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Prediction of mechanical strength of magnesium alloy AZ31 with calcium addition using a neural network based model

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Prediction of mechanical strength of magnesium alloy AZ31 with calcium addition using a neural network based model

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Abstract. The aim of the research is to develop a neural network model to predict the mechanical strength of AZ31 magnesium alloy in addition with Calcium. This would help researchers or academicians to fabricate the magnesium alloy AZ31+x wt. % Ca which finds more importance in making biodegradable implants in orthopedic surgery. As the yield strength of human bone lies between 104.9 – 114.3 MPa whereas for pure Mg it is very lesser, it is needed to make alloys suitable for biomedical applications which are to be satisfied with their mechanical properties and biocompatibility. An artificial neural network-based model is used to predict the mechanical properties of Mg alloys AZ31+x wt. % Ca with compositions of Al, Zn, Mn and Ca as countable parts with various proportions. The compositions and properties of twenty different as cast alloys were used for training and prediction of the desired mechanical properties using Artificial Neural Network and the outputs are compared with the experimental results. The results show that the Levenberg-Marquardt (LM) algorithm serves better in prediction of mechanical properties of Mg alloys AZ31 and AZ31+1 wt. % Ca. Also the results were found significant at 90%, 95% and 99% confidence limits.

1. Introduction

Prediction of properties of metal alloys and composites using artificial neural networks before finding their properties experimentally becomes necessary to decide the composition of materials to be taken in account to achieve the desired results. The predictions reduce the time and cost of the researchers before fabricating and testing of the materials. Though many prediction methods give only approximate values against the exact one, it would be possible to predict the level of accuracy of the outputs saving the time for the researchers, academicians and scientists [1]. Magnesium finds its remarkable applications in automotive, naval, aerospace and even in biomedical applications with its density lesser than Aluminium [2-6].

This research is focused on prediction of mechanical properties (Yield strength) of Mg alloys that are adoptable for biomedical applications after adding Aluminum, Zinc and Calcium. The alloys prove its

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Artificial Intelligence Based Reduced Switch Multilevel Inverter For Grid Connected PV Applications

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Abstract— **Due to the rise in computer power, tools, and data collection, artificial intelligence (AI) is becoming more and more prevalent in diverse photovoltaic (PV) system applications. The basics of grid-connected multilevel inverters for PV systems is provided, together with information on the drivers, characteristics, evaluation criteria, topologies, modulation schemes, and selection criteria for various applications. The results of a thorough reliability investigation of basic 15L multilevel inverter (MLI) are examined in this study. The inverter is the most crucial component of a grid-connected PV system. This study provides a survey of the system topologies and grid-connected PV inverters utilized for PV systems linked to the grid.**

Key words: MPPT – Maximum Power Point Tracker, PV – Photovoltaic, ANN – Artificial Neural Network, SEPIC – Single-ended primary-inductance converter.

I. INTRODUCTION

The worldwide population is significantly impacted by global warming and environmental harm caused by an overreliance on renewable energy sources like coal, oil, and gas. Photovoltaic sources of energy are by far the greatest among renewable energy sources when thinking of how they contribute to the world's power output [1]. The photovoltaic standalone system is becoming increasingly important, especially for rural applications like solar illumination, battery charging, and PV water pumping. Given the consequences of fossil fuels on the environment and their scarcity, a movement towards using a growing amount renewable energy has emerged [2]. This has led to the widespread use of solar panels installed on residential roofs and PV farms next to country highways. Over 99% of PV installed capacity is accounted for by grid-connected solar power plants, as opposed to individual panels, that require batteries. Since all of the electricity produced by the PV plant is uploaded to the grid for immediate transfer, distribution, and use, storage are not required in grid-connected PV systems. [3].

In order to set themselves apart from rivals and gain a competitive edge in the expanding PV converter industry, makers of exclusive technology have also been driving forces behind the creation of innovative PV converter designs. This has resulted in a variety of fresh and distinctive power converter designs that have been especially created for PV applications and will be discussed in this session [4]. When employing a grid-connected inverter, the power line receives and distributes the energy produced by a PV plant directly. Compared to a stand-alone system, the configuration takes up less room and needs less maintenance because batteries and other power storage options are no longer required [5]. Due to the growing importance of grid-connected PV uses, international and national committees continually maintain a number of standard standards and rules to ensure the safety and efficient transfer of electricity into the grid [6].

The increased usage of PV inverters in residential and commercial settings has driven down losses and increased efficiency. With the intention of decreasing the size and cost, several companies have developed transformer less inverters with effective topologies and control strategies that do not detect zero crossing. This non-isolated set of converters consists of five basic kinds, commonly mentioned to as the boost, buck, buck-boost, Sepic, Cuk and zeta converters. In contrast to the boost converter, which is used for voltage step-up, the buck converter is applied for voltage step-down [7]. The buck converter's disadvantage is its slow response to fast load steps. It is necessary to compensate for error amplifiers has to take slope into consideration. The buck boost converter is employed to enhance this mistake. A more effective option is provided by buck-boost converters, which have fewer, shorter external elements. The 'Cuk converter, which has the benefit of low wave current at both the effort and the output, is similar to a buck-boost converter in that the voltages of the input and output are inverted [8].

According to the findings of earlier research, the Sepic Converter performs with an efficiency of at least 88%.Right-half plane zero, non-isolated topology, a complicated control

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Design of Interleaved Cuk Converter with fuzzy based MPPT in standalone PV Application

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Abstract—**In recent days, the demand for energy is rapidly growing due to industrial revolution. The best option for supplying the rising need for energy is renewable energy. Because of its vast availability, environmental friendliness, and adaptability, solar energy is seen as the most promising energy source. However, there are a lot of benefits to solar energy. Due to variations in solar light, it has challenges in producing a high conversion ratio and steady supply of energy. The proposed strategy addresses the aforementioned issues. An Interleaved Cuk Converter with an intelligent maximum power point tracker and fuzzy logic is coupled to a photovoltaic (PV) solar module in the proposed system. An Interleaved Cuk Converter used in this approach improves the voltage with minimized switching stress and ripples. To track the peak power, fuzzy based Maximum Power Point Tracking (MPPT) is used which is highly efficient in tracking as well as it shows dynamic response in case of changing atmospheric conditions. The proposed method provides higher efficiency and better performance regarding tracking efficacy and response time. The efficiency of the system is validated through MATLAB simulation.**

Keywords— Interleaved Cuk Converter (ICC), Fuzzy based MPPT, Peak power, MATLAB, Solar energy

I. INTRODUCTION

The industrial revolution has increased the need for energy in our everyday lives. In the most developing countries, such as India, a major portion of energy output is based on non-renewable energy sources. The progressive depletion of these sources, such as fossil fuels, oils etc, is pushing emerging countries towards civilization's unsustainable end. In addition, the production of energy from traditional sources contributes to greenhouse gas emissions. So, it has become a great task to deteriorate the emission of greenhouse gases like CO2 and CO3. By making sure there is clean, secure, and economical energy, the objective is accomplished, where all these conditions get satisfied through renewable energy sources. But there are several renewable sources like solar, wind and hydro energy are available. Among these sources, PV is found as the best one as it is the most efficient renewable sources with benefits like clean, no noise due to absence of moving parts, pollution and maintenance free. However, it has complexities like low efficiency of energy conversion and fluctuation due to weather conditions which hinders the stability at the side of load [1-3]. In order to solve this issue, a DC-DC converter that serves as a conduit across the PV module and the load is needed.

Several DC-DC converters were used to increase efficiency of PV system. Buck and boost facilities, which are used for power handling, are included in basic circuit configuration for DC-DC converters [4-6]. Due to the availability of an inductor at either input or output, they generate pulsed currents on either side. Consequently, pulsed power has an impact on the power quality. SEPIC has a pulsing output current, just like buck-boost converters do. As it lowers ripple voltage and current levels without changing polarities [7] [8], the Luo converter is utilised to prevent these problems. However, a large output capacitor is required to lower the ripple voltage [9]. As a result, the Cuk converter is utilised to solve these issues. The presence of inductor at input and output avoid pulsated current and generates continuous flow of current. At continuous conduction mode, the Cuk converter [10] produces a significant input current ripple and introduces unwanted harmonics into the source. High voltage gain, constant input current, decreased voltage ripples, and minimal input current ripple are all features of the interleaved DC-DC Cuk converter.

Although constant input current is fed to load. To monitor the maximum power generated by solar cell, several MPPT algorithm is used such as voltage and current feedback, hill climbing, neural network, perturb and observation ,fuzzy logic and incremental conductance. Hill climbing [11] and voltage feedback are two of these methods that are simple to use, but they are less effective in detecting the peak power in cases of rapid variations brought on by weather conditions. In the aforementioned algorithm, incremental conductance and perturb and observation (P&O) are widely used techniques. It's tracking efficiency shows good result but it consumes too much of time as it involves an additional P-I loop [12], [13]. In recent days, Artificial Neural Network (ANN) based algorithm has gained great attention with impressive enhancement and high efficiency but the implementation process is difficult as a result of the choice of neurons and the

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Review of Maximum Power Point Tracking Based Novel Converters Used In EV Applications

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Abstract—**The usage of renewable energy plays a significant part to make a pollution-free environment. The best solution for regulating DC voltage and maximising the performance of RES is to employ DC-DC converters. A Maximum Power Point Tracking (MPPT) controller is used to monitor Photovoltaic (PV) panel's maximum output power. Here, an evaluation is done to identify the most effective controller acting as MPPT with Converter is discussed. An evaluation of several dc-dc converter models took into account a number of factors, including price, the materials utilised, current ripple, and efficiency. Lastly, we demonstrate comparative analysis to find out the most effective conversion for PV-fed applications. From the comparison result, the Artificial Neural Network (ANN) technique obtained better tracking accuracy for MPPT method.**

Keywords— PV, DC-DC Converters, MPPT, Comparative analysis. ANN

I. Introduction

Solar photovoltaic (PV) systems, including decentralised and string configurations, frequently employ a DC-DC transmitter to restrict electricity production to optimize solar power under a wide range of climatic and board situations. The DC-DC converter should offer an extensive variation of output input voltage change ratios as quick voltage and current regulation to provide optimal tracking of power points (MPPT). PV systems frequently use inverter for DC-DC conversion, but the only workable amperage ratios are step-up wattage proportions [1]. A creative Power converter arrangement for photovoltaic (PV) applications that have substantial proposed converter and seamless potential. PV systems are heavily used hybrid renewable energy systems integration. These processes must conquer a number of challenges in order to improve their effectiveness and serviceability. These methodologies differ in a number of ways, which include complexity, cost, and the type of detector required, application, and efficacy [2]. The DC bus is then combined to composite Dc conversion, which control the current and voltage of the output for charging batteries. Because the Medium Voltage (MV) transistor already isolates the entire system, the DC-DC inverters, as discussed, can be a non-isolated controller. This framework is now widely used due to its greater effectiveness. However, the 2-stage rectification system remains, and it is connected to the rest of the framework via a link capacitor for DC power [3].

Other applications of the Partial Power Converter (PPC) principle include wind turbines, which use a double-fed inductive power supply with a direct grid connection to the stator and a significant indirect four dimension dc-dc converter attached between the rotor conductors and the grid. It has been known by various names over the years, including PV Balancers, Voltage Control Compensation, Partial Volume Adapters, and Partial Power Processing Inverter [4]. By using dc conversion, the MPPT, a two stages a grid's connection PV system with configurable dc power, is identified. However, Battery Energy Storage System (BESS) is not present in the system. Because of the abnormality and unpredictability of renewable radiation, the framework and power grid will frequently interact. For a Photovoltaic with BESS, a home energy strategy based on DC bus signalling was suggested. The structure has the potential to improve normality and resource usage [5].

For systems that generate electricity from renewable sources, dc-dc converter is an especially appealing and showing promise conversion. The total output of solar or wind energy conversion systems is significantly different. An input power inverter stage, a multilevel inverter is employed to strengthen AC voltage to satisfy grid requirements for efficient synchronisation. The presence of the 50 Hz transformer, on the other hand, makes it larger, bulkier, and less efficient overall, particularly when exposed to natural conditions [6]. Numerous transformer and capacitors configurations are used in various Dc conversions to obtain higher power output despite rising bloodsucking failures and heavy layout. Multi-port inverters innovations have been shown to effectively use renewable energy sources. A solution for feeding PV energy to high voltage DC buses has been discovered because of its capacity to accept various input sources. This inverters, however, required a large number of inductances and semiconductors, making the circuit expensive and bulky [7].

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Original Article

Implementation of PV-Wind based Microgrid System using Whale Optimization Algorithm

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Abstract *- Recently, Micro Grids (MGs) have become extremely popular due to their advantages of effective power conversion and high transmission efficiency. The MG and Nonlinear Loads (NL) are being incorporated into the electricity network. MGs are connected by Voltage Source Converters (VSCs), and NL infuses harmonics into the utility grid using power devices. However, the emergence of stability problems in the MG is caused by the nonlinear characteristics of Renewable Energy Sources (RESs), the rising use of power electronic devices and unexpected variations in load. This paper aims to suggest a microgrid that employs RESs comprising wind and Photovoltaic (PV) systems. This method is established to distribute stable power to loads without any interruptions. A Doubly Fed Induction Generator (DFIG) is deployed as a wind system. To stabilize the PV input voltage, the Boost converter is implemented. Furthermore, intended for enhancing the microgrid's performance, a constant output without distortion is attained from the converter with the deployment of a Whale Optimized Proportional Integral (WO-PI) controller. The 3ϕ inverter is utilized to sustain the DC link voltage, and it combines PV, wind, and battery output at a single point and feeds it to the grid. The results are implemented using the MATLAB platform, and simulation outcomes show that the suggested control technique is effective with a THD of 2.33% and reduced overshoot issues.*

Keywords *- PV system, Wind system, Boost converter, WO-PI controller, MG, DFIG.*

1. Introduction

RESs have recently taken substantial importance as a consequence of the increasing need for electricity. Using innovative, clean energy sources has become essential due to the demand for fossil fuels for power generation [1-3]. As a result, the construction of clean energy using wind and PV input power is projected to be a feasible option in the future. Solar and wind energies are affordable to use and produce no emissions. Also, it brings electricity to isolated locations not handled by electricity companies or connected to the grid. Furthermore, it can provide a remedy for nations experiencing a shortage of fossil fuel energy [4, 5].

Unfortunately, the accessibility of these sources is intermittent and weather-dependent. The power system has challenges while using these resources because of the unpredictable nature of power output and its variations [6]. The utility grid's stability and standalone applications ultimately depend on incorporating clean energy sources [7]. So, adopting Energy Storage Systems (ESS) offers a fantastic remedy for the intermittent issue. Consequently, hybrid energy systems incorporating ESS are highly suggested to ensure an effective and smooth power transfer. Hence, MGs are a crucial paradigm to combine alongside ESS with distributed and renewable energy sources [9-11].

In the modern world, dealing with the growth of clean energy requires the development of the MG model. It has the potential to enable the final user to store, regulate, produce, and maintain a portion of the energy consumed, turning the client into a contributor to the network instead of a consumer [13]. MG offers numerous benefits to customers and utilities like each other. Reduced power flow on transmission and distribution lines, reduced power losses and lower costs[21,25] for excess energy sources are all benefits of the MG approach. MG can also minimize the load demand on the electrical grid and contributes to lowering pollutants that represent a concern from climate change. Also, it can help in fixing network issues [14].

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LPG Gas Level Monitoring and Leakage Detection System

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Abstract—**Liquefied Petroleum Gas (LPG) plays a significant role in our daily lives. However, handling it with the utmost care is crucial due to its high ignitability, which can lead to fire outbreaks and explosions. The accurate calculation of gas leakage and the precise capacity of LPG cylinders remains challenging. To address these concerns, a robust gas leakage detection and monitoring system becomes imperative. The primary objective of this research design is to provide real-time information regarding the LPG gas level within the cylinder and promptly identify any instances of gas leakage. In the event of a gas leak, an alert mechanism, such as a buzzer, will notify the user. The design incorporates gas detectors and cargo cells that enable gas level identification and leak detection. Additionally, a television display visualizes the quantity of gas present, accompanied by alert messages. By activating the buzzer and indicator upon gas leakage detection, immediate attention is drawn to prevent potential hazards. This research design not only offers insights into the LPG gas level during refilling. It also functions as a powerful tool to mitigate gas leakage incidents and promote overall safety. Consequently, it proves instrumental in advancing LPG cylinder technology.**

Keywords—Arduino, Liquefied petroleum gas (LPG), gas leakage, Gas sensor, Liquid-crystal display (LCD).

I. Introduction

LPG refers to a gas mixture made up of butane and propane that has no odour at all. It has both unsaturated and saturated hydrocarbons. Ethyl Mercaptan is a substance that is added to LPG to remove its natural smell. LPG in air has an explosive range of 1.8% to 9.5% of the gas volume. Depending on how much it weighs in the cylinder, LPG is divided into three categories: household, commercial, and industrial. 14.2 kg of LPG is the normal capacity of a residential cylinder[1]. In parallel, LPG cylinders in the Industrial and there are two types of commercial categories: one weighing 19 kilograms and the other weighing 35 kilograms. LPG is usually filled up to only 85%, because any amount beyond that will cause the gas to turn into vapor. This is because all are being careful to prevent dangers. If the temperature increases by 1°C, then the pressure of LPG in the cylinder goes up by 15 kilograms per square centimetre. LPG possesses a high level of danger due to its inherent flammability and potential hazards[2]. In the present age, where electricity dominates as the primary energy source, even a minor spark within the vicinity during a leakage of LPG can lead to a catastrophic explosion. Knowing the key safety protocols to adhere to during a gas leak is crucial for all users. Studies have been done on monitoring and finding leaks in LPG. Their attention was directed towards assessing the viability and credibility.

II. Implementation Setup

Here the product used to detect gas leaks and monitor LPG levels. A loadcell signal is amplified and sent to the Arduino via the HX711 amplifier. Arduino sends signals to the LCD. On the LCD, the percentage of gas in the cylinder is displayed.

By utilising the MQ-2 gas sensor [3-4], it is possible to detect gas leaks more easily. On the LCD, a warning message is appeared when the gas leak occurs, and a buzzer and BLDC fan are triggered.

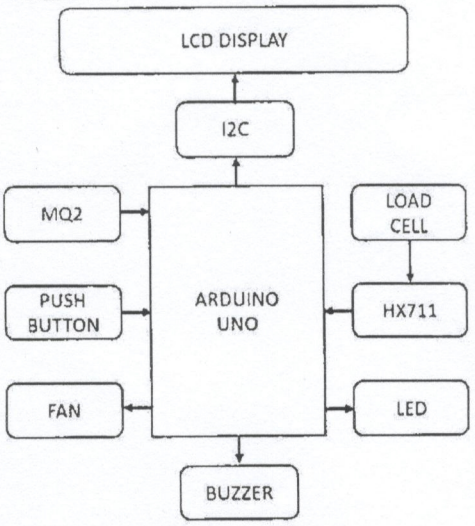

Fig. 1. Block Diagram of the work

An Inclusive and Effective End-of-Life Vehicle Recycling System in India: Balancing Economy and Ecology from Grave to Cradle

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ABSTRACT: *End-of-Life Vehicles (ELVs) in India are often recycled by car-breaking yards operating in the informal sector. In the absence of well-established, state-of-the-art ELV mechanisms, their work – ensures the crucial recycling of ELVs. Multiple qualitative analysis methods, such as desk study, literature review, and field visits, are utilized. Our study shows the following: car-breaking yards frequently work in an inefficient manner causing environmental hazards and health risks; the replacement policy adopted during vehicle servicing by Original Equipment Manufacturers and Authorized Dealers results in inefficient material use; Informal actors such as Private workshop owners and Reconditioning shops enable significant savings in material and costs, partly by substituting capital and energy with labor. We propose an inclusive 3R (reuse, recondition, and recycle) framework, which integrates various informal actors involved in ELV recycling. This sustainability-oriented framework ensures that the components and materials circulate in a closed loop.*

KEYWORDS: *Circular Economy; 3R - Reuse, Remanufacture, and Recycle; End-of-Life Vehicle; Inclusive supply chain; Sustainable development goals.*

INTRODUCTION

The extraction of raw materials such as fossil fuels, metal ores, and minerals requires enormous energy and water. Also, it generates a large amount of waste. We are losing freshwater ecosystems and marine water ecosystems at the rate of 6% and 4% a year, respectively [2]. A recent analysis by the World Wide Fund for Nature states that humans, with their current consumption pattern, are using 50% more resources than nature can replenish (Guardian, 2014). Since 1970 in 44 years, global emissions of CO_2 have increased by 90%.

In developing countries like India, more middle-class people possess higher purchasing power in the coming years. This will cause a drastic increase in resource consumption and industrial pollution (IGEP, 2013). Annual sales of passenger vehicles in India for the year 2017-18 were about 3.29 million units, and the number of registered cars by 2029 is estimated to be 100 million units (SIAM, 2019). This shows that the Indian vehicle industry is growing at a fast pace. In ten years, there has been a considerable increase in production plants. The absence of a proper end-of-life (ELV) recycling infrastructure to handle ELVs is a significant concern. The status quo of ELVs being processed by the informal sector in an unhealthy and inefficient manner pollutes the environment and generates more

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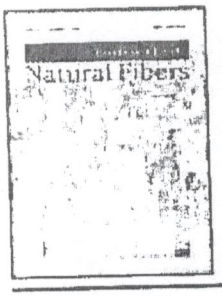

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Characterization of raw and alkali treated new cellulosic fiber from the rinds of Thespesia populnea plant

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Characterization of raw and alkali treated new cellulosic fiber from the rinds of Thespesia populnea plant

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ABSTRACT

This current study aims to evaluate the suitability of a new cellulosic fiber by characterization methods. Raw fibers are extracted from the rinds of Thespesia Populnea plant by the water-retting process. The extracted raw fibers are treated with 1% (w/v) of NaOH solution with a soaking time of 90 minutes. The characterization outcomes report that alkali treatment increases the crystalline index and cellulose content from 41% to 65% and 52.5 wt% to 58.9 wt%, respectively. The FT-IR spectra analysis confirms diminishing of non-cellulosic substances in alkali-treated fiber. The alkali treatment alters the fiber surface and fiber diameter, which is evidenced in morphological analysis.

KEYWORDS

Natural fiber; chemical treatment; crystallinity index; thermal stability; Thespesia populnea; morphological analysis

关键词

天然纤维; 化学处理; 结晶度指数; 热稳定性; 白杨树; 形态分析

摘要

本研究旨在通过表征方法来评估一种新型纤维素纤维的适用性. 通过水浸法从白杨皮中提取粗纤维. 提取的粗纤维用1%(w/v)的NaOH溶液处理,浸泡时间为90分钟. 表征结果表明,碱处理使结晶指数和纤维素含量分别从41%提高到65%和52.5%到58.9%. 红外光谱分析证实碱处理后纤维中非纤维素类物质减少. 形态分析表明,碱处理改变了纤维表面和纤维直径.

Introduction

Synthetic fibers (Man-made fibers) usage causes skin irritation to the users, abrasion to the equipment, and also leads to environmental problems. With the intention of reducing the environmental pollution, scientists and engineers have been focusing on alternative sources instead of synthetic fibers. Hence, they are trying to use natural fibers as reinforcement in place of synthetic fibers. Natural fibers have more attractive features like high specific strength and stiffness, low cost, non-abrasiveness, ease of manufacturing, abundant availability, and biodegradability (Buitrago, Jaramillo, and Maryory 2015; Baskaran et al. 2017; Kathiresan et al. 2016; Manimaran et al. 2018; Pandiarajan, Kathiresan, and Sornakumar 2019; Pandiarajan and Kathiresan 2018; Rajesh Jesudoss Hynes et al. 2017; Senthamaraikannan et al. 2018; Thiruchitrambalam et al. 2010). The drawbacks of natural fibers are such as low processing temperature, poor wettability, brittleness, moisture absorption, and incompatibility with polymer matrices (Athijayamani et al. 2009). The hydrophilic property of natural fiber may weaken the adhesion strength between fiber and matrices and also affects the properties of composites (Wang et al. 2007). Various fiber surface modification techniques such as physical (corona discharge, plasma, and U.V. bombardment) and chemical (alkali, grafting, acrylation, permanganate, acetylation, silane, and peroxide) treatment methods (Bozaci et al. 2013; John and Anandjiwala 2008; Thakur et al. 2010) are used to improve the adhesive property of fiber with the matrix. Among these treatments, alkali treatment is a cost-effective and active method to alter the fiber surfaces. The alkali treatment on natural fiber modifies the physical and chemical structure of fiber surface and may also improve the bonding between fiber and matrix

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Physico Chemical Characterization of Fiber from Melia Azedarach Barks as an Effective Reinforcement in Polymer Matrices

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ABSTRACT

The present study aimed to investigate the physico-chemical properties of new cellulosic fiber obtained from the bark of Melia Azedarach tree. The investigation outcomes revealed that, the cellulose content, crystallinity index and density of Melia Azedarach Fiber (MAF) were determined as 66.5 wt.%, 45.45% and 950 Kg/m^3, respectively. The MAF had thermal stability up to 220^{0}C which is evidenced from the thermo gravimetric analysis. The Fourier Transform Infra Red test clearly specified the existence of cellulosic and non-cellulosic substance in MAF. The morphological analysis showed that MAF contains smooth surfaces and its diameter is measured as 48.2 ± 2 µm. The results of this investigation on MAF were evident that it can be used as future reinforcement material to develop the green composite for potential applications.

KEYWORDS

Melia Azedarach fiber; physico-chemical; thermal stability; infra-red; surface morphology; crystallinity Index

关键词

Melia Azedarach fiber, 苦楝纤维, Physico-chemical, 理化, Thermal stability, 热稳定性, Infra-red, 红外, Surface morphology, 表面形貌, Crystallinity Index结晶度指数

摘要

研究了从苦楝树皮中提取的新型纤维素纤维的理化性质. 结果表明，苦楝纤维（MAF）的纤维素含量为66.5%，结晶指数为45.45%，密度为950kg/m3. 热重分析表明，MAF的热稳定性高达220θC. 傅立叶变换红外试验清楚地说明了MAF中存在纤维素和非纤维素物质. 形态分析表明，MAF具有光滑的表面，其直径为48.2±2µm. 研究结果表明，MAF可以作为未来的增强材料，开发具有潜在应用价值的绿色复合材料.

Introduction

In recent decades, researchers and scientist have been focusing on new fibers with the characteristics of light weight, inexpensive, easy available and particularly eco-friendly in nature to use as a reinforcement in polymer composites (Dufresne 2013; Obi Reddy et al. 2013; Pandiarajan and Kathiresan 2018; Thiruchitrambalam et al. 2010). Hence, they found that the use of natural fiber as reinforcement instead of manmade fiber such as glass, carbon, aramid in polymer composites due to their special features such as low cost, light weight, biodegradability, rich availability and non-abrasion of processing equipment, reduced wear of tooling, good working condition and no skin irritation (Ahmad et al. 2008; Buitrago, Jaramillo, and Maryory 2015; Joseph et al. 2009; Laly Pothan, Thomas, and Groeninckx 2006; Sreekala, Kumaran, and Thomas 1997; Sreekala and Thomas 2003). The use of natural fiber-reinforced composites have found in various domestic and industrial applications including aerospace engineering, gas turbines for civil and military aircraft (Balakrishnan et al. (2016)). Generally, natural fiber can be obtained from the different parts of the plant such as root (Indran, Edwin Raj, and Sreenivasan 2014), leaf (Kathiresan et al. 2016; Reddy and Yang 2008), stem (Reddy and Yang

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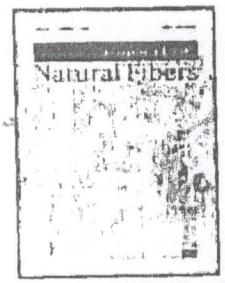

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Effect of Alkali-treatment on Structural, Thermal, Tensile Properties of *Dichrostachys Cinerea* Bark Fiber and Its Composites

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Effect of Alkali-treatment on Structural, Thermal, Tensile Properties of *Dichrostachys Cinerea* Bark Fiber and Its Composites

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ABSTRACT

The effect of alkali-treatment of the chemical composition, structure, thermal stability, tensile strength, and surface topology of *dichrostachys cinerea* bark fibers (DCFs) was analyzed by Chemical analysis, XRD, FTIR, TGA, SEM, and AFM in this investigation. The alkali treatment of raw DCFs with 5% (w/v) NaOH and 90 min of soaking period were recognized to be optimal by the chemical analysis. It is interesting to notice that optimally treated DCFs own improved cellulose (78.4 wt.%), lesser hemicellulose (4.6 wt.%) and lignin (9.12 wt.%) contents, increased crystallinity index (65.63%), tensile strength, thermal stability, and improved surface topography compared with raw DCFs. The findings revealed that optimally treated DCFs were appropriate fiber as reinforcement material in polymer composites. The various weight percentages of raw and optimally treated DCF composites were prepared by hand lay up and compression molding methods. Further, the mechanical testing of prepared composites was undergone as per the ASTM standard.

KEYWORDS

Dichrostachyscinerea fibers; chemical analysis; thermal stability; surface topology; scanning electron microscope; tensile strength

关键词

纤维; 化学分析; 热稳定性; 表面拓扑结构; 扫描电子显微镜; 抗拉强度

摘要

摘要采用化学分析、XRD、FTIR、TGA、SEM和AFM等手段，研究了碱化处理对灰树花树皮纤维(DCFs)化学成分、结构、热稳定性、拉伸强度和表面形貌的影响.

化学分析结果表明，用5% (w/v) NaOH和90min浸泡时间对原料DCFs进行碱处理效果最佳. 值得注意的是，与未处理的DCFs相比，经过优化处理的DCFs具有较好的纤维素(78.4 wt.%)、较低的半纤维素(4.6 wt.%)和木质素(9.12 wt.%)含量、较高的结晶度指数(65.63%)、较高的抗拉强度、热稳定性和较好的表面形貌. 结果表明，在聚合物复合材料中，对DCFs进行优化处理是合适的增强材料. 采用手糊法和模压法制备了各种比例的DCF复合材料，并对其进行了优化处理. 此外，制备的复合材料的机械测试按照ASTM标准进行.

Introduction

Growing environmental responsiveness all over the world has steered scientists to create new green materials that increase the environmental quality of products (Indran, Edwin Raj, and Sreenivasan 2014). Among organic fillers, plant fibers deliver a number of advantages as reinforcement for polymers. Many natural fibersrevealnoticeable properties such as high-specific modulus, strength, excellent process ability, easily available, easy to extract, easy to handle, light weight, easy to fabricate as composite, biodegradability, and cost-effectiveness (Senthamaraikannan et al. 2016). Along with

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