ByPalma 2023

3rd World Confrence on Byproducts of Palms

Towards a Sustainable Bioeconomy

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Book of Abstracts

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FOREWORD

The Palmae family includes a wide variety of species and they're considered the main source of livelihood for a significant proportion of the world population.

Unfortunately, their byproducts (secondary products) are often regarded as waste, despite that they represent a sustainable material base for a wide spectrum of industries ranging from compost, wood substitutes, pulp, up to fiber reinforcements for advanced composites.

ByPalma is the only conference solely focusing on the byproducts of palm plantation around the globe and their current and potential applications. This includes all Palmae family, such as Date palms, Coconut palms, Oil palms, Doum palms, sugar palm…etc.

This conference will highlight the great potential of valorization of the palm byproducts towards a sustainable bioeconomy!

The main aims of ByPalma 2023 conference are:

- Bringing together researchers and practitioners working in the area of industrial utilization of palm byproducts and providing a live dialogue and exchanging experience between them.
- Rediscovering palm by-products and maximizing their added value via industrial technological advancement that can help in the environmental sustainability and circular bioeconomy.
- Establishing an international network of scientists, engineers, artisans, and industry professionals active in the area of palm byproducts R&D, manufacturing, and crafts.

ByPalma 2023 conference covers a wide range of trends on palm byproducts in wood substitutes, composite reinforcements, biotechnology, fertilizers, food, paper, textiles and bioenergy.

ByPalma 2023 conference occurs concurrently with the international Conference and Exhibition for Dates, organized by our strategic partner the National Center for Palms and Dates, bridging the gap in the palm economy by integrating the primary and secondary products of palms.

ByPalma 2023 is the main gathering for celebrating and rediscovering palm byproducts!

Riyadh, 5th December 2023

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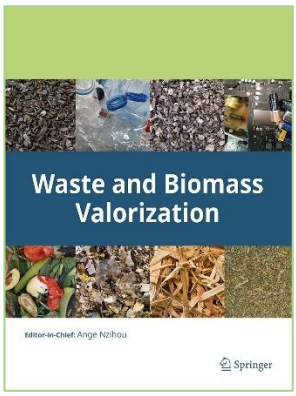
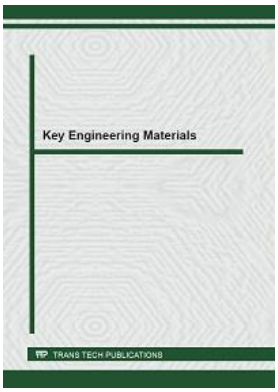
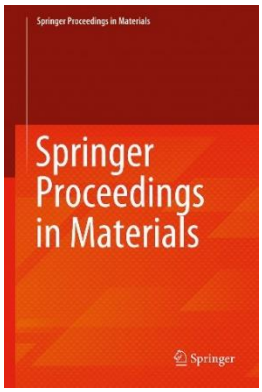


Waste and Biomass Valorization (Springer, Scopus, IF:3.449)

Journal of King Saud University – Engineering Sciences (Elsevier, Scopus, Cite Score: 9.2)



Key Engineering Materials (Scopus)



Springer Proceedings in Materials (Scopus)

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KEYNOTE LECTURE

PALM BIOMASS FOR MULTIPLE USE – STRONG PLAYER IN SUSTAINABLE, SOCIAL AND ECOLOGICAL DEVELOPMENT

Arno Fruehwald
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Keywords: Palms, palm wood, palm fiber, products, energy, palm wood and fiber processing

ABSTRACT

Out of the more than 400 palm species five or six species grow in large quantities like oil palm (25 million ha), coconut palm (12 million ha), date palm (140 million palms, some 12 million ha) and nipa palm (4 million ha). These species have the potential for industrial size utilization operations. The less available palms also provide wood and fiber in quantities for smaller, local operations and handicraft. Especially palm species grown in plantations can offer raw material supply with relatively low transport distances. The biomass of palms is of quite different type. Wood from palm trunks offer possibilities like the use of “normal wood species”, the more fiber type palm biomass from fronds, leaves and fruit stands and fruit residues offer different uses like fibers for panels, insulation material, fiber-plastic-composites, textiles, and other fiber-based uses. Use of extracted sugars and starch or even the solid biomass allow producing a wide variety of chemicals. Lastly, energy uses are possible with all biomass types and processing residues. Many of the palms grow in tropical regions where harvesting and storage of the raw material is challenging, but other palms grow in dry areas like date palm, where easy storage and open-air drying is possible. With present technologies the use of palm trunks seems quite easy, and it can be estimated that 90 % of the yearly available coconut trunks can be converted into products (some 22 million m^3/y, resulting in potentially 2,500 million UD$ product value). For oil palm trunks the numbers are >100 million m^3/y resulting in >10,000 million US$ and for date palm trunks some 2-3 million m^3/y with >1,000 million US$. For the enormous quantity of fiber type palm biomass R&D is necessary to find technical and cost-effective processing into products. An example are fronds from date palm for panels which can be used for furniture etc. or as insulation material. In addition, the technology to produce fibers for textiles (technical application and fashion) is already under development. Energy products, chemicals and soil improvement materials are also opportunities. The use of the palm material can provide a high number of jobs in rural areas and support the local and national development. Palms often grow together with other agricultural crops and palms are multifunctional plants, they provide oil, fruits, generally food and the residues can provide other products and/or energy. Substitution of fossil carbon can contribute to the climate-oriented national development. The presentation discusses strategic routes to use palm biomass and gives examples on the potential for jobs, income, generated value, and carbon mitigation potential.

KEYNOTE LECTURE

WALKING THE TALK: CONSIDERATIONS TO ACCELERATE THE SECTORAL DEVELOPMENTS OF THE PALM CROP NON-FOOD BYPRODUCTS

Dilip Tambyrajah

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Keywords: Policy, Sector development, Business Development

ABSTRACT

Coconut palms are mostly grown for food and not for coir fiber derived from the coconut husks. Even though coir fiber is used in a wide range of products. For example, a coir combined with natural latex, an advanced bio-composite material, for automotive seats. The date palm trees have provided materials for non-food products for centuries and these may even earn the title of heritage and cultural artefacts in some parts of the world. Few plant date palms for the byproducts only. This narrow focus of palm crops for food has historical reasons. The narrative about these valuable crops for multiple purposes has been mostly neglected, also by the sectors themselves. The reasons are many, for instance: non-food parts may not be the priority of estate owners; managing a wide range of value chains needs extensive market knowledge; the businesses involved in the non-food products are unable to take a lead role in sectoral development. Economically spoken they are followers and not leaders. Does this mean the palm crops non-food by-products (PCNFBY) have no future and an existential challenge needs to be addressed? Would the technical self- talk of the PCNFBY community save the sector? A quick glance at the mainly 'technical' topics of the ByPalma2023 conference should ring alarm bells. Some may argue that it is a 'technology conference': What do you expect? Technology self-talk is necessary but may not be sufficient to maximize the potential and even the survival of PCNFBY. This presentation will attempt to challenge the participants to reflect on two perspectives. (1) accept that all industries have a lifecycle and eventually are marginalized to irrelevance or disappear (2) recognize the existential challenges and take actions to articulate a strategic program which will transcend disciplinary boundaries in an effort to reposition palm crop non-food co-products i.e. to revitalize, renew and reposition in the international market places. Not just by technological innovation but also more importantly by social innovation.

KEYNOTE LECTURE

DATE PALM BYPRODUCTS: A SPRINGBOARD FOR CIRCULAR BIO ECONOMY

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ABSTRACT

This abstract is concerned with the date palm byproducts. These byproducts have two sources: i) annual generation in the date palm plantations (e.g. leaves or fronds, petioles, empty fruit bunches, spathes, leaf sheaths and trunks of unproductive palms), or ii) sites of date palm processing industries (date seeds and waste dates). The amounts of their weights range from hundreds, to thousands or even millions of tons depending on the size of their sources whether palm plantations or industrial sites. These byproducts represent an inexhaustible sustainable treasure of renewable useful materials. Their sources are geographically dispersed being located in 38 countries which are distributed in the five main continents. Unfortunately, these byproducts are currently viewed in most countries as waste materials and accordingly they are mistreated. They are either burnt in open fields or dumped in landfills. This mistreatment of such a natural treasure not only causes heavy environmental pollution(soil contamination and air pollution), but also inflicts huge economic losses. Here comes this book to present an alternative fresh look at date palm byproducts as a springboard for bio economy. This book is an invitation to rediscover date palm byproducts as a system of biomaterials. The book chapters will show and exemplify how these sustainable biomaterials can be the base for a wide spectrum of products and uses. Examples of these numerous products and uses are demonstrated and categorized in the book as five principal uses: i) pharmaceutical, cosmetics and natural wax ,ii) textiles and composites, cellulose and cellulose derivatives, iii)timber and wood substitutes, architecture insulation and building materials, iv) organic fertilizer, compost and soil amendment and water treatment purposes, v) natural fodder and silage , green fuels and bioenergy. I hope that the serious and dedicated research endeavors in this book inspire futuristic entrepreneurs around the world and motivate heroes of circular bio economy. I hope this book helps them take pioneer steps to launch their innovative pilot projects relying on the sustainably available – in huge quantities– date palm byproducts.

References

[1] El-Mously H, Midani M, Darwish E A, “Date Palm Byproducts: A Springboard for Circular Bio Economy” Springer Nature Singapore, May 2023. DOI: 10.1007/978-981-99-0475-4

KEYNOTE LECTURE

CELLULOSE AS SUBSTRATE FOR ACTIVE SURFACES: THEORY AND APPLICATIONS

Mohamed Naceur BELGACEM & Julien BRAS.

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Keywords: Cellulose; Surface; Chemical modification.

ABSTRACT

The present lecture is focused on the recent advances on surface phenomena of cellulose and it will be divided into four parts: 1. The first part will be devoted to the basic concepts associated with the surface of solids and liquids and the theory behind physico-chemical parameters characteristic to their surface. In this context, the origin of the surface energy, the contaminations, the adhesions, will be discussed, etc. [1, 2]. A systematic comparison between bulk and surface properties will be given. 2. The second part will give the most known surface treatments and their effect on the resulting materials. This will include (i) physical (mostly mechanical) (ii) physico-chemical (such as Corona, plasma, UV…); and (iii) chemical treatments like grafting by direct condensation, “grafting from” and “grafting onto” approaches. In this context, recent works investigating green solvent-based or solvent-free systems will be reported [1, 2]. 3. The third part will be devoted to the techniques of characterization and will point out the difficulties associated with such an approach. 3. The last part will be devoted to concrete examples of active surfaces, as applied in several applications, such as medicals and packaging. Some relevant concluding remarks and perspectives will also be given.

References

[1] Rol F., M. N. Belgacem M. N., Gandini A., Bras J. Recent advances in surface modified cellulose nanofibrils. Progress in Polymer Science, 88 (2019) 241–264

[2] A. Gandini, Belgacem M. N. The surface and in-depth modification of cellulose fibers. Advances in Polymer Science, 271 (2016)169-206.

KEYNOTE LECTURE

DATE PALM WASTE INNOVATIVE PRODUCTS FOR SUSTAINABLE ENVIRONMENT

Nashi Khalid Alqahtani

King Faisal University, Alahsa, Saudi Arabia:

Keywords: Innovative products, technologies, Excellence, Research, King Faisal University

ABSTRACT

The speech will touch and highlight 4 key areas, namely: the date palm sector in Saudi Arabia and the relating annual palm waste; the scientific research progress over the years through a success story of the Date Palm Research Center of Excellence in King Faisal University. Furthermore, the innovative products and technologies generated through the Center research programs will be reflected taking into consideration the environmentally friendly products, those related to natural resources and the food innovative products. The outcomes of the research programs were a result of national and international collaborations with reputable scientific institutions. The Center over the years has been awarded a number of national and international prizes. The success story of the Center and its innovative technologies is largely based on a well oriented strategic and development plans covering the years (2010-2020) and (2020-2024). These plans are in line with the university strategic plan and its food security and sustainable environment identities. Most of the innovative products and technologies are marketable and others already obtained patents. The center will continue pursuing targeted innovative products in the future through its national and international stakeholders.

KEYNOTE LECTURE

HARNESSING RENEWABLE FIBERS FROM PALM AND CACTUS FOR SMART MATERIALS: RESEARCH TO COMMERCIALIZATION

Mohini Sain, Omri Menashe, Viktoriya Pakerenko

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ABSTRACT

Palm Biomass is an important natural source of global climate solution. Over past 20 years Palm oil became a center point for talks around the world. Although there has been significant progress to develop palm plantation and palm oil production with sustainable management techniques and policy, it is important to note that global perception of Palm industry needs more disruptive technologies and policy framework to bring Palm industry in the mainstream material and energy sector. In Asia and the Middle East Palm plantation has been growing by more than 10% over past 20 years. When primary driver for growth is palm oil for food and industrial usage, biomass generated from palm oil became a significant resource for secondary use sectors including first generation ethanol from palm leaf and other palm biomass and more recently palm leaf are finding more applications in packaging and advanced materials including molded nanobiocomposites for specialty application. This paper will present two aspects of potential mass utilization of palm leaf and biomass for packaging materials and energy applications. By demonstrating unique manufacturing technology for fast and precision molding as well as isolation and drainage technology to sustainably manufacture nano fibrillated palm cellulose from sugar palm fibers produced by a chemo-mechanical approach, thus opening a new way to utilize waste products more efficiently. Chemical pre-treatments, namely delignification and mercerization processes, were initially involved to extract the sugar palm cellulose. Then, mechanical pre-treatment was performed by passing the sugar palm cellulose through a refiner to avoid clogging in the subsequent process of high pressurized homogenization. The fiber and palm leaf direct utilization engineering science developed at University of Toronto promises to be a very versatile material by having a huge potential in many applications, encompassing bio-packaging to scaffolds for tissue regeneration.

Palm biomass-based biorefineries have emerged as an effective and productive pathway to secure bioproducts and green energy in future. Palm biomass lignin, an abundantly available biomass sourced from pulp industry’s waste stream, provides various opportunities in the development of value-added bioproducts and green fuels. However, due to the high level of color and low biodegradability, lignin is categorized as a serious pollutant particularly in the aquatic ecosystem. This present will provide a more holistic approach towards Palm biomass and palm leaf utilization and their potential commercial opportunities in a broad range of value chains including biomedical, packaging, transportation and electronics.

KEYNOTE LECTURE

PALM TREE RESIDUES - RAW MATERIAL OF TOMORROW

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Keywords: Palm tree residue, animal feed, compost, growing media, energy pellets

ABSTRACT

The livestock sector plays an effective role in achieving food security; however, animal feed is considered the main determinant of the growth of the animal production sector, as feed alone contributes 70-80% of the total cost of production of livestock products.

Saudi Arabia with its promising Vision 2030, aspires to achieve food security, however, with limited water resources and pastures, manufactured (concentrated) animal feed represents the main product on which it depends, especially after the decision to limit growing green fodder. Therefore, non-conventional feed resources must be brought into practice at a wider level as animals are able to convert low quality feed to valuable food products. Date palm tree residue is abundant, over a million tons of these residue are available annually, which can be directed to animal feed manufacturing for more sustainable livestock production. In addition to taking advantage of this renewable resource, this waste will be directed away from the traditional practice followed by most farmers (burning), thus reducing carbon emissions that pollute the environment and thus achieving the aspirations of our Kingdom's vision 2030.

Dariya - the historical capital - suffers, like other governorates of the Kingdom, from the practice of random burning, On April 4, 2021, SABIC, Dariya Health City Program and KSU signed a cooperation agreement for the purpose of utilizing date Palm tree residue as a partial constituent of animal feed. 60% of the visited farms within the scope of the study agreed to participate in the project to safely dispose of waste and stop random burning as a method of disposal. 33% of which had installed a pilot-scale line, while 24% adapted the idea but negotiated the cost. The implementation of this project had contributed to not only solving the problem faced by breeders but also had economic and environmental importance.

References

[1] Alkoaik F., Palm Remains project In Dariya Health City; Protection and sustainability (Final Project report, 2022).

KEYNOTE LECTURE

RECENT ADVANCES ON BIO-THERMOPLASTICS BASED DATE PALM FIBERS

Abou El-Kacem Qaiss

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ABSTRACT

In recent years, there has been a growing interest in sustainable materials that can contribute to a more environmentally friendly future. This keynote presentation will delve into the exciting and innovative realm of bio thermoplastics derived from date palm fibers. Date palm fibers, abundant in many parts of the world, have shown great potential as a renewable and biodegradable resource for creating thermoplastic materials.

This presentation will highlight the main steps and reflections to take into account, as well as the various methodologies for extracting and processing date palm fibers, and the development of bio thermoplastics from these fibers. We will explore the rheological and mechanical properties of these materials during the processing.

Furthermore, this keynote will discuss the shift to an industrial scale for utilizing date palm fibers as a source for bio thermoplastics. We will also address the challenges and future prospects of this innovative approach to materials, emphasizing the need for collaborative efforts and ongoing research.

PLENARY LECTURE

SIGNIFICANT REDUCTIONS IN GREENHOUSE GAS EMISSIONS BY OPTIMIZED USE OF BY-PRODUCTS FROM PALM OIL PRODUCTION: A COMPREHENSIVE ASSESSMENT

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Keywords: Sustainability assessment, life cycle assessment (LCA), CO2-footprint, oil palm byproducts

ABSTRACT

The production of palm oil is known for generating many by-products, several of which are used today for different applications. Some examples include:

• The distribution of empty fruit bunches (EFB) to the oil palm plantations where they serve as fertilizer.

• Disused oil palm trunks are chipped and scattered so that when an oil palm plantation becomes re-established, they rot and serve as fertilizer.

• Palm kernel shells can be used to build roads.

Unfortunately, these applications go no way towards tapping into the full potential of achieving reduction in greenhouse gases. This has been proven in several investigations covering the Carbon footprint of the use of by-products from palm oil production. The presentation will focus on the potential options for each by-product, to optimize their use in maximizing GHG savings. For example, oil palm trunks can be used to produce furniture or in the construction or building sector. EFB can also be used in cascades by producing biogas before using their potential as fertilizer. Several valuable substances such as carotenoids and other phytonutrients can be extracted. The identification of the optimized use options of the by-products of palm oil productions to maximize GHG savings can be quantified. On top of that, their inter relationships can be ranked to give all stakeholders including producers, politicians and consumers sufficient information towards the most effective and sustainable use of the by-products. The presentation does not cover optimizations of palm oil production but rather highlights the optimal use of all by-products of oil palm production. As palm oil production is under heavy discussion in some parts of the world such as Europe because of its environmental implications, using the findings presented, the acceptance of palm oil in the public can be increased significantly.

PLENARY LECTURE

PERFORMANCE TARGETS AND WAYS TO ACHIEVE INDUSTRIAL APPLICATIONS OF DATE PLAM FIBER REINFORCED SUSTAINABLE BIO-COMPOSITES: OPPORTUNITIES, CHALLENGES AND FUTURE PERSPECTIVES

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Keywords: Date palm fiber, Performance targets, Morphological characterization, Mechanical properties, Industrial applications, Environmental conditions, Sustainability.

ABSTRACT

This plenary talk will highlight history and evolution of conventional composites, natural fiber reinforced composites with particular focus on date palm fiber as reinforcements in composite materials by reviewing some of the research and development works that have been already performed. The plenary talk will focus on the following key areas:

First, the talk will emphasize the environmental impacts of fiber reinforced plastic composites (FRP) production and consumption, which has caused serious issues relating to climate change. With this, the history of general conventional composite materials, their applications and market uptake will be covered. Then emerging materials such as bio-based composites as an alternative material on tackling the current environmental issues will be introduced. Following this, the talk will attempt to compare the key properties of established natural fiber composites, linking to key industrial application areas including automotive, marine, building and construction and aerospace, to DPF and their morphological aspects, characterization, their chemical constituents, fiber structure and behavior along with key properties. Second, the talk will then focus on structure property relationships, influence of various environmental conditions on key mechanical and thermal properties of date palm fiber reinforced bio-composites by analyzing some results recorded from various experimental works. This will be correlated to key performance targets. Then fabrication techniques and their influence on the various properties and ways to enhance the properties and functionalities of date palm fiber composites will be discussed. Third and finally, the potential lightweight applications, environmental benefits linking to end-of-life options (supported by life cycle assessment, LCA) of date palm fiber reinforced bio-composites, challenges and new opportunities as well as future perspectives will be presented and discussed.

INVITED LECTURE

NOVEL THERMAL INSULATION AND SOUND-ABSORBING MATERIALS DEVELOPED FROM THE SURFACE FIBERS AND LEAVES OF PALM TREES AND THEIR HYBRID WITH OTHER MATERIALS

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Keywords: Date Palm Fiber, Thermal Insulation, Sound Absorbing, Hybrid Materials, Waste Utilization

ABSTRACT

Date palm trees' surface fibers (DPSF) and leaves (DPL) are one of the most common environmental wastes in the Middle East and especially in Saudi Arabia. The thermal and microstructure of date palm tree surface fibers and leaves reveal that they could be used as a new building insulation material. Natural binders such as cornstarch and wood adhesive are used as a resin to bind the fibers, which makes the insulation material totally natural. The thermal conductivity of the proposed insulation material is measured for the developed specimens. The results show that the minimum and maximum values are 0.0475 and 0.0697 W/m K, respectively for bound PTSF. These values were obtained for bound DPL as 0.050 to 0.062 W/m K. Five Hybrid PTSF and Apple of Sodom fibers (AOSF) samples were produced for different ratios of mass and densities. In addition to that, hybrid samples of date palm tree leaves and wheat straw fibers were produced as a potential use in buildings' insulation. The Scanning Electron Microscopy (SEM) analysis of the fibers and leaves was implemented to obtain the diameter of the fibers and the thickness of the leaves. Thermogravimetric Analysis (TGA and DTGA) were used to determine the thermal stability analysis of the fibers. The three points bending test is used to determine the maximum flexural strength and Young's Modulus for some specimens of bounded fibers and relationships between load-deflection and flexural strength-deflection are obtained. The proposed natural material is comparable to conventional insulation material with the advantages of being safe for human beings as well as utilizing waste material. Sound absorption coefficients were obtained for the hybrid samples and indicate the potential of using these samples for sound absorption. The tests indicated the feasibility of using such hybrid samples as thermal insulating and sound-absorbing materials.

INVITED LECTURE

PRODUCTION OF NANO CELLULOSE AND NANO-COMPOSITES FROM DATE PALM BIOMASS FOR ECO-FRIENDLY AND SUSTAINABLE GREENER FUTURE

Hassan Ali-Dinar[1], Hisham Mohamed[1], Mohamed Gouda[2]

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Keywords: Smart Fertilizer, Green Economy, Sustainable Development, Date Palm Biomass

ABSTRACT

Recent years have seen a major increase in interest in renewable biomass as a precursor for sophisticated materials. Our study focuses on manufacturing nano-cellulose and nano-composites from date palm biomass, explicitly evaluating the potential of date palm waste as a sustainable and abundant raw material supply. This is because date palm biomass recorded a high cellulose content (< 50% / dry-base). Because of its remarkable mechanical qualities, large surface area, and biodegradability, nanocellulose—a cellulose derivative at the nanoscale—shows great promise for several uses. There are multiple crucial processes in the production process. Date palm biomass is first processed to get rid of contaminants and improve the accessibility of cellulose. The cellulose is then subjected to chemical processes that fragment into nanoscale fibrils, producing pure nanocellulose crystals. The resulting nano-cellulose can be further altered through surface functionalization to improve its qualities and compatibility with other matrices. Moreover, nanocellulose can be incorporated into polymer matrices to create nano-composites with improved thermal, mechanical, and barrier qualities. These nano-composites have exceptional stiffness, strength, and gas and moisture permeability resistance. Because date palm biomass is renewable, adding nanocellulose to the final nano-composites makes them more sustainable. Numerous methods, including Fourier-transform infrared spectroscopy (FTIR), transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-ray diffraction (XRD), and thermal analysis, are used to characterize nanocellulose and nano-composites. These methods help to optimize the generated nanomaterials for particular uses by offering insights into their morphology, structure, and characteristics. Date palm biomass can be used to create a wide range of products, including water treatment membranes, medicine delivery systems, reinforcing agents for composites, and packaging materials. These materials—smart hydrogel, organic sand-fixing formula, anti-bacterial bands, UV-wave protection cream, water-treatment filters, bio-plastic, etc.—offer a sustainable substitute for petroleum-based goods and lessen their adverse environmental effects.

In conclusion, the ability to use date palm biomass as a valuable resource for advanced materials is demonstrated by the creation of nanocellulose and nano-composites from this abundant agricultural waste. Creating these materials has enormous potential for environmentally benign and sustainable uses in various sectors, opening the door to a more sustainable future.

References

[1] Ben Hamou, K., Erchiqui, F., Habibi, Y., & Kaddami, H. (2023). Nanocellulose from Date Palm: Production, Properties and Applications. In Annual Plant: Sources of Fibers, Nanocellulose and Cellulosic Derivatives: Processing, Properties and Applications (pp. 91-112). Singapore: Springer Nature Singapore.

[2] Khatun, M. A., Sultana, S., Islam, Z., Kabir, M. S., Hossain, M. S., Nur, H. P., & Chowdhury, A. S. (2023). Extraction of crystalline nanocellulose (CNC) from date palm mat fibers and its application in the production of nano-composites with polyvinyl alcohol and polyvinylpyrrolidone blended films. Results in Engineering, 17, 101031.

[3] Khiari, R., & Belgacem, M. N. (2020). Date palm nanofibers and composites. Date palm fiber composites: processing, properties and applications, 185-206.

[4] Mehanny, S., Abu-El Magd, E. E., Ibrahim, M., Farag, M., Gil-San-Millan, R., Navarro, J., & El-Kashif, E. (2021). Extraction and characterization of nanocellulose from three types of palm residues. journal of materials research and technology, 10, 526-537. [5] Shaikh, H.

INVITED LECTURE

DATE PALM DERIVED BIOCHAR AMENDMENTS TO MITIGATE WATER DEFICIT EFFECTS IN GREENHOUSE GROWN CUCUMBERS

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Keywords: Smart Fertilizer, Green Economy, Sustainable Development, Date Palm Biomass

ABSTRACT

Sustainable agricultural production strategies are crucial for ensuring food security in regions with limited water resources. Using biochar as a soil amendment conditioner is one of the strategies employed to conserve water. The potential of biochar for carbon sequestration is enormous. Assessing the impact of biochar on cucumber yield under deficit irrigation is crucial for developing effective greenhouse production management strategies that conserve water while enhancing yield. Therefore, the present study aimed to assess the effects of biochar addition on the growth and quality of cucumbers under water stress conditions. Cucumber plants were grown under three surface bubbler irrigation regimes: 100%, 80%, and 60% of the field capacity (FC), representing high-water stress, moderate-water stress, and no-water stress conditions, respectively. Two different feedstocks of date palm biomass were used to produce biochar, i.e., leaf and stem, whereas sandy loam alone was used as control. Findings of the experiment revealed that cucumber plants grown in leaf and stem biochar amended potting media and received water at 100% FC enhanced the crop growth, physiology, yield, and quality attributes. The study also found that cucumber plants grown in leaf and stem biochar amended media at 80% and 60% FC showed superior growth and development traits compared to the control (sandy loam alone) at 100% FC. Cucumber plants grown in sandy loam (control) at 80% and 60% FC showed significantly negative results. Leaf biochar at 100% FC produced superior results; however, water conservation at 80% and 60% FC is possible at a slight compromise to cucumber growth, yield, and quality attributes.

INVITED LECTURE

UP-SCALING PRODUCTION OF MARINE GRADE EQUIVALENT (MGE) PLYWOOD FROM OIL PALM TRUNK

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Keywords: phenolic, resin treatment, durability, bending strength, bond shear

ABSTRACT

In consideration of the aggravating wood supply situation in the local plywood industry, oil palm trunk (OPT) is being used as an alternative raw material to replenish the material stock. Marine plywood comes into sight as it is the highest grade of plywood which is designated to stand up to the harsh marine environment for marine craft. To meet the stringent requirements of marine plywood, OPT veneers were treated with resin polymer to enhance its properties and durability. The main objective of this study is to establish a pilot scale facility to carry out resin impregnation process of OPT veneers followed by hot pressing of the phenolic-treated OPT veneers. Based on the laboratory works and a series of explorations, the workable pressing temperature and time to achieve good bonding are 140 °C for 12 min or longer for OPT veneers treated with 30% PF and 150 °C for 12 min for OPT veneers treated with 20% PF. The OPT veneers were treated using a VPI system having a pressure vessel of size 1800mm (OD) x 14592mm shell length. In one run. around 6,500 pieces of veneers were treated using designated flow of treatment process. The WPG varied between height of each stack and within the same veneer layer irrespective of their position in the vessel. The treated OPT veneers were dried and consolidated into 5-ply and hot pressed using a 500T hot press machine of 2440 x 1220 mm with 10 openings, ten gutters on every layer of platen plate and specially treated platen surface. The moisture content of the dried treated veneers varied between 25 to 30%. After being conditioned, the panels were cut into 680 x 680 mm size for determining the density, bond shear, bending strength, hardness and formaldehyde emission. MGE plywood made from OPT veneers as core and rubberwood veneers as face and back has higher density increment compared to that of 100% RW and 100% OPT. The properties of MGE plywood produced from this process are within the anticipated range. It is recommended to apply additional glue spreading before hot pressing to improve the bonding performance of the MGE plywood. The bending performance of the MGE plywood with rubberwood as face and back is higher than that of the MGE plywood made of 100% OPT veneers. The study also suggests that it is very crucial to have wood veneer as face and back to provide higher strength to the plywood. Janka hardness of the MGE plywood is comparable to that of commercial plywood, owing to the presence of rubberwood on face and back of the panel. The MGE plywood also displayed excellent biological durability in comparison

to control rubberwood samples (categorized as Class 5 - not durable against white rot fungi; as Class III - moderately durable against subterranean termite). The MGE plywood produced in this study was found to be very durable (Class 1) against white rot fungi; and durable (Class II) and very durable (Class I) against termite attack. The MGE plywood emit notable low formaldehyde (F****) compared to that of commercial OPT (F*) and RW (F*) plywood. The estimated profit earnings by selling as marine-grade equivalent plywood is 40%.

References

[1] Yusoh A.S., Sabaruddin F.A., Tahir, P.M., Lee. S.H, Anwar, U.M.K., Husain, H., Ghani, A. and Hiziroglu, S. Shear strength and hardness of two tropical wood species as function of heat treatment. Maderas-Cienc Tecnol, 24,. 2022. pp.1-10.

[2] Che Ismail, A., Salim, S., Md Tahir, P., Lee, S. H., Abd Ghani, M. A., Al Edrus, S. S., & Ahmad Faisal, F. Q. Properties Enhancement of Oil Palm Trunk Plywood against Decay and Termite for Marine Applications. Polymers, 14(13). 2022. 2680.

[3] Wan Nabilah Ahamad, Sabiha Salim, Seng Hua Lee, Muhammad Aizat Abdul Ghani, Rabiatol Adawiah Mohd Ali, Paridah Md Tahir, Widya Fatriasari, Petar Antov, Muhammad Adly Rahandi Lubis. Effects of Compression Ratio and Phenolic Resin Concentration on The Properties of Laminated Compreg Inner Oil Palm and Sesenduk Wood Composites. Forests 2023, 14, 83. https://doi.org/10.3390/f14010083.

[4] Paridah M.T., Juliana A.H., Zaidon, A., Abdul Khalil, H.P.S. Nonwood Based Composites. Current Forestry Reports, 1(4), 221-238. 2015.

[5] Choo, A.C.Y., Paridah, M.T., Karimi, A., Bakar, E.S., Khalina, A., Azmi, I. and Juliana, A.H. Pre-drying Optimization of Oil Palm Veneers by Response Surface Methodology. European Journal of Wood and Wood Products 73: 493-498. 2015. DOI 10.1007/s00107-015-0893-1 (IF=1.235)

[6] Leemon, N. F., Ashaari, Z., Uyup, M. K. A., Bakar, E. S., Paridah M. T., Saliman, M. A. R., ... & Lee, S. H. Characterisation of phenolic resin and nanoclay admixture and its effect on impreg wood. Wood Science and Technology. 2015. 1-16.

[7] Paridah M.T., Hoong Y.B., Noryuziah M. Y., Loh Y.F., and Hashim W.S., Properties Enhancement of Oil Palm Plywood, in Handbook of Oil Palm Trunk Plywood Manufacturing.Loh, Y.F., Anis, M., Paridah, M.T., Choong, K.K., Hashim, W.S., and Hoong, Y.B. (Eds.). Malaysian Timber Industry Board: Kuala Lumpur, 2014, pp. 89-108. ISBN 978-967-5384-51-6

TECHNICAL REPORT AND FEASIBILITY STUDY OF PARTICLEBOARD PRODUCTION FROM DATE PALM WASTES IN SAUDI ARABIA

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ABSTRACT

Pruning date palm trees produce annually huge quantities of fronds waste that may be considered a vital source of natural fibers. The date palm waste exceeded 800 thousand tons annually. The waste comes from an estimated 32 million date palm trees in the Kingdom. This number represents 50-60 commercial varieties that provide different waste amounts according to the variety, palm age, and vegetative condition. Most farm owners dispose of the palm fronds' waste by burning it. Few farm owners recognize the benefit of the waste and use it as organic compost and/or handmade products. Using and recycling palm front waste in the wood and particleboard industry will add economic measures to this sector. In addition, it reduces the burning of emissions to the environment. This study included two essential prerequisite parts that support the final feasibility study outputs. The first part covers data collection regarding the annual amount of palm waste in the targeted regions (Eastern, Qassim, and Riyadh). The data are collected through field surveys in the three regions. The survey questionnaire covered essential information regarding the annual date palm waste. The official Ministry of Environment, Water and Agriculture (MEWA) palm waste data were obtained from all 13 Kingdom regions to enrich and validate the data. Furthermore, a practical pruning investigation was conducted to identify the amount of waste from certain varieties. The sampling number of a questionnaire in each targeted region considered the number of farms and palm trees in each region. The outcome of the surveys revealed insignificant differences between the practical investigation, the survey, and the official data. The second study included manufacturing particleboard samples from different palm frond waste varieties. The manufactured specimens were evaluated to verify different physicomechanical properties among the date palm varieties compared to commercial particleboard samples. The manufactured particleboard samples were superior in the measured quality parameters compared to the commercial ones. In addition, date palm waste samples have low thermal conductivity and can be used for insulation. Moreover, no differences were observed between the manufactured samples from the waste of the different date palm varieties. Therefore, the feasibility study was conducted to verify whether local particleboard manufacturing from palm waste is economically feasible. Based on the feasibility analysis results, investing in date palm waste as a sustainable and eco-friendly source of wood material is highly profitable. The payback of the firm production line can be refunded within three and half years from the operation's commencement.

LIGNOCELLULOSIC COMPONENTS OBTAINED BY ORGANOSOLV DESTRUCTURATION OF BIOMASS MATERIAL

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Keywords: Cellulose, Lignin, Organosolv, Biomass

ABSTRACT

Obtaining cellulose fibers from biomass material using the traditional Kraft procedure consists of degrading a large amount of lignin and hemicelluloses and making them soluble in the alkaline medium. During the past two decades various new technologies have been developed for separating the chemical components of vegetable matter without combustion of the cooking liquor. The lignin and sugars can be isolated and the cooking agents are easily recyclable. We report in this communication the production of crude pulp by treating vegetable matter (almond shells, date palm rachis, green algae, spent coffee grounds, …) at low temperature under atmospheric pressure in acetic acid/formic acid/water media according to the organosolv process and then the application of a delignification and bleaching sequence using organic peracids and alkali hydrogen peroxide. In order to use organosolv lignin as a raw material for the production of new organic materials, its structure and properties must be known as far as possible. We report here the extensive characterization of crude organosolv lignin using NMR methods and complementary techniques, IR spectroscopy, and TGA analysis.

WATER ABSORPTION OF HDPE/WASHINGTONIA FILIFERA FIBER BIOCOMPOSITES: MODELING USING RSM AND GA-ANN

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Keywords: Washingtonia filifera fiber; HDPE matrix; Water absorption; Fick model; ANN/RSM; Genetic Algorithm.

ABSTRACT

The present study aims to investigate the phenomenon of water absorption scattering mechanisms and biocomposite kinetics by the immersion of different HDPE matrix reinforced with different amounts of Washingtonia filifera (WF) fibers (10, 20, and 30% by mass) in distilled water at room temperature. The response surface methodology (RSM), artificial neural network (ANN) models with genetic algorithm (GA) were examined by considering WF fiber content and immersion time in the water absorption of HDPE/WF biocomposite. In this study, the central composite design (CCD) model of RSM was used to perform test design, modelling, and optimization. The process of water absorption was revealed to be tracking the diffusion mode of Fickian. The results obtained show that the addition of WF fibers to HDPE matrix reduced diffusivity. The results also reveal that ANN models were highly accurate in the prediction of water absorption with the training, validation, and test correlation coefficients of 0.9955, 0.9999, and 0.9915, respectively. The optimal conditions obtained by RSM and GA for minimum absorption were a fiber content of 10% and an immersion time of 1 hours. Moreover, a highly appropriate model to predict HDPE/WF biocomposites water absorption suitable for various industrial applications is proposed.

References

[1] Ahmed Belaadi, Abdelaziz Lekrine, Messaouda Boumaaza, Hassan Alshahrani, Mostefa Bourchak, Khalid A Juhany, Fouad Damiri, Indran Suyambulingam & Suchart Siengchin (2023) Water Uptake of HDPE Reinforced with Washingtonia Fiber Biocomposites: Mathematical Modelling using Artificial Neural Network, Response Surface Methodology and Genetic Algorithm, Advances in Materials and Processing Technologies, DOI: 10.1080/2374068X.2023.2198828

ADVANCED POLYMERS ENFORCEMENT WITH LOCAL PALM MATERIALS FOR WIND TURBINES

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Keywords: wind energy, palm fibers, natural fiber composites (NFC), wind turbine blades

ABSTRACT

Dewax is utilized as the main mold coating to produce an epoxy composite, and a release agent is applied to the wooden mold bottom and wall. To make a matrix and cover the molds bottom, epoxy resin and catalyst are mixed in a 10:5 weight ratio. Five layers make up the composite specimen, three of which are coated on the bottom, middle, and top with epoxy resin. The second and fourth layers are made of palm. The palm fibers, which are divided into 30 mm and 20 mm lengths, are evenly distributed throughout the second and fourth layers of the mold. This process will be repeated three times. The common factor is the measurements of the mold and the polymer used. The difference will be in the type of palm fibers. For the first time, the most common fiber, which is the fronds leaflets fibers, will be used, then the trunk and the root fibers will take their place in the process. To prevent and get rid of air bubbles, the matrix is evenly poured over the fibers and then crushed and pushed down with the iron roller. Following production, the composite specimen was left in the sun for several hours to drain any remaining moisture. Excess resin and fiber edges on the specimen are correctly removed by the dimensions of mechanical testing. The blade construction is done through 3 stages, firstly we extract and characterize the behavior of natural fibers, then characterize the behavior of the natural fiber's composites reinforced wind turbine blade, then test it. The blade structure will be evaluated analytically and experimentally in order to create the blades and examine the performance of the natural palm fibers on a horizontal axis wind turbine. Finding the appropriate load case is the first step in modeling the wind turbine blade structure. In this investigation, two load cases during normal operation and under extremely windy conditions were taken into consideration. Finding the appropriate load case is the first step in the modeling of the wind turbine blade construction. Two load cases—one at normal operation and the other under extremely high wind loads—were taken into consideration for this study. After constructing the 3 blades with the different natural palm fibers, they will be examined through tests in order to check every fiber's property and discover the point of strength of each of the fibers so we can search for the perfect combination to address the weaknesses and get the strongest possible blade. The composite should be capable of handling complex wind loading in general. To avoid any quick deterioration caused by the presence of water or any other undesirable ingredient, the natural fibers were carefully chosen, removed, and treated. A composite material with a strafed multilayer layup chosen to withstand a combined load. The uses of natural fibers composites based on cellulosic fibers for constructing wind turbine blades can be considered as a potential candidate for the manufacturing of total recycling wind turbine blades from natural fibers.

THE EFFECT OF SOME HORMONES ON THE IN VITRO CULTURE OF DATE PALM (PHOENIX DACTYLIFERA L.) OF BOU-SAÂDA, ALGERIA

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Keywords: Bou-Saâda oasis, In vitro culture, Deglet-Nour, Mech-Degla, 2,4-D, AIB, GA3, Organogenesis.

ABSTRACT

The Oasis of Bou-Saada is gradually deteriorating due to the attack of insect pests such as white scale Parlatoria blanchardi Targ., the palm worm Myeloïs ceratoniae Zell and some fungal pests. In addition, polluted irrigation water coming from the wadi Bou-Saada has seriously damaged the oasis palm. Consequently, 23 promising date palm varieties are facing extinction. The Rehabilitation of the oasis palms of Bou-Saâda requires mass propagation of the endangered date palm varieties to conserve the fauna and the genotypes. The Tissue Culture technique is the only method through which date palm oases Bou-Saâda can be restored in a short period as compared to growing the trees through seeds or offshoots. As the first phase of conservation of the oases, this research project was initiated whereas propagation of two highly promising varieties Deglet-Nour and Mech-Degla was carried out through tissue culture technique on MS medium using various concentrations of three different hormones (AIB, GA3, 2,4-D) to obtain organogenesis. Results revealed that the growth in length of explants of the variety Deglet-Nourand its overall development was better as compared to the variety Mech-Degla with the AIB (2mg/l). The GA3hormone performed the best in relation to the development of organogenesis in the two varieties because it stimulates cell division better, followed by AIB hormone than the 2,4-D with overall mean lengths of 1.36, 1,26 and 0.84 centimeters, respectively. The formation of the callus was noticed only in the case of the variety Deglet-Nour.

References

[1] Guettouchi, A., M.S. Ahmedani, L. Redaoui and A. Yahiaoui. 2022. The effect of some hormones on the in vitro culture of date palm (Phoenix dactylifera L.) of Bou-Saâda, Algeria. Pak. J. Bot., 54(6): DOI: http://dx.doi.org/10.30848/PJB2022-6(11)

[2] A. Guettouchi, H. Aabasi and N. Ykhlef, Determining factors of declining of palm oasis of Bou-Saada to promote agricultural sector. Conference on the investment in date palm sector (reality and prospect). Muscat – Oman, 23 – 25th May (2016).

ENHANCEMENT OF GREEN ECONOMY AND SUSTAINABILITY VIA VALORIZATION OF DATE PALM TREE WASTES USING BULK AND NANO SIZE BIOCHAR AS SOIL ADDETIVES

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Keywords: Recycling date farm wastes, Soil amendments, Biochar, Soil properties

ABSTRACT

Date palm plantations are mainly grown in locations and regions with hot climates, water scarcity and poor sandy soil. In every farm, huge amounts of dead leaves are produced each year as plant wastes. These farm wastes must be properly recycled. Date palm Biochar and nano biochar has been produced and tested as a soil amendment.

In this study, each ton of the date palm waste generated a yield of 28-32% biochar. Nano-biochar performs much better as soil amendment compared to bulk biochar, CEC increased from 2950% to 8950% and bulk density reduced from 0.530 to 0.098 kg/m3. Treated sandy soil with different biochar improved its physical chemical and biological properties. CEC increased in the sandy soil from 9.25 to 19.0 meq/100 gram soil when we applied 20 tons per hectare of nano biochar and WHC increased from 35.2% to 135.0 % for nano biochar. Microbial activity (bacteria, fungi and Actinomycetes) increased with increasing biochar dose. Nano biochar performed much better and showed TPC increased from 22.0 X 10^6 to 41 X 10^6 Per gram soil.

References

[1] M.A. Badawi, Production of Biochar from Date Palm Fronds and its Effects on Soil Properties. By-Products of Palm Trees and Their Applications Materials Research Forum LLC. Materials Research Proceedings 11 (2019) 159- 168.

[2] M.A. Badawi, Water Saver is a Natural Product for Saving Irrigation Water in Date Palm and Golf Course Plantations in UAE. Journal of Agriculture Food and Development, 2019, 5, 57-62 57.

SUPERIOR FRACTURE-SEAL MATERIAL USING CRUSHED DATE PALM SEEDS FOR OIL AND GAS WELL DRILLING OPERATIONS

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Keywords: Palm Date Seeds, Rock Fractures Seal, Oil Well Drilling, Pressure, Temperature, Filtration Loss

ABSTRACT

Expenses for drilling represent 25% of the total oilfield exploitation cost. Drilling fluids represent 15–18% of the total cost of well petroleum drilling operations. The main drilling fluids problem is the loss into fractured and vugs. Prevention or mitigation of severe lost circulation is a main challenge while drilling in fractured formations where conventional lost circulation materials (LCM) will not cure these losses. Therefore, specialized treatment is required when drilling fractured formations. In this study, a superior LCM made from crushed date palm seeds was tested at laboratory for its ability to seal artificially fractured cores under High Temperature High Pressure (HT-HP) conditions. For this purpose, the conventional 500 ml HT-HP filter press was modified to accommodate a fractured core plug of length and diameter equal to 38.1 mm (1.5 inch) instead of the ceramic disc. Using the modified HT-HP filter press, crushed date palm seeds proved its ability to completely seal the artificially made fracture in the test core samples at overbalance pressures up to 1000 psi and temperatures up to 90 °C. The optimum mud composition was fresh water, 7% by weight bentonite, 3.5% fine crushed date palm seeds, and 3.5% coarse crushed date palm seeds in weight bases. In addition to its superior ability to seal fractured formation, the crushed date palm seeds material is cheap, locally available in commercially quantities, and environmentally friendly material.

References

[1] Amanullah, Md. 2016. Characteristics, behavior and performance of ARC Plug-A date seed-based sized particulate LCM. In: SPE paper no. 182840-MS presented at the SPE-KSAAnnual Technical Symposium and Exhibition held in Dammam, Saudi Arabia, April 25–28.

[2] Musaed N.J. AlAwad, K.A. Fattah, Superior fracture-seal material using crushed date palm seeds for oil and gas well drilling operations, Journal of King Saud University - Engineering Sciences, Volume 31, Issue 1, 2019, Pages 97-103, ISSN 1018-3639, https://doi.org/10.1016/j.jksues.2017.01.003.

ISOLATION OF LIPID DROPLETS FROM SEEDS OF DATE PALM (PHOENIX DACTYLIFERA L.) AND THEIR APPLICATION AS SEQUESTRATION AGENTS AGAINST HYDROPHOBIC CONTAMINANTS

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Keywords: date palm, Phoenix dactylifera, lipid droplets, LD-associated protein, sequestration, TCDD

ABSTRACT

Contamination of aquatic environments with dioxins, the most toxic group of persistent organic pollutants (POPs), is a major ecological issue. Dioxins are highly lipophilic contaminants and can bioaccumulate in fatty tissues of marine organisms used for seafood where they constitute a potential risk for human health. Plant lipid droplets (LDs) fractioned from date palm seeds, Phoenix dactylifera, were characterized and their capacity to extract dioxins from aquatic systems was assessed. The bioaffinity of date palm LDs towards 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the most toxic congener of dioxins was determined. Characteristically, fractioned LDs were spheroidal with mean diameters of 2.5 µm, enclosing an oil-rich core. Isolated LDs did not aggregate and/or coalesce unless placed in acidic media and were associated with three major groups of polypeptides, characterized as oleosins, caleosins and steroleosins. Efficient partitioning of TCDD into LDs occurred with a coefficient of log KLB/w,TCDD = 7.528 ± 0.024; it was optimal at neutral pH and was dependent on the presence of the oil-rich core, but was independent of the presence of LD-associated proteins. Our results suggest that the plant LDs could be used in ecological remediation strategies to remove POPs from aquatic environments. Recent reports suggest that several fungal and algal species also use LDs to sequester both external and internally derived hydrophobic toxins, which indicates that our approach could be used as a broader biomimetic strategy for toxin removal from aquatic environment. This research was solicited by The Economist Newspaper under the title “It’s the pits”.

References

[1] A. Hanano, I. Almousally, M. Shaban, F. Rahman, E. Blee and D. Murphy, Biochemical, transcriptional and bioinformatic analysis of lipid droplets from seeds of date palm (Phoenix dactylifera L.) and their use as potent sequestration agents against the toxic pollutant, 2,3,7,8-tetrachlorinated dibenzo-p-dioxin, Frontiers in Plant Science (2016).

NANO CELLULOSE AND NANOCOMPOSITES FROM PALM BYPRODUCTS

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Keywords: Nanotechnology, biotechnology, nanocellulose, nanocomposite, sustainable future.

ABSTRACT

In decades, nanotechnology is used in agriculture not only to improve production but also to utilize byproducts while maintaining or even improving nutritional content, quality, boost food output globally and safety. The term "nanocellulose" refers to cellulose that has been nanostructured. Cellulose nanocrystals, cellulose nanofibers, also known as nano fibrillated cellulose, refers to nano-structured cellulose produced by chemically modification. The palm agriculture industry is one of the largest producers of biomass, but only a small portion of the palm biomass waste it produces each year is turned into products with added value. The remainder is either burned or allowed to rot on the plantations, which releases dangerous gases and frequently causes severe air pollution. Researchers have therefore made significant efforts to create a more sustainable circular economy for palm trees, with the production of nanomaterials from lignocellulosic residues being the key to success. Due to its excellent mechanical properties, abundance, renewability, and biodegradability, nanocellulose may end up being one of the green materials that is most favorable for the processing of nanocomposite materials. A new class of nanoscale biopolymers called nanocellulose is revolutionizing the use of bio-based materials in the 21st century for a wide range of interdisciplinary applications, including flexible electronics, biomedical devices, pharmaceuticals, membranes, 3D printing, and packaging. In this keynote speech, I will focus on the key issues surrounding recent nanotechnology research based on nanocellulose and nanocomposites preparation from palm byproducts and their application for a smart sustainable future.

UNLOCKING THE POTENTIAL OF DATE FRUIT POMACE: LACTIC ACID FERMENTATION AND ADSORBENT MATERIAL VALORIZATION

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Keywords: Date fruit pomace, Lactic acid, Adsorbent, Valorization

ABSTRACT

Date fruit processing is a major food industry in United Arab Emirates with dates syrup as one of their key products. Date syrup was separated from fibrous material using filter press [1]. The solid fibrous residue from this industry, the date fruit pomace (DFP), is sold as an under-valued ingredient mainly to the animal feed industry. DFP contains 35% sugars [2] on a dry basis and can be regarded as a potential renewable resource to be used as a substrate for fermentation by microorganisms. The aim of this study was to valorize the DFP to produce lactic acid through fermentation by Lactobacillus casei and from the fermentation residue, an adsorbent material was developed to remove sulfate from reject brine from desalination plants. At a controlled pH and upon hydrolysis with 40 FPU/g DFP Cellic CTec2, a lactic acid concentration of 457 ± 1.4 g/kg DFP was achieved when 80 g DFP was inoculated with bacteria and incubated for 7 days. The solid residue remaining after fermentation was converted to an activated carbon using NaOH. Sulfate removal of 90.9% was obtained when 500 mg/L brine was treated with 20 g/L of activated carbon at 25oC for 2h with a BET surface area of 166.48 m2/g. The mechanism of the sulfate adsorption fits the Langmuir model (monolayer adsorption) with a maximum adsorption capacity of 415.2 mg/g. The adsorption isotherms and kinetic model indicate that the adsorption follows a monolayer adsorption and is both physical as well as chemical in nature. XRD, SEM-EDS and FTIR analysis of activated carbon after adsorption showed the presence of sulfate on the surface of the bioadsorbent. This study showed that converting DFP to produce lactic acid and an adsorbent is a promising valorization strategy.

References

[1] Heidarinejad, Z., Rahmanian, O., Fazlzadeh, M., & Heidari, M., Enhancement of methylene blue adsorption onto activated carbon prepared from Date Press Cake by low frequency ultrasound, J. Mol. Liq., 264, (2018). 591–599.

CHARACTERIZATION OF RAW AND CHEMICALLY-MODIFIED DATE PALM LEAVES BIOMASS AND ITS APPLICATION FOR THE REMEDIATION OF 2,4,6-TRICHLOROPHENOL FROM AN AQUEOUS ENVIRONMENT

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Keywords: Date palm leaves, 2,4,6-TCP, Adsorption, Characterization, Kinetic and Isotherm Studies

ABSTRACT

The chlorinated phenolic derivatives are considered an important class of emerging environmental pollutants due to their high toxicity and carcinogenicity which can affect humans and the aquatic environment. Among the chlorophenols, 2,4,6-Trichlorophenol (2,4,6-TCP) is considered one of the toxic pollutants because of its harmful effects and U.S. Environmental Protection Agency (USEPA) has also classified it as a priority pollutant. The 2,4,6-TCP is discharged into the aquatic environment from a variety of sources. Therefore, it the important to develop low-cost and eco-friendly techniques for the effective removal of contaminated wastewater. This study proposes to develop a low-cost biomaterial by chemically modifying an abundant agro-waste derived from date palm leaves biomass (RDPL and CMDPL) to remove an important class of emerging industrial pollutants, i.e. 2,4,6-Trichlorophenol (2,4,6-TCP) from industrial effluent towards sustainable waste utilization and the development of low-cost remediation technology. The biomaterial was first thoroughly characterized by using different techniques, viz. particle size, BET surface area, elemental analysis (CHN), FTIR, and FESEM-EDS. The performance of CMDPL and RDPL biomass was investigated by batch equilibrium studies. The role of critical experimental parameters, such as the pH, contact time, amount of adsorbent dosage, initial concentration, and the temperature was carefully investigated in the removal efficacy of the biosorbent. Increasing the amount of the chemically modified biomass increased the 2,4,6-TCP removal efficacy. Its biosorption capacity at equilibrium, i.e. qe (mg/g) however decreased with greater dosage amount. The experimental results correlated well with the Langmuir isotherm model whereas the pseudo-second-order model best represented the biosorption kinetics. The thermodynamic parameters showed that the adsorption procedure was feasible, spontaneous, and exothermic in nature. The maximum removal efficiency of RDPL and CMDPL were 84% and 92%, respectively. The present results demonstrated that the chemically-modified (CMDPL) biomass could be a low-cost and eco-friendly alternative for effective removal of the 2,4,6-TCP from the industrial effluent stream.

VALORIZATION OF DATE STONES IN THE TREATMENT OF AQUEOUS EFFLUENTS BY ADSORPTION PROCESS

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Keywords: Bioadsorbent, Adsorption, Methylene blue

ABSTRACT

Our work focuses on the valorisation of “daglat nour” date stones by using them as a bioadsorbent in the elimination of the methylene blue dye released in the aqueous effluents of the textile industry. We performed a parametric study by varying various factors that may affect the yield of the adsorption. The parametric adsorption study showed a good removal within the first 30 minutes at ambient temperature and the initial hydrogen potential (pH) of the methylene blue solution. The study of the amount of adsorption as a function of the quantity of the adsorbed dye methylene blue showed that the adsorbed amount increases with the increase of the concentration of methylene blue. We have seen an increase in the adsorbed amount of methylene blue when the hydrogen potential (pH) of the solution increases, hydrogen potentials that have been optimized are superior to the point of zero charge (PZC). Finally, the percentage removal of the dye increases as the mass of the adsorbent increases because the increase in the mass of the adsorbent increases the specific surface area and therefore the number of available adsorption sites results in increasing the amount of adsorbed dye. Equilibrium data of methylene blue showed good correlation with LANGMUIR isotherm. The kinetic analysis showed that the adsorption achieved equilibrium within 60 min; it fitted well in pseudo-second order kinetics. Thermodynamic studies indicated the adsorption was endothermic and high temperature was beneficial for the adsorption.

References

[1] G.G.Stavropoulos; A.A. Zabaniotou, Production and characterization of activated carbons from olive-seed waste residue, Microporous and Mesoporous Materials (82), (2005), 79-85.

[2] A.C. Lau; F.Y. Lua, J. Guo, Influence of pyrolysis conditions on pore development of oil-palm-shell activated carbons, J. Analytical and Applied Pyrolisis (76), (2006), 96-102.

DATE PALM FRUIT SEED (PHOENIX DACTYLIFERA L.) NOVEL FINDINGS AND FUTURE DIRECTIONS FOR FOOD AND DRUG DISCOVERY

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Keywords: Palm Fruit Seed, Ischemic heart diseases, Anticancer, Treatment of Various Disorders, Drug Discovery

ABSTRACT

Date palm seeds, a by-product of date fruit production, are usually treated as waste and as animal feed. There have been extensive studies carried out on the effects of date seeds in terms of pharmacological activities, such as antioxidant, anti-inflammation, antidiabetic, antibacterial, antiviral properties, anticancer activities, and date seeds possess high potential as a nutritional therapeutic agent for several chronic diseases,1-10 ischemic heart diseases are leading causes of mortality in developing as well as developed countries. A method of treating ischemic heart disease can include administering a therapeutically effective amount of a composition including date seed nanoparticles to a subject in need thereof. 11

Ajwa Nanopreparation Prevents Doxorubicin-Associated Cardiac Dysfunction: Effect on Cardiac Ischemia and Antioxidant Capacity. Bioactive Compounds Improve the Safety of Doxorubicin without Compromising its Anticancer Efficacy in Breast Cancer. 12-13 Using Nano Co-encapsulation for the Prevention and Treatment of Various Disorders.14 P. dactylifera can be considered as a complete food in addition to its curative effects against various complaints, It contains phytochemicals like phenolics, flavonoids, and carotenoids, which have anticancer and antioxidant potentials. The protective effects of P. dactylifera seeds are thought to be due to not only the fiber, vitamins, and minerals, but also to a diversity of plant secondary metabolites as flavonoids and phenolics, may act in combination with other phenolics as free radical scavengers or heavy metal chelators, and in turn, they can prevent the oxidative stress and inflammation. The anti-inflammatory effects of date palm seeds have wound healing activities, and cardioprotective15. Studies proofed the antidiabetic effect, Anti- Hyperglycemic, and Antihyperlipidemic Activities16-18

More work is required in large clinical trials to demonstrate the value of date palm seeds. The pharmaceutical industry will hopefully be able to address the important of date seeds in the treatment and prevention of various disorders.

PRESENTATION OF THE BOOK (DATE PALMS BY-PRODUCTS. THEIR TYPES AND ECONOMIC IMPORTANCE)

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ABSTRACT

In 2017, Saleh Abdulaziz Al Rajhi Endowments Management, Kingdom of Saudi Arabia issued a new book entitled "Date palm trees by-products ... their types and economic importance", 226 pages authored by Mr. Saud bin Abdulkarim AlFadda the General manager of the Saleh Al Rajhi Endowment management and Prof. Dr. Ramzy Abdul Rahim Aboaiana, head of Technical Affairs, the Agricultural Department. This book presents the main products of date palm which considered as the first book to this subject in some detail in Arabic. This book includes four main chapters. The first chapter shows the estimation of date palm by- products locally and in the world according to the statistics and studies adopted, where the second chapter is devoted to presenting the characteristics of date palm pruning products and their uses. While the most important of these characteristics is that they are compatible with the desires of consumers, the relative stability of the prices of locally produced raw materials and their availability throughout the year, and their contribution to raising the added value of local industrial and agricultural production. The third chapter explain The six by-products of date palms are date seeds, pollen, offshoots, aerial offshoots, palm pruning residues, where estimating the annual production of these products and their medical, industrial and agricultural uses. The fourth chapter presents Saleh Al Rajhi endowments management vision, mission and goals which include the various aspects of charity.

ETHNOBOTANICAL SURVEY OF DATE PALM BYPRODUCTS USED IN SOUTHERN ALGERIA OASES: LOCAL KNOWLEDGE AND INTERESTS

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Keywords: date palm, byproducts dates, traditional use.

ABSTRACT

The date (edible sweet fruit of date palm) constitutes an important nutritional and food resource in human diet, mainly due to the presence of phenolic compounds, source of antioxidants which have a role in lowering cholesterol levels, stimulating the cardiovascular and immune system as well as the manufacture of anti-aging cosmetic products and cancer prevention [1]. For several centuries, palm byproducts have been used for specific purposes to develop food and pharmaceutical products traditionally. Food and /or pharmaceutical industry that deserves to be developed in the world is that of the manufacture of pharmaceutical products using by-products of this monocot (leaves, dates, pollen, etc.). The assessment of most date palm cultivars with interests (production and medicinal use) across some regions of southern Algeria, has shown different processes and used practices on byproducts in daily life by combining traditional with scientific knowledge to the modern interest. To determine the active constituents of each part, a phytochemical screening was performed. A previous study showed a positive effect of date palm pollen on animal models [2].

References

[1] N. Bouguedoura, M Bennaceur, S Babahani, SE Benziouche Date palm genetic resources and utilization (2015), 125- 168.

[2] C. Selmani, D. Chabane and N. Bouguedoura. Ethnobotanical survey of Phoenix dactylifera L. pollen used for the treatment of infertility problems in Algerian oases. African journal of Traditional, Complementary and Alternative Medecines14 (3) (2017) 175-186.

DAMAGE ANALYSIS OF COMPOSITES REINFORCED WITH DATE PALM FIBER: MECHANICAL BEHAVIOR AND DEBONDING AT THE COMPOSITE-ALUMINUM INTERFACE

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Keywords: Date Palm Fibers, Epoxy, Composites, Aluminum, Interfaces, 3-points bending test

ABSTRACT

One of the most widely grown palm trees is the date palm (Phoenix dactylifera). The Afro-Asiatic dry band, which runs from North Africa to the Middle East, is where it is most frequently found. It can survive in cold and dry-hot regions with ease. The significance of composites reinforced with date palm fibers is very important, these fibers offer promising alternatives to costly synthetic fibers having an impact on the environment. In addition, its application is very wide. These biocomposites are typically used in nautical and aeronautical industries, as well as in car manufacturing and construction. However, the composites have also been limited by adhesion between the adhesive and aluminum. This study investigated the effect of date palm fiber reinforcement with different weight fractions (0, 10, 20 and 30 wt%) on both the mechanical behavior of epoxy/date palm fiber composites and aluminum- composite interface resistance. For this purpose, 3-point bending tests were performed on pure epoxy, epoxy/date palm fiber composite specimens and the adhesive failure initiation of the composite-aluminum interface. Trials of 3-point bending tests were conducted on an aluminum 2017 substrate. Based on the mechanical tests of the composite-aluminum interface, a finite element model of the interface sample was developed to analyze the interfacial failure of the composite-aluminum adhesion. The test results showed that the date palm fiber with 30 wt % were capable of enhancing the mechanical properties of the epoxy/ date palm fiber composite. Whatever the initial geometry of the 3-point bending test is, it is then possible to determine the energy required to initiate the adhesive failure for a certain system. The analysis of composite-aluminum interface resistance enables the definition of an energy threshold for the beginning of adhesive failure.

References

[1] L.A. Elseify, M. Midani, Characterization of Date Palm Fiber. In: Midani, M., Saba, N., Alothman, O.Y. (eds) Date Palm Fiber Composites. Composites Science and Technology (2020). Springer.

UTILIZATION OF GRAPHENE OXIDE DERIVED FROM DATE PITS FOR ADSORPTION MECHANISM OF BROMOPYROGALLOL RED (BPR) DYE.

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Keywords: Graphite, Graphene Oxide, Date pits, Phenolic Dyes, Removal of dyes.

ABSTRACT

This study aims to prepare graphene oxide (GO) from date pits (DP) that consider one of available agricultural waste in Saudi Arabia. The method of preparation is done by conversion of date seeds to lignin then to graphite which is used in modified Hummer's method to obtain GO. The prepared compounds were characterized using available analytical tools as Fourier transform infrared spectrometer (FT-IR), X-ray diffraction (XRD), Scanning electronic microscope (SEM), Thermal gravimetric analysis (TGA) and Brunauer-Emmett-Teller (BET). Various factors affecting the adsorption process of (BPR) dye were studied as shaking time, dyes concentrations, adsorbent dose, pH as well as temperature. The maximum adsorption capacity of GO for uptake of (BPR) was 42.48 mg/g. The adsorption system was more fitting with Freundlich isotherm model so this finding proved participation of the multilayer chemical adsorption process onto heterogeneous surfaces. The calculated maximum adsorption capacity (qe) from pseudo second order kinetic model was fitting with experimental findings and found to be 43.668mg/g from aqueous solution. The negative value of change in free energy ΔG revealed spontaneous nature of the adsorption while positive value of change in enthalpy ΔH and change in entropy ΔS correspond to endothermic nature of the adsorption and affinity of the adsorbent towards the adsorbate molecules respectively. The relatively high value of activation energy (Ea) demonstrates that adsorption of BPR on to GO is chemical adsorption and found to be 50.74KJ/mol. Also, in this study, we were able to reuse the adsorbed material that were prepared and used to get rid of the dye using warm water for desorption of BPR dye with the same efficiency for 3 times.

References

[1] Awwad, N.S., El-Zahhar, A.A., Fouda, A.M. and Ibrahium, H.A , Removal of heavy metal ions from ground and surface water samples using carbons derived from date pits. Journal of environmental chemical engineering, 1(3), (2013) pp.416-423.

[2] Fan, L., Luo, C., Li, X., Lu, F., Qiu, H. and Sun, M., 2012. Fabrication of novel magnetic chitosan grafted with graphene oxide to enhance adsorption properties for methyl blue. Journal of hazardous materials, 215, pp.272-279.

EFFECT OF PLANT FIBERS ON THE PHYSICO-MECHANICAL PROPERTIES OF CONCRETES IN THE SAHARA ZONE

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Keywords: Vegetable fiber concrete (Raffia), vegetable fibers, super-plasticizer (SP) and compressive strength.

ABSTRACT

In order to reinforce local materials, to contribute to the reduction of construction costs, fibers have been used to improve their mechanical characteristics, in particular their resistance to bending and cracking. This work studies the effect of the incorporation of vegetable fibers (Biskra palm raffia) on the mechanical properties of BFV Raffia. The mechanical properties of fiber-reinforced concrete depend on several factors, which are the conditions of implementation, the dosage, the spacing, the orientation and the distribution of the fibers in the concrete. The study focused on the effect of fiber on mechanical strength and fiber dosage using four fiber contents (0.2, 0.4, 0.6 and 1% with super-plasticizer) of cement weight. The results indicate that there is a slight improvement in the compressive strength of concrete with 0.6% fiber, but for the rest of the cases studied, the addition of fibers has an inert or negative effect.

AGEING EFFECTS ON THE STRENGTH PROPERTIES OF COMPOSITE TILES REINFORCED WITH COIR FIBERS

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ABSTRACT

Fiber-reinforced composite tiles have excellent mechanical and physical properties. Composites developed from coir fibers often showed an increase in toughness and reduced thermal conductivity of the composites. This study examines the ageing effects on the strength properties of composite tiles reinforced with coir fibers. Chicken Eggshell Ash (CESA) was incinerated at 900oC and hydrolyzed before use, Calcium Carbide Waste (CCW) was pulverized and screened with 75µm and Limestone Portland Cement (LPC). For composite production, coir fiber content was 6% of cement mass; cement:water mass ratio was 0.4, cement:sand ratio was 1:2. A super-plasticizer 0.3% of cement mass was added. Cement admixtures were 70%LPC+ 15%CCW+15%CESA and 90%LPC + 10%CESA. Control specimens were thermally cured at 60oC for 5 days. Other specimen samples were CO2- cured and exposed to 15% CO2 at 60oC, 60% RH and 0.34MPa for 3 hours. 100 cycles of the ageing test were carried out on the samples. Six, 160 x 40 x 6 mm3 replicate samples were tested to determine composite Bulk Density (BD), Water Absorption (WA), Modulus of Rupture (MOR) and Fracture Toughness (FT). The average BD ranged 2.07 – 2.13gcm-3), WA ranged (7.31 – 8.08%), MOR ranged (9.18 – 12.88MPa) and FT ranged (94.0 – 165.0 Jm-2). The average ranged of values after 100 cycles ageing were BD (2.04 – 2.07 gcm-3), WA (7.76 – 8.47%), MOR (6.52 – 8.69MPa) and FT (70.0 - 83.0 Jm-2). Observable increases in strength and toughness properties were observed in composite containing admixtures of cement-calcium carbide-eggshell ash. Composite tile will be suitable for roofing tiles, ceiling board and fiber-reinforced floor tiles.

EVALUATION OF FUNGAL DECAY AND BIODEGRADATION OF THERMOPLASTIC COMPOSITES REINFORCED WITH DATE PALM FIBER

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Key words: PLA; RPVC; Date palm fibers; Biodegradable composites; Fungal resistance; Biodegradation.

ABSTRACT:

Natural fibers are being used to make sustainable and biodegradable composite materials as environmental concerns increase. One of the most abundant agricultural biomass wastes in the MENA region, date palm trees (DPT) account for more than 4.5 million tons of waste annually worldwide. The biological resilience of thermoplastic composites developed from polylactic acid (PLA) and recycled polyvinyl chloride (RPVC) and reinforced with date palm fiber (DPF) was assessed in this study at various concentrations (10, 20, 30, 40 wt.%) and fiber size (250 – 500 µm and ≥1,000 µm). Composites were exposed to Tyromyces palustris, Irpex lacteus, white-rot fungus, and brown-rot fungus to assess biodegradation resistance. According to the findings, composites manufactured with PLA lost more weight on average than samples reinforced with RPVC. When combined with various polymer matrixes, composites with higher DPF concentrations degraded at faster rates. The breakdown of the composites was also significantly influenced by the length of the DPF. When subjected to Tyromyces palustris and Irpex lacteus, the DPF/PLA composites reinforced with 40 weight percent DPF showed the highest weight loss percentages (WL%) of 5.61% and 5.46%, respectively. Even though biodegradation was a prominent factor in the composites' breakdown, PLA composites reinforced with 40 weight percent DPF showed a high level of biodegradation (61.40%).

IMPROVEMENT OF CEMENT THERMAL INSULATION WITH NATURAL PALM POLYMERIC FIBER

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Keywords: Date Palm Wastes, Insulation, Cement, Compression Strength, Composites

ABSTRACT

Due to the hot weather that most Gulf counties experience almost three quarters of the year, thermal insulation in buildings is essential. Saudi Arabia has over 31 million date palm trees, while valorized waste produces only about 460 tons of waste [1]. This study aimed to examine the effectiveness of incorporating palm frond into cement for insulation purposes. 1-3wt% palm frond was successfully incorporated into cement using the standard cement preparation method. Results demonstrated that the addition of 3wt% palm frond into cement has significantly reduced the thermal conductivity by 25%, from 1.56 to 1.17 W/mK as compared to the pure cement sample. The compression strength test was also conducted to assess the influence of palm frond into cement. Experimental results demonstrated that incorporation of palm frond into cement decreased compression strength. The lost compression strength was found for the sample prepared with 3wt% palm frond at 54.5 KPa where pure cement sample had the highest compression strength value at 94.4 KPa.

References

[1] National center for palms & dates (2023).

THERMAL ANALYSES OF PALM DATE SEEDS

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Keywords: Date seeds, TGA analysis, DSC Analysis, XRF

ABSTRACT

In most date-producing countries, the date seeds are either discarded or partially incorporated into animal feed. Apart from a few traditional applications, their valorization is largely unexplored. Recent research has shown that date seeds can be valorized into a variety of products [1-3]: biofuel extraction, wastewater treatment, energy storage, biomedical applications, etc. In order to shed light on the possibilities of these valorizations, we carried out in this study thermal analyses on two varieties of date seeds: the first is Al-ajwa, a Saudi Arabian variety grown mainly in the Medina region, and the second is Deglet-Nour, an Algerian date variety grown in Biskra region. Thermo-gravimetric (TGA) and differential Scanning calorimetry (DSC) analyses were carried out on date seeds of both varieties. X-ray fluorescence (XRF) analysis and micro-hardness testing completed these analyses. The different analyses showed that the date seeds underwent three stages of transformation as a function of temperature.

The first stage of fast pyrolysis extends from ambient temperature up to a temperature of 237°C for Al-Ajwa pits with a mass loss of 11.40% and up to a temperature of 234°C for Deglet-Nour seeds with a mass loss of 11.45%. The second pyrolysis stage extends to 369°C for Al-Ajwa pits and 377°C for Deglet-Nour pits. Mass losses are 45.22% for Algerian dates and 44.36% for Saudi dates. The extremes temperatures of the first two stages show that biodiesel can be extracted from date seeds. The third stage ends with a temperature of 492°C (with a mass loss of 69.28%) for Al-Ajwa seeds, a temperature of 489°C (with a mass loss of 69.92%) for Deglet-Nour seeds. The different analysis showed that the date seeds contain about 30% of mineral materials. As a conclusion of the different analysis, bio-fuel can be extracted from the date seeds and the residual biochar can be used for the treatment of wastewater.

References

[1] Babiker ME, et al. Pyrolysis characteristics of Phoenix dactylifera date palm seeds using thermo-gravimetric analysis (TGA). Int J Environ Sci Develop 2013;4(5):521.

[2] Hai A, et al. Pyrolysis of date seeds loaded with layered double hydroxide: kinetics, thermodynamics, and pyrolytic gas properties. Energ Conver Manage 2022;252: 115127

EVALUATION AND COMPARISON BETWEEN DATE PALM FIBERS AND ALFA FIBERS COMPOSITES

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Keywords: Date Palm Fibers, Alfa fibers, Epoxy, Composites, aging, 3-points bending test

ABSTRACT

The importance of creating and using green items made of natural fibers and natural fiber composites rather than conventional goods has increased as awareness of sustainability has grown. However, It will take a lot of work to improve these green composites' performance characteristics and expand their use in new applications, so this is a long path. By carefully choosing the components of the composite material and using trustworthy decision-making techniques, natural fiber composites' characteristics can be improved. These techniques ought to evaluate bio-composites using many evaluation criteria. Date palm fibers were compared to and evaluated against Stipa tenacissima (Alfa) fibers used for composites under atmospheric aging conditions. Date palm fibers were harvested from region of Mascara (North-West area of Algeria), and Alfa fibers from Bougtob El Bayadh (South-West area of Algeria). This study investigated the effects of atmospheric aging through three months on the mechanical properties of two different composites (epoxy/date palm fibers and epoxy/alfa fibers. Epoxy–Natural fibers composites have been synthesized and characterized successfully with various reinforced ratios of Natural fibers (i.e., 5, 10, 15, and 20 wt %). Epoxy– Natural fibers composites were prepared by silicone molds after pouring the mixture into the cavities. For this purpose, 3-point bending tests were performed on pure epoxy, epoxy/date palm fiber composites and epoxy/alfa fiber composites specimens. The test results showed that the date palm fibers have been demonstrated to have potential for natural fiber composites under a variety of environmental circumstances. The palm fibers were found to be beneficial to decelerate aging effect of the polymeric palm composites compared to another natural fibers. This antiaging behavior encourages palm-based composites to be more versatile and more likely to replace synthetic fibers. The potential of the novel composite materials for diverse industrial applications would be discovered with the aid of such trustworthy evaluations of natural fibers.

References

[1] AL-Oqla, F.M. (2020). Evaluation and Comparison of Date Palm Fibers with Other Common Natural Fibers. In: Midani, M., Saba, N., Alothman, O.Y. (eds) Date Palm Fiber Composites. Composites Science and Technology. Springer, Singapore. https://doi.org/10.1007/978-981-15-9339-0_10.

RECOVERY OF PALM TREE WASTE INTO PLANT FIBERS FOR REINFORCING CONSTRUCTION CONCRETE

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Keywords: Plant fibers; Palm; Extraction; Fiber-reinforced concrete; Mechanical behaviour

ABSTRACT

The use of plant fibers in cementitious materials not only offers a solution to tensile strength problems, but also has a positive environmental impact by recovering organic waste. These fibers, particularly those extracted from palm stalks, are an abundant and inexpensive local natural resource, making them a promising choice for reinforcing construction concrete. However, the incorporation of plant fibers into ordinary concrete can affect the workability of the mix, making it essential to study these compounds in depth. In this project, the main objective is to scientifically explore the method for extracting plant fibers. By incorporating these fibers into concrete, we aim to optimize the composition, which good workability with improved mechanical performance, specifically an improved flexural tensile strength. We will take into account various factors influencing this composition, in particular the percentage of fibers.

References

[1] GOSSA Nabil « Elaboration et caractérisation expérimentale du comportement mécanique du béton à base de fibers de palmier dattier» 2012-2013

[2] BLEDZKI, A. K and GASSAN. J, Composites reinforced with cellulose based fibers ELSEVIER, Progress in polymer science, volume 24, pp.221-274

[3] P. Jodin, "Le Bois: matériau d'ingénierie" Nancy:Arbolor.

[4] NILSON, L., Reinforcedconcretewith sisal and othervegetablefibers, Swedishcouncil for building research, document d 14, 1975.

MODELING ALKALINE TREATMENT PARAMETERS FOR DATE PALM FIBERS USING EXPERIMENTAL DESIGN

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Keywords: date palm fiber, alkali treatment, modeling, design of experiments

ABSTRACT

Modeling alkaline treatment parameters for date palm fibers using experimental design is an important step in optimizing the process to achieve desired outcomes. Alkaline treatment is often used to remove lignin, hemicellulose and other impurities [1], increase fiber flexibility, and improve fiber properties for various applications such as composites, textiles, and paper production [2]. Designing experiments to study the effects of different parameters on tensile properties and understand how variations in parameter values may affect the outcomes. Using an unconventional design; where time takes four levels (24, 48, 72 and 96 h), temperature takes two levels (19 and 35 °C), sulfuric acid concentration three levels (0.7, 0.8, and 1%), and three concentration levels for alkali concentration NaOH (1, 2 and 3%, w/v) is crucial for achieving the best results. Mathematical models show a good combine correlation for the tensile proprieties where R2 equals to: 093, 0.82, 0.88 for elongation rate, strength and Young's modulus respectively with a validity of models up to 60%. Using the developed models, the optimal combination of parameters that will yield the best properties of date palm fibers are: time of 24 to 32h, temperature of 19°C, sulfuric acid of 0.7%, alkali concentration of 1 to 1.6 %, w/v for elongation rate of 6.41%, strength of 0.375E3 MPa and Young's modulus of 15.6E3 MPa. This study helps assess the robustness of the optimized condition and scaling up the process for industrial or large-scale production.

References

[1] L. Chopra, Manikanika, Extraction of cellulosic fibers from the natural resources: A short review, Materials Today: Proceedings 48 (2022) 1265-1270.

[2] M. Faris, AL-Oqla, Mohd S. Salit, Natural fiber composites, Materials Selection for Natural Fiber Composites (2017) 23-48.

PRODUCTION OF INSULATION PANELS FROM THE PETIOLE OF DATE PALM AS BYPRODUCTS

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Keywords: Date palm, byproducts, wooden products, insulation panels

ABSTRACT:

The Southern regions of Algeria are characterized by hot and dry climate during eight months from March to October. Temperatures in summer reach over 45° C in amber. These regions are commonly called "Oasis" and they are characterized by the cultivation of date palm. The date palm maintenance and cleaning operation produces huge quantities of byproducts every year. These wastes are either thrown away or burned. The objective of this study is to produce the insulation panels from the Petiole as a byproduct for date palm. In fact, currently in Algeria, the number one material used in the production of insulating panels is the cork this material, which generally excites in the Northeast of Algeria presents a reduction of production from year to year. The Object of this research is to present some methods for starting the production of insulation panels based on date palm byproduct and offering an environmental solution.

References

[1] A. Chehma, HF. Longo valorisation des sous produits des palmier dattier en vue de leur utilisation en alimentation des bétail, Rev. Energ. Ren. : Production et Valorisation – Biomasse, (2001), pp. 59-64.

[2] H. ELmously, Rediscovering Date Palm by-products: an a portunity for Sustainable Development, Materials Research Proceedings 11 (2019), pp. 3-61

[3] A. Kriker , G. Debicki , A. Bali , M.M. Khenfer , and M. Chabannet, Mechanical properties of date palm fibers and concrete reinforced with date palm fibers in hot-dry climate, vol. 27, (2005), pp. 554-564.

RELIABILITY ANALYSIS OF DATE PALM FIBERS AS A REINFORCING AGENT IN COMPOSITES

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Keywords: Date palm fiber, Alkali process, Reliability assessment, Monte Carlo Method, Durability

ABSTRACT

Fiber-reinforced composites offer a number of unique properties that make them suitable for use in a wide range of industries, from aerospace and construction to the co-industrial sector. For such quality, the properties especially the mechanical ones and durability of the fibers used as reinforcing agents, as well as the conditions under which synthetic fibers are synthesized or natural fibers are extracted are the determining parameters. The extraction of natural fibers is a subject of interest to researchers because of their abundance, high specific resistance, low density, low cost, good mechanical properties, environmental friendliness, and biodegradability in nature [1-3]. Several processes have been studied, including mechanical, biological, chemical and combined processes. In this study, the process chosen for extracting date palm fibers is the chemical alkali process (extraction using a basic bath with NaOH as the agent for attacking the non-fibrous part of the date palm). This study presents reliability analysis of the durability of date palm fibers as a reinforcing Agent in Composites. The effect of time, NaOH concentration, and H2SO4 concentration on tensile properties is presented. The Monte Carlo method is used to predict the distribution function of the composite. The failure probability of the composite was calculated by considering both the statistical uncertainty on the basic variables and the model uncertainty as previously discussed. The probability density function (pdf) is obtained by fitting the histogram with theoretical models. Three distribution laws are investigated Lorentz, Gaussian and Polynomial (9th order). The Gaussian law offers an acceptable approximation of the E (x) probability density function, with good estimation of the average. The uncertainties of the time, NaOH concentration, and H2SO4 parameters have a significant effect on increasing the probability of failure and reduced of the durability of the date palm fiber.

References

[1] S.H. Kamarudin, L.C. Abdullah, M.M. Aung, C.T. Ratnam, A study of mechanical and morphological properties of PLA based biocomposites prepared with EJO vegetable oil based plasticiser and kenaf fibers, IOP Conf. Ser. Mater. Sci. Eng 368 (2018) 8531.

[2] T.H. Mokhothu, M.J. John, Review on hygroscopic aging of cellulose fibers and their biocomposites, Carbohydr. Polym 131 (2015) 337–354.

DATE PALM WASTE IS A GOOD LOCAL SUBSTRATE FOR VEGETABLE CROPS GROWN IN SOILLESS CULTURE.

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Keywords: Date palm waste, substrates, soilless culture, greenhouse

ABSTRACT

Date palm waste (DPW) is a renewable source, locally available in large quantities since date production is a major industry in Saudi Arabia. Riyadh region has 7,030,731 palm trees (24.6%) of the total number of palm trees in the Kingdom. Soilless culture is considered the best system for growing crops in protected culture, to overcome problems of soil-borne diseases and for achieving sustainable goals for saving water and nutrients. However, in many countries, the commonly used growing media are expensive or even unavailable. This project was conducted at the National Research and Development Center for Unsuitable Agriculture (ESTIDAMAH) at Riyadh Techno Valley, Saudi Arabia. Different fraction sizes of DPW, pre-treated in several ways (sieved, flushed, sterilized), were compared with standard rockwool (RW), volcanic rock (VR) and perlite (PL) as a based growing media, in term of physical and chemical properties as well as production of cucumber and sweet pepper grown in a climate-controlled Venlo-type greenhouse with Pad-Fan cooling system. The two years trials were focused on the applicability of water-and nutrient conditions and the crop performance in growing cycles of 10 months. The results and experiences of the first experiment were used to improve the DPW and VR treatments for the next trial. The first trial (cucumber) showed dramatic yield reduction for VR (21.7 kg/m2), in comparison to DPW (24.1 kg/m2). For the next crop (sweet pepper), the use of DPW raw material revealed lower BER fruits (10.8%) than PL (15.7%) or RW (18.8%), respectively. In this work, the potential of using DPW as a local alternative soilless growing media is visible, when compared to other commercial substrates in greenhouses.

References

[1] W. Abid. Date palm wastes co-composted product: an efficient substrate for tomato (Solanum lycopersicum L.) seedling production. Waste Biomass Valorization, 9 (2016) p 45-55.

[2] M. Raviv. Soilless Culture: Theory and Practice Theory and Practice, 2 (2019) p.587-635.

EVALUATION OF QUALITY OF YOGHURT WITH THE ADDITION OF DATE SYRUP (ROB) AND STUDY OF ITS STABILITY DURING STORAGE BY REFRIGERATION

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ABSTRACT

In recent years, we see that the Algerian economy relies heavily on the manufacture of local food products on agricultural materials. From this point of view, our scientific research aims to evaluate a very useful and common food substance, which is dates, and to determine the effect of date syrup (rob) on the overall quality of the yoghurt during the post-acidification stage. The samples were kept at a positive temperature of 4°C for 21 days. In this context, we used date syrup for colored component of the produced yogurt. Where we prepared 3 types of yogurt with different percentages of date syrup with different concentrations as follows: 0%, 2.5% and 5% for each type and changes in selected physicochemical, microbiological and sensory parameters were monitored during storage. Each parameter studied is represented by three 30 ml pots, the following measurements and controls were carried out every 7 days on each processed product. From the beginning to the end of the post-acidification period, the acidity values of the Yogurts measured are proportionally increased with the addition of date syrup. Overall average acidity levels between 78°D at the beginning of fermentation up to 82.34°D at the end of the post-acidification period. During the experiment, however, the acidity of the experiments did not exceed the commercially acceptable standards of 150 ° D. Similarly, Choi et al. (2016) reported that acidity continued to increase independently of the addition of ethanolic cinnamon extract during storage yogurt at 4°C for 28 days. In yogurts with added pectin from peel of Citrus at different concentrations, a progressive increase in acidity was observed giving average values of 95.12; 96.23 and 96.69 °D on the 7th, 14th and 21st day of storage at 4°C, respectively (Arioui et al., 2017). Differences between values recorded can be explained by the composition of the environment and the acidifying activity of the startup culture as indicated by Vénica et al. (2018). The latter reported acidity between 70 and 80 °D in different types of yogurt (traditional; traditional sucrose; delactosed and delactosed with sucrose) after 28 days of storage. The protein, moisture, fat and ash contents of the yoghurt samples decreased the addition of date syrup. The carbohydrate, total solids, total solids non-fat, titrable acidity, vitamin C, and Calcium contents increased. Moreover, the number of specific yogurt germs namely streptococcus thermophilus and lactobacillus bulgariccus proves to meet the standards required, and we remark the absence of pathogenic flora for every 21 days. In general, the addition of date syrup in the fermented milk did not alter the main organoleptic criteria of the products namely: adhesiveness, sweet taste, acid taste, odor and color.

CELLULOSE AEROGELS MADE FROM DATE PALM WOOD FOR HEAT INSULATION IN CONSTRUCTION

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Keywords: Cellulose, Aerogels, Date Palm Wood, Heat Insulators, Sustainable Buildings Materials.

ABSTRACT

Herein, cellulose fibers that were extracted from local date palm trees wood in the United Arab Emirates are employed to produce cellulose aerogels. The potential of these ultra-light, highly porous and highly insulating cellulose aerogels to be used as heat insulation materials in buildings is examined in this research. The aim of this study is to reduce the reliance on fossil-fuel based materials in construction, and to replace them with sustainable and ecological materials. Cellulose initially was extracted from date palm trees using traditional alkaline treatment for the lignin removal, followed by bleaching to reject the hemicellulose. Afterwards, cellulose aerogels were prepared through dissolving the extracted cellulose fibers in imidazolium based ionic liquids that served as green solvent, followed by gelation and freeze-drying. The aerogels were prepared with cellulose weight percentages of 3, 5, 7, and 9 wt.%, with respect to the ionic liquid solvent. The materials achieved promising results for the relevant properties, by having a low density of 0.068 g/cm3, and a low thermal conductivity of 0.03 W/m·k. The produced cellulose aerogels retain great properties that can compete with the commercial fossil-fuel based insulators such as expanded and extruded polystyrene. Other properties such as TGA, FTIR, XRD, DSC, and mechanical properties are explored to further assess the suitability of the materials for the desired application.

HYDROGEN PRODUCTION VIA CATALYTIC METHANE DECOMPOSITION OVER IRON-SUPPORTED ON ACTIVATED CARBON DERIVED FROM WASTE DATE PALMS

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Keywords: Hydrogen Production, Methane Decomposition, Iron Catalyst, Waste Date Palm, Activated Carbon Support.

ABSTRACT

The production of pure hydrogen is greatly enhanced by employing methane thermocatalytic decomposition (TCD). In this study, the catalyst was synthesized via a one-step method to create iron supported on activated carbon (AC) using waste material from date palms as the AC precursor. To enhance the activation process metal salts (KOH) were added and calcined at 800 °C under a controlled flow of 150ml/min of N2 gas. For this purpose, two catalysts were synthesized namely, 30%Fe/AC-700 and 30%Fe/AC-600. Our investigation focused on examining how variations in temperature during biomass pyrolysis (specifically, 600°C, and 700°C) affect both the textural structure and catalytic performance in the process of methane decomposition. A stainless-steel fixed-bed reactor operated under atmospheric pressure and 800 °C was used. The input gases for the reactor included a mixture of CH4 and N2 in a ratio of 2:1 with a total space velocity of 6800 ml/hr.gcat. The resulting gases were connected to a gas chromatograph (GC) to be analyzed. The textural and morphological characteristics of the fresh calcined and spent catalysts were investigated utilizing several characterization techniques such as BET, temperature-programmed reduction (TPR), and Raman spectroscopy. According to the findings, it can be concluded that the 30%Fe/AC-700 catalyst exhibits superior and more consistent activity when compared to the 30%Fe/AC-600 catalysts. The 30%Fe/AC-700 catalyst achieved a hydrogen percentage yield of 20%. Additionally, the results indicate that as the temperature of biomass pyrolysis increases, the catalysts demonstrate enhanced activity and stability while the catalysts' surface area and pore volume decrease with rising temperature (30%Fe/AC-700=657.42 m2/g and 30%Fe/AC-600= 722.97m2/g). In terms of the deactivation catalyst, the 30%Fe/AC-600 exhibited a faster rate of deactivation compared to the 30%Fe/AC-700. Analysis of the Raman spectroscopy revealed that all the catalysts used in the experiment produced amorphous carbon types.

RENEWABLE AND SUSTAINABLE ECO–COMPOSITES OBTAINED FROM BIOMASS WASTES FOR INDUSTRIAL APPLICATION: CHALLENGES AND INNOVATIONS

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Keywords: Nut shells residues, Alkaline treatment, Bio composite, coupling agent mechanical properties.

ABSTRACT

Due to depleting natural resources, new environmental regulations and economic considerations, there is a constantly growing interest in using renewable resources. Our investigation has focused on the possibility to expand the use of some agriculture by-products (nut shells residues) by turning them into new eco–composites and to investigate their structural, morphological, thermo-mechanical and water absorption behavior by combining a chemical treatment of biofillers and physical modification of polymer matrix [1]. Novel materials based on polypropylene (PP) and different biomass wastes as almond shells, coir shells, and argan shells have been obtained and analyzed [2]. The comparison between the properties of these eco-composites and those of the corresponding ones made with coupling agent reveals that the incorporation of the coupling agent causes significant improvements in morphological, thermal, rheological, and hygroscopic properties [3]. In addition, the coupling agent led to optimization between a stiffness and ductility of bio composites. As an example, the Young's modulus of the Argan shells reinforced PP biocomposites shows the maximum results, with a gain of 61%. The water diffusion study divulges that the diffusion of water into the polymer biocomposites was reduced with addition of coupling agent, irrespective of the polymer matrix. Finally, the experimental data were compared with several theoretical models as Tsai–Pagano to determine the intrinsic elastic modulus of individual bio-filler particle and results are promising. This study represents a new opportunity to valorize biomass residues into green materials, which could reduce domestic dependence on petroleum-based thermoplastics.

References

[1] Tiouitchi G, Raji M, Mounkachi O, Ali MA, Mahmoud A, Boschini F, et al. Black phosphorus-based polyvinylidene fluoride nanocomposites: Synthesis, processing and characterization. Compos Part B Eng 2019;175:107165.

ANTIOXIDANT AND ANTICHOLINESTERASE ACTIVITIES OF FRUITS AND STALKS OF THREE VARIETIES OF ALGERIAN *PHOENIX DACTYLIFERA* L.

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Keywords: Phoenix dactylifera, Fruits, Jam, Stalks, Antioxidant, Anticholinesterase

ABSTRACT

Phoenix dactylifera L. is a monocotyledonous woody perennial species of the Arecaceae family. The nutrition values and health benefits of date palm is well known [1]. Phoenix dactylifera fruits are commonly consumed in many Arabian countries. Algeria is one of the most important producer of date in the world. Various parts of Phoenix dactylifera are widely used in traditional medicine for the treatment of various disorders which include memory disturbances, fever and inflammation [2]. Fruits, Jam and stalks of three varieties of Algerian dates, Deglet Nour (Zelfana), Hmaira (Adrar) and Azerza (Ghardaia) were investigated for their antioxidant effect and inhibitory potential of acetylcholinesterase (AChE) and butyrycholinesterase (BChE). The results showed that Deglet Nour stalks from Ghardaia showed the best antioxidant activity in DDPH method (IC50: 57.11±1.09 µg/mL) and the highest AChE (IC50: 80.07±1.13 µg/mL) and BChE (IC50: 39.86±1.72 µg/mL) inhibition effect which may be due to their highest polyphenols content. Thus, stalks of Deglet Nour variety from Ghardaia may find applications as a source of antioxidant and anti-Alzheimer agent.

References

[1] M. Boukouada M, Yousfi, Phytochemical study of date seeds lipids of three fruits (Phoenix dactylifera) produced in Ouargla, Annales de la Faculté des Sciences et Sciences de l'Ingénieur 1(3) (2009). 1-9.

[2] N. Echegaray, M. Pateiro, B. Gullón, R. Amarowicz, J.M. Misihairabgwi, JM. .Lorenzo, Phoenix dactylifera products in human health – A review, Trends in Food Science & Technology 105 (2020) 238-250.

BIOLOGICAL POTENTIAL OF PITS AND VINEGAR FROM OF VARIETIES OF ALGERIAN *PHOENIX DACTYLIFERA* L.

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Keywords: Phoenix dactylifera L., Pits, Vinegar, Biological activities

ABSTRACT

From ancient times, Phoenix dactylifera L. has been used as a food and in folk medicine due to its recognized nutritional value and health benefits. Algeria is considered as one of the major date producing countries with Deglet Nour as one of the best varieties. Different parts of palm date (fruits, leaves, pits and pollen) have been reported to treat various health diseases including inflammation [1,2]. Pits and vinegar of three varieties of Algerian dates, Deglet Nour (Zelfana), Hmaira (Adrar) and Azerza (Ghardaia) were investigated for their antioxidant activity by the use of three methods (DPPH, ABTS and CUPRAC) and inhibitory potential of acetylcholinesterase (AChE) and butyrycholinesterase (BChE). Pits of Deglet Nour from Ghardaia exhibited the highest antioxidant activity in ABTS method (IC50: 35.01±0.18 µg/mL) whereas the vinegar from Zelfana showed the highest activity with DPPH method (IC50:145.27±2.13 µg/mL) but it was lower than the pit's. The powdered pits were extracted with a Soxhlet using n-hexane. Concentration under reduced pressure afforded an oil which was analyzed by GC and GC/MS revealing the presence of 1,2,3-propanetriyl tris[(E)-9-octadecenoate] (11.52%), dodecanoic acid (9.75%), oleic acid methyl ester (7.17%) and oleic acid (5.99 %) as the major components. Furthermore, pits from Ghardaia showed the highest AChE (IC50: 60.97±1.02 µg/mL) and BChE (IC50: 480.09±0.23 µg/mL) inhibition effect whereas the vinegar did not show any activity. These results suggest the application of pits of Deglet Nour from Ghardaia and Zelfana as antioxidant and anti-Alzheimer agents.

References

[1] S.R. Bhat, S. Al-Daihan, Antibacterial properties of different cultivars of Phoenix dactylifera L. and their corresponding protein content, Annals of Biological Research, 3 (2012) 4751-4757.

[2] H. E.Kehili, S. Zerizer, K.A. Beladjila, Z. Kabouche, Anti-inflammatory effect of Algerian date fruit (Phoenix dactylifera) Food and Agricultural Immunology 27 (2016) 820–829.

LEAN MANUFACTURING IMPLEMENTATION IN THE BIO-COMPOSITE INDUSTRY: A BIBLIOMETRIC ANALYSIS OF WOOD AND PALM-BASED PRODUCTS

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Keywords: Lean Manufacturing, Bio-composite, Wood Products, Palm-based Products, Bibliometric

ABSTRACT

High levels of scrap remain a problem for many small and medium-sized enterprises (SMEs). Lean manufacturing is just one of several methods used to reduce waste while simultaneously improving efficiency, fostering company culture, and increasing or preserving customer happiness [1-7]. The purpose of this study is to conduct a bibliometric analysis of research on the lean manufacturing implementation in the bio-composite industry within the context of the bioresources products, such as wood and palm, and to determine which raw materials are most used in its manufacture. The analysis was conducted based on a search for scientific articles (peer-reviewed papers) at the Scopus database from 1989 to June 2023 specifically for the wood and palm. A performance analysis was carried out by applying a descriptive and metric approach concerning research constituents (authors, institutions, countries and keywords) and science mapping to clarify scientific collaborations and cognitive and intellectual structure patterns by using the VOSviewer software. The retrieved papers were assessed separately to categorize the studies that examined wood and palm product manufacturing while using lean manufacturing techniques. Interestingly, there were 99 scientific papers that met the screening criteria, and the first publication on lean implementation in the wood and palm-based businesses was recorded in 2003, accordingly revealing that the lean concept is new for practitioners. The present study offers a valuable insight into the development of a lean implementation framework specifically for the wood and palm-based products and is the first attempt to examining the industry-level variable which can lead to new theoretical insight.

References

[1] Abu, F., et al., Pathways of lean manufacturing in wood and furniture industries: a bibliometric and systematic review. European Journal of Wood and Wood Products, 2021. 79(4): p. 753-772.

SOLAR DRIVEN INTERFACIAL EVAPORATION SYSTEM USING DATE PALM BIOCHAR AND BIOPOLYMERIC NANOFIBEROUS MEMBRANES

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Keywords: Water Purification, Interfacial Evaporation, Solar Driven Interfacial Evaporation, Palm Biochar membrane.

ABSTRACT

The deficiency of drinkable water on earth has become a critical crisis for human beings and economic development. Mostly, conventional water purification techniques are utilized to meet the demand for fresh water; however, high costs, environmental pollution, and intensive energy consumption are major hindrances. Solar driven interfacial evaporation (SDIE) is considered as a very viable alternative to conventional water treatment techniques due to the utilization of solar energy to generate localized heat in order to enhance evaporation efficiency, low cost, and sustainability. It has potential applications in seawater desalination, power generation, and wastewater purification. The interfacial evaporator consists of a solar energy absorption layer and a substrate for thermal insulation and water transportation. However, the water vapor transfer rate is restricted by the solar energy absorption capacity of photothermal materials. In this work, the use of membranes composed of environmentally friendly biopolymer and biochar extracted from palm trees fibers is used for the solar driven interfacial evaporation process. This is achieved by utilizing the combination of phase inversion and electrospinning techniques. The solar absorption membrane, consisting of palm-based biochar and fabricated by phase inversion technique, is able to absorb a broad band of light and generate effective localized heat. Electrospinning is used to fabricate the substrate membrane by using biopolymer. In order to ensure stability of the form of the membrane, a heat treatment process employed to couple the palm biochar evaporator membrane with substrate membrane. Efficiency of membranes is characterized in terms of the evaporation rate (kgm-2h-1) under one sun irradiation intensity (1 kW m-2).

MICROWAVE-ASSISTED PRODUCTION OF HYDROCHAR BY HYDROTHERMAL CARBONIZATION OF DATE PALM BIOMASS AND ITS APPLICATION TO THE REMOVAL OF DYES FROM WASTEWATER

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Keywords: Date palm biomass, Hydrothermal carbonization, Microwave, Hydrochar, Dyes removal

ABSTRACT

This study presents new findings on the synthesis of hydrochar from date palm (Phoenix dactylifera) seeds using the microwave hydrothermal carbonization (HTC) process. Different powers, temperatures, and reaction times were investigated to obtain the highest yield. The maximum yield that was obtained is 0.46%. The prepared material was then impregnated in phosphoric acid and carbonized in the tube furnace at three different temperatures (450, 500, and 650 ^{o}C) for 1.5 hours with a nitrogen flow of 50 CCM. The samples were analyzed before and after activation by scanning electron microscopy (SEM), Brunauer–Emmet–Teller (BET), Fourier transform infrared (FTIR), and elemental analysis (CHNS). After activation, the samples exhibited high BET surface areas of up to 1500 m^2/g. The prepared material was tested for adsorption of methylene blue and reached a maximum adsorption capacity of 400 mg/g. The results reveal that the microwave assisted method is a viable alternative to the conventional hydrothermal method to produce hydrochar at lower temperatures and in a shorter time.

OPTIMIZATION OF PROCESS CONDITIONS FOR THE SYNTHESIS OF HIGH EFFICACY ACTIVATED CARBON FROM PALM LEAFLET WASTES FOR CO_2 CAPTURE

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Keywords: Carbon capture, date-palm leaflet waste, activated carbon, pyrolysis

ABSTRACT

The incessant increase of the green-house gases in the atmosphere, contributed mainly by the emission of the carbon dioxide (CO2), is the primary cause of the global warming [1, 2]. Inevitably, the development of technologies for the efficient and cost-effective carbon dioxide capture is the foremost need of the hour. Another important environmental challenge is the sustainable disposal of the ever-increasing amount of wastes to produce value added products. Therefore, the present research utilized the most abundant agricultural waste in the Kingdom, i.e. date-palm leaflets for the optimal synthesis of high efficacy activated carbon (AC) for the adsorptive removal of carbon dioxide from flue gases [3-5]. Using local date-palm leaflets waste as precursor, the synthesis conditions for the preparation of the AC from biochar were optimized. The effect of three key variables, namely the chemical activator/biochar mass ratio (KOH/C), pyrolysis temperature and pyrolysis duration, were assessed on the adsorbent's carbon capture capacity as a part of the present optimization study. The adsorbed amount of CO2 on the optimal sample at 1 bar was as high as 6.71 and 4.21 mmol g^{-1} at 273 and 298 K, respectively, which is a twofold enhancement in the carbon capture capacity as compared to that of the commercial AC at identical conditions. Because the morphological evolution of the internal pore structure during the pyrolysis process critically affects the CO2 adsorption capacity, the different samples of ACs prepared were thoroughly characterized for their physical, and chemical properties in addition to surface texture using different advanced techniques, such as elemental analyzer (CHN), BET specific surface area, SEM and FTIR in order to correlate their properties with their carbon dioxide removal potential. Moreover, the isosteric enthalpy of adsorption was evaluated with the help of the Clausius-Clapeyron equation by carrying out experiments at different temperatures.

References

[1] Huaman, R.N.E. and T.X. Jun, Energy related CO2 emissions and the progress on CCS projects: a review. Renewable and Sustainable Energy Reviews, 2014. 31: p. 368-385.

[2] Ritchie, H. and M. Roser, CO_2 and greenhouse gas emissions. Our world in data, 2020.

[3] Hussain, A., et al., Pyrolysis of Saudi Arabian date palm waste: A viable option for converting waste into wealth. Life Sci. J., 2014. 11: p. 667–671.

THE DATE PALM (PHOENIX DACTYLIFERA L.)FROM ALGERIA: AN OVERVIEW OF BIOLOGY, USES, AND CULTIVATION

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Keywords: Date palm, Biology, Uses and cultivation, Algeria

ABSTRACT

Date palm (Phoenix dactylifera L.) is a fruit-bearing palm tree native to North Africa, specifically originating from the region of Algeria. This tree holds significant cultural, economic, and nutritional importance in Algeria and throughout the world. Here's an overview of its biology, uses, and cultivation:

Culinary Uses: Dates are consumed both fresh and dried. Fresh dates are sweet and have a soft texture, while dried dates are commonly found in markets around the world and are often used in various culinary preparations, desserts, and snacks.

Nutritional Value: Dates are rich in carbohydrates, particularly natural sugars like glucose and fructose, making them a good source of quick energy. They also contain essential vitamins and minerals, including potassium, magnesium, and vitamin B6.

Traditional Medicine: In some cultures, various parts of the date palm tree, including the leaves, sap, and fruit, have been used in traditional medicine for their potential health benefits.

Livestock Feed: Date palm by-products, such as date pits and leaves, can be used as fodder for livestock.

Crafts and Construction: The leaves and stems of the date palm are used in crafting items like baskets, mats, and traditional roofs in some regions.

Economic Importance: Date cultivation and trade have significant economic value in countries like Algeria, contributing to local and national economies.

SUBMERGED CULTIVATION OF *SCHIZOPHYLLUM COMMUNE* ON DATE PALM RESIDUES

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Keywords: Nanomaterials, Processing, Microstructure, Microfluidics, Date palm residue, Schizophyllum commune, Basidiomycota, SPG production.

ABSTRACT

Schizophyllan (SPG) is a gel-forming b-glucan produce by the edible fungus Schizophyllum commune (Basidiomycota) and appreciated as a multipurpose compound applicable in many fields, including food industry and pharmacy as important for the prevention of Alzheimer's disease. Submerged cultivation of Turkish isolate of S. commune using different proportion of date palm residues (seeds + leaves). The growth, nutritional value and SPG production were variable significantly based on the proportion of residue mixture. The optimum fungal growth was accompanied with more seeds content, however the maximum SPG production was associated with balance content of both seeds and leaves. The higher protein content in the basidiocarp found with cultivation the basidiomycete on medium with high leaves content, however the lipids content detected with higher seeds content of the mixture. No significant changes were detected with changing the proportion of date palm residues in the culture medium. The study revealed that the cultivated the Turkish strain of S. commune has a moderately higher nutritional content with regards to fats, crude proteins, total carbohydrates and SPG production. The obtained results were discussed from the agro-bio-ecological point of view, to use the date palm residue for simple and healthy food production.

References

[1] J. Miškovič, M. Karaman, M. Rašeta, N. Krsmanovič, S. Berežni, D. Jakovljevič, F. Piattoni, A. Zambonelli, Gargano M.L., Venturella G., Comparison of Two Schizophyllum commune Strains in Production of Acetylcholinesterase Inhibitors and Antioxidants from Submerged Cultivation. J. Fungi 2021, 7, 115. https://doi.org/10.3390/jof7020115

ANTIOXIDANT ACTIVITY AND PHENOLIC CONTENT OF EXTRACTS FROM TWO VARIETIES OF DATES GROWN IN TUNISIA

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Keywords: Date fruits, antioxidant, phenolic compounds, flavonoids, biomolecules.

ABSTRACT

In Tunisia, the date palm sector plays a very important role in the southern Tunisian regions on social, economic, and ecological levels. It is directly or indirectly a source of life through its production of dates and through the various uses of its by-products for the oasis dwellers. Indeed, dates have been, since time immemorial, a very important element in the diet, both for humans and for animals. In this context, this present work aims to evaluate the antioxidant activity and the contents of total phenolic compounds, flavonoids, and condensed tannins in the extracts of two varieties of Tunisian dates: Daglet Nour and Boufagous. The extraction was carried out by soxhlet using ethanol, ethyl acetate, and petroleum ether as solvents. The results show that the ethanolic extracts have higher contents of total phenolic compounds, flavonoids, and condensed tannins than those of the ethyl acetate and petroleum ether extracts. The ethanolic extract of Daglet Nour has contents in total phenolic compounds and condensed tannins clearly higher than those of the Boufagous variety. However, the ethanolic extract of Boufagous is richer in flavonoids than that of Daglet Nour. The antioxidant activity study (DPPH test) shows increased activity in the ethanolic extract of Daglet Nour in comparison with that of the Boufagous variety. This activity can be explained by the high levels of phenolic compounds and flavonoids in the extracts of the two types of dates, which can be seen in the profiles of the HPLC chromatographic analyses of the extracts. These compounds include gallic acid, catechin, p-hydroxybenzoic acid, syringic acid, vanillic acid, caffeic acid, p-coumaric acid, ferulic acid, rutin, quercetin, and kampferol. Phenolics are compounds that have more than one hydroxyl group attached to one or more benzene rings, which allows them to act as reducing initiators, chelating agents, or by preventing oxidative reactions caused by active singlet oxygen [1-3]. The richest composition in antioxidant compounds and the higher antioxidant capacity activity of ethanolic extracts from date fruits can improve the use of these fruits in various fields, such as the pharmaceutical, cosmetic, and agroalimentary industries.

DESIGN OF SUSTAINABLE OIL SPILL CLEANUP ADSORBENT MATERIAL USING AGRICULTURE WASTE

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Keywords: Oil, Hydrochar, Agriculture Waste.

ABSTRACT

Oil spills, one of the major causes of water pollution, trigger severe environmental damage as well as economic catastrophes. It significantly reduces marine biodiversity by disrupting the environmental balance of the oceans and other water streams. Thus, sufficient oil cleanup response is mandatory to minimize the spillage's harsh effects and rehabilitate the environment. The project introduced the design of a sustainable, green, and cost-effective oil adsorbent material derived from agricultural waste. The abundance of biobased wasted materials, especially palm waste, within the Kingdom of Saudi Arabia (KSA) boarders made a clear design pathway targeting KSA's waste management plan and circular economy goals. Palm waste was synthesized using hydrothermal carbonization (HTC) process to produce Hydrochar (HC) at temperatures of 160, 180, and 200°C for 24hr. Response Surface Methodology (RSM) optimization tool was employed using Design of Expert software to adjust 3 design factors (oil concentration, adsorbent dosage, and contact time), and 2 responses were targeted (removal efficiency and adsorption capacity). ASTM standards (F1780-18, F726-12) have been utilized to test the adsorption system recovery effectiveness and adsorbent performance respectively using lab bench scale model. Raw biomass and Hydrochar produced at different temperatures were analyzed for both contact angle and Scanning Electron Microscopy (SEM). The contact angle associated with HC-200 reached 146° which indicates high hydrophobicity. Moreover, the SEM tests demonstrate that HC-200 showed a wider fiber structure with a high porous surface area allowing oil to penetrate. While performing the experimental absorbency test, HC-200 attained a maximum of 98% and 8.72g/g removal efficiency and adsorption capacity, respectively. Promising outcomes were accomplished in both oil recovery and regeneration that aspire further research. The originality of the design showed potential results intending to support Kingdom of Saudi Arabia waste management plan that promotes circular economy objectives.

STABILIZATION OF SUNFLOWER OIL DURING ACCELERATED STORAGE: USE OF DATE PALM LEAVES EXTRACT AS A POTENTIAL ALTERNATIVE TO SYNTHETIC ANTIOXIDANTS

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Keywords: Date Palm Leaves, Sunflower oil, Antioxidant activity, Thermal stability

ABSTRACT

Date palm leaves (DPL) are considered as an agricultural waste. This study has evaluated influence of date palm leaves extract (DPLE) on stabilization of sunflower oil (SFO). Antioxidant efficacy of DPLE extract has been estimated in stabilization of sunflower oil. Ethanolic extract was found to be highest in yield 24.72% and antioxidant activity IC50 = 2.573 ug mL Trolox. DPLE at concentrations of 400, 600, 800, 1000,1200,1500 ppm was added to sunflower oil samples. As standard, synthetic antioxidant Tert-Butylhydroquinone (TBHQ) of 200 ppm was used as a control. The oxidative properties of sunflower oil supplemented with date palm leaves extract at different concentrations in comparison with (TBHQ) at 200 ppm, were investigated beside control sample. The supplemented sunflower oil samples were stored under accelerated conditions for 20 days at 65°C (the temperature of 65°C was selected as a speedy technique to imitate the storage in actual conditions, and each day under such oven storage test at 65°C is comparable to one month of storage at the typical room temperature). For every 5- day interval, the oxidative properties of the supplemented sunflower oil were evaluated based on the following tests, Peroxide value (PV), P-anisidine value (p-AnV), Thiobarbituric Acid Reactive Substances (TBARS) assay, Iodine value (IV) and free fatty acids (FFAs). The Total Oxidation (TOTOX) values were also calculated based on the peroxide values and p-anisidine values. Results from different parameters were in agreement with each other, suggesting higher efficiency of SFO-1500 ppm followed by SFO-TBHQ followed by SFO-1200 samples, respectively. As a result, show DPLE to be a potent antioxidant for stabilizing sunflower oil during high temperatures during storage, and this effect will be more effective if the oil is stored in a dark place. This will prolong the oil's shelf life. Due to its strong free radical activity and phytochemical content to delay lipid oxidation, DPLE might be employed as an antioxidant in the oil industry.

References

[1] Abuelgassim, A. O. (2020). Towards the utilization of date palm (Phoenix dactylifera) leaves as a rich source of antioxidants. J. Food Nutr. Res, 8, 632-637.

CHARACTERIZATION OF THAILAND OIL PALM: ANATOMICAL, PHYSICAL, AND MECHANICAL PROPERTIES

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Keywords: Oil palm wood, Anatomical properties, Vascular bundles, Timber grading

ABSTRACT

This study examined the anatomical, physical, and mechanical properties of oil palm wood in Thailand to improve product design, engineering of product properties, and wood processing. Various laboratory tests were conducted, including measurements of frequency, diameter, area, cross-cut area, and density of vascular bundles, as well as ultimate tensile strength, modulus of elasticity, and compression strength parallel to the grain of the wood. The findings revealed a close relationship between the density and mechanical properties of oil palm wood and its anatomical characteristics. As the radial distance from the inner to the outer zone of the trunk increased, all properties, including wood density, frequency of vascular bundles, and mechanical properties, also increased. Furthermore, the properties of density and strength decreased from the bottom to the top of the trunk. These fundamental studies can be used to develop a mechanical model for palm wood, which could explain most mechanical properties based on the wood's structure and density. Such a model is valuable for the development of timber lumber grading strategies and methods.

CONCEPTUAL DESIGN OF ZERO WASTE DATES PROCESSING: *FROM DATES* TO *VALUABLE PRODUCTS AND* BYPRODUCTS

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Keywords: Dates Processing plant, Date Syrup, Fructose, Ethanol, Dates seed oil.

ABSTRACT

Date palm is a socio-economically and traditionally important crop in north Africa and the middle East. With a production of 1.54 tons and more than 300 varieties of dates, Saudi Arabia is one of largest producers worldwide. For the most part, these dates are used for domestic consumption; in recent years however, many small to medium size companies started to valorize dates by transforming them into valuable products and byproducts such as syrups, sugar crystals, medical grade alcohol, etc. Dates are rich in carbohydrates and other nutrients such as minerals, proteins, fats, and vitamins. The present work is a capstone design project aiming to explore ways of transforming dates into added value products and byproducts. In the framework of zero waste transformation, an integrated dates valorization plant consisting of three processing lines has been optimized. The first processing line is Date syrup extraction, the second processing line is the selective fermentation of 50% of the extracted Date syrup to produce Fructose and Ethanol. The third production line aims at utilizing the seeds to extract Date seed oil. As a case-study, the project targeted the design a plant to transform 100 kt/y of raw dates. The plant is projected to produce about 47.15 kt/y syrup, 17.8 kt/y Fructose, 6.62 kt/y Ethanol, 1.26 kt/y seed oil, 9.79 kt/y Animal Feed, and 3.83 kt/y Carbon dioxide. Based on material and energy balances, equipment sizing had been performed. An economic analysis showed that the payback period is 4 years with a profit of $11.63 million.

DESIGN, PROCESSING, TESTING AND CHARACTERIZING FOR ORTHODONTICS OF PALM-FIBERS BASED BIO-NANOCOMPOSITE

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Keywords: Dental biomaterials, layered zirconium nanocomposites, orthodontics, palm fibers bio-nanocomposites.

ABSTRACT

The high necessity for finding new bio-materials and new techniques for dental materials for restoration and orthodontics with high bio-compatibility with human bones and tissue, force the researchers to look for natural nanocomposites. Due to the rare of such these types of materials naturally the researchers use layered-materials containing ceramics and metals like zirconium and titanium. The dental biomaterials should have special mechanical, chemical, thermal and fracture properties to resist the effects of occlusal loads of mastication on the short and long run with sustainability avoiding any serious side effect or diseases for the human body with orofacial esthetics and normal lingual ability. The previous and recent existing bio-dental materials still have serious problems. In the current research, we are introducing a new bio-dental nanocomposite with new techniques for applications for different types of orthodontics such as dental crowns, dental abutments, different types of dental bridges and dental implants. The current dental material is bio-nanocomposites made of several different types of materials such as zirconium stabilized yttrium, special types of hybrid palm- fibers based nanocomposites, and others. The study included processing, design, testing and characterization of different properties. The testing included detailed fundamental experimental work for investigation of the mechanical and fracture properties based of the recent advances of fundamental applications of fracture mechanics science and theories. The characterization included the investigation of chemical composition, microstructure, homogeneity, morphological aspects of producing best bio-compatible nanocomposites for safe dental applications with safe healthy techniques for clinical applications and restoration technologies. The results and comparison are promising for a new era of dental applications which encourage the researchers, dentists and dental-companies for extra research to stabilize these natural based bio-nanocomposites for human applications with reducing the time and cost while other previous materials and techniques are very expensive and need long-time of implementation.

UTILIZATION OF DATE PALM WASTE IN GREEN COMPOSITES: THERMAL, PHYSICAL AND MECHANICAL PROPERTIES

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Keywords: date palm waste, green composites, bio-polyester, natural fiber, poly lactic acid, poly(β-hydroxybutyrate)

ABSTRACT

The use of natural fiber–reinforced bio-composites has been increasing over the past decade in different engineering applications. The date palm waste is considered as one of the major sources of natural fibers in the MENA region. In this work, a comparison between the performance of different types of date palm waste and different types of bio-polyesters to form green composites is presented. Green composites consisting of date palm waste (date palm wood (DPW) or date pits (DPP)) and bio-polyesters (polylactic acid (PLA) or poly(β-hydroxybutyrate) (PHB)) were prepared. Date palm waste (10–50 wt.%) was mixed with bio-polyester in a melt extruder, followed by compression molding and annealing processes. The composites were investigated to evaluate their physical (density, water absorption and degree of crystallization), thermal (thermal conductivity, thermal diffusivity, glass transition and melting temperature) and mechanical properties. In addition, the structure of the developed composites was characterized by FTIR, XRD and SEM techniques. The characterized properties of the developed composites displayed that a thermally stable composite material with insulation and construction capacity can be produced by the addition of date palm waste to bio-polyester matrix. Different chemical treatments were applied on date palm fibers to overcome some major drawbacks of natural fiber-based composites like high water retention and low mechanical strength. The results of this work revealed that recycling of date palm waste, which is cheap, as filler materials for green composites, is of significant benefits to both the economy and environment. Moreover, date palm waste-based composites have promising properties and could be used in several industrial and domestic applications.

A NEW OPTIMIZED GREEN COMPOSITE BASED ON POLYLACTIC ACID MIXED WITH DATE PALM WASTE FOR BIODEGRADABLE PLASTIC CUTLERY

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Keywords: date palm waste, biodegradable, PLA, single-use plastics, green composites, plasticizer, antioxidant, antiaging, anticaking

ABSTRACT

Petroleum-based plastic is extensively used in practically all fields and approximately 300 million tons of plastic waste is produced worldwide every year (Single-Use Plastics 101, 2020). Half of the plastic waste comes from single-use products, such as plastic bottles and plastic cutlery, used just once and then discarded. This work utilizes date palm rachis waste (DPW) mixed with polylactic acid (PLA) derived from natural resources for the production of green biodegradable composites intended for cutlery and packaging applications. The UAE produces 500,000 tons of date palm waste every year (Waste and Recycling Middle East and Africa, 2019). These are disposed of in landfills or burned in farms causing environmental pollution. The date palm waste was used without any chemical treatment or surface modification to avoid the use of chemicals in food-grade applications, save energy, and reduce production costs. DPW–PLA cutlery such as spoon, knife, fork, and stirrer were developed using a melt-mixing extruder at 180°C by varying the date palm waste composition between 20 wt% to 27 wt% followed by injection molding. Additives such as food-grade PE wax, zinc stearate, antioxidant, and stearic acid were added with a total of around 5 wt% to optimize the composite formula. Scanning electron microscopy (SEM) images illustrated that the biomass is well distributed in the PLA matrix for all formulas. All formulas showed high thermal stability up to 95% upon using Thermogravimetric Analysis and melt flow index (MFI) below 30 g/10 minutes. The tested formulas showed acceptable tensile strength (39-42 MPa) and young modulus of elasticity (1.4-1.8 GPa) intended to be used for biodegradable cutlery closer to that of petroleum-based plastics such as PET, PS, and PP. This study is the first of its kind developed from date palm waste to build a new economy that helps replace single-use plastics in the UAE and beyond.

SEPARATION AND IDENTIFICATION OF FATTY ACIDS FROM DATE SEED OIL USING GS-MS GAS CHROMATOGRAPHY MASS SPECTROSCOPY

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Keywords: GS-MS, Fatty Acids From Date Seed Oil , Extraction Of Mineral Elements From Ground Date Seed Oil, Extraction Of Phenols From Ground Date Seed Oil, Date Varieties, DateSeed, Ground Date Seed Oil, Food Products Manufactured From Ground Date Seed Oil (Mayonnaise, Bread, Chocolate)

ABSTRACT

This study was conducted for the purpose of extracting oil from ground date pits (Phoenix dactylifera L.) after conducting physical and chemical analyzes of the fruits and pits of three local Iraqi varieties, namely Al-Zahdi, Al-Halawi, and Al-Sair, using the Soxolite method. The total content of phenols, unsaponifiables, and mineral elements was estimated, and the content of vitamin E (tocopherol) was estimated using a high-performance liquid chromatography (HPLC) device. The extracted oil content of total saturated and unsaturated fatty acids was studied and diagnostic tests were conducted using a Gas Chromatography / Mass Spectrometry (GC/MS) device. The results were analyzed statistically using the ready-made statistical program SPSS and a completely randomized design (CRD) with three replications, with the studied factors tested for least significant difference (R.L.S.D) at the probability level (0.05).

The results were as follows:

1- The results of the statistical analysis of the physical characteristics of the date varieties showed a significant difference in weight, length, volume, flesh weight and diameter, where the Al-Halawi variety was superior in terms of pit weight (1.05) grams, then Al -Zahdi (0.89) grams, and finally Al-Sayer (0.74) grams.

2-Many differences appeared in the chemical properties of the extracted crude oil, such as moisture, ash, protein, oil, and carbohydrates, where the Al-Zahdi variety was superior in the percentage of carbohydrates (80.62%), moisture (4.77%), and the percentage of oil (8.48%), while the Al-Sayer variety was superior in the percentage of protein (6.25%) and sweets in ash percentage (1.18%)

3-The Al-Zahdi variety was superior in its content of unsaponifiables (0.97%), its total phenols content was 520.40 mg, gallic acid/100g, and vitamin E (27.46) ppm.

4-The content of the Al-Halawi variety of mineral elements was 8.43, 36.55, 0.039, and 1.2 ppm for iron, magnesium, zinc, and phosphorus, respectively, and in Al-Sayer 6.078, 27.36, 0.027, and 0.911 ppm, respectively, and in Al-Zahdi 6.66, 22.97, 0.026, 0.93 ppm on straight.

5-The fatty acid content of the kernel oil included unsaturated fatty acids (oleic and linoleic) and saturated fatty acids (caprylic, capric, lauric, myristic, palmitic, stearic, and arachidic.

6-Sensory tests of mayonnaise made with kernel oil showed significant superiority compared to commercial mayonnaise, especially in terms of general acceptability Search for details

UTILIZING DATE PITS IN MICROENCAPSULATION: EFFECT OF DIFFERENT VARIATIONS ON PROBIOTIC SURVIVABILITY UNDER IN-VITRO DIGESTION

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Keywords: Date pit, Encapsulation, Gravitational dripping, Probiotics, Streptococcus thermophilus.

ABSTRACT

This study's primary goal was to examine the release of probiotics (such as Streptococcus thermophilus) from varieties of date pit within formed beads into the human intestine. An in-vitro procedure was utilized to examine the digested beads and the release of live probiotic cells after the beads were created using the gravity dripping approach. For Raziz, Naghal, and Khadrawy date varieties, the best ratio was 0.10 g of date pit powder per 0.20 g of sodium alginate (0.5:1 ratio), resulting in viable probiotic cell counts of log10 5.8, 5.3, and 4.7 CFU/ml, respectively. However, Lulu date pit powder required an equal ratio of 0.20 g each of date powder and sodium alginate (1:1 ratio) to achieve the highest desired viable cell count. On the other hand, Naptit Saif required the least amount of date pit powder in the mixture to obtain the highest viable probiotic cell count of log10 6.2 CFU/ml. The use of date pit powder as an encapsulation material demonstrated promising results for protecting and delivering beneficial probiotics to the target organ of the body, the intestine. Significantly, the effectiveness of the encapsulation method is evident from the number of viable probiotics observed after simulating the digestive system. In unencapsulated probiotics, there were no live probiotic cells, whereas in encapsulated samples, the viability varied, with some reaching a cell count as high as log10 6.2 CFU/ml. This indicates that the encapsulation process successfully shielded the probiotics from degradation in the harsh environment of the digestive system.

COMPARATIVE STUDY OF MECHANICAL BEHAVIOR BETWEEN AN ADHESIVE MADE FROM DATE PALM WASTE AND FM-73 ADHESIVE

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Keywords: Date palm waste, Adhesive, Crack propagation, Composite, Patch, NASGRO model.

ABSTRACT

The thickness of the adhesive has a major influence on the shear strength of bonded assemblies. This work is based on a study of the fatigue behavior of two cracked aluminum (2024 T351) plates repaired by patch (graphit/epoxy) under cyclic loading. For this we used a computer code to study the propagation of fatigue cracks to predict the life of the plates repaired named AFGROW. The first plate was repaired using an adhesive made from date palm waste whereas the second plate was repaired using FM-73 adhesive. The results obtained from this study show that, despite the low shear modulus of the adhesive made from date palm waste and the very low film thickness, the joint bonded with the latter gives good joint strength and a lifetime (number of cycles) similar to the joint bonded with the FM-73 adhesive when the thickness of the joint of the adhesive is greater than that of the adhesive made by the waste of the date palm. This shows that the strength of the bonded joint increases rapidly from very low thicknesses (less than a few hundredths of a millimeter). Finally we recommend using the adhesive made from date palm waste for patch repair as well as for applications such as lightweight construction, electric vehicles or solar panels.

References

[1] Moulgada et al. Study of mechanical behavior by fatigue of a cracked plate repaired by different composite patches, Frattura ed Integrità Strutturale 15 195-202. (2021)

[2] Maleki, et al. The fatigue failure study of repaired aluminum plates by composite patches using acoustic emission. Engineering Fracture Mechanics 210 300-311(2019)

[3] Maierhofer, R. Pippan, and H-P. Gänser Modified NASGRO equation for physically short cracks. International Journal of fatigue 59 200-207. (2014)

[4] L. Rezgani., K. Madani, M. Mokhtari, X. Feaugas, S. Cohendoz, S. Touzain, & S. Mallarino Hygrothermal ageing effect of ADEKIT A140 adhesive on the J-integral of a plate repaired by composite patch. Journal of adhesion science and Technology 32(13) 1393-1409. (2018)

SELECTIVE FERMENTATION OF WASTED SAUDI DATES' SYRUPS INTO FRUCTOSE AND BIOETHANOL OR SINGLE CELL PROTEIN

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Keywords: Dates syrup, Fructose, Glucose, Ethanol, Single cell protein

ABSTRACT

The Kingdom of Saudi Arabia (KSA) is one of the top dates' fruits producer in the world; KSA produces over one million tons annually. About 25-35% of this quantity is unused because of low quality or damaged dates. These wasted quantities can be used to produce many added-value product. The main sugars in dates' syrups are glucose and fructose, in almost equal amounts; both constitute over 75% of dates' dry weight. In this contribution, selective fermentation of glucose has been used to produce fructose, and ethanol or single cell protein. Mutant yeasts Saccharomyces Cerevisiae ATCC36858 and ATCC36859 are used to perform the selective fermentation. Fructose and ethanol are produced under anaerobic conditions whereas fructose and single cell protein under aerobic conditions. Proper yeast propagation media, extracted dates' syrup, and fermentation media have been prepared and used; the fermentations were conducted at 30 and 33ºC. Various instruments, such as HPLC, cell counter, spectrometers have been used to determine the concentrations of glucose, fructose, sucrose, ethanol, and cells as well as pH. Three fermentors of sizes 1L, 7.5L and 80L were used to elucidate scale up problems; working volumes of 0.4:4:40 liters respectively. For comparison purposes, a wild strain of Saccharomyces Cerevisiae was used. At 30ºC, the average percentage fructose yield and the percentage ethanol yield in the three fermentor was 98+0.3 and 72.8+1.76 for ATCC36858 and 94.2+0.98 and 68.6+1.13 for ATCC36859. Similar results were obtained at 33ºC. The aerobic fermentation revealed that over 90% fructose yield and single cell yields ranging 0.19-0.4 gcelsl/gglucose when the initial substrate concentration is changed from 84-20g/L. when the air flow rate was in the range of 0.1-1.25 vvm, the fructose yield was over 91% and average cell yield was 0.2 g/g. A conceptual block diagram for commercial production of fructose-ethanol and for fructose-cell will be presented.

INVESTIGATION ON THE PROCESSABILITY AND THERMAL ASPECTS OF DATE PALM NANOFILLER/POLYPROPYLENE BIOCOMPOSITES PROCESSED VIA MELT CAST FILM EXTRUSION.

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Keywords: Date Palm, Polypropylene, melt cast extrusion, Thermal analysis.

ABSTRACT

To preserve the environment and its resources for future generations, research must focus on alternate methods of producing materials that begin with an environmentally friendly and sustainable source. In view of this, nanosize reinforcing fillers were obtained from date palm agricultural waste. Date nanofillers (DNF) with typical filler sizes ranging from 30-110 nm in width and 1-10 mm in length were obtained using rotary mechanical ball milling methods. This filler was then dry blended with polypropylene (PP) to make a biocomposites thin film to study processability. The loading of this filler was kept in the range of 1-5wt. % and film were melt casted through slit height of 0.6 mm. The resulting PP/DNF biocomposites films were subsequently analyzed by various analytical techniques to establish structure property relationship. The change in thermal properties with loading of this filler was investigated using thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). The TGA analysis shows good thermal stability of these composite while DSC analysis revealed inconsistent and non-uniform melting behavior. The surface morphology of some samples shows the compact and smooth feature, indicating the incorporation of fiber fillers could improve the structure of polymer. Therefore, study gave some insight into the processing behavior of such composites, which may be useful in some packaging applications.

ENHANCING POLYMERIC MEMBRANES WITH LIGNIN FROM PALM TREE WASTE FOR EFFICIENT OILY WASTEWATER TREATMENT

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Keywords: Oases wastes, Lignin, Polymeric membranes, Oily wastewater treatment

ABSTRACT

Industries generate substantial volumes of oily wastewater, necessitating effective treatment methods like membrane microfiltration. In this study, we investigate the impact of incorporating lignin, extracted from waste oases, into polymeric membranes to improve their performance in treating oily wastewater. The membranes were prepared using waste low-density polyethylene (LDPE) as the polymer and xylene as the solvent [1], while lignin was extracted from Gabes oases waste using the Klason method [2]. The resulting membranes were characterized using FTIR, SEM, contact angle, and porosity analysis. The performance was assessed through dead-end microfiltration experiments. The results revealed a remarkable 102% increase in membrane porosity, reaching a value of 37.29% ± 1.26%, with a rise in lignin concentration in the polymeric solution from 0.125% to 0.5%. Moreover, a slight decrease in the contact angle indicated the membrane's maintained hydrophobicity. Dead-end microfiltration experiments used an oil solution with an oil concentration of 125 mg/L. The findings demonstrated that the membrane prepared with a 0.25% lignin concentration exhibited the highest oil rejection value of 97.2% and a permeate flux of 118.2 x 10-6 m3/m2s. These results strongly suggest that the incorporation of lignin into polymeric membranes significantly enhances their efficiency in treating oily wastewater. The increase in membrane porosity and the decrease in contact angle indicate that lignin plays a vital role in enhancing the membrane's capability to separate oil from water. Furthermore, this study highlights the environmental integration aspect of utilizing lignin, providing a more effective and sustainable approach to treating oily wastewater and reducing the environmental impact of industrial activities. The research contributes valuable insights to the palm products industry, offering a greener and more efficient solution for oily wastewater treatment.

References

[1] H. Ajari, A. Zrelli, B. Chaouchi, M. Pontie, Preparation and Characterization of Hydrophobic Flat Sheet Membranes Based on a Recycled Polyme, International Polymer Processing Journal 3 (2019) pp. 376-382.

THE USE OF BIOCHAR TO IMPROVE THE HYDRO-PHYSICAL PROPERTIES OF SANDY SOILS IN ARID REGIONS.

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ABSTRACT:

Coarse textured (sandy) soils (Typic Torrripsamments) dominate in arid regions such as Saudi Arabia, characterized by high infiltration, high evaporation, high hydraulic conductivity, and very low water holding capacity. Water management practices in conserving water for arid ese soils are crucial in sustaining agriculture and food production. Biochar research has received more significant interest in recent years because of its potential beneficial effects on soil properties and efficiency as a long-term C sequester. One of these uses is to mitigate the adverse effects of these properties by improving the hydro-physical properties of sandy soils. A series of soil columns experiments were conducted to investigate the application effects of date palm waste and Conocarpus biochar at different rates on evaporation, moisture distribution, infiltration, sorptivity (Sp), saturated hydraulic conductivity (Ksat), and water holding capacity (WHC). In addition, fieldwork has been conducted to study the effects of biochar on the production of cucumbers, sweet peppers, and tomatoes. Results showed that increasing biochar application reduced cumulative evaporation by 5.4% to 12.1%. Applying biochar enhanced the soil's capacity to retain water by 8.9%, 17.6%, 28.1%, and 30.9% for soils treated with 5, 10, 15, and 20 g kg−1 biochar rates, respectively. Water content at field capacity increased in the top 10 cm by 7.2% to 15.9%. Water-holding capacity was increased by increasing the application rate of biochar. The results showed that a reduction in the water supply caused significant decreases in the morphological traits of pepper plants during flowering, fruit set, and vigorous fruit-bearing stages. It can be concluded that the ability of biochar to reduce water evaporation and improve the water retention of coarse-textured sandy soils can help to enhance soil quality and productivity, reduce the amount of irrigation water, and maintain crop yields for crops exposed to water stress, especially in arid and semiarid regions.

PALM WASTE HEAT UTILIZATION IN COOLING AND DRYING OF DATES

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Keywords: Dates processing, Cooling, Drying, Palm leaves, Waste heat

ABSTRACT

Preservation of dates can be ensured by thermal and non-thermal methods. Heat treatment, refrigeration or drying are thermal methods commonly used to preserve dates for long periods. These methods are, however, energy intensive. There is a significant interest in considering renewable energy sources for such dates processes since using clean energy and taking energy efficiency measures are the key to achieve sustainability. A good number of works have been conducted on solar drying of this nutritious fruit. Additionally, heat available from combustion of dates palm agro-waste in the form of dried leaves and harvested palm waste can be recovered and utilized for cooling and drying of dates purposes. This work will be a feasibility study of using palm fronds and leaves as a biomass to be an alternative energy source to drive dates processing thermal methods. Therefore, dates processing devices such as cooling and drying systems can be driven by low cost and sustainable energy sources complying with the country's strategic vision. The work will propose and develop theoretical and numerical models based on mass and energy conservation principles to explore the impact of using palm waste heat in dates processing. The proposed systems for such combined processes will include a combustion device for the palm biomass waste, a cooling system based on absorption cooling process and a drying device. The theoretical model will consider the thermo-physical properties of palm leaves and fronds and dates as well as the design aspects of the cooling and drying systems to conduct several simulations on the overall performance of the combined process in terms of energy efficiency, quality of the products and other indicators.

EFFECT OF TREATMENT ON PROPERTIES OF NITRILE RUBBER REINFORCED WITH DATE PALM FIBERS

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Keywords: date palm fibers, nitrile rubber, natural fiber composite, fiber treatment.

ABSTRACT

In this research, different characterizations of nitrile rubber (NBR) reinforced with date palm fibers are discussed. Two types of fibers were used in this study a) untreated b) treated (washed with NaOH and addition of silane while mixing). With initial loading of DFPs (date palm fibers) without treatment the properties were deteriorated in comparison to the unfilled rubber. The tensile properties for untreated DPF filled composites were lesser in comparison to unfilled NBR, while treatment of fibers affects the tensile properties and slight increase in tensile strength was witnessed in comparison to the untreated counterpart. The elongation properties for the case of untreated fibers were comparable to unfilled NBR while after treatment the elongation was reduced due to coupling of fibers with the NBR after treatment. The tensile moduli of the samples prepared with untreated fibers were reduced when compared to NBR. However, after the fiber treatment the modulus was improved when compared with untreated counterpart thus indicating fiber matrix interaction after treatment. The influence of fiber addition (treated and untreated) on thermal properties was analyzed and it was found that DPF does not significantly influence the thermal properties of the composites.

EFFECT OF AGING ON PROPERTIES OF NITRILE RUBBER REINFORCED WITH DATE PALM FIBERS

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Keywords: date palm fibers, nitrile rubber, natural fiber composite, Aging.

ABSTRACT

In this study the nitrile rubber (NBR) was reinforced with Date palm fibers (DPFs). The fiber reinforcements were used as untreated and treated. The fiber treatment was done initially by washing the fibers with NaOH and then introduction of silane during mixing procedure. The prepared composites were then subjected to hot air, ozone and liquid submerge (oil) aging. After aging the tensile strength, tensile modulus and elongation were evaluated to check the effect of aging on these properties of DPF filled NBR. After the aging of NBR with hot air, ozone and liquid the results for tensile strength were slightly inconsistent were higher level of degradation or loss of strength was observed with air and ozone aging. The introduction of fibers in NBR resulted in slight loss of properties as compared to unfilled NBR but the effect of aging was very less for all the prepared samples, whereas the treated fibers improved the tensile properties in every domain when compared to the similar (untreated fiber) counterpart. The elongation properties for the case of untreated fibers were comparable to unfilled NBR after aging process. Result for the treated fibers after aging process suggests reduction in elongation properties due to coupling of fibers with the NBR. The tensile modulus of the sample prepared with untreated fibers after aging were comparable to the samples without fibers. However, after the fiber treatment and aging the properties were slightly reduced when compared with untreated counterpart. With all the properties analyzed after fiber treatment and aging of the composite it is worth noticing that the composites performance was better and comparable after hot air and ozone aging. The performance of these composites was below par in case on oil aging because of the fact that fiber are prone to soak and swell in the oil thus resulted in lower properties as compared to other aging conditions.

DATE PALM WASTE BIOCHAR FOR SUSTAINABLE CO_2 CAPTURE. PERFORMANCE AND SWOT ANALYSIS

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Keywords: Date palm biochar; CO2 capture; column adsorption; SWOT analysis

ABSTRACT

The most widespread human-caused greenhouse gas is carbon dioxide (CO2), leading to an increase in the global average temperature. The sustainable and cost-effective net zero CO2 emission can be achieved by utilizing sustainable materials exhibiting high CO2 selectivity and reusability. Biochar is a porous high-carbon and low-cost material with excellent surface characteristics for effective and sustainable CO2 adsorption. Saudi Arabia is world's largest date producer and generates enormous amounts of date palm waste which can be transformed into value-added products such as biochar. Therefore, the aim of this work is to produce high-quality biochar derived from Saudi Arabia's date palm waste and investigate its performance for CO2 capture. The biochar was produced from date palm frond waste at different pyrolysis temperatures (700-800 °C) and time (2 and 4h). The physicochemical properties of biochar were analyzed using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and Brunauer-Emmett-Teller (BET). The biochar produced at pyrolysis conditions (700°C, 4h) and (800°C, 2h) indicated more micropores and better textural characteristics. The CO2 capture performance onto biochar was investigated in a fixed bed column reactor connected with CO2 sensors at a constant gas flow rate (100 mL/min), CO2 concentration (2500 mg/L), biochar amount (5g), and temperature (25°C). The breakthrough adsorption results showed that B-700-4 and B-800-2 have high CO2 affinity with equilibrium time achieved at 280 and 320 minutes, respectively. However, B-700-2 and B-800-4 are saturated at elapsed times of 150 and 210 minutes, respectively. The maximum adsorption capacity estimated using Yoon Nelson model was 2.05, 3.19, 3.61, and 2.34 mmol/g for B-700-2, B-7004, B-800-2, and B-800-4, respectively. The SWOT analysis demonstrated that the application of biochar derived from palm waste is a cost-effective and sustainable approach toward achieving net zero CO2 emissions. Various opportunities for sustainable agriculture palm waste management and application for direct air capture technology. However, intensive energy and high cost in biochar production, and the design of appropriate biochar properties are the key challenges for the commercialization.

References

[1] Kellogg, William W. Climate change and society: consequences of increasing atmospheric carbon dioxide. Routledge, 2019

EFFECT OF ANNEALED STEEL SLAG DOSES ON THE PHYSICOCHEMICAL PROPERTIES OF BIOCHAR DERIVED FROM WASTE DATE PALM FRONDS

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Keywords: Valorization of Waste, Date Palm, Graphitic Biochar, Pyrolysis, Steel Slag, Ball-Milling, Magnetic Composite

ABSTRACT

Large quantities of date palm fronds waste generated from the pruning process are accumulated or burned in burn barrels, harming the environment and having very little economic value. However, because of the lack of data revealing the characteristic magnetic material of biochar derived from date palm fronds, further research in low-cost and sustainable strategy could offer a new composite material and serve to extend the way for novel applications. In this study, we have prepared the graphitic biochar derived from palm fronds via the pyrolysis method under a limited oxygen atmosphere at the lower temperature of 300℃ for 2 hours. Doping variations of steel slag material (0%, 5%, 15%, 25% w) to the biochar and the magnetic mixture was engineered by the ball-milling technology. The physicochemical characteristic of the magnetic biochar composite was subsequently detected using scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), X-ray diffraction spectrometer (XRD), Fourier-transform infrared spectroscopy (FTIR) and UV-vis spectroscopy. Our findings showed that the low pyrolysis method is a successful step for palm fronds-derived graphitic biochar material, possessing a high porosity and good surface area for different morphology. The magnetism of the obtained composite was imparted and proved by EDS and FTIR analysis. Slag-doped biochar absorption depends on the slag content. The effect of doping contents on the structure and optical properties is detected. This result signifies the synthetic optimization and potential application of magnetic graphitic biochar material for composites that could be employed in energy conversion and storage.

References

[1] Quah, R. V., Tan, Y. H., Mubarak, N. M., Kansedo, J., Khalid, M., Abdullah, E. C., & Abdullah, M. O. (2020). Magnetic biochar derived from waste palm kernel shell for biodiesel production via sulfonation. Waste Management, 118, 626-636.

RECOVERY OF CELLULOSE FIBERS FROM DATE PALM BUNCH FOR PULP AND PAPER MAKING APPLIED IN ACTIVE FOOD PACKAGING

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Keywords: active food packaging; Lignin; date palm branch; pulp

ABSTRACT

Food packaging has the potential to enhance food safety by preventing bacterial contamination or monitoring spoilage (Halloub et al., 2022). Developing active or smart packaging to monitor food spoilage is a critical factor in the sustained development of the packaging industry (Raji et al., 2022). Active packaging that modifies the internal environment to interact with food can preserve it, enhance health safety, and reduce plastic waste over the shelf-life of a product. To create this valuable application, the date palm branch was converted into pulp and then paper employing a straightforward delignification and bleaching process. Bio-sourced lignin was incorporated into the active packaging, providing unique features such as renewability, availability, biodegradability, biocompatibility, low cost, and surface properties that can be customized. This makes it ideal for producing packaging that is antibacterial, antioxidant, and anti-UV (Dghoughi et al., 2023). The objective of this presentation is to develop active packaging using lignin particles and cellulose fibers extracted from date palm branches. We investigated the chemical extraction of the products using FTIR, TGA, and SEM. The use of lignin particles provided antibacterial, antioxidant, and anti-UV properties. The mechanical properties of the produced board show up to a maximum value of 1151 MPa, while its surface density is around 400 g/m², which makes the manufactured cardboard useful in food packaging with shelf life-extending.

References

[1] Dghoughi, A., Nazih, F. E., Halloub, A., Raji, M., Essabir, H., Bensalah, M. O., Bouhfid, R., & Qaiss, A. el kacem. (2023). Development of shelf life-extending packaging for vitamin C syrup based on high-density polyethylene and extracted lignin argan shells. International Journal of Biological Macromolecules, 242. https://doi.org/10.1016/j.ijbiomac.2023.125077

[2] Halloub, A., Raji, M., Essabir, H., Chakchak, H., boussen, R., Bensalah, M. ouadi, Bouhfid, R., & Qaiss, A. el kacem. (2022). Intelligent food packaging film containing lignin and cellulose nanocrystals for shelf life extension of food. Carbohydrate Polymers, 296.

SURFACE MODIFICATION ROUTS FOR DATE PALM FIBERS TOWARDS IMPROVED INTERFACIAL CROSSLINKING

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Keywords: Bio-Composites; Filler/Polymer Compatibility; Chemical Treatment; Functionalization; Interfacial Bonding.

ABSTRACT

In natural fiber reinforced composites, surface modification of bio-filler becomes crucial to enhance its compatibility with hosting polymer [1]. A limited number of studies on grafting bio-fillers to improve its reactivity with the polymer matrix can be found in the literature. This research focuses on introducing crosslinking between Date Palm Particles (DPP) and Polypropylene (PP) through developed innovative techniques. The experimental setup involves chemical modifications of PP, leading to the formation of PP-g-NCO using an efficient Taguchi design approach. Subsequently, the two components are blended, thus, a urethane linkage between the filler and the polymer is established. In a different way, enhancing compatibility between natural filler and polymer requires appropriate modification of the filler. Until now, existing filler treatments have primarily focused on chemically modifying the surface to achieve better filler/polymer compatibility. However, in this experimental study, a groundbreaking approach is introduced, involving the production of a cellulosic-rich filler from date palm pedicels agro-residues through a multistep chemical treatment process assisted by microwave [2]. This novel method not only improves surface characteristics, but it enhances the filler's performance to achieve optimal filler crystallinity as well. Following the fabrication of bio-composite sheets based on the designed experiments, various specimens were prepared and subjected to comprehensive testing to evaluate their chemical characteristics, thermal stability as well as mechanical properties. The primary objective of these tests was to validate the effectiveness of the proposed techniques. The findings obtained from the experimentation revealed an enhancement in the interfacial adhesion of the filler/polymer, which was confirmed through the Scanning Electron Microscope (SEM) analysis. This improvement can be attributed to the innovative crosslinking approach that was employed in the manufacturing process. The new composite exhibited enhanced strength, ductility, and overall reliability, showcasing its potential as a bio-based polymeric material.

References

[1] N. R. Rajendran Royan, J. S. Leong, W. N. Chan, J. R. Tan, and Z. S. B. Shamsuddin, “Current state and challenges of natural fiber-reinforced polymer composites as feeder in fdm-based 3d printing,” Polymers (Basel)., vol. 13, no. 14, 2021, doi: 10.3390/polym13142289.

NATURAL SWEETENERS FROM LOCAL DATES - PRACTICAL APPLICATIONS FOR CALCULATING NUTRIENTS AND CALORIES

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Keywords: Date syrup, date sugar powder, nutrients, calories

ABSTRACT

Objectives

- Identify the natural sweeteners extracted and manufactured from dates.
- Identify the content of calorie and nutrients in dates natural sweeteners.
- Calculate the calorie and nutrient content of date sweeteners per serving size.
- Apply calculation of calorie and nutrient content of food with date sweeteners compared to commonly used sweeteners.

Contents

- Natural sweeteners extracted and manufactured from dates.
- Date sweeteners content of nutrients and calories
- Nutrients and calories of date sweeteners per serving size
- Adding date sweeteners into food and compare their content of nutritional value with commonly used sweeteners.
- Applications and calculations

Outcomes

- Participant will be able to:
- Identify natural sweeteners extracted and manufactured from dates.
- Identify the content of nutrients and calories in date sweeteners.
- Estimate the calories and nutrients of date sweeteners per serving.
- Calculate nutrients and calories for foods in which these sweeteners are used.

References

[1] Al-Farsi M, Alasalvar C, Al-Abid M, Al-Shoaily K, Al-Amry M, Al-Rawahy F (2007) Compositional and functional characteristics of dates, syrups and their by-products. Food Chem104:943–947. doi: 10.1016/j.foodchem.2006.12.051

[2] Al-Farsi MA, Lee CY (2008) Nutritional and functional properties of dates: a review. Crit Rev Food Sci Nutr 48:877–887. doi: 10.1080/10408390701724264

PREPARATION OF ACTIVATED CARBON FROM DATE PALM RACHIS BY CHEMICAL ACTIVATION: OPTIMIZATION AND APPLICATION FOR REMOVAL OF METHYL ORANGE

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Keywords: Activated carbon, chemical activation, date palm, adsorption, methyl orange.

ABSTRACT

High-surface-area porous activated carbon has been prepared from date palm rachis by chemical activation using ortho-Phosphoric acid (H3PO4) as the agent of activation [1]. The process has been conducted at different impregnation ratios (H3PO4/precursor = 0.5–3) and carbonization temperatures (500–700°C). Activated carbon obtained at optimal conditions was characterized using scanning electron microscopy, Fourier Transform Infrared Spectroscopy, surface area measurement (BET), elemental analyses, pH zero-point charge measurement (pHPZC), Boehm titration, and elemental analysis [2,3]. The activated carbon obtained using an impregnation ratio of 1.5 and carbonization for 2h at 600°C, has a mesoporous structure with a specific surface area of 1240 m2 g-1 and its surface contains mainly basic groups with a pHZCN=4.6. The activated carbon obtained was then used as an adsorbent for the removal of methyl orange from aqueous solutions in batch mode. The effects of pH, adsorbent dose, contact time, and initial concentration on the adsorption of methyl orange were examined. The pseudo-first-order model and the pseudo-second-order model were applied to the experimental data to elucidate the possible mechanisms involved in the adsorption of methyl orange onto activated carbon. The experimental data were analyzed by the Langmuir and Freundlich isotherm models. The equilibrium isotherms and kinetics were best described by Langmuir and pseudo-second-order models, respectively. The present study concludes that date palm rachis could be employed as a low-cost precursor to produce suitable adsorbents adsorbent for the removal of pollutants from aqueous solutions [2,3].

FIBER REINFORCED COMPOSITE MATERIAL OF PALM USED IN THE THERMAL INSULATION OF CONSTRUCTIONS

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Keywords: Gypsum mortar, Palm fibers, Mechanical resistance, Thermal insulation.

ABSTRACT

The objective of this work is the study of the performance of the mechanical properties of gypsum mortar reinforced with different rates of addition of palm fibers, to expand the field of use of this material in construction and building. For the purpose of acoustic and thermal insulation of the walls of the construction. The experimental work done for mortar formulations with different fiber content shows that the reinforcement of mortars with fine fibers has better mechanical resistance than that of mortars reinforced with coarse fibers and that the presence of fibers made the material more ductile. In addition, we also subjected our mortars to water content tests, and we concluded that water absorption depends on two vectors, the specific surface of the fibers and the time of exposure to water. The results show that the material is a semiconductor and a phonetic insulator with $\lambda = 0.20$ W/m*k.

References

[1] T. Ashour, H. Georg, W. Wu, "Performance of straw bale wall: A case of study," Energy and Buildings, vol. 43, pp. 1960-1967, 2011.

[2] G. Li, Z. Zhao, J. Li, C. Li, "Properties study of cotton stalk fiber/gypsum composite," ement and Concrete Research, vol. 33, pp. 43-46, 2003.

AN INSIGHT OF OIL PALM TRUNK FIBER UTILIZATION FOR COMPOSITE PANELS, BIOENERGY, AND FUNCTIONAL TEXTILE

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Keywords: Oil Palm Trunk, Fiber, Composite Panels, Bioenergy, Functional Textile

ABSTRACT

Rejuvenation of oil palm (Elaeis guineensis Jacq.) plantation in Indonesia is resulting abundant waste of oil palm trunk or OPT. Up to now, this OPT has not been utilized optimally, only laid out, decayed, or burned. Objective of this study was to summary some efforts to utilize the OPT fiber as the raw material of composite panels, bioenergy, and functional textile. In order to obtain the fiber, OPT was extracted using a crusher [1] or pressure cooker [2]. For the first tool, resulted fiber was broken and the parenchyma was still existed while for the latter equipment, the fiber was enabled in the form of long shape of vascular bundles and the parenchyma was vanished. Composite panels could be produced using broken fiber as form of particleboard [1] as well as using long shape vascular bundles as form of oriented strand board [3]. For bioenergy purpose, fiber derived from OPT could be converted into bio-pellet even though the resulted properties were still unsatisfactory [4]. For functional textile, fiber of OPT could be converted into yarn though pulping process or directly knitted as a fabric.

References

[1] A. Nuryawan, et al., Panel products made of oil palm trunk bagasse (OPTB) and MMA (Methyl methacrylate)-styrofoam binder, Global Forest Journal 1(1) (2023) 72-80. https://talenta.usu.ac.id/gfj/article/view/13245/6356

[2] A. Nuryawan & H. Tambunan, Methods of separating vascular bundles within oil palm stem using pressure cooker. Indonesian paten granted IDS000006288 (2023)

[3] A. Nuryawan et. al., Panel Products Made of Oil Palm Trunk: A Review of Potency, Environmental Aspect, and Comparison with Wood-Based Composites, Polymers 14(9) (2022) 1758 https://doi.org/10.3390/polym14091758

[4] A.R.Putra, et al., Characterization of Biopellets Manufactured from Various Lignocellulosic Feedstocks as Alternative Renewable Energy Sources, Industrial Crops & Products (2023) (submitted)

THE PERSPECTIVE OF THE CONTRIBUTION TO THE VALORIZATION OF THE EGYPTIAN DATE PALM AGROBIODIVERSITY.

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Keywords: Date palm, Date palm manufacturing industries, Date palm medicinal potential, Leaves composts

ABSTRACT:

The date palm tree is a vital part of Arab life, representing both food and economy. The benefits of this tree are not limited to fruit production alone. The whole tree can be utilized for various purposes. Recycling crop byproducts and waste instead of burning them is a crucial environmental safety measure. With an estimated production of 1.8 million tons, Egypt leads the world in date palm fruit production. In recent years, the Egyptian government has initiated projects to expand the cultivation of date palm trees in large areas. The present study shows the new manufacturing and pharmaceutical industries of date palm leaves, seeds and pollen grains. A new vision of future expectations for manufacturing date palm byproducts to increase the income of date palm cultivation in Egypt, especially in the regions with a large number of growing date palms, (like Siwa, Tushka, Elwady elgdid) to ensure objectives for the national projects concerned with the date palm trees in Egypt.

References

[1] M. Chandrasekaranand and A.H Bahkali., Valorization of date palm (Phoenix dactylifera) fruit processing by-products and wastes using bioprocess technology–Review. Saudi Journal of Biological Sciences, 20(2), (2013) pp.105-120.

[2] A. Faiad, A. Muathi, A.Mohamed, M. Bouazizi, B.Alzahrani, and H. Alrobei. "Date palm tree waste recycling: treatment and processing for potential engineering applications." Sustainability 14, no. 3 (2022): 1134.

THE BIOACTIVE COMPOUNDS PRODUCTION FROM UNDIFFERENTIATED CALLUS CULTURES AND THE PHYSIOLOGICAL COMPONENTS OF THE UNDIFFERENTIATED CALLUS OF DATE PALM TISSUES

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Keywords: Phoenix dactylifera, Pharmaceutical compound, Steroids, Flavonides, Micropropagation

ABSTRACT

The in vitro techniques to produce bioactive compounds from medicinal plants in the pharmaceutical industry have become a significant source of economic income. Date palm (Phoenix dactylifera) bioactive compounds have been extensively researched for their therapeutic potential. Although numerous research papers have discussed the tissue culture techniques of date palm micropropagation, few studies have been conducted on the in vitro production of the date palm bioactive compounds from the reproductive differentiated callus cultures (DCC). Typically, undifferentiated callus cultures are discarded as waste during the micropropagation cycle. This study was conducted for the first time to investigate the ability of undifferentiated callus cultures (UDCC) to produce bioactive compounds such as total steroids, total phenolic compounds, and total flavonoids compared to their production from differentiated callus cultures, using a 2.5 g sample weight of both (DCC) and (UDCC). The chemical components such as nitrogen, calcium, amino acids, protein, indole, phenols, polyphenols, and humidity levels were evaluated using a 5 g sample weight of both (DCC) and (UDCC), to study the physiological differences between them. The study found that total steroids recorded the lowest values in the samples of (UDCC) (1.25 mg/g d.w.) compared to its indicated values in (DCC) (2.00 mg/g d.w.), while total phenolic compounds and total flavonoid values were the highest in (UDCC) (4.25 mg/g d.w., 2.26 mg/g d.w. respectively) compared to their indicated values in (DCC) (3.23 mg/g d.w., 2.15 mg/g d.w. respectively). For the other results of the physiological differences between DCC and UDCC, chemical analysis evaluations confirmed the activity of the differentiated callus cultures during the micropropagation cycle of date palm tissues. This study concluded that undifferentiated callus could not be discarded because it might be a source of the in vitro date palm bioactive compounds. For the prospective vision of the pharmaceutical industry of date palm secondary metabolites, more studies are needed to enhance the bioactive compound production from the differentiated and undifferentiated callus cultures by the different elicitors and to scale up the use of the bioreactor system.

ORICULTURE: A SUSTAINABLE SOLUTION FOR PALM WASTE MANAGEMENT

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Keywords: Coconut pith, biodegradation, waste management, mite

ABSTRACT:

Coconut is one of the popular palms of cultivation and is a common crop in Kerala, Tamil Nadu, Karnataka, and other southern states and Union Territories of South India. Centuries of farming experience of this palm by native Keralites, now equipped with modern technologies and innovative ideas have unfurled into unique products out of this wonderful natural resource. Coconut-based industries are plenty, of which processing of copra, coconut oil production, and manufacturing of coir are the most dominant and traditional industries. Many processed food items, cosmetic ingredients, products for home furniture and interior decoration dominate the newly found industrial products introduced in recent years. All parts of the coconut tree are utilized for one or the other purpose, and hence waste generation is minimum in coconut farming. But still, whichever parts are left over due to quality standards for industrial purposes and the wastage during industrial processing of coir and coir-based products generate tons of waste materials in the farms and industrial premises. Unlike other farm and industrial wastes, the waste from coconut and coir are slow to degrade as they are composed of lignin and cellulose as the major components, besides phenol and hence coconut pith, the major waste of coir industry requires conditioning before use in farming as soil supplement [1]. The conditioning involves its partial degradation and is known to be carried out by microorganisms, as illustrated in our previous reports [2, 3]. Our studies on the coconut palm waste biodegradation by mite-microbe consortium have yielded encouraging results, improving Nitrogen content and -refining the C/N ratio in the treated medium along with acceleration of the degradation process. These findings confirm the prospects of the use of ‘Oriculture Technology’ in the waste management of palm-based farming and industries.

References

[1] R Vetturayasudharsanan, S E Manu, Prem Thapa, R Sujithraj, S Kathiresan, Assessment of soil properties from coir pith waste dump yard, IOP Conference Series: Earth and Environmental Science 1125 (2022) :1-8.

[2] M A Haq, Oriculture Technology-a better tribute to crop production. Journal of Acarology, 16 (2007)): 100-103.

[3] M A Haq, Oricultural farming practice: a novel approach to agricultural productivity, Journal of the Acarological Society of Japan, 25 (Suppl 1) (2016): S51-S75.

ELECTRICITY PRODUCTION POTENTIAL USING DATE PALM BIOMASS

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Keywords: Power Generation, Biomass, Date Palm, ORC, Sustainability.

ABSTRACT

Renewable energy sources, including solar and biomass energy, have become attractive and promising solutions to reduce the environmental impacts associated with the use of fossil fuels to generate electricity and heat. Solar energy via concentrated solar power plants (CSP) has been successfully employed in various countries in the last few decades. However, the use of biomass is still less spread and not widely investigated and utilized. Many Asian and African countries have expanded regions with thousands of palm trees each. For instance, AlAhsa oasis in the kingdom of Saudi Arabia includes more than 2.5 million palm trees extending over an area of more than 85 km2. Therefore, the huge amounts of date palm tree residues can be valorized and used in different ways including as waste heat generators. The present work presentsthe idea of utilizing the waste heat generated from date palm biomass for generating electricity through design, modeling, and simulations. The work aims to investigate the use of date palm biomass to drive small scale power generator based on Organic Rankine cycle (ORC). It will present a general model and simulations on the performance of the combined palm biomass combustion and power generation system. The results will cover the impact of the thermo-physical properties of the date palm, the nature of the ORC working fluid and its operating pressure and temperature on the amount of power generated and the efficiency of the ORC system. In addition, a preliminary design of the plant intended to be used for decentralized power generation for the benefits of local small villages and communities will be presented.

VALORIZATION OF DATE BY-PRODUCT BY COMPOSTING AND ORGANIC FERTILIZER PRODUCTION

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Keywords: Date palm waste, Compost, Fertilizer, Environment

ABSTRACT

Management date palm waste is social, ecological and economic challenge having effect on the quality of neighbor's oasis life and environmental environment. Lack of management of date palm waste causes many problems on hosting date palm and dates pests, and help the date palm infestation season to season. The increase of waste production over the next decades, and lack of their management invites us to wonder about the best ways of their treatment and their management. Composting date palm waste is one of the processes of degradation of organic matter that applied to biodegradable wastes, called fermentable wastes. Organic waste is used as fertilizer in agriculture mainly to improve the physical and chemical properties of soil and as sources of nutrients to crops. The need of organic fertilizers is increasing in agriculture especially with the increase of organic farming practices and soil fertility depletion. Date palm waste needs to be shredded before starting the composting process. Composting requires good contact between bacteria, organic matter, and air; and are better leads with finely shredded and sufficient moisture rate (at least 35%). Compositing date palm waste is the main way to valorize the huge quantity of date palm waste. Date palm trees produce 20-30 kg per year (leafs, bunches, fibrillium etc.) Experiences conducted in MENA regions on date palm waste valorization by compositing will be presented and discussed.

CHEMICAL AND THERMAL PROPERTIES OF A NEW INSULATING MATERIAL BASED ON PORTLAND CEMENT REINFORCED WITH DATE PALM FIBERS

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Keywords: Biosourced materials, SEM, FTIR, XRD, TGA, Thermal conductiity

ABSTRACT

The objective of this research is to develop an innovative eco-friendly composite material for construction, specifically focusing on achieving effective thermal insulation using a simple and cost-effective method. The composite is primarily composed of Portland cement and palm fiber, particularly date palm fiber (DPF). The study involved a comprehensive experimental analysis of the composite samples using various techniques, including Raman spectroscopy, differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), mud method, and scanning electron microscopy (SEM). The key findings and implications of this study are as follows: Thermal Behavior: The research aimed to assess how the addition of date palm fibers affects the thermal behavior of the composite material. The results indicate that the inclusion of date palm fibers did not significantly impact the thermal behavior of the Portland cement matrix. This suggests that the composite retains its thermal insulation properties. Porosity and Thermal Conductivity: The study found that the incorporation of date palm fibers increased the porosity of the composite material. This increase in porosity was associated with a decrease in the material's thermal conductivity. This is an essential finding, as lower thermal conductivity contributes to better insulation. The vibrations caused by the inclusion of date palm fibers in the cement matrix may explain this behavior. Adhesion and Incorporation: The results demonstrated that there is good adhesion between the Portland cement and the date palm fibers. Additionally, the fibers were well incorporated into the matrix. This suggests that the composite material is structurally sound and can be used effectively in construction applications. Optimal Thermal Insulation: The study identified that the composite material prepared with a 5% addition of date palm fibers exhibited the best thermal insulation properties. This material can contribute significantly to energy efficiency in buildings, as it offers high thermal insulation capacity. Low-Cost Insulation: The research implies that date palm fiber-based composites could serve as low-cost insulation materials. These materials have the potential to be used as wall coverings, providing effective insulation at an affordable price point. Competitive Properties: Finally, the study suggests that composites containing date palm fibers can compete favorably with traditional building materials. Their excellent thermal insulation properties make them a practical choice for construction applications, contributing to sustainability and energy efficiency goals. In summary, this research presents a promising eco-composite construction material that combines Portland cement with date palm fibers.

INVESTIGATION THE FEATURES OF ALGAL BIOCHAR DOPED WITH GREEN SYNTHESIZED SILVER NANOPARTICLES FROM PALM LEAVES WASTE AND STUDY SOME OF THEIR POSSIBLE APPLICATIONS

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Keywords: Algal biochar, Date Palm, Silver Nanoparticles, Ball-Milling, green synthesized

ABSTRACT

Converting environmental solid waste into metal nanomaterials or biochar can be an excellent solution for controlling the waste disposal problem. There is a growing interest in the utilization of palms and algal wastes in different applications due to their ecological and economic benefits. Silver nanoparticles AgNPs have regular dispersions and remarkable absorption, electrical, optical, and antimicrobial features. Moreover, Macro marine algae have high photosynthetic efficiency with rapid growth rate and an extremely high potential for carbon dioxide CO2 capturing and sequestration. The biochar derived from algae BA is rich in nutrients such as phosphorus and nitrogen. Also, it has great efficiency in ion exchange. In the current study, we prepared a complex of BA contains mix of brown algae (Turbinaria ornata, Sargassum crassifolium) and green algae (Ulva lactuca, Chaetomorpha linum) wastes which were collected from marine environments (red-sea shore), then we doped this BA compound with silver nanoparticles in spherical shape and (20 to 40 nm size) which were green synthesized from date palm leaves waste (Phoenix dactylifera L. var. Khalas) by using Nitric acid as a capping agent and ball-milling process in liquid media for 1 hour. The produced composite was characterized by using high-tech techniques such as UV-visible spectroscopy, scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), X-ray diffraction (XRD), and transform-infrared spectrometry (FTIR). Then we assessed and investigated the possible influence of this product in some applications like water treatment and crop productivity. The result showed that Ag nanoparticles dispersed and incorporated and in the BA composite successfully, and gave significant positive results in previous applications.

EVALUATION OF THE ANALYTICAL AND PHYTOCHEMICAL STUDY OF THE EXTRACTS FROM THE HEART OF PHOENIX DACTYLIFERA L. IN SOUTHEAST ALGERIA

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Keywords: Heart of Phoenix dactylifera, AAS, phenolic compounds, biological activity, antioxidant, anticancer.

ABSTRACT

Heart of Phoenix dactylifera L. is serves as the central core of the date palm (Phoenix dactylifera L.) and is a rich source of dietary fibers, proteins, sugars, healthy fats, and essential minerals. Moreover, it contains phenolic compounds responsible for numerous nutritional and health properties. In this study, our objectives include examining the chemical composition and identifying the minerals and elements present in samples of Heart of Phoenix dactylifera L. (HPd), known as "Al-Jammar," from the southeast region of Algeria. We have selected two date palm cultivars, "Deglet Nour" and "Talaa Al-Dakar," and will utilize Atomic Absorption Spectrophotometry (AAS) and Scanning Electron Microscopy (SEM) analysis techniques. The AAS analysis revealed the presence of several minerals in both cultivars, including Mg (Magnesium), Fe (Iron), Ca (Calcium), Si (Silicon), Zn (Zinc), Cd (Cadmium), B (Boron), and K (Potassium).The concentrations of these minerals differ between the "Deglet Nour" and "Talaa Al-Dakar" cultivars. Furthermore, the study involves extracting phenolic compounds from HPd and estimating their proportions. In addition to estimating the content of sugars and proteins, using the UV-Vis spectroscopic method (UV-Vis). The biological activity of these compounds will be evaluated and characterized through various techniques, including Gas Chromatography-Mass Spectrometry (GC/MS), contributing to the assessment of their antioxidant and anticancer capabilities.

References

[1] M.Dokhanchi; Effects of heart of palm (Palmito) extract on reproductive system of adult male rats. Asian Pacific Journal of Reproduction Vol2(4), December 2013, 272-276.

[2] A.H.Sourki, (Kinetic studies on palm heart protein solubility and investigation of physicochemical, functional and thermal properties of palm heart protein isolate). J Food Sci Technol (April 2019) 56(4):1820–1828.

[3]. Y. A. Elhassaneen, Anti-obesity Effect of Date Palm Pith in High- Fat Induced Obese Rats; Journal of Home Economics Volume 30, Number (1), 202.

CHARACTERIZATION AND BEHAVIOR SIMULATION OF EXTRUDED CLAY BRICKS WITH LIGHT WEIGHT DATE PALM FIBERS

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Keywords: Extruded clay brick, date palm fibers, mechanical, thermo-physical properties, Simulation

ABSTRACT

Even they are not suitable for arid zones in Algeria, as they have poor insulating properties, concrete and clay bricks are the main construction materials used. Therefore, people living in houses made with these construction materials suffer from discomfort. On the other hand, these areas harness the wealth of plants that generate waste which are involved in the process of manufacturing materials with good insulating properties. New extruded clay bricks have been developed by incorporating date palm fibers into the clay matrix. These are considered renewable and are abundant agricultural waste generated by date palm trees each year without exploitation. By maintaining constant the sum of the masses (clay and fiber) to 80%, seven compositions have been prepared with clay/fiber ratios from 80 %/0 % to 68 %/12 %. For the rest (20%), dune sand to complete the mixture. Results show that for a composition with 68 wt.-% clay, 20 wt.-% dune sand and 12 wt.-% fiber, the bricks prepared were light weight, had good thermal properties and met compressive strength requirements. For this composition the weight reduction exceeded 23 % for an energy saving impact of more than 44 % in a dry state, while by numerical simulation under Comsol Multiphysics and for a period of one year with real climatic conditions (taking into account the coupled transfers of heat, air and humidity) the energy saving in Heating consumption has been rated at 30% in winter and 25% for air conditioning in summer.

References

[1] A. K. Elwaleed, N. Nikabdullah, M. J. M. Nor, M. F. M. Tahir, R. Zulkifli, Experimental investigation of sound absorption properties of perforated date palm fibers panel, G. Hyatt (Ed.): Proc. of the International Conference on Manufacturing, Optimization, Industrial and Material Engineering Vol.46 (1), IOP Conference Series: Materials Science and Engineering, Bandung (2013), pp. 012-027

[2] R. W. Nixon: The date palm-"Tree of life" in the subtropical deserts, Economic Botany 5 (1951), 3, pp. 274-301

PREPARATION AND CHARACTERIZATION OF CELLULOSE FIBER OBTAINED FROM DATE PALM LEAVES: PAPERMAKING APPLICATION

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Keywords: Date palm leaves, cellulose fiber, paper industry

ABSTRACT

The date palm tree (Phoenix dactylifera L.) is the oldest cultivated tree and is very commonly seen in Arab countries. In recent times, researchers have been focusing on the conversion of date palm leaves into value-added products. Cellulose fiber is considered the best option to be obtained from date palm leaves and can be used as an alternative biomaterial in wide fields of application due to its renewability and sustainability. In this study, we evaluated the preparation and characterization of cellulose fiber from date palm leaves. These leaves were chemically treated with sulfuric acid, sodium hydroxide, and hydrogen peroxide to remove waxes, lignin, and hemicelluloses to obtain cellulose fiber with high purity, which was our starting material for the preparation of paper sheet samples. The chemical composition of the obtained cellulose fiber was represented as 68% cellulose, 15% hemicellulose, 6% lignin, and 0.35% ash. Cellulose fiber was characterized by scanning electron microscopy (SEM), Fourier Transform infrared spectroscopy (FTIR), X-Ray diffraction (XRY), and energy dispersive X-ray (EDX). Also, the mechanical and optical properties of the resulting paper sheet samples were investigated.

DATE SEED-DERIVED ACTIVATED CARBON: A COMPARATIVE STUDY FOR HEAVY METAL REMOVAL IN AQUEOUS SOLUTION

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Keywords: Activated carbon, heavy metal, adsorption, water wastewater treatment

ABSTRACT

The effectiveness of activated carbon that had been made from a variety of natural precursors was investigated in this research. Acorns from Red Oak trees (Quercus rubra), date seeds, and peach seeds were used as precursors using the thermal activation process. Prepared activated carbon was characterized by SEM. Using batch adsorption experiments, activated carbon that had been prepared was tested to see how well it removed heavy metals (i.e., Pb, Cu, etc.) from solution. The effects of several factors on the adsorption process, including sorbent dose, pH, the presence of disinfectant, and dissolved organic matter (DOM), were examined. The amount of sorbent used has a positive correlation with the amount of metal removed. The elimination of lead was seen to be lower at a pH of 7 than it was at 3 and 5. Copper was removed at a higher rate at pH 7 than at pH 5. At pH 5, acorn and date seed-derived activated carbon showed the highest and lowest metal removal, respectively. With monochloramine (4 ppm), lead from the solution was almost 100% removed. While the concentration of free chlorine was increased from 2 to 4 mg/L, there was a 20 to 60% reduction in the removal of metal from water. The presence of DOM at concentrations of 1 and 6 mg/L resulted in much less metal removal than did the presence of DOM at 3 mg/L. However, all three activated carbons (i.e., Acorns, date seeds, and peach seeds) showed potential and differences in their adsorption characteristics. The results of this research may be applicable to systems that treat water and wastewater.

VALORIZATION OF OASIS WASTES BY COMPOSTING PROCEDURE IN THE SAHARAN REGIONS

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Key words: Composting, Oasis wastes, Temperature, pH, EC, C/N, Pathogenic Germs. Saharan regions

ABSRACT

Composting is an aerobic biological process of degradation and valorization of organic matter into a stabilized and hygienic product. The present work aims to control the evolution of some physical, physico-chemical and microbiological parameters of four types of compost prepared from a mixture of plant wastes (date palm waste, phragmite residues) and poultry manure. Treatments were: T1: 30% poultry manure (PM) + 60% date palm residues (DPR) + 10% phragmite residues (PR) ; T2: 20 % poultry manure (PM) + 50% date palm residues + 30% phragmite residues, T3: 30% poultry manure + 70% date palm residues; (DPR); T4: 30% phragmite residues (PR)+70% date palm residues (DPR). Results obtained after 90 days of the composting showed a difference in behavior between the four mixtures during composting. In fact, the highest temperature was recorded by treatment (T1) at the beginning of the experimental period with a temperature of 68°C. Moreover, a significant decrease in the rate of organic matter, electrical conductivity and C/N ratio between the beginning and the end of the composting, especially in treatment (T1). The microbiological results recorded also showed a remarkable decrease of pathogenic germs between the beginning and the end of the experiment. In the light of the results, it can be concluded that the composts obtained by the three mixtures depend on the characteristics of a hygienic stable product and suitable for use in sustainable agriculture.

References

[1] W. Abid,, Mahmoud, Masmoudi I. B.,, S., M. A. Triki,, S. Mounier,, & Ammar, E. (2020). Physico-chemical and spectroscopic quality assessment of compost from date palm (Phoenix dactylifera L.) waste valorization. Journal of environmental management, 264, 110492.

[2] F. Laouar,, M. Halilat,, Oustani, M., , F. Benbrahim, , A. Aidoud, & H. Guessoum, (2020). Evolution of the physical and physico-chemical parameters of compost resulting from a mixture of oasis waste and poultry manure. Journal of Fundamental and Applied Sciences, 12(3), 1436-1451.

PRODUCTION OF BIO-ETHANOL FROM DATES FOR BIOFUELS AND BIOCHEMICAL PRODUCTION

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Keywords: Dates, Yeast, Fermentation, Ethanol

ABSTRACT

Substrates extracted from date fruits were used for ethanol production. Molasses substrates were also used as reference. The fermentation was done using bioreactors and shaking flasks. Three yeast strains were used: a Kluyveromyces marxianus NCYC 179, S. cerevisiae NCYC 431 and a K. marxianus strain isolated by the research team from local habitats in Alahsa, Saudi Arabia. Production was in batch and fed-batch processes, at 30 and 40°C and sugar concentrations of 20%. In batch processes at 30°C the yeast S. cerevisiae NCYC 431 produced about 12% w/v end ethanol in 32 hours of fermentation. The yields of ethanol on sugar were 94.6%, 96.6% and 95.4% of the theoretical from the same substrates, respectively. The yeast K. marxianus NCYC 179 produced a maximum of about 7% w/v from date extract in 32 hours of fermentation with ethanol yield on sugar of only 54.9% of the theoretical. The yeast K. marxianus isolated by the research team produced about 9.3%, 9.5% and 8.7% w/v ethanol end from date extract, molasses and the mixed substrate with 20% sugar concentration in 24 hours of fermentation at 40°C, respectively. The yields of ethanol on sugar were 92.7%, 95.8% and 85.7% of the theoretical, respectively with the yield on the mixed substrate significantly lower than the other yields. In fed-batch processes the yeast S. cerevisiae NCYC 431 produced end ethanol of about 12% w/v in 24 hours of fermentation. The yields of ethanol on sugar were 97.2%, 96.4% and 95.1% of the theoretical from date extract, molasses and the 1:1 mixture of the two substrates, respectively. There were no significant differences between the yields from the three substrates. It can be concluded that date extract can be used as substrate for ethanol production by many strains of yeasts with an efficiency comparable to that of molasses substrate.

HYBRID INSULATION MATERIALS FROM PALM TREES SURFACE FIBERS AND OTHER AGRO MATERIALS

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Keywords: Thermal insulation materials, Sound absorbing coefficient, Palm tree waste, Agro waste materials

ABSTRACT

Because of the increasing energy consumption and its negative impact on the environment, one of the solutions to reduce this consumption is by using insulation materials in buildings and other applications. A material is usually considered a thermal insulator if it has a thermal conductivity lower than 0.07 W/m-K [1] alternatives to synthetic ones, in order to combine high acoustic and thermal performance with a low impact on the environment and human health [2]. This study presents new natural waste materials that can be used as thermal insulators. These materials are extracted and developed from plants grown in Saudi Arabia. These materials are palm date surface fibers (PDSF) and Conocarpus tree leaves (CTL) (as shown in Fig. 1 and Fig. 2 below). Thermal conductivity of both loose and bound for both single and hybrid agro materials at different densities and temperatures are determined. The thermal conductivity for hybrid materials between PDSF and CTL is between 0.055 and 0.075 W/m K, respectively at different percent of both materials. Sound absorbing coefficients are determined for both bound and hybrid agro materials at different densities. Thermogravimetric analyses (TGA and DTGA), morphology analysis scanning electron microscope (SEM) and Fourier transformation infrared analysis (FT-IR) of the materials are obtained to characterize the stability, size, and chemical functional group, respectively.

References

[1] Asdrubali, F., et al., A review of unconventional sustainable building insulation materials. 2015. 4: p. 1-17.

[2]Asdrubali, F., et al. Lightweight screeds made of concrete and recycled polymers: acoustic, thermal, mechanical and chemical characterization. in Proceedings of 6th Forum Acusticum, Aalborg, Denmark. 2011.

PALM TREES: PROMISING BIO-SOURCED MATERIALS FOR THE SUSTAINABLE CONSTRUCTION OF BUILDINGS

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Keywords: Palm Fiber, Bio-Sourced Materials, Buildings

ABSTRACT

In this work, we investigated the effect of incorporating palm fiber into bio-based concrete. The results showed that the addition of palm fibers led to a decrease in the thermal conductivity of the material, indicating improved thermal insulation. In addition, we observed an increase in flexural strength with the addition of fibers, suggesting that palm fibers can improve the mechanical properties of concrete. However, more research is needed to evaluate the effect of fiber addition on compressive strength. Additionally, the study highlights the environmentally friendly nature of palm fiber as a bio-based concrete reinforcement since it is derived from renewable resources. This aspect contributes to the overall sustainability of the construction industry. The research also highlights the potential cost-effectiveness of using palm fiber in concrete production, which could lead to more economical and environmentally friendly construction methods. The results of this study provide valuable insight into the feasibility and benefits of incorporating palm fiber into bio-based concrete formulations and encourage further research and optimization of this innovative building material for sustainable building practices. In this study, we have presented in detail all the elements of the experimental analysis, starting with the characterization of the different constituents, the formulation of the mixtures to obtain the optimal formulation, the manufacture of the test specimens, the operating mode and the various mechanical tests and thermal considered in this work. we have also made a comparison with the results of the literature New biobased building materials are currently being developed to improve the performance of buildings and reduce their environmental impact [1-2].

References

[1] L. Liu, H. Li, A. Lazzaretto, G. Manente, C. Tong, Q. Liu, and N. Li, The development history and prospects of biomass-based insulation materials for buildings, Renewable and Sustainable Energy Reviews, (2017) pp. 912-932.

[2] O. Faruk, A. K. Bledzki, H.P. Fink, and M. Sain, Bio composites reinforced with natural fibers: 2000-2010, Progress in polymer science, (2012) pp. 1552-1596.

FABRICATION AND CHARACTERIZATION OF HIGHLY POROUS PHOSPHORYLATED CARBAMATE CELLULOSE /LIGNIN HYDROGEL BEADS WITH HIGH ABSORPTION CAPACITY FOR PURIFICATION APPLICATIONS

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Keywords: Hydrogels beads, cellulose carbamate, lignin, absorption.

ABSTRACT

The use of hydrogel beads made of biopolymers has increased significantly in several applications due to their inherent low toxicity, biodegradability, and biocompatibility. Cellulose and lignin are considered to be the most prevalent renewable biomaterials out of all the diverse biopolymers. In this study, cellulose derived from palm fibers was employed to develop biodegradable phosphorylated cellulose carbamate PCC / lignin beads utilizing a green synthesis technique. The PCC hydrogels were formulated from cellulose/urea mixtures using minimum amounts of urea and various Cellulose/phosphoric acid ratios. The preparation of the beads involved dissolving lignin in the PCC hydrogels, shaping the obtained hydrogels into beads, and then regeneration of the beads using ethanol as a nonsolvent for the coagulation bath. The mechanism of drying behavior of regenerated PCC / lignin beads, their morphological and structural properties, as well as their thermal stability were evaluated using optical and scanning electron microscopy, Fourier transform infrared spectroscopy, and thermogravimetric analysis techniques. The effect of cellulose concentration and phosphoric acid content in the phosphorylation reaction of PCC hydrogels as well as the influence of lignin amount on the properties of the produced beads were examined as well. The obtained PCC / lignin beads were highly porous particles with spherical shape and high absorption efficiency. Therefore, the elaborated beads might have broad prospects for potential utilization in purification applications.

SUSTAINABLE GREYWATER MANAGEMENT IN RIYADH CITY MOSQUES: UNLEASHING THE POWER OF PALM RESIDUE FOR ECO-FRIENDLY SOLUTIONS

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Keywords: Ablution water, Palm tree leaves, Filtration, Turbidity, Total dissolved solids, Riyadh.

ABSTRACT

Water scarcity is a pressing global issue, prompting countries worldwide to seek new water sources. Greywater reuse emerges as a promising solution, being a renewable resource with relatively low treatment costs due to its low pollutant content. In Saudi Arabia, ablution water (AW) serves as a significant example of greywater due to its substantial quantities. This study focuses on the environmental aspect of a comprehensive research endeavor, encompassing and economic components, exploring AW reuse in mosques. Various AW samples were collected from 24 mosques distributed across Riyadh, Saudi Arabia, considering geographic location and local activity. The collected samples underwent measurement and comparison of total dissolved solids (TDS), pH, conductivity and turbidity. A filtration process was conducted using palm tree leaves (PTL) as a green filtration media with varying thicknesses to achieve the optimum TDS and turbidity removal. The findings exhibited significant decreases in turbidity, up to 90%, while TDS and conductivity lowered by up to 15%. pH levels varied based on the surrounding area's activities, decreasing for domestic and increasing for commercial and industrial regions, meeting the standard pH environmental levels. An engineering scaled-up green filtration unit based on PTL was conceived to confirm the feasibility of the tested green filtration unit in various Saudi mosques. In addition, an integrated economic evaluation for treating 1 L/min of AW has been thoughtfully presented to assess the unit's commercial viability. In conclusion, this study sheds light on the potential of greywater recycling in Riyadh's mosques, contributing to efforts in mitigating water scarcity and promoting sustainable water management practices.

DATE PALM FIBER RESOURCES AND THEIR POTENTIAL TO STRENGTHEN BIO-BASED PRODUCTS IN IRAN

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Keywords: Date palm fiber resources, Bio-based products, Sustainable product development, Industrialization strategies

ABSTRACT

This paper explores the potential of date palm fiber resources in Iran to strengthen the development of bio-based products. The country boasts a significant area and volume of date palms, making it an abundant source of raw materials for various industries. Date palm trunks and other fiber volumes available for utilization have been identified as promising resources for sustainable product development. The study highlights the potential products that can be derived from date palm fiber resources. These include panels such as Medium Density Fiberboard (MDF), particleboard, and Oriented Strand Board (OSB) manufactured from palm midribs. Additionally, the use of date palm trunks for furniture production is also recognized as a viable application. To fully utilize the potential of date palm fiber resources, a comprehensive approach involving research and industrialization strategies is necessary. Research efforts should focus on optimizing extraction and logistic techniques, improving fiber quality, and developing innovative processing technology. Industrialization strategies should include the design and establishment of efficient production facilities and the development of markets for bio-based products. Collaboration between academia, government institutions, and industry stakeholders are essential to drive this transition. By capitalizing on the available date palm fiber resources, Iran can enhance its bio-based product sector, contributing to sustainable economic growth, job creation, and reduced environmental impact. This paper provides insights into the potential of utilizing date palm fiber resources and offers a roadmap for future research and industrialization strategies in this domain.

SYNTHESIS AND CHARACTERIZATION OF CARBOXYMETHYLCELLULOSE (CMC) DERIVED FROM DATE PALM FRONDS

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Keywords: Palm date biomass, Extraction, Hemicelluloses, Carboxymethyl cellulose (CMC)

ABSTRACT

Cellulose is a low-cost, naturally occurring, renewable, and biodegradable polymer. Because of these attractive properties, cellulose and its derivatives can be used in modern industrial technologies either as permanent products or as transient intermediates. Date palm fronds are cellulose-rich lignocellulosic biomass that has enormous potential to be used as a feedstock to produce carboxymethylcellulose (CMC). Therefore, this study investigated the extraction of cellulose from date palm biomass and its conversion to CMC. The lignin was first solubilized from the biomass using 30% sodium hydroxide and 70% ethanol at 75 °C. Then, hemicellulose was isolated by an alkaline extraction method under optimal reaction conditions, followed by bleaching with hydrogen peroxide. The yield of extracted cellulose was about 50 wt%. Subsequently, the extracted cellulose was converted into CMC. Finally, the synthesized CMC was characterized by scanning electron microscope (SEM) and Fourier transform infrared (FTIR), and the results were compared with those of commercial CMC. The synthesized CMC can be further utilized in various industrial applications such as water retention agents, foodstuffs, cosmetics, textiles, and other industrial products.

POTENTIAL USES OF DATE PALM RESIDUES AS ORGANIC AMENDMENTS TO IMPROVE CROP GROWTH AND ARID SOIL PROPERTIES

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Keywords: Date palm residues, Soil, Biochar, Crop, Nutrient

ABSTRACT

Date palm trees generate large amounts of residues, consisting mainly of dry leaves, fronds, empty fruit bunches and trunks. It was estimated that each palm tree produces approximately 20 kg dry leaves each year, resulting in tons of these residues being produced annually. Currently, the majority of this waste is disposed of by incineration, and this can have adverse impacts on the environment. Date palm residues (DPR) are rich in organic carbon and minerals and their direct recycling via addition to nutrient-poor soils in arid zone may be a prober method of their utilization. However, a better benefit of DPR may be achieved by converting these materials to biochar or compost and use as organic amendments to enhance arid soil quality and productivity. The aim of this study is to provide an overview of the efficient methods of recycling DPR to agricultural soil that can maximize their benefits for soil and crop. In addition, results obtained from short term experiments conducted to evaluate the effects of DPR application on crop growth, soil microbial respiration and soil properties will be presented. Preliminary results showed that DPR stimulated soil microbial respiration when used directly or converted to biochars; however, the effect magnitude significantly decreased with increasing the pyrolysis temperature. Crop growth and nutrient uptake were also improved following the addition of DPR combined with mineral fertilizers. The DPR and its biochar produced at 300 °C were able to reduce NO_3-N leached from fertilized soil compared to the control.

A GREEN SURFACTANT FROM DATE SEEDS FOR DIFFERENT OIL FIELD APPLICATIONS

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Keywords: Crude Oil, EOR, Green Surfactant, Date Seeds

ABSTRACT

The increase in using natural surfactants for enhanced oil recovery (EOR) purposes in recent years is mainly attributed to the widespread global awareness of the environmental effects the oil and gas industry causes. In accordance with KSA Vision 2030 and the corresponding global direction, the purpose of this study is to discover a cost effective, readily available, environmentally friendly, and locally sourced surfactant. This surfactant will help reduce the interfacial tension (IFT) between reservoir liquids to enhance the reservoir's productivity and increase its ultimate recovery. In this study, date seeds have been chosen as the green surfactant source due to the abundance of such seeds. Al-Khalas, which is a well-known palm tree that grows in Qassim, Al-Kharj, and Al-Ahsa provinces in KSA was chosen. The seeds were cleaned and placed for 24 hours in an oven for drying at 70 °C. Following that, the dried seeds were ground into a fine powder which was agitated for 24 hours in seawater (37,000 ppm), formation brine (168,000 ppm), and distilled water at concentrations of 1, 5, and 10% by weight. The agitated mixture was then filtered to separate the liquid for measurement purposes. Properties such as surface tension (ST), IFT, pH, and density were measured to evaluate the effectiveness of date seeds as a natural surfactant. ST results showed a reduction from 72 mN/m (of distilled water) to 46 mN/m using the new surfactant in formation water at 10 wt%. Also, IFT of the new surfactant with Saudi medium oil (26 API) was 10 mN/m compared to 18 mN/m of a formation water-oil system which is a 40% reduction. Overall, the novel surfactant studied in this research shows great promise in being an effective EOR agent in addition to eliminating the negative impacts of regular surfactants on the environment.

IN *VITRO* APPROACHES TO ASSESS THE EFFECTS OF DATE SYRUPS AND THEIR POLYPHENOL AVAILABILITY AND THE SUBSEQUENT IMPACT ON THE GUT MICROBIOTA IN RATS.

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Keywords: Date syrups, Antioxidants, Polypehnols, Gut health.

ABSTRACT

Date palm fruit (Phoenix dactylifera), a species of the family Arecaceae that isrich in many essential nutrients and polyphenols, is one of the most commonly consumed fruits in the Middle East and North Africa1. Previous study suggested that consumption of date fruits may enhance colon health by increasing beneficial bacterial growth and inhibiting the proliferation of colon cancer cells2. Date syrup is an important food source of sugars, minerals, vitamins, and antioxidants. The aim of this study is to investigate the impact polyphenols in date syrup, date sugar and table sugars in blood glucose, lipid profile and gut microbiota in rats. Total phenolic content, antioxidants activity of date syrups analysis and identification and qualification of phenolic compounds were analysis by HPLC. Healthy male rats were randomly divided into five equal-sized groups that included (i) basal diet or negative control group, (ii) high-fat diet group (basal diet + 20% fat), (iii) date syrup1-treated high-fat diet group (high fat diet + 10% date syrup1), (iv) date syrup2-treated high-fat diet group (high-fat diet + 10% date syrup 2) and (v) date sugar treated high-fat diet group (high-fat diet + 10% date sugar). The rats were treated daily for 6 weeks, and body weight data and blood samples were collected for each group. The study has reported that date syrup has contain high amount of antioxidant and phenolic compounds which has an effect in human health and reduce risk of cardiovascular disease (CVD), diabetes, certain cancers and improve gut health.

References

[1] Ibrahim, S. A., Ayad, A. A., Williams, L. L., Ayivi, R. D., Gyawali, R., Krastanov, A., & Aljaloud, S. O. (2021). Date fruit: A review of the chemical and nutritional compounds, functional effects and food application in nutrition bars for athletes. International Journal of Food Science & Technology, 56(4), 1503-1513.

[2] Eid, N., Enani, S., Walton, G., Corona, G., Costabile, A., Gibson, G., ... & Spencer, J. P. (2014). The impact of date palm fruits and their component polyphenols, on gut microbial ecology, bacterial metabolites and colon cancer cell proliferation. Journal of nutritional science, 3, e46.

APPROACHES FOR CONVERTING DATE PALM RESIDUES INTO EFFECTIVE ORGANIC AMENDMENTS FOR ARID SOIL

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Keywords: Date palm residues, Recycling, Compost, Biochar

ABSTRACT

Large amounts of date palm residues (DPR) being produced annually in the major dates producing countries require finding an efficient and sustainable method for their recycling and reuse. Most date palm is cultivated in arid areas where many soil productivity constraints exist, and recycling date palm residues to these soils may be a better option of their utilization. However, converting crop residues into more stable products, such as compost or biochar has been found to be an effective approach to recycle these byproducts as soil amendments. Composting and pyrolysis are widely proven techniques to process organic waste and convert it into sustainable soil amendments; however, their application to date palm residues have been limited. This work will summarize the potential of converting date palm residues into compost and biochar to maximize their use as soil amendments in addition to their expected fertilizing value.

WASTE NOT, WANT NOT: SUSTAINABLE MANAGEMENT STRATEGIES FOR CONVERTING PALM BYPRODUCTS INTO VALUABLE RESOURCES TOWARD THRIVING FUTURE

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Keywords: Climate Change; Palm byproducts; Sustainable Management; Circular Economy; Biochar; Biohydrogen.

ABSTRACT

Climate change poses significant challenges to the sustainable management of water and energy resources, necessitating a transition towards a circular economy approach [1]. This approach emphasizes the efficient use of resources and the reduction of waste, promoting a regenerative and restorative model of economic development. By embracing a circular economy and sustainable management practices, we can address the challenges of climate change and promote a more resilient and equitable future for all. In this context, the management of palm by-products represents a major challenge for sustainable development due to its impact on water and energy sectors, as well as climate change [2]. However, recycling these by-products into valuable sources such as biochar, biohydrogen, and biogas offers a promising solution to these challenges [3]. These products can be employed in different areas, including water treatment, soil fertility, and the energy sector, which are facing increasing demands for sustainable solutions. Biochar is a carbon-rich material produced by the pyrolysis of organic matter and has been shown to be an effective soil amendment for improving soil quality and sequestering carbon [4]. Biohydrogen, on the other hand, is a clean and renewable energy source that can be produced through the anaerobic fermentation of organic matter [5]. Biogas, a mixture of methane and carbon dioxide, can also be produced through the anaerobic digestion of organic matter and can be used as a fuel for heating and electricity generation [6]. The adoption of a circular economic approach to palm by-product management can not only reduce the environmental impact of the palm oil industry but also create economic opportunities for local communities. Moreover, the production of biochar, biohydrogen, and biogas from palm by-products can contribute to mitigating climate change by reducing greenhouse gas emissions. In conclusion, the recycling of palm by-products into valuable sources such as biochar, biohydrogen, and biogas offers a promising solution to the challenges facing the water and energy sectors, as well as climate change [7]. The adoption of a circular economy approach can not only promote sustainable management of palm by-products but also create economic opportunities for local communities.

A REVIEW ON APPLICATION OF AN ARTIFICIAL NEURAL NETWORK FOR INDUSTRY OF BYPRODUCTS OF PALMS

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Keywords: Machine learning, Date palm, Processing, Control, Residues

ABSTRACT

Machine learning has confirmed to be a powerful procedure during the past years. Artificial neural network (ANN), as one of the most widespread machine learning systems, has been commonly applied to numerous fields. However, its uses for industry of byproducts of palms was not well considered until recent decades. In this review, we aim to review the applications of ANN for industry of byproducts of palms research described in the literature. We display how these powerful procedure assistances individuals address the highly difficult problems and hurry the growth of the byproducts of palms community. As example, ANN was applied to predict the viscosity of milk-dibbs of some date palm cultivars. From the viewpoints of both experiment and theory, this review displays how ANN can be successfully applied for byproducts of palms prediction, discrimination, etc. for design, creating, evaluation, etc. of new byproducts of palms.

References

[1] A.M. Alhamdan, A.A. Al-Janobi, A.M. Aboukarima, and K.A.M. Ahmed, applications of neural networks in predicting apparent viscosity of Milk-Dibbs drink. Alex. J. Agric. Res. 46(2) (2001), pp.1-9.

[2] R. Andayesh, M. Abrishamkar, and H. Hodaee, using artificial neural network modeling in predicting the amount of methyl violet dye absorption by modified palm fiber, Journal of Sciences, Islamic Republic of Iran, 31(3) (2020), pp. 221 – 231.

[3] E. A. Uchechukwu and O. Austin, artificial neural network application to the compressive strength of palm kernel shell concrete, MOJ Civil Eng., 6(1) (2020), pp.1-10.

IMPLEMENTATION OF A BIOTECHNOLOGICAL CONCEPT FOR VALORIZATION OF TUNISIAN DATE WASTES (PHOENIX DACTYLIFERA L.)

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Keywords: Date byproducts, Biorefinery, date syrup, Biofuel, Fructo-oligosaccharides, food products.

ABSTRACT

In North Africa and the Middle East, palm dates (from Phoenix dactylifera L.) are considered the most important fruits. In Tunisia, the total annual production of dates reaches 245,000 tons, where 75% comes from the variety “Deglet Nour” with the highest sales value, notably in the European market. Unfortunately, the production and commercialization of “Deglet Nour” dates are accompanied by substantial fruit losses that occur either directly on the palm grove, or during the picking, storage and conditioning processes. Consequently, an important loss, estimated at 25,000 tons, is recorded every year in Tunisia [1,2]. To valorize this abundant biomass, an innovative biorefinery concept was implemented based on biotechnological tools. It consists of a coproduction of biogas/ biohydrogen as biofuels, and date syrup as food ingredient (sucrose substitute). The chemical analysis showed that ‘Deglet Nour’ discarded flesh is rich in soluble sugars (79.8% ± 0.8%) and fibers (12.3% ± 0.4%). A processing approach was therefore implemented to permit the production of biohydrogen from the flesh and biogas from the crude fiber fraction after soluble sugars extraction. This approach showed interesting results since the obtained biochemical hydrogen potential and the maximum methane yield were 292 mL H2/gVS initial and 235 mL CH4/gVS fibers respectively [3]. Parallelly, the “hot water” soluble sugar fraction (date extract) was of interest for agri-food applications. More investigations allowed us to produce a concentrated date syrup at a pilot scale through a three-stage process, consisting of discontinuous hot water solid/liquid extraction, clarification, and evaporation (yield of 0.7 kg/kg at 70% brix with an estimated cost of 0.45 USD/kg). We extended its applications to produce high value-added products such as Fructooligosaccharides (FOS) as prebiotics [1], or food products like sponge cakes and energetic bars [2]. Overall, through these results, we demonstrate the proof of concept that the biotechnological valorization of date waste is a promising way to produce sustainable bioproducts in a circular economy context.

References

[1] Smaali et al. Enzymatic synthesis of fructooligosaccharides from date by-products using an immobilized crude enzyme preparation of β-D-fructofuranosidase from Aspergillus awamori NBRC 4033. Biotechnology and Bioprocess Engineering, 17: 385-392, (2012).

OIL PALM TRUNK AND FIBER UTILIZATION – FLOW OF MATERIAL, NUTRIENTS AND CARBON

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Keywords: Palms, palm wood, palm fiber, processing products, carbon flow, nutrient flow

ABSTRACT

Today, oil palms grow on some 25 million ha worldwide with a strong increase. Due to clearing plantations after an age of 25 years, around one million ha are cleared annually. The trunk volume from clearing operations reaches 150-170 million m³ annually (55 to 60 million t/y dry matter), the fiber volume from empty fruit bunches and fronds amounts to some 5,000-million-ton dry matter annually. With the introduction of zero burning and the discovering of biological problems when all biomass remains on the plantation site, the interest for using the plantation residues as material (including chemicals) or for energy is growing. This is also supported by declining availability of common tree species for wood utilization. As the biomass from oil palms is quite different in shape (wood, fronds, fruit bunches) and material properties (density, moisture, sugar, and starch content), different utilization strategies are necessary. Moreover, biomass contains many nutrients, which might be necessary to remain or brought back to the plantation sites. For trunk utilization highest value can be expected with solid wood-based products (building purposes, furniture), but only for high and medium density material (some 50 % of the trunks volume). The low-density material may be used for fibers (panels or insulation). Energy from the low-density material is not easy as high moisture demands much energy for drying. Similar problems occur with empty fruit bunces and fronds, both contain high moisture. A strategy to reduce moisture is mechanical dewatering which can go as low as 50 % mc. From that mc-level strategies for panels or pellets for energy seem feasible. Oil palms need a lot of nutrients for their rapid growth. A strategy for low-density material and low-quality fibers could be to produce “nutrition-pellets” where pellets contain urea-glue and artificial nutrients for a time-defined release of the nutrients on the plantation site. Together with material flow and nutrient flow studies, carbon flow can also be studied. The life cycle for carbon balancing starts with plantation establishment and ends with products and energy end of life. For some variations of material and energy use modelling has shown impressive results. With the help of a model for multiple use of palm biomass, the presentation discusses ideas for utilization strategies and the importance for nutrient and carbon flows.

IMPORTANCE OF THE DATE SEED POWDERS PRETREATMENT AND GREEN SOLVENT FOR OIL EXTRACTION

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Keywords: Date seed oil, Limonene, Green extraction, Irradiation pretreatment

ABSTRACT

The date seed oil has numerous potential benefits such as antioxidant and antimicrobial activities, anti-inflammatory effects, and skin health. However, date seed oil extraction remains not economically viable, as the yield is very low, and with organic solvents which cause serious problems. Innovative and eco-friendly oil extraction methods look for approaches that prioritize minimizing environmental impact and optimizing resource utilization. In this study, we aim to test the ability of Limonene as a green solvent to extract date seed oil. Promising results were obtained regarding the recovery and quality of the oil. Additionally, pretreatment is an essential step in the oil extraction process that prepares the seeds for efficient extraction. For this reason, we investigate the effects of gamma radiation on the date palm seed powders before crude oil extraction. This ecofriendly method applied low doses of gamma radiation (1 and 5 kGy). The pretreatment allowed to gain additional benefits by making oil and numerous chemical compounds more extractable.

References

[1] Hamza, Hammadi, Walid Elfalleh, and Kameleddine Nagaz. "Date palm seed oil (phoenix dactylifera l.) green extraction: Physicochemical properties, antioxidant activities, and phenolic and fatty acid profiles." Journal of Food Quality 2021 (2021): 1-9.

PHYSICO-CHEMICAL, MICROBIOLOGICAL AND TOXICOLOGICAL MONITORING OF COMPOST FROM MIXING PALM DATE RESIDUES AND URBAN SEWAGE SLUDGE

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Keywords: Composting, Date Palm Residues, Urban Sewage Sludge, Temperature, pH, CE, C/N, Heavy Metals, Pathogenic Microbial, Phytotoxicity.

ABSRACT

The aim of this work is to monitoring some physical, physico-chemical, microbiological and toxicological parameters, as well as the appreciation of the degree of maturity of the composts prepared from different mixtures of date palm residues and urban sewage sludge the Ouargla region. For this, four mixtures (M1, M2, M3 and M4) were prepared, in pits of 1m3 volume for each mixture using date palm residues (DPR) mixed with sewage sludge in different proportions. The mixtures made are: M1: 40% date palm residues (DPR) + 60% sewage treatment plant sludge (USS); M2: 50% date palm residues (DPR) + 50% sewage sludge (USS); M3: 60% date palm residues (DPR) + 40% sewage sludge (USS); M4: 75% date palm residues (DPR) + 25% sewage sludge (USS). During the process, physic-chemical parameters (Temperature, pH, Electrical Conductivity (EC), Organic Carbon (OC), Organic Nitrogen (ON), C/N ratio), Heavy Metals Pathogenic, Pathogenic Microbial indicators were measured. The results obtained after six months of the test show a difference in behavior between the four mixtures prepared. The highest temperature was recorded by M1 in the thermophilic phase with a maximum temperature of 65.4 C°. (OC), (ON), (C/N) undergo significant reductions during the test, especially for treatments that contain sewage sludge. Meanwhile, the electrical conductivity recorded an increase for all the treatments, in particularly for the M1. The heavy metal content (Zn, Cu, Cd, Pb, Ni and Mn) at the end of the trial are in the standard range of heavy metals in compost for all mixtures. Moreover, microbial analyses show a remarkable decrease in pathogenic germs (Enterobacteriaceae, Staphylococci, Salmonella, and Yeasts) at the end of the experiment for all treatments. The phytotoxicity test of prepared composts carried out on the culture of lettuce, radish and broad bean reveals that the impact on the germination and vegetative growth of these plant species depends both on the type of mixture prepared and on the species cultivated.

References

[1] A. Vico, M.D. Pérez-Murcia, M.A. Bustamante, E. Agulló, F.C. Marhuenda-Egea, J.A. Sáez, C. Paredes, A. Pérez-Espinosa, R. Moral, Valorization of date palm (Phoenix dactylifera L.)

PERFORMANCE CHARACTERISTICS OF COMPOSITE TILES PRODUCED FROM CHICKEN EGGSHELL ASH REINFORCED WITH COIR FIBERS

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Keywords: Limestone Portland Cement, Chicken Eggshell Ash, Coir Fibers.

ABSTRACT

The incorporation of fibers into the composites improves the mechanical properties (for example brittle fracture strength) of the matrix material and retaining the fire resistance properties associated with the matrix. The versatile nature of fiber–cement products is a good merit in manufacturing of products such as flat tiles for construction purposes. Eggshell is a good accelerator for cement–based material due to its potential extra calcium oxide content. This study examines the performance characteristics of coir fiber reinforced composite developed from chicken eggshell ash. Coir fibers were dried, chopped to average length of about 7mm – 9mm, and screened from particles. Chicken Eggshell Ash (CESA) was incinerated at 900oC and hydrolyzed with water at ratio 1:3 by mass of CESA. It was screened with 75µm. Limestone Portland Cement (LPC) was procured. For composite tiles development, coir fibers was 6% by mass of cement, water:cement mass ratio was 0.4, cement:sand ratio was 1:2. A super plasticizer (meflux) 0.3% mass of cement was used. Limestone Portland cement was partially replaced with CESA at 10%, 20% and 30% by mass of cement. Composite samples were CO2 cured and exposed to 15% CO2 at 600C, 60% relative humidity and 0.34MPa for 3 hours. Six replicate samples of 160 x 40x 6mm3 were produced, and tested to determine the Bulk Density (BD), Water Absorption (WA), Moduli of Rupture (MOR), and Moduli of Elasticity (MOE). The range of values for BD ranged between 2.06 – 2.13, WA ranged between 7.31 – 9.40 for physical properties. For mechanical properties, MOR ranged between 9.18 – 11.14MPa, and MOE ranged between 27.21 – 32.76GPa. It was observed that the percentage replacement of cement with CESA is inversely proportional to the BD of composite sample, it might be justified based on the finess property of CESA which helps in bonding interaction. Also, the higher the percentage of CESA in composites the lower the MOE, but the greater the value of MOR.

References

[1] S. Ikai, J.R.Reichert, A.V. Rodrigues, V.A. Zampieri. Asbestos free technology with new high toughness polypropylene PP fibers in air cured Hatschek process. Construction and Building materials 2010 24(2): 171-180.

EFFECT OF PARTICLE SIZE ON BEHAVIOR OF BIOCOMPOSITE BASED ON DATE PALM SEED: DESTRUCTIVE AND NON-DESTRUCTIVE INVESTIGATION

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Keywords: Date palm seed, Particle size, Bio-composite, Waste valorisation, Non-destructive testing, Mechanical behavior

ABSTRACT

This study presents the effect of date palm seed powder (DPSP) as reinforcement obtained from Touggourt oasis, Algeria on the elastic properties of bio-composites based on the two prepared (DPS) with size 300µm and 500µm mixed on epoxy (ER) matrix. Weight percentage of powder with 5%, 10% and 15% were used to obtain epoxy matrix (ER)/ date seed powder (DSP) bio-composites. The effects of DPSP size on the elastic properties of ER/DPSS bio-composites such as ultrasonic wave velocities (longitudinal and shear), longitudinal modulus, shear modulus, bulk modulus, Young's modulus of elasticity ultrasonic micro-hardness, Poisson ration and acoustic impedance of the bio-composites were determined using the nondestructive testing (NDT) via ultrasonic pulse-echo method. In addition, in the two prepared bio-composites to analyze the chemical change of the functional groups and morphological were studied using X-ray diffraction experiment and optical microscopy, respectively. The results of ultrasonic characterization of ER/ DPSP composites show that there is relationship between sizes of date palm seed powder (DPSP) and elastic constants values. Also, the experimental results illustrate that the optimum weight of DPSP reinforcement for excellent behavior of ER/ DPSP composites is 5% and 10% for 300µm and 500µm, respectively. XRD analysis results revealed the role of reinforcement DSP powder. And the morphological results showed better interfacial adhesion between the DPSP and the ER matrix.

References

[1] Saba, N., et al., Date palm reinforced epoxy composites: tensile, impact and morphological properties. Journal of Materials Research and Technology, 2019. 8(5): p. 3959-3969.

[2] Rabhi, S., et al., Green epoxy resin/date stone flour biocomposites: Effect of filler chemical treatments on elastic properties. Polymer Composites, 2021. 42(9): p. 4736-4753.

VALORIZATION OF OASIS WASTES BY COMPOSTING PROCEDURE IN THE SAHARAN REGIONS

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Key words: Composting, Oasis wastes, Temperature, pH, EC, C/N, Pathogenic Germs. Saharan regions

ABSRACT

Composting is an aerobic biological process of degradation and valorization of organic matter into a stabilized and hygienic product. The present work aims to follow the evolution of some physical, physico-chemical and microbiological parameters of four types of compost prepared from a mixture of plant wastes (date palm waste, phragmite residues) and poultry manure. Treatments were : T1: 30% poultry manure (PM) + 60% date palm residues (DPR) + 10% phragmite residues (PR) ; T2: 20 % poultry manure (PM) + 50% date palm residues + 30% phragmite residues, T3: 30% poultry manure + 70% date palm residues; (DPR); T4: 30% phragmite residues (PR)+70% date palm residues (DPR) . Results obtained after 90 days of the composting showed a difference in behavior between the four mixtures during composting. In fact, the highest temperature was recorded by treatment (T1) at the beginning of the experimental period with a temperature of 68°C. Moreover, a significant decrease in the rate of organic matter, electrical conductivity and C/N ratio between the beginning and the end of the composting, especially in treatment (T1). The microbiological results recorded also showed a remarkable decrease of pathogenic germs between the beginning and the end of the experiment. In the light of the results, it can be concluded that the composts obtained by the three mixtures depend on the characteristics of a hygienic stable product and suitable for use in sustainable agriculture.

References

[1] W. Abid,, Mahmoud, Masmoudi I. B.,, S., M. A. Triki,, S. Mounier,, & Ammar, E. (2020). Physico-chemical and spectroscopic quality assessment of compost from date palm (Phoenix dactylifera L.) waste valorization. Journal of environmental management, 264, 110492.

[2] F. Laouar,, M. Halilat,, Oustani, M., , F. Benbrahim, , A. Aidoud, & H. Guessoum, (2020). Evolution of the physical and physico-chemical parameters of compost resulting from a mixture of oasis waste and poultry manure. Journal of Fundamental and Applied Sciences, 12(3), 1436-1451.

FURFURAL PRODUCTION PROCESS FROM DATE KERNELS

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Keywords: Dates Processing plant, Furfural extraction, biomass process optimization.

ABSTRACT

Furfural is one of those promising chemicals obtained from biomass that is able to compete with petrochemicals. In this capstone design project, we intended to process 3000tons/year of raw material (date seeds) to produce furfural with a capacity of 450 tons per year and a working duration of 24 hours per day and a total working day of 330 per year The project goal is to develop and design a process to produce furfural from wasted date seed. The production of furfural from wasted date seed creates an opportunity to turn wasted date seed into sellable product. The process occurs in one step process, depolymerization of pentosans in xylose by acids and dehydration to furfural occurs simultaneously. The purpose of this design is to seize the local wasted date seeds in Saudi Arabia and make a desirable product. The plant is proposed to be established in Saudi Arabia where date seed are available. Chapter three gives a detailed material balance calculation for each unit. Also, Chapter three provides a detailed energy balance for each unit. Chapter four discusses the environmental consideration. And carries the factors that affect the selection of the plant site and layout design. Preliminary economic analysis indicates that the project is profitable.

DATE POLLEN GRAINS, GINSENG, AND TRIBULUS EXTRACTS SUPPLEMENTATION IMPROVES SEXUAL STATE, TESTES REDOX STATUS, AND TESTICULAR HISTOLOGY IN NILE TILAPIA MALES

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Keywords: Date palm pollen, Tribulus terrestris; Ginseng; Antioxidant status; Sexual performance

ABSTRACT

This study aimed to investigate the effect of dietary supplementation of three natural antioxidants on sex hormone levels, enzymatic and non-enzymatic antioxidant systems, and histological changes in the testes of male Nile tilapia, Oreochromis niloticus. A total of 210 male Nile tilapia were distributed into seven treatments (three replicates for each) with an initial weight of 3.67 g fish-1. The fish were fed experimental diets (32% crude protein) without supplementation as control or supplemented with ginseng extract (GE; 0.2 and 0.4 g GE kg-1 diet), Tribulus terrestris extract (TT; 0.6 and 1.2 g TT kg-1 diet), and date palm pollen grains (DPPG; 3 and 6 g DPPG kg-1 diet) for 84 days. The results revealed a significant increase in the luteinizing hormone level with TT, DPPG, and GE supplementation increased the levels by 22.9%, 18.5%, and 17.6%, respectively. The testosterone level also increased significantly with TT1.2, GE0.4, TT0.6, and DPPG6 by 86.23%, 64.49%, 57.40%, and 24.62%, respectively. The antioxidant status in the testis homogenate showed a significant decrease in the level of thiobarbituric acid-reactive substances when using different dietary substances. In addition, glutathione reduced contents, glutathione S-transferases, glutathione peroxidase, catalase, and superoxide dismutase activities significantly increased with different dietary supplementation in a dose-dependent manner. The histological evaluation revealed normal histological features of the testes in all treatments with increasing active seminiferous tubules (%) in GE, TT, and DPPG supplemented groups, especially with the highest levels. In conclusion, the dietary supplementation of GE, TT, and DPPG enhanced sex hormones level, redox status, and testis structure and could improve the male reproductive performance of Nile tilapia.

References

[1] Mansour, A.T.; Alsaqufi, A.S.; Omar, E.A.; El-Beltagi, H.S.; Srour, T.M.; Yousef, M.I. Ginseng, Tribulus Extracts and Pollen Grains Supplementation Improves Sexual State, Testes Redox Status, and Testicular Histology in Nile Tilapia Males. Antioxidants 2022, 11, 875. https://doi.org/10.3390/antiox11050875

SUSTAINABLE APPROACHES FOR THE FABRICATION OF CELLULOSE-POLYAMIDE MEMBRANES BASED ON DATE PALM LEAVES FOR WATER TREATMENT

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Keywords: Sustainability, palm leaves, Cellulose-PA membrane, water-treatment

ABSTRACT

There is an insistent concern with the worldwide warming and climate change occurring on our planet. According to UN water statistics, freshwater accounts for around 2.5% of the total water capacity of the Earth. Some elements are caused by natural processes, while others are caused by human actions, both of which have the potential to change the physical environment. In Recent year, due to its continuous development, reverse osmosis is now the most widely used process in membrane technology. Recent research has highlighted the importance of the surface properties of support layers in thin film membranes for improving reverse osmosis performance. Interfacial polymerization was used to prepare the membranes in this work, with the polyamide acting as a selective layer on the polysulfone support film. Cellulose nanostructures are the derivatives of cellulose that formed through acid hydrolysis of cellulose under controlled temperature. Three membranes were prepared with different proportions cellulose (0.005%, 0.01%, and 0.015% w/v) extracted from palm leaves. The effectiveness of the membranes was improved by increasing water permeability while maintaining excellent salt retention. All membranes prepared were tested by different characterization methods. The water permeability of the polyamide-cellulose membranes with 0.015% cellulose was 56.18 L/m2 h bar, which was more than double the polyamide membrane's typical permeability (23.63 L/m2 h bar). Salt rejection was also improved (from 97.73% for NaCl to 99.29% in the same circumstances, and from 97.39% for MgSO4 to 99.62%). According to SEM, the PA-cellulose 0.015% membrane displayed lower surface roughness, greater hydrophobicity, and higher water contact angle readings. Thus, the polyamide-cellulose membranes can help in overcoming the current challenges associated with water treatment processes.

References

[1] Ani PC, Nzereogu PU, Agbogu AC, Ezema FI, Nwanya AC. 2022. Cellulose from waste materials for electrochemical energy storage applications: A review. Applied Surface Science Advances. 2022.

CARBON NANOSTRUCTURES DERIVED FROM DATE PALM: OPPORTUNITIES AND APPLICATIONS

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Key words: Data Palm By-products, Carbon Nanostructures, Carbon nanoparticles, Graphene, Carbon nanotubes, Carbon Nanofibers, Applications.

ABSTRACT:

Carbon-based nanomaterials have gained much focus due to their excellent structural, mechanical, optical, and electrical properties. Although several research studies have been successfully done to utilize them in various applications, the cost-effectiveness of their raw material sources and the rapid synthetic technologies are still highly necessary. On the other hand, carbonized date palm by-products can produce a graphitic powder material by thermal treatment considered a natural and new carbon precursor. The graphitization degree of this powder is high and mostly in graphitic form (ID/IG < 1), depending on the annealing conditions. In Saudi Arabia, the number of date palm trees is more than 25 million trees, producing roughly 40 Kg of date crop per tree, suggesting a large-scale production of carbon in a sustainable and renewable fashion. A few recent studies of carbonized date palm by-products including fronds and leaves were used to produce carbon nanoparticles (CNPs), carbon nanofibers (CNFs), graphene quantum dots (GQDs) and carbon nanotubes (CNTs). They were grown by (i) bottom-up routes such as the hydrothermal method, vapor precipitation method and the chemical vapor deposition (CVD) method, and (ii) top-down routes such as the high-energy ball milling method. These grown carbon nanostructures were successfully examined with remarkable results in dye removal from polluted water such as phenol and eosin [1,2], supercapacitor electrodes for energy storage [3] and enhanced oil recovery applications [4]. These outcomes can make a economic value of the date palm waste and also open new opportunities for advanced products potentially utilized in nanotechnological and vital applications.

References

[1] Alminderej, et al., (2022). The superior adsorption capacity of phenol from aqueous solution using Modified Date Palm Nanomaterials: A performance and kinetic study. Arabian Journal of Chemistry 15, 104120.

MECHANICAL PROPERTIES OF NANO DATE PALM VERSUS NANO TITANIUM DIOXIDE PARTICLES REINFORCED COMPOSITES: EXPERIMENTAL CHARACTERIZATION

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Keywords: Nano composites, Natural fiber, mechanical properties, Nano date palm, Recycled Polypropylene, Bio-composites.

ABSTRACT

This research work is about characterization of the mechanical properties of two newly developed nanocomposite materials. The produced composites are made by mixing either Nano date palm particles (NDPP) or Nano Titanium Dioxide particles (NTiO2P), as a reinforcement filler, with recycled polypropylene (rPP). Particularly, downsizing the date palm microfibers generated from waste to Nano-sized lignocellulose fillers has been accomplished by ball milling machine. The powdering process is done at a high speed of 12 cycles per minute for four cycles. The manufacturing process involves making composite sheets using a twin-screw extruder in a hot melt state followed by compression molding. After that, test specimens are prepared following ASTM standards and then tested in Universal Testing Machine (UTM) setup. Experimental results showed that the highest tensile strength of the reinforced polymer can be accomplished at 3% wt. NDPP and 6% wt. NTiO2P. These filler loadings increased the tensile strength by 49% and 63% over the neat rPP, respectively. Moreover, the flexural strength of NDPP based nanocomposite increased by 30% at 3% wt. while the strength of NTiO2P based composite was improved 33% at 6% wt. over the neat polymer. Due to the soft nanofillers, both Nano particles exhibit a slight decrease in Young's modulus; 15% and 7.2% at 3% wt. NDPP and 6% wt. NTiO2P, respectively. Similarly, the increase in elongation at break and flexural modulus for both nanocomposites contribute to improve the ductility of the neat polymer. The results from the morphological analysis using Field Emission Scanning Electron Microscope (FESEM) revealed that NTiO2P with 6% wt. has better interlocking with the polymeric matrix and better filler distribution over 5% wt. NDPP. This study confirms that bio-composites produced from NDPP are economically viable and ecologically friendly materials that have a high potential to be utilized in a variety of industrial applications.

References

[1] Zahrouni A, Bendaoued A, Salhi R. Effect of Sol-Gel Derived Tio2 Nanopowders on the Mechanical and Structural Properties of A Polymer Matrix Nanocomposites Developed by Vacuum-Assisted Resin Transfer Molding (VARTM). Ceram Int 2020;47:975562.

EFFECT OF DATE'S SEED (PHOENIX DACTYLIFERA L.) POLY PHENOLS ON HUMAN BREAST CANCER CELLS

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Keywords: date seeds, cancer, phenolic compounds, Khalas

ABSTRACT:

Breast cancer is the main cause of death among women in the world. In recent years, there is a significant increase in the incidence of breast cancer in Saudi Arabia, especially among younger females, compared to females with breast cancer in Western countries. Attention has turned at the present time to date seeds, as they are an excellent source of many nutritional components that a person needs in his food, including the phenolic compounds that play a great role as antioxidants and to prevent cancer and treat it. The main objective of the work was to study the anticancer activity of polyphenols of date palm (Phoenix dactylifera) extracts against MCF-7 breast cancer cells. Phoenix dactylifera (Khalas) was extracted using four different polar solvents, namely, absolute methanol, aqueous methanol, ethanol and chloroform. Then, the inhibitory effect of these extracts against breast cancer cells was studied using the MTT assay. The active extracts were then selected to study the possibility of causing cell death through the programmed cell death pathway by investigating the morphological changes using Hoechst fluorescence dye and explore the gene expression of genes related to apoptosis using the RT-PCR technique. The study showed that aqueous methanol extract was the most active extract, as the half-inhibitory concentration was (IC50 = 195.77 µg / ml) followed by ethanol extract (IC50 = 214.5 µg / ml) while the remaining extracts showed little activity. The results of the reverse polymerase chain reaction (RT-PCR) also showed that treating cancer cells with these extracts led to an increase in the gene expression of the P53, Bax and Caspase 3 genes and a decrease in the gene expression of the BCL-2 gene which clearly indicated the ability of the extracts to inhibit the growth of breast cancer cells. This thesis provided clear evidence of the ability of date seed extracts (Khalas) to inhibit the proliferation of breast cancer cells.

References

[1] Alimohammadi, M., Lahiani, M. H., McGehee, D., & Khodakovskaya, M. (2017). Polyphenolic extract of InsP 5-ptase expressing tomato plants reduce the proliferation of MCF-7 breast cancer cells .PLoS ONE, 12(4), e0175778.

[2] Al-Zubaidy, N., et al. (2016). "The anti-proliferative activity of phoenix dactylifera seed extract on MCF-7 breast cancer cell line." Int J Pharm Sci Rev Res 41(2): 358-362 .

IDENTIFICATION OF SECONDARY METABOLITES IN AJWA DATE SEED AND OPTIMIZED CONDITION OF ENZYMES INHIBITION USING RESPONSE SURFACE METHODOLOGY AND ARTIFICIAL NEURONAL NETWORK MODELS

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Key words: Date palm, Ajwa date seed, Enzymatic activity, artificial neural network, polyphenolics, response surface methodology

ABSTRACT:

The aim of this study was to optimize the heat reflux extraction (HRE) of Ajwa Date Seed using response surface methodology (RSM) and artificial neural network (ANN) modeling to increase its polyphenolic content and enzymatic activities. A Box Behnken Design was used to optimize HRE to achieve the maximum polyphenolic compounds and enzymes activity of target responses as a function of ethanol concentration, extraction time, and extraction temperature. From RSM estimates, 50.5 % ethanol and 85 min (extraction time), and 60.9 °C (extraction temperature) were the optimum conditions for generating total phenolic content (23.506 ± 1.02 mg GAE/g), total flavonoid content (22.069 ± 0.65 mg CAE/g), α-glucosidase (33.78 ± 0.78 % of inhibition) and elastase (19.75 ± 0.78 % of inhibition), tyrosinase (65.62 ± 0.78 % of inhibition). The good performance of the ANN was validated by statistical metrics. Additionally, 73 secondary metabolites, including 13 new bioactive chemicals, were detected using high-resolution mass spectroscopy. Together, these results suggest that the current Ajwa date seed active metabolites can be utilized in field of food, mitracenttcal and cosmetics.

ECO-FRIENDLY FABRICATION OF CU/AG FUNCTIONALIZED NANOCELLULOSE FOR BIOMEDICAL APPLICATIONS

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Keywords: Copper, Silver, Nanostructures, Antimicrobial

ABSTRACT

Phoenix dactylifera (PD) generates a vast amount of biomass every year. However, those residues are not entirely exploited adequately [1]. It is essential to convert agricultural-based biomass waste into energy and valuable products to achieve sustainable agriculture and waste management [2]. As a result, it can reduce environmental pollution, decrease dependence on fossil fuels, and promote the circular economy by utilizing renewable resources and reducing waste generation. In this study, we used PD biomass as a precursor to fabricate nanocellulose through a sequential process. Furthermore, the PD biomass-derived nanocellulose was functionalized with Cu/Ag bimetallic nanostructures using an eco-friendly approach. The Cu/Ag-functionalized nanocellulose was thoroughly characterized using various analytical techniques, including scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier-transform infrared spectroscopy (FTIR), and X-ray diffraction (XRD). The antimicrobial activity of the Cu/Ag-functionalized nanocellulose was evaluated using standard agar diffusion tests against a panel of microbial strains. The TEM images indicate that Cu/Ag nanostructures adhered to the nanocellulose surface. The antimicrobial activity assessment results demonstrated the Cu/Ag functionalized nanocellulose has superior antimicrobial efficacy, as evidenced by enhanced inhibition zones compared to the control nanocellulose. In conclusion, this study presents a novel approach for functionalizing nanocellulose with copper and silver nanoparticles, resulting in a composite with enhanced antimicrobial activity. The nanohybrid could apply to various applications, such as food packaging, wound dressings, tissue engineering scaffolds, and drug delivery systems.

References

[1] Athinarayanan, J., Periasamy, V.S. and Alshatwi, A.A., Phoenix dactylifera lignocellulosic biomass as precursor for nanostructure fabrication using integrated process. International journal of biological macromolecules, 134 (2019) 1179-1186.

[2] Haque, F., Fan, C. and Lee, Y.Y., From waste to value: Addressing the relevance of waste recovery to agricultural sector in line with circular economy. Journal of Cleaner Production (2023) 137873.

VALORIZATION OF *PHOENIX DACTYLIFERA* BIOMASS BY MANUFACTURING NANOSTRUCTURED MATERIALS

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Keywords: Nanostructures, Graphene, Nanocellulose, Lignin

ABSTRACT

Phoenix dactylifera is a vital tree, widely growing in arid and semiarid regions of the world. There are 7 million tons of edible dates produced each year by Phoenix dactylifera, along with large quantities of lignocellulosic biomass, which is non-edible [1]. The lignocellulosic biomass is not used in an appropriate manner. By contrast, they are disposed of or burned outdoors [2]. Therefore, we have attempted to produce nanostructured materials from Phoenix dactylifera biomass in this study. In the study, several techniques are explored for the extraction and processing of biomass into cellulose nanofibers, carbon nanodots, graphene nanosheets, and lignin nanoparticles. Several analytical methods were used to characterize the nanostructured materials, including scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier-transform infrared spectroscopy (FTIR), and X-ray diffraction (XRD). Based on these results, Phoenix dactylifera biomass has the potential to manufacture novel and sustainable nanostructured materials in a wide range of applications, including biomedicine, cosmetics and food. We conclude our study by emphasizing the importance of this research to the promotion of sustainable development and the circular economy.

References

[1] Mariod, A.A., Mirghani, M.E.S. and Hussein, I., 2017. Chapter 29–Phoenix dactylifera date palm kernel oil. Unconventional oilseeds and oil sources.

[2] Abid, W. and Ammar, E., 2022. Date palm (Phoenix dactylifera L.) wastes valorization: A circular economy approach. In Mediterranean Fruits Bio-Wastes: Chemistry, Functionality and Technological Applications (pp. 403-430). Cham: Springer International Publishing.

UTILIZATION OF AGRICULTURAL AND PLASTIC WASTES FOR BUILDING AND CONSTRUCTION APPLICATIONS

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ABSTRACT

The exploitation of recyclable, natural and environment friendly materials is rapidly increasing for various industrial applications. These materials include both agricultural and plastic wastes. This is due to certain characteristics such as abundance, ease of processing, low density and cost as well as environmental conservation. In this project, efforts have been made to take advantage of such wastes. Palm residues (trunk) were cleaned, grinded to micro/nanosize using mechanical treatment. This reduction into small sizes without any chemical treatment is a feasible choice from both commercial and environmental point of view. On the other hand, plastic water bottle caps are cleaned and then recycled mechanically to be mixed with treated trunk. The waste materials compounded together using an extrusion process followed by hot press technique to fabricate prototypes include tiles and general sheets. Thermal and mechanical properties of obtained composite materials characterized by a wide range of analytical and testing techniques. The results showed that the initial thermal decomposition of composite materials > 180 ^{o}C and tensile strength ~ 30 MPa. These results indicate that the investigated composite materials could be utilized for building and construction usage in terms of strength and thermal stability.

DATE PALM DERIVED BIOCHAR AS CATALYST SUPPORT FOR METHANE DECOMPOSITION REACTION: A PROMISING APPROACH FOR SUSTAINABLE HYDROGEN PRODUCTION

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Keywords: Date palm, Date palm wastes, Biochar, Methane decomposition

ABSTRACT

In recent years the global growing need for clean and renewable energy sources has derived much attention toward methane decomposition (MD) reaction, which is a promising reaction that converts methane (CH4) into hydrogen (H2). In this regard, nickel-based catalysts have shown great potential, as they possess excellent catalytic properties in MD reaction. However, the agglomeration and deactivation of nickel particles during the reaction remain significant challenges. In this work the utilization of biochar (BC), derived from date palm tree residues, as a support material in MD reaction, was investigated. Different catalysts were prepared using the impregnation method and characterized via various techniques, including Brunauer-Emmett-Teller (BET), temperature-programmed reduction (TPR), thermogravimetric analysis (TGA) and Raman microscopy. The catalytic performance of the nickel-based catalysts supported on BC prepared at different pyrolysis temperatures (300, 500, 700 °C), was evaluated in a fixed-bed reactor at various reaction temperatures. The results showed that the 10 wt.% Ni/BC700 catalyst exhibited the highest activity, with initial H2 and carbon yield of 47.6% and 23.8%, respectively, at 800°C. This relatively good performance of the catalyst can be attributed to the synergistic effect between the nickel active particles and the BC support, due to the BC porous structure and large surface area (~250 m2/g), that facilitates uniform dispersion of the Ni nanoparticles. These results indicate that Ni-based catalysts supported on biochar derived from date palm tree wastes may have great potential for application in industrial MD processes.

RECOVERY OF PALM TREE WASTE INTO PLANT FIBERS FOR REINFORCING CONSTRUCTION CONCRETE

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Keywords: Plant fibers; Palm; Extraction; Fiber-reinforced concrete; Mechanical behaviour

ABSTRACT

The use of plant fibers in cementitious materials not only offers a solution to tensile strength problems, but also has a positive environmental impact by recovering organic waste. These fibers, particularly those extracted from palm stalks, are an abundant and inexpensive local natural resource, making them a promising choice for reinforcing construction concrete. However, the incorporation of plant fibers into ordinary concrete can affect the workability of the mix, making it essential to study these compounds in depth. In this project, the main objective is to scientifically explore the method for extracting plant fibers. From the vast range of plant fibers, we have chosen the fiber from the Washingtonia filifera palm. We will describe the experimental protocol we have chosen for extracting fibers from the Washingtonia filifera palm, mechanically, chemically, biologically and in combination. By incorporating these fibers into concrete, we aim to optimize the composition, which good workability with improved mechanical performance, specifically an improved flexural tensile strength. We will consider various factors influencing this composition, in particular the percentage of fibers.

References

[1] GOSSA Nabil « Elaboration et caractérisation expérimentale du comportement mécanique du béton à base de fibers de palmier dattier » 2012-2013

[2] BLEDZKI, A. K and GASSAN. J, Composites reinforced with cellulose based fibers ELSEVIER, Progress in polymer science, volume 24, pp.221-274

[3] P. Jodin, "Le Bois : matériau d'ingénierie" Nancy:Arbolor.

[4] NILSON, L., Reinforcedconcretewith sisal and othervegetablefibers, Swedishcouncil for building research, document d 14, 1975.

A LOOK AT PALM AND DATE LOSSES AND OPPORTUNITIES FOR SUSTAINABLE INVESTMENT

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Keywords: Date palm, fruits, losses, waste, sustainable, utilization.

ABSTRACT

Losses and waste of date Palm sector in date-producing countries is high, which creates a major challenge for opportunities to best utilization into various products. Losses may occur in the farm (pre-harvest operations) and during post-harvest operations (pruning, transportation, handling, preparation, storage, and distribution). Post-harvest losses for fruit and vegetable products were estimated between 11-50%. Dates are the most important fruit crop in the MENA region, and the losses range between 19-32% from farms, markets, and factories. As a result, low economic return exists for palm farms in which many farmers hesitate to continue in this sector due to the high costs of palm service and date production and the decrease in marketing prices, which make it a discouraging investment. A number of those farm owners put their farms for sale or rent. The other loss is the remnants of date palm trees and pruning parts, which exceed one million tons annually in SA and are often disposed of by burning or in landfills, which causes environmental and health problems for society, as well as losing an important economic value. It is essential to investigate opportunities to reduce such losses by first estimating the quantities of this loss/waste precisely and then identifying the sources of weakness and strength in the production chain from the field until consumed at the end. Possible measures to best utilize dates and other palm parts and their challenges will be discussed. A brief review of the expertise of the Chair of Dates Industry and Technology (CDIT) at King Saud University for this sector will be presented as well.

References

[1] Alhamdan Abdullah M. NIR Spectroscopy Assessment of Quality Index of Fermented Milk (Laban) Drink Flavored with Date Syrup during Cold Storage. Fermentation 2022, 8, 438. https://doi.org/10.3390/fermentation8090438. [2] Alhamdan Abdullah M, et al. 2022. "Response Surface Methodology (RSM) Optimization of the Physicochemical Quality Attributes of Ultraviolet (UV-C)-Treated Barhi Dates" Plants 11, no. 17: 2322. https://doi.org/10.3390/plants11172322.

OPTIMIZATION OF PYROLYSIS FOR PALM WASTE BIOCHAR AS CEMENT REPLACEMENT USING RESPONSE SURFACE METHODOLOGY

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Keywords: palm kernel shell, empty fruit bunch, pyrolysis, biochar, supplementary cementitious material

ABSTRACT

The production of cement a commonly utilized construction material, has negative environmental consequences due to increased carbon emissions. As a result, there has been a rise in research on supplementary cementitious materials to promote sustainability in the construction industry. The use of materials such as biochar have been explored in small quantities as cement substitutes and have shown improvements in the mechanical properties of mortar and concrete composites. Palm oil mills in Malaysia generate various wastes including empty fruit bunch, mesocarp fibers, palm kernel shell, and palm oil effluent. The use of empty fruit bunch biochar and palm kernel shell as a cement substitute is investigated by analyzing the physicochemical properties highlighted in previous studies and selecting the optimal production parameters using response surface methodology. To avoid conducting numerous time and resource-consuming experiments, researchers have also investigated the use of machine learning techniques to optimize production parameters. This study focuses on the use of empty fruit bunch and palm kernel shell, which were commonly used as fuel for steam boilers and in the form of biochar for power generation. Pyrolysis was the selected thermochemical conversion process, as it favors biochar yield more than biogas and bio-oil. The investigated pyrolysis parameters are temperature, heating rate and residence time. The responses chosen are biochar yield and the carbon, oxygen, potassium, and silicon content. The analysis uses Thermogravimetric and Field Emission Scanning Electron Microscope–Electron Dispersive X-ray Microscope to characterize the resultant biochar. It was found that the optimal parameters are 455°C, 15°C/min, and 20 min for empty fruit bunch and 409°C, 15°C/min, and 120 min for palm kernel shell which is required for use as a cement replacement. This study would prove the potential of utilization of palm waste biochar as a building material which would support sustainable construction in terms of environmental and economic aspects.

CROSS-LAMINATED TIMBER (CLT) MADE FROM OIL PALM WOOD (*ELAEIS GUINEENSIS* JACQ.)

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Keywords: Oil Palm Wood, Cross-Laminated Timber, CLT, Properties

ABSTRACT

Oil palms (Elaeis guineensis Jacq.) are a versatile crop producing palm and palm kernel oil, used across industries including food, chemicals, pharmaceuticals, and energy. Up to 180 million cbm of usable oil palm wood is generated annually after the 25-30 year economic lifespan [1]. However, its potential for utilization and substitution common wood species remains largely unexplored due to limited understanding of the oil palm wood properties. The wood's unique anatomy with a homogeneous macrostructure, differing from typical construction woods, lacks secondary thickness growth, annual rings, knots, and wood rays. The material resembles long-fiber reinforced composites, and its elastomechanical properties correlate with density [2]. The density variations within the trunk provide potential for glued building products like GLT [3] and CLT. To investigate the applicability of oil palm wood for cross-laminated timber (CLT), test specimens were produced by ripping boards to smaller cross-sections with 60 mm x 20 mm (and resulting reduced density gradients) and subsequent grading into density classes. Five-layer CLT test specimens were produced to investigate the flexural properties with the dimension of 3200 mm x 600 mm x 100 mm [4+5]. Test specimen layups vary according to density classes, and the study explores the impact of different layups. Flexural and compression properties were determined and compared with the results from the finite element modelling using RFEM 6.02 software (Dlubal Software GmbH). Elastomechanical properties for the modelling were derived from density correlations [2], assuming solid bonding between lamellae faces and a bond using friction coefficients on the edges. Ongoing research aims to compare modelling results with laboratory tests, offering insights for optimizing the modelling process and computer-aided enhancement of cross-laminated timber structures. This study holds potential for revolutionizing the use of oil palm wood in sustainable construction.

References

[1] A. Fruehwald, K. Fruehwald-Koenig, The Use of Oil Palm Trunks for Wood Products. By-Products of Palm Trees and Their Applications (2019) pp. 69–80

[2] K. Fruehwald-Koenig, L. Heister, Macro- and Micromechanical Behavior of Oil Palm Wood (Elaeis guineensis Jacq.): Tensile, Compression and Bending Properties. Submitted publication (2023).

DEVELOPMENT OF PCL/DATE PALM FIBER BIO-COMPOSITES FOR SUSTAINABLE PACKAGING APPLICATIONS: EFFECTS OF DRY BLENDING PROCESS ON BIO-COMPOSITES' MECHANICAL AND THERMAL PERFORMANCES

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KEYWORDS: Date palm fiber, Compression moulding, Melt blending, Morphological characterisation

ABSTRACT:

Polycaprolactone (PCL)/date palm fiber (DPF) reinforced fully bio-degradable composites were developed for sustainable packaging applications. A comprehensive literature review was conducted in order to understand and present the current research scenario of the use of date palm fiber-based bio-composites in sustainable packaging applications. Dry blending process was applied to mix polymer and fibers for producing their bio-composites, using the compression molding technique and investigated the effects of dry blending process on composites' mechanical and thermal properties. These properties were compared with the melt-blended PCL/DPF composites' properties found in the available published literature. In a melt blending process, polymer matrix is melted, and fiber contents are blended in the polymer matrix, employing a high shear pressure and heating temperature using an extrusion machine, whereas, in a dry blending process, polymer and fiber contents are mixed manually or in a shear mixer without application of heating or melting. In this work, the dry blended PCL/DPF bio-composites were produced by mixing fibers at various concentrations (2.5-10%, w/w) in the main PCL polymer matrix. The distribution of fibers in the polymer matrix was evaluated using SEM images. Mechanical properties were characterized with tensile tests, while thermal and thermomechanical properties were tested with DSC, TGA and DMA processes respectively. In addition to these, water contact angle measurement was also done to understand the surface properties of developed bio-composites in response to water absorption affinity. Despite melt blending process being popular and considered to have better mixing capability compared to the dry blending process, polymer and fibers can be degraded during the application of high temperature and pressure in the extrusion process. In addition to this, the melt blending process requires time, high process energy consumption and initial equipment investment. In this work, the dry-blending was able to produce PCL-DPF bio-composites successfully where the dry-blended bio-composites showed similar mechanical properties to melt-blended PCL-DPF bio-composites found in the existing literature. Therefore, this dry-blending technique can be further explored as a suitable potential alternative to produce bio-composites and use this technique more frequently in the industrial sector.

THE INFLUENCE OF CHARCOAL ADDITION ON THE MECHANICAL PROPERTIES OF MORTARS

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Keywords: Charcoal, Cement, Mechanical strength, Absorption, Mortar.

ABSTRACT

The use of mineral and organic additions in the preparation of concrete has become a necessity to obtain the desired performance in civil engineering. This requires expanding scientific research to collect as much information as possible about the new materials used. The objective of this study is to analyze the physico-mechanical behavior of mortars made by different dosages of activated Charcoal (AC). Charcoal has a setting retarding effect, where it covers the cement grains and interrupts the hydration of C3A tricalcium aluminates, decreasing its hydrolysis and the formation of ettringite. Its presence in the cementitious material forms a protective layer on the anhydrous C3A and C3S particles and slows down the hydration action. On the other hand, improvements in microstructure associated with increased hydration of cementitious binders occur in the presence of activated Charcoal, which is probably due to internal hardening caused by high porosity of CA. The results obtained have shown the efficiency of using low dosage of activated carbon (AC) on improvement of the mechanical strength and the porosity of the mortars. The contribution of additions to the properties of the material requires compliance with the appropriate dosage and adjusting the formulations according to the criteria required for the choice of the appropriate product.

MECHANICAL DEWATERING OF OIL PALM LUMBER (*ELAEIS GUINEENSIS* JACQ.) TO REDUCE COSTS AND IMPROVE QUALITY

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Keywords: Oil Palm Wood, Mechanical Dewatering, Costs, Properties

ABSTRACT

For nearly four decades, researchers have explored the productive utilization of oil palm wood, an abundant but underutilized resource typically considered agricultural waste. Processing oil palm wood traditionally failed among other reasons due to its high moisture content (up to 500 %) and poor drying efficiency. To address this, a novel thermo-hygro-mechanical (THM) densification method was developed, which employs cold compression and subsequent press-drying with compression rates of 40, 60, and 75 %. Densified wood is prone to partially recover from compression, especially under humid conditions. Therefore, the hygroscopic behavior of THM-densified oil palm wood is compared with kiln-dried unmodified reference specimens. The equilibrium moisture content (Emc) is reduced by the THM densification process by around 20 %. The swelling and shrinkage of the densified wood depends strongly on the densification rate and the analyzed direction. In the direction of compression (thickness), the densified specimens show higher values for all analyzed swelling and shrinkage parameters than the undensified specimens from the equivalent position within the trunk. Perpendicular to compression and to the vascular bundles (width) and parallel to the vascular bundles (length), the values of densified and undensified specimens are comparable with only slight differences. Surprisingly, the high thickness swelling of 22 to 38 % during water soaking is mostly reversed by shrinkage during re-drying and a comparably low permanent recovery of 3 to 8 % is measured. The wide range in elastomechanical property values found in undensified oil palm wood remains present in densified oil palm wood and increases through the densification process. The THM densification process significantly improves bending properties, particularly for outer and intermediate boards. A compression rate of 60 % outperformed 40 % for MOE and MOR values, while inner boards displayed better results at 60 % than 75 %. Shear properties experienced minor improvement through densification, being more dependent on parenchyma properties and interconnections between the structural elements than on the overall density. Densification achieves MOR, MOE, and Young's moduli similar to common wood species in the outer trunk. However, shear properties remained lower. The substantial variation in density, strength, and stiffness underscores the need for precise processing and grading of both undensified and densified oil palm wood.

SIGNIFICANCE OF NATURAL DYES EXTRACTED FROM DATE PALM FIBER FIBRILLIUM AND ASSESSMENT OF DYEABILITY ON CELLULOSIC FIBER VIA STATISTICAL MODELING

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Keywords: Date Palm Fiber Fibrillium; Response surface methodology; Optimization; Qualitative and quantitative analysis

ABSTRACT

The utilization of natural dyes in various industries has gained considerable attention due to growing environmental concerns and consumer preferences for sustainable products. The study explores the potential of colorant extraction from date palm fiber, specifically focusing on the fibrillium component. The extracted colorant's dyeing properties on cotton fibers are systematically investigated using advanced statistical modeling techniques. The dyeing of cotton with date palm fibrillium was optimized using response surface methodology with the aim of introducing a new source of natural dye and producing a sustainable coloring process. According to the findings, increasing dye concentration and dyebath temperature enhanced color strength (K/S), while lowering K/S by raising dyebath pH and mordant content. The variance analysis (ANOVA) was used to determine the significance of the statistical model generated for the study. The predicted optimum K/S value was validated experimentally using the optimum conditions and confirmed with the experimental values. The sample dyed under ideal circumstances had good color fastness characteristics.

EFFICIENT LIQUEFACTION OF LIGNIN IN METHANOL USING ZRO2 ELECTROSPUN NANOFIBROUS CATALYST

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Keywords: lignin catalytic cracking; methanol; electrospinning; ZrO2 nanofiberous catalyst;

ABSTRACT

Agricultural solid biomass is a naturally plentiful, renewable, and clean resource. It contains a considerable calorific value, which can substitute a portion of the expected depletion of petroleum and fossil feedstock for sustainable production of value-added chemicals and fuels. Among the numerous constituents present in biomass, lignin is the most stable and considered a refractory material [1-4]. Lignin are complex naturally occurring organic polymers that consist of both aliphatic and aromatic constituents, which are amorphous, and hydrophobic in nature [5]. Lignin is a major constituent of palm leaves and can be used as a naturally sustainable source for the value-addition of biomass. Lignin is mainly used for fuel and chemicals production and has many valuable applications such as synthesis of nanoparticles, polycarboxylic acid, supercapacitor electrode, hydrogels, water flocculants, photocatalyst, photovoltaic and related applications. Recent, researchers highlighted more sustainable bioenergy production technologies. However, efficient conversion routes of lignin are still facing challenges to accomplish due to the complicated nature of lignin. The catalytic decomposition of lignin was achieved using methanol as a solvent at different reaction temperatures in the range 180-300 ºC and at different reaction times from 2 to 8 hours, using lignin extracted from palm mixed with ZrO2 nanofibrous catalyst. The results show that the conversion of lignin increased with an increase in the amount of ZrO2 nanofibrous catalyst up to 50 mg. Further increase in the catalyst content had an adverse effect on the lignin conversion. Most of the lignin conversion (45 to 65%) occurred within the initial 2 hours of the decomposition reaction at all reaction temperatures. After these initial 2 hours, the lignin decomposition rate was slow down, and the decomposition of the lignin decreased to around 10-15% during the next 8 hours. The major compounds detected in the reaction products were vanillin, homovanillic acid, vanillic acid methyl ester, apocynin, methyl dehydroabietate, and dehydroabietic acid.

References

[1] M.A. Ali, et al., (2022). Efficient liquefaction of lignin in methanol using ZrO2 electrospun nanofibrous catalyst, Jazan University Journal.

FILLING THE GAP IN THE PHARMA INDUSTRY SUPPLY CHAIN BY PRODUCING NON-API PHARMACY INGREDIENTS FROM PALM TREE WASTE

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Keywords: non-API compounds, Cellulose, Carboxymethyl cellulose, microcrystalline cellulose

ABSTRACT

Palm tree agricultural waste (PAW) in Saudi Arabia arises from the extensive cultivation of date palms, posing significant environmental challenges. The disposal of discarded leaves, stems, and fruit remnants contributes to space and health concerns, worsened by improper disposal practices and burning, resulting in pollution. This study introduces a novel methodology for the production of two value-added non-API compounds namely carboxymethyl cellulose (CMC) and microcrystalline cellulose (MCC) from PAW. The PAW contains a cellulose matrix enveloped by lignin and hemicellulose as amorphous components. The process involves dewaxing and subsequent delignification through thermal treatment or bleaching. The bleached PAW then undergoes acid hydrolysis to extract cellulose, wherein part was used for the production of CMC, and part was subjected to further crystallization to yield MCC. The CMC was produced from cellulose by etherifying the hydroxyl groups with monochloroacetic acid (MCAA) in the presence of aqueous alkali. On the other hand, MCC was produced by crystallization of acid-treated cellulose. The FTIR analysis confirms the removal of amorphous content from PAW, with the resulting MCC demonstrating characteristic peaks of cellulose such as C-H vibration, C-O-O stretching, C6 Hydrogen of aromatic rings, and -OH bands. The XRD of bleached PAW and the MCC exhibited distinct peaks of native cellulose. But there is a significant change in the crystallinity due to acid hydrolysis, which reveals that acid hydrolysis converts the native cellulose into microcrystalline cellulose. The SEM of PAW, bleached PAW, and the MCC were performed, and remarkable changes were observed. The amorphous shape of the PAW was converted to cellulose fibers in the range of µm diameter. The agglomerated spherical-shaped cellulose microcrystal was found in µm range after the acid hydrolysis of bleached PAW. Finally, the TGA showed thermal stability of MCC. This study provides a cost-effective method for synthesizing MCC from agricultural waste, presenting potential applications in the food and pharmaceutical industries, including the preparation of bio nanocomposites with improved surface and thermal properties.

TiO_2 ACTIVATED CARBON PHOTOCATALYST PREPARED USING DATE PITS FOR THE DEGRADATION OF METHANE AND PHENOL.

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ABSTRACT

The Kingdom of Saudi Arabia is one of the leading countries in planting several million date palms. After the dates are consumed, large quantities of date seeds are produced as waste. These seeds/pits can be reused to produce activated carbon for water treatment, which is beneficial from both an environmental and economic perspective. Untreated hazardous wastes from industry and agrochemicals pose an immediate threat to drinking water. Therefore, in order to avoid water scarcity due to water pollution, the development of simple, efficient and affordable methods and materials for the removal of water contaminants (dyes, phenols, pesticides, etc.) is crucial. Photocatalysis, adsorption, filtration and sedimentation are some of the techniques used to remove industrial and agrochemical contaminants from wastewater. Photocatalysis has attracted the interest of researchers because it is a simple, efficient, cost-effective, and environmentally friendly process that enables the complete degradation of various organic pollutants. In addition, photocatalysis is a sustainable method with strong oxidation capacity and lower energy consumption than other purification methods. The most studied and active catalysts for the degradation of industrial and agrochemical wastes are titanium dioxide (TiO2) NPs, zinc oxide (ZnO) NPs, and tungsten oxide (WO3) NPs. However, TiO2 NPs are widely used photocatalysts for environmental remediation: due to their chemical inertness, low cost, non-toxicity, photosensitivity and high oxidation ability under ultraviolet (UV) light. In the present study, a TiO2/date-pit activated carbon photocatalyst was prepared by a combination of chemical, thermal and impregnation processes. The photocatalysts were tested with respect to the degradation of methane and phenol. The degradation of methane was more than 73-99%, and that of phenol was 80-91%. The differences in degradation depend on the type of photocatalyst and the design of the reactor. The results show that organic molecules can be degraded best with this technology.

IMPROVEMENT OF MECHANICAL QUALITIES OF CLAY MATERIAL THROUGH COCONUT FIBER STABILIZATION.

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Keywords: Mechanical properties, coconut fiber, clay, geotechnical properties.

ABSTRACT

The criticisms regularly formulated towards clay or soil, in general, are its weak mechanical qualities and low water quality. Therefore, it is necessary to find techniques to improve the properties of this material, which is widely used worldwide. Here, we propose stabilizing clay with coconut fiber as a solution to enhance its mechanical properties. To do this, we used an experimental method, first determining the geotechnical properties of the clay and then its mechanical properties. The geotechnical study using the Proctor Test revealed that the dry density of the clay is γ_b = 1.42 g/cm3, and its water content is W = 22.3%. By applying the rolling method, the Atterberg limits were determined: liquid limit Wl = 63.6, plastic limit Wp = 27.9, plasticity index Ip = 35.7, and consistency index Ic = 1.46. With 25 < IP = 35.7 < 40, the material falls into class A3, a marly clay. Additionally, Ic = 1.45 > 1.3, according to the water classification, it falls into class A3ts. The mechanical part focused on compression and flexural strengths obtained using a PROETI hydraulic press. We obtained a flexural strength of 0.75 MPa for simple clay (BA); 1.34 MPa for clay + 0.25% fiber (BAF1/4); 1.57 MPa for clay + 0.5% fiber (BAF1/2); 1.72 MPa for clay + 0.75% fiber (BAF3/4); and 2.91 MPa for clay + 1% fiber (BAF1). As for the compression strength, BA = 5.90 MPa, BAF1/4 = 6.395 MPa, BAF1/2 = 6.292 MPa, BAF3/4 = 6.065 MPa, and BAF1 = 5.423 MPa. The addition of fiber has thus improved the mechanical qualities of the simple clay. Hese stabilized bricks can be used for sustainable and bioclimatic construction, providing higher durability and good comfort.

References

[1] Armel B. LAIBI, Moussa GOMINA, Brahima SORGHO, Etienne SAGBO4, Philippe BLANCHART, Mohamed BOUTOUIL et Dominique K. C. SOHOUNHLOULE1 Caractérisation physico-chimique et géotechnique de deux sites argileux du Bénin en vue de leur valorisation dans l'écoconstruction, Int. J. Biol. Chem. Sci. 11(1): 499-514, February 2017, DOI : http://dx.doi.org/10.4314/ijbcs.v11i1.40

EFFECT OF ADDING DATE PALM POLLEN GRAINS ON THE NUTRITIONAL VALUE, SENSORY AND NATURAL (PHYSICAL) PROPERTIES OF CAKE

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Keywords: Date Palm Pollen Grains, Cake, Fortified, microbial

ABSTRACT

In this study, date palm pollen grains (DPPG) from Al-Ahsa were studied, the pollen has therapeutic benefits, as treating infertility in men and preserving fertility in females. Palm pollen and its extracts also have a blood sugar-lowering effect, in addition to being effective in managing diabetes complications such as hyperlipidemia. And nutritional benefits. Pollen has been studied as a functional ingredient for fortifying baked goods (cakes). The polyphenol content of DPPG was fractionated using HPLC. Palm pollen was added to 72% wheat flour in proportions of 2, 5, and 8% to prepare a cake. The ability of palm pollen to remove free radicals was measured as well as that of fortified cake. Cake and pollen were also analyzed for their nutritional components and their content of the minerals zinc, Ferrum, and potassium. The ability of DPPG to inhibit microbial growth during the storage period of fortified cake was estimated by estimating the total number of bacteria. The results indicated that date palm pollen contains polyphenol compounds. Methyl gallate, pyrocatechol, and syringic acid had the highest amounts, followed by naringenin, chlorogenic acid, and gallic acid. DPPG has an ability exceeding 70% to remove free radicals. DPPG content of protein and fiber was 39 and 18 g/100 g, respectively, and Ferrum, zinc, and potassium were 11, 9, and 830 mg/100 g, respectively. In addition, whenever the amount of DPPG in the cake increased, the nutritional and mineral components increased. Sensory evaluation showed significantly that DPPG did not affect the sensory quality of the fortified cake and was generally accepted. The results showed a significant ability of DPPG to suppress microbial growth in cake fortified at 8% within 14 days. The study conducts further studies, considering pollen as a potential nutritional supplement, and studying its addition in larger proportions to produce functional food products.

References

[1] Abdel-Shaheed, M. M., Abdalla, E. S., Khalil, A. F., & El-Hadidy, E. M. (2021). Effect of Egyptian Date Palm Pollen (Phoenix dactylifera L.) and Its Hydroethanolic Extracts on Serum Glucose and Lipid Profiles in Induced Diabetic Rats. Food and Nutrition Sciences, 12(02), 147

PALM STEARIN AS A SOURCE OF PHASE CHANGE MATERIAL FOR SOLAR THERMAL ENERGY STORAGE

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Keywords: Solar Energy, PCM, Energy Storage, Palm Oil

ABSTRACT

Palm stearin (PS) is the heavy fraction obtained during palm oil refining. It consists mainly of saturated fatty acids and is often an unwanted by-product. Although it is currently used in the manufacture of margarine or industrial vegetable fats, the increase in palm oil production will lead to higher production of PS. The composition, low cost and physicochemical characteristics of PS make it an ideal raw material for obtaining phase change materials for thermal energy storage in solar thermal energy systems [1]. This work explores the characterization of hydrogenated and trans esterified PS for its use as phase change materials. For both raw materials and products, melting and solidification temperatures and enthalpies, and heat capacity were determined by DSC according to ASTME793-06(2018) and ASTME1269-11(2018) [2]. Hydrogenation allowed the melting temperature of PS to be increased by up to 17%. Additionally, the performance as PCM of hydrogenated palm stearin (HPS) vs. paraffin wax, which is the most used PCM [3], was compared at laboratory scale. A test bench was built with a capacity of 6 kg of PCM, implementing a hot water recirculation system with flow and temperature measurement and including 9 temperature sensors inside the PCM. The melting process was conducted by recirculating water with a temperature of 75° C and a flow rate of 2 L/min. Results show that HPS can store up to 30% more thermal energy than paraffine wax of petrochemical origin, with a cost in unit value of kJ/kg up to 40% lower. The potential of using hydrogenated palm stearin as a phase change material to substitute paraffin wax can diversify the oil palm value chain, reduce manufacturing costs of thermal energy storage systems that implement PCM and promote the implementation of solar thermal energy technologies that are integrated with the use of plant-based biomass.

References

[1] Fleischer, A. S. Thermal Energy Storage Using Phase Change Materials: Fundamentals and Applications. SpringerBriefs Appl. Sci. Technol. 2015, 7–35.

[2] Teles dos Santos, M.; Viana, I. S.; Ract, J. N. R.; Le Roux, G. A. C. Thermal Properties of Palm Stearin, Canola Oil and Fully Hydrogenated Soybean Oil Blends: Coupling Experiments and Modeling. J. Food Eng. 2016, 185, 17–25.

DESIGN OF AN EFFICIENT, COST EFFECTIVE DATE PALM-DERIVED BIOCHAR-SILK FOR OIL SPILLS CLEANUP

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Keywords: biochar, hydrophobicity, absorption, oil spills

ABSTRACT

Water pollution caused by oil spills has become a growing concern worldwide due to the significant environmental impact it causes. Oil spills can occur in various ways, including accidents involving oil tankers, discharges from oil refineries, and transport of oil through pipelines. The effects of oil spills on water bodies can be devastating, leading to the death of aquatic life, destruction of habitats, and damage to the local economy. The most common oil adsorbents include natural and synthetic materials. Natural materials that are commonly used as oil adsorbents include peat, sawdust, straw, and cotton, while synthetic materials include polyurethane foam, polymer resin, and activated carbon. However, these materials have limitations in terms of their effectiveness, cost, and environmental impact. Recently, biochar, which is a type of charcoal produced from the pyrolysis of organic material, has been discovered as a potential oil adsorbent. Biochar has a high surface area and porosity, which allows it to adsorb oil effectively. Furthermore, it is an environmentally friendly material that can be produced from renewable sources. Silk material modified with biochar can enhance its oil adsorption capacity. The modification of silk with biochar creates a hybrid material with a high surface area and good mechanical properties. Additionally, silk has unique properties such as biocompatibility, biodegradability, and good water absorption, which can make it an excellent choice for oil spill cleanup. The paper studies the application of biochar to silk fabric modification as an innovative sustainable approach. The silk material modified with biochar displayed improved hydrophobicity, thermal stability, and antibacterial properties. The surface morphology of the silk fabric was significantly altered, revealing the successful incorporation of biochar. The modified silk fabric also showed a reduction in water absorption and oil repellent properties. This characteristic could prevent water pollution with oil by repelling oil from the surface and therefore reducing the exposure of aquatic life to harmful chemicals.

References

[1] Soto-Onate, David, and Gonzalo Caballero. "Oil spills, governance and institutional performance: The 1992 regime of liability and compensation for oil pollution damage." Journal of Cleaner Production 166 (2017): 299-311.

[2] Zhang, Junping, and Stefan Seeger. "Polyester materials with superwetting silicone nanofilaments for oil/water separation and selective oil absorption." Advanced Functional Materials 21.24 (2011): 4699-4704.

ENHANCING ARID AGRICULTURE WITH PALM BYPRODUCTS AND OTHER POLYSACCHARIDES: SUSTAINABLE SOLUTIONS AND INNOVATIONS

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Keywords: Cellulose, Nanocellulose, Cellulose derivatives, Sand, Desertification, Water response

ABSTRACT

Soil quality is the main limiting factor in the development of the food sector in arid areas, mainly due to the poor mechanics and the lack of water retention 1. Soil's organic carbon is nearly absent in arid soils, though it is important for water and nutrient transport, to soil mechanics, and to prevent erosion, and as a long-term carbon sink 2. In this study, we evaluate the potential benefits to of inert sand of a range of, mainly, cellulosic polysaccharide networks, in their polymeric or structured (fiber) forms, analogously to those found in healthy soils. We explore the impact of a wide range of non-food polysaccharide-based amendments, including pulp fibers, nanocellulosic fibers, cellulose derivatives, and other readily available carbohydrate polymers from arthropods (chitosan) or fruit peels (pectin). A practical methodology is presented to form sand-polymer composites to evaluate solid mechanics in compression as a function of humidity and the dynamics of their response to water. The mechanics are correlated with the network of polymers formed within pores of the sandy soil, as observed by electron microscopy. The response to water is correlated with both the features of the network and their intrinsic physico-chemical architecture. We expect this work to provide a rapid and reproducible methodology to benchmark sustainable organic amendments for arid soils.

References

[1] Tardy, B. L. et al. Integrating Arid Areas in the Global Bioeconomy: Opportunities and Challenges toward Sustainable Biomass Generation and Management. ACS Sustainable Chemistry and Engineering vol. 11 12177–12193 at https://doi.org/10.1021/acssuschemeng.3c01853 (2023).

[2] Ajdary, R., Tardy, B. L., Mattos, B. D., Bai, L. & Rojas, O. J. Plant Nanomaterials and Inspiration from Nature: Water Interactions and Hierarchically Structured Hydrogels. Advanced Materials vol. 33 2001085 at https://doi.org/10.1002/adma.202001085 (2021).

DATE PALM SEEDS-ZEOLITE COMPOSITE: A SUSTAINABLE AND EFFECTIVE COAGULANT FOR PHARMACEUTICAL CONTAMINANTS IN WATER

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Keywords: Cellulose, Nanocellulose, Cellulose derivatives, Sand, Desertification, Water response

ABSTRACT

The issue of water contamination caused by pharmaceutical chemicals is increasingly recognized as a significant environmental and public health challenge. As a result, there is a need to identify and develop sustainable and effective coagulants for the purpose of cleanup. The present study aims to examine the efficacy of a composite material made from Date Palm Seeds-Zeolite (DPSZC) as a new coagulant for the removal of pharmaceutical pollutants in water treatment processes. The creation of the composite entails the activation of zeolite and the integration of date palm seeds, both of which are recognized for their adsorption properties. The composite material was subsequently subjected to characterization utilizing a range of analytical techniques, such as scanning electron microscopy (SEM), X-ray diffraction (XRD), and Fourier transform infrared spectroscopy (FTIR). The findings indicated that the composite material exhibited a substantial surface area and a notable affinity for pharmaceutical pollutants.

The initial trials provide evidence of the composite's distinct ability to coagulate, displaying exceptional effectiveness in removing various pharmaceutical impurities. The findings demonstrate that DPSZC can achieve efficient coagulation while also providing a viable and economically advantageous approach. Furthermore, the research findings demonstrate the potential of the composite material for wider use in the field of wastewater treatment, thereby positioning it as a feasible option for implementing sustainable solutions to mitigate pharmaceutical contaminants.

Stabilization of Sunflower Oil During Accelerated Storage: Use of Date Palm Leaves Extract as a Potential Alternative to Synthetic Antioxidants

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Keywords: Date Palm Leaves, Sunflower oil, Antioxidant activity, Thermal stability

ABSTRACT

Date palm leaves (DPL) are considered as an agricultural waste. This study has evaluated the influence of date palm leaves extract (DPLE) on stabilization of sunflower oil (SFO). Antioxidant efficacy of DPLE extract has been estimated in stabilization of sunflower oil. Ethanolic extract was found to be highest in yield 24.72% and antioxidant activity IC50 = 2.573 ug mL Trolox. DPLE at concentrations of 400, 600, 800, 1000,1200,1500 ppm was added to sunflower oil samples. As standard, synthetic antioxidant Tert-Butylhydroquinone (TBHQ) of 200 ppm was used as a control. The oxidative properties of sunflower oil supplemented with date palm leaves extract at different concentrations in comparison with (TBHQ) at 200 ppm, were investigated beside control sample. The supplemented sunflower oil samples were stored under accelerated conditions for 20 days at 65°C (the temperature of 65°C was selected as a speedy technique to imitate the storage in actual conditions, and each day under such oven storage test at 65°C is comparable to one month of storage at the typical room temperature). For every 5-day interval, the oxidative properties of the supplemented sunflower oil were evaluated based on the following tests, Peroxide value (PV), P-anisidine value (p-AnV), Thiobarbituric Acid Reactive Substances (TBARS) assay, Iodine value (IV) and free fatty acids (FFAs). The Total Oxidation (TOTOX) values were also calculated based on the peroxide values and p-anisidine values. Results from different parameters were in agreement with each other, suggesting higher efficiency of SFO-1500 ppm followed by SFO-TBHQ followed by SFO-1200 samples, respectively. As a result, show DPLE to be a potent antioxidant for stabilizing sunflower oil during high temperatures during storage, and this effect will be more effective if the oil is stored in a dark place. This will prolong the oil's shelf life. Due to its strong free radical activity and phytochemical content to delay lipid oxidation, DPLE might be employed as an antioxidant in the oil industry.

References

[1] Abuelgassim, A. O. (2020). Towards the utilization of date palm (Phoenix dactylifera) leaves as a rich source of antioxidants. J. Food Nutr. Res, 8, 632-637.

[2] Ajdary, R., Tardy, B. L., Mattos, B. D., Bai, L. & Rojas, O. J. Plant Nanomaterials and Inspiration from Nature: Water Interactions and Hierarchically Structured Hydrogels. Advanced Materials vol. 33 2001085 at https://doi.org/10.1002/adma.202001085 (2021).