EASTERN KARBI ANGLONG COLLEGE

Sarihajan, Karbi Anglong, Assam

Key Indicator

3.2- Research Publication and Awards

Metric No. 3.2.1

Number of papers published per teacher in the Journals notified on UGC website during the year

PeerJ

Estimation of environment stability for fruit yield and capsaicin content by using two models in *Capsicum chinense* Jacq. (Ghost Pepper) with multi-year evaluation

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ABSTRACT

Background: *Capsicum chinense* Jacq. (Ghost Pepper) is well-known for its high pungency and pleasant aroma. The recent years witnessed a significant decline in popularity of this important crop due to the use of inferior planting material and lack of elite lines. To maintain constant performance across a variety of settings, it is crucial to choose stable lines with high yield and capsaicin content, as these are the most promising traits of Ghost Pepper.

Method: In this study, 120 high-capsaicin genotypes were subjected to a 3-year (*kharif* 2017, 2018 and 2019) stability investigation utilizing two well-known stability methods: Eberhart-Russell (ER) and additive main effects and multiple interaction (AMMI). Three replications were used following Randomized Complete Block Design for 11 traits. The experiment soil was sandy loam with pH 4.9. Minimum and maximum temperature of 18.5 °C, 17.5 °C, 17.4 °C and 32.2 °C, 31.3 °C, 32.7 °C and rainfall of 1,781, 2,099, 1,972 mm respectively was recorded for the study period.

Result: The genotype-environment linear interaction (G×E Lin.) was highly significant for days to 50% flowering, capsaicin content, fruit length and girth, fruit yield per plant and number of fruits per plant at $p < 0.005$. G×E interaction for fruit yield and capsaicin content in AMMI-analysis of variance reported 67.07% and 71.51% contribution by IPCA-1 (interactive principal component axis) and 32.76% and 28.49% by IPCA-2, respectively. Eight genotypes were identified to be stable with high yield and capsaicin content. The identified stable lines can be opted for cultivation to reduce the impact of crop failure when grown in different macro-environments. Moreover, the pharmaceutical and spice sectors will also be benefitted from the lines with high capsaicin content. Further research assessing the lines' performance across various regions of India can provide a solid foundation for the crop's evaluation at national level.

Subjects Agricultural Science, Plant Science
Keywords Ghost pepper, Pungency, Crop failure, Stability, Macro-environments

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Additional Information and Declarations can be found on page 14

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ACS APPLIED BIO MATERIALS

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Article

Self-Assembly Driven Formation of Functional Ultralong "Artificial Fibers" to Mitigate the Neuronal Damage Associated with Alzheimer's Disease

Subrata Mondal, Yoya Vashi, Priyam Ghosh, Pankaj Kalita, Sachin Kumar, and Parameswar Krishnan Iyer*

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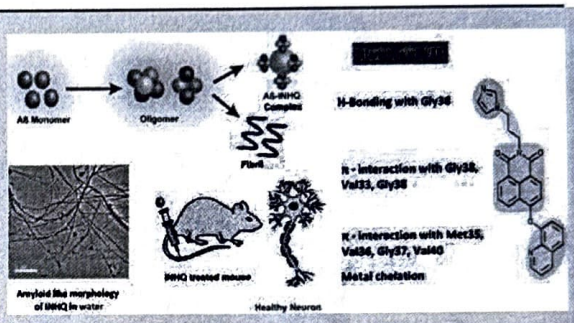
ABSTRACT: Fibrillation of amyloid beta (Aβ) is the key event in the amyloid neurotoxicity process that induces a chain of toxic events including oxidative stress, caspase activation, poly(ADP-ribose) polymerase cleavage, and mitochondrial dysfunction resulting in neuronal loss and memory decline manifesting as clinical dementia in humans. Herein, we report the development of a novel, biologically active supramolecular probe, INHQ, and achieve functional nanoarchitectures via a self-assembly process such that ultralong fibers are achieved spontaneously. With specifically decorated functional groups on INHQ such as imidazole, hydroxyquinoline, hydrophobic chain, and hydroxyquinoline molecules, these ultralong fibers coassembled efficiently with toxic Aβ oligomers and mitigated the amyloid-induced neurotoxicity by blocking the aforementioned biochemical events leading to neuronal damage in mice. These functional ultralong "Artificial Fibers" morphologically resemble the amyloid fibers and provide a higher surface area of interaction that improves its clearance ability against the Aβ aggregates. The efficacy of this novel INHQ molecule was ascertained by its high ability to interact with Aβ. Moreover, this injectable, ultralong INHQ functional "artificial fiber" translocates through the blood−brain barrier and successfully attenuates the amyloid-triggered neuronal damage and pyknosis in the cerebral cortex of wild-type mouse. Utilizing various spectroscopic techniques, morphology analysis, and in vitro, in silico, and in vivo studies, these ultralong INHQ fibers are proven to hold great promise for treating neurological disorders at all stages with a potential to replace the existing medications, reduce complications in the brain, and eradicate the amyloid-triggered neurotoxicity implicated in numerous disorders in human through a rare synergistic mechanism.



KEYWORDS: *amyloid inhibitor, blood−brain barrier permeability, artificial fiber, neurotoxicity, neuronal damage*

INTRODUCTION

Alzheimer's disease (AD) is a fatal age-related neurodegenerative disorder that results in irreversible memory decline and behavioral changes in humans. Post-mortem analysis of the AD brain reveals that the extracellular Aβ aggregates and neurofibrillary tangles are the major hallmark of AD.[1] According to the amyloid cascade hypothesis, the imbalance between the Aβ catabolism and anabolism leads to an enhanced amount of the Aβ aggregates that initiate a chain of neurochemical events resulting in neuronal death manifesting as clinical dementia.[2,3] Recent reports reveal that the metastable, soluble Aβ oligomers are the most neurotoxic species and play a key role in neuronal damage.[4,5] The β-enriched oligomers produce high level of oxidative stress inducing mitochondrial dysfunction.[6] As mitochondria operate a wide range of cellular processes like metabolism and energy production, the consequence of the mitochondrial dysfunction can be devastating. In addition, the defensive mechanism of the mitochondria against oxidative stress and protein misfolding could further accelerate the progression of AD.[7] Further, the role of poly(ADP-ribose) polymerase (PARP) has been strongly implicated in mitochondrial dysfunction. A recent report reveals that PARP induces mitochondrial apoptosis by releasing the apoptosis-inducing factor (AIF) to cause depolarization in mitochondrial membrane potential (MMP). Several therapeutic materials including peptides, engineered nanoparticles, functionalized polymers, and most recently monoclonal antibodies have exhibited appreciable degree of anti-Alzheimer's activities.[8−13] However, most of these amyloid-targeting therapeutic material have proven to be inefficient and failed in the different phases of clinical trial.[14,15]

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A novel route to fabricate ZnO nanoparticles using *Xanthium indicum* ethanolic leaf extract: Green nanosynthesis perspective towards photocatalytic and biological applications

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ARTICLE INFO

Keywords:
Zinc oxide nanoparticle
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Photocatalytic activity
Biological activity

ABSTRACT

Fabrication of nanoparticles using green synthetic route is always preferred over conventional chemical route owing to reduced toxicity issue required in biomedical application. In fact, it will also develop ecofriendly and cost-effective materials. Generally, a suitable plant leaf extract is applied for this purpose to act as reducing and stabilization agents during green nanoparticle synthesis which offers ease of biomolecule conjugation. Here, we attempted to synthesize Zinc oxide (ZnO) nanoparticles using ethanolic leaf extract of *Xanthium indicum* plant for the first time. The plant is available only in North-East India and has been utilized in different traditional biological practices. So, it might have a great probable pharmaceutical prospect that is yet to explore. The developed ZnO nanoparticles were characterized with different techniques like DLS, TEM, FTIR, UV–Vis and XRD. Furthermore, they were employed to explore the antioxidant, antimicrobial, antifungal, cytotoxicity, and photocatalytic activities. The green synthesized ZnO (GZnO) nanoparticles were compared with conventional chemically synthesized ZnO nanoparticles in all the activities and the effectiveness could be seen for the green synthesized nanoparticles. As a result, the work reveals the use of unexplored *X. indicum* plant leaf extract for the fabrication of nanoparticles and sets up the avenue for further study based on our findings.

1. Introduction

Nanobiotechnology is an emerging branch of science initiating a revolutionary change in every branch of science. Nanotechnology plays with the nanoparticles (NPs) which are the atomic or molecular aggregates having the size less than 100 nm [1]. Because of their characteristic and fascinating properties over its bulk counterparts, it has been utilized in various applications including biomedical and agriculture fields [2]. To name a few, nanoparticles originated from carbon sources have been extensively studied in such applications like drug delivery, sensing, toxin removal and nano-bio interaction [3–7]. Further, metal nanoparticles, integrating with a tailored functional characteristic like gold nanoparticles (AuNP), zinc oxide nanoparticles (ZnO NPs) etc., explore a precious pioneer for rational design of different nano systems for their advantageous properties and applications [8,9]. Among them, particularly, ZnO NPs serve a promising role in biological field application including in antibacterial field. Potentiality of ZnO NPs to produce reactive oxygen species (ROS) in the biological systems helps to use it as an apoptotic, antibacterial and antifungal agents. Because of the cost effectiveness and environment friendly prospects, the ZnO NPs attract remarkable attention from the nanobiotechnologists towards its use in biomedical and agricultural fields [10]. The inorganic nanomaterials are found to have smart properties because of its high surface area which helps them to enter inside the cells via pores of plasma membrane proteins at nano-size inducing altered biological properties like ROS (reactive oxygen species) production or other molecular

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RESEARCH

Excimer Fluorescence of Acriflavine Dye in Glycerol and Ethylene Glycol

Hiren Swargiary[1,2] · Seikh Mustafa Radiul[1] · Simanta Hazarika[1]

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Abstract
This research investigates the excimerisation of acriflavine dye in ethylene glycol and glycerol solvents. Acriflavine, a member of the acridine dye family, exhibits unique fluorescence properties with applications in various fields, including cellular nucleus observation, nucleic acid analysis, and dye laser active media etc. The study explores the impact of solvent and concentration on acriflavine's emission properties, with a focus on excimer formation, which can influence its suitability as a dye laser active medium. UV-Visible absorption spectroscopy reveals concentration-dependent absorption profiles, with distinctive monomer bands. Steady-state fluorescence studies demonstrate the emergence of red-shifted excimer fluorescence bands as concentrations increase in both solvents. Temperature-dependent fluorescence studies reveal the dynamics of excimer formation, suggesting dynamic diffusion as the excimerisation mechanism. Time-resolved fluorescence spectroscopy confirms the singlet character of both monomer and excimer states, providing insights into the excimerisation process. Critical concentration values are determined, representing the equilibrium between monomeric and excimeric forms. The study also explores pH-induced spectral shifts, highlighting the influence of acidity on fluorescence properties. Overall, this research deepens our understanding of acriflavine's excimerisation in ethylene glycol and glycerol, offering insights that can enhance its diverse applications, especially in laser technologies.

Keywords Aggregation · Excimer · Monomer · Fluorescence · Acriflavine · Diffusion-controlled · Dye-laser

Introduction

The photophysical characteristics of dye molecules in different solvent environments and their interactions with solvents are critical considerations for potential applications [1]. Fluorescence spectroscopy has historically served as a powerful tool for investigating and interpreting the photophysical features resulting from dye-solvent interactions into practical applications. Among fluorescent dyes, acriflavine, a member of the acridine family, has garnered significant global interest due to its unique fluorescence properties. It finds applications in diverse fields such as fluorescence-based cellular nucleus observation [2], analysis of nucleic acid structures [3], functioning as an active medium in laser dyes [4], and catalyzing various intermolecular electron transfer processes [5]. Acriflavine's high-emission yield qualifies it for use as a photosensitizer [6], a fluorescent probe, and a donor/acceptor agent in Förster resonance energy transfer (FRET) processes for efficient sensing [7–9].

Since 1966, when organic compound-based emissions for lasers were introduced [10], the search for effective luminescent organic compounds has become prominent. Among these, organic dyes stand out due to their robust luminescence and conjugated π-bond structures [11]. Their broad emission bands facilitate wavelength tuning within the emission range [12], which can be further influenced by varying dye concentration and solvent choice when used in laser applications [13]. Adjusting dye concentration in specific solvents can lead to dye molecule aggregation, forming dimers or excimers in the solvent, potentially affecting emission wavelengths [14]. Commonly used organic dyes for dye lasers include coumarin, xanthene, and pyrromethene [15]. Acriflavine, a high quantum yield acridine dye, has also been explored as a dye laser active medium [2]. Effective laser emissions from organic dyes rely on their dissolution in appropriate solvents, such as water, alcohol, ethylene glycol, and glycerol [16] etc. Thus, investigating

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Review

Layered double hydroxides derived from waste for highly efficient electrocatalytic water splitting: Challenges and implications towards circular economy driven green energy

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ARTICLE INFO

Keywords:
Layered double hydroxides
Sustainable environment
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Circular economy
Green hydrogen

ABSTRACT

Waste from industry is inexpensive and has a great capacity for storage but because of heavy metal leaching, it also significantly harms the environment. On the other side, electrolytic water splitting could be used to produce green hydrogen in a sustainable manner. The objective of this review is to critically analyze the waste-derived layered double hydroxides (LDH) production, emphasizing their utility in efficient electrochemical water splitting for generation of green hydrogen as sustainable energy. The broad idea of water electrolysis, its design methodologies are critically studied involving waste-derived LDH and waste-derived functionalized LDH, followed by a representation of current waste transformation strategies. The relationship between the framework and the effectiveness of waste-derived LDH is also discussed. This review further highlights the mechanistic pathways of electrocatalytic water splitting and also emphasizes the application of waste-derived LDH for circular economy-based sustainable development of green hydrogen. The challenges and future directions in this rapidly evolving subject are also critically discussed. It is envisaged that this critical review would offer insightful information on the design strategies and applications of waste-derived LDH electrocatalysts for the generation of green hydrogen based on circular economy.

1. Introduction

The use of conventional carbon-based fuels has raised severe questions regarding pollution and environmental damage [1,2]. Furthermore, the ever-increasing global energy consumption is critical to the continued growth of our civilization. As a result, it is essential to investigate environment friendly and sustainable energy solutions in order to tackle these power-related concerns. Hydrogen (H_2) fuel with its zero-carbon impact, availability on earth and exceptionally high energy density constitutes the most exciting opportunities to revolutionize the world's electrical grid [3-5]. The entire hydrogen power economic chain includes H_2 generation, distribution, transport, and consumption. The clean generation of H_2 gas in large-scale is a necessity for the continued growth of the hydrogen ecosystem. Due to the significant greenhouse gas emissions involved in the manufacturing process, fossil reformation-based H_2 manufacturing facilities are neither sustainable nor carbon neutral [6]. As a result, in the hunt for trustworthy avenues for renewable power, electrocatalytic water splitting has sparked widespread interest around the world [7,8], as evidenced by the sheer number of research articles published in the Clarivate Web of Science (WOS) utilizing the keyword "electrocatalytic water splitting" from 2018 to 2023 (Fig. 1).

While water electrolysis has reached an advanced stage of technological willingness [9,10] its comparatively low efficiency of energy consumption (61–82 %), as well as the elevated cost of H_2 ($4.78–5.84/kg H_2, alkaline water electrolysers), remain significant barriers to large-scale use in the industry [9]. Since 2000, significant breakthroughs in electrocatalytic water splitting employing a range of materials have been generated, as shown in Fig. 2, which emphasizes the scientific breakthroughs. Given the presence of contemporaneous phases that

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Review

Severe deterioration in food-energy-ecosystem nexus due to ongoing Russia-Ukraine war: A critical review

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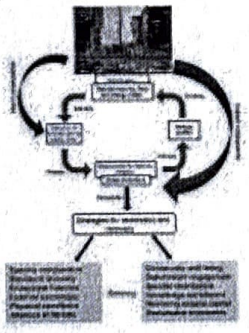
HIGHLIGHTS

- A critical assessment of Russia-Ukraine war in relation to the environment
- The ongoing war impacted the food-energy-ecosystem nexus.
- War impacts on the essential commodities' supply chain are described.
- A plausible post war ecosystem restoration strategy is presented.
- An eye opener to realise the environmental harm caused by the war

GRAPHICAL ABSTRACT



ARTICLE INFO

Editor: Paulo Pereira

Keywords:
Russia-Ukraine war
Inflation
Environmental degradation
Resource recovery and ecosystem restoration

ABSTRACT

The Russia-Ukraine war is having far-reaching negative impacts on the food-energy-ecosystem nexus and has resulted in an increase in environmental pollution not only in the war-affected regions. The purpose of this review is to critically evaluate the degradation caused by the war and its implications for the food-energy-ecosystem nexus. By examining the specific environmental impacts, this review provides an in-depth understanding of the extent of the damage and its consequences for the interconnected systems of food production, energy supply, and the overall ecosystem. Furthermore, this review addresses the impacts of the ongoing war on the food-energy-ecosystem nexus and underlines the challenges associated with resource recovery in the aftermath of the war. It also highlights the war impacts on the essential commodities' supply chain. Moreover, a plausible strategy for post-war ecosystem restoration has been presented in order to prioritise on the recovery and rejuvenation of the environment. This review also attempts to act as a wake-up call to the urgency of

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$WO_3 \cdot H_2O$ micro-flowers decorated PVDF/Ti_3C_2 MXene membrane for oily wastewater treatment

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Highlights

- PVDF/Ti_3C_2 membrane was prepared via electrospinning method.
- $WO_3 \cdot H_2O$ MFs was hydrothermally integrated to prepare PVDF/Ti_3C_2/$WO_3 \cdot H_2O$ composite membrane.