H. R. Patel Institute of Pharmaceutical Education and Research, Shirpur

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Scientific paper

Design of "Turn-Off" Fluorescent Nanoprobe for Highly Sensitive Detection of Uric Acid using Green Synthesized Nitrogen-Doped Graphene Quantum Dots

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Abstract

Green synthesized graphene quantum dots (GQD) have been doped with nitrogen in an attempt to boost their optical characteristics and application sectors. In the present investigation, the blue luminescent nitrogen-doped GQDs (N-GQDs) were synthesized by single-step hydrothermal synthesis using tamarind shell powder as a precursor. The particle size and zeta potential of N-GQDs were found to be 11.40 nm and be –35.53 mV, respectively. A quantum yield as high as 23.78 % was accomplished at an excitation wavelength of 330 nm at neutral pH. It gets quenched sensitively in the existence of uric acid (UA) combining static quenching, electron transfer, and an inner filter effect mechanism. A linear range was obtained for UA from 10 μM to 100 μM, with a limit of detection (LOD) of 401.72 ± 0.04 pM. Additionally, the N-GQDs were selective toward UA in presence of metal ions and biomolecules that indicated its impending use to monitor UA in clinical samples. In conclusion, this work demonstrates that the N-GQDs as a sensing probe for UA recognition with notable advantages including socioeconomic, simple, and less time-consuming methods as compared to other methods. In the future, it can be potentially explored as a biosensor for UA detection in clinical samples.

Keywords: Graphene Quantum Dots; N-GQDs; Uric acid; Biosensor; Tamarind Shell Powder

1. Introduction

Principally, UA (2.6,8-trihydroxypurine) is the primary product of purine synthesis.[1] As per literature, in the general population, UA is referred to between 0.13 mM to 0.46 mM and 2.49 mM to 4.46 mM in serum and urine, respectively.[2] As we know, the abnormal levels of such metabolites in body fluids can cause several diseases.[3] Plentiful literature revealed that the increased UA levels in body samples are indicative of hypertension, gout, cardiovascular disease, kidney disease, high cholesterol, and many more.[4] In comparison, low concentrations of UA are also connected with multiple sclerosis and oxidative stress.[5,6] In diagnosis and healthcare, it is crucial to quantify metabolites in blood or other biological samples. Therefore, a rapid, responsive, precise, and cheap method of assessment must be developed to track such metabolites in body fluids including serum and urine.[5]

Literature survey reported that electrochemical sensing,[7] a colorimetric method,[8] a chromatographic method,[9] etc. are currently engaged detection techniques for UA in different body fluid samples. However, some in-conveniences such as complicated synthesis or challenging extraction, advanced equipment, expensive and tedious limiting their practical uses, are present in these approaches.[5] There are no exceptions for benefit of fluorescence. It is highly sensitive, and it shows a fast reaction, and operative simplicity in contrast to the oth-

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Chitosan mediated layer-by-layer assembly based graphene oxide decorated surface plasmon resonance biosensor for highly sensitive detection of β-amyloid

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ABSTRACT

Alzheimer's disease (AD), and its consequent effect primarily clinical dementia, Parkinson's disease dementia, etc. currently bring potential avenues for diagnosis centered on identification of beta-amyloid$_{1-42}$ (Aβ_{1-42}). Unfortunately, techniques engaged in AD core biomarker (Aβ_{1-42}) detection are majorly suffering from poor sensitivity and selectivity. Thus, we fabricated graphene oxide (GO) surface decorated chitosan (CS) mediated layer-by-layer (LbL) assembly based surface plasmon resonance (SPR) biosensor for highly sensitive and selective recognition of Aβ_{1-42}. Briefly, silver nanoparticles (AgNPs) and GO synthesis were achieved through a greener approach. LbL assembly was designed using CS and polystyrene sulphonate (PSS) on surface of AgNPs (AgNPs-CS-PSS-CS) and then antibodies of Aβ (anti-Aβ) were fixed on LbL assembly (AgNPs-CS-PSS-CS@anti-Aβ). Herein, amine functionality of CS offers a plethora of sites for anti-Aβ antibody immobilization that gives specific direction, high selectivity, and an adequate amount of antibody immobilization. For fabrication, synthesized GO was immobilized on an amine-modified gold-coated sensor chip via carbodiimide chemistry followed by AgNPs-CS-PSS-CS@anti-Aβ immobilization on an activated GO surface. Inimitable features of LbL assembly showed improved selectivity towards Aβ peptide whereas utilization of affinity biotransducer with a combination of plasmonic and non-plasmonic nanomaterial improved sensitivity and selectivity. Consequently, linearity range and limit of detection (LOD) of Aβ_{1-42} antigens were found to be 2 fg/mL to 400 ng/mL and 1.21 fg/mL, respectively. Moreover, analysis of Aβ_{1-42} in AD-induced rats confirmed the real-time-applicability of the designed SPR biosensor. Hence, GO surface decorated AgNPs-CS-PSS-CS@anti-Aβ mediated SPR biosensor would provide a novel approach for exceptionally sensitive and selective Aβ detection.

1. Introduction

Alzheimer's disease (AD) is a progressive, and irreversible neurodegenerative disease [1]. Subsequently, continuous progress in AD results in clinical dementia [2]. Importantly, AD is defined biologically by the presence of β -amyloid (Aβ) plaques and tau-containing neurofibrillary tangles in the brain [3]. It causes amnestic cognitive impairment in the prototypical form and non-amnestic cognitive impairment in the less common variants [3,4]. Literature divulged that AD is perhaps the leading prevalent form of dementia among individuals over the age of 65. It affects approximately 5 million individuals in the United States (US). As the population ages, the number of AD cases in the US is expected to climb to 16 million by 2050 [5]. Conventional diagnostic methods including imaging, laboratory analysis, examination, and initial history of the patient have been preferred to diagnose AD [5,6]. Such methods are suffering from plenteous demerits including less detection accuracy, extremely expensive, time-consuming, etc. Moreover, there is no promising treatment existed for the management of AD whereas symptomatic treatment can endow with a short period of relief. As a result, there is necessary to establish a newish solution to diagnose AD and clinical dementia at an early stage, which can contribute to the improvement of individual life [6,7].

Merely on AD phenotype, it is complicated to determine the fundamental disease process concerned in AD. Herein, assorted biomarkers might be of considerable assistance in expediting the early recognition of AD [8]. As per literature, biomarkers are quantitative signals that are expressed within a certain stage of the ailment. It renders them essential for both diagnosis and tracking therapy response [9]. In the case of AD,

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Short communication

Design of graphene quantum dots decorated MnO_2 nanosheet based fluorescence turn "On-Off-On" nanoprobe for highly sensitive detection of lactoferrin

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ABSTRACT

Lactoferrin estimation is increasingly acquiring prominence as a novel biomarker for the diagnosis of periodontal disease. To date, diverse lactoferrin detection methods which include electrochemical, surface-enhanced Raman scattering, colorimetric, and others have been extensively portrayed. Unfortunately, these systems have significant shortcomings including low sensitivity, selectivity, high cost, arduous and time-consuming technique, and so forth. Recently, the fluorescence-based method shows remarkable uniqueness that overcomes the demerits of traditionally reported techniques. Therefore, graphene quantum dots (GQDs) and manganese dioxide nanosheets (MnO_2-NS) based simplistic, highly sensitive, and selective fluorescent turn 'Off-On' mediated GQDs@MnO_2-NS nanoprobe was designed. Herein, MnO_2-NS addition demonstrated the quenching of GQDs containing fluorescence through inner filter effects (IFE) and strong interaction between GQDs and MnO_2-NS. The lactoferrin addition destroyed the MnO_2-NS and fluorescence emission of GQDs reappeared which may be because of redox reaction between lactoferrin and prepared MnO_2-NS. Herein, nanoprobe offers a wide concentration range and low limit of detection of 5 to 1600 ng/mL and 1.69 ng/mL, respectively. As fabricated GQDs@MnO_2-NS nanoprobe sensor demonstrated high selectivity, good stability, and reproducibility towards lactoferrin that assuring applicability of biosensor. Therefore, the GQDs@MnO_2-NS nanoprobe will offer a simplistic sensor with adequate sensitivity to achieve highly responsive and selective detection of lactoferrin.

1. Introduction

Periodontal disease is common in many countries [1], and is frequently produced by microbial infection. It stimulates the adherence of connective tissue and the prevention of bone surrounding the teeth at the onset of illness [2,3]. Despite this, its following inflammatory response adds to the loss of periodontal tissues in a patient. As a result, it is a prolonged inflammatory illness in people that causes not only regional mouth diseases but also systemic organ abnormalities [3]. Importantly, periodontal disease if remain untreated, the illness progresses to gradual bone damage, resulting in tooth movement and eventual tooth loss. As per literature, periodontal disease affects more than half of the grownup people in the United States, with around 10% suffering from serious disease those results in earlier tooth loss [4]. To prevent additional severances of periodontal disease, it is critical to accurately diagnose it. In this regard, biomarker detection is essential in the prediction of health difficulties, and scientists are presently investigating novel biomarkers for sickness diagnosis. In latest days, advances in the science of diagnosing oral as well as periodontal illness have evolved into ways for measuring periodontal threats employing quantifiable evidence kind of as biomarkers [5].

Lactoferrin (family: transferrin) is an iron-binding glycoprotein found in secondary neutrophil granulocytes [6]. As per literature, it demonstrates responsiveness to acute inflammation [3]. In addition, lactoferrin is observed in tears and saliva [6]. Lactoferrin estimation has received a lot of attention during the last two decades as a new biomarker [7] for the diagnosis of periodontal disease. Furthermore, it may be recommended for the diagnosis of various inflammatory illnesses [8]. Several identification studies have proposed various approaches for lactoferrin detection. Mainly, single radial

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Biofabricated functionalized graphene quantum dots (fGQDs): unraveling its fluorescence sensing mechanism of human telomerase reverse transcriptase (hTERT) antigen and *in vitro* bioimaging application

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Keywords: functionalized graphene quantum dots, hTERT, fluorescence quenching, turn 'On-off-On' biosensing, bioimaging

Supplementary material for this article is available online

Abstract

Lung cancer (LC) is a deadly malignancy that is posing a serious threat to human health. Therefore, early detection of LC biomarkers is the key to reducing LC-related fatalities. Herein, we present the first fluorescent-based selective detection of LC biomarker human telomerase reverse transcriptase (hTERT) using polyethyleneimine (PEI) functionalized graphene quantum dots (fGQDs). One-pot *in situ* synthesis of amine-functionalized GQDs was accomplished by hydrothermal carbonization of biowaste-derived cellulose and PEI. Synthesized fGQDs were characterized by various analytical techniques. Synthesized fGQDs not only exhibited enhanced fluorescence life-time but also excellent stability in the different solvents compared to bare GQDs. The surface activation of hTERT-Ab by carbodiimide chemistry (EDC-NHS) resulted in stacking interactions with fGQDs, involving adsorption-desorption as well as competitive mechanisms. The higher inherent affinity of hTERT-Ag (hTERT antigen) for hTERT-Ab (hTERT antibody) resulted in complex formation and recovery of fGQD fluorescence. As a result, this fluorescence sensing demonstrated a greater linear detection range (0.01 ng ml^{-1}–100 μg ml^{-1}) as well as a notable low detection limit (36.3 pg ml^{-1}). Furthermore, the fabricated immunosensor (Ab@fGQDs) has excellent stability and performance in real samples, with an average recovery of 97.32%. The results of cytotoxicity and cellular bioimaging study in A549 cells show that fGQDs can be used for additional nanotherapeutics and biological applications.

1. Introduction

Among all cancer-related deaths worldwide, lung cancer (LC) is accounted for the highest mortality rate on a global scale [1]. The global pattern of LC incidence and mortality rates is changing every day, with experts predicting that the general population will be at a higher risk of developing LC [2]. According to recent reports, LC is the most commonly diagnosed cancer (11.4%) and has the highest death rate (18%) of all cancers [3]. The literature revealed that a variety of LC biomarkers have been studied independently viz. cancer antigen 125 (CA125) [4], cytokeratin fragment (CYFRA21-1) [5], neuron-specific enolase (NSE) [6, 7], melanoma-associated antigens (MAGE A2, MAGE A11) [8], carcinoembryonic antigen (CEA) [9], heterogeneous nuclear ribonucleoprotein (hnRNP A2-B1) [10] and fibrin degradation product (D-dimers) [11], including human telomerase reverse transcriptase (hTERT) [12–14].

The hTERT is a ribonucleoprotein polymerase (RNP), which adds the TTAGGG repeating units to the telomere by which it performs its characteristic functions [15]. Telomerase is mostly found in fetal tissues, mature germ cells, and tumor cells about 70%–90%. Telomerase expression is critical for cellular immortalization and cellular senescence. The ectopic expression of hTERT plays an important role in the

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Design of zero-dimensional graphene quantum dots based nanostructures for the detection of organophosphorus pesticides in food and water: A review

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ABSTRACT

From its inception, traditional analytical approaches have been the primary strategies for sensing organophosphorus pesticides (OPPs). Unfortunately, traditionally reported methods are suffering from plentiful limitations that include their cost factor, poor responsiveness, low specificity, tedious, etc. Recently, graphene quantum dots (GQDs) have been widely applied to researchers' recognition of OPPs sensing in water and food samples, due to their outstanding and versatile attributes. Moreover, the combination of other nanomaterials like inorganic and organic materials, along with surface tuning of GQDs such as doping and functionalization, shows the potential to boost the performance of the sensing system. Despite this indubitable development, there is no detailed report on the design of zero-dimensional GQD-based nanostructures for the detection of OPPs in food and water. Therefore, we have addressed the GQDs-centered nanostructures for the recognition of OPPs in water and food. Importantly, it covers the consumption of OPPs and their impact on human health, while the synthesis and properties of nanosized GQDs have been reviewed. Besides, GQDs based on fluorescent, electrochemical, and colorimetric nanoprobe for monitoring OPPs have been illustrated. Moreover, sensing mechanisms, anti-interference potential, current challenges, and future research have been described. Fascinatingly, modification of GQDs enabled sensors exhibits supreme responsiveness and specificity for recognition of OPPs in provided samples. Accordingly, existing architectured GQDs mediated nanoprobes furnish the lower detection limit for OPPs up to a picogram. In near future, the nano-design of GQD-centered sensors will open up a new door for sensing OPPs in real-time samples.

1. Introduction

Pesticides are increasingly being utilized in crop management and pest control in advanced agricultural practices. Surprisingly, the world food demand rises, leading to increased pesticide utilization [1]. Pesticides have been categorized into rodenticides, insecticides, fungicides, and herbicides [2]. As well, pesticides such as organochlorines, organophosphorus, carbamates, pyrethrin, and pyrethroids are often chemically categorized [3]. Among reported pesticides, organophosphorus pesticides (OPPs) are most widely employed in agriculture due to the relatively long half-life, low persistence, cheaper price, high insecticidal efficacy, and high effectiveness [4,5]. Principally, OPPs are phosphoric acid ester, thiol, or amides derivatives with a diverse range of carbon, oxygen, sulfur, and nitrogen bonded compositions [6]. There are hundreds of OPPs in use due to the enormous number of chemical combinations. Moreover, most extensively OPFs used in agriculture are malathion, parathion, methyl parathion, azamethiphos azinphos-methyl, chlorpyrifos, diazinon, dichlorvos, disulfoton, fenitrothion, fonofos, phosmet, tetrachlorvinphos, terbufos, etc [7]. Owning to lethal effect on the target pests and easy accessibility, OPPs are extensively utilized over the globe [8]. Likewise, organochlorine pesticides such as dichlorodiphenyltrichloroethane (DDT), aldrin, and dieldrin have been phased out due to lack of effectiveness and environmental persistence. OPPs are usually soluble in water and rapidly degrade via hydrolysis once introduced into the air, sunlight, and soil [9]. Moreover, the extensive use and non-persistent nature of OPPs remain for a longer period in the environment. It leads to environmental contamination and has gradually evolved into the food supply chain via water, air, and soil [10]. Surprisingly, OPPs residues accumulate in the body even at very low concentrations, triggering serious health issues [11].

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Fabrication of poly (aspartic) acid functionalized graphene quantum dots based FRET sensor for selective and sensitive detection of MAGE-A11 antigen

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Bioimaging

ABSTRACT

In the present work, we investigated a label-free fluorescence resonance energy transfer (FRET) based poly (aspartic) acid (PAsP) functionalized graphene quantum dot (PAsP-GQDs) immunosensor for the selective and sensitive sensing of MAGE-A11 antigen.

Synthesis of GQDs was accomplished with hydrothermal carbonization of Onion hull (ONI-GQDs). Synthesized PAsP-GQDs were characterized for fluorescence performance, functional compositions and morphological analysis. To form a typical FRET system, functionalized GQDs conjugated with anti-MAGE-A11 (antibody) using EDC/NHS chemistry served as an energy donor, while graphene nanosheets served as energy acceptors (quenchers). The fabricated PAsP-GQDs@M−A11−Ab immunosensor demonstrated high selectivity to MAGE-A11 with a broader detection range about of 0.05 ng mL^{-1} – 5 μg mL^{-1} (R^2 = 0.9906) and a detection limit of about of 5.6 pg mL^{-1}, with a rapid response time of 12 min. The performance of the developed immunosensor was established using real sample analysis, which showed an average recovery of 96.8 % with % RSD 0.71 indicating the high precision and reproducibility of the method. Furthermore, to implicate the post-functionalization modifications, cellular bioimaging potential and cytotoxicity studies were conducted as a comparative assessment. The present immunosensing strategies can be utilized as an analytical tool for detecting MAGE-A11 in various cancers.

1. Introduction:

The global cancer risk is growing steadily, with a high fatality rate per year. The most recent epidemiological survey statistics raised concerns about the possibility of imposing cancer cases [1]. Among the various types of cancer, lung cancer (LC) is the most frequently diagnosed cancer worldwide next to breast cancer [2]. With precise early detection testing, the stages of LC can be identified. In that, identification of different tumor markers could be the key finding to arrest at the proper stage with desirable treatment. Different types of tumor marker (protein) were identified as an indication of the LC such as carcinoembryonic antigen (CEA), cancer antigen-125, pro-gastrin-releasing peptide (proGRP), cytokeratin fragment (CYFRA 21–1), Melanoma-associated antigen family proteins (MAGE's) and neuron-specific enolase (NSE) etc. [3,4]. Amongst these, MAGEs are often observed in the fetal keratinocytes, placenta, and male germ cells as well as different human malignancies. Melanoma-associated antigen-A11 (MAGE-A11) is an X-linked gene that is expressed at a lower rate specifically in the placenta, testis, endometrium and ovary of humans [5]. The MAGEs family protein plays a vital role in physiology as well as pathology of germ cell development embryogenesis, neurogenetic, cell cycle progression, apoptosis, etc. MAGE-A11 antigen expression is also found at differential levels in lung cancer, breast cancer and prostate cancer [6]. Surprisingly, it was found at higher levels in adenocarcinoma than in squamous cell carcinoma of lungs. Hence, MAGE family antigens are considered ideal target markers for immunotherapy as well as early diagnosis and management [7,8].

Accordingly, the use of different methods such as Southern blotting with reproductive tract fluid (RTF), polymerase chain reaction-based (PCR) based methods, high-resolution telomere length analysis (STELA), DNA-Microarrays, enzyme-linked immunosorbent assay (ELISA), etc. being investigated as supportive methods [9]. Though the systematic estimation methodology of MAGEs is limited, there is growing interest in researchers for the assessment of their interactions

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Formulation, optimization, and *in-vitro-ex-vivo* evaluation of dual-crosslinked zinc pectinate-neem gum-interpenetrating polymer network mediated lansoprazole loaded floating microbeads

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ARTICLE INFO

Keywords:
Low methoxy pectin
Neem gum
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Floating profile
Mucoadhesion

ABSTRACT

Low methoxy pectin (LM pectin) suffers from burst release owing to its high swellability and solubility in water. Consequently, in ways to design an ideal drug delivery system, these obstacles must be surmounted. Therefore, the work aimed to design dual crosslinked LM pectin -neem gum (NG) mediated interpenetrating polymer network (IPN) floating mucoadhesive microbeads for lansoprazole (LNZ) gastro-retentive delivery. In short, LNZ-loaded floating microbeads were achieved by using the ionic gelation method wherein zinc acetate was preferred as a crosslinking agent. The optimization of IPN microbeads was performed employing a 3^2factorial design wherein concentration of pectin and NG was considered as independent factors whereas dependant factors are entrapment efficiency and drug release. Importantly, carboxylic functionality of low methoxy (LM) pectin and hydroxylic functionality NG cross-linked with Zn^{+2} forms a 3D network. Diffractogram and thermogram revealed that conversion of drug from crystalline to amorphous form because of entrapment of drug within polymeric network. Anticipated floating microbeads showed that polymer concentration had considerable effect on drug encapsulation efficiency and drug release. Briefly, optimizing floating microbeads (Batch B:5) showed maximum drug entrapment (87.47 %) with a delayed drug release (69.20 %, at 8 h) due to formation of strong IPN. Moreover, it showed good mucoadhesive aptitude with goat stomach mucosa because of entanglement between gum and mucus layer. In addition, use of calcium silicate assists to modulate floating profile of IPN microbeads. Therefore, designing dual crosslinked zinc-pectinate-NG mediated IPN floating mucoadhesive microbeads will offer a new substitute for floating delivery.

1. Introduction

Gastro-retentive drug delivery system (GRDDS) one of the oral drug delivery systems gained popularity due to various qualities, such as decreased therapy costs, easy administration, self-medication, greater patient compliance, and acceptability [1]. It is an approach that overcomes the problems in drug absorption due to the short residence time in the stomach faced by conventional drug delivery. It can markedly extend the residence time of drugs in the stomach, increasing bioavailability and decreasing drug waste. Therefore, it is possible to achieve site-specific drug delivery specifically to the stomach and upper small intestine [2,3]. Floating drug delivery is one of the major approaches of GRDDS to achieving prolonged gastric retention to attain appropriate drug bioavailability and drug targeting [2]. These devices release the medicine gradually at a predetermined and controlled rate without influencing the gastric emptying rate [4,5]. At the moment, dual-functioning systems that combine floating and mucoadhesive processes are getting a lot of interest since they can greatly boost the performance of traditional GRDDS [6,7]. Additionally, the multiple-unit GRDDS demonstrates its advantage over the single-unit forms by ensuring uniform dispersion across the gastrointestinal tract [8].

Nowadays, Recent trends incline toward the use of natural products derived from plant materials [9,10] to minimize and restrict the use of synthetic additives because the former is biodegradable, found in abundance in nature, non-toxic, and provides ease in working and at low cost [11,12]. In the current scenario, due to their outstanding

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REVIEW ARTICLE

Nanosuspension: A New Horizon in the Drug Delivery System

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ABSTRACT

Solubility is one of the major concerns in various drug formulations. Since the majority of new drug molecules belong to the BCS II (Biopharmaceutical Classification of Drug) they often lead to poor bioavailability and ultimately affect the drug's effectiveness. The majority of new drug molecules are insoluble and hence poorly bioavailable. Because of these limitations, the proportion of newly discovered drugs reaching the market is decreasing. Nano-suspension emerges as one of the novel solutions for these problems. As it helps in delivering poorly water-soluble drugs, due to their all-around features and unique advantages. The distinctive features of nanosuspensions allow them to be used in a variety of dosage forms, including mucoadhesive hydrogels, nanogels, etc. The present review article provides information regarding the introduction to nanosuspensions, the advantages, and disadvantages of nanosuspensions, different methods of their preparations, and numerous practical applications in drug delivery.

Keywords

Nanosupension, Dissolution, Surfactant, Solubility, Bioavailability.

Introduction

Nanosuspension is a biphasic dispersion of superficially stabilized micron-sized drug particles. Therapeutic nanosuspensions seem to be very tiny solid particles of a drug suspended in an aqueous carrier for administration via oral, local, parenteral, or pulmonary routes. Dispersed particles in nanosuspensions are in the size range of 200 to 600 nm (Èller et al., n.d.). The drug maintains the ideal crystalline state with smaller particles in nanosuspension technology, enhancing the rate of dissolving and penetration and improving bioavailability. Higher solubility and micronized particle penetration (particle size <10 μm) is associated with increased surface area and thus dissolution rate. Nano-sized particles can increase the dissolution rate and solubility. Except; as the diffusion distance on the drug nanoparticle surface decreases, the concentration gradient increases (Mü & Peters, 1998). The stability of nanosuspension is affected by the size of the particles produced by the various manufacturing processes. Crystal development and consequent fine particle production are caused by Ostwald ripening. The difference in dissolution rate between fine and coarse particles is due to the availability of surface area. Molecules diffuse from a zone of greater concentration to a region of lower drug concentration. As a result, a supersaturated solution forms surrounding the large particles, causing the medication to crystallize and huge particles to proliferate. Sedimentation, high-pressure homogenization, emulsification, and milling processes can all be used to make nanosuspensions. Nanosuspensions can be made in one of two ways.

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ORIGINAL ARTICLE

Fabrication of polyaspartic acid surface-modified highly fluorescent carbon quantum dot nanoprobe for sensing of reduced glutathione in real sample

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Abstract
The goal of this study was to create a polyaspartic acid (PAA) surface-modified blue luminescent carbon quantum dots (CDs)-based biosensor (PAA-CDs) that could detect calcium (II) ions and glutathione (GSH) with excellent sensitivity and selectivity. Herein, the hydrothermal approach was adopted to produce blue luminescent CDs from mint plant stalks. To improve surface irregularities, quantum confinement effects, and to impart recognition sites for the analyte sensing, the CDs were surface-functionalized with PAA. Spectroscopic techniques like UV, FT-IR, XPS, and other techniques were used to sanction the synthesis and surface functionalization of PAA-CDs. The probe PAA-CDs was utilized for the detection of Ca (II) ions via a quenching process (turn-off) and subsequently, restoration in fluorescence intensity (turn-on) was accomplished by incorporation of GSH, forming a novel probe for sensing of biothiol. For a linearity range of 0–45 µM concentration of Ca (II), the LOD was obtained as 25 nM in phosphate-buffered saline solutions (PBS, pH 7.4). Similarly, for a linearity range of 0–40 µM concentration of GSH, LOD was obtained as 64 nM. The surface-modified PAA-CDs exhibited stronger affinity towards Ca (II) ions via the FRET mechanism, which formed the Ca (II)@PAA-CDs complex that was unable to emit photons when excited. Thereafter, thiol (-SH) group of GSH offered selective attraction with Ca (II) ions among the various biomolecules; this caused the breaking of Ca (II) from Ca(II)@PAA-CDs complex. So, the detachment of Ca (II) from the complex re-established the fluorescence intensity of PAA-CDs in linear fashion. In addition, the cytotoxicity study of the PAA-CDs revealed their biocompatible nature, and the methodology was effectively practical to estimate the GSH concentration in human serum samples.

Keywords Carbon quantum dots · Polyaspartic acid · Functionalized carbon quantum dots · Calcium (II) ions sensing · Glutathione sensing · Fluorescent probe

Introduction

The reduced glutathione (GSH), homocysteine (Hcys), and cysteine (Cys) are major biothiols playing noteworthy functions in the conservation of pathological and physiological processes (Ballatori et al. 2009). The distinguished biothiol, GSH, is an important biological stuff that could be monitored to diagnose a number of diseases (Staal and Ela 1992).

The GSH is a putative antioxidant that performs a variety of important biological tasks such as maintaining biological redox status, modulating cell growth, gene regulation, decontamination, and metabolic activity (Yoo et al. 2019). GSH is reportedly found in normal cells (1–10 mM) and plasma (1–6 µM) (Khan and Patil 2020). Abnormal levels of GSH are linked to numerous diseases and disorders. According to the study, increasing GSH levels boosted antioxidant levels and oxidative stress resistance in cancer cells (Lucero and Chan 2021). Reduced GSH levels, on the other hand, indicate the loss of immune system functions as well as the possibility of an aging problem. Similarly, its shortage may lead to enhanced levels of oxidative stress, causing cancer (Bottino et al. 2021).

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Preparation And Characterization Of Dapsone Hydrogel Using Quality By Design

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ABSTRACT:

The present study work undertaken with the intend to develop a topical hydrogel formulation of dapsone 7.5% which would attenuate the first pass metabolism associated with an oral administration. Dapsone has low solubility and low permeability and classified as BCS class II drug as per biopharmaceutics classification system. The dapsone is formulated as hydrogel which premeditated to application by topical route for the treatment of skin disease acne vulgaris. The QTPP was define considering the product quality and efficacy. CQAs are drug product quality metrics and identified for process validation. The hydrogel formulation containing dapsone was optimized by using central composed design (CCD). Concentration of polymer's and concentration of pH modifier were identified as independent variables and drug release, pH measurement, viscosity and extrudability were dependent variables. Hydroxypropyl methyl cellulose (HPMC) with concentration of 5 – 10 %, Sodium Carboxymethyl Cellulose (Sod. CMC) with 5 – 10 % as pH modifier Triethanolamine (TEA) with 2.5 – 7.5 %. The optimization study confirms with 20 runs which designate a high level of prognostic skill of response surface methodology. The formulations characterized by drug content, pH, extrudability, residence time, drug release and viscosity. From the obtained results of drug release it was concluded that an optimized formulation shows a complete drug release. An accelerated stability study analysis showed acceptable results for an optimized trial formulation.

Keywords: Hydrogel, CCD, dapsone, extrudability, etc

Introduction:

The administrations of topically applied drugs are considered as local drug delivery method everywhere on body such as skin, vaginal, rectal, ocular and topical route. Dermal layer is the major way of drug delivery system for topical administration because skin is one of the largest and most easily available organ on the human body. Skin plays a major obstruction for access of many substances and this is mostly because of stratum corneum of the skin, it allows only small molecules to penetrate over a period of time into a systemic circulation.

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Bovine serum albumin-derived poly-L-glutamic acid-functionalized graphene quantum dots embedded UiO-66-NH_2 MOFs as a fluorescence 'On-Off-On' magic gate for *para*-aminohippuric acid sensing

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ARTICLE INFO

Keywords:
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Poly-L-glutamic acid
Graphene quantum dots

ABSTRACT

Evaluating *para*-aminohippuric acid (PAH) is emerging as a promising biomarker for the diagnostics of renal disease and other kidney-related illnesses. The present study aims to develop novel bovine serum albumin-derived poly-L-glutamic acid (PLGA) functionalized graphene quantum dots (PLGA-fGQDs) embedded in UiO-66-NH_2 metal–organic frameworks (PLGA-fGQDs@UiO-66-NH_2 MOFs) for monitoring of PAH. Initially, GQDs were achieved from bovine serum albumin (green precursor) via the single-step hydrothermal method. Here, functionalization with PLGA offers a tremendous increment in optical properties of GQDs. Then, highly luminescent UiO-66-NH_2 MOFs were achieved using zirconium tetrachloride ($ZrCl_4$) and 2-Aminoterephthalic acid (2-ATA) as a metal ion source and organic linker. Here, surface modification of GQDs with PLGA offered high quantum yield (QY), and responsiveness. Also, luminous UiO-66-NH_2 MOFs afford a wide surface area for decorating of PLGA-fGQDs. The addition of gallium ions (Ga^{3+}) into the probe solution resulted in fluorescence quenching (Turn-Off) whereas the incorporation of PAH resulted in fluorescence recovery (Turn-On). It is because of interaction with carboxylic functionality of PAH to Ga^{3+} followed by Ga-PAH complex formation. Herein, the wide concentration range and lowest limit of detection (LOD) were found to be 10 ng/mL to 900 ng/mL and 15.88 ng/mL, respectively. The specificity and real-time analysis in artificial urine validated the real-time adoption of a sensor for PAH detection. As well, it demonstrated good intraday/interday precision, stability analysis, and repeatability. In near future, the bundled illuminating PLGA-fGQDs@UiO-66-NH_2 MOFs nanoprobe will be an attractive preference for tracking PAH in clinical specimens.

1. Introduction

Renal diseases have already been considered a major public health concern around the globe. In this shade, the scientific community constantly committed to the advancement of screening methods [1]. In this ray, *para*-amino hippuric acid (PAH, 4-amino derivative of hippuric acid) is utilized in the assessment of renal plasma flow (RPF) as a diagnostic agent [2]. Hence, PAH is a valuable agent for accurately measuring effective renal plasma flow (ERPF) in clinical and laboratory research to evaluate renal functioning [3,4]. Basically, PAH is an amide derivative of glycine and *para*-aminobenzoic acid. It doesn't naturally occur in humans. As a result, it must be injected via intravenous (IV) prior to diagnosis. As an outcome, at low plasma concentrations (1 mg to 2 mg/100 mL), the kidneys can remove 90 % of aminohippurate from the renal circulating blood in a single circulation. As a function, PAH can be exploited to examine renal function as an essential indicator [5]. The renal extraction ratio of PAH in a normal individual is between 0.92 and 1.65 mL/min/kg [6]. Traditionally acknowledged indications of renal dysfunction encompass high uric acid levels and an imbalance in PAH levels [7]. In this regard, numerous analytical techniques, such as HPLC with UV detection [6], colorimetric detection [8], tandem mass spectrometry [9], and electrochemical detection [10], have been proposed

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Original Article

Mucoadhesive Tablets of Atenolol: Design, Formulation by using Thiomer Matrix and In-Vitro Evaluation

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Abstract

The major goal of this study was to develop and evaluate gastric retentive mucoadhesive tablets of atenolol and synthesized a xyloglucan- or thiomer of tamarind seed polysaccharide-were used. The oral sustained release formulations with low risk of dosage clearance are particularly well suited for the mucoadhesive drug delivery systems. Amounts of synthesised and oxidised Xyloglucan-Cysteine conjugates (Thiomer), HPMC K100M, PVP K 30, Mg-Stearate, talc, and lactose were used to create the seven formulations F1 to F7, which were used to create mucoadhesive tablets using the direct compression technique. Weight variation, friability, hardness, thickness, drug content, swelling index, drug release profiles, and mucoadhesion studies were all assessed for the produced tablets. Characterization was carried out. The formulation (F3) shown highest drug release i.e., 94% because of highest percentage of lactose and F2 shown highest mucoadhesive force comparatively. It was observed that Thiomer tablet remains in stomach for 7h, while Xyloglucan tablet disappears within 3h. The developed tablets shown drug release time T50 between 4.5-9hrs, had release after 12hrs between 42-94%, had Mucoadhesive force between 6.8-18.4g and sustained the drug release beyond 12h. The bioavailability of Atenolol was seen to have increased by use of Thiomer. The use of drug delivery carrier can be further explored for increasing bioavailability of limited permeability drugs.

KEYWORDS: Mucoadhesion, bioavailability, Atenolol, Xyloglucan, Thiomer.

INTRODUCTION

In order to deliver medications to a specific area of the body for extended periods of time, mucoadhesive drug delivery systems make use of the bioadhesion of specific polymers, which acquire adhesive following hydration. Two materials are kept together by interfacial forces in the case of bioadhesion, an interfacial phenomenon, where at least one of the components is biologically active. The bonding could occur between an artificial substance and a biological substrate, for as when a polymer adheres to a biological membrane [1]. The term "mucoadhesion" refers to the attachment of a polymer to a mucin layer of a mucosal membrane. [2] Mucoadhesive drug delivery methods include buccal, oral, nasal, ocular, vaginal, and rectal delivery drug delivery system. The most prominent drug delivery system is oral Drug delivery system for many medications. There are three types of drug delivery through the mucous membranes (1) Sublingual Drug Delivery and (2) Buccal Drug Delivery. (3) Local distribution of drugs. An appealing route of administration for precise and controlled systemic medication distribution is the buccal area of the oral mucosa. Buccal delivery refers to the distribution of medication through the mucosal lining of the cheeks. Although buccal mucosa is preferred for systemic transmucosal medication administration, sublingual mucosa is generally acknowledged to be more permeable. This is because the buccal mucosa has a larger span of smooth muscle and is comparatively immobile, making it a more desirable area for retentive systems. The buccal mucosa is a more suitable site for retentive systems due to the fact that it contains a broader span of smooth muscles and is relatively stationary. Therefore, the buccal mucosa is more suited for sustained medication administration [3].

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A Review Article: Formulation of Topical Gel by QbD Approach

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Abstract Application of drug by topical route is an alternate route for the treatment of skin diseases for systemic route. The skin diseases can be treated by administration of drug by local application and may avoid first pass metabolism. It minimizes systemic side effects and when applied locally can be removed easily if any side effects occur like, irritation, skin rash, redness at the application site. The topical drug delivery has been beneficial for longer period of time because of availability of large surface area of skin which exposed to circulatory routes. Because of this route, one can be directly applied to any external body surface and it is only for local application. Amongst many types of topical dosage form delivery, gel is most likely to be used and is a patient-friendly dosage form. Due to the lack of insoluble excipients and oily bases, the gel represents better release of drug as compared to other topical drug delivery system. Nowadays, many industries follow QbD (Quality by Design) approach for the formulation of Gel to prepare a quality medicine delivery to patients. The QbD approach describes the CQA, CMA and CPP of the formulation which ensures the quality of dosage form. This review article focuses on the different dosage forms, types of gel, evaluation by taking parameters such as drug content, pH, spreadability, extrudability, viscosity, swelling index and in-vitro drug diffusion and application of QbD approach to gel formulation.

Keywords Gel, QbD Approach, Topical Drug Delivery

1. Introduction

1.1. Drug Delivery System (DDS) by Topical Route

The administrations of topically applied drugs are considered as local drug delivery system anywhere on the body such as skin, vaginal, rectal and ophthalmic topical routes. Skin is the major way of drug delivery system for topical administration because skin is one of the largest and most easily available organs on the human body. Skin plays a major obstruction for access of many substances keen on the body and this is mostly due to stratum corneum which is outer layer of the skin, it allows only small molecules to penetrate over a period of time into a systemic circulation. Avoidance of the risk and inconveniences of injectable delivery and varied physiological condition like gastric emptying time, pH change, absorption, presence of enzyme are advantages of drug delivery by topical route. The topical drug delivery systems generally used where the other systems of drug administration fail or it is mainly used in pain management, contraception and acne. Topical drug delivery system is well-defined as an application of drug comprising preparation onto the skin which directly delight cutaneous maladies (e.g. acne) or the cutaneous

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Original Article

Thai Journal of Pharmaceutical Sciences

Development of amino acid salt-based curcumin@lysine acetate co-amorphous system using liquid-assisted grinding for improved solubility and dissolution

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ABSTRACT

Curcumin, multivalued phytoceutical, exhibits appreciable safety. However, its therapeutic utility is significantly compromised due to low aqueous solubility, and thus, poor absorption and low bioavailability become apparent. To surpass this limitation, the present work aims to develop amino acid salt-based curcumin@lysine acetate co-amorphous system for improved solubility and dissolution. Initially, screening of curcumin-amino acid mixtures was performed for saturation solubility assessment. Considering the outcome, lysine acetate was formulated to generate a co-amorphous mixture (COAM) by liquid-assisted grinding and evaluated for saturation solubility and different spectroscopical characterizations. Curcumin-lysine acetate COAM tablet formulation was developed by direct compression method and evaluated for appearance, thickness, hardness, weight variation, friability, drug content, disintegration, and *in vitro* dissolution studies. Further, curcumin-lysine acetate COAM and tablet formulation were screened for the accelerated stability study. Resultantly, curcumin-lysine acetate binary mixture demonstrated the highest saturation solubility among screened curcumin-amino acid binary mixtures that might be ascribed to the hydrotropic properties of lysine acetate. Moreover, 476-fold solubility enhancement in water was observed by curcumin-lysine acetate COAM. Later, the amorphization of the curcumin-lysine acetate COAM was confirmed using Fourier-transform infrared spectroscopy, differential scanning calorimetry, and powder X-ray diffraction. COAM tablet formulation showed optimum evaluation characteristics with improved drug dissolution. Therefore, the amino acid salt-based co-amorphous system can be used for solubility and dissolution improvement of curcumin and other multivalued phytoceutical.

Keywords: Amino acid, co-amorphism, curcumin, dissolution, lysine acetate, solubility

Graphical Abstract

Development of lysine acetate-based curcumin co-amorphous system using liquid-assisted grinding for improved solubility and dissolution.

INTRODUCTION

Co-amorphism has been widely attempted for improving the physicochemical and technological properties of actives.[1,2] The co-amorphous mixture (COAM)

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Design of polyacrylamide grafted sesbania gum-mediated pH-responsive IPN-based microbeads for delivery of diclofenac sodium: *In-vitro-in-vivo* characterizations

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pH-sensitive microbeads, diclofenac sodium

ABSTRACT

Microwave-assisted grafting of polyacrylamide on sesbania gum (PAAM-g-SG) was implemented employing a 3^2 full factorial experimental design and was hydrolyzed using sodium hydroxide (NaOH) to form H-PAAM-g-SG. Further, the diclofenac sodium-loaded novel pH-sensitive interpenetrating polymeric network (IPN) microbeads were designed using an optimized H-PAAM-g-SG and sodium alginate (SA). Different spectroscopic analysis including FTIR spectroscopy, ^{1}H NMR spectroscopy, elemental analysis, thermal analysis, *etc.* was performed to confirm the synthesis of PAAM-g-SG and diclofenac-loaded pH-sensitive IPN H-PAAM-g-SG-SA microbeads. Here, Ca^{+2} ions combine with two strands of SA and form a round-shape structure that encloses uncross-linked H-PAAM-g-SG polymer and diclofenac sodium. As well, glutaraldehyde (GL) addition improved the mechanical strength due to acetal structure between hydroxyl of H-PAAM-g-SG and aldehyde of GL. The drug entrapment was confirmed proportional relationship to the Ca^{+2} ions concentration whereas an increase in GL concentration resulted in a reduced drug entrapment. The pH pulsatile study assured the reversible swelling-shrinkage behavior of IPN microbeads due to the carboxyl group of PAAM-g-SG. The drug release from H-PAAM-g-SG-SA microbeads (batch: S9) was found to be 84.21 % (12*h*) which was non-significant ($p > 0.05$; f2 = 79 ~ 90) over marketed formulation (83.31 %). Moreover, it follows the Korsmeyer Peppas ($R^2 = 0.996$) as the best-fit release kinetic model. The pH-sensitive release of diclofenac sodium from IPN H-PAAM-g-SG-SA microbeads was assured based on *in vivo* anti-inflammatory activity ($p < 0.05$). Therefore, developed novel pH-sensitive IPN microbeads based on H-PAAM-g-SG are a promising polymeric carrier substitute for delivery of drugs actuated by a pH stimulus.

1. Introduction

Sesbania gum is a natural polysaccharide obtained from the annual legume seeds (biological source: *Sesbania grandiflora*; family: Leguminosae). Importantly, it contains a synthetic framework similar to guar gum. The constituent of SG is α (1–6) glycosidic bond to galactose as well as β (1–4) glycosidic bond to mannose. Hence, it is composed of mannose and galactose with a proportion of 2:1. In pharmaceutical dosage form, it has been reported as a thickening agent, floating agent, cosmetics, *etc.* [1,2]. Literature reported that SG can be a suitable alternative for the development of advanced pharmaceutical dosage forms [3,4] such as hydrogels, beads, *etc.* It ensured that limited consideration was given to the utilization of SG as a potential replacement for excipients in pharmaceutical applications. Regardless of these benefits, there are issues with natural polysaccharides like uncontrolled hydration, lower shelf life, pH-dependent solubility, change in viscosity during storage, and terrific swellability. For the development of pharmaceutical dosage, there is a design to overcome the demerits of natural polysaccharides [5]. A wide variety of chemically modified/grafted polysaccharides has become an essential element in various biomedical applications [6].

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Medicinal Benefits of Black Rice (*Oryza Sativa L. Indica*): A Review

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Abstract Black rice (*Oryza sativa L. indica*) is also called purple rice (gluten free rice), emperor's rice (tribute food) and king's rice. It is abundantly grown worldwide, specifically in Asian countries such as Bangladesh, China, Japan, Sri Lanka, Indonesia, and Thailand. In India, it is majorly found in north-eastern states, including Meghalaya, Assam, and Manipur, which are the cultivators of black rice. It is also considered a superfood owing to its potent antioxidant activity which mediates numerous health-beneficial effects with anticancer, anti-inflammatory, immunomodulatory and anti-allergic characteristics. Black rice has a high nutritional value due to its rich source of various vitamins (A, B, E), amino acids and lipids, dietary fibre. The presence of the flavonoid plant pigment anthocyanin contributes to its purple-black colour and strong antioxidant properties. Other components like manganese and calcium support a healthy metabolism and stronger bones. Black rice is getting popularized in recent times because of its very low toxicity and higher nutritional qualities. This review focuses on the nutritional composition, toxicity, pharmacological uses and future opportunities of black rice for better health and well-being.

Keywords Black Rice, Health, Antioxidant, Nutrition, Pharmacology, Toxicology

1. Introduction

Rice is one of the most common key regular meal food components universally engross, specifically in South Asia. Most of the population of the countries, including India, China, Japan and other southeast countries, prefer rice over wheat as their primary food source. In ancient times in China, due to its big nutritional value, black rice was restricted only to emperors and was called "Imperial Rice" [1]. In India, people have a basic predisposition for white rice, due to the percipience of the cleaner mien of the shining and cleaner grain. Black rice is aboriginal to the North-Eastern states in India, like Assam, Manipur, and Meghalaya. Other states like Odisha, West Bengal, and some parts of Jharkhand also cultivate it [2]. In the native language of Manipur, it is commonly pronounced as'chak-hao ', where chak means rice and ahaoba means delicious, which is majorly consumed during the traditional feasts. It comes in various forms, such as short grain and long grain. The presence of the flavonoid plant pigment anthocyanin contributes to its purple-black color and is also a potent antioxidant. Black rice is growing in popularity because it is gluten- and cholesterol-free and low in sugar, salt and fat. Black rice contains more nutrients like vitamins, minerals, and proteins. Black rice contains 18 amino acids, carotene, vitamin E, iron, zinc, and copper [1]. Apart from the anthocyanins, black rice also contains many types of flavonoids and carotenoids and more than 23 other plant

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Fabrication and Characterization of Curcumin-loaded Gelatin Nanoparticle Using A Two-Step Desolvation Protocol

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Abstract Recently gelatin nanoparticles (G-NPs) have been gaining substantial consideration because they offer excellent properties like low cost, biocompatibility, and biodegradability. One of the protein materials that can be utilized to make nanoparticles is gelatin. The emphasis is constructed on the datum that gelatin is non-toxic, easy to crosslink, and chemically changeable, and hence consumes a gigantic potential for colloidal drug delivery system synthesis. The surface of G-NPs can be easily cat-ionized with a variety of amine derivatives to provide targeted and sustained drug delivery. Curcumin-loaded gelatin G-NPs were manufactured using a two-step desolvation progression in this study. A glutaraldehyde cross-linker was also employed to provide G-NP with good stability. Inclusive, the ordinary size of the curcumin-loaded gelatin (CGNPs) was 112 nm, with a zeta potential of +31.80 mV. An *In-vitro* dissolution study confirmed 88 % of the drug was released from the CGNP within 24 h. In comparison, drug release showed a lower release rate, at about 66 % after 24 h. In the present work, we fabricated a curcumin-loaded gelatin nanoparticle to improve the solubility and thereby enhance the stability of a formulation, which will further encourage the progress of curcumin based on nanoformulation. Curcumin-loaded gelatin nanoparticles have a higher stability in biological fluids than colloidal carriers, allowing for the desired delimited and unrelenting release of encapsulated drug molecules. In all, the fabricated curcumin-loaded gelatin nanoparticle proved to be a sustained-release drug delivery system.

Keywords Gelatin Nanoparticle, Gelatin, Curcumin-loaded Gelatin Nanoparticles, Glutaraldehyde, Anti-Cancer, Desolvation Method

1. Background

Because of their excellent biocompatibility and biodegradability, gelatin nanoparticles (G-NPs) have been widely used as drug and gene carriers for diseased tissues such as HIV infection [1], tuberculosis, and cancer [2]. Coating with gelatin, for example, reduces cytotoxicity while also allowing G-NPs to traverse the blood-brain barrier, allowing them to better target brain problems [3]. Recently, nanoparticles (NPs) have provided enormous benefits in terms of improving drug delivery systems by

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Article

Neuroprotective Effect of Barbaloin on Streptozotocin-Induced Cognitive Dysfunction in Rats via Inhibiting Cholinergic and Neuroinflammatory Cytokines Pathway—TNF-α/IL-1β/IL-6/NF-κB

Asma B. Omer, Obaid Afzal, Abdulmalik S. A. Altamimi, Shaktipal Patil,* Shareefa A. AlGhamdi, Amira M. Alghamdi, Sami I. Alzarea, Waleed Hassan Almalki, and Imran Kazmi

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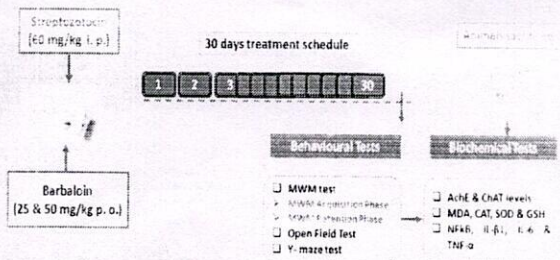
ABSTRACT: Streptozotocin (STZ) impairs memory in rats through altering the central nervous systems (CNS) as a result of impaired cholinergic dysfunction, oxidative stress, persistent hyperglycemia, and alterations in the glucagon-like peptide (GLP). In this model cholinergic agonist, antioxidant and antihyperglycemic treatment has been shown to have positive effects. Barbaloin has a variety of pharmacological effects. However, there is no evidence on how barbaloin improves memory dysfunction caused by STZ. Thus, we examined its effectiveness against cognitive damage caused by STZ at a dose of 60 mg/kg i.p. in Wistar rats. Blood glucose levels (BGL) and body weight (BW) were assessed. To assess learning and memory skills, the Y-maze test and Morris water maze (MWM) test were utilized. Superoxide dismutase (SOD), malondialdehyde (MDA), catalase (CAT), and glutathione (GSH) as oxidative stress markers were regulated to reverse the cognitive deterioration, and choline-acetyltransferase (ChAT) and acetyl-cholinesterase (AChE) as indicators of cholinergic dysfunction, nuclear factor kappa-B (NF-κB), IL-1β (interleukin-1β), IL-6, and tumor necrosis factor-α (TNF-α) contents were used. Barbaloin treatment thereby significantly decreased the BW and learning and memory capacities, resulting in substantial behavioral improvement in the Y-maze and MWM test. BGL, SOD, CAT, MDA, GSH, AChE, ChAT, NF-κB, IL-6, TNF-α, and IL-1β levels were also altered. In conclusion, the findings revealed that barbaloin had a protective impact against cognitive dysfunction caused by STZ.



1. INTRODUCTION

Diabetes mellitus (DM), which has been around for a while, is regarded as a prevalent metabolic illness that has a negative influence on people's quality of life. Brain atrophy and cognitive decline are two neurological problems that are recurrently seen in the CNS and peripheral system.[1−3] Multiple organs, including the brain, eyes, heart, lower limb blood vessels, and lungs, may have complications as a result of DM. There is growing evidence that DM causes memory loss and cognitive dysfunction in diabetic (DM) animal models. Although the precise mechanism is unknown, a major risk factor for cognitive decline is DM. The hippocampus is a crucial part of the brain that regulates learning and memory, and it has been shown that chronic hyperglycemia can cause ultrastructural destruction of the hippocampus.[4,5]

There are a number of things that seem to contribute to cognitive decline in diabetics.[6] Many investigations have shown that hyperlipidemia and persistent hyperglycemia are important initiating and developing factors for diabetes-related cognitive impairments.[7−9] Additionally, deposition of amyloid-β (Aβ), aberrant insulin signaling, and a strong inflammatory reaction can all result from a disruption of protein, carbohydrate, and lipid metabolism under diabetic conditions, which also contributes to diabetes-related neuronal injury and cognitive deficiencies.[9−11]

The cerebrovascular changes,[12−14] oxidative stress,[15] enhanced advanced-glycation end products,[17,18] and underlying causes of diabetic dementias are assumed to be dysfunctions in brain insulin signaling systems.[19] Additionally, it has been suggested that antioxidants,[20,21] hypoglycemics, and insulin sensitizing medications[22] can decreased DM-related cognitive decline. However, no specific medications are offered at this time to address or prevent cognitive impairment in DM.

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Research Article

Nano Biomed Eng

Graphene Quantum Dots Incorporated UiO-66-NH_2 Based Fluorescent Nanocomposite for Highly Sensitive Detection of Quercetin

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Abstract

Quercetin can help with a variety of health problems. Most methods for measuring quercetin in biological fluids are characterized by low sensitivity and selectivity. The employment of metal–organic frameworks in sensor applications with carbon-based materials ushers in a new era. In this study, blue fluorescent graphene quantum dots (GQDs) embedded in a UiO-66-NH_2 metal–organic framework-based nanoprobe (GQDs@UiO-66-NH_2) were constructed for quercetin sensing. Initially, maize husk was used to produce blue fluorescent GQDs, whereas zirconium tetrachloride and 2-aminoterephthalic acid were used to synthesize extremely luminous UiO-66-NH_2. The addition of quercetin to GQDs@UiO-66-NH_2 leads to fluorescence dampening due to the adsorption potential of UiO-66-NH_2. The complexation of zirconium ions with the 3-OH and 4-C=O functionalities of quercetin resulted in fluorescence quenching. The sensor has a linear concentration range and limit of detection for quercetin of 50–500 and 2.82 ng/mL, respectively. The nanoprobe's usefulness for quercetin detection was then validated by a selectivity investigation in the presence of interfering chemicals. Furthermore, the percentage relative standard deviations were 4.20% and 2.90%, respectively, indicating great stability and repeatability. Fluorescence "Turn-On–Off" nanoprobes provide a simple, quick, sensitive, and selective method for monitoring quercetin.

Keywords: quercetin; graphene quantum dots (GQDs); fluorescence; nanoprobe; metal–organic framework; GQDs@UiO-66 NH_2; sensitivity

Introduction

Quercetin is the most important flavonoid in fruits and vegetables [1]. It does not produce in human bodies [2]. Quercetin is widely reported for antioxidant, antiviral, immunomodulation, antitumor [3], and anti-inflammatory [4] applications. The literature claimed that 945 mg/m² is the safe dose for quercetin. A high dose of quercetin can produce different several health issues including hypertension, a decline in potassium levels in serum, and emesis [2]. Therefore, accurate measurement of the concentration of quercetin is essential in the biomedical field [3]. Moreover, to measure the bioavailability of quercetin, it is essential for pharmacological response [1]. In general, analysis of quercetin with a simplistic, speedy, highly selective, and sensitive method is a prime necessity [4].

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Preparation of pirfenidone loaded chitosan-polyvinyl alcohol-graphene oxide-based scaffold: Spectroscopical characterizations and antibacterial activity

Dinesh D. Borhade [a,1], Sopan N. Nangare [b,1], Dilip A. Patil [b], Pravin O. Patil [b], Gaurav S. Patil [a], Ganesh B. Patil [a,*]

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Chitosan
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ABSTRACT

The antibacterial activity against *Staphylococcus aureus (S. aureus)* in diabetic foot wound treatment is an appealing area for budding researchers. In this case, drug-loaded chitosan (CS)/polyvinyl alcohol (PVA)/graphene oxide (GO)-based composites can be used as an excellent option for antibacterial activity in diabetic foot wound treatment. Therefore, the present study aims to design a pirfenidone-loaded CS/PVA/GO nanocomposite (PFD-CS/PVA/GO) based scaffold via solvent casting method for improved antibacterial activity. In brief, CS with PVA forms the polyelectrolyte complex due to hydrogen bonding between amine functionality (CS) and a hydroxyl group (PVA). The GO nanosheet addition into CS/PVA resulted in covalent bonding between the amine functionality (CS) and the carboxylic functionality (GO) whereas PFD was fixed in CS/PVA/GO via π-π stacking. In this study, optimized PFD-CS/PVA/GO (6% w/w) scaffold percent entrapment efficiency, tensile strength, moisture content, % drug release, % swelling degree, % elongation at break, and water retention capacity were found to be 77.60%, 70.35 g/cm^2, 16.39%, 50.60% (7 days), 236%, 45%, and 543.47%, respectively. Release kinetics assured that the Higuchi matrix was the best-fit model ($R^2 = 0.99$). Interestingly, the GO avoids burst drug release at the beginning followed by extending the release whereas CS into PFD-CS/PVA/GO provides a good adhesive ability. Finally, antibacterial activity against *S. aureus* of PFD-CS/PVA/GO (6% w/w) shows a high (12.06 mm) zone of inhibition over a separate component of the scaffold. Concisely, optimized PFD-CS/PVA/GO (6% w/w) scaffolds provide improved antibacterial potential owing to their combined benefits of CS, and GO. In the future, anticipated PFD-CS/PVA/GO scaffolds will open a new door for antibacterial potential in diabetic foot wound healing.

1. Introduction

Diabetes mellitus (DM) is a critical condition in the healthcare sector. Epidemiological studies indicate approximately 285 million cases of DM in 2010 whereas it would be more than 360 million cases of DM in 2030. As per the literature, DM patients are susceptible to several problems wherein diabetes chronic foot wounds are one of them [1]. Unfortunately, diabetes chronic foot wounds take longer to heal because of disruptions in the process of collagen synthesis [2]. In addition, diabetic food infection is associated with poly-microbial infections. In that, *Staphylococcus aureus (S. aureus)* is the most common pathogen. Presently, with the continuous preferences for antibiotics, there are chances of antimicrobial resistance for this pathogen [3]. To treat this critical healing condition of patients, several types of advanced approaches have been revealed. Current treatment approaches incorporating active for particular tasks, such as nanoparticles, nanogels, beads, biofilms, bandages, nanofibrous membranes, and so on, are unable to provide the necessary effects [2]. In addition, available therapies including tissue transplants, bioengineered skin, growth factors, hyperbaric oxygen treatment, and negative pressure wound therapy have shown healing

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Chemopreventive aspects, investigational anticancer applications and current perspectives on allyl isothiocyanate (AITC): a review

Prashant Bhagwan Patil[1,2] · **Jayvadan Kantilal Patel**[1,3]

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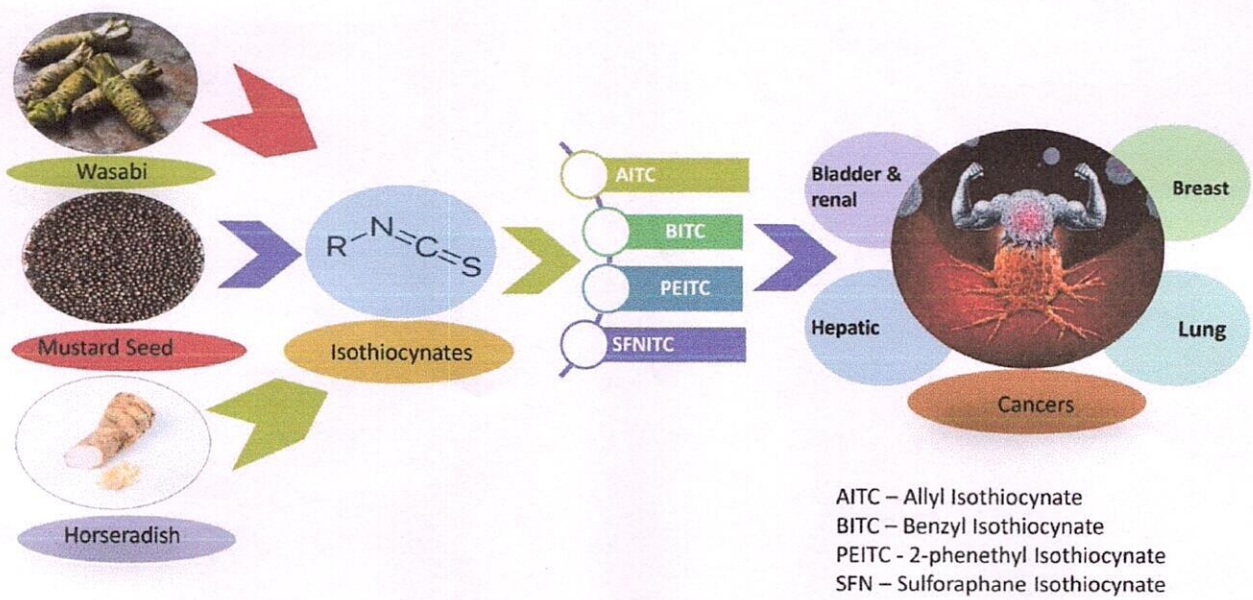
Abstract

Allyl isothiocyanates (AITC) have gained recognition in recent years as effective chemotherapeutic and epigenetic modulators. The chemopreventive properties and toxicological perspectives of AITCs from the last few decades were taken into account by a number of investigations. Their active therapeutic relevance was hindered by a number of factors, including instability under typical physiological conditions and low bioavailability due to low aqueous solubility. In this review, we highlighted the chemopreventive attributes of AITC in relation to its molecular mechanisms and metabolic fate for cancer. Moreover, we emphasized on investigational anticancer activities and various strategies for delivery of AITC in different types of cancer. Considering cellular interactions, we shed light on the toxicological properties of AITCs to address further issues regarding their assessment in therapeutic development. This review identifies knowledge gaps with various contemporary approaches involving most recent studies and may pave the way for a better understanding for the development of novel AITC therapeutics.

Graphical abstract



Keywords Allyl isothiocyanate · Molecular mechanisms · Anticancer-activity · Drug delivery · Toxicity

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Extended author information available on the last page of the article

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Original Article

Thai Journal of Pharmaceutical Sciences

Prevalence, distribution, treatment, and modern methods for *in vitro* diagnosis of Alzheimer's disease in India: Challenges and future prospective

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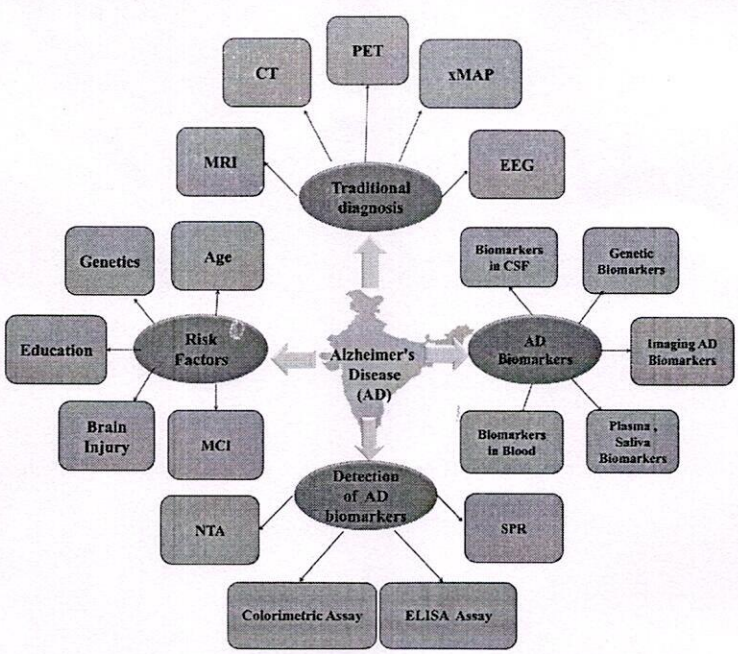
ABSTRACT

In India, the plethora of evidence indicates that neurodegenerative conditions are a significant public health issue wherein over 4 million Indian peoples have been affected. For the past two decades, the prevalence of Alzheimer's disease (AD) is growing rapidly in India that may due to the significant lack of health-care services and poor knowledge of AD and another form of dementia. Therefore, this in turn to develop ultramodern techniques for the efficient detection of AD biomarkers that helps to the prognosis and diagnosis of AD. Recently, significant progress has been observed in the area of AD that includes prognosis, and diagnosis of AD. This review article discussed different risk factors associated with AD, data on the dissemination of AD in India according to different virtues and socio-economic categories. The different standard diagnostic techniques commonly used for the identification of AD biomarkers are mentioned. This review also focuses on the new techniques established by Indian researchers such as surface plasmon resonance centered biosensors, and fluorescence-based probes that offer the enormous potential of highly sensitive and selective detection AD biomarkers. In conclusion, the present review article is providing a short overview of AD prevalence and AD-centered research in India.

Keywords: Alzheimer's disease, biomarkers, biosensing, *in vitro* diagnosis, India



Graphical Abstract: Alzheimer's disease friendly India: Prevalence, distribution, treatment, and modern methods for *in vitro* diagnosis of AD

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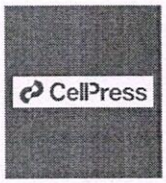

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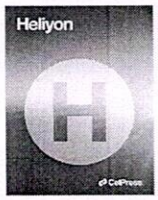

Research article

Phytochemical profile, antioxidant, cytotoxic and anti-inflammatory activities of stem bark extract and fractions of *Ailanthus excelsa* Roxb.: *In vitro, in vivo* and *in silico* approaches

Priyanka R. Sapkal [a], Anilkumar U. Tatiya [a], Sandip D. Firke [a], Vivek K. Redasani [b], Shailendra S. Gurav [c], Muniappan Ayyanar [d], Prasad G. Jamkhande [e], Sanjay J. Surana [a], Rakesh E. Mutha [f], Mohan G. Kalaskar [a,*]

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ARTICLE INFO

Keywords:
Ailanthus excelsa
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ABSTRACT

This study aimed to assess the phytochemical composition, *in vitro* antioxidant, cytotoxicity, and *in vivo* anti-inflammatory activities of the methanolic extract of Ailanthus excelsa (Simaroubaceae) stem bark and its fractions. Quantitative phytochemical analysis revealed that methanolic extract and all fractions contained a high level of flavonoids (20.40–22.91 mg/g QE), phenolics (1.72–7.41 mg/g GAE), saponins (33.28–51.87 mg/g DE), and alkaloids (0.21–0.33 mg/g AE). The antioxidant potential was evaluated *in vitro* using a range of assays, i.e., DPPH•, ABTS radical scavenging ability, and total antioxidant capacity. The chloroform and ethyl acetate fractions showed stronger antioxidant activity than the methanol extract. In vitro cytotoxic activity was investigated in three human tumor cell lines (A-549, MCF7 and HepG2) using the SRB assay. In addition, the *in vivo* anti-inflammatory effect was assessed by carrageenan-induced paw edema in rats. The chloroform fraction showed a more pronounced effect by effectively controlling the growth with the lowest GI50 and TGI concentrations. The human lung cancer cell line (A-549) was found to be more sensitive to the chloroform fraction. Furthermore, the chloroform fraction exhibited significant anti-inflammatory activity at a dose of 200 mg/kg in the latter phase of inflammation. Besides, methanol extract and ethyl acetate fraction revealed a significant cytotoxic and anti-inflammatory effects. The chloroform fraction of stem bark showed a strong anti-inflammatory effect in experimental animals and significant COX-2 inhibitory potential in the *in vitro* experiments. GC-MS analysis of chloroform fraction identified the phytochemicals like caftaric acid, 3,4-dihydroxy phenylacetic acid, arachidonic acid, cinnamic acid, 3-hydroxyphenylvaleric acid, caffeic acid, hexadeconoic acid, and oleanolic acid. The *in-silico* results suggest that identified compounds have better affinity towards the selected targets, viz. the BAX protein (PDB ID: 1F16), p53-binding protein Mdm-2 (PDB ID: 1YCR), and topoisomerase II (PDB ID: 1QZR). Amongst all, caftaric acid exhibited the best binding affinity for all three targets. Thus, it can be

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Antifungal Nail Lacquer For Enhanced Transungual Delivery Of Ciclopirox Olamine

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Abstract:
Onychomycosis of the nails, onychomycosis is the most common nail disease. It is characterized by discoloration, brittleness and thickening of the nail infection and is usually caused by dermatophytes but can also be caused by non-dermatophyte molds and yeasts. Besides the negative effects of the nails, it can be painful and sometimes serious in some severe cases of the disease. There is also a link between onychomycosis and other fungal diseases (athlete's foot, hand, etc.) and the spread of hand infection to other parts of the body, etc. believed to spread. There is also a link between onychomycosis and HIV, which may indicate that patients are immune to the virus. It can also cause diabetes and uncontrolled diabetes, which is important for the disease. Other conditions that can increase the risk of onychomycosis are trauma, age, and peripheral vascular disease, although genetics also play a role. In addition, studies have shown that nail mold can affect patients' mental and health, affect their self-confidence and quality of life, and affect their ability to work. Because of its increasing global prevalence and greater prevalence in elderly patients or people with comorbidities, this is an important disease that needs to be addressed.

Keywords: Transungual, Onychomycosis, Antifungal.

Introduction

Current treatment recommendations for onychomycosis include treatment with oral or topical antibiotics. Oral treatment preference of the patient and the doctor is low due to its known side effects, especially pain. Cosmetics are unsatisfactory in terms of performance and are limited by the impermeability of the nail plate to hydrophobic antifungal agents. Cosmetic treatments often need to be combined with oral antibiotics to achieve the desired results. But researchers are working to develop antibiotics that can be applied topically to the infected area, and some show promise.1-2

Recent methods for effective delivery of antibiotics include the use of modified materials such as colloidal or chemical substances or improved penetration methods of cosmetic use. Chemical methods that improve access have some advantages over physical methods, such as being cheaper, attached to or used with models, and can be easily used without expert practice.3

Deck's structure is essentially a composite of keratin fibers with a low lipid content (0.1% - 1%) and water (10 - 25%). Many researchers refer to nail files as hydrogels and have found that better hydrated nails are more permeable due to loose structure and increased porosity.

This is thought to be due to changes in van der Waals forces, hydrogen bonding, and ionic interactions between the matrix and proteins, which lead to the elasticity and breakdown of the keratin matrix during hydration.

By design, solutions and varnishes are the most popular, but creams and gels have also been tried as drug delivery vehicles. Lacquers are a promising distribution as they are based on the idea that after the solvent has evaporated, they form a polymeric drug-laden film on the tissue that contains a lot of chemicals and has

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Poly(allylamine) coated layer-by-layer assembly decorated 2D carbon backbone for highly sensitive and selective detection of Tau-441 using surface plasmon resonance biosensor

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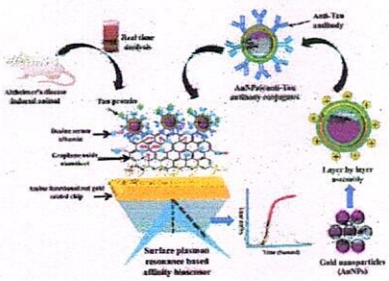
HIGHLIGHTS

- The first-time layer-by-layer (LbL) approach was preferred for selective and sensitive recognition of Tau-441 antigen.
- Antibody immobilization on poly(allylamine) coated gold nanoparticles (AuNPs) LbL assembly gives affinity biotransducer.
- Graphene oxide (GO) layered surface plasmon resonance (SPR) biosensor provides detection limit up to femtogram level.
- Spiked sample and preclinical studies assured the feasibility of GO@LbL-AuNPs-Anti-Tau SPR biosensor for Tau-441 sensing.
- Report on label-free, highly sensitive, and selective detection of Tau-441 using GO@LbL-AuNPs-Anti-Tau SPR biosensor.

GRAPHICAL ABSTRACT



ARTICLE INFO

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ABSTRACT

The determination of clinically significant amounts of tau protein in bodily fluids is a major problem in Alzheimer's disease (AD) diagnosis. As a result, the present work aims to develop a simple, label-free, fast, highly sensitive, and selective 2D carbon backbone graphene oxide (GO) patterned surface plasmon resonance (SPR) mediated affinity biosensor for Tau-441 monitoring. Initially, non-plasmonic nanosized GO was made using a modified Hummers' method, whereas green synthesized gold nanoparticles (AuNPs) were subjected to a layer-by-layer (LbL) design employing anionic and cationic polyelectrolytes. Several spectroscopical evaluations were carried out to ensure the synthesis of GO, AuNPs, and LbL assembly. Following that, the Anti-Tau rabbit antibody was immobilized on the designed LbL assembly using carbodiimide chemistry, and various studies such as sensitivity, selectivity, stability, repeatability, spiked sample analysis, etc., were conducted using the constructed affinity GO@LbL-AuNPs-Anti-Tau SPR biosensor. As an output, it shows a broad concentration range and a very low detection limit of 150 ng/mL to 5 fg/mL and 13.25 fg/mL, respectively. The remarkable sensitivity of this SPR biosensor represents the merits of a combination of plasmonic AuNPs and a non-plasmonic GO.

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RESEARCH ARTICLE

Development and Evaluation of Vasoactive Intestinal Peptide Freeze-Dried Injection

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ABSTRACT

Introduction: Vasoactive intestinal peptide (VIP), a ubiquitous, naturally synthesized human peptide is extensively documented to have diverse physiological effects like anti-inflammatory, immune-modulatory, anti-hypertensive, stimulation of contractility in the heart, vasodilation, and promoting neuroendocrine-immune communication. The synthetic form of VIP is called aviptadil (AVP). The main objective of this research was to develop a novel stable lyophilized dosage of VIP (Aviptadil) using sucrose as a bulking agent.

AVP is a peptide with known concern for aqueous stability, which seems to be challenging for storing finished drug products and supply chain management. The VIP injection was developed using the lyophilization technique in the presence of bulking agent and some other pH-adjusting agent. The bulking agent and solvent system selection depends upon the solubility, stability of the drug substance, and feasibility during manufacturing. During product formulation development, the bulk solution was evaluated for processing time and temperature impact. The lyophilization cycle was developed using the most advanced freeze-drying technology.

Result and discussion: With the usage of bulking agent (sucrose) as may act as a cryoprotectant for peptide, the formulated bulk solution was freeze-dried, and primary drying was done at-25°C (below than critical product temperature) followed by secondary drying at 25°C. The critical quality attributes of lyophilized drug products like the description of lyophilized cake/ powder, moisture content, reconstitution time, active drug content and color of the solution were evaluated. The developed formulation bulk solution was stable and compatible with contact materials like SS vessels when hold up to 24 hours at 2 to 8°C. The optimized freeze-dried product meets the predefined acceptance criteria as part of the quality target product profile.

Conclusions: It can be concluded from the research work carried out that a stable lyophilized parenteral formulation containing VIP (AVP) was developed using sucrose as a bulking agent. These findings show that the freeze-dried formulation is an appropriate technological remedy for stabilizing VIP in lyophilized injectable dosage form.

Keywords: Vasoactive intestinal peptide, Aviptadil, sucrose, quality by design, Freeze dried microscope, lyophilization.

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Conflict of interest: None

INTRODUCTION

Vasoactive intestinal peptide (VIP), a ubiquitous, naturally synthesized human peptide, is extensively documented to have diverse physiological effects like anti-inflammatory, immune-modulatory, anti-hypertensive, stimulation of contractility in the heart, vasodilation, and promoting neuroendocrine-immune communication.[1] VIP is the synthetic form of VIP that increases adenosine cyclase activity with consequent smooth muscle relaxation. Relief Therapeutics has been granted investigational new drug (IND) status in the US and Europe, along with orphan drug designation for the use of VIP in acute respiratory distress syndrome (ARDS), acute lung injury (ALI), pulmonary fibrosis, and sarcoidosis.[2]

The male genital tract naturally contains the 28-amino acid neurotransmitter known as the VIP (VIP: International non-proprietary name, Aviptadil), which is thought to play a part in the local neurological control of smooth muscle activity and penile erection.[3] VIP appears to play a specialized role in smooth muscle relaxation, which results in systemic vasodilation, enhanced cardiac output, and bronchodilation.

VIP has a variety of physiological effects, including smooth muscle relaxation that causes systemic vasodilation, increased cardiac output, bronchodilation, some variations in the effects on gastric motility and secretory processes, hyperglycemia, inhibition of smooth muscle cell proliferation, hormonal regulation, analgesia, hyperthermia, neurotropic effects,

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RESEARCH ARTICLE

Design, Development and Characterization of Ropinirole Mouth Dissolving Film by using Spin Coating Technique

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ABSTRACT

The aim of the research was to develop a ropinirole mouth-dissolving film employing solvent casting and spin coating methods with sesbenia gum acting as a film-forming agent. Parkinson's disease is treated with ropinirole. Sesbenia gum was designed as a film-forming ingredient in the 25 to 600 mg concentration range for solvent casting and 50 to 250 mg for spin coating. For both procedures, the concentration of the plasticizer propylene glycol was optimized between (0.3 and 1.0 mL). Film-forming agent and plasticizer effects at various concentrations were examined. For the solvent casting and spin coating processes, the plasticizer concentration was 0.3 mL for each, while the optimal film-forming agent concentrations were 50 and 150 mg, respectively. Ropinirole MDFs were made employing an enhanced concentration and more excipients. In comparison to the solvent casting approach, the spin coating process produced films with better surface morphology, a 24 seconds shorter disintegration time, good tensile strength of 3.2 (N/mm^2), a thinner thickness of 0.2 mm, and a maximum drug content of 93.14%. Sesbenia gum has been discovered to have greater potential for the spin-coating method of developing a ropinirole mouth-dissolving film.

Keywords: Sesbenia gum, Ropinirole, Mouth dissolving film, Solvent casting and spin coating method.

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Conflict of interest: None

INTRODUCTION

For most therapeutic agents, administration through the mouth has been considered the most convenient and well-liked delivery method. Over the past few decades, researchers have been working on developing intraoral delivery systems (IODS) that can provide the ideal drug exposure for the optimum therapeutic benefit. In order to provide those who had trouble in swallowing tablets, capsules and syrup, with an alternative to these traditional solid dosage forms, in the late 1970s, the first fast-dissolving drug delivery system was developed. The problem of swallowing solid dosage forms can be resolved with new and innovative oral drug delivery system, which swiftly dissolves in the mouth in a few seconds without water. Tablets, granules, pills, caplets, films, wafers and powders are part of fast and quick dissolving system. The tongue's top or bottom is where the film is placed. It maintains the application site while rapidly releasing the active ingredient for local and/or systemic absorption.[1]

A novel oral fast-dissolving dose form combines the convenience of dosing without water or beverage with the simplicity of administration. Despite their quick disintegration/ dissolution times, some patient groups still worry about swallowing solid pills and run the danger of choking. Fast-dissolving film eliminated The possibility of choking.[2] Oral films can be divided into the following three categories.[3]

- Mucoadhesive sustained release wafers,
- Mucoadhesive melt away wafers and
- Flash release

Fast-dissolving film criteria: A good oral film should melt or disintegrate in mouth in few seconds without being swallowed, and it should work effectively for flavor masking. There should be no little residue left in the mouth on oral intake. Environmental variables, including humidity and temperature, have minimal effects on oral fast-dissolving film.

Ropinirole is used to treat Parkinson's disease and the symptoms of restless legs syndrome. The production of oral films involves the rolling method, hot melt extrusion, solid dispersion, semisolid casting, and solvent casting. The current investigation used spin coating and solvent casting to produce the oral film for the drug ropinirole.[3]

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RESEARCH ARTICLE

Synthesis and Characterization of Hydroxypropyl *Sesbania* Galactamannan Seed Gum for Pharmaceutical Application

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ABSTRACT

The core focus of current research is chemical polysaccharide modification in pharmaceutical applications. The gum is made from the endosperm of *Sesbania grandiflora* Plant seeds that belongs to family Leguminosae. Both water-soluble and water-insoluble gum were present in the *Sesbania* seed powder; the water-soluble gum was removed during purification, yielding a 30% purification yield. In order to increase the applications of partially hydroxypropyl *Sesbania* gum, the modifications indicated here entail adding hydroxypropyl groups to the molecule under a variety of different conditions. Among the factors that were looked at were the etherifying agent concentration, alkaline volume, and preparation medium parameters, including the reaction time and temperature. The degree of substitution (DS) was raised, which boosted the unaltered gum's solubility, stability, and viscosity. Increases in an etherifying agent and alkali concentration, volume, reaction duration, and temperature increase DS from 0.4 to 0.7. The finished product was characterized using IR spectroscopy, differential scanning calorimetry, X-ray diffraction, scanning electron microscopy, rheologic property, solubility, swelling index, and gel fraction analysis of batch F1 as an improved batch. The alternate method for developing drug-loaded nanoparticles for controlled release dosages form by suing hydroxypropyl *Sesbania* gum.

Keywords: *Sesbania* gum, Hydroxypropylation, Chemical modification, Degree of substitution, Viscosity, Solubility.

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Conflict of interest: None

INTRODUCTION

Polysaccharide gums are among the most popular industry components and have become the subject of much research regarding their long-term sustainability, biodegradability and biological safety.[1] A few drawbacks, however accompany the use of gums. They include the potential of microbial contamination, changing rates of hydration, influenced by pH soluble content, thickening up, and viscosity loss on storage are a few of these. Gums can be chemically altered to reduce these limitations while simultaneously increasing their solubility and viscosity.[2]

According to Duke *et al.*, the endosperm, or outermost layer, of a seed of the species *Sesbania grandiflora* (Leguminosae) is used to make *Sesbania* gum. According to Faroogi *et al.*, *Sesbania* seeds are composed of a coat 6.9 to 18.9%, endosperm 40 to 42% and germ about 51.1%.

The outermost layer of seed is made up of galactose side chain residues linked by -(1-6) and a mannan backbone connected by -(1-4) glycosidic connections, which is known as galactomannan. According to one study, the ratio of galactose to mannose produced by the acid hydrolysis of *Sesbania* galactamannan gum was 1.2:2.2 as opposed to 1:3.9 for locust bean (carob), and for tara gum 1:2, and 1:3. It is believed that the varying degrees of branching are what produce the variances in the characteristics of galactamannan gums. More side groups reduce the amount of molecular bonding and improve the cold-water dispersion of gum, as reported as.[3,4]

Galactamannan, sometimes referred to as galactose side chain residues and a mannan backbone coupled by -(1-4) glycosidic linkages, make up the endosperm. In contrast to the ratios of 1:3.9 for locust bean (carob), 1:2, and 1:3 for Tara gum, one study found that the ratio of galactose to mannose generated by the acid hydrolysis of *Sesbania* galactamannan gum was 1.2:2.2. The differences in properties of galactamannan gums are assumed to be caused by the varied degree of branching.[5]

The reagents utilized and the reaction conditions have a significant impact on how effective the hydroxy propylation reaction is. Due to its accessible structure, the amorphous area

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Clotrimazole-loaded Silver Nano - cellulose fibre preparation and characterization

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ABSTRACT:

In this study, a brand-new, simple procedure for environmentally friendly silver nanoparticle and Clotrimazole production on wheat fibre was reported. The Polyethylene glycol-400 (PEG 400) was used in the liquid phase chemical technique to produce silver nanoparticles. PEG 400 was used in the manufacture of silver nanoparticles as a stabilizer and reducing agent. The typical silver nanoparticle is 150 nm in size. The produced silver nanoparticles may be distributed in water, ethanol, and other polar solvents, and they have promising uses in the electrical and biological sciences. Silver nanoparticle aggregation was reduced by using ethanol as a solvent. Clotrimazole was physically loaded onto cellulose fibre using a physical loading technique. The Wheat fibre received an effective antifungal property from the combination of Clotrimazole and silver nanoparticles. After washing, there was hardly any loss in the antifungal effectiveness of the cotton fabrics treated with nano silver and clotrimazole. As more silver nanoparticles were loaded onto the outer layers of the white Wheat fabrics, their colour altered to a yellowish brown. Additionally, the antifungal effectiveness of wheat fibre loaded with drugs and AgNP was assessed against the common fungus Candida albicans. The presence of Clotrimazole and silver

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