International Journal of Innovation in Advanced Physics
ISSN XXXX-XXXX

IJIAP Volume 01, Issue 01, July 2021

An Influence of Linear Energy Transfer of High Energy Ions on the Electrical Characteristics of NPN rf Power Transistors

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Abstract— ***NPN rf power transistors are exposed to 50 MeV Lithium (Li^{3+}) and 140 MeV Silicon (Si^{10+}) high energy ions separately for different doses from 100 krad to 100 Mrad. The transistor electrical characteristics such as excess base current ($\Delta I_B = I_{Bpost} - I_{Bpre}$), dc current gain ($h_{FE}$) and collector-saturation current (I_{CSat}) are methodically studied before and after ion impact on transistors. The base current (I_B) was found to increase appreciably after ion impact and this in turn decreases the h_{FE} of the transistors. The output characteristics of ion impact transistors are also studied and observed that the collector current in the saturation region (I_{CSat}) reduces with increase in ion dose. The degradation observed in the electrical characteristics of NPN rf power transistors is almost same for both types of ions with similar total doses although there is a large difference in the linear energy transfer (LET).***

Keywords- Transistor; ion impact; linear energy transfer; excess base current; gain degradation.

I. INTRODUCTION

Bipolar junction transistors (BJTs) continue to play an important role in integrated-circuit technology, particularly in the areas of analog or mixed-signal ICs and BiCMOS circuits. When Si NPN rf power transistors are exposed to ionizing radiation, trapped oxide charges and interface states collect in the oxide that lie over the surface of the intrinsic base, leads to an enhance in surface recombination current in the emitter-base diode. As a result, there is a raise in the base current of the device and the bipolar transistor suffers from a defeat of dc current gain. In addition to this, high energy ions can also construct different trap levels in the bandgap of silicon, which reduces the minority carrier lifetime and that leads to lessen the current gain of the transistors [1-3]. It is well established that the Si NPN BJT gain degradation is mainly due to the increase in base current whereas the collector current is almost unaffected [4–5]. However, recent studies have reported that it is necessary to consider the damage of the collector region for the degradation of gain. Therefore, it is essential to understand basic damage mechanisms for different types of ionizing radiation in Si BJTs, predominantly for the less investigated large area rf power transistors. The objective of this work is to explore the effect of different LET ions like 50 MeV Li^{3+} ions and 140 MeV Si^{10+} ions on electrical characteristics of the NPN rf power transistors.

II. EXPERIMENT

The silicon NPN rf power transistors (BEL 2N 3866) studied in the present investigation are useful for high power gain driver for VHF/UHF applications in military and communication equipment. The cross-sectional view of the NPN transistor is defined elsewhere [6]. The NPN transistors are separately exposed to 140 MeV Si^{10+} and 50 MeV Li^{3+} ions using the facility, the 15 UD 16 MV Pelletron Accelerator at Inter University Accelerator Center (IUAC), New Delhi, India. The experiment was performed at room temperature with ion fluence ranging from 1.4×10^9 ions/cm^2 to 1.53×10^{13} ions/cm^2 and its comparable gamma dose is ranges from 100 krad to 100 Mrad. The typical beam current was one particle nano-ampere for 50 MeV Li^{3+} and 0.1 particle nano ampere for 140 MeV Si^{10+} ions respectively. The ion beam was scanned in an area of 1cm x 1cm on the transistor to have identical dose. All the terminals of the transistors are grounded during the experiment. The transistors are characterized before and after ion impact using computer interfaced 4155 Agilent semiconductor parameter analyzer.

International Journal of Innovation in Advanced Physics
ISSN XXXX-XXXX

IJIAP Volume 01, Issue 01, July 2021

^{60}Co Gamma Influence on Transconductance in N-Channel MOS Device and its Revival under Isochronal Annealing Technique

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Abstract: ***N-channel depletion MOSFETs are exposed to ^{60}Co gamma up to 60 Mega rad of radiation dose. Transconductance is one of the important electrical characteristics of MOSFET is studied before and after the impact of ^{60}Co gamma on MOSFETs. It was found that transconductance to be decreased with increase in ^{60}Co gamma radiation dose. After isochronal annealing the transconductance and peak transconductance are recovered about 90% at 300°C.***

Keywords: ***MOSFET; transconductance; ^{60}Co gamma radiation; isochronal annealing.***

I. INTRODUCTION

N-channel depletion metal oxide semiconductor field effect transistors (MOSFETs) are used in many applications, including in integrated circuit industry, space, military and other radiation environments like in large hadron colliders (LHC). However, MOS devices are sensitive to radiation and even face functional damage [1-2]. The basic damage effects of radiation in MOS devices results from the generation of interface and oxide trapped charge in the gate oxide [3]. This trapped charge degrades the important electrical properties of MOSFETs such as threshold voltage (V_{TH}), transconductance (g_m) and mobility of carriers (μ) in the channel. In order to use MOS devices in radiation present vicinity like in space, the devices need to radiation resist up to a few Mega rad of gamma dose. The main objective of this work is to explore the effect of ^{60}Co gamma on g_m of the MOSFET and its revival by isochronal annealing.

II. EXPERIMENT

The devices used for this work are two serially connected N-channels with independent dual gate depletion MOSFETs (BEL 3N187) [1-3]. It is evident that, when high energy ion passes through a solid, it loses its energy by two processes namely, electronic energy loss, <dE/dx>e and nuclear energy loss, <dE/dx>n. Due to the lower elastic scattering cross section, nuclear energy loss in a material is significantly smaller (three orders of magnitude) than electronic energy loss. As a result, all of the energy deposited in the material is mostly owing to the electronic energy loss process during the substance's early passage. Near the end of the ion range, nuclear energy loss becomes dominant. The N-channel MOSFETs are exposed to ^{60}Co Gamma radiation using gamma chamber 5000 with a dose rate of 167 rad/s at Pondicherry University, Puduchery, India. MOSFETs are exposed to ^{60}Co gamma radiation in a

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Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 10 [11]October 2021 : 23-34

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

ORIGINAL ARTICLE
OPEN ACCESS

Computational based approach in discovering the phytocompound based complex inhibition against *Ralstonia solanacearum* and root-knot nematode *Meloidogyne incognita*

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ABSTRACT

India is considered as a global agriculture powerhouse since ages, agriculture being the largest private enterprise in India, contributes a major part for the development and fulfillment of basic needs of Indian economy. Most of the Indian population say about 65% depend on agriculture as their traditional occupation. Infections to solanaceae plants has a worldwide economic importance since the disease is devastating to a large number of important crops and causes great losses in tomato. The bacterial wilt and the root knot nematodes are very tiny in nature and nematode make place on the plant and become the parasites, they give entry into the tomato root through small injuries and the eelworms are very common nematode found in the tomato root.Silver nanoparticles has shown evidence of being a potentially effective nematicide and its toxicity is associated with induction of oxidative stress in the cells of targeted nematodes. Usage of plant-derived antimicrobial agents might be effective in reducing the dependence on antibiotics and minimizing the chances of antibiotic resistance in food borne pathogenic microorganisms. In the present study, the author has made an attempt to evaluate the antimicrobial activities of phytocompounds of Alstonia macrophylla complexed with silver nanoparticles against Ralstonia solanacearum and root-knot nematode Meloidogyne incognita.

Key words: Solanaceae, nematode, nanoparticles, antimicrobial, Ralstonia solanacearum

Received 21.04.2021 Revised 06.07.2021 Accepted 09.09.2021

INTRODUCTION

Tomato is the second most important vegetable crop next to potato. Present world production of tomato is about 100 million tons produced on 3.7 million hectares. The area harvested under tomato in India is 479200 ha, yield being 179169 hg/ha (hg =hectogram) and the production quantity is 8585800 tones [1].The crop land varies from region to region, based on their soil type, nutritional status, weather, management practices etc. Argo-climatic condition also play an important role for the development of crops, were weather plays an important role. With the manufacturing sector agriculture derives its importance for vital supply and demand links. In past five years agriculture sectors shows a remarkable advance for production and productivity of vegetables, dairy, poultry, fruits, oilseeds, food grains etc, India stands second place for large producer of fruits and vegetables across the globe. Among various crops tomato is the most common staple food and stands second most important botanical fruit but a culinary vegetable [2].

20.6%. Root-knot nematodes (RKNs, Meloidogyne species) have broad host plant specificity and are responsible for > US$125 billion annually in world-wide crop losses. Crops [3]. The most damaging of all root-knot nematodes is the southern RKN, M. incognita, which infects almost all agricultural plants including tomato, Biosynthetic of metal (Ag, Au, Cu and Cd) nano-formulation of plant extracts has received

International Journal of Pharmacy and Biological Sciences-IJPBS™ (2021) 11 (3): 227-235
Online ISSN: 2230-7605, Print ISSN: 2321-3272
Research Article | Biological Sciences | OA Journal | MCI Approved | Index Copernicus

Radical Scavenging Activity of Peptide Fraction from *Curcuma pseudomontana* L. A Wild Variety Of Turmeric

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Received: 06 Aug2021 / Accepted: 29 Aug 2021 / Published online: 12 Nov 2021
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Abstract

The present investigation focusses on antioxidant activity of peptide fraction P4 from a wild variety of turmeric, *Curcuma pseudomontana* L. (*Zingiberaceae*). P4 was purified by standard protein purification protocol. 80% saturated ammonium sulphate protein precipitate exhibited 78±2.65% hydroxyl radical scavenging activity, was purified on Sephadex G-75 column that resulted in two peaks labelled as AS1 and AS2. AS2 showed 75±0.76% hydroxyl radical scavenging activity and AS1 exhibited 40±1.23% at 100µg/ml each compared to the reduced glutathione and butylated hydroxyltoluene. AS2 on preparative *rp*-HPLC eluted at different retention time into four fractions labelled as P1, P2, P3 and P4. The peptide fraction, P4 eluted at 39.73min showed 65±0.88% hydroxyl radical scavenging activity. Peak fractions 1, 2, and 3 exhibited 48±0.98%, 42±1.34% and 49±0.67% hydroxyl radical scavenging activities respectively. P4 efficiently quenched 2,2-diphenyl-1-picrylhydrazyl radicals by 68±0.94%. The ferric ion reducing ability of P4 was concentration dependent which showed 79±1.04% at 25µg/ml. P4 showed lipid peroxidation inhibition activity in a linoleic acid model system.

Keywords

Reduced glutathione (GSH), *Curcuma pseudomontana*, Peak fraction, Radical scavenging activity.

*****

1. INTRODUCTION

In multicellular organism the normal endogenous cellular metabolism releases reactive oxygen species that includes hydroxyl free radicals, superoxide radicals and reactive nitrogen species like nitric and nitrous oxide free radicals [1] that play deceptive role during cellular processes like apoptosis, cell division and are also involved in redox reactions at physiological cell concentration [2]. The cell's protective system is well equipped with endogenous enzymes such as thioredoxin, peroxidase, Catalase and super oxide dismutase, other natural compounds that can neutralize the effect of disproportionate amount of ROS/RNS, include peptide antioxidant glutathione, and natural antioxidants, carotenoids, flavonoids, vitamin derived compounds like tocopherols play a significant role in protecting the cell against these species. Adverse external factors like radiations, toxic chemicals released in the environment, inefficiently metabolised drugs and carcinogens present in cigarettes, xenobiotics [3] could deplete the concentration of these protective enzymes leading to an imbalance of superfluous ROS that in turn could cause lipid peroxidation and finally effecting the cellular macromolecules including DNA

Current Research in Food Science 4 (2021) 829–839

Contents lists available at ScienceDirect

Current Research in Food Science

journal homepage: www.sciencedirect.com/journal/current-research-in-food-science

Copper chelating protein hydrolysate from *Salvia hispanica* L. by pepsin-pancreatin treatment

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ARTICLE INFO

Keywords:
Chia seed
Protein hydrolysate
Copper chelating peptides

ABSTRACT

Salvia hispanica L. (Chia) seeds are good source of proteins with diverse health benefits. The seed protein was extracted through alkaline solubilisation followed by acid precipitation to separate fibres and are digested sequentially by pepsin and pancreatin. Enzyme-substrate ratio, temperature and contact time had high impact on degree of hydrolysis affecting their chelating ability. Maximum degree of hydrolysis (14.06%) and maximum copper chelation (74.98%) was obtained at 4% w/w enzyme-substrate ratio at 37 °C for 4 h. Copper chelating enzymatic hydrolysate was isolated by HiTrap chelating column and purified further by rpHPLC. Out of nine fractions obtained by rpHPLC the sixth fraction with 93.09 ± 0.16% of copper chelating activity and 82.91 ± 0.52% of antioxidant activity was further characterized as Copper chelating Chia Protein Hydrolysate (CCPH). Ultraviolet spectroscopy and fluorescence spectroscopic studies revealed the interaction of the major chelating sites of the CCPH with the copper divalent ion. The purified CCPH was subjected to LC-MS/ESI-TOF analysis from which six major intense peaks obtained with m/z value ranging from 0.4 kDa to 2.5 kDa were identified and sequenced using Mascot database. The functional behaviour and the binding capacity of these peptides were analysed by their amino acid composition. The CCPH was stable in a simulated gastric condition and its chelating ability remained unaltered. These results explored an informative bioactive peptides with varied activity and one valuable among is the copper chelating with antioxidant property. Furthermore, these Chia seed protein hydrolysates can be useful as dietary supplements to enhance mineral bioavailability.

1. Introduction

Protein hydrolysates and derived peptides are known to possess several biological activities, such as antioxidant, anti-inflammatory, anti-hypertensive, and mineral chelation. Bioactive peptides have varied effects on organism's health and chelation of transient divalent metal ions like iron, calcium, copper, zinc etc., is one of their proposed mechanisms of action. Now a day's food industries are showing great interest over functional foods which have paved research in this field focusing mainly on natural products that are rich in bioactive compound and one such bioactive compound is peptides/proteins. Among various bioactivities of proteins/peptides, the ability to bind with metals, hence acting as chelating agent has high significance. Although copper and iron are essential co-factors for various enzymes, their excess can have unfavourable pro-oxidant effects *in vivo*, by the formation of reactive oxygen species. They also aid oxidative reactions in food which in succession has negative influence on the flavour, texture, nutritive value and shelf life of food products. Hence, chelating peptides make up a powerful tool for preventing these oxidative processes both in foods and *in vivo*. Peptide-metal complexes are more stable than metal in its free form under gastrointestinal conditions (Fernandes et al., 2019). Also, chelating of metal ions prevents the formation of insoluble metal complexes with other food components, which is a major cause of decrease in its bioavailability. This also indicates that peptide-metal complex may have a significant role in improving the nutritional quality of foods, thus, enhancing the health of an individual. The production of protein isolates is proposed as a method to reduce anti-nutritional and toxic factors. These protein isolates can be further processed to obtain protein hydrolysates (PH) which have better functional and nutritional properties (Gilani et al., 2005). These protein hydrolysates are also sources of bioactive peptides that may show beneficial biological effects. The chelating phosphopeptides procured from milk proteins have been best characterized and their positive impact on *in vivo* and in vitro absorption of minerals such as zinc, calcium or iron has been reported (Kim et al.,

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https://doi.org/10.1016/j.crfs.2021.11.007
Received 12 June 2021; Received in revised form 11 November 2021; Accepted 16 November 2021
Available online 24 November 2021

J Mater Sci: Mater Electron (2021) 32:14028–14046

Green synthesis and evaluation of antiangiogenic, photocatalytic, and electrochemical activities of $BiVO_4$ nanoparticles

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Received: 21 November 2020
Accepted: 15 April 2021
Published online: 4 May 2021

ABSTRACT

Nanocrystalline bismuth vanadate has been steadily gaining attention in recent years due to its potential energy conversion and eco-friendly nature. Herein, we report the green synthesis of bismuth vanadate nanoparticles (BVNPs) using jackfruit extract as a fuel and its characterization using various analytical and/or spectroscopic techniques for the assessment of physicochemical and structural properties. Further, bismuth vanadate nanoparticles were characterized by P-XRD, SEM, HRTEM, FTIR, EDX, Raman spectroscopy, and photoluminescence spectroscopy (PL). Pharmaceutical and personal care products being used and their accumulation in various water bodies are raising concern among the public health. As a part of our study, synthesized bismuth vanadate nanoparticles were subjected to photocatalytic activity due to their high separation rate of photodegraded charge carriers leading to degradation up to 98.3% under visible light irradiation for 120 min. A feasible mechanism of photodegradation has been explained by considering methylene blue dye as a model organic pollutant. Further, bismuth compounds has been used extensively as medicines in various treatments, and therefore, bismuth vanadate nanoparticles were subjected for cell viability test against *MCF-7* breast cancer cell lines using trypan blue and MTT assays. In continuation, the synthesized bismuth vanadate nanoparticles were shown to have antiangiogenic property confirmed by shell-less CAM assay. The electrochemical properties of BVNPs have been studied by using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS), and these results depict BVNPs could be used as super capacitors and bio-

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https://doi.org/10.1007/s10854-021-05980-w

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www.bioinformation.net
Volume 17(3)

Research Article

Design, synthesis, docking, Hirshfeld surface analysis and DFT calculations of 2-methylxanthen-9-with the FtsZ protein from *Staphylococcus aureus*

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Received February 28, 2021; Revised March 10, 2021; Accepted March 11, 2021, Published March 31, 2021

DOI: 10.6026/97320630017393

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The corresponding author declares that official e-mail from their institution is not available for all authors

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Abstract:
It is of interest to document the design, synthesis, docking, Hirshfeld surface analysis and DFT calculations of 2-methylxanthen-9-with the FtsZ protein (PDB ID: 3VOB) from Staphylococcus aureus for antimicrobial applications. We report the quantitative structure function data in this context.

Keywords: Synthesis, 2-Methylxanthen-9-one, antimicrobial, docking and DFT.

Background:
Xanthones are natural or synthetic compounds which are structurally related to anthraquinones and among these mitoxantrone is a well-established anti-cancer drug. [1,2] Extracts of the pericarp of ripe fruits possess immuno modulating [3], anti-bacterial [4], anti-mutagenic [5,6], anti-cancer [7] and other pharmacological activities. It is known that naturally occurring pyranoxanthones are more active than dihydropyrano xanthones in terms of their biological activities [8]. Xanthones also concern semi-synthetic and synthetic heterocyclic compounds with the dibenzo-γ-pyrone scaffold. Interest on xanthone analogues has been growing considerably due to the wide range of pharmacological applications exhibited by this group of compounds, including anticancer, immuno modulation and other promising activities [9-13]. Therefore, it is of interest to document the design, synthesis, docking, Hirshfeld surface analysis and DFT calculations of 2-methylxanthen-9-with the FtsZ protein

Journal of the Iranian Chemical Society
https://doi.org/10.1007/s13738-021-02230-y

ORIGINAL PAPER

Synthesis, characterization, docking study and antimicrobial activity of 2-(4-benzoylphenoxy)-1-[2-(1-methyl-1*H*-indol-3-yl) methyl)-1*H*-benzo[d]imidazol-1-yl] ethanone derivatives

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Received: 9 September 2020 / Accepted: 26 February 2021

Abstract
The occurrence of drug-resistant bacterial infections impulses the development of new antibacterial agents that own a mechanism of action different from traditional antibiotics. From the earlier days, benzophenone, indole and benzimidazole moieties alone are one of the most important frameworks in the discovery of innovative drugs. In this present study, we have described a detailed synthesis and structural elucidation of new benzimidazole bridged benzophenone substituted indole scaffolds **11a–k**. Further, all the newly synthesized compounds were tested for *in vitro* antimicrobial activity by disk diffusion and serial dilution method and the compounds **11b, 11e, 11f** and **11h** were revealed as potent compounds among the tested strains in the series**11a–k**. Further, compounds **11b, 11e, 11f** and **11h** were subjected for *in silico* studies and FtsZ has been recognized as a key functional protein in bacterial cell division and it is currently considered to be a potential target for the growth of novel antibacterial agents. In continuation, the results obtained from docking studies were in accordance with *in vitro* results and compounds **11b, 11e, 11f** and **11h** emerged as potent molecules in the series **11a–k**.

Introduction

Antibiotics are of our most important weapons in fighting bacterial infections and have greatly benefited the health-related quality of human life since their introduction [1]. Conversely, over the past few decades, these health benefits are at risk as many commonly used antibiotics have become less and less effective against certain diseases not only because many of them produce toxic reactions but also due to the emergence of drug resistant bacteria. In this view, it is highly essential to investigate newer drugs, with lesser resistance [2]. Over the past several years, the emergence of organisms resistant to nearly all the class of antimicrobial agents has become a serious public health concern [3]. Normally, bacteria have the genetic ability to transmit and attain resistance to drugs, which are utilized as therapeutic agents[4]. In the past two decades, there has been a significant increase in the frequency of systematic fungal infection in man. The first orally active antifungal agent that was effective against a broad array of systematic and superficial fungal infections was ketoconazole [5]. Further, a number of azole antifungal agents, viz. itraconazole, fluconazole [6], voriconazole [7], ravuconazole [8] and glucan synthesis inhibitor caspofungin [9], have been introduced to the clinic.

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Published online: 19 March 2021

Journal of Cluster Science (2022) 33:2233–2248
https://doi.org/10.1007/s10876-021-02147-9

ORIGINAL PAPER

Eco-Mediated Synthesis of Visible Active Bi_2WO_6 Nanoparticles and its Performance Towards Photocatalyst, Supercapacitor, Biosensor, and Antioxidant Activity

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Received: 15 May 2021 / Accepted: 27 July 2021 / Published online: 17 August 2021

Abstract
A heterogeneous photocatalyst exhibits more significant potential for the conversion of photon energy into chemical energy. In this work, we have been successfully synthesized multifunctional heterogeneous photocatalyst bismuth tungstate (Bi_2WO_6) nanoparticles by solution combustion route employing jackfruit extract as fuel. Structural characteristics of nanoparticles were investigated by powder X-ray diffraction (PXRD), Fourier transforms infrared (FTIR), and UV–Visible (UV–Vis) spectroscopy, and Raman spectroscopy. In contrast, surface morphologies were studied by SEM analysis. Further, the material's bandgap was found to be 2.8 eV, indicating the semiconducting nature of prepared nanoparticles. The Bi_2WO_6 nanoparticles were subjected to photoluminescence, photocatalytic, antioxidant activity, and it has also been used to detect Dopamine at the tracer level and act as stimulating electrode material for supercapacitors. Furthermore, we also report that Bi_2WO_6 nanoparticles are an efficient heterogeneous photocatalyst for the degradation of industrial dye in polluted water under visible light irradiation.

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J Mater Sci: Mater Electron (2022) 33:617–634

Enhanced photocatalytic, electrochemical and antimicrobial activities of α-$Mn_2V_2O_7$ nanopebbles

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Received: 11 May 2021
Accepted: 31 October 2021
Published online: 24 November 2021

ABSTRACT

Manganese(II) divanadate nanopebbles (α-$Mn_2V_2O_7$) were prepared by a simple solution combustion method and calcinated at 400 °C for 3 h. X-ray diffraction studies and Fourier transform infrared spectroscopy confirmed the monoclinic structure of α-$Mn_2V_2O_7$ nanoparticles with metallic bond (Mn–O, V–O and V–O–V) vibrations. Morphological features of manganese(II) divanadate nanoparticles were observed as pebble-like morphology via scanning electron microscopy and high resolution transmission electron microscopic analysis. The photocatalytic activities of manganese(II) divanadate nanopebbles have been evaluated by photocatalytic degradation of methylene blue in an aqueous solution as a model pollutant under the visible light irradiation. Pseudocapacitance nature of prepared manganese(II) divanadate nanopebbles were investigated by electrochemical impedance spectroscopy and cyclic voltammetric techniques in 5 mM aqueous KCl electrolyte. Further, the antimicrobial property of manganese(II) divanadate nanopebbles were investigated using various bacterial and fungus strains using well diffusion method.

1 Introduction

For the past few years, due to an increase in the population, world is facing two major problems namely energy demand and environmental pollution [1]. Society demands energy to provide electricity, communication, transportation and health. Even the increased use of nonrenewable energy sources fails to meet the demand [2]. Researchers across the disciplines emphasize on renewable energy such as solar, hydro, wind and biomass [3]. Solar and hydro energies are the two major sources of energy present abundantly on Earth. The energy produced through the photocatalytic water splitting is clean, quite inexpensive and can be controlled easily [4], in this context, various photocatalysts have been synthesized based on the materials bandgap and light/photon absorption property. The first photocatalyst,

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https://doi.org/10.1007/s10854-021-07331-1

Optical Performance Appraisal of Mechanically Flexible and Visibly Clear PVP-PVA/Calcium doped Zirconium Oxide Nanocomposites for UV Shielding Applications

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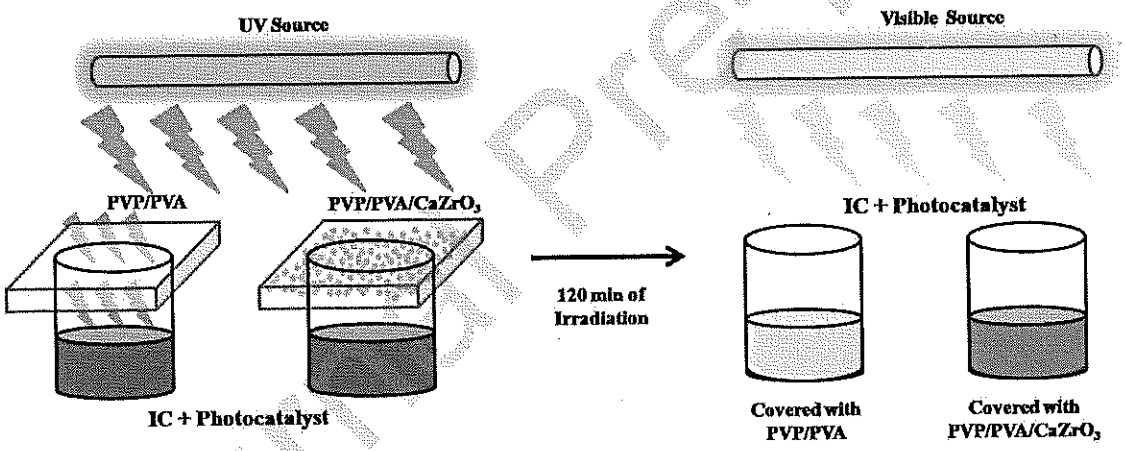
Graphical abstract



Abstract

Herein, we report the successful development and optical performance evaluation of mechanically flexible, optically clear and UV-shielding poly vinyl pyrrolidone (PVP) - poly vinyl alcohol (PVA) (50:50) nanocomposite (NC) thick films, containing 0.0, 0.5, 1.0, 2.0 and 4.0 Wt% calcium doped zirconium oxide ($CaZrO_3$) nanofillers. The solution combustion synthesized nanofillers and aqueous solution casted NCs were characterized for their gross structural, micro-structural, surface morphological, mechanical and optical properties, with

Journal of Molecular Structure 1247 (2022) 131333

Contents lists available at ScienceDirect

Journal of Molecular Structure

journal homepage: www.elsevier.com/locate/molstr

Design, synthesis, molecular docking and DFT computational insight on the structure of Piperazine sulfynol derivatives as a new antibacterial contender against superbugs MRSA

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ARTICLE INFO

Article history:
Received 5 July 2021
Revised 15 August 2021
Accepted 17 August 2021
Available online 20 August 2021

Keywords:
Piperazine sulfynol derivatives
Antibacterial activity
DFT
Molecular docking
MRSA

ABSTRACT

In this investigation, a series of piperazine sulfynol derivatives 5(a-l) were synthesized and amply characterized by various spectral techniques viz, LC-MS, ^{1}H NMR, ^{13}C NMR, and FT-IR. The energy and other quantum chemical computations of all the piperazine sulfynol derivatives were achieved using Density functional theory (DFT), Absorption, Distribution, Metabolism and Excretion (ADME), Blood Brain Barrier (BBB) and their Prediction of Activity Spectra of Computational Screening (PASS) for their possible approaches for biological applications were evaluated. The synthesized compounds were checked for the physicochemical properties such as clogP, clogS, drug-likeness, total surface area, polar surface area, H-acceptor, and H-donor parameters. The considerable change in the design with sulfonyl moiety on the piperazine core motivates to find out new antibacterial contender of the resultant molecules against superbugs-MRSA. All 5(a-l) moieties were tested for antibacterial potency against MRSA. The 5e moiety shows a MIC value of 35±0.41 μg/mL and 9.90±0.03 ZOI in mm compared to drug bacitracin 10 μg/disk (10.21±0.04) and streptomycin 10 μg/disk (14.10±0.06) ZOI in mm. The action of biocidal properties against MRSA was confirmed by an *in silico* docking study on the protein 1FZP and 3SRW of MRSA. The revealed data strongly recommended 5e having a good docking score, binding energy, and glide energy with high binding affinity. The antibacterial activity was validated by SEM, cellular leakage, potassium efflux and inhibitory effect on electron transport chain. The behavior of the 5e analog in haemostatic condition was well established and cytotoxicity was evaluated against L6 cell lines. The revealed data showed that 5e analog is a potential antibacterial contender against MRSA and it can be used as a futuristic drug in the eradication of MRSA infections.

1. Introduction

The discovery of antibiotics was a turning point that has revolutionized medical science for the treatment of bacterial, fungal and parasitic infections [1,2]. Infectious diseases have a large impact on public health and have affected significant portions of the human population globally [3,4]. Drug resistance incidences are increasing every year throughout the world and the majority of Hospital-acquired infections are caused by ESKAPE (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumonia, Acinetobacter baumannii, Pseudomonas aeruginosa,* and *Enterobacter species*) pathogenic bacteria [5-6]. Piperazine is currently the most important building block used in drug discovery with a high number of positive hits encountered in biological screens of this heterocycle and its congeners. A literature survey revealed that piperazine derivatives are important pharmacophores across several different therapeutic areas [7] and act as antifungal [8], antibacterial, antimalarial, antipsychotic [9], and anti-HIV protease [10]. Piperazine sulfonamides are the most widely used antibacterial agents [11] in the world, chiefly because of their low cost, low toxicity, and ex-

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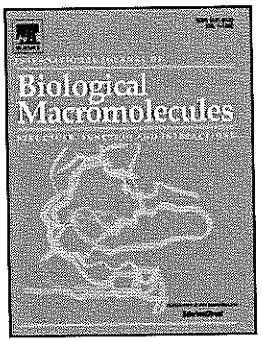
https://doi.org/10.1016/j.molstruc.2021.131333
0022-2860/

Journal Pre-proof



Synthesis and characterization of chitosan silver nanoparticle decorated with benzodioxane coupled piperazine as an effective anti-biofilm agent against MRSA: A validation of molecular docking and dynamics

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PII: S0141-8130(21)00654-1

DOI: https://doi.org/10.1016/j.ijbiomac.2021.03.119

Reference: BIOMAC 18165

To appear in: *International Journal of Biological Macromolecules*

Received date: 2 February 2021

Revised date: 19 March 2021

Accepted date: 21 March 2021

Please cite this article as: C.S. Karthik, M.H. Chethana, H.M. Manukumar, et al., Synthesis and characterization of chitosan silver nanoparticle decorated with benzodioxane coupled piperazine as an effective anti-biofilm agent against MRSA: A validation of molecular docking and dynamics, *International Journal of Biological Macromolecules* (2018), https://doi.org/10.1016/j.ijbiomac.2021.03.119

Anticonvulsant activity of 2-amino-4-chloro-6-methyl pyrimidine derivatives: synthesis and characterization

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Abstract
A series of new 2-amino-4-chloro-6-methylpyrimidine derivatives, 3(a-f) was synthesized by using different aryl aldehydes. The synthesized compounds were characterized by FT-IR and ^1H NMR spectral studies. The maximal electroshock seizure (MES) model was used for anticonvulsant activity and phenytoin was used as standard drug.

The rotorod test for neurotoxic effects was determined. Compound 3e was found to be most potent of this series. The compound 3e showed 65.10% protection in comparison to phenytoin which completely inhibited the convulsions produced by electro-convulsometer, Similarly, compound 3a showed moderate protective effects.

Keywords: Pyrimidine, aldehyde, characterization, MES, neurotoxicity.

Introduction

A variety of disorders reflecting underlying brain dysfunction that may result from many different causes[1] due to epilepsy is not a singular disease entity. Therefore, there is continuing demand for new anticonvulsant agents. So, there is an urgent requirement for the discovery and development of some novel anticonvulsant agents with more selective activity and lower toxicity for the effective treatment of epilepsy. Numerous 5-member systems of aromatic having 3-heteroatom at symmetrical positions have been studied extensively owing to their interesting biological activities. The word epilepsy usually describes a group of common chronic neurological disorders characterized by recurrent unprovoked seizures due to synchronous neuronal activity in the brain. Several new drugs have appeared in the market; the development of novel agents, particularly compounds effective against complex partial seizures remains a major focus of antiepileptic drug research[2].

A review on new structural entities having anticonvulsant activity has recently appeared[3].The anticonvulsants are a diverse group of pharmaceuticals used in the treatment of epileptic seizures. The aim of this activity is to suppress the fast and extreme firing of neurons that start a seizure.

Biological importance and structural variety of N-containing heterocycles have made them attractive targets for preparation over many years. They are found in various natural products and have been identified as products of chemical and biological importance. Pyrimidine is considered to be a resonance hybrid of the charged and uncharged cannonical structures; its resonance energy is found to be less than benzene or pyridine. The pyrimidine moiety is a versatile lead molecule in pharmaceutical development and has a wide range of biological activities. In the past few years, the therapeutic interest of pyrimidine derivatives in pharmaceutical and medicinal field has been given a great attention. Pyrimidine ring is fused to various heterocycles that represent an important class of heterocyclic compounds having wide range of applications[4,5].

The existing methods for the preparation of triazolopyrimidines are based on heterocyclic hydrazones. A large number of pyrimidine derivatives are reported to exhibit antimycobacterial[6], antitumor[7], antiviral[8], anticancer[9], anti-inflammatory[10] and antimicrobial[11] activities. Title compound was used to study the influence of Cl-substitution in ring on proton donor ability of amino group in 2-pyrimidine aminopyrimidine[12]. In the present study, a series of new pyrimidine analogues, 3(a-f) has been synthesized and their anticonvulsant activity were determined.

Material and Methods

All solvents and reagents were purchased from Sigma Aldrich Chemicals Pvt. Ltd. Melting range was determined by GLNR SELEC apparatus. The UV-visible spectra were recorded on Agilent 60 UV–visible double beam spectrophotometer with quartz cell of 1.0 cm path length in methanol. The new compounds were analyzed with FT-IR spectrophotometer (Agilent FT-IR ATR Cary 630) in the range of 7000-350 cm^{-1}. ^1H NMR spectra were recorded on Bruker DRX -500 spectrometer at 300 MHz using d_6-DMSO as solvent and TMS as an internal standard.

General procedure for the synthesis of pyrimidine derivatives 3(a-f): Equimolar concentrations of 2-amino-4-chloro-6-methylpyrimidine (1, 0.0019mol) and aryl aldehydes (2a-f, 0.0019 mol) were added to mortar and ground for about 2 to 4 hours by adding portions of 2-3ml of glacial acetic acid. It was recrystallized from methanol (Scheme 1, Table 1).

Anticonvulsant activity: Male wistar rats were procured from National Institute of Nutrition, Hyderabad (190-220 g) and were used in the present study. The animals were kept in individual cages for one week to acclimatize for the laboratory conditions. They were allowed to free access of water and food.

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Articles

Sulfation Code and Conformational Plasticity of L-Iduronic Acid Homo-Oligosaccharides Mimic the Biological Functions of Heparan Sulfate

Chethan D. Shanthamurthy, Ana Gimeno, Shani Leviatan Ben-Arye, Nanjundaswamy Vijendra Kumar, Prashant Jain, Vered Padler-Karavani,* Jesús Jiménez-Barbero,* and Ragahvendra Kikkeri*

Cite This: *ACS Chem. Biol.* 2021, 16, 2481−2489

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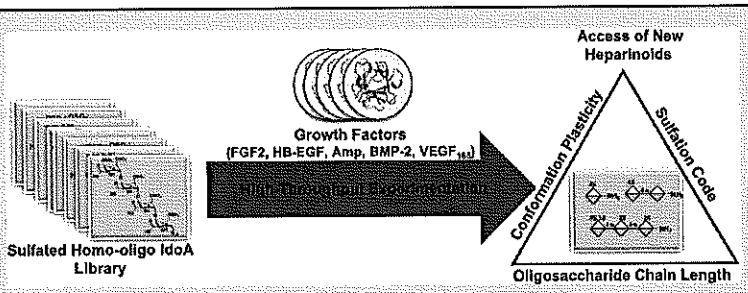

ABSTRACT: Recently, the activity of heparan sulfate (HS) has led to the discovery of many drug candidates that have the potential to impact both medical science and human health. However, structural diversity and synthetic challenges impede the progress of HS research. Here, we report a library of novel L-iduronic acid (IdoA)-based HS mimics that are highly tunable in conformation plasticity and sulfation patterns to produce many of the functions of native HS oligosaccharides. The NMR analysis of HS mimics confirmed that 4-*O*-sulfation enhances the population of the $^1C_4$ geometry. Interestingly, the $^1C_4$ conformer becomes exclusive upon additional 2-*O*-sulfation. HS mimic microarray binding studies with different growth factors showed that selectivity and avidity are greatly modulated by the oligosaccharide length, sulfation code, and IdoA conformation. Particularly, we have identified 4-*O*-sulfated IdoA disaccharide (**I-21**) as a potential ligand for vascular endothelial growth factor ($VEGF_{165}$), which in a multivalent display modulated endothelial cell proliferation, migration, and angiogenesis. Overall, these results encourage the consideration of HS mimics for therapeutic applications.

INTRODUCTION

The nearly 100 years of progress in heparan sulfate/heparin (HS/HP) research has led to numerous advances in the development of anticoagulants and in cancer theranostics.[1−3] Nonetheless, complete utilization of HS/HP in clinical settings remains elusive due to the structural heterogeneity and the inability to synthesize all possible HS oligosaccharides.[4−6] For example, despite the emergence of efficient chemical and enzymatic methods to synthesize HS oligosaccharides, only a small number of synthetic HS analogs have been reported.[7−9] These challenges are further exacerbated by the limited ability to structurally characterize them and track their biological functions.[10] The recognition of HS by the myriad of protein surfaces[11,12] is modulated by its four key inherent structural aspects, (a) sulfation patterns (*O*- and *N*-sulfation),[13−15] (b) uronic acid composition (L-iduronic acid (IdoA) and D-glucuronic acid),[16] (c) oligosaccharide chain length,[11,12,17] and (d) conformation plasticity of IdoA.[18−22] These four factors dictate the ability of a specific HS domain to bind proteins, challenging the discovery of specific HS structural domains to modulate individual heparan sulfate binding protein (HSBP) activity. This challenge has spurred the development of biomimetic analogs of HS and their study in molecular recognition processes. Several HS mimics have been reported in the literature.[23−29] However, they do not provide the structural variation needed to produce multiple functions like the native HS does. Thus, HS biomimetic analogs offer several advantages. First, the heterogeneity and chemical complexity of native HS can be minimized by a limited number of biomimetic analogs. Second, unlike native HS, biomimetic analogs can be designed with pure IdoA residues. This exposes IdoA at reducing and nonreducing ends of the oligosaccharides, giving a unique scaffold to study the conformation plasticity of IdoA at different positions. Here, we report the

Received: July 27, 2021
Accepted: September 15, 2021
Published: September 29, 2021

https://doi.org/10.1021/acschembio.1c00582
ACS Chem. Biol. 2021, 16, 2481−2489

Journal of Hazardous Materials Advances 4 (2021) 100032

Contents lists available at ScienceDirect

Journal of Hazardous Materials Advances

journal homepage: www.elsevier.com/locate/hazadv

Facile synthesis of stable Cu and CuO particles for 4-nitrophenol reduction, methylene blue photodegradation and antibacterial activity

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ARTICLE INFO

Keywords:
Stable Cu submicron particles
Reduction of 4-nitrophenol
MB degradation by CuO

ABSTRACT

For the first time, highly stable Cu metal particles were prepared using cupric acetate precursor and ascorbic acid as a reducing agent in ethylene glycol (EG) at ambient conditions. These submicron particles (SMPs) have shown an excellent catalytic reduction of 4-nitrophenol (NP) to 4-aminophenol (AP) in the presence of $NaBH_4$ at room temperature in the aqueous medium. During, the successive cycles, the time required for complete reduction was prolonged by a few minutes as a fraction of Cu was converted to Cu_2O/ CuO over the period of reuse. The spent Cu SMPs were converted to CuO nanoparticles upon heating at around 450 °C for 5 h. The band gap of CuO nanoparticles was determined using Tauc's equation and found to be 3.33 eV. This semiconducting CuO was used as a photocatalyst for the degradation of methylene blue (MB) dye under UV light in basic pH. Active species scavenger study confirms, the $OH^{\cdot}$ are primary species in MB degradation. The possible degraded products of 4-NP reduction and MB degradation were analyzed by mass spectrometry. Furthermore, both Cu and CuO were tested for their antibacterial activity against six different bacterial pathogens. As expected, Cu exhibited good bactericidal activity, when compared to CuO.

1. Introduction

Metal/ metal oxide nanoparticles exhibit exceptional chemical and physical properties such as catalysis, optical, electronic, sensors, antimicrobial, etc. (Emory and Nie, 1998; Pradhan et al., 2002; Kaviya et al., 2011). Since the noble metal nanoparticles such as Au, Ag, Pt, Pd, Ru or their alloys (Pradhan et al., 2002; Ghosh et al., 2004; Yallappa et al., 2013a, 2015; Lakshminarayana et al., 2018; Gregor et al., 2018) are not cost-effective, it is worth focusing on other metal particles having the same potential as that of noble metals, especially for common usage and large-scale applications. In this context, Cu metal seems to be a better alternative having similar potential as that of noble metals. It is extensively used in the electric and electronic parts of various devices. The Cu nanoparticles are found to be excellent catalysts in the organic reactions such as reduction of $-NO_2$ groups in aromatic compounds (Zhang et al., 2013; Nasrollahzadeh et al., 2015a), A3 coupling (Gholinejad et al., 2016), Sonogashira coupling (Kou et al., 2012), Huisgen [3+2] cycloaddition (Nasrollahzadeh and Sajadi, 2015b). Since the synthesis of stable Cu is quite difficult as it gets oxidized to Cu_2O. Several methods involving stabilizing agents such as CTAB (Bicer and Sisman, 2010), carboxylic acid (Deng et al., 2013), SDS (Granata et al., 2016), L-cysteine (Kumar and Upadhyay, 2016), Tween 80 (Ramyadevi et al., 2012) or extracts of various plants like Cammelinanudi flora (Kuppusamy et al., 2017) and T. arjuna bark (Yallappa et al., 2013b), have been reported. Sometimes, these additives are not compatible with the application system. Thus, the synthesis of Cu by a simple and environmentally benign route is essential. Furthermore, Cu_2O and CuO are easily formed from the Cu metal particles. Considering the oxidative nature of Cu_2O, the more stable CuO phase is considered as the efficient, environmentally benign, non-toxic, and cost-effective semiconductor. It is having a band gap of 1.2–1.5 eV (Yin et al., 2005; Kumar et al., 2019) and used for a variety of applications such as photocatalyst (Bhosale et al., 2016; Kumar et al., 2019) heterogeneous catalyst (Roy et al., 2014), gas sensor (Chethana et al., 2021), antimicrobial agent (Sreeju et al., 2017), anticancer (Rehana et al., 2017), toxic metal adsorbent (Raul et al., 2014), etc.

Nitroaromatic compounds, including nitrophenols, are extensively used in the industries, as precursors for the synthesis of dyes, drugs,

EG, Ethylene glycol; SMPs, Submicron particles; 4-NP, 4-nitrophenol; 4-AP, 4-aminophenol; MB, Methylene blue; AA, Ascorbic acid; RT, Room temperature; AMH, Alginate magnetic hybride.

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https://doi.org/10.1016/j.hazadv.2021.100032
Received 17 September 2021; Received in revised form 25 November 2021; Accepted 28 November 2021

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Article

Investigation of Antifungal Properties of Synthetic Dimethyl-4-Bromo-1-(Substituted Benzoyl) Pyrrolo[1,2-a] Quinoline-2,3-Dicarboxylates Analogues: Molecular Docking Studies and Conceptual DFT-Based Chemical Reactivity Descriptors and Pharmacokinetics Evaluation

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check for updates

Citation: Uppar, V.; Chandrashekharappa, S.; Shivamallu, C.; P, S.; Kollur, S.P.; Ortega-Castro, J.; Frau, J.; Flores-Holguín, N.; Basarikatti, A.I.; Chougala, M.; et al. Investigation of Antifungal Properties of Synthetic Dimethyl-4-Bromo-1-(Substituted Benzoyl) Pyrrolo[1,2-a] Quinoline-2,3-Dicarboxylates Analogues: Molecular Docking Studies and Conceptual DFT-Based Chemical Reactivity Descriptors and Pharmacokinetics Evaluation. *Molecules* **2021**, *26*, 2722. https://doi.org/10.3390/molecules26092722

Academic Editor: Jan Brezovsky

Received: 18 January 2021
Accepted: 2 March 2021
Published: 6 May 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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Abstract: *Candida albicans*, an opportunistic fungal pathogen, frequently colonizes immune-compromised patients and causes mild to severe systemic reactions. Only few antifungal drugs are currently in use for therapeutic treatment. However, evolution of a drug-resistant *C. albicans* fungal pathogen is of major concern in the treatment of patients, hence the clinical need for novel drug design and development. In this study, in vitro *screening* of novel putative pyrrolo[1,2-a]quinoline derivatives as the lead drug targets and in silico prediction of the binding potential of these lead molecules

Int. J. Pharm. Investigation, 2021;11(1):88-93

Original Article

Cloning and Expression of Vacuolating Cytotoxin A (*VacA*) Antigenic Protein in *Nicotiana benthamiana* Leaves a Potential Source of the Vaccine against *Helicobacter pylori*

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ABSTRACT

Background: The applications of transgenic plants in the healthcare system are immense. They offer an alternative strategy for the fabrication of antigenic determinants of medically important pathogens. **Objectives:** Cloning and transient expression of the vacuolating cytotoxin A (*vacA*) gene of *Helicobacter pylori* in *Nicotiana benthamiana* is undertaken in the present study. **Methods:** The *vacA* gene of *H. pylori* was amplified. The *vacA* and pBI121 vectors were digested with BamHI and SacI and the *vacA* gene was cloned in pBI121 by T4 ligation. The vacA-pBI121 construct was transformed into *Escherichia coli* DH5α and the transformants were confirmed by isolation and sequencing of vacA-pBI121. Further, the vacA-pBI121 was transformed into *Agrobacterium tumefaciens* EHA105 by electroporation. The transformants were used for agroinfection of *N. benthamiana* by agroinjection technique and the transgenic plant was screened for *vacA* gene expression by Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis (SDS-PAGE). **Results:** The *vacA* gene amplification was confirmed by observing an intense DNA band in agarose electrophoresis. Sequencing of *vacA* gene of *E. coli* DH5α transformants indicated a gene size of about 2877bp which revealed 99.82% sequence similarity with online available *H. pylori vacA* gene sequence. The *A. tumefaciens* EHA105 transformants were confirmed by amplification of the *vacA* gene. The screening of transgenic leaves of *N. benthamiana* for *vacA* gene expression by SDS-PAGE showed *VacA* protein with a molecular weight of 105kDa. **Conclusion:** A novel transgenic plant expressing *VacA* protein was developed as a source of eco-friendly-based synthesis of antigenic determinants for various medical applications.

Key words: Transgenic plant, Cloning *vacA* gene, VacA determinant, Transient expression, *Nicotiana* sp., Peptic ulcer.

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DOI: 10.5530/ijpi.2021.1.16

INTRODUCTION

India was known to have a good collection of medicinal plants, which have been used for many years to extract drugs and perfumery products. Over many decades of efforts, plants with favorable characteristics have been produced by time-consuming conventional breeding methods.[1] To overcome this drawback genetic engineering was evolved as an alternative technology. Genetic engineering can be used to produce plants resistant against extreme conditions of temperature, salinity, drought, and also to produce monoclonal antibodies and vaccines.[2,3]

Transgenic plants also serve as a substitute resource for the production and supply of vaccines called edible vaccines.[4] In 1990, for the first time the "edible vaccine" term was coined which are nothing but, edible GM crops that contain added "immunity" against specific diseases.[5] These vaccines are being developed against several diseases like Hepatitis B and C, foot and mouth disease, cholera, and measles.[4] The transgenic plant is also used as well-established recombinant technology in the production of biopharmaceuticals like therapeutic protein, vaccine, and antigenic determinants. It is an environmentally friendly, robust, low cost, and easily scalable. Transgenic plants can be developed using a simple and low-cost agroinjection technique used for transfer for the gene of interest in plants through *A. tumefaciens* infection.[6] Agroinjection is more efficient, provides rapid scalability, easy genetic modifications, and low cost.[7] Moreover, the yield of protein is *Nicotiana* species can be enhanced by adapting transient expression foreign protein. The transient expression has several advantages like a high yield of antibody production in less time compared to stable expression of the protein.[8]

Dwarf tobacco plant *Nicotiana benthamiana* from the Solanaceae family is a native Australian species and is an allotetraploid with 19 chromosomes in its genome.[9] In-plant virology, *N. benthamiana* is the frequently used host as most of the plant viruses can infect the plant successfully. Genes coding for beta-glucuronidase and green fluorescent protein have been successfully transferred and expressed in *N. benthamiana*.[10] *N. benthamiana* has been used for the production of many antibodies against hepatitis viruses, Influenza, Ebola virus, and coronavirus.[11]

H. pylori bacterium is a helical-shaped, motile, microaerophilic, Gram-negative in cell wall nature was discovered by Robin Warren in 1979. Approximately, 70 to 90% population of age of fewer than 10 years in developing nations are a carrier of infection caused by the *H. pylori* bacterium.[12] Also the *H. pylori* infection is associated with various disorders of including gastritis, 10–15% of peptic ulcer disease,1–3% of gastric cancer, and 0.1% of mucosa-associated lymphoid tissue lymphoma.[13] In *H. pylori*, the cytotoxin-associated gene A and vacA are the main antigenic determinants and the pathogen also possess several

Original Article

Evaluation of *iceA1* Gene Expression of *Helicobacter pylori* Risk Factor of Gastric Cancer in Transgenic Brinjal

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ABSTRACT

Background: The advancement of plant biotechnology improved crop production by revolutionizing plant science. Humans were commonly infected by *Helicobacter pylori*, and it was closely linked to stomach ulcers and cancer. In addition to traditional vaccines for *H. pylori*, transgenic plants have also been produced to produce its antigens as well as edible and non-edible parts that can produce an immune response after consumption. The protein present in *H. pylori* associated with virulence (*iceA1*) is believed to predispose to stomach cancer. **Objectives:** The current study was aimed to evaluate the *iceA1* gene expression within brinjal plant to produce novel transgenic lines LC420461-B7, -B10, -B15, -B22 and -B27. **Materials and Methods:** In the present study, amplified *iceA1* gene from *H. pylori* strain 26695 was transformed into callus of brinjal (from leaf explants) through *Agrobacterium tumefacians* (EHA105). pBI121 vector was used in constructing the plant expression vector, and the transgenics generated were further evaluated by quantitative Real-Time PCR and western blot analysis. **Results:** Out of the 46 plants obtained five of them were found to be positive for the *iceA1* expression. Both real time and western blot confirmed of the presence of expressed gene *iceA1* within the plant sample leaves. By studying transgenic brinjal, the study may result in an *H. pylori* vaccine candidate. As well, the data can be used by researchers to get valid scientific information.

Key words: *Helicobacter pylori*, Transgenic brinjal, *iceA1*, *Agrobacterium*, Callus induction, Real-time PCR.

INTRODUCTION

Agricultural biotechnology has always worked towards improved crop production and increased sustainability since its inception.[1] A vaccine, in contrast, generates an immune response through the inactivation of bacteria or viruses forming a revolutionary phenomenon in the 19th century. These are simply proteins found in an inactivated form that resemble pathogens and stimulate the immune system to recognize the foreign antigen later on.[2] A number of *H. pylori* biomarkers/traits have been associated with the onset of gastric cancer. Some of these factors, including cytotoxin-associated gene A (*cagA*), vacuolar cytotoxin (*vacA*), and outer inflammatory protein A (*oipA*) are responsible for the development of gastric cancer. Due to these factors, *H. pylori* is considered a potent carcinogen. Since *H. pylori* infection is associated with a reduced risk of gastric cancer, eliminating *H. pylori* infection has been beneficial, but

Submission Date: 29-08-2021;
Revision Date: 05-10-2021;
Accepted Date: 08-11-2021.

DOI: 10.5530/ijper.55.4.219

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www.ijper.org

Int. J. Pharm. Investigation, 2021; 11(3) : 338-344

Original Article

Cloning and Expression of *Helicobacter pylori* ulcer Associated Gene - *iceA1* in Brinjal (*Solanum melongena* L.)

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ABSTRACT

Background: Plant biotechnology revolutionized the branch of plant sciences contributing to improving crop production. *Helicobacter pylori* was predominantly seen among all the sectors of the human population, closely stuck to stomach ulcers and cancer. Even though traditional vaccines are effective in preventing *H. pylori*, edible and non-edible parts of special transgenic plants were also being generated to express its antigens which could elicit an immune response after consuming. The induce by contact with epithelium (*iceA1*) protein of *H. pylori* is associated with virulence and stated as predisposing factor to stomach cancer. **Objectives:** This study intends to study the expression levels of *iceA1* gene in the brinjal plant. **Materials and Methods:** The present study, magnified the *iceA1* gene from *H. pylori strain* 26695 and transformed it into callus of brinjal (from leaf explants) through *Agrobacterium tumefaciens* (EHA105). pBI121 vector was used to construct the plant expression vector, and the transgenic plants generated were further validated through gene amplification and protein expression studies. **Results:** Out of the 46 plants obtained from this study, five of them were found to be positive for the *iceA1* expression as seen on validation assays like gene amplification and protein expression studies. **Conclusion:** The study could beneficially produce a vaccine candidate against *H. pylori* from transgenic brinjal. In Addition, it could provide, valid scientific data which can further be used by researchers.

Key words: *Helicobacter pylori*, Transgenic brinjal, *iceA1*, *Agrobacterium*, Edible Vaccine.

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DOI: 10.5530/ijpi.2021.3.60

INTRODUCTION

Since its inception, plant biotechnology has always worked towards improving crop production and significantly leading to sustainability in the agriculture sector.[1] Vaccines, on the other hand, try to generate immune response, towards inactivated biological samples from bacteria or viruses forming a paramount revolution in the 19th century. To define, they are simply proteins, which bear resemblance to a pathogen, in an inactivated form stimulating the body's immune system in recognizing the foreign antigen at a later stage.[2]

A new form of vaccine has been shaped in the recent decades, to minimize the risk effects of earlier mentioned traditional vaccines. Such vaccines are mass-produced from genetically modified plants, which are artificially inserted with a disease-causing gene of pathogens (bacteria or virus), without altering the immunogenic capacity. These vaccines, called edible vaccines are found to switch on both systemic and mucosal response against a disease-causing pathogen.[2] The ever-increasing world's population along with living standards are forcing the biologists to implement novel agro-biotechnological methods wherein they can substantially generate crops.[3] that are of high yield producing diverse rich products like antibodies, therapeutic proteins, vaccines and many more secondary metabolites.[4] Gastric cancer is the 7th most prevalent cancer which accounts for 8.3% of global cancer mortality.[5]

This pathogenesis is due to the interaction of *Helicobacter pylori* with the environment and genetic factors. The pathogen invades, survives, colonizes and stimulates inflammation along the stomach mucosal layer causing severe evasion eventually leading to malignancy.[6] *Helicobacter pylori*, a flagellated, helical-shaped bacterium, is said to enhance its survival within the gastric environment. Such spiral form makes it capable to pierce through the gastric layer, colonizing the epithelium leading to aggressive invasiveness.[6]

H. pylori, was credited as class I carcinogen causing gastric cancer, by both the World Health Organization (WHO) and the International Agency for Research on Cancer.[7] Its infection among the human hosts leads to chronic gastritis causing peptic ulcer disease.[8] It also plays a critical role in the development of gastric adenocarcinoma mostly associated with stomach mucosa-associated lymphoid tissue (MALT) lymphoma, thereby adding to stomach carcinogenesis elevating the gastric cells to proliferate profoundly.[9]

Such infections are estimated to be 85–95% among the developing nations and accurately 30–50% within developed nations.[10] Bacteria enter the host either by oral-to-oral or fecal-to-oral routes. *H. pylori* adapts itself, within the gastric microenvironment, enabling it to survive even at low pH of 3.0.[11] *H. pylori* is said to enhance its virulence, by altering the host signaling pathways creating an inflammatory response

Biotechnology Reports 33 (2022) e00699

Contents lists available at ScienceDirect

Biotechnology Reports

journal homepage: www.elsevier.com/locate/btre

Research Article

Transient recombinant expression of highly immunogenic *CagA, VacA* and *NapA* in *Nicotiana benthamiana*

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ARTICLE INFO

Keywords:
Helicobacter pylori
CagA
VacA
NapA
Nicotiana bethamiana
qRT-PCR
ELISA

ABSTRACT

Interest in the plant-based transient production of recombinant immunogenic antigens has tremendously progressed because plants are cost-effective, easily selectable, free of mammalian contamination, and support complex post-translational modifications. *Nicotiana benthamiana* is a convenient system for transient expression of recombinant antigens. The present study documented a platform for rapid production of *Helicobacter pylori CagA, VacA* and *NapA* antigens three days (first harvest, FH) and six days (second harvest, SH) after agro-infiltration using a syringe. In this study, *CagA, VacA* and *NapA* antigen genes from *Helicobacter pylori* were cloned into the binary vector pBI121 and transformed into *Nicotiana benthamiana* by the *Agrobacterium*-mediated process. Leaves of four to five weeks old *Nicotiana benthamiana* plants were agroinfiltrated with EHA105 subtype of *Agrobacterium tumefaciens* strain containing cloned *CagA* (pBI121-CagA), *VacA* (pBI121-VacA) and *NapA* (pBI121-NapA) constructs. The transient expression and accumulation of the recombinant genes containing *CagA, VacA* and *NapA* expression cassettes were confirmed using qRT-PCR by comparing the relative expression at FH and SH post-infiltration with the non-infiltrated (control) samples and using ELISA at 1/5 and 1/10 dilution ratios. The qRT-PCR findings showed that Agrobacterium-mediated syringe infiltration of leaves of four to five weeks old *Nicotiana benthamiana* plants produced significantly higher transcript levels of *CagA* (about 8-fold and 7-fold), *VacA* (38-fold and 24-fold) and *NapA* (7-fold and 5-fold) genes at FH and SH compared to the control sample. Besides, the maximum amount of *CagA, VacA* and *NapA* antigens were detected at the FH stage compared to the SH stage, when the antibody concentrations of the agro-infiltrated leaf extracts containing these recombinant antigens were diluted in a 1/5 ratio. This study has developed evidence to support that recombinant *CagA, VacA* and *NapA* can be transiently produced in *Nicotiana benthamiana* plants.

1. Introduction

Helicobacter pylori bacterium is the most prevalent cause of chronic gastroduodenal ulcer, infecting nearly 50% of human beings, globally [1]. The occurrence of the infection in adults varies as per geographical regions, where more than three-fourth of the populations in Latin American, Asian, and African regions are infected by this bacterium [2]. This chronic bacterial infection may develop into a gastroduodenal ulcer in nearly 10% – 15% of the infected individuals and into severe disease outcomes like gastric cancer in nearly 1% – 3% of the infected individuals [3]. Except for gastric cancer, all gastroduodenal infections of this bacterium can be cured by immunization [4]. An effective vaccine could overcome the challenges of treatment related to *Helicobacter pylori* infection and thereby prevent the linked complications.

In-silico identification of membrane proteins for outer membrane localization in 53 *Helicobacter pylori* immunogenic strains reported 826 conserved proteins as potential vaccines and therapeutic targets [5]. Highly immunogenic subtypes encode 128–145 KDa the cytotoxin-associated gene (*CagA*) antigen, which resides within the variable region Cag pathogenicity island (PAI). The CagPAI contains genes that synthesize the type 4 (T4) secretion system (SS), where the chromosomal transfer of *CagA* into the epithelial lining of the host

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https://doi.org/10.1016/j.btre.2021.e00699
Received 30 July 2021; Received in revised form 22 December 2021; Accepted 28 December 2021
Available online 29 December 2021

PLANT SCIENCE TODAY
ISSN 2348-1900 (online)
Vol x(x): xx–xx
https://doi.org/10.14719/pst.1416

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RESEARCH ARTICLE

Phytochemical screening, antimicrobial, anti-inflammatory and anti-cancerous activities of ethanol and hexane extracts of *Urochloa ramosa*

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OPEN ACCESS

ARTICLE HISTORY
Received: 27 July 2021
Accepted: 25 December 2021
Available online
Version 1.0 (Early Access): XX XXXX 2022

Check for updates

Additional information

Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

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Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, etc. See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

CITE THIS ARTICLE

Singh A M, Rekha N D, Udayashankar A C, Sumana K. Phytochemical screening, antimicrobial, anti-inflammatory and anti-cancerous activities of ethanol and hexane extracts of *Urochloa ramosa*. Plant Science Today (Early Access). https://doi.org/10.14719/pst.1416

Abstract

Urochloa ramosa is known for its environmental benefits such as stabilization and reclamation of polluted soils, in agriculture to control root-knot nematodes infecting crops, in medicine to treat cardiovascular diseases, duodenal ulcer, hyperglycemia, nephritis and snake bites. Qualitative analyses of phytochemicals in ethanol and hexane extracts were performed by standard methods. *In vitro* anti-microbial assay was performed against gram positive bacteria viz., *Bacillus subtilis* and *Staphylococcus aureus,* Gram negative bacteria *viz., Pseudomonas aeruginosa* and *Escherichia coli* and fungus *Candida albicans* by disc diffusion method. Hexane extract of *Urochloa ramosa* was found to be 70% effective against *Candida albicans* indicating potent antifungal property. *In vitro* anti-inflammatory activity was performed by albumin denaturation assay, proteinase inhibition activity assay and membrane stabilization assay using various concentrations of extracts with Aspirin and Diclofenac sodium as standard. Heat induced protein denaturation was considerably prevented by ethanol and hexane extract at concentrations between 200-500 µg/ml resulting in 60 and 62% inhibition respectively. Heat induced haemolysis of erythrocyte was remarkably inhibited (59 and 68 % respectively) at concentration of 500 µg/ml. 62 and 65 % Hypotonicity induced haemolysis was also inhibited between concentration of 300-500 µg/ml in both extracts respectively. Inhibition of formation of new blood vessels by Chorioallantoic membrane (CAM) assay proved anti-angiogenic effects of extracts. Purification, characterization and structural elucidation of bioactive molecules present in ethanol and hexane extracts are needed to be explored further for assessment of better biological activites than crude extract.

Keywords

Antiangiogenic activity, anti-inflammatory activity, antimicrobial activity, Chorioallantoic membrane (CAM), phytochemicals, *Urochloa ramosa*.

Introduction

Plants are rich source of bioactive phytochemicals as they serve as raw materials for the manufacture and development of drugs which offer profound benefits for the treatment of inflammatory and infectious diseases without many side effects and also they offer a more affordable treatment compared to chemically synthesized drugs with potential toxicity (1).

Anal. Bioanal. Electrochem., Vol. 13, No. 1, 2021, 33-51

Analytical & Bioanalytical Electrochemistry

Full Paper

Highly Selective Sensors for Assay of Donepezil Hydrochloride by Potentiometry: Green Approaches

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Received: 25 July 2020 / Received in revised form: 28 November 2020 / Accepted: 26 July 2021 / Published online: 31 August 2021

Abstract- Donepezil hydrochloride (DPH), an indan and piperidine derivative, is a selective medicament of Alzheimer's disease. Two highly selective and eco-friendly membrane based sensors have been designed to determine DPH. Sodium tetraphenyl boron (STPB) and sodium phosphotungestate (SPT) have been used as ion-exchangers, for construction of Sensors 1 and 2, respectively, with β-cyclodextrin (β-CD) as ionophore and nitrophenyl octyl ether (NPOE) as a plasticizer. The sensors are highly capable to determine DPH of linear concentration range 1.0×10^{-6} to 8.0×10^{-3} M at the pH ranged between 5 and 8. The regression coefficient values for the resulted calibration lines were 0.9992 and 0.9984 with Sensor 1 (DPH-STPB sensor) and Sensor 2 (DPH-SPT sensor), respectively. The Nernstian slopes of 58.51±0.80 and 57.24±0.67, for Sensor 1 and 2, respectively, reflected the appropriate functioning of sensors in relative to concentration of DPH. The limits of detections (LOD) values were calculated to be 6.3×10^{-7} and 7.14×10^{-7} M for Sensor 1 (DPH-STPB sensor) and Sensor 2 (DPH-SPT sensor), respectively. The results from validation of both the sensors reflected high selectivity for measuring potential of DPH solutions. Sensors have been subjected to validity check through accuracy, precision, robustness and ruggedness. Specific functioning of Sensor 1 and 2 permitted to achieve 99.26% as mean recovery of DPH from tablets analyses. The outcome of statistical tests between the results from sensors 1 and 2 with reference method pronounced the extraordinary applicability of the proposed new methods to determine DPH in pharmaceuticals. These methods are greener approaches due to the non-usage of any organic toxic solvent and pre-treatment and extraction steps' absence.

Keywords- Donepezil; Sensors; Potentiometry; Determination; Pharmaceuticals

Applications of Pyrrole Based Molecularly Imprinted Polymers as Analytical Sensors: a Review

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Received 23/11/2020; accepted 10/10/2021
https://doi.org/10.4152/pea.2022400404

Abstract

Molecularly imprinted polymers (MIPs) are an important class of compounds with wider sensing applications for the determination of substances ranging from small molecular masses to macro size. The hyphenation of MIP principle with other likewise conducting polymers yields the devices for sensing purposes. MIPs are robust against environmental conditions, more economical than natural receptors, and their preparation is also adequate for substances without natural receptors. Organic mediated MIPs compounds are of current interest, due to their applicability as quantification tools to determine electroactive substances in a variety of real samples. MIPs are highly selective for target molecules, mechanically strong, resistant to temperature and pressure, inert towards acids, bases, metal ions and organic solvents, highly stable for longer periods, and operative at room-temperature. Therefore, during past years, MIPs have been used as electrochemical and optical sensors, sorbents, solid phase media, and so on. Herein, there is a focus on the use of Pyrrole (Py) as a monomeric molecule to fabricate MIPs. Py or poly-Py (p-Py) based MIPs are synthesized and used in various capacities as chemo electrochemical sensors. A detailed discussion on the application of Py-mediated MIPs for the electrochemical determination of some organic compounds of therapeutic and environmental interest is herein presented as a review.

Keywords: fabrication, Py, MIPs, electrochemical sensors and determination.

Introduction

Over the past three decades, MIPs have attracted broad interest from scientists engaged in sensors development. In the recent years, MIPs have proved that they are important materials for the design of new analytical methodologies, because they are selective molecular recognition phases [1]. MIPs can be tailored for different target analyses [2-4], and required templates are possible to obtain by using highly cross-linked co-polymers. Hence, MIPs are selective for the detection of a variety of analyte molecules. Depending upon the nature of the involved chemical bonds, MIPs synthesis techniques can be executed either by covalent or non-covalent imprinting [5]. Non-covalent imprinting is widely preferred, due to its flexibility in the choice of functional monomers and template molecules. The main non-covalent interactions are hydrogen bonding, ion-

SIMPLE AND HIGHLY SELECTIVE DIRECT STABILITY INDICATING ULTRAVIOLET AND INDIRECT VISIBLE SPECTROPHOTOMETRIC METHODS FOR DETERMINATION OF ENROFLOXACIN IN PHARMACEUTICALS **

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Three simple, economic, selective and accurate and precise spectrophotometric methods are developed for determination of enrofloxacin (EFX) in pharmaceuticals. Method A is based on the measurement of absorbance of EFX in 0.1M HOAc at 315 nm. The ketoxime formation reaction has been employed in method B, in which the absorbance measurement of EFX oxime product at 275 nm is described. The third method (Method C) is indirect one and is based on the oxidation of EFX by cerium(IV), reaction of unreacted cerium(IV) with p-toludine (p-TD) and measurement of coloured solution at 540 nm. The Beer's law is obeyed in the concentration ranges of 1.2–24, 1–8, and 1–20 μg/mL EFX in methods A, B, and C, respectively, with the corresponding molar extinction coefficients of 1.52×10^4, 3.86×10^4, and 6.6×10^3 L/mol/cm. The regression coefficients of calibration lines are 0.9996, 0.9913, and –0.9965, in methods A, B, and C, respectively. The limits of detection (LOD) and quantification (LOQ) have also been reported for each method. The methods have been validated to check accuracy, precision, robustness and ruggedness. The application of the methods proposed to determine EFX in tablets has been described and the results have been compared with a standard method. The results of validation and application have been found to be with excellent agreement. The standard addition procedure has been adopted in recovery experiments to further ascertain the accuracy of the methods and the results of the experiments are well satisfied. The stability indicating ability of Method A has been studied by subjecting EFX to acid and alkaline hydrolysis, oxidative, thermal and UV degradation followed by measurement of absorbance of resultant EFX solutions at 315 nm. The results of degradation study indicated unsusceptible nature of EFX to any of the stress conditions.

Keywords: *enrofloxacin, spectrophotometry, determination, pharmaceuticals, stability indicating.*

ВЫСОКОСЕЛЕКТИВНЫЕ ПРЯМЫЕ И НЕПРЯМЫЕ СПЕКТРОФОТОМЕТРИЧЕСКИЕ МЕТОДЫ ОПРЕДЕЛЕНИЯ ЭНРОФЛОКСАЦИНА В ФАРМАЦЕВТИЧЕСКИХ ПРЕПАРАТАХ

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УДК 543.42.062
https://doi.org/10.47612/0514-7506-2021-88-6-982-992

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(Поступила 7 июля 2020)

Для определения энрофлоксацина (EFX) в фармацевтических препаратах разработаны три спектрофотометрических метода. Метод А основан на измерении поглощения EFX в 0.1 М HOAc на длине волны 315 нм. В методе В использованы реакция образования кетоксима и измерение продукта оксима EFX на 275 нм. Метод С является косвенным и основан на окислении EFX церием(IV), реакции непрореагировавшего церия(IV) с р-толудином (р-TD) и измерении поглощения окрашенного раствора на 540 нм. Закон Бера соблюдается в диапазонах концентраций EFX 1.2–24, 1–8 и 1–20 г/мл

** This paper is published in electronic version of ZhPS V. 88, No. 6 (http://www.elibrary.ru/title_about.asp?id=7318; sales@elibrary.ru).

A Selective PVC Matrix Assisted Potentiometric Sensor for the Determination of Hydroxyzine Hydrochloride (HDH)

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Received 23/06/2021; accepted 30/10/2021
https://doi.org/10.4152/pea.2022400503

Abstract
A membrane sensor using an ion association complex of hydroxyzine hydrochloride (HDH) with Orange II (ORG-II) dye, in a polyvinyl chloride (PVC) matrix, has been developed and used as a selective electrode for HDH quantification in pharmaceuticals. The sensor is suitable to determine 2.2×10^{-5} - 1.1×10^{-3} mol L^{-1} HDH, in the pH range from 2.5 to 5.21, with the Nernstian slope of 57.41±1.04 mV/decade, under optimum conditions. The regression coefficient (RC) value of 0.999 shows a good correlation between HDH concentration and the potential measured using the proposed sensor. The sensor limit of detection (LOD) was 4.5×10^{-6} M. A standard-addition procedure was followed to study the effect of various interferents. The results revealed no variations caused by foreign ions or species. The regression equation (RE) and relative standard deviation (RSD) values, from 1.67 to 5, and from 1.86 to 4.81%, respectively, indicated the HDH-ORG sensor acceptable accuracy and precision. The RSD values of ≤5.67 and <5% indicated the sensor acceptable robustness and ruggedness, respectively. It has been successfully used to determine HDH in tablets, and excellent results were obtained.

Keywords: HDH, ORG-II, ion-associate, PVC and membrane sensor.

Introduction

HDH is hydroxyzine hydrochloride salt, with the international union of pure and applied chemistry (IUPAC) name 2-[2-[4-[(4-chlorophenyl)-phenylmethyl]piperazin-1-yl]ethoxy]ethanol;dihydrochloride, shown in Fig. 1.

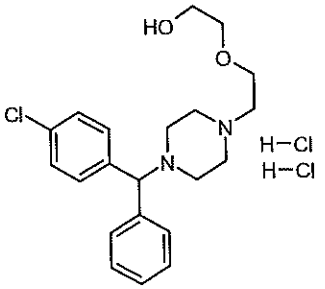

Figure 1. Structural formula of HDH.

Review Article

Thai Journal of Pharmaceutical Sciences

Probable selective compounds for inhibition of SARS-CoV-2 infection: A review

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Received: Aug 13, 2020
Accepted: Jan 11, 2021
Published: Dec 16, 2021

ABSTRACT

The world is severely facing the pandemic COVID-19 Corona viral disease. Many people died and more than five millions are fighting for their life in the world. The viral candidate has become to play villain role for the real life due to non-availability of medication. In this background attempt is made to present a review report on the probable and effective compounds to inhibit the viral activity of SARS-CoV-2. The works on the use of plant-based and synthetic compounds to suppress the viral functioning is summarized. Wherever possible, the mechanism of action with the results and effect of dose are described. Compounds showing exemplary abilities to inhibit viral functioning including those associated to SARS, Ebola, MERS, etc., were highlighted. The mechanism of action and inhibitory ability of the candidate compounds have been highlighted so that the choice to undertake further research to identify effective anti-viral drugs to treat COVID-19 decease. This review will definitely make researchers to raise the hope for use or modification of existing medications to treat this epidemic COVID-19 disease.

Keywords: Corona virus, COVID-19, pandemic, SARS-CoV-2, therapeutic compounds

INTRODUCTION

The coronavirus, a third pathogenic human corona virus (HCoV) [Figure 1], named as 2019 novel Corona Virus (SARS-CoV-2), was found reported in Wuhan of China[1] very recently. Corona virus, denoted by SARS-CoV-2, is a similar virus to the severe acute respiratory syndrome (SARS) virus that became responsible organism for an outbreak in 2003[2] and to the Middle-East respiratory disease virus (MERS-CoV) that emerged in 2012 which led to global epidemics with high morbidity and mortality.[3]

These HCoVs cause high-morbidity lower respiratory tract conditions, such as pneumonia, bronchiolitis, and croup, especially in the elders and young children.[4-6]

The SARS-CoV-2 is a single-stranded RNA genome (size range between 26.2 and 31.7 kb, positive sense), largest among all RNA viruses, with an enveloped structure[7,8] bearing the club-shaped projections of glycoproteins (diameter 80–120 nm).[7] The number of open reading frames in the CoV genome ranges from six to ten.[8] Its genetic material is susceptible for frequent recombination process, which can give rise to new strains with alteration in virulence.[9]

The spike (S) trimeric, membrane (M), envelop (E), and the nucleocapsid (N) proteins are principal chemical blocks in the structure of SARS-CoV-2. These along with glycoproteins have to be destroyed by targeted molecules to cure COVID-19 disease. Chemically, either N-linked or O-linked glycoproteins with sugar residues enriched with hydroxymethyl or hydroxy groups are more active in viruses, and these groups are taken into account to suppress the viral infection. Thus, with the chemical and biological background one must be keen to identify the target molecule in discovering the vaccine or a drug to cure COVID-19 disease.

The literature survey revealed non-availability of a definite therapy for COVID-19 disease. However, from the contributions of past and present researchers the way of finding the remedy to cure the pandemic disease can be made bit convenient. In this direction, a review has been undertaken to present the efforts put by various workers on synthesis and study of antiviral activity of some chemical compounds and to propose the probable active compounds to treat COVID-19.

DISCUSSION

Edible Oils with Antiviral Properties

Ayurveda has been proved as one of the best medication methods to treat many diseases right from ancient days. Rajesh *et al.*[10] presented a review for methods available to

Received: 16 December 2020 | Revised: 22 February 2021 | Accepted: 26 February 2021

DOI: 10.1002/ardp.202000468

ARCH PHARM DPhG
Archiv der Pharmazie

FULL PAPER

Multitarget-directed therapeutics: (Urea/thiourea)$_2$ derivatives of diverse heterocyclic-Lys conjugates

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Abstract

The synthesis of a new small library of molecules containing *bis*-urea/thiourea pendants in lysine conjugated to three different heterocycles is described. The heterocycles used in this study have benzisoxazole/piperazine/piperidine units. After a detailed antimicrobial, antioxidant, and anti-inflammatory evaluation, it was found that the most active compounds are **10**, **11**, **14**, **15**, **18**, **19** and **10**, **11**, **19** and **8**, **9**, **12**, **13**, **16**, **17**, respectively. Further, it was observed that the presence of all three entities, that is, urea/thiourea, the substituent (OMe/F), as well as the heterocycle, is highly essential for exerting potent activity. Among the heterocycles, the presence of isoxazole seems to be highly beneficial for exerting good potency. In continuation, docking studies have revealed extraordinary binding efficiency for some of the active compounds. Given their potent biological results and docking score, some of the title compounds could be potential drug candidates for microbial-related diseases and provide a basis for future research into the development of molecules possessing multitask ability.

KEYWORDS
docking, Lys-conjugates, therapeutics, urea/thiourea

1 | INTRODUCTION

One molecule focusing on many targets is the core of present-day research. The typical drug design based on the "one-molecule–one-target" model is shown to be ineffective in many instances, including diseases like Alzheimer's disease (Reference [1] and references cited therein). In this sense, a novel method of "multitarget-directed ligand strategy" has come into force[2] in the field of medicinal chemistry. This methodology is based on the fact that a single molecule has the ability to hit many targets. The platform will have a combination of two or more diverse entities in the same unit that will work synchronously.[3–5] In principle, each entity should be able to interact effectively with the target site(s), producing multiple pharmacophoric responses useful for eliminating or reducing the risk of disease(s).

With this strong underpinning strategy in mind, there are numerous efforts on multitarget drug discovery in place, with multitarget drugs and drug candidates entering several stages of clinical trials.[6] Focusing on this fact, our research group recently reported the multipharmacophoric development of molecules based on amino acid-heterocyclic conjugates bearing distinct pharmacophores working on different targets.[7]

Thanks to the exceptional profile,[7] which inspired the development of series of analogs of multitarget-directed molecules with good therapeutic potential. In a quest to increase the effort of developing more multitarget molecules, we focused our attention on the *bis*-urea/thiourea containing Lys-heterocyclic conjugates. The basis for the design of the current investigation comes from the results of our previous investigations as follows: Initially, we reported the conjugates having one amino acid (Lys or Glu), one urea/thiourea, and one heterocycle,[8] which was followed by the same strategy but with two homo-heterocycles.[9] In another article, we reported the conjugates possessing a dipeptide, no urea/thiourea, and two/three different heterocycles.[7] In all these aforementioned, we were successful in getting good to best therapeutic activity. Enthused by these contemplations and as a result of our

Results in Surfaces and Interfaces 5 (2021) 100023

Contents lists available at ScienceDirect

Results in Surfaces and Interfaces

journal homepage: www.elsevier.com/locate/rsurfi

Experimental and DFT explorations of *tert*-butyl(1-(2-(4-nitrobenzylidene) -hydrazinyl)-1-oxopropan-2yl)-carbamate on CRCA metal in 1M HCl solution

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ARTICLE INFO

Keywords:
CRCA steel
EIS
PDP
SEM
DFT
1M HCl

ABSTRACT

The performance of a novel corrosion inhibitor tert-butyl(1-(2-(4-nitrobenzylidene)hydrazinyl)-1-oxopropan-2yl)carbamate (AAD) has been accounted here along with physicochemical characterization studies like Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM),^{1}H NMR and Density function theory (DFT). Additionally, thermodynamic parameters such as weight loss, Langmuir adsorption, and the effect of temperature are investigated and are incorporated to show the enhancement of inhibition effectiveness with increasing dosages of synthesized inhibitor. A decreasing order of corrosion efficiency has been observed at elevated temperatures. Currently, AAD is examined using electrochemical methods including Potentiodynamic polarization (PDP) and Electrochemical impedance spectroscopy (EIS) to see how effective it is in inhibiting corrosion on cold-rolled close-annealed material (CRCA). According to the examination, the corrosion inhibitor showed anodic type of inhibition activity on CRCA metals with high corrosion efficiency.

1. Introduction

It is known, metals and alloys more easily corrode when exposed to acidic conditions. As structural elements, automobile peripherals, and so on, these metals have many applications in the automobile/engineering industries. Moreover, they are inexpensive and easy to fabricate because these metals being superior and having good mechanical, physical and chemical properties. The destructive nature of corrosion makes it a topic of interest throughout the world. The array of application practices makes the steel come in contact with varied destructive environments, (Callister, 1991; Clayton, 1987) at lower pH solutions all along the course of processes like acid pickling, etching, acid cleaning, acid descaling and oil well acidification. Most corrosion inhibition studies of mild steel have been conducted in an acidic and salt medium (Verma et al., 2016; Qiang et al., 2021; Khadiri et al., 2016; Khadom et al., 2009; Musa et al., 2010; Qiang et al., 2020).

In light of this, there is a crucial need for some outstanding corrosion prevention methods. One of the feasible methods to minimize corrosion is by the addition of organic inhibitors or by the addition of natural plant extracts (Khadom et al., 2010; Noor and Al-Moubaraki, 2008). The effectiveness of organic inhibitors is much better in comparison to natural extracts is determined by their capacity to get adsorbed and protect the metal surfaces. According to sources, the adsorption of inhibitors on metal/solution interfaces is also affected by the type of metal surface, surface charge, and corrosive electrolyte (Sudheer and Quraishi, 2014; Bhrara et al., 2008). Thus, the use of synthetic organic inhibitors which contain exclusively nitrogen is considered to lessen the corrosion attack on steel (Qiang et al., 2018). In spite of this, organic compounds containing heteroatoms, like S, O, and P have been validated as effective in a variety of acidic solutions (Bentiss et al., 2005; Khadom et al., 2018b; Qiang et al., 2017a, 2016). It is due to the influence of lone pairs and p electrons that an electron transfers from an inhibitor to the metal forming a bond. The inhibitors are known to have specific physicochemical properties that contribute to adsorption. The strength of physisorption/chemisorption is governed primarily by electron density and polarizability. An inhibitor's effectiveness is subsequently determined by its ability to get adsorb on the surface of the metal, which involves a substitution of water molecules at the interface. A decrease in the electron density may explain the decline in the cathodic or anodic reactions (Prakash et al., 2006; Oguzie et al., 2007). Hence, this paper reports on the synthesis and inhibition behavior of AAD on CRCA metal sheets in 1*M* HCl solution by employing weight loss and electrochemical techniques (EIS and

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https://doi.org/10.1016/j.rsurfi.2021.100023

Environmental Nanotechnology, Monitoring & Management xxx (xxxx) xxx-xxx

Contents lists available at ScienceDirect

Environmental Nanotechnology, Monitoring & Management

journal homepage: http://ees.elsevier.com

Bio-mediated synthesis of ZnO nanoparticles using *Lantana Camara* flower extract: Its characterizations, photocatalytic, electrochemical and anti-inflammatory applications

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ARTICLE INFO

Keywords
Green synthesis
Zinc oxide
Photocatalytic activity
Electrochemical application
Anti-inflammatory
Application

ABSTRACT

The present study was reported as effective green assisted preparation of zinc oxide nanoparticles (ZnO NPs) by combustion method using environmentally benign green extract (Lantana camara flowers) as a fuel for the first time. The purity, particle size and morphological structure with high stability of ZnO NPs were well characterized by PXRD, SEM-EDAX, FT-IR, UV–vis and Raman spectral techniques. PXRD examination showed the hexagonal configuration having an average crystallite size between 21.4–27.2 nm in diameter confirmed as highly crystalline in nature. UV–vis spectral investigation of ZnO photocatalyst showed a strong absorption peak at 352 nm and corresponding to the energy band gap at 3.56 eV. The present research examination focused an excellent photodegradation (98 %) performance towards the decomposition of Methylene Blue (MB) dye under UV light and electrochemical assessment reveals that an excellent oxidation-reduction reaction carried out in 0.1 M KCl with the graphite electrode paste were discussed. Further, anti-inflammatory activity of prepared ZnO NPs were tested and reported that the ZnO-2 has high potent inhibitor of PLA_2 with MIC value of 41 μg/mL.

1. Introduction

The green synthesized nanoparticles have received serious attention towards reducing usage of chemicals and cost effective with eco-friendly in nature. Nanoparticles are of great significance due to their greater biological and physic-chemical assets than their bulk phase. According to literature, the nanotechnology attributes with distribution, surface morphology of the substances with crystallite size less than 100 nm and their applications are capture more attention towards semiconductor materials from few decades (Marie-Christine and Didier, 2004). Currently, syntheses of nanoparticles by green-friendly methods have become fashionable for researchers due to its environmental applications. The plant extracts are potential promising alternate tool for facile synthesis of nanoparticles via green methods (Rajeshwar and de Tacconi, 2009). Therefore, the increasing need for an alternative method of eco-friendly, cost-effective synthesis of ZnO nanoparticles was achieved by *Lantana camara flowers* extract.

Accordingly, ZnO nanoparticles are illustrated as semiconductor material due to its exceptional features including in the field of biomedical systems, optics, massive charge carrier recombination, electronics research, energy band gap, easy electron shuttling capability in photocatalytic activities etc (Malleshappa et al., 2015; Gunalan et al., 2012; Cao et al., 2019; Sharma et al., 2010). These properties of nanoparticles are easily modified by changing their size, morphology and mainly attributed to photocatalytic and photooxidizing ability over the chemical and biological species. These metal oxide or nano-metal complexes obtained from green extract allows a specific size, shapes with a meticulous synthesis are regulates the chemical toxicity in the surroundings (Taschuk et al., 2012; Sharma et al., 2010; Taschuk et al., 2012; Cross et al., 2007; Zhou. et al., 2006; Rasmussen. et al., 2010). Nowadays, ZnO NPs have been more attention is drawn towards various applications particularly in the areas of dye degradation.

Generally, the available anti-inflammatory drugs show several side effects to human body systems due to the slow absorption in case of acute inflammation. The inorganic nanomaterials have revealed significant antibacterial, antioxidant and anti-inflammatory applications at very low concentration due to their physic-chemical properties (high surface area to volume ratio) (Rai et al., 2009). Therefore, the development of nanomaterials is the platform substance playing a vital role towards improvement of anti-inflammatory properties with reduced side effects (Nagajyothi et al., 2015). Thus, zinc oxide nanoparticles have drawn more attention towards excellent biomedical properties like wound healing, catalytic, antibacterial, anti-inflammatory, etc. The present research work discusses the *Lantana camara flower* extract synthesis of ZnO NPs and its photocatalytic degrading efficiency was tested

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https://doi.org/10.1016/j.enmm.2021.100442
Received 27 October 2020; Received in revised form 10 February 2021; Accepted 10 February 2021
Available online xxx
2215-1532/

A subordination result and integral mean for a class of analytic functions defined by q-differintegral operator

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Abstract. In this paper, we derive a subordination result and integral mean for certain class of analytic functions defined by means of a fractional q-differintegral operator $\Omega^{\delta}_{q,z} f(z)$.

Keywords: analytic functions, univalent functions, subordinating factor sequence, q-difference operator, Hadamard product (or convolution).

1. Introduction

Let $\mathcal{A}$ denote the family of functions of the form

$$f(z) = z + \sum_{m=2}^{\infty} a_m z^m \tag{1}$$

which are analytic in the open unit disc $\mathcal{U} = \{z : |z| < 1\}$. Also denote by $\mathcal{T}$, the subclass of $\mathcal{A}$ consisting of functions of the form

$$f(z) = z - \sum_{m=2}^{\infty} |a_m| z^m \tag{2}$$

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Indian J. Applied & Pure Bio. Special Vol. 2(1): 256-262 (2021). **ISSN: 0970-2091**
National e-Conference on Biodiversity Building and Natural Resource Management (NC BBNRM) Date: 22nd-23rd, December, 2021 **A web of Science Journal**

A study on the diversity of Spiders in different localities of Mysore city, Karnataka

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Abstract

Spiders belong to the largest order Aranae of the class Arachnida Phylum Arthropoda. Spiders are important food source of many vertebrates such as birds, lizards, etc., and thus become an important part of various food chain and food web. The present study was undertaken to know the diversity of Spiders in three different study sites of Mysore city. The study sites were selected based on the anthropogenic activity. Field survey was conducted during March to May 2021 in the morning between 6:30 to 8:30 am. The observations were recorded according to visual count method and all out search method and standard methods were followed to identify the different species of spider. Total 41 species of spiders belonging to 18 families were recorded during the study period. The Araneidae family was the dominant family with highest number of species recorded followed by

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 12, December 2021

DOI: 10.17148/IARJSET.2021.81227

Phytochemical analysis and antibacterial activity of Cleome gynandra L. Stem and Leaf extracts

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Abstract : The crude extraction of **Cleome gynandra L.** leaf and stem obtained in different solvents like methanol, ethanol and water was subjected to preliminary phytochemical analysis and the antibacterial screening against the gram-negative bacteria. Phytochemical study of both stem and leaf extracts shows the presence of secondary metabolites like **Alkaloid, Cardiac glycosides, Flavonoids, Phlobatannins, Amino acids and Proteins** which were predominantly present in all tested solvent extracts, followed by **Saponins** were present only in the methanol and water extract of both stem and leaf. Among all the three tested solvent of stem and leaf extract shows the various degree of significant antibacterial activity against **Escherichia coli** and **Pseudomonas aeruginosa**. Methanol extract of leaf shows the maximum inhibitory activity against E. coli and ethanol extract of both stem and leaf shows the similar inhibitory action against both tested bacteria. Water extract of stem and leaf shows the minimum inhibition with reference to the standard (Chloramphenicol).

Keywords- Phytochemical analysis, Antibacterial activity, Cleome gynandra L.

1. INTRODUCTION

Phytochemicals are the chemicals which are present in the plants naturally; in recent years these phytochemicals have become more popular because of its innumerable medicinal uses. Unlike synthetic chemicals, these phytochemicals do not have any side effects, because they are considered as a human friendly and can cure lots of diseases and disorders [1]. From the classical time across the world people are exploring plants to obtain new drugs. Almost 80 to 90 % people are depended on plants for their treatment of diseases. Most of the medicinal plants are used in traditional system like Unani, Ayurveda, Homeopathy and Siddha [2]. Plants are the treasure homestead of the prospective drugs. These drugs are known for their effectiveness, less expensive, safety and efficiency. Plants are capable to produce some compounds which are having the ability to show activity against various pathogenic bacteria. Most of the phytochemicals belongs to the different chemical classes which has the capability to inhibit all type of microorganism in vitro [3]. But now there are challenges to obtain resistance to bacterial pathogens with available drugs, therefore analysis of antibacterial activity is the matter of concern to develop drugs to various bacterial diseases [4].

Cleome gynandra L. is an herb belong to the family Cleomaceae, earlier it was placed in Capparaceae, under the division Angiosperm, distributed in Asia and African countries. It is having a long taproot with secondary roots and root hairs and aerial stem with glandular hairs. Leaves digitately palmate, having 5 leaflets with long petiole and arranged in alternative manner. Leaflets are having dentate margin with oval or elliptical in shape. Terminal inflorescence which denotes raceme bearing flowers with long pedicel arises singly in the axis of small leafy bract. Basically, flowers are white in colour, tetramerous having 6 stamens with long pedicel arises from elongated receptacle [5].

2. EXPERIMENTAL METHODS OR METHODOLOGY

2.1 Collection of plant materials

Fresh aerial parts of the Cleome gynandra L. were collected from the Hulimavu gudda which is located in Nanjangudu taluk, Mysuru district. It lies in 12.119708 Latitude and 76.682792 Longitude. The collected plant material was taxonomically identified and authenticated by the taxonomist and also confirmed using Gamble flora. Herbarium was submitted to the PG Department of Botany, JSS college of Arts, commerce and science, Ooty road, Mysuru. Collected plant parts washed thoroughly with the running tap water to remove the dust particles, then again wash with distilled water [6]. After washing leaves and stem part were separated, the plant material was shade dried. After completion of drying, the plant materials were ground well using mechanical blender into fine powder and transferred into airtight containers with proper labelling for future use [7].