INCREaSE 2019

INternational CongRess on Engineering and Sustainability in the XXI cEntury

BOOK OF ABSTRACTS

Faro, Portugal, October 09-11, 2019

Editors

Jânio Monteiro
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Preface

It is our pleasure to present the Book of Abstracts of the 2nd International Congress on Engineering and Sustainability in the XXI Century, INCREaSE 2019. INCREaSE is a multiple-track congress consisting of high-quality, previously un-published papers, intended to act as a forum for research groups, engineers, and practitioners to present recent results, improvements, and promising future directions in engineering and sustainable development.

The contribution to the engineering and sustainable development is made in a multidisciplinary way, reflected by research and technology in the fields of Civil, Electronics, Food and Mechanical engineering. The work presented in the event includes several transversal challenges, such as Sustainable Development and Circular Economy, Climate Changes and Environmental Protection, Sustainable Technologies, Ocean and Coastal Technologies, Renewable Energy and Energy Efficiency, Water for Ecosystems and Societies, Healthy Food: Production, Characterization and Innovation, Sustainable Tourism, Natural and Anthropogenic Risks, Smart Cities, Smart Mobility and Accessibility, Nearly Zero Energy Buildings.

This year's INCREaSE was held during October 09-11, 2019, in Faro, Portugal, organized by the Institute of Engineering and hosted by University of Algarve. There was a very positive response to the Call for Papers for INCREaSE 2019. We received 172 works, from 481 different authors, from 21 countries, being accepted for publication 93 papers, where at least two reviewers reviewed each paper.

The essential actors of any conference are the authors, who submitted their scientific contributions. They are the main responsible for the high quality of the scientific program of INCREaSE 2019. The reviewers, members of the Scientific Committee and all the other committees, also played a key role with their dedicated and thorough work.

INCREaSE 2019 had an excellent group of invited speakers: Andrew Patton McCoy (Virginia Polytechnic Institute & State University, United States of America), Cláudia Sequeira (Project Culatra 2030, Universidade do Algarve, Portugal), Edmilson Teixeira (Professor in Water Resources Management and Environmental Hydrodynamics – Federal University of Espírito Santo State, Brazil), Filipe Duarte do Santos (Faculty of Sciences, University of Lisbon, Portugal), Isabel Ferreira (Instituto Politécnico de Bragança, Portugal), José Paulo Costa (STAP, Portugal), Stephen Thomas (OGI Groundwater Specialists, UK), Frederico Custódio (CEIIA, Portugal). We are grateful to these leading experts for their inspiring participation in INCREaSE 2019.

We wish to express our gratitude to all of the above participants that enabled the success of the second edition of INCREaSE.

Finally, we look forward to meeting you again at the next edition of INCREaSE, in 2021.

October, 2019

Jânio Monteiro
António João Silva
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INternational CongRess on Engineering and Sustainability in the XXI cEntury – INCREaSE 2019
Keynote Talk

ITeCons a dynamic interface between scientific knowledge and applied industry

P.V. Antunes, Nuno Simões

ITeCons - Institute for Research and Technological Development in Construction, Energy, Environment and Sustainability, Rua Pedro Hispano, 3030-289, Coimbra, Portugal

Abstract: Established in 2006, Itecons is a non-profit association acting as a dynamic interface of knowledge between the scientific community and industry. It provides applied research, testing, consulting and training services in the fields of construction, energy, environment and sustainability. As example of its valences to the areas of applied research and consulting two projects will be presented:

- ReNatural NZEB - develop Nearly Zero Energy Buildings with low carbon footprint, using recycled and natural materials and products. Introduce and promote sustainable construction materials and technologies with low market rate in Spain and Portugal.
- OBSERVE - constitute a channel for the dissemination of information related to the sustainability of tourism activity in a perspective of destination promotion, provide a decision support tool and transmit technical information objectively and reliably. Monitoring, Regular Platform Availability.

Keywords: knowledge transfer; specialized services; applied research, innovation, sustainability

INternational CongRess on Engineering and Sustainability in the XXI cEntury – INCREaSE 2019
Keynote Talk

Adapting novel food additives development to sustainability principles

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Abstract. Natural sources have been increasingly explored for their countless beneficial effects on human health, specially plants and mushrooms. Beyond their nutritional properties, which make them important components of a balanced diet, these matrices are also rich in bioactive molecules that exert important functions as antioxidant and antimicrobial agents. Given these properties, several researches have been focusing the development of bio-based ingredients, namely colouring, bioactive, and preservative additives, through sustainable practices and processes. From this point of view, the exploitation of food industry residues to produce such ingredients is an increasing concern, along with the use of green solvents in the extraction procedures, among others.

Several compounds extracted from plants and mushrooms have been applied in food matrices with different purposes. For example, betalains (e.g. gomphrenin II, gomphrenin III, isogomphrenin II, and isogomphrenin III) and anthocyanins (e.g. cyanidin, delphinidin, and malvidin derivatives) obtained from purple globe amaranth, rose, dahlia, centaurea, strawberry-tree, roselle, and blueberry have proved bioactive and colouring properties when incorporated in ice-cream, yogurt, and waffles [e.g. 2]. Moreover, phenolic acids (e.g. rosmarinic acid), flavonoids (e.g. quercetin derivatives), and ellagitannins (e.g. sanguiin H-10 and lambertianin) from mushrooms, wild strawberry, rosemary, mountain sandwort, and flowers of *silva brava* demonstrated bioactive properties when introduced in gelatin, yogurt, and cottage cheese [e.g. 1]. On the other hand, strawberry-tree, basil, lemon balm, sweet chestnut flowers, fennel, and German chamomile revealed to be great sources of preserving molecules with antioxidant and antimicrobial activity, such as flavonoids (e.g. catechin, and quercetin and luteolin derivatives), phenolic acids (e.g. rosmarinic, chicoric, lithospermic, caffeic, and caffeoylquinic acids), and hydrolysable tannins (e.g. trigalloyl-HHDP-glucoside), which were tested in loaf bread, cupcakes, yogurt, cheese, and cottage cheese [e.g. 3].

The creation of new bio-based ingredients is, therefore, of great importance and justifies the focus of novel researches on improving their development in order to guarantee the sustainability of their application.

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INternational CongRess on Engineering and Sustainability in the XXI cEntury – INCREaSE 2019
Keynote Talk

Leveraging Building Technology Towards Affordability in the US Housing Market

Andrew P. Mccoy

Virginia Polytechnic Institute & State University, USA

Abstract. Buildings have a large impact on the environment; are complex systems and are increasingly un-affordable to produce. Yet architecture, engineering, and construction (AEC) professionals often perform their work without considering the technologies that could be leveraged towards more affordable options. This presentation aims to explore the current use of technologies that harness technology for more affordable housing units in the US market, including: Human-Building rInteraction for human-centered, adaptive housing, Artificial Intelligence, Augmented Technologies for Building Systems (sensing and instrumentation), current "off-the-shelf technologies" and the affordability metrics they hope to disrupt.

Keywords: Housing Affordability, Building Technologies, Human-Building rInteraction for human-centered, adaptive housing, Artificial Intelligence, Augmented Technologies for Building Systems

Sustainable Energy Community - Culatra 2030

Cláudia Sequeira

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Abstract. Culatra 2030 Sustainable Energy Island project intends to create a decentralized system of electricity production, creating a community spirit that empowers the population of Culatra Island to produce their own electricity and become independent energetically, also introduce new mobility concepts, trough solar boats. This project aims to be a pilot of sustainability to became an icon in order to be replicated in other locations.

Keywords: Sustainable Islands, Energy Community, Clean Energy, Energy Production, Green School, Electric boats, Plastic.

Abstracts: Posters Sessions

Baker's yeast production from potato peel waste

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Abstract. Food waste valorization is one of the current research areas that has attracted a great deal of attention over the past few years as a potential alternative to the disposal of a wide range of residues in landfill sites. The increasing use of food waste sources has been the impetus to search for novel cost-effective carbon sources for the production of value-added products. In the present study, potato peel waste (PPW) was chosen as an economical source for baker's yeast production by Saccharomyces cerevisiae. However, a pretreatment process is needed to convert the starch of potato into fermentable sugars before fermentation. PPW was used as a sole carbon with HCl acidic pretreatment method or liquefaction by using alpha-amylase. The maximum cell mass obtained was 12 g/L with a productivity of 0.47 g/L.h after 24 hours of fermentation. In conclusion, potato peel waste was proven to be an economically feasible raw material for baker's yeast production.

Keywords: Starch hydrolysis; Baker's yeast; Saccharomyces cerevisiae; fermentation; waste

Lactic acid fermentation of fennels and carrots

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Abstract. Fresh vegetables have a very short shelf-life since these are subjected to physiological and rapid microbial spoilage and in some cases contamination by pathogens also. Lactic acid fermentation represents the easiest and the most suitable way for increasing the daily consumption of these fresh vegetables. The aim of this study was to use mixed cultures of Lactobacillus casei and Lactococcus lactis, as starter cultures for fermenting carrot and fennels. The fermentations are carried out under two types of conditions: (i) vegetables fermentation using a salty solution with, or without glucose enrichment, ii) vegetables fermentation using vegetable wastes juice extract as a carbon source. The effect of inoculum size was also investigated to enhance lactic acid production. The best rate of Dornic acidity, 140°D, has achieved in fermentation using an inoculum size of 10%. The obtained pH was sufficiently low (3.07). The vegetables had a pleasantly sour taste, good savor and texture.

Keywords: Vegetables, Lactic acid bacteria, Lactic acid fermentation, Dornic acidity

Implementation and Monitoring of a Waste Management Plan at the university based on Brazilian Law 12,305/10 - National Solid Waste Policy (NSWP)

Larissa Marchetti Dolphine, Adriana Yumi Maeda and Clauciana Schmidt Bueno de Moraes

Universidade Estadual Paulista- Unesp

Abstract. Proper management of solid waste is essential for institutions concerned with the environmental impacts of their activities. In Brazil, according to Federal Law No. 12,305 / 10 – National Solid Waste Policy (NSWP), responsibility for waste is shared, with obligations involving citizens, companies, municipalities and state and federal governments, as well as public and private companies and institutions. This work presents the procedures for the application and monitoring of the Waste Management Plan of the Paulista State University (UNESP), Rio Claro campus (SP), by conducting audits in the University sectors, and proposing corrective and preventive actions, together with the verification of compliance with the applicable legislation to each residue diagnosed, according to the items required by the NSWP. It is based on the concept of the 4 R's (Reduce, Reuse, Recycle and Rethink) and the PDCA method to carry out its steps. From the analysis of the audits carried out, it was possible to propose actions to be implemented for the management of each waste, as well as more emergency measures to be carried out. In addition, an Audit Plan was carried out by the University, which presents the information regarding the scope, objectives, criteria and logistics. Through these studies, it was possible to emphasize the importance of auditing as a tool for monitoring the Waste Management Plan, and it should be carried out periodically to avoid penalties and environmental impacts, as well as to assist in the proper waste management.

Keywords: Waste, Management, Higher Education Institutions

Environmental Protection and Climate Change - The Perfect Alliance

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Abstract. The quality of life on Earth in the 21st century depends on how we deal with global trends. Quoting [1], the world is getting hot, flat and full. That is, global warming, the spectacular increase in the middle class around the world, and the rapid population growth have converged in such a way that they can make our planet dangerously unstable. More specifically, the convergence of these factors is limiting energy supplies, intensifying the extinction of plants and animals, deepening energy poverty, reinforce the oil dictatorship and accelerating climate change. Without additional emission reduction policies, the global average temperature is expected to rise by between 1.1 and 6.4 degrees Celsius throughout this century. The Fifth Assessment Report of the Intergovernmental Panel of the United Nations on Climate Change [2], it is extremely likely that global warming is of anthropogenic origin. In [3], it is know that the scientific community confirms the anthropogenic alteration of the climate. The use of fossil fuels, deforestation and agriculture give rise to emissions of carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and fluorocarbons. The concentrations of these greenhouse gases are increasing in the atmosphere. [4], the Azores has followed the global trend, especially in the North Atlantic basin, of increasing temperature: Higher temperatures, less precipitation and more intense climatic phenomena. During the last 18 years, there has been a positive trend of 0.12 K decade. As for precipitation, there is a negative trend of -133 mm / decade. The increase in CO2 concentration observed in the Azores follows the observations made at other reference stations (e.g. Mauna Loa). These results shows, that the climate is already changing in the Azores, and that this change is likely due to the Climate Change.
Through the 2030, Action Framework on Climate and Energy, which also represents the commitment made under the Paris Agreement, the EU has committed itself to achieving the following objectives, to be achieved by 2030: reducing greenhouse gas emissions by at least 40% compared to 1990 levels, to improve energy efficiency by 27% (indicative target to be revised by 2020) and to increase the share of renewable

energy sources to 27% of final consumption. This context of mitigation necessarily involves a change in lifestyle in which the transition to electric mobility, is thought to be good practice. According to the Population Division of the Department of Economic and Social Affairs of the United Nations, in its report of March 13, 2007, there is a reference to an increase of the population, which, is estimated around 2.5 billion inhabitants. In 2050 we moved from the current 6.7 billion people to 9.2 billion. Countries need to adjust their path in a direction of energy sustainability by taking measures that minimize anthropogenic causes and prepare society to deal with its biophysical and socio-economic impacts.

In the area of sustainability, Portugal must take advantage of the green economy, conserving and valuing natural resources, and establish green and intelligent mobility, based on technology with low ecological impact. The substantial reduction in the cost of batteries in recent years, the car manufacturers commitment to this technology with the increasing availability of new models in the market, the existence of ambitious emissions reduction targets for new vehicles, makes electric mobility a hot topic.

In order to understand the level of knowledge of the Azorean population on climate change and environmental sustainability, a questionnaire survey was conducted approaching this theme. The questions formulated for the questionnaire were divided into two parts, one is the perception of the Azoreans regarding climate and climate change and the other is about environmental sustainability / electric mobility. The age range of the respondents ranged from 15 to 57 years. Although, most were between the ages of 19 and 25, with 60% having university attendance, and 63% are female.

In this article we will quantify in percentage, the answers obtained to some of the questions formulated. 100% of respondents are unanimous in stating that the atmospheric warming causes them some concern. Respondents present good knowledge about environmental sustainability and are familiar with recycling. They revealed little knowledge about the subject of electric mobility. 58% answered that they never travelled in an electric vehicle. However, 60% say that in the future intends to acquire an electric vehicle.

Of the issues that were the subject of study in this survey, which presented a 100% agreement, was the question regarding the sample's concern about global warming. There is an awareness that man is contributing to the climate change we are experiencing. It was also verified that, there is a concern with the future climate, but there is not great perception of the present phenomena relating them with the past. It was noticed that the majority of respondents have an environmental conscience, being willing to change habits, and to acquire alternative products that contribute to the green economy. Regarding the electric mobility, the population is not very awake for this transport solution.

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Keywords: Climate changes, Environmental sustainability, Greenhouse gases.

Possibilities to Use Laser Scanning 3D to Measurements of Complex Technical Infrastructure

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Abstract. The dissemination of knowledge of the TLS (Terrestrial Laser Scanning) method is a derivative of the technology availability and the growing competitive market of measuring instruments manufacturers. At the same time, the performance of multithreaded workstations allows an increasingly significant reduction in the time required for post-processing needed to register and establish georeferenced multi-station measurement sessions. The paper presents use examples of TLS (Terrestrial Laser Scanning) technology for investment projects with a complex technical infrastructure and an improved implementation routine. Developing the TLS measurement technique, the author's team focuses on improving the efficiency and accuracy of the registration of subsequent scans and the quality of the georeferenced reference. In particular, the technique of improving accuracy is being developed through the use of reference objects such as prisms or measuring spheres.

Keywords: Laser scanning, Measurements, Infrastructure

Observatory of Sustainability of the Algarve Region for Tourism - OBSERVE project, an overview

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Abstract. The Observatory of Sustainability of the Algarve Region for Tourism (OBSERVE) is an instrument for monitoring and evaluating the sustainability levels of the region. Its main goal is to provide environmental, economic, socio-cultural and institutional indicators to support the decision making process for a sustainable growth of the region.

This project has the following main objectives:

i) To make more efficient and quick the process of systematizing and exchanging information on sustainable development and its implications on tourism;

ii) To provide a broad base of sustainable development indicators, including environmental, economic, socio-cultural and institutional aspects relevant to the region;

iii) To support the monitoring of the sustainable development strategies of the region and the tourist activity;

iv) To provide a decision support instrument;

v) To communicate technical information in an objective and reliable way;

vi) To improve communication;

vii) To evaluate the integration of sustainability in the different sectors of tourism activity;

viii) To involve actively all stakeholders in the assessment and reporting of sustainability;

ix) To create a channel for the dissemination of information related to sustainability and tourism activity in a perspective of promoting the destination.

The OBSERVE platform will be dynamic, interactive and able to self-update data. It will have several modules designed to interact with social platforms, like, Facebook and Twitter; to manage and send periodic newsletters to the stakeholders; to validate data and detect system faults and, also, to link to data sources and continuously self-update the indicators.

It is design to be an instrument of huge importance for the future reflecting the reality of the region and supporting the decision-making considering fundamental aspects, such as: environmental quality, social equity, economic efficiency and increasing public awareness and citizen participation.

This communication introduces the main goals of the project and highlights the relevance of a frameset of indicators in the OBSERVE project.

"

Keywords: Sustainability; OBSERVE; Indicators; Tourism; Algarve.

Sustainable Construction Materials

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Abstract. The concept of sustainability is creating big discussions, it can be defined in different ways. PVC is one of the most common, widely used, and earliest plastic developed to use commercially. International standards are in most countries used to control the production, qualities, and use of PVC. This material has a wide range of long-life applications such as, pipes, flooring, cables, window frames, children toys, a big variety of life saving medical devices, etc. PVC can be recycled multiple times. The professional designers, ar-chitects, specifiers and engineers must be well informed about low impact products, sustainable systems and technologies. The selection of those products will make a considerable impact to achieve sustainability. PVC sheet piles can be an alternative material to rock, wood, steel and concrete for the construction industry. They are production-, logistics-, and assembly friendly thanks to their lightweight construction. Simple and fast installation using standard and non-heavy equipment, which gives a significant CO2 reduction.

Keywords: Sustainability, Sustainable construction material, PVC, PVC sheet piles

Intervention Project Methodology in Buildings in Service

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Abstract. The maintenance and rehabilitation in buildings in service have very different specificities compared to those applicable to new buildings or buildings requiring deep rehabilitation.
In the interventions in buildings in service, the users remain in the building during the accomplishment of the works.
These works, generally promoted by the managers of the buildings, generally do not require licensing by the municipality and most of the time they are executed without the participation of technicians who dominate the construction sciences.
In this presentation we discuss the procedures inherent to the construction process and the necessary adjustment of technical and legal procedures so that this type of interventions is of a quality and guarantee maximum satisfaction to the users of the buildings. Some examples are given with reference to work cases.

Keywords: Maintenance; Rehabilitation; Project; Buildings; Users.

Toward a simple cold box adapted to warm climates: a case study in Mediterranean climate

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Abstract. The accurate estimation of the thermal transmittance of buildings' envelope is fundamental to study the thermal behaviour of buildings. Thermal transmittance can be determined by means of theoretical and experimental methods. A method known as simple cold box (SCB) was designed in this research work. Such method consists of cooling the internal side of the wall so that a high thermal gradient is generated with the external ambient. To assess the performance of the method, a case study characteristic of the southern part of Europe was assessed with two-dimension simulation. Time series of the external temperature were also used to guarantee a representative simulation. Based on these simulations, the results of thermal transmittance were analysed, as well as the deviation presented by the results according to a representative value of the façade. Likewise, the energy consumption related to the test was assessed by means of simulation using EnergyPlus. SCB can constitute an opportunity for engineers and architects to ease and hasten the task of improving the performance of buildings.

Keywords: Simple cold box (SCB), Thermal transmittance, Mediterranean climate, Simulation

Moisture sorption isotherm and storage stability of dried Salicornia (*Salicornia ramosissima*)

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Abstract. *Salicornia ramosissima* is a halophyte plant widely distributed in coastal zones of Portugal (e.g. Ria Formosa in Algarve) and in many other similar Iberian Peninsula areas. Currently considered a gourmet product, salicornia is consumed both fresh and dried to season salads and other dishes due to its salty taste. Although, the dried product presents better stability compared with the fresh one, it is of great interest to determine the shelf-life of this product. In this work an accelerated shelf-life study was first carried out at 4 temperatures (35, 40 45 and 50 °C) to test the product's temperature sensitivity. The parameters evaluated over a 70 days period of storage were color (*Lab*), humidity and water activity (a_w). Results showed that color was not affected by temperature but that drying occurred during storage at higher temperatures ($k_{42.5\ °C}$ = 0.029 $days^{-1}$, E_a= 118 $kJ.mol^{-1}$, N=0.72) favoring the product's preservation. Next, the product's sensitivity to humidity was tested. First, the aluminium package water vapor transmission (WVTR) was determined (4.5 $g.day^{-1}m^{-2}$). Then, the moisture sorption isotherm was studied and the critical (M_c) and equilibrium moistures (M_e) were obtained (12 and 14 $g_{H2O}/100g_{drymatter}$, respectively), besides the *b* parameter =9.3 (slope of the linear part of the isotherm). The shelf-life of the salicornia salt, considering the gain in humidity, was finally determined to be around 75 days, for samples stored at 25 °C and 60% relative humidity and using Labuza's equation for shelf-life determination.

SPOOLs – sustainable pools project, an overview

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Abstract. The University of Algarve, in consortium with Saint-Gobain Weber Portugal and Cristal Construções - Materiais e Obras de Construção Civil, is developing a new concept of sustainable swimming pool (SPOOLs – sustainable pools project), more energy efficient, with a lower environmental footprint and with reduced maintenance costs. This project aims to answer to the global demands and challenges of designing more sustainable structures, attending to the environment impact and to the financial cost.

Under the environmental point of view, four major aspects will be considered, throughout their life cycle, which are: Reduce the consumption of virgin materials; Reduce CO2 emissions; Reduce water losses; Reduce energy depletion and enhancing at the same time solar gains throughout the thermal inertia of the materials used on the surroundings of the pool.

Under the economic point of view, this new concept of sustainable swimming pool, will reduce the maintenance costs, when compared with conventional approach, increasing the durability of solutions and reducing the energy consumption during its lifetime.

During the experimental period, new formulations of concretes and mortars were developed, incorporating recycled materials and other materials produced with low CO2 emissions. Other important aspect concerns to the development of an innovative passive mode system to recovery energy from the area surrounding the pool.

One of the outputs of this project is the construction of a semi-scale prototype of a swimming pool (10m x 5m x 1,5m), which reflects the characteristics mentioned above, in order to test and validate the proposed developments.

Currently the swimming pools lifetimes are relatively small. In many cases, repairs are necessary 5 to 10 years after their construction. The causes associated to this kind of rehabilitations are varied, being frequent project errors, faulty execution, inappropriate material behavior and misuse. Taking into account the aspects focused before, the second output of this project is the development of a handbook that describes the fundamental concepts, concerning the construction processes, the maintenance, the use of the swimming pools, as well as their rehabilitation. The project is particularly addressed to Algarve region where there is a large quantity of private swimming pools, either in villas or resorts once the main economic activity is tourism. The Manual intends to be a reference document for the various players in the process, such as designers, contractors, maintenance companies and users.

Keywords: swimming pools; sustainability, prototype, handbook

Life-Cycle Assessment of New Cladding Panels Composed of Rice By-Products

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Abstract: High environmental impacts have been attributed to the construction sector since it uses many natural resources and produces a large amount of waste. Therefore, it is essential to search for alternative solutions to minimize this burden, such as the development of new eco-friendly materials. In addition, the market has seen a more systematic demand for high-performance products that can meet the needs of modern architecture and sustainable construction.

Aware of these issues, new composite panels have been developed combining the most useful properties of different waste products (e.g. rice husk and cork granules), whose characteristics are better than those of its components. Commercial success will be boosted by showing that the new cladding panels ensure all the functional requirements are met and introduce high standards of sustainability.

This paper presents the results of a Life-cycle Assessment (LCA) study developed with the aim of quantifying the environmental performance of the new cladding panels in accordance with the standards ISO 14040:2006, ISO 14044:2006/Amd1:2017 and EN 15804:2012+A1:2013. For this, a life-cycle model and inventory were developed, covering aspects from the extraction and processing of raw materials to the usage stage of the building. The life cycle performance was eventually assessed by the CML-IA method to get insight on the environmental profile.

Keywords: Life cycle assessment, Rice by-products, Sustainable materials

Innovation in Residential Construction - The role of federal agencies

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Abstract. Globally, housing innovations are being developed to facilitate the execution of improved standards and practices in residential construction. This study highlights a national housing workshop in the United States of America sponsored by Housing and Urban Development (HUD) which has begun the process of increasing communication and collaboration between federal and private housing stakeholders. Media, research, industry, and manufacturing stakeholders collaborated to discuss strategies for improving housing innovation in the United States specifically focused on innovation for housing affordability, sustainability, and resiliency. This paper outlines the process of facilitating this discussion and providing an opportunity for housing stakeholders to move beyond words to actions. Significant problems and solutions such as data availability and federally moderated databases are presented to describe the plan for the United States towards a sustainable future in the residential building sector. By connecting workshop findings to literature review data, further analysis of suggested solutions is provided in hopes of learning from past events and policies. The model discussed in this paper can and should be duplicated for years to come to create a more comprehensive understanding of contemporary issues in the sustainable buildings sector. As climate change impacts become more severe, the frequency of these strategic conversations will need to increase in response to natural disasters, energy scarcity, and affordability.

Keywords: Housing, Policy, Energy Efficiency, Construction Innovation

Methodology for hazard assessment of hydrological disasters combining rainfall thresholds and social-environmental criteria using open data

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Abstract. Landslides represent constant threats in mountainous regions with high rainfall and inappropriate anthropic occupation. The city of Cubatão, São Paulo State (BR), is historically affected by geotechnical disasters (23 occurrences between 2000 and 2016) and is an example of this scenario. The goal of this paper was to present a methodology of a hazard mapping considering three factors: geotechnical disaster, triggering rain, and anthropic occupation. The city of Cubatão was used as case study. Firstly, the disaster occurrences were spatially distributed in a GIS software in order to know the geology, geomorphology and geotechnical characteristics. Each one received a weight according to its recurrence, resulting in the environmental factors. Secondly, the social factors included attributes regarding population density, elderly population and poverty index. The sum of both factors resulted in the socionatural criteria. The statistical analysis of the rainfall thresholds took into account the accumulated amount of 7 days, 3 days and the day of the event and their occurrence probability. Both socionatural criteria and trigger criteria received a ranking from one to five, indicating very low, low, medium, high and very high. The grades composed a square matrix and the combination of both socionatural and triggering criteria resulted in eight hazard classification. As final comment, accumulated rains of three days were the one that led to higher hazard ratings.

Keywords: hazard assessment, trigger rainfall, socionatural criteria, landslide