOMMISSIONING, CIRCULAR ECONOMY AND NATIONAL SOLID WASTE POLICY

LIFE CYCLE ASSESSMENT OF WATER HEATING SYSTEMS: COMPARATIVE IMPACT STUDY OF RESIDENTIAL SOLAR AND GAS SYSTEMS AS A SOURCE OF PROJECT DECISION-MAKING INFORMATION

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Buildings are largely responsible for energy consumption and potential environmental impact emissions throughout its life-cycle. In this approach, water heating systems are facilities that contribute with the building energy consumption, mostly in residential buildings, throughout its operational phase. The variability of available possibilities of heating energy sources, reservation equipment and materials for water distribution allows us, in the pre-construction or project development phase, to make different decisions about how is going to be the layout and system features. Many times, typology system definition comes from a technical and economic decision involving project and construction elaboration process stakeholders. However, the facilities possibility spectrum must count the energy consumption and impact generation throughout these systems life-cycles as a whole, factors that are still hazy in decision-making processes to choose one or other system type. This study aims to present a specific method to apply an environmental management tool, Life-Cycle Assessment (LCA), in these building water heating facilities in project development phase through a comparative study of solar and gas water heating systems to a residential multi-family building to be built in the city of Rio de Janeiro. The method is applied in the pre-operational phase, in order to obtain relevant information related to systems and their material about embodied energy, production and transport impacts, as well as the construction and use impacts, in a cradle-to-gate approach, to help the decision-making process by the technical and management project team, incorporating important environmental information to it.

CHEMICAL PROCESS, COMPANY AND VALUE-CHAIN SUSTAINABILITY: METHOD FOR DESIGN AND OPERATION WITH INDICATOR STATISTICAL SCREENING

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ABSTRACT

To target sustainability of systems and products, environmental, social, and economic issues must be assessed in an unbiased straightforward way. A critical review analyzed 46 state-of-the-art methods for sustainability assessment that can be applied to the chemical industry, chemical process, chemical products or process systems engineering. The evaluation identified a sharp increase of literature about sustainable chemical design and production from 2010, but pointed that the field is far from developing fully integrated assessment methods. The majority of the literature assessed stood for industrial gate-to-gate design methods. As the life cycle boundaries expanded, single dimension analysis is more frequent, indicating a trade-off between life cycle boundaries, inclusion of sustainability dimensions and quality. The decision-making analysis highlighted the dominance of compensatory approaches, pointing that most methods allow compensability between indicators. In general, the methods did not investigate the application of different aggregation metrics, a shortcoming that pinpointed the further need to apply statistical analysis of sustainability indexes. Based on these findings, this work proposes a cradle-to-gate three-level hierarchical method called Sustainable Process Systems Engineering (S-PSE), which assesses the sustainability of industrial chemical systems, and can be employed to evaluate either process, company or value-chain sustainability. The main goal of this work is to support sustainable process design and production by developing an approach that is comprehensive – comprising social, economic and environmental dimensions; integrated – combining design and operation production stages, corporate and industrial levels, cradle-to-gate and value-chain boundaries; and reliable – selecting and screening indicators using statistical tools and testing decision-making metrics robustness. The method is integrated to computer-aided design tools and does not use generic databases that commonly exclude process-specific conditions from the analysis. On the contrary, it relies mainly on technology-specific indicators, favoring an in-depth analysis of process systems. The first-level is for process design and retrofit, selecting most sustainable plant-wide feedstock-product configuration; the second-level is both for process design and operation, diagnosing sustainability hotspots across unit-operations and encouraging continuous improvement; and the third-level is for operation, evaluating corporate metrics. The first two levels of the method are tested for two process design case studies, one for biorefineries and the other for the petrochemical sector. The first application selects biorefinery configurations among pathways from three possible feedstocks (soybean, palm and microalgae oils) and three possible products (biodiesel, green diesel and propylene glycol), with the design goal of identifying the most sustainable processing pathways and feedstock-product configuration for this biorefinery. The best configuration was palm oil producing biodiesel. The second case applies S-PSE method to evaluate and compare the sustainability of two plants producing ethylene oxide from alternative technologies: a conventional and an innovative process employing a supersonic separator to enhance ethylene oxide recovery. The alternative comprising supersonic separator increases ethylene oxide recovery by 40 kg/h, being the option with best economic performance. Ethylene oxidation reaction, distillation tower for CO_2 desorption, cooling water tower and cooling tower air-blower are the main unit-operations with sustainability hotspots. Reaction drawbacks are associated with energy consumption and environmental impacts, the distillation tower is the most energy-intensive operation, and the cooling water tower and air-blower are the most material-intensive. The case studies clearly demonstrates coordination of computer-aided design tools (Aspen Hysys, Excel and Matlab) to sustainable process design. The current work is an attempt to bring the chemical process industry closer to the path of sustainability by providing solutions to the following questions: (i) how can chemical engineers know if a process

is more sustainable than other? (ii) how can chemical engineers identify major barriers for sustainability performance within a process? (iii) how can the chemical industry move towards more integrated and reliable sustainability analysis for chemical process design and production?

KEY WORDS: Sustainability assessment; Process design; Composite index.

EVALUATION OF THE LEVEL OF COMMITMENT AND KNOWLEDGE OF ENVIRONMENTAL MANAGEMENT IMPLEMENTED IN A MILITARY ORGANIZATION IN THE MUNICIPALITY OF RIO DE JANEIRO.

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Abstract

The activities of each shipyard are peculiar to its infrastructure and the type of activity, can be subject to several environmental problems, many of them can be prevented with the implementation of the Environmental Management System (EMS). The participation of those involved is fundamental to the operation, however, often the degree of commitment is still lacking. The motivation of this work came after this author realized that, even with the EMS implemented and in full operation, there was a lack of greater involvement of the representatives and substitutes. With this, the objective of this work is to evaluate the level of participation, knowledge and involvement of the SGA actors within a shipyard. It also aims to present opportunities for improvement. The study was conducted through face-to-face or email interviews. Initially, all 14 potentially polluting areas were listed, as well as a further six sectors (called managements), which deal directly with customers (i.e. directly participate in industrial activities). Each sector contains 02 representatives who participate in SGA events, meetings and audits. The questionnaire had 07 questions about the profile of the agent and another 28 about their perception about issues of the EMS and the working environment. The questionnaire was assembled on the Google Form platform with multiple type choices and checkboxes. After completion, the data were compiled into charts. In a preliminary survey of 13 participants, 27.3% answered that they had more than three years of experience and 45.5% had between 1 and 3 years of experience in SGA. Most of them (61.5%) believe that the EMS has between 75 and 100% relevance in their routine activities. Regarding the system of selective waste collection in the yard, between 53.8 and 46.2% believe that activity is of very high to high importance. However, only 38.5% of the agents participate or encourage selective waste collection. When asked which environmental issues they consider most relevant, most responded: "water", "garbage" and "energy." With regard to the training provided by the institution, the participation in internal training and the courses carried out externally were the most indicated by the interviewed. Thus, it is clear that, although experienced in EMS, some of the assumptions of this system (e.g. selective waste collection) are not followed by those who should encourage best management practices.

KEY WORDS: Environmental Management System; Environment; Knowledge

THE IMPORTANCE OF RISK MANAGEMENT IN THE PREVENTION OF FIRE STARTING IN PUBLIC ORGANIZATIONS

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ABSTRCT

The discovery of fire, as well as the controlled use of fire, was one of the greatest experiences of early humans. Over the years, its existence enabled progress and had several repercussions.As well as the evolution of technological advances related to fire prevention and combat, it is noted that there is still some vulnerability related to this subject and the incidence of greatlosses remains constant, especially with regard to public organizations. Brazil and the rest of the world have a large and differentiated range of public buildings, often designated landmarks. Such constructions offer to the cities significant value, not only historical, but also cultural. However, many of these buildings are damaged due to the action of time, including the original design barriers, when implementing the guarantees of comfort and safety to the users.

In addition to the series of problems related to the action of time, there are also the setbacks associated with providing maintenance in public buildings, which usually include legal limitations on their management and scarce subsidies. Although most of the public buildings have been constructed using conventional masonry, which does not give rise to many concerns regarding the type of combustible material and the occurrence of fires, they are still liable to losses.There is a certain omission that is influenced by human behavior itself and often causes a lassitude established by current thoughts, in which there is a false sense of security and self-control of situations that may not happen, one of them being the loss.This leads us to believe that it is important to have a more accurate view of the segment related to the human factor in public institutions, where there is a concentration of a significant number of people. The main purpose of this research project is to identify, analyze and understand the importance of risk management in the prevention of fire in public organizations.Therefore, by compiling data of losses already incurred, it is intended to list the risk management strategies and good practices related to these buildings, as well as the difficulties of interventions in the area of public management, taking also into account the issues related to the Human Factor, Safety Culture and relevant Legislation.METHODOLOGY

This research paper is subdivided into seven different stages:Stage 1: It consists of bibliographic review on the subject;Stage 2: Contextualize the importance of maintenance and conservation of public buildings together with the partnership of public management;Stage 3: Study more carefully the influence of the human factor in the risk management related to the prevention of fire starting.Stage 4: Survey of cases of loss involving fire in public buildings aiming at the critical analysis of each case, determination of diagnoses through analysis and verification of needs considering; Stage 5: Define a method and proposals that seek the best adequacy of the public buildings through fire risk management based on the current legislation.

Stage 6: Use of questionnaires addressed to specialists in fire safety and safety culture.

Stage 7: Publish the study in the academic community, as well as suggest the implementation of policies related to these actions in public buildings.It is expected that by means of the studies conducted, it will be possible to elaborate a model of prevention and fire fighting applicable to public institutions, taking into account not only the current laws and regulations, but also taking as an example the cases of loss already incurred in public buildings, with its main risks and problems involved in building maintenance.

KEYWORDS: Fire hazard; fire prevention policies; fire in public buildings; human factor.

COMPARISON OF VEGETATION RECOMPOSITION METHODS IN A TROPICAL FOREST AREA DEGRADED BY BAUXITE EXTRACTION

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ABSTRACT

In Brazil, as in the world, the mining sector is expanding steadily. Currently, the sector represents 5% of the country's gross domestic product. Brazil is the world's third largest bauxite exporter in the world and its production increased by 9% in 2017 compared to 2016. The environmental impacts of mining and other activities that compete for land use need to be evaluated. The objective of this work was to assess vegetation recomposition in an area where bauxite extraction occurred, using site visits and analysis of a vegetation index calculated from satellite images. The method was applied at a bauxite mine in Paragominas, Pará, Brazil. The evaluations covered the steps of opening the area, mining operation and replanting, considering three types of replanting: natural regeneration, traditional planting, and nucleation, for the period between 2013 and 2018, using 2006 as the base situation for the secondary forest. The results showed that the replanting method directly influences the vegetation index from satellite images. Several factors affected the values obtained, such as operational factors and topsoil used. The natural regeneration method was found to produce the best results.

KEYWORDSRecovery of degraded areas – Vegetation indices – Remote sensing – Bauxite mining

ANALYSIS OF TAILINGS DAMS FAILURES USING RISKS SERIES METHODOLOGY

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ABSTRACT

Mining is one of the main sectors of the global economy, supplying raw materials for many industrial activities. The mining industry typically produces large amounts of tailings, commonly stored in ponds behind dams, which have a great potential for damage in case of rupture. Tailing dam is the most way to manage de residues, because they are built to dilute disposal costs of the tailings through successive rises during the dam life. From 1915 to 2019, a total of 356 tailings dams failed in the world. Over time the trend the increase of mineral production from low concentrations will increase the tailings volume and, consequently, the number of accidents and fatalities. The main causes of tailings dam failure are: lack of water and construction control, and general lack of understanding the characteristics that control safe operations. Risks Serie analysis is a qualitative tool that allows assessing the sequence of possible events and consequently control of the risks through preventive and mitigating measures. This method is usually used by Safety Engineering professionals in the analysis of occupational accidents. In the Risks Serie, events can be connected to each other by "AND" and "OR" connections or may have a direct relationship. The tool was applied to analyze how the rupture of a dam by liquefaction can be triggered, and what the consequences of this break. The historic of reported accidents does not provide all necessary information on how each dam has broken. Risk Series allowing an abstraction of the system behavior, establishing the relationship between variables that, depending on the combination, can lead to prioritization of the cause event that will minimize or mitigate risks. In this way, the tool can be used as evidence in the establishment of processes, assist environmental agencies in the application of penalties, and help dams owners better understand how the financial health of the business will be impacted by these failures.

KEY WORDS: Risk analysis, Tailings Dam, Dam Failure

DEVELOPMENT OF A RISK-BASED MULTI-CRITERIA METHODOLOGY FOR DECISION MAKING IN PROCESS SAFETY MANAGEMENT

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ABSTRACT

After several major acidentes at the process industry, like Flixborough incident (1974), Bophal disaster (1984), Piper Alpha explosion (1988) between others, governments and technical institutions has been developing and charging the implementation of standards of process safety management with the objective of reducing accidents frequency and severity.

A Process Safety Management System (PSMS) is a systematic framework that applies good management, operational, design and engineering practices to ensure the integrity of processes and operating systems using hazardous substances. PSMS deals with preventing, preparing for, mitigating, responding to, or restoring catastrophic releases of chemicals or energy from a process associated with an installation that may cause toxic effects, fire or explosion and may result in serious injury, property damage, loss of production and environmental impact.

Brazilian National Agency for Oil, Natural Gas and Biofuels, based on PSMS standards developed by countries like the United States of America, Norway and United Kingdom, set up in 2007 the ANP nº 43 Resolution that stablishes the Operational Safety Management System for offshore oil and gas exploration and production plants.

Despite the effort applied around the world, serious accidents continue to occur, which shows that PSMS need to be improved.

The objective of this project is to develop a multi-criteria risk-based methodology to support decision-making in analyzing non-conformities of process safety audits performed to verify adherence to ANP 43 requirements. The methodology enables to assess and improve the PSMS of Brazilian offshore plants.

To develop the risk-based multi-criteria methodology, a group of specialists will be consulted to stablish the cause-effect chain management practices of the ANP 43 Resolution using DEMATEL (Decision Making Trial and Evaluation Laboratory).

After stablished the cause-effect relationship between management practices of ANP 43 Resolution, the thesis will be assessed by data analysis of non-conformities to the ANP 43 management practices pointed out in audits performed in 135 offshore platforms between 2006 and 2016.

The results are expected to allow the development of a framework for assessing and improving the Process Safety Management System of chemical industry.

KEYWORDS: Process Safety Management, DEMATEL, Offshore plataforms

5th Workshop on Environmental Engineering:
Challenges in Environmental Engineering
Environmental Engineering Program (PEA)

METHODOLOGY FOR ANALYSIS AND IMPLEMENTATION OF PERFORMANCE AND RISK PARAMETERS IN INTEGRATED MANAGEMENT SYSTEMS CASE STUDY IN PETROCHEMICAL COMPANIES

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ABSTRACT

The use of management systems, according to ISO 9001, 14001 and 45001 (OHSAS 18001), has increased, as well as the need to integrate them. Companies from several market niches understand that it is not only a matter of illustrative certification, but of a strategic vision, which increasingly needs to be produced in an efficient, optimized, sustainable and safe way. In the last decades, Integrated Management Systems (IMS) are competitive advantages over decentralized management, which generate rework and liabilities for companies. Risks inherent to safety processes, mainly involving machinery and equipment have been particularly highlighted in the current production scenario. Thus, factors such as environmental concern, traceability, standardization of processes and concern with occupational safety and health have become competitive differentials and are still showing a steady rise. There are several issues to be managed in an integrated methodology. The definition of performance parameters should be assertive as such mapping reflects the subsequent level of occupational exposure, quantitative deviations, and process failures. In this way, the objective of this work is to propose the organization and monitoring of each phase, through systematic with specific checkpoints, focusing on workplace safety and interactions with machines and equipment. With the commitment to this way of conducting the field processes, we obtain the adequate matrix of responsibilities, risks and the team effort, which culminates in the effectiveness proposed here. In the consumption of information, any data collected or coming from the field must be reviewed, judged and stored. It is in this area that the correlations are made, groupings of elements, inferences and key performance indicators are highlighted. The focus is the minimization of failures through assertive general risk assessment. The present work proposes a methodology for the analysis and maintenance of Integrated Management Systems, minimizing the risks inherent in their processes, through specific definitions and risk assessments that impact workers, managers and companies. The objectives are to present mapping and to establish the optimized parameters for the Integrated Management Systems, to quantify the risks associated to IMS requirements - emphasis on ISO 45001 and to perform qualitative and quantitative mapping of risks in the interaction with machines and equipment – Regulatory Standard 12. At the end of the studies and analyzes, it is expected to obtain an overview of IMS risks, obtained by weighing each parameter measured by the proposed methodology, the acknowledgments and general overview of machines and equipment operation risks, in case studies and their impacts in the IMS and demonstration of the improvement of the risk scenario in the productive processes evaluated.

KEY WORDS: Integrated Management Systems; Risk assessment; Regulatory Standard.

A MODEL FOR THE QUANTITATIVE ASSESSMENT OF THE RISK OF TRANSPORT ACCIDENTS AND THEIR INTERFACES

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ABSTRACT

The Brazilian passenger and freight transport sector represents approximately 7.15% of GDP, with 170,000 companies and 2.5 million employees (IBGE / 2013), a huge infrastructure to transport billions of passengers and tons of products, in an increasingly integrated activity such as air, land, waterway and pipeline modalities, in an operational conjuncture that entails an inevitable association of the risks of the parts on the basis of the configuration of the final route and the use of different modal. In only one of the segments, the land transport, in traffic, fatal accidents are among the ten largest causes of death in the world, according to data from the World Health Organization in 2016. The rate shows 29.4 deaths per 100,000 inhabitants, accounting for more than 1.4 million deaths this year, the highest rate in low-income countries. In Brazil, even though the death rate has decreased by 14% since the implementation of the Drought Law in 2008, the number is still high - 32,615 deaths recorded in 2017, according to data from the Ministry of Health. Thus, the overall objective of the work is to develop a tool for quantitative assessment of the risks of accidents and their respective interfaces such as the route, user, drivers, cargo, the means of transportation taken, and others related. The project is justified since there is no tool which supports the understanding of integrated and segmented risks of accidents, that is, one being capable of subsidizing the management of human, financial, logistic, stock-in-trade and other resources, both in private and public organizations. Therefore, a study will be carried out on the historical figures of accidents of greater frequency and relevance based on the information of the public regulatory and supervisory sectors, insurance and class entities, as well as a bibliographic review on the subject. Based on the data, a study will be carried out to: 1. Determine the importance that each interface exerts on the global risk of accidents, based on existing risk rating models and evaluating their nonconformities and specificities; 2. Apply the tool in a practical example, with real data obtained from a business organization to be defined in the course of the work and compared with the history of accidents occurred. It is expected that this tool will be of practical and clear use and evaluate quantitatively the risk of accidents to which the transport is submitted so that its results are reliable and serve as subsidies for possible preventive actions and planning in risk management.

KEY WORDS: Risk analysis, Accident prevention, transport accidents.

COMPARATIVE STUDY OF THE QUANTITATIVE AND QUALITATIVE RISKS OF NATURAL GAS LEAKAGE IN A SCHOOL MATERNITY

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ABSTRACT

Industries together and hospitals are susceptible to all sorts risks and accidents. These risks could affect the environment, workers and, others stakeholders, such as hospital patients. In hospitals there are numerous specific conditions that could increase the risk of accidents. Clinics, nurse homes and hospitals utilize several medical gases in the patient's care. It is possible to use air and also gases like oxygen, nitrogen and nitrous oxide in a wide range of health conditions including surgeries. However, in the case of gas leaking these gases could become an issue. Like many others, the Maternity School, located in Rio de Janeiro, Brazil, use medical gases in the care of patients. This maternity has social relevance by offering an integrated perinatal assistance for women and children as part of the Brazilian Public Health Service. Through the trainee program, students of nutrition, social assistance, nurse, medicine, public health, psychology, physiotherapy and speech therapy collaborate to expand quality of the health assistance offered in the maternity and improve their own professional qualifications. About 2 thousand children are born per annum in the maternity, thus any accident could have devastating consequences for patients, workers and environment.To address the issue of accident dealing with gases, it was conducted a series of risk assessment for this case study. The methodology overall of this study was divided into a study of vulnerability and qualitative study. the risk analysis surveys the possible causes and their consequences of accidents are identified. This process comprises several steps, including the estimation of the risk scenarios. Risk scenarios can be modeled through simulations of possible leaks that can even generate an explosion. From this simulation through a software it is possible to quantify the possible damages on facilities, human beings, environment, extension of the affected areas.The vulnerability was studied by modeling the gas leak, forming a cloud followed by explosions applying the ALOHA software for the simulations of the affected area, physical effects, possible fires, explosions and the disturbances generated in the occurrences of these accidents. Preliminary Risk Analysis (APR) is a risk analysis tool based on a multicriteria methodology, structured to identify, analyze and assess (prioritize) risks in existing facilities, processes, equipment or systems. In the context of the APR, an accident scenario is defined as being the set formed by the hazard identified, its causes and likely consequences. The APR - Preliminary Risk Analysis seeks to identify potential hazards arising from the installation of new units, systems or the operation of existing units and systems. This methodology seeks to examine possible identified events, causes, available detection methods and effects on the environment.The risk study of this work follows the methodology of the Preliminary Risk Analysis (APR). In this study, in particular, the tool proposed in MIL-STD-882, revision E (USDoD (US Department of Defense), 2012) will be used. The APR tool is to establish risk and hazard scenarios and, for each scenario, to establish causes and effects. Once this is done, the causes are parameterized, and a frequency is determined. The risk study will provide the determination of the scenarios to be simulated as well as the necessary data such as mass, density and volume of gases, floating population and existing barriers and thus quantify the risks to estimate the possible consequences of an accident or undesirable situation. Mathematical analysis aims to calculate area of influence in case of gas / explosion leakage. In the end, the ALOHA computer program developed by the Environmental Protection Agency (EPA) will be used initially; and the recommended SLAB for the characterization of fires and explosion in the processing industry will be used in the simulation stage of the reaches caused by the physical effects. It should be noted that the ALOHA database does not include all gases in the hospital, so that the storage of nitrous oxide, nitric oxide and carbon dioxide gases will be analyzed as a matter of priority.Once the previous steps have been completed, the pertinent legislation will be analyzed, seeking to verify if the legal constraints are sufficient to mitigate the risks studied, in opposition to the vulnerabilities modeled. The legislations studied will be

COSCIP, NR 23, NR 20, in addition to NFPA and ABNT standards of relevance to the subject.This work has as general objective to study the consequences of explosion of a possible gas leak of a cylinder of nitric oxide, nitrous oxide and carbonic gas in a Maternity School. And as specific objectives, simulate a possible gas explosion; determine the regions affected; and determine the extent of damage. Moreover, the present study makes a risk study in a maternity hospital, followed by vulnerability simulations, and, in the end, makes a comparative diagnosis with the pertinent legal requirements and evaluates whether compliance with standards would effectively mitigate the calculated risks. This study is important because the risks involved in gas leaks have historically already caused a number of accidents with victims.

A CONTRIBUIÇÃO DA AVALIAÇÃO SOCIAL DO CICLO DE VIDA PARA A CONSTRUÇÃO DA SUSTENTABILIDADE: BALANÇO CRÍTICO E APLICAÇÃO NO SETOR ELÉTRICO BRASILEIRO

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ABSTRACT

The electricity sector plays a key role in the development of a region or a country, as it affects several environmental, economic and social issues throughout it's supply chain. This sector can be divided into generation, transmission and distribution activities. In Brazil, the electricity generation of public services and self-producers reached 588 TWh in 2017, with public power stations being responsible for 83.5% of the total generation. Currently, Brazil has 7,441 generation facilities in operation, totaling 164,821,404 kW of installed capacity. Much is known about the environmental impacts and key factors that may influence the choice of an electricity generation technology such as water availability, wind potential and high incidence of direct solar irradiation. Social aspects are equally important to assess sustainability, and must be considered when deciding for a technology vis-à-vis its location and its social environment. In this context, the Social Life Cycle Assessment (S-LCA) is a tool to assess potential social impacts of products and processes along their life cycle encompassing from the origin of raw material to final disposal and decommissioning of the production installations. It is a systematic and useful process for increasing knowledge, informing choices and promoting the improvement of social conditions in product lifecycles. However, S-LCA does not have the goal nor pretends to provide information on the question of whether a product should be produced or not. The aim of this study is of establishing a set of indicators for assessing social impacts, to assist the process of choosing the most friendly electricity generation technology, considering Brazilian regional properties. Through extensive literature research, the main social and environmental indicators in the electricity sector are compiled. Next, the selected set is tested for their capacity of discriminating performance of electricity generation technologies. So far, the main social indicators studied are: Occupational Health and Safety; Generation and Maintenance of Employment; and, Fair Wage. At the environmental level, the Life Cycle Impact Assessment ReCiPe 2008 midpoint categories indicators are used. As part of the results of the social sustainability assessment, up to now, the numbers of direct and indirect jobs in the life cycle of Brazilian hydropower and gas power plants are 98.79 jobs.year / TWh and 62.58 jobs.year / TWh, respectively. As part of the environmental results, the electricity from natural gas was used as reference technology for the comparisons in the sustainability assessment. In the Climate Change midpoint category, for example, power from oil products is the environmentally least sustainable of all, with a 79.9% higher impact than the reference technology, while nuclear power was the least impacting, with 98.52% less impact than natural gas power. Regarding the Terrestrial Ecotoxicity midpoint category, solar technology is the least sustainable technology overall, scoring an impact of 4,151% above natural gas, while hydropower electricity was the least impacting, with 82.5% less impact than the reference technology. It is worth noting that the analysis does not incorporate regional specificities, which is the subject of a forthcoming stage of the work. In addition, the set of social indicators will be expanded.

KEY WORDS: Social Life Cycle Assessment; Electricity Sector; Social Indicators

Apresentações

do

Dia 31 de maio de 2019

BEETLE ELEVATIONAL SPECIALIZATION AND THE MONITORING OF ENVIRONMENTAL DISTURBANCE IN MOUNTAINS

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ABSTRACT

Population growth and the development of human activities is generating an increasing pressure on natural resources, mainly impacting biodiversity and natural ecosystems. In this scenario, the evaluation of ecological integrity of natural systems plays an important role on conservation decisions. Bioindicators are excellent for monitoring the environmental conditions of an area, as living organisms are susceptible and highly sensitive to disturbances on the environment, allowing us to assess the quality of natural conditions as well as how it changes over time. Mountains are exposed to different anthropogenic disturbances, such as land use change (e.g. agriculture, livestock, land speculation and pollution) and climate change, and present a great variability in environmental parameters in a small scale, such as temperature and precipitation, which affect the occurrence, abundance and distribution of living organisms along the gradient. Mountain organisms from tropical forests are expected to have low thermal tolerance and narrow elevational ranges (being specialized to certain habitats), making them particularly vulnerable to environmental disturbances. The situation may be even worse in mountaintops, as they present smaller habitat areas and many endemic species. Insects are highly suitable as biological indicators because of their sensitivity and rapid response to anthropogenic disturbance. In this context, the aim of this study is to evaluate the degree of elevational specialization of different groups of beetles to propose a protocol for monitoring the effects of different environmental disturbances regarding the biota in mountains. To do that, we will describe the elevational distribution of different groups of beetles in order to propose the most suitable group(s) (the ones with the narrowest elevational distribution) and the protocol for monitoring of disturbances in different elevational ranges. Sampling was conducted at Serra dos Órgãos National Park (State of Rio de Janeiro), which ranges from 80 m to 2263 m a.s.l., in the Atlantic Rainforest biome, one of the main global biodiversity "hotspot" and an area of high conservation significance. For that, we used 30 flight interception traps at 15 elevation sites along the entire gradient from December 2014 to February 2015. Insect samples were sorted and six groups of beetles were counted and identified to the lowest taxonomic level. These groups present different trophic positions in the ecosystem, so they could respond differently to environmental disturbances and present different degree of elevational specialization. Herbivores are expected to present a tight relation to host-plant phenology and occurrence, being more restricted to a certain elevation. Predators and saprotrophs will probably present broader elevational ranges than herbivores, as they are often more generalists. The trophic groups were represented by predators (Carabidae, Lampyridae and Phengodidae), herbivores (Cerambycidae and Eumolpinae) and saprotrophs (Anthribidae). Species elevational range will be calculated as the highest minus the lowest elevations where each species was collected. Using this information we can assess the degree of specialization of different groups on the mountain and propose the ones with the narrowest elevational ranges as those most suitable for monitoring disturbances along with the detailed sampling and identification protocol. A total of 2963 beetles belonging to the six studied groups were collected during the sampling. From those, 115 species were predators, 112 were herbivores and 47 were saprotrophs. Studies on bioindicators have potential applications for environmental management, including the elaboration of management plans, assessment of anthropogenic impacts on the environment and climate change, for licensing and legal compensation, and either for the establishment of natural reserves.

KEY WORDS: Bioindicators; environmental monitoring, elevational specialization.

PROBABILISTIC ANALYSIS OF RAINFALL INDUCED LANDSLIDES AT RIO DE JANEIRO CITY

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ABSTRACT

At tropical region, most of the landslides occur due to rain. Studies in this research line show At tropical region, most of the landslides are triggered by rainfall. Studies in this research line show that soil mechanical behavior in different locations responds differently to rainfall because of local, natural and anthropogenic factors. Rainfall thresholds investigation helps landslide disaster mitigation as it can be used for early warning systems to evacuate the population in landslide risk areas. These thresholds may be studied by the observation of landslide historical series of a specific place. This research aims at the study of the correlation of rainfall-induced landslide and the rainfall in the municipality of Rio de Janeiro considering the influence of physical factors in order to help decision making of early warning systems. A literary review about methodologies used in the association between rainfall and landslide occurrences are being made. A great database about landslide occurrence from the geotechnical office of the municipality of Rio de Janeiro (Georio) composed by 15,575 inspection reports made from 1998 to 2016 will be used in the study. These reports are being organized in spreadsheets containing information concerning date/hour of occurrence, types of the landslide, urban occupation, drainage, soil, slope steepness, and other relevant information. Statistical studies will be carried out using these data. At first, these data will be used to analyze the influence of physical (natural and anthropogenic) factors (except the rainfall) in the landslide occurrence probability, using Minitab software. In a second stage, these data will be clustered in groups of similar physical characteristics and, after that, the landslide occurrence will be associated to accumulated rainfall measurements aiming at a more accurate correlation between rainfall and landslides. It is expected to develop a method of rainfall thresholds definition that can be replicable to other places.

KEY WORDS: probabilistic analysis; landslides; rainfall.

CO-DIGESTION OF SEWAGE SLUDGE AND FOOD WASTE WITH PREVIOUS EVALUATION OF WASTE TREATMENT

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ABSTRACT

The efficiency in Wastewater Treatment Plants (WWTP) management is related with the reduction in generation of sludge mass, higher generation of biomethane and energy recovery through anaerobic digestion (AD). An alternative to optimize AD process is adding more than one substrate, which is called "co-digestion" (AcoD). For the purpose to enhance the biomethane production, food waste (FW) is a co-substrate that is widely used and studied due caracterics as high biodegradability and the synergistic effect with sludge. Another measure to improve the anaerobic digestion performance can be a pretreatment apply in one of the substrates. In this context, this research intends to study the application of an aerobic digestion stage in room temperature, called "natural fermentation", which can be tested in tropical countries without great losses related to the mesophilic temperature. This stage will precede the co-digestion, being applied just in the FW. Therefore, this study aims to analyze the performance of an anaerobic co-digestion of excess sludge from a sewage secondary treatment stage and FW submitted to a biological pretreatment. For this, experiments will be conducted on laboratory and pilot scale to survey the best fermentation conditions and to monitor the efficiency of the co-digestion process with and without FW pretreatment. Moreover, it will be evaluated how this type of pretreatment may shape the microbial community and enzymatic activity. The methodology implemented was divided into three steps: natural fermentation experiments; co-digestion experiments in laboratory scale; and co-digestion experiments in pilot scale. In the first step the FW will be collected, processed, and submitted to a natural fermentation in 10L reactor under mechanical agitation and controlled temperature. Daily aliquots will be collected to quantify volatile suspended solids (VSS) and volatile dissolved solids (VDS) in order to verify the effect of the fermentation in the organic solids solubilization. In the second step after the optimum conditions of fermentation being selected, the co-digestion experiments will be executed in 1L bath digesters with hydraulic retention time of 30 days, in which will be tested the following conditions: i) secondary sludge mono digestion; ii) sludge + freshly prepared FW; iii) sludge + pretreated FW. In this phase it will be analyzed: VSS, biogas composition and its volume. Currently the work is in step two and the results are as expected, with both co-digestion process having a better performance when compared with mono digestion and the co-digestion with FW pretreated presenting higher solid removal and biogas production compared to the other tested conditions. Hereafter in a last step, the conditions ii and iii tested in laboratory will be conducted in pilot scale.

KEY WORDS: co-digestion, biogas, secondary sludge.

LEADING INDICATORS OF PROCESS SAFETY AND HUMAN PERFORMANCE IN THE OFFSHORE INSTALLATIONS

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ABSTRACT

The inherent hazards of crude oil and other hydrocarbons have led the companies that work with these products to act toward the prevention of major accidents, so that their activities do not cause damages to the population, property and environment, apart from guaranteeing the operational continuity and survival of business. Major accidents are caused when simultaneous failures of the protection layers of the process safety management system occur. The process safety leading indicators are a group of metrics that indicates the performance of the main work processes and of the protection layers that prevent accidents. These indicators are used to identify weaknesses of the management system of process safety. Establishing leading indicators that demonstrate process safety performance is necessary to support decision-making and prevent the degradation of safety systems and to avoid major accidents. For the implementation of these indicators, it is necessary that the anomalies related to process safety are properly and separately appropriated from occupational safety anomalies.It is important that company be able to develop actions to prevent these accidents. Since it is not possible to establish effective preventive action without previously being aware of abnormalities, the correct choice of process safety leading indicators, those reflect the trend of major accidents, is the main goal of any organization. Human performance, in individual sense, is a series of behaviors executed in order to accomplish specific task objectives. Human performance, in organizational sense, is what the leaders and managers are doing or have done those influence behaviors and eventually affects the physical plant. Human performance improvement is an approach to reducing human errors. Human error is caused by a variety of conditions related to individual behavior, management and leadership practices, and organizational processes. Where human failures are identified, it is necessary to identify the factors that make the failure more or less likely. Performance Shaping Factors (PSFs) are the characteristics of people, tasks and organizations that influence human performance and therefore the likelihood of human failure. PSFs include time pressure, fatigue, design of controls/displays, quality of procedures, stress and so on. This work aims to develop a model of integration, identification and analysis of a set of leading indicators related to process safety and human performance, applied in the offshore installation. The methodological framework includes the following item: define a general database of process safety leading indicators related to offshore installations through the theoretical references; define and apply criteria to be used for grouping the leading indicators by themes; apply a fuzzy method for determining of the degree of importance and ranking of leading indicators; identify leading indicators that are dependent on or influenced by human performance and develop a continuous human performance monitoring program. A human performance monitoring program will help to verify that the applicant has prepared a proactive strategy for ensuring that no safety degradation occurred in the protection layers of the process safety management system related to work environment and works. The principal objective is to develop a model of integration, identification and analysis of a set of indicators related to process safety and human performance.

KEY WORDS: offshore installations, leading indicators, human performance, process safety.

STUDY OF INTENSE RAINFALLS OF PIABANHA BASIN USING GUMBEL'S DISTRIBUTION.

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ABSTRACT

Storm water can generate flooding in the hydrographic basin due to excessive rainfall that cannot be drained, flooding several regions into one locality. These events occur at random due to local and regional climatic processes. As the population waterproofs the soil, flow through the drainage system increases, producing floods more frequent than those that existed when the surface was permeable and the natural flow through the rivers and streams. Rio de Janeiro often presents intense rains, which cause great social and economic loss. The study of heavy rains is essential for urban drainage projects, sludge risk management and the planning of the use of water resources in a locality. The objective of this work is to analyze the maximum annual rainfall, based on observations of rain gauges, associated with different return periods for each rainfall station selected from the cities of Teresópolis, Petrópolis, Areal and São José do Vale do Rio Preto located in Piabanha basin. The Gumbel distribution was used to model the annual maximum rain for a period of 39 years (1978 to 2017). The data of rainfall were collected and seven precipitation stations were selected. The series of annual maximum rainfall were defined with a duration of 10, 15, 20, 25, 30, 60, 120, 240, 360, 480, 600, 720 e 1.440 min using the DAEE/CETESB methodology. For each return period of 2, 5, 10, 15, 20, 25, 50 e 100 years, were estimated a maximum rainfall using Gumbel's distribution, which can prove useful for the storm management in the area. It is of great importance to confirm if the observed rain data collected follows Gumbel's distribution or not. In order to achieve this, the observed data is arranged in descending order (the highest coming first) and assigning the return period for each rain; the reduced variable corresponding to each rain is computed using the equation $y_T = -\{ln(ln(T/T-1))\}$. A plot of the reduced variable and magnitude of rain is made using a computational program. And if the plotted data suggest a straight line, then it is reasonable to conclude that Gumbel's distribution is a good fit for the observed rain data.

KEY WORDS: rainfall; Gumbel; return periods.

MULTICRITERIA ANALYSIS OF METHANE MITIGATION TECHNOLOGIES ON OFFSHORE OIL AND GAS PRODUCTION PLATFORMS

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ABSTRACT

The oil and gas exploration and production sector is one of the most significant methane emitters through sources of fossil fuel combustion and fugitive emissions. There is a growing increase in the interest of the industry in mitigating methane emissions, mainly due to its impact on global warming and its association with the natural gas production chain. In Brazil, there are few studies focused on the mitigation of methane in the oil sector. The objective of the present work is to use a multicriteria analysis methodology to compare different methane mitigation technologies applicable to offshore oil and gas platforms. In the study, six different mitigation options were compared through the Analytic Hierarchy Process methodology, considering environmental, financial and operational criteria. With the problem structured in a hierarchy, a prioritization process of its elements was performed, assigning different weights to the evaluated criteria. Environmental and financial indicators were calculated based on actual data from three oil and gas offshore platforms and the operational indicators were evaluated through interviews with experts. The quantitative and qualitative indicators for each mitigation option were converted into standard scores. The final results were calculated for each mitigation option considering the scores of each criterion and their respective relative weights, obtained in the prioritization of the elements. This unique score obtained through the Analytic Hierarchy Process made it possible to compare the mitigation alternatives. The alternative that received the best score considering the evaluated criteria was the recovery of vapor from cargo tanks with methane energy reuse, being highlighted mainly due to its high potential for mitigation. The alternative to the Gas-to-liquid (GTL) process received the lowest score due to its high implementation cost and low operating performance.

Key-words: Greenhouse Gases. Methane. Oil and gas.

THE EVALUATION OF POSSIBILITY USE OF CONDENSATION WATER IN THE UFRJ BUILDING

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ABSTRACT

Being the water a fundamental resource for life and that its scarcity can occur due to climatic, hydrological conditions, excessive demands or even environmental degradation (TUCCI.2009).The use of water produced through air conditioners is a strategy that can contribute to the alleviation of the demand on the water sources, contributing to the improvement of the environment besides reducing the cost with the acquisition of water from concessionaires. The condensation water is produced inside the refrigeration equipment through dripping when cooling environments. From this perspective, the use of water produced by condensation in the air conditioning equipment's is a responsible and low-cost socio-environmental alternative. The motivation for this dissertation is to introduce in the execution of engineering projects inside UFRJ, by using the condensation water of the air conditioning systems, contributing with a quality water for the reduction of the consumption of water of the public concessionaire thus contributing to the preservation of the environment. The main aim of this study is to evaluate the technical and economic viability of the construction of a system for the use of water generated by the air conditioning system of the future gastronomy building that will be installed on the campus of the Federal University of Rio de Janeiro. The specific aim includes: 1) Evaluate and estimate the production of condensation water; 2) Experiments will be performed to evaluate water production on the refrigeration system already implanted on UFRJ campus. The methodology to be adopted in the development of the theme will be through research in books; analysis of the functioning of the building; analysis of the building's cooling system and other systems; analysis of the data obtained and estimated calculations of condensation water production; verification of the technical and economic viability of the proposed reuse solution for the use of the condensation water in the target building of this work. This work will contribute to the improvement of the environment through the relief of water sources, greater reliability in the estimation of condensation water production in the refrigeration systems to be implanted in the campus of UFRJ and reduction of the expenses with the acquisition of concessionaire water.

KEY WORDS: Condensation Water; Reuse; Economic feasibility.

ANALYSIS OF THE SUSTAINABLE PRACTICES OF THE ACQUISITIONS OF GOODS AND MATERIALS OF THE FEDERAL UNIVERSITY OF RIO DE JANEIRO

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ABSTRACT

This research is being carried out with the general purpose of analyzing the admission and insertion of environmental sustainability criteria in the procurement processes within the Administrative Units of General Services (in Portuguese, UASG) of the Federal University of Rio de Janeiro (in Portuguese, UFRJ). For the study, it is necessary to identify the existing legal instruments in Brazil used in public procurement and the sustainable criteria set forth in Standard 01/2010 of the Ministry of Planning, Budget and Management / Secretariat of Logistics and Information Technology (in Portuguese, MPOG / SLTI), which establishes the environmental requirements in the acquisition of goods and materials and hiring services. The research is exploratory in nature, since it aims to provide greater knowledge with an unexplored subject, as it makes it clearer. The methodology involves: bibliographic search in search bases of journals, scientific articles, theses and dissertations, and in electronic pages of organizations related to the subject; data collection carried out through documentary research, related to bidding documents recently promoted at UFRJ, available at the federal government procurement portal (https://www.comprasgovernamental.gov.br/); survey and analysis of relevant legislation. The expected results at the end of the proposed activities are: identification of the UFRJ's purchasing model and the challenges to comply with the legal determinations regarding the acquisition of goods / materials with sustainable criteria in the bids; and proposing measures that seek the balance between sustainability and the principle of economicity in the UFRJ purchasing model, that is, the union of quality, speed and lower cost in the acquisition of goods and materials with the sustainability criteria.

KEY WORDS: Bidding, Sustainability, UFRJ

LIFE CYCLE ASSESMENT OF BIOETHANOL FROM MAIZE AND SORGHUM HAVERSTED FROM INTEGRATED CROP-LIVESTOCK SYSTEM

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ABSTRACT

Production of biofuels and foods in a sustainable pattern is one of the priorities of the agropastoral sector. Brazil is one of top leaders of food and biofuels producer increasing the activities in 60's and 70's decade. Meanwhile, this has intensified a degradation process, which motivated the development of new solutions like the Integrated Crop-Livestock System (ICLS). Maize and Sorghum are some of the popular cultures, which has been cultivated in ICLS, with soy and cattle. They can be used as feed/food or to produce bioethanol. Renovabio, a policy created to promote biofuel production, as the biofuel producer receives a certificate (CBIO), which can be negotiated in the market with the fossil fuel distributors, whom has CO_2 abatement goals. The biofuel producer, which has lower carbon intensity, receives more CBIO, so that the bioethanol coming from ICLS can be an alternative providing more CBIO to the producer. The objective of this work is to use the Life Cycle Assessment (LCA) of the bioethanol from maize and sorghum coming from ICLS. The methodology to develop the work is create a data set of maize and sorghum from ICLS, the production of bioethanol in a first generation plant (1G), dedicated or flex, second generation (2G), and an integrated process (1G2G). The SIMAPRO, a LCA software, will be used to compare the performance from each process, in a carbon intensity and economic feasibility, with the conventional bioethanol production from sugar cane and maize, popular cultures in Brazil. The dataset of maize and sorghum production are going to be collected from farms located in Mato Grosso do Sul. The data of bioethanol process will be collected from bioethanol national producers. Bioethanol from maize and sorghum is expected to have a low carbon intensity compared to the conventional way of bioethanol production.

KEY WORDS: LCA, bioethanol, Renovabio, maize, sorghum

EVALUATION OF NITROGEN REMOVAL IN A SUBMERGED AERATED BIOFILTER SYSTEMS APPLIED AS POST TREATMENT OF UASB REACTORS EFFLUENTS USING A MODELLING SOFTWARE BIOWIN

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ABSTRACT

The proper treatment of domestic wastewater is very important for the preservation of water resources and an important factor for the protection of public health. In Brazil, the application of anaerobic processes for treatment of domestic wastewater, specially Upflow Anaerobic Sludge Blanket reactors (UASB), has been widespread due to its numerous advantages, such as low operating cost and operational simplicity. However, this type of treatment cannot meet the release standards determined by national legislation. Due to this, it is necessary to apply a post treatment to complement the removal of organic load and nutrients. The application of submerged aerated biofilters as post-treatment of UASB reactors has been used in domestic sewage treatment plants, however, their real capacity to meet the more restrictive limits of Total Nitrogen (TN) and Ammoniacal Nitrogen (NH3-N) releases may be questioned. Another point of discussion refers to the ideal conditions for nitrification and denitrification processes, such as carbon source, percentual of recycling effluent, aeration system and pH. The main objective of this study is evaluating the nitrogen removal conditions in submerged biofilters systems applied as post treatment of UASB reactors and their compliance with the standards recommended in the Federal and State laws of Rio de Janeiro, using the simulations of operational conditions and process in a modelling software - Biowin. For the development of this work will be considered a sewage treatment plant, installed in a municipality in the state of Rio de Janeiro, with capacity to treat up to 50 L / s. For post-treatment will be considered a system of multiple tanks, starting with an anoxic filter of ascending flow, followed by a submerged aerated biofilter and secondary decanter. Initially, it is expected define the design of the system through the data found in the literature and then to define the operational configuration that presents the best results for the removal of Total Nitrogen and Ammoniacal Nitrogen in a way that it is possible to reach the respective discharge standards determined by current environmental standards.

KEY WORDS: submerged aerated biofilter; UASB reactors; BIOWIN.

CASE STUDY OF THE TECHNOLOGY " UPFLOW ANAEROBIC-AEROBIC PACKED-BED REACTOR" AND PROPOSALS OF NEW CONFIGURATIONS TO OPTIMIZE TOTAL NITROGEN REMOVAL

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ABSTRACT

The present work was proposed to evaluate the technology employed in the Wastewater Treatment Plant (WWTP) Maria Paula and its capacity to remove pollutants according to the standards established by the legislation in the city of Niterói. The WWTP was inaugurated in 2016 to serve the neighborhoods of Maria Paula and Matapaca and has an average influent COD of 450 mg/L and a and Kjeldahl Nitrogen of 50 mg/L

The treatment process employed in the plant is known as Combined Bioreator, composed of fixed bed upflow reactor containing an anaerobic treatment step followed by an aerobic step. This system uses biomass immobilizing supports (BioBob® - a matrix of

polyurethane encased by a rigid polypropylene structure with cylindrical geometry

of 45 mm in diameter and 60 mm in height.) to increase of the biomass concentration in biological reactors, with aim to improve the reactor capacity for the removal of suspended solids, organic matter and nitrogen.

The receiving water body is lotic (Pendotiba River), therefore, only a concentration of ammonia below 5 mg/l is required at the final effluent and the WWTP was designed to attempt this standard. The objective of the research is to evaluate this configuration, with bench tests, comparing with this same technology submitted to a recirculation of the treated effluent, with rates of two, three and four times the nominal influent flow, to promote an anoxic state in the reactor and achieve denitrification.

The experimental investigation is being conducted in the concessionaire Águas de Niterói using the effluent of the mechanical pre-treatment of the Maria Paula plant. The anaerobic reactor consisted of a cylindrical Plexiglas tube (19 cm in diameter) with a volume of 2,8l. The aerobic reactor aerobic reactor consisted of the same structure, with 5,4l. The support for biomass immobilization (BioBob®) is a developed model for lab scale trials with cylindrical geometry of 15 mm in diameter and 20 mm in height.

The reactor is operating with hydraulic retention time of the nominal flow of the WWTP, and a flowrate of 0.9 l/h was adopted. The second part of the experiment, where the aim is to achieve denitrification, a flowrate of recirculation will be 1.8 l/h, 2.7 l/h and 3.6 l/h.

KEY WORDS: aerobic processes, anaerobic processes, denitrification

IWA METHODOLOGY IN THE CONTROL OF WATER LOSS FROM WATER SUPPLY SYSTEM - CASE STUDY IN THE RESIDENTIAL VILLAGE OF THE FEDERAL UNIVERSITY OF RIO DE JANEIRO / UFRJ

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ABSTRACT

The control and reduction of water loss in the water supply system are essential for promoting the rational use of water and the preservation of water resources. Loss control allows for the postponement of investments in expansion of water production systems and contributes to better equalize investments for universal access to services (BRITTO, 2011). The International Water Association (IWA) formatted and presented a methodology for the control of water losses, with emphasis on the study of the Water Balance Matrix; definition and implementation of sectorization for losses through DMA's (District Meter Areas), ZMC's (Measurement and Control Zones) or DP's (Pitometrical Districts); among other actions and activities. This work aims to contribute to the studies of control and reduction of losses in water supply systems. Specifically, it intends to establish the volumes of water lost in distribution network pipes subject to different types of faults and different pressure levels, based on data obtained in the macro and micro meter readings existing in the Residential Village – Cravos' street, University City of the Federal University of Rio de Janeiro (UFRJ). The UFRJ Residential Village, a living witness of the history of the University City, a region lacking urban and social planning, suffers from lack of control of the effective management of water resources and with a consequent high loss of water supply. Through the study of the Water Balance Matrix, according to the methodology of the IWA, ways of identifying and mitigating water loss in the system are sought. It is also envisaged to extend such concepts to attend to the responsible management of the water resources of the University City itself, UFRJ. General objective: The study aims to analyze the occurrence of water loss in the water supply system in the University City / UFRJ, using the premises of the IWA methodology. The approach will be, firstly, carried out in Residential Village – Cravos' street. Specific Objectives: Drafting of the Water Balance of the Water Supply System of Residential Village – Cravos' street of UFRJ, for the period from June 2016 to June 2017; Elaboration of studies for the proposal of a Control Plan and Reduction of Losses in the University City; Elaboration of a qualitative and quantitative survey of the provision of the water supply service from the point of view of the consumer / Residential village – Cravos' street, UFRJ; Mapping of residential units for future studies of apparent losses. Methodology: As for the purposes this study will characterize as an exploratory research, as it may provide new ideas and discoveries on the subject. As for the means to bibliographical research, it will be carried out by reading books and manuals, laws, scientific articles and specialized magazines in Water Resources Management, Basic Sanitation, Water Supply Systems and losses in the water supply system. In consultation with the service provider of the region - CEDAE, it is available to collaborate in the provision of the necessary data regarding micrometer. Expected results: Obtain estimates of the volumes of real and apparent losses of Residential Village – Cravos' street, from the University City of UFRJ; Quantitative and qualitative evaluation of the management of the water distribution system of the University City of UFRJ; Stimulate the adoption of losses management in the University City of UFRJ; To attend to the responsible management of the water resources of the University City, UFRJ, in agreement with the goals of the Master Plan (PDCIDUNI 2020)

KEY WORDS: Water loss; International Water Association; Water Balance Matrix

ENVIRONMENTAL MANAGEMENT ASPECTS APPLIED TO ORGANIZATIONS: CASE STUDY OF THE OPERATION OF A SHOPPING CENTER

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ABSTRACT

Considering environmental management (EM) as a set of directives and administrative activities carried out to address environmental problems resulting from its performance by an organization, its importance reflects the concern of society with the environment in which it is inserted. Since the 1980s, the Brazilian business sector has been evolving from a reactive to a proactive position with regard to combating environmental issues. The increasing importance of development of EM within organizations is a process of mutual influence, in other words, once society is more environmentally aware, the greater the requirement in terms of environmental performance. In this context, the shopping center sector stands out. In its operation phase, its impacts are similar to those of a residential building where there is generation of waste and consumption of water and energy. However, it is worth mentioning that the order of magnitude is superior, given the area occupied by the enterprises and the flow of people they receive daily. In the context of the search for the management of environmental responsibilities, this paper aims to make explicit the application of aspects of environmental management in organizations, especially in the shopping center sector. In addition, the aim is to characterize the benefits and economic gains of adopting its practices and tools, by reviewing the literature and applying it in a case study.

KEY WORDS: environmental management in organizations; shopping center; case study.

ANALYSIS OF ENVIRONMENTAL HYDRODYNAMICS AND WATER QUALITY IN THE MUNDAÚ MANGUABA ESTUARINE LAGUNAR COMPLEX (AL) VIA COMPUTATIONAL MODELING.

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ABSTRACT

The region of the Mundaú and Manguaba lagoons in Alagoas covers one of the most important estuarine systems in the country, known as the Mundaú Manguaba Estuarine Lagunar Complex (CELMM), and has undergone an accelerated process of environmental degradation, directly and indirectly affecting about 260 thousand inhabitants living in its surroundings, of which 5,000 are fishermen. The disorderly growth of the urban area of Maceió associated with a lack of adequate sanitation, besides the presence of a chlorochemical pole and intense sugar and alcohol industry along its watersheds are factors that result in a critical situation when placed in front of the environmental vulnerability and the socio-economic-cultural importance of the region. The deterioration of natural heritage and local cultural values results from the form and speed of exploitation of the natural resources of the CELMM, linked to its strategic location, which provided an intensive use and appropriation of the territory and its resources, generating, on the one hand, business, employment and income opportunities, but, on the other hand, leading to the exhaustive and non-sustainable exploitation of it. Given this scenario, it is pertinent to establish studies, among them, environmental modeling. This is characterized as an integrative tool, without which it is difficult to obtain a dynamic view of phenomena, such as the impacts of anthropic activities on environmental quality in complex environmental systems such as rivers, lakes and reservoirs, estuaries, bays and coastal areas. They are, therefore, indispensable tools for the environmental management and the planning of actions in natural water bodies. The general objective of this study is to characterize the hydrodynamic circulation pattern of CELMM, to analyze the renewal rate and the age of the water, and to evaluate the dispersion of effluents by means of the thermotolerant coliform parameter, released without due treatment in the lagoons. The models that will be used in the development of this work are part of the SisBaHiA® - Base System of Environmental Hydrodynamics, which has been constantly improving at COPPE/UFRJ since 1987. In SisBaHiA®, the following submodels will be used: Hydrodynamic model, Eulerian transport, Lagrangean transport and Quality. In order to do so, it will be necessary to obtain the input data of the model. These data refer to the definition of the study area; the modeling domain; the boundary conditions and the initial conditions; tidal data, tributary flow and concentrations, wind, bathymetry, roughness, among others. It is expected through the use of modeling to obtain results that allow to characterize the hydrodynamic and water quality conditions of the site and to provide subsidies for future studies that propose interventions that improve the environmental quality of the lagoon system. It is also expected to evaluate the sensitivity of the coastal water body to the environmental degradation caused by lack of sanitation (sewage collection and treatment) in the lagoon contribution basin, especially the municipality of Maceió.

KEY WORDS: Environmental modeling; Mundaú; Manguaba.

DEVELOPMENT OF A PROSPECTIVE AND RETROSPECTIVE INVESTIGATION AND ANALYSIS TOOL FOR OCCUPATIONAL ACCIDENTS FOR INDUSTRIAL FACILITIES

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ABSTRACT

Despite significant advances in workplace (new technologies, improvements in working conditions, etc.), hundreds of millions of deaths and disabilities of workers occur every year as a consequence of occupational accidents, making them one of the biggest global problems currently. Most of the time, these accidents are not investigated correctly, then limits the lack of analysis of the determinants of these events. Many accident investigation processes are based on an already outdated scientific theory, known as the traditional approach, in which accidents are viewed as simple, unicausal phenomena. This type of approach does not have the capacity to investigate events of high complexity, as the work accidents. Although inefficient and inadequate for the analysis and investigation of high complexity events, the tools based on the traditional model are widely used by most professionals in various economic sectors in Brazil and in the world. Work accidents are considered multi-causals and events of high complexity and consequently their investigation is considered complex, since it involves several variables and interpretations, can occur in a non-linear, unpredictable way and at spatial and temporal scales. The traditional models are based on linear and probabilistic relationships, often indicating that the accident was generated by a single cause and this does not represent the events of high complexity, since the non-linear processes are not considered. It occurs that in an analysis of events of high complexity it is necessary to consider the emergent properties that arise from interactions of several variables. Thus the objective of this work is the development of a retrospective and prospective work accident investigation and analysis tool based on a consolidated methodology, with a special focus on the human factors, treatment of uncertainty and potential surprises related to the functioning of these events, that is robust enough to consider all the properties and variables that lead to the occurrence of an event of high complexity, such as work accidents, in industrial facilities. To carry out this work, it will be necessary to identify a consolidated approach for the structuring of the retrospective and prospective investigation and analysis tool proposed in this work. There are currently several models, methods and approaches for investigating high complexity events. Each model or approach provides a different vision and outcome for investigation. Thus, the first methodological step of this work, will be to study and research the different approaches and tools, in order to verify the existing approaches with the objective of constructing a new method structured and able to identify the technical and human factors that lead to the accidents. The second step methodological step of this work will be develop a prospective and retrospective tool for investigation and data collection of high complexity events based on a consolidated approach. The third step of the work will be conduct a test of the new tool for investigation and data collection of high complexity events in a real event, in order to verify the efficiency of the tool. It is hoped that the new tool will be robust enough to avoid recurrence and occurrence of future work-related accidents.

KEY WORDS: work accidents ; human factors ; accident investigation.

CURRENT MARKET SURVEY AND ECONOMIC FEASIBILITY OF PHOTOVOLTAIC SYSTEMS IN A SINGLE-FAMILY RESIDENCE IN THE WESTERN ZONE OF RIO DE JANEIRO CITY

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ABSTRACT

The civil construction sector involves several multidisciplinary activities, such as construction activities, project planning and urban infrastructure in different segments. In this way, it is expected that entrepreners in the area can promote sustainability in projects and in urban areas. For example, the implementation of residential projects and the development of urban projects with principles and guidelines sustainable. This study aims to the elaboration of the current market survey of photovoltaic systems, with concept of representativeness in the western zone of Rio de Janeiro City, and the economic feasibility of photovoltaic systems in single-family residence. The study presents economic indicators, technical and design aspects of the on-grid photovoltaic system in the locality of the case study, with the objective of collaborating with architecture and civil engineering professionals, real estate investors and residential customers in order to understand the investment in photovoltaic systems and the investment advantage in the renewable energy sector. With applications of measures that benefit the energy performance in residential buildings, thus contributing to less environmental impacts and lower monthly expenses with the consumption of electric energy. The methodology consists of analyzing the budgets received by the companies integrating photovoltaic systems that were previously chosen because they are located close to the case study. The data analyzed were separated into comparative worksheet by technical and design parameters. In addition, it was proposed to realize a comparative economic study between on-grid, off-grid and hybrid photovoltaic systems for the same average monthly consumption and the same locality. Also, the present study provides basic explanatory information about the main important points for the knowledge and differentiation of each photovoltaic system, divided into on-grid, off-grid and hybrid. However, with more focus on the on-grid photovoltaic system, which is the basis of this study. It was not intended to emphasize deep electrical details, electronics, recognition of possible failures or deepening of photovoltaic technology. The main results demonstrate that the on-grid photovoltaic system for the proposed monthly average generation and locality parameters are satisfactory for the installation and investment in the system. The main conclusions are that the investments in the residential photovoltaic system are profitable and have energy efficiency favorable to the proposed case study.

ESTIMATION OF GREENHOUSE GAS EFFECT (GHG) EMISSIONS IN CIVIL CONSTRUCTION, COMPARING A MODULAR CONSTRUCTION WITH A "TRADITIONAL": A CASE STUDY.

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ABSTRACT

The increase in greenhouse gas (GHG) emissions has caused global climate change in recent years. According to United Nations data, the Civil Construction Industry is recognized as one of the activities with the greatest environmental impact on the planet.

In buildings, emissions are primarily from the use of energy, from 80 to 90% generated in the use and operation stage and from 10 to 20% related to the extraction and processing of raw materials. Therefore, the construction industry also has an important role in reducing greenhouse gas emissions in the atmosphere and can contribute significantly and proactively. Considering the perspective, the present study focuses on presenting not only the GHG Protocol methodology in the context of civil construction, but also to adjust (customizing) the GHG emissions quantification tool, demonstrating its application to comparative inventories in this sector.

The main goal of this work is to use real data of a project for the implementation of a modular civil works (constructive method with isothermal panels), located at the Federal University of Rio de Janeiro - UFRJ, using the methodology "GHG Protocol "for civil construction projects, in order to quantify their GHG emissions, and thus to measure their applicability in relation to the scope of the various construction materials, and simultaneously to develop the tool and make a comparison between a modular construction and a "traditional". Identify the processes most susceptible to GHG emissions in the industrial process of manufacturing of civil construction materials and in particular of the modular panels. From the result, to establish and provide constructive choices and methods aligned to low carbon scenarios, based on the respective GHG Emissions Inventories.

As specific objectives: the comparative study, regarding GHG emissions, among the constructive methods proposed in this case study; validation of the tool used for GHG emission inventories; discuss the possibility of implementing new technologies and construction methods that allow the reduction of GHG emissions within the scope of UFRJ; to propose solutions of more efficient occupation of the spaces in the UFRJ, with direct effects in the design phase of projects, with the context of reduction of pollutant emissions and preservation of the environment.

The methodology to be adopted in the development of the theme will be through research in books; newspapers; magazines, articles published; and internet research, duly registered in the bibliographic references at the end of the work. The Greenhouse Gas Protocol tool (GHG Protocol - version 2018.1.4) will be used to compile the inventory, in order to verify the applicability of the proposed method through its use in a case study, with the respective conclusions and recommendations for future work.

Based on this work and the respective result, create conditions to foster and raise awareness of the Units responsible for project preparation and execution and supervision of works on the UFRJ Campus (ETU-UFRJ / PU-UFRJ Technical Office and Planning Offices), to adhere to the necessary changes and adaptations, and its main objective is to develop low carbon scenarios based on the respective GHG Emissions Inventory. Likewise, to encourage other public entities to participate in the process and thereby ensure not only the comparability and the quality of the inventories generated, but also the responsibility to develop, update national emission inventories and, in particular, disseminate.

KEY WORDS: Constructive Method; GHG Protocol; Modular Panels.

DEVELOPMENT AND ANALYSIS OF TECHNOLOGICAL ALTERNATIVES FOR CARBON REDUCTION IN ELECTRICITY GENERATION AND CO_2-RICH NATURAL GAS PURIFICATION

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ABSTRACT

In a scenario of general threat concerning the long-term consequences of global warming, implementing technological alternatives for carbon reduction in thermal power plants is critical to make feasible attaining the current targets of carbon reduction. Moreover, considering the historical and prospective growth on natural gas utilization as a fuel, and given the exploration of large proven reserves containing gas with high CO_2 content, this study reflects a world panorama that calls for energy security while requires mitigation of CO_2 emissions. This work develops and analyzes, via technical, economic and environmental assessments, several new technological alternatives that meet the current challenges associated with carbon reduction in electricity generation and CO_2-rich natural gas (NG) purification. Three lines of research are addressed: (i) oxy-combustion CO_2 capture, with emphasis on oxygen production via cryogenic air separation; (ii) offshore CO_2-rich NG processing; and (iii) biorefineries for carbon reduction via chemical and biochemical CO_2 sequestration. For this purpose, two biomass sources are conceived: microalgae – due to its high photosynthesis efficiency – and corncobs –a large-scale agricultural residue. Techno-economic performances of three corncob-to-energy pathways are investigated: gasification to methanol, fast pyrolysis to bio-oil and combustion to electricity. With microalgae as biomass source, potential barriers for implementation of large scale CO_2 utilization in microalgae biorrefineries were identified assuming an economic scenario with incidence of CO_2 taxation. The following routes were investigated for microalgae conversion to commercial products: (i) gasification for methanol production, in addition to liquid extraction for microalgae oil; and (ii) anaerobic digestion for biogas production to power generation or biomethane production. Large-scale floating platforms with high gas-to-oil ratio and high CO_2 content (67%mol) were evaluated through the prism that main processing steps of the gas should be conducted by SS whenever possible owing to its compactness compared to other technologies. In the proposed case, raw NG dehydration and CO_2 removal were performed by sequential SS steps. As membrane permeation (MP) is another compact technology for CO_2 removal, technical and economical assessments identify which is the best process alternative to target 20%mol CO_2: SS or MP. Cryogenic air fractionation for oxygen production was evaluated from technical perspective proposing a novel cryogenic top vapor recompression distillation alternative (TVR) and comparing it to several high performance cryogenic processes already existing in the literature. For air pre-purification, another innovative process was proposed: a combination of supersonic separator (SS) heading bulk purification (air dehydration) followed by finishing adsorption for trace impurities removal (SS-TSA), which was compared in technical and economical fields to a conventional process fully based in Temperature Swing Adsorption (FULL-TSA), assuming that large-scale purified air supply to Cold Box could be outsourced as a commercial industrial plant. Process configurations were defined and implemented in Aspen Hysys v8.8 with unit operation extensions for SS design and simulation and rigorous sound speed estimation, which results were utilized in economic and environmental analyzes of alternatives. The TVR alternative using single low-pressure column for oxygen production exhibited lower power consumption than current state-of-art triple-column distillation – 139 against 158 kWh/t O_2 – which is related with lower Cold Box air feed pressure – from ≈3 bar to ≈2 bar – due to high performance of cryogenic fractionation process. Furthermore, superiority of the proposed SS-TSA alternative for air pre-purification over conventional FULL-TSA choice was also demonstrated owing to excellent SS performance showing 98.65% H_2O removal with high 98.59% pressure recovery, implying in 88% lower consumption of low-pressure steam in TSA for just 0.4% higher compression power demand, virtually reducing purified air price from 5.29 to 5.18 US\$/kNm³ for reduced plant CAPEX and OPEX. SS utilization for CO_2 removal

from dehydrated CO_2-rich NG stream presented better performance than MP due to higher backpressure of CO_2-rich stream: 53.74 bar in SS condensate (64% pressure recovery) against 8 bar in MP permeate, so the overall power demand from MP to SS reduces by ≈5%, meanwhile plant CAPEX was not significantly affected. Regarding a low-priced scenario for microalgae oil at 0.50 US$/kg, the thermochemical microalgae biorrefinery had better economic performance than conventional Carbon Capture and Storage alternative but required high CO_2 taxation above 100 US$/t CO_2 to be economically feasible. Economic feasibility of biochemical route was demonstrated for slightly lower CO_2 taxation of 75 US$/t CO_2 using low-grade (waste heat) thermal pre-treatment prior to anaerobic digestion of microalgae substrate. The results in this regard demonstrate biogas upgrading to biomethane as being economically superior to biogas use for power generation. The most relevant barrier for implementation of microalgae-based biorefinery is the immense land area required for microalgae cultivation for biofixation of CO_2 from a typical NG power plant: ≈1000 ha for ≈200 MW. In corncob processing, all investigated alternatives are economically feasible provided biomass cost is lower than US$75.5/t. The minimum allowable product prices for economic attractiveness of gasification, combustion and pyrolysis routes are US$305/t methanol, US$80.1/MWh electricity and US$1.47/gasoline-gallon-equivalent bio-oil. Despite its vulnerability to price volatility, gasification presents the highest net present value, seconded by the combustion route, which has lower medium-term payback and investment than gasification due to its process simplicity. Techno-economic analysis of large-scale floating platforms processing CO_2-rich NG pointed better performance of CO_2 removal to SS in comparison with MP. Proposed alternatives related with oxygen production proved superiority over conventional processes.

KEYWORDS: Air separation; CO_2 capture; biorefinery.

IWA METHODOLOGY IN THE CONTROL OF WATER LOSS FROM WATER SUPPLY SYSTEM - CASE STUDY IN THE RESIDENTIAL VILLAGE OF THE FEDERAL UNIVERSITY OF RIO DE JANEIRO / UFRJ

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ABSTRACT

The control and reduction of water loss in the water supply system are essential for promoting the rational use of water and the preservation of water resources. Loss control allows for the postponement of investments in expansion of water production systems and contributes to better equalize investments for universal access to services (BRITTO, 2011). The International Water Association (IWA) formatted and presented a methodology for the control of water losses, with emphasis on the study of the Water Balance Matrix; definition and implementation of sectorization for losses through DMA's (District Meter Areas), ZMC's (Measurement and Control Zones) or DP's (Pitometrical Districts); among other actions and activities. This work aims to contribute to the studies of control and reduction of losses in water supply systems. Specifically, it intends to establish the volumes of water lost in distribution network pipes subject to different types of faults and different pressure levels, based on data obtained in the macro and micro meter readings existing in the Residential Village – Cravos' street, University City of the Federal University of Rio de Janeiro (UFRJ). The UFRJ Residential Village, a living witness of the history of the University City, a region lacking urban and social planning, suffers from lack of control of the effective management of water resources and with a consequent high loss of water supply. Through the study of the Water Balance Matrix, according to the methodology of the IWA, ways of identifying and mitigating water loss in the system are sought. It is also envisaged to extend such concepts to attend to the responsible management of the water resources of the University City itself, UFRJ. General objective: The study aims to analyze the occurrence of water loss in the water supply system in the University City / UFRJ, using the premises of the IWA methodology. The approach will be, firstly, carried out in Residential Village – Cravos' street. Specific Objectives: Drafting of the Water Balance of the Water Supply System of Residential Village – Cravos' street of UFRJ, for the period from June 2016 to June 2017; Elaboration of studies for the proposal of a Control Plan and Reduction of Losses in the University City; Elaboration of a qualitative and quantitative survey of the provision of the water supply service from the point of view of the consumer / Residential village – Cravos' street, UFRJ; Mapping of residential units for future studies of apparent losses. Methodology: As for the purposes this study will characterize as an exploratory research, as it may provide new ideas and discoveries on the subject. As for the means to bibliographical research, it will be carried out by reading books and manuals, laws, scientific articles and specialized magazines in Water Resources Management, Basic Sanitation, Water Supply Systems and losses in the water supply system. In consultation with the service provider of the region - CEDAE, it is available to collaborate in the provision of the necessary data regarding micrometer. Expected results: Obtain estimates of the volumes of real and apparent losses of Residential Village – Cravos' street, from the University City of UFRJ; Quantitative and qualitative evaluation of the management of the water distribution system of the University City of UFRJ; Stimulate the adoption of losses management in the University City of UFRJ; To attend to the responsible management of the water resources of the University City, UFRJ, in agreement with the goals of the Master Plan (PDCIDUNI 2020)

KEY WORDS: Water loss; International Water Association; Water Balance Matrix

PLASTICS IN REVERSE LOGISTICS OF POSTCONSUMPTION PRODUCTS

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ABSTRACT

Introduction: The National Solid Waste Policy (PNRS) is related to the integrated management of waste, including hazardous waste, the responsibilities of generators and public power and the applicable economic instruments, providing its principles, objectives and guidelines. However, according to the National Sanitation Information System (SNIS), from 85.2% of the mass collected in the country, 59% are disposed in landfills, 9.6% in controlled landfills, 10.3% in dumps and 3,4% sent to sorting and composting units. In Brazil, 21.8% of the municipalities have a selective collection service and 44.1% do not. According to the research, for each 10 kg of waste available for collection, only 400 grams are collected in a selective manner, being considered a very low value considering the recyclable potential of municipal solid waste. In Rio de Janeiro city, for example, gravimetric characterization of household solid waste collected in 2018 revealed that 43% of the mass of waste belongs to the recyclable fraction (plastic, paper, metal and glass). Among the various PNRS provisions, reverse logistics shared responsibility and sectoral agreements are some of the essential and innovative instruments of this new proposal for collective behavior toward sustainability, and indicates that public policies to address these issues tend to be increasingly demanded by society. The validity of the PNRS would establish reverse logistics as one of the instruments of the principle of shared responsibility for the life cycle of the products, in order to make feasible the set of actions for collection and restitution of products and solid waste for the business sector. Since 2015, the Brazilian Association of the Plastic Industry has signed with the Ministry of the Environment the Sector Agreement for Reverse Packaging Logistics, in order to ensure that the sector and its associates can comply with the PNRS, and participate in the planned logistics system actions at the national level. They will have to invest in their own systems for reverse logistics, point of Voluntary Drop-Off Points (PEVs), training of cooperatives among other initiatives, according to Decree 9,177 of 2017. Recently, in Rio de Janeiro, companies that produce, import or market packaging or packaged products will be required to fund the reverse logistics system for packaging and packaging waste, with selective collection targets increasing by at least 10% every two years from 2019. The decrease in the amount of recyclable waste recovered from plastics from 2012 to 2017 indicates the need to increase the efficiency of recycling policies for plastic products together with reverse logistics. **Objective**: To perform the gravimetry of household solid waste from the selective collection of the districts of the Rio de Janeiro city, analyzing the plastic production chain with emphasis on recycling, as the instrument of reverse logistics with the producers and importers of post consumer products, interconnecting consumer and disposal. **Methodology**: The selected area for the study is the city of Rio de Janeiro, among the chosen districts will be classified according to the Human Development Index - HDI in three lanes for the study: high class (high HDI), middle class (averege HDI) and low class (low HDI). 240L of recyclable household waste will be collected from each city's collection route, over a year. The types of plastics will be segregated according to the Society of Plastics Indutry classification, - SPI, 1 - PET Poly (ethylene terephthalate); 2 - HDPE High density polyethylene; 3 - PVC Poly (vinyl chloride); 4 - LDPE (LDPE) Low density polyethylene; 5 - PP Polypropylene; 6 - PS Polystyrene; and 7 - Others. The samples will not include collection during times of vacations, Carnival, Easter, and weekends to avoid the influence of these periods on the quantity and quality of the sample components. The samples will be immediately sent to the Laboratory of Gravimetric Characterization of the Center of Applied Research of COMLURB, where they will be separated into different components. For the description of environmental problems, exploratory and descriptive research methodologies will be adopted. As preliminary results, the gravimetry of the neighborhoods of Jardim Botânico, Horto and Gávea, had a total of 13.23 kg of recyclable materials, being plastic 2,45 kg (18,51%); paper 4.51kg (34.12%);

glass 5.43 (41.05%); and metal 0.84kg (6.32%). The plastic recyclable fraction of the study scope had the following preliminary configuration: PET crystal 1.03kg (7.76%); HDPE white 0.24kg (1.81%); HDPE other stains 0.11 kg (0.85%); White LDPE 0.01kg (0.08%); White PP 0.05kg (0.39%); PS 0.03kg (0.20%); Plastics Film PP and PE 0.98kg (7.42%).

KEYWORDS: Reprocessing of polymers; Nylon 11; Nylon 12; decommissioning.

EVALUATION OF REPROCESSING OF INTERNAL PRESSURE BARRIER RESIDUES FROM FLEXIBLE PIPES FROM DECOMMISSIONED PLATFORMS OFFSHORE

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ABSTRACT

Global dependence on oil products makes it necessary to develop increasingly innovative technologies for oil extraction on onshore or offshore platforms. These innovations are necessary to ensure increased security for the process and to make it more cost-effective. Among the equipment used in oil operations, flexible pipes are essential, since it is through these structures that the crude oil extracted from the wells is conveyed to the platforms. These structures are made up of layers of polymeric and metallic materials. The polymers used commercially in the manufacture of the inner layer (called pressure barrier), which are in direct contact with oil, are polyamide 11 (or nylon 11) (PA11); polyamide 12 (or nylon 12) (PA 12) and polyvinylidene fluoride (PVDF). In the present study, the pressure barrier based on PA11 will be evaluated. At the end of the flexible pipe operating time, these structures must be replaced with new one, ensuring process safety. In addition, in view of to the decommissioning of the offshore platforms, due to the exhaustion of the oil wells, these structures are discarded, generating a large amount of waste and leading to a great environmental impact if the guidelines indicated by the National Solid Waste Policy ("*Política Nacional de Resíduos Sólidos*" - PNRS) are not met. It is important to mentioned that even after their use, the polymers constituting the pressure barrier still maintain good properties related to their mechanical integrity, which allows their reuse in several industrial segments. It is important to note that, currently, there are no procedures and studies in the literature for the development of new products through the reuse of pressure barriers of flexible pipes after decommissioning processes. In view of this scenario, the aim of this work is to evaluate the technical viability of the use of recycling as a treatment method for the reuse of these materials. To achieve this goal, methodologies for processing will be developed by establishing the processing and reprocessing parameters of the virgin resin PA11 and of a post-consumption pressure barrier. In addition, the feasibility of reuse of post-consumer waste in pipe-to-pipe technology for automotive industry will also be evaluated. The methodology to be developed involves the steps of bibliographical review on nylon recycling processes, material acquisition, cutting of samples for further processing in a twin screw extruder and characterization analyzes. The main results to be expected are the development of the methodology for reuse and recycling the pressure barrier of flexible pipes after decommissioning and evaluation of the potential of post-consumer use in pipe-to-pipe technology for application in the industry automobile industry.

KEY WORDS: Plastic waste; Reverse Logistics, Recycling.

APPLYING URBAN METABOLISM AND CIRCULAR ECONOMY CONCEPTS IN URBAN WATER CYCLE

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ABSTRACT

Cities adaptations to issues related to water are one of the major challenges of the 21st century. Due to increased urbanization and uncertainties associated with climate change, intense events such as floods, water shortages, heat waves, and others tend to increase in frequency, intensity and magnitude. Inputs and outputs from water supply and sewage are well developed in literature when dealing with the water balance of the city as an open system. However, the themes involving precipitation, evaporation, infiltration and mainly surface runoff are still at a preliminary stage. In this context, the present study aims to adapt and incorporate the concepts of urban metabolism and circular economy in urban water management involving water cycle parcels. A *quasi-2d* hydrodynamic is introduced to quantify run-off outputs and empirical models to address evaporation and infiltration. The Macrobasin of Jacarepaguá will be used as case study. The region is composed by a set of urban catchment highly subject to floods in west zone of Rio de Janeiro city will be used as case study.

KEY WORDS: urban water cycle; urban metabolism; circular economy.

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