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In Vitro Propagation and Antibacterial Activity of *Ocimum basilicum* Linn.

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Abstract

The study introduced a simple, reliable procedure for the in vitro culture and standardization of indigenous plant *Ocimum basilicum.* A potential antibacterial activity was observed in the extracts (chloroform, methanol and petroleum ether) of *Ocimum basilicum* against selected bacterial strains (MTCC type strains) and their MIC (Minimal Inhibitory Concentration) values were 62.5 and 125 µg mL^{-1}. Existence of tannin, carbohydtares, phenolic compounds, proteins and aminoacids, anthraquinone glycosides, alkaloids were confirmed by phytochemical analysis. *In vitro* propagation from nodal explants and shoot tip of *O. basilicum* showed a higher level frequency of micro shoots on MS medium containing plant growth regulators at various combinations and concentrations. The nodal explants produced maximum shooting response (98 %); maximum shoot length (7.9 cm) and maximum multiple shoot formation (n=4.5) in BAP containing medium after 40 days. A 50% concentration of MS medium with combination of IBA and BAP showed maximum rooting response (78 %), maximum number of roots (n=12) and maximum length of root (8.67 cm) after 25 days. The regenerates were then hardened off and young plants were transferred to field. Nodal explants in MS medium with 2, 4 – D showed a fast growth and pale brown colored calli.

Keywords: Antibacterial Activity, MIC, Micropropagation, *Ocimum basilicum*

1. Introduction

The most important source of medicines are plants. *Ocimum basilicum* Linn., is fascinating in nature, hence the total part of plant is used as medicine for household treatment towards many human ailments [1]. Many studies prove that extracts of *O. basilicum* doesn't posses any antifungal activities but anti candidal and antibacterial effects [2]. It imparts strength and smoothness with certain perfume compounds mainly jasmine blends and hence used in preparation of scents. It also possesses insecticidal and insect repellent properties and effective against houseflies and mosquitoes. Besides its economic importance, it also has medicinal properties; which cures kidney problems, stomach associated ailments, headaches, coughs and shows bactericidal property against *Salmonella typhosa* [3], [4]. Anticancer activity and evaluation of fractions of *O. basilicum* extracts using human cancer cell lines were tested very recently [5].

High quality plant based medicines production is an important advantage of *in vitro* propagation. Conventional vegetative propagation has several limitations, which can overcome by micropropagation. Micro propagation has many advantages over conventional methods of vegetative propagation, which suffer from several limitations. Tissue culture plays an important role in genetic engineering process including gene transfer and development of transgenic plant. Simple extraction procedures and absence of significant amount of pigments make purification of compounds from tissue cultured plants which reduces the production and processing cost [6]. *Ocimum basilicum*

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A Novel *Streptomyces* sp. Mediated Gold Nanoparticle Synthesis and Its Efficacy on Antibiogram and Cytotoxic Activity on Breast Cancer (MCF-7) Cell Line

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Abstract: A novel *Streptomyces cavouresis* KF974778 were isolated from vermicompost by 1.5% phenol pretreatment. Gold nanoparticles (Au-Np) were synthesized from chloroauric acid using cell free supernatant of *Streptomyces cavouresis* KF974778 grown in yeast extract-malt extract broth. These nanoparticles were characterized by UV-visible spectroscopy, X-ray diffraction (XRD), Energy dispersive X-ray (EDX), Scanning electron microscopy (SEM) analysis and Transmission electron microscopy(TEM) analysis. The *Streptomyces cavouresis* KF974778 mediated Au-Np exhibited potential antibacterial activity against *E. coli, Bacillus, Streptococcus, Proteus* and *Pseudomonas* in well-diffusion method and cytotoxic activity was evaluated by MTT assay against MCF-7 breast cancer cell line confirmed that gold nanoparticles had cytotoxic activity.

Key words: Antibacterial · Cytotoxic activity · Gold nanoparticles · *Streptomyces cavouresis*

INTRODUCTION

Noble metal nanoparticles such as gold, silver and platinum are widely applied to human contacting area and there is a need to develop eco-friendly approach for nanoparticles [1]. Nobel metals have highly sensitive sensing system in healthcare, environment monitoring and probing technologies. Such metal nanoparticles have applications in drug delivery, imaging sensing and delivery of gene. Biological methods for nanoparticles synthesis using microorganism, enzyme and plant extract have been suggested as eco-friendly, compared to physical and chemical methods [2].

Actinomycetes are members of a large group of pleomorphic Gram-positive bacteria, many of which have some tendency towards mycelium growth. Actinomycetes are found in vermicompost and vermiwash, it plays an important role not only in the decomposition of organic materials and plant growth promoter, but also in their ability to produce extra cellular enzyme of pharmacological and agricultural interest [3]. Actinomycetes have high commercial values and are able to produce wide range of extracellular enzymes [4].

We have previously reported that isolation of actinomycetes from vermicompost were characterized and identified as *Streptomyces cavouresis.* 16S rRNA gene sequence is submitted in the gene bank (NCBI, USA) with accession number KF974778. The culture conditions on extracellular compound production indicated that higher biological activities were obtained when yeast extract malt extract media was used as a base. The extracellular compound of this strain has antimicrobial activity against pathogenic bacteria (*E. coli, Bacillus, Pseudomonas, Streptococcus* and *Proteus*) and fungi (*C. albicans*) [5]. The spectroscopy analysis of ethyl acetate extracellular compound from *Streptomyces cavouresis* KF974778 have shown favorable free radical scavenging activity and cytotoxic against cervical cancer (HeLa) cell line [5]. The objective of this research is extracellular synthesis of gold nanoparticles from *Streptomyces cavouresis* KF974778 and to evaluate the antibiogram and cytotoxic activity on breast cancer (MCF-7) cell line.

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RESEARCH ARTICLE

BIOMIMETICS OF SILVER NANOPARTICLES FROM GANODERMA LUCIDUM (CURTIS) P.KARST AND ITS ANTICANCER POTENTIAL ON BREAST CANCER CELLS

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ABSTRACT

Ganoderma lucidum is a fungus belonging to family Ganodermataceae of polypore mushrooms which grows on woody root region of a tree. These mushrooms are extensively used as a traditional Asian medicine and are well known for their potential in bioremediation of metals. The present study was carried out with the objective of using the above mushroom for developing silver nanoparticles(Ag-NPs) and characterization of the same using ultraviolet-visible spectroscopy (UV-Vis), Fourier transform infrared (FT-IR) spectroscopy ,X-ray diffraction (XRD), energy dispersive X-ray (EDX), and scanning electron microscopy (SEM), followed by High resolution-Transmission Electron Microscopy(HR-TEM).Surface Plasmon resonance showed the formation of silver nanoparticles in UV-Visible spectra at 438 nm. The Fourier transform infrared spectroscopy (FTIR) analysis was carried out to identify and study the functional groups responsible for the bio-reduction of silver ions. The XRD study showed that the particles as crystalline in nature with a Face Centered Cubic (FCC) structure. The synthesized Ag-NPs were poly dispersed spherical particles as confirmed by EDAX-SEM and stabilized in the solution with the spherical shapes further confirmed by HRTEM analysis to be in the range of 12-20 nm. The present findings of Ag-NPs of *Ganoderma lucidum* promisingly proved have strong anti-cancer activity on MCF-7 cell line; in future these findings may contribute to the improvement of a suitable anticancer drug.

INTRODUCTION

Breast cancer is a diverse disease which is categorized by the propagation and unusual variation of malignant adolescent cells that often carry abnormalities that liberalize hundreds or even thousands of genes (Ghodake and Lee, 2011). It has perceived an enormous proliferation in most recent times, predominantly in emerging nations like India and it accounts for 30% prevalence frequency in the new female cancers (Siegel *et al*., 2012). Age, family history, reproductive aberrations, exogenous hormone contraceptives or hormone replacement therapies and environmental localities are some of the risk dynamics (American Cancer Society, 2007). Numerous clinical trials have been conducted to treat breast cancer but the trials have revealed minimum eminent effects .To overcome these complications, investigators have introduced the usage of nanoparticles therapy in breast cancer treatment (Yezhelyev *et al*., 2006) *Ganoderma lucidum is* commonly known as Lingzhi or Reishi which belongs to the family Ganodermatace, recognized across the world as an oriental fungus with medicinal properties for over 2000 years and its prevailing effects have been recognized in ancient scripts (Wasser *et al*., 2005).

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In addition to these, mushrooms have been found to contain an extensive variety of bioactive molecules such as terpenoids, steroids, phenols, nucleotides and their derivatives, glycoproteins, and polysaccharides. *G. lucidum* has been used for hundreds of years as a health promotion and treatment strategy; there are now many published studies that are based on animal and cell culture models and on *in vitro* valuation of the health effects of *G. lucidum*, and there are also some reports of human trials in the field. Silver nanoparticles (Ag-NPs) can perform unique communications with biomolecules both on the outside and inside the body cells, which may bring help in cancer identification and treatment (Liu *et al*., 2012). It has shown to be efficacious for antimicrobial, antifungal, antioxidant, and anti-inflammatory effects and nanoparticles are believed to play a major role in cancer diagnosis and treatment (Seigneuric *et al*., 2010). The shape of the NPs plays a significant role in tuning the properties and is vital to manipulate systematically (Gupta, 1998) in the past few decades, numerous chemical and physical approaches for synthesis of silver nano particles have been described. The drawbacks of chemical methods of nanoparticle synthesis include exclusive instruments and the discharge of toxic chemicals.Hence, biological methodologies using micro-organisms, mushrooms and plants extracts for metal nanoparticles synthesis are appreciable replacements to chemical methods (Sastry *et al*., 2004).

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Review Article

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GREEN ROUTE: AN APPROACH FOR SYNTHESIS OF SILVER AND GOLD NANOPARTICLES

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Abstract

The field of nanotechnology and its applications are the most attractive area of research in modern materials science and biomedical sciences. A large number of physical, chemical, biological and hybrid methods are currently employed to synthesize silver, gold and other metal oxide nanoparticles. The problem with chemical and physical methods is that the synthesis is expensive and possible exploitation of toxic chemical substances. Need of the hour is to develop ecofriendly and cost effective methods for nanoparticles preparation. Synthesis of nanoparticles via biological method has been adopted as a feasible alternative in recent times. This mini review provides petite fine points of biologically synthesized nanoparticles such as silver and gold.

Key word: *Nanoparticles, Silver, Gold, Microbes, Plants*

1. INTRODUCTION

Nanotechnology has dramatically developed as an important field of modern research with potential effects in electronic and medicine and they are the particles with a characteristic size range from 1-100 nm. Nanoparticles are at the leading edge of nanoscience and nanotechnology since, the applications of nanosize materials have increased significantly. Nanoscale materials have been used in chronic disease diagnostics, food industry, pharmaceutical, nanoengineering and nanochemistry to enhance the immobilization and activity of catalysts (Wang, 2006). Recently, green synthesis of nanoparticles has received particular interest in various fields ranging from material science to biotechnology (Loza *et al*., 2014; Shanmugavadivu *et al*., 2014). Green synthesis of nanoparticles from plant extracts is an important branch in biosynthesis reaction. Bulk production of metal nanoparticles was synthesized from several microorganisms, such as yeasts, fungi and bacteria. The synthesis of metal nanoparticles from plant extract has drawn attention recently, because of its economical, eco-friendly and single step technique (Huang *et al*., 2007; Ranjithkumar *et al*., 2013).

Metal oxide nanoparticles which have high specific surface area and a high fraction of surface atoms have been studied extensively because of their unique physico chemical characteristics including magnetic, optical, electronics, catalytic, and antibacterial properties (Catauro *et al*., 2004). The properties of many conventional materials change when they formed from nanoparticles because; nanoparticles have a greater surface area per weight than larger particles. This causes them to be more reactive to certain other molecules. Nanoparticles are effectively a bridge between bulk materials and atomic or molecular structures (Buzea *et al*., 2007).

The present review article depicts attention to the present knowledge regarding the possible of green source such as microorganisms and plant extracts for the biosynthesis silver and gold nanoparticles.

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Research Article

IN VITRO ASSESSMENT OF FREE RADICAL SCAVENGING ACTIVITY OF *JASMINUM GRANDIFLORUM* (L.) FLOWER

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ABSTRACT

Objectives: The aim of the present study was to evaluate the *in vitro* free radical scavenging activity of *Jasminum grandiflorum* flower.

Methods: The free radical potential of ethanoic extract *J. grandiflorum* was assessed against 2, 2-diphenyl-1-picrylhydrazyl (DPPH), radical, 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) ($ABTS^+$) radical, hydrogen, hydrogen peroxide radical, and ferric reducing antioxidant power assay.

Results: At (20-100 µg/ml) concentration, ethanolic extract of *J. grandiflorum* flower exhibited free radical quenching capacity against various antioxidant assays when compared to the standard Vitamin C with increasing percentage of inhibition in a dose-dependent manner. The maximum percentage of inhibition was shown at the concentration 100 µg/ml.

Conclusion: Hence, the ethanolic extract of *J. grandiflorum* flower may be a potent source of natural antioxidant and it may be used in the management of diseases associated with oxidative stress.

Keywords: *Jasminum grandiflorum,* 2, 2-diphenyl-1-picrylhydrazyl, Antioxidant power assay, Vitamin C, Free radical, Natural antioxidant.

INTRODUCTION

Free radicals are formed in our body due to biological oxidation and over production of oxidative stress which leads to the excessive damage of biomolecules such as proteins, DNA, and lipid which is associated with the various ailments including cancer, coronary artery diseases, hypertension, and diabetes, etc [1]. The most common free radicals include hydrogen peroxide (H_2O_2), superoxide anion (O_2–), peroxyl (ROO^-) radicals, and reactive hydroxyl radicals (OH^-). The nitrogen derived free radicals are nitric oxide (NO_2) and peroxynitrate anion ($ONOO^-$). All these free radicals are known as reactive oxygen species (ROS), which can able to react with those biomolecules resulting in cellular damage [2].

Antioxidants are compounds which are potential quenchers of free radicals or ROS. Recent investigations have also revealed plant products as potential antioxidants against various diseases, induced by free radicals due to the presence of secondary metabolites [3]. The most commonly used antioxidants are butylated hydroxyanisole, butylated hydroxytoluene, propyl gallate, and tert-butylhydroquinone [4]. However, they have been suspected of being responsible for liver damage and carcinogenesis in laboratory animals. Therefore, the development and use of more effective antioxidants are desired [5].

Jasminum grandiflorum Linn. (Oleaceae) is commonly known as Jasmine. It is a well-known glabrous twining shrub widely grown in gardens throughout India. The flower is acrid, bitter with a sharp taste. The leaves of *J. grandiflorum* are used in the treatment of odontalgia, fixing loose teeth, ulcerative stomatitis, leprosy, skin diseases, otorrhea, otalgia, strangury, dysmenorrhea, ulcers, wounds, and corns [6]. The *J. grandiflorum* flowers and leaves are largely used in folk medicine to prevent and treat breast cancer and stopping uterine bleeding [7]. It is widely used in the ayurveda, as an antileprotic, skin diseases, and wound healing [8].

No scientific studies have been carried out concerning *in vitro* anti-inflammatory of *J. grandiflorum*. Hence, the study was undertaken to evaluate the antioxidant, anti-bacterial, and anti-inflammatory activity from the ethanolic extract of *J. grandifloruim* flower.

METHODS

Plant material

The flowers of *J. grandiflorum* were collected from Coimbatore District. The plant was authentified by plant taxonomist in Kongunadu Arts and Science College, Coimbatore.

Preparation of extract

J. grandiflorum flowers were picked and washed under running tap water, air-dried, powdered, and stored in airtight bottles. 30 g of dried powder was extracted in 300 ml of ethanol for 72 hrs using a soxhlet apparatus. The extracts were filtered through Whatman No.1 filter paper. The filtered sample was concentrated and dried. The plant extract was stored at 0-4°C further studies.

Antioxidant activity

2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity

The radical scavenging activity of the ethanolic extract was evaluated using DPPH as an indicator [9]. Various concentrations of samples and Vitamin C were taken in different test tubes. The volume was adjusted to 500 µl by adding methanol. 5 ml of 0.1 mM methanolic solution of DPPH was added to these test tubes and vortexed. The tubes were allowed to stand at room temperature for 20 minutes. The control was prepared as above without any extract and methanol was used for the baseline correction. Changes in the absorbance of the samples were measured at 517 nm. Vitamin C was taken as the reference standard. The percentage inhibition versus concentration was plotted, and the concentration required for 50% inhibition of radicals was expressed as IC_{50} value.

2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) ($ABTS^+$) radical scavenging activity

The radical scavenging activity of the ethanolic extract was evaluated using $ABTS^+$ as an indicator [10]. Samples were diluted to produce 0.2-1.0 mg/ml. The reaction was initiated by the addition of 1.0 ml of diluted ABTSto10 µl of different concentration of ethanolic extract of

FULL LENGTH	Iranian Biomedical Journal 20(4): 235-240 2016

Production of Non-Ribosomal Peptide Synthetase (NRPS)-Dependent Siderophore by Aeromonas Isolates

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ABSTRACT

Background*: Aeromonas* species are Gram-negative ubiquitous bacteria, facultative anaerobic rods that infect both invertebrates and vertebrates. Various fish species develop hemorrhagic disease and furunculosis due to *Aeromonas* spp. *Aeromonas* strains generate certain active compounds such as siderophores, which are the final products of non-ribosomal peptide synthetase (NRPS) activity. The present study attempted to investigate the prevalence of *Aeromonas* isolates in marketed fish sources. We also examined the siderophore production ability of these isolates. **Methods**: Among the molecular tools, 16S rRNA analysis was used to identify *Aeromonas* species and their epidemiological distributions. The hemolytic activity of the strains and biochemical assays were used to confirm the identity of the isolates. We also determined the chemical nature of siderophores in these strains. **Results:** A total of seven *Aeromonas* isolates obtained from fish were included to determine the siderophore production. Of 7 isolates, 4 produced siderophore, and their chemical nature was also determined. The siderophore produced by *Aeromonas* was invariably found to be of hydroxamate. Four *Aeromonas* isolates were selected for PCR identification of NRPS-encoding gene. The conserved sequence was present in all four selected isolates. Furthermore, siderophores were qualitatively tested for their antibacterial activity against pathogenic bacteria and a significant level of inhibitory activity was observed in siderophores from the four isolates. **Conclusion:** Our results showed the ability of the isolated strains in production of siderophores with a high level of activity against *Salmonella paratyphi*. These siderophores could find applications in biomedical industries. ***DOI: 10.7508/ibj.2016.04.008***

Keywords: Aeromonas, Siderophores, Hydroxamate

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INTRODUCTION

Aeromonas spp. was thought to be an opportunistic pathogen in immunocompromized humans. The species belongs to the family Aeromonadaceae and has a broad host spectrum, with both cold- and warm-blooded organisms, including human being[1]. *Aeromonas* spp. are catalase- and oxidase-positive bacteria and reduce nitrate to nitrite, as well as they show large zones of hemolysis around colonies on blood agar[2]. In fish, these bacteria cause hemorrhagic septicemia, fin rot, soft tissue rot and furunculosis[3]. A variety of extracellular virulence factors such as enterotoxins, cytotoxins, hemolysins, erolysins, proteases and hemagglutinins produced by *A. hydrophila* support their epidemiological associations[4]. Apart from extracellular virulent proteins, *Aeromonas* also produces the catecholate siderophores, an iron-binding protein either amonabactin or enterobactin that are considered as

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Transparent with wide band gap InZnO nano thin film: Preparation and characterizations

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ABSTRACT

Novel indium zinc oxide (InZnO) thin film of 100 nm thickness was prepared onto pre-cleaned glass plate by thermal evaporation technique from InZnO nanoparticles. The metal oxide (In–O and Zn–O) bond and In, Zn and O elements present in the films were confirmed by Fourier transform infrared spectroscopy and energy dispersive X-ray spectroscopy. The X-ray diffraction patterns revealed the mixed phase of cubic In_2O_3 and wurzite-hexagonal ZnO structure. SEM images showed smooth surface with uniform distribution of grains (201–240 nm) over the entire film surface. High transparency and low absorption obtained from optical study. The band gap energy was evaluated to be about 3.46–3.55 eV by Tauc's plot. The structure, smooth surface and high transparency with wide band gap energy lead the thermally evaporated InZnO nano thin film to be used for transparent layer in optoelectronic devices in the future.

1. Introduction

Transparent Conducting Oxides (TCOs) are technologically important semiconducting materials with fascinating physical, chemical and electrical properties with a wide range of applications commonly found in everyday life. The utility of thin film based TCOs (In_2O_3, SnO_2, ZnO, ITO, FTO, AZO, IGZO, IZO, etc.) have been significantly increased over the last three to four decades [1–7]. TCOs have been touted as the natural successor material for microelectronic devices, which offer great prospects for the most efficient and cost effective utilization of a wide variety of applications [8]. Among the many kinds of TCOs, ITO is a most effective industrial material presently being used in device fabrications. The majority of known TCOs materials are n-type semiconductors where defects such as oxygen vacancies, impurity substitution and interstitials donate electrons to the conduction band providing charge carriers for the flow of electric current [9,10]. The TCOs thin film with higher transparency in the visible region, wide band gap and good electrical conductivity is realized through oxygen vacancies in the lattice (making it metal rich) resulting in excess conduction electrons. These characteristics are required in various applications dealing with transparent heating elements for air craft and car windows, photovoltaic devices, solar cells, gas sensors and transistors. Along with the electrical properties such as resistivity, mobility and conductivity, the optical properties are important parameters of TCOs.

Good optical properties of semiconductor thin films are very important for optical coatings in optoelectronic devices. Optical characterization of thin film gives information about other physical properties such as band gap energy, band structure and optically active defects, which are essential for different applications. The optical properties depend strongly on preparation and growth conditions such as film thickness, dopant type, annealing temperature or heat treatment and deposition condition [11]. In addition to that, crystallinity, smooth surface morphology and uniform film thickness are playing a major role in thin film for optical devices. Impressively, annealing effect can enhance the crystallinity and grain size of the thin film. Optical properties of thin film are significantly affected by annealing temperature due to increase in crystallinity [8]. Also, annealing often smoothens the surface of a film and makes its thickness more uniform [12]. Homogeneous with smooth surface morphology is very important in order to reduce the optical loss by light scattering and the optical transmission deterioration [13]. The improved surface morphology, minimum optical signal transmission loss and less defects/void formations are essential for utilization as optical coating thin film in optical devices.

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Review Article

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INDUCED RESISTANCE BY NEEM EXTRACTS IN PLANTS

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Abstract

Induced-resistance systems in plants can be due to biological or chemical elicitor. Plant extracts may play a eco-friendly approach to induce defense response in plants. Systemic Acquired Resistance (SAR) is characterized by broad-spectrum disease resistance in host plants with accumulation of SA, enhanced expression of pathogenesis-related (*PR*) genes and accumulation of their expression products, activation of phenylpropanoid pathway, leading to the synthesis of higher phenolic compounds toxic to microbial pathogens. Neem fruit extract elicit the signaling through protein-protein interactions, followed by DNA-protein interaction and enhance the expression of defense-related genes, enzymes and isoenzymes leading to defense response in tomato plants.

Key word: *defense; enzymes; isoenzymes; signal.*

1. INTRODUCTION

Induced resistance in plants can be subdivided into two broad categories. Systemic Acquired Resistance (SAR) is characterized by broad-spectrum disease resistance and is mediated via a salicylic acid (SA) dependent process (Mauch and Metraux, 1998), whereas Induced Systemic Resistance (ISR) is mediated by a jasmonate/ethylene sensitive pathway (Pieterse and Van Loon, 1999).

2. INDUCED RESISTANCE IN PLANTS

Inducers show similar responses when they are applied exogenously, and there is considerable crosstalk between the pathways (Harman *et al*., 2004). Induced-resistance systems in plants are complex, but have been partially elucidated in several model plant systems. The figure 1 shows a model of induced resistance in tomato. Successful control of the pathogen is also possible through induction of SAR in host plants. SAR is the phenomenon by which plant's own defense mechanisms are induced by prior treatment with either a biological or chemical agent (Percival, 2001). It is characteristically associated with accumulation of SA, enhanced expression of pathogenesis-related (*PR*) genes and accumulation of their expression products, activation of phenylpropanoid pathway, leading to the synthesis of higher phenolic compounds toxic to microbial pathogens (Durrant and Dong, 2004).

The term "pathogenesis-related proteins" is a collective term for all microbe-induced proteins and their homologues to the extent that enzymes such as phenylalanine ammonialyase (PAL), peroxidase (POX), and polyphenoloxidase (PPO), which are generally present constitutively and increased only during most infections, are often also referred to as PR proteins. The term "inducible defense-related proteins" was used by Van Loon *et al.* (2006) to coin both the known PR-protein families and non-classified proteins meeting the criteria above. PAL, POX, PPO are the key enzymes involved in biosynthesis of phenolic compounds has been reported in plants to show enhanced activity due to the treatment with various biotic and abiotic inducers of resistance (Bhuvaneswari *et al*. 2012; Bhuvaneshwari and Paul 2012; Paul and Sharma, 2002; Raghvendra *et al.*, 2007).

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Research Article

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MODULATORY EFFECT OF *Ananus comosus* (L.) PEEL ON DMBA INDUCED MAMMARY CANCER IN RAT MODEL

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Abstract

The peel of *Ananus comosus* is a well known ingredient in ethanomedicine. The present study was aimed to evaluate therapeutic potential by assaying the activities of liver marker, lysosomal enzymes and mitochondrial marker enzymes in 7, 12 dimethylbenz(α)anthracene induced mammary cancer bearing rats. Animals were divided into five groups of six animals. Group I served as control, group II induced mammary carcinogenesis by 7, 12 dimethylbenz(α)anthracene, group III and IV are treatment groups (plant extract 250 mg/kg body weight and standard drug 20 mg/kg body weight) and group V served as animals treated with plant extract alone. All the animals were sacrificed after 30 days treatment, liver and renal tissues were used for the analysis of liver marker enzymes, lysosomal marker enzymes and TCA cycle marker enzymes using standard protocols. The rats were induced with mammary cancer by DMBA showed altered the levels of liver marker enzymes, lysosomal marker enzymes and TCA cycle marker enzymes in tissues and serum. On the other hand, oral administrations of ethanolic extract of *Ananus comosus* peel (250 mg/kg body weight) and standard drug tamoxifen to mammary cancer bearing rats for 30 days, those levels were brought back to near normal. The histology of liver tissue inevitably supports the biochemical alterations and this was attributed due to the interaction of *Ananus comosus* peel through the induction or inhibition of metabolism and also the modulating property in the marker, lysosomal enzymes and TCA cycle marker enzymes.

Key word: *Ananus comosus, mammary cancer, liver marker and lysosomal marker enzymes, TCA cycle marker enzymes, biochemical alterations*

1. INTRODUCTION

Worldwide, breast cancer is the most common cancer among women after skin cancer, and it is also the second leading cause of cancer death (after lung cancer) in women (Veena *et al*., 2006). Annually, 910,000 new patients are diagnosed with breast cancer and 376,000 women die from the disease. The etiology of breast cancer is multifactorial and the risk factors include early menarche, late menopause, nuliparity and late age at first birth, postmenopausal obesity, extended use of oral contraceptives, hormone replacement therapy, family history and previous benign breast disease (McPherson et al., 2000). Exposure to environmental pollutants such as polycyclic aromatic hydrocarbon (PAH) is associated with the development of numerous cancers in human (Nebert *et al*., 2004). Polycyclic aromatic hydrocarbons (PAHs) are products formed by incomplete combustion of organic matter. They are the most important class of carcinogens implicated in the development of mammary carcinogenesis in humans (Tsuchiya *et al*., 2005). Once these chemicals are consumed, our body will metabolize and transform these compounds into DNA-attacking mutagens (Chan *et al*., 2002). Enzymatic activation of PAHs leads to the generation of active oxygen species like peroxides and superoxide anion radicals, which induce oxidative stress in the form of lipid peroxidation. Uncontrolled increase of these highly reactive molecules lead to free radical mediated chain reactions of which indiscriminately damage proteins, lipids and DNA resulting at last resort in cell death (Lenaz, 2001).

Higher amounts of PAH-DNA adducts have been found in human breast tumors than

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GREEN ROUTE SYNTHESIZED SILVER NANOPARTICLES: AS POTENTIAL ANTIBACTERIAL MATERIAL

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ABSTRACT

The green-synthesized method is rapid, superficial, toxic free, suitable, less time consuming, environmental safe and can be applied in a variety of applications in medicinal field. In the present study demonstrated antibacterial action of *Vinca rosea* Leaf extract medicated Silver Nanoparticles (VrL-AgNPs) tested against both Gram positive and Gram negative pathogens such as *Staphylococcus aureus, Escherchia coli* and *Pseudomonas aeruginosa.* The obtained results indicate the VrL-AgNPs achieved maximum zone of inhibition against test pathogens *P. aeruginosa* and significant action against *E.coli* and *S. aureus.* These green routes synthesized silver nanoparticles using biological sources like plant and plant extract which makes them a potent source of antibacterial agent.

Keywords: AgNPs, VrL, Antibacterial, ZOI, pathogenic.

1. INTRODUCTION

Nanotechnology is fast growing by producing nanoproducts and nanoparticles that can have novel and size-associated physico-chemical properties differing considerably from larger matter. The new properties of nanoparticles have been subjugated in a broad range of potential applications in cosmetics, renewable energies material, medicine, biomedical devices and environmental remediation (Tran *et al*., 2013). Metals like gold, silver, platinum and zinc have been used for the biosynthesis of nanoparticles having greater potentials application in field of nanotechnology. Among the all metal nanoparticles, the silver nanoparticles (nanosilver or AgNPs) have increasing attention due to their unique chemical, physical and biological properties. Silver nanoparticles are very important and most widely used nanoparticles with potential applications in biomedical nanotechnology (Arunachalam *et al*., 2013).

The emerging infectious diseases and the development of drug resistance in the pathogenic bacteria and fungi at an alarming rate is a matter of serious concern. Despite the increased knowledge of microbial pathogenesis and application of modern therapeutics, the morbidity and mortality associated with the microbial infections still remains high (Kolar *et al*., 2001). Therefore, there is a pressing demand to discover novel strategies and identify new antimicrobial agents from natural and inorganic substances to develop the next generation of drugs or agents to control microbial infections. Prior to the extensive use of chemotherapeutics in modern health care system, inorganic antimicrobials such as silver and copper were used since ancient times to treat microbial infections (Moghimi, 2005). In the recent times, the advances in the field of nanosciences and nanotechnology has brought to fore the nanosized inorganic and organic particles which are finding increasing applications as amendments in industrial, medicine and therapeutics, synthetic textiles and food packaging products (Gajjar *et al*., 2009; Silvestre *et al*., 2011). This is present study deals with antibacterial properties *Vinca rosea* Leaf (VrL) extract medicated Silver Nanoparticles (VrL-AgNPs) using *Vinca rosea* plant extract tested against both Gram positive and Gram negative pathogens.

2. MATERIALS AND METHODS

2.1. Green Synthesis VrL-AgNP

Our earlier study reported that the simple and environmental free green route was used to synthesis AgNPs from silver nitrate using aqueous extract of *Vinca rosea* (VrL) leaf. VrL extract mediated synthesized AgNPs was characterized using by UV visible spectroscopy (UV-Vis), X-ray Diffraction Spectrum (XRD), Scanning Electron

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Thickness dependence on structural, dielectric and AC conduction studies of vacuum evaporated Sr doped $BaTiO_3$ thin films

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ABSTRACT

Barium titanate ($BaTiO_3$) doped with Strontium (BST) nanoparticles prepared by using wet chemical method were thermally evaporated on to well cleaned glass substrates under the vacuum of 2×10^{-5} Torr, using 12A4 Hind Hivac coating unit. The thickness of the film was measured by quartz crystal monitor. From X-ray analysis, it has been found that $BaTiO_3$ nanoparticles possess tetragonal structure and deposited films has a polycrystalline in nature, whereas the crystallinity of film increases with increase of temperature. Surface morphology of the prepared thin film was found to be uniform. The transport mechanism in these films under a.c. fields was studied in the frequency range 12 Hz to 100 kHz, at different temperatures (303–483 K). The dependence of dielectric constant and loss factor for different thickness was investigated and results are discussed. The process of a.c. conduction has been explained on the basis of hopping conduction mechanism. The dielectric constant (ε'), temperature co-efficient of capacitance (TCC) and temperature co-efficient of permitivity (TCP) were estimated. The dependence of activation energy on thickness also studied and reported.

1. Introduction

Barium titanate doped with strontium having perovskite structure is a common ferroelectric material with a high dielectric constant. It is an attractive material for applications such as multilayer capacitor, pyroelectric detectors, dynamic random access memory device, non-volatile memories, integrated circuit technology, energy storage devices, field-effect transistors, energy harvesters and positive temperature coefficient of resistance [PTCR] sensor [1]. Several novel devices have been fabricated based on Sr doped $BaTiO_3$ thin films, which include phase shifter, thin film capacitors, photovoltaic devices, optoelectronic devices and humidity sensors. Due to the desirable properties and applications, over the last few decades, synthesis of $BaTiO_3$ nanoparticles and thin film has attracted great attention. Most of the experimental work carried out so far relate to preparation of nanoparticles like polymeric precursor method [2] co-precipitation, alkoxide hydrolysis [3], metal-organic processing [4], hydrothermal treatment [5] and the solid state reaction of mixed oxide route [6]. Among this method wet chemical method is a promising technique that offers relative low cost, uniform size and homogenous particles. A detailed survey of the literature reveals that even though some work on dielectric properties has been carried out to prepare thin film of strontium doped barium titanate such as sol–gel method [7,8], r.f. – sputtering [9], pulsed laser ablation [10] and metal-organic chemical vapor deposition [11]. No work is found in the literature about to preparation of thin films by vacuum evaporation method using glass substrate. Hence the present paper discusses the structure, dielectric and a.c. conduction mechanism in vacuum evaporated Sr doped $BaTiO_3$ thin films.

2. Experimental details

2.1. Synthesis of $BaSrTiO_3$ nanoparticles

BST nanoparticles were synthesized using wet chemical method. The starting materials used were barium chloride ($BaCl_2 \cdot 2H_2O$), titanium dioxide (TiO_2), strontium carbonate ($SrCO_3$) and oxalic acid. A solution of Ba:Ti:oxalic acid:$SrCO_3$ having mole ratio 1:1:1:0.1 was stirred and evaporated at 70 °C

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ANTIMICROBIAL PROPERTIES OF LANTHANUM ALUMINATE NANOPARTICLES

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ABSTRACT

The sol-gel route synthesized LA-NPs were tested for antimicrobial properties against different human pathogenic bacteria and fungi. The test organisms used were clinical isolates *viz., Streptococcus pyogenes, Staphylococcus aureus, Escherichia coli, Klebsiella nemoniae* and the human fungal pathogens like *Candida albicans* and *Trichoderma viride.* The LA- NPs achieved maximum activity against *S. aureus* compared with other three tested organisms such as *S. pyogenes, E. coli* and *K. pneumonia.* It also showed very good antimicrobial properties against studied fungi. At the concentration 1 mg/ml LA-NPs impregnated filter paper disk achieved maximum activity against human pathogen.

Keywords: Antimicrobial activity, Lanthanum aluminate nanoparticles, human pathogens.

1. INTRODUCTION

The application of nanomaterials in biotechnology merges the fields of material science and biology. Nanoparticles provide a mostly useful platform, demonstrating distinctive properties with potentially wide-ranging applications in therapeutic field (Gao *et al.,* 2004). The advancements in the area of nanoparticles technology and nanotechnology have offered an understanding and controlling of the materials at atomic and molecular levels. It has also assisted in fabricating advanced materials with added optical, electrical, magnetic and biological properties for pharmaceutical and biomedical applications (Iconaru *et al*., 2012). Nanovectors in the field of delivery are promising novel tools for controlled release of drug (Maya *et al*., 2015). Bio macromolecule external recognition by nanomaterials as artificial receptors provides a potential tool for controlling cellular and extracellular processes for numerous biological applications such as enzymatic inhibition, transcription regulation delivery and sensing. The biological application of nanoparticles depending on the core size of material providing a suitable platform for the interaction of nanomaterial with biomolecules (Hostetler *et al*., 1998). Nanomaterials have already been used for a wide range of applications both *in-vitro* and *in-vivo*. The surface and core properties of nanomaterials can be engineered for individual and multimodal applications, including biomolecular recognition, therapeutic delivery such as antimicrobial, anticancer, biosensing and bio imaging (Mrinmoy *et al.,* 2008).

In this world of emerging nanotechnology, one of the primary concerns is the potential environment impact of nanoparticles. An efficient way to estimate nanotoxicity is to monitor the response of bacteria exposed to these particles. Resistance of bacteria to bactericides and antibiotic has increased in recent years due to the development of resistant strains. Some antimicrobial agents are extremely irritant and toxic and there is much interest in finding ways to formulate new type of safe and cost-effective biocidal materials (Brayner, 2008). Earlier studies have been shown that antimicrobial formulations in the form of nanoparticles could be used as effective bactericidal materials. Recently, it has been reported that highly reactive metal oxide nanoparticles exhibit excellent biocidal active against Gram positive and Gram negative bacteria (Kim *et al*., 2007; Savithramma *et al.,* 2011; Kagan *et al*., 2002).

Bacteria are generally characterized by a cell membrane, cell wall, and cytoplasm. The cell wall lies outside the cell membrane and is composed mostly of a homogeneous peptidoglycan layer. The cell wall maintains the osmotic pressure of the cytoplasm as well the characteristic cell shape. Gram positive bacteria have one cytoplasmic membrane with multilayer of peptidoglycan polymer and a thicker cell wall (20-80 nm).Whereas gram-negative bacteria wall is composed of two cell membranes, an outer membrane and a plasma membrane with a thin layer of peptidoglycan with a thickness of 7-8 nm. Nanopartilces size within such ranges can readily pass through the peptidoglycan and hence are highly susceptible to damage (Fu *et al*., 2005;

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DATA MINING ON CRUDE, PARTIALLY PURIFIED AND DOPED SILVER NANOPARTICLES OF TWO PLANT SPECIES AGAINST DENGUE VECTOR, *Aedes aegypti*

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between all authors. Author's RD and HL designed the study, wrote the protocol and interpreted the data. Author RR anchored the field study, gathered the initial data and performed preliminary data analysis. Authors LK and CSB managed the literature searches and produced the initial draft. All authors read and approved the final manuscript.

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ABSTRACT

Data mining is one of the essential steps in knowledge discovery from databases process to understand comparative analysis of specific value. The raw data are extracted from the database and preprocessed to clean the data which is inconsistent. Intelligent methods are implemented to extract data patterns from the database is the main process of data mining to identify with accurate assessment. The present study focused on evaluating the crude, partially purified and doped silver nanoparticles of two plant species, *Tridax procumbens* and *Annona squamosa* against the developmental stages of Dengue vector, *Aedes aegypti.* This paper elucidates the process of extracting the clean data from the actual (raw) data against the developmental stages of Dengue vector, *A. aegypti* using TANAGRA tool. This comparative analysis clearly shows that the experimental plants doped silver nanoparticles showed maximum efficacy on various stages of the Dengue vector, *A. aegypti.*

Keywords: Data mining; AgNPs*; Aedes aegypti; Tridax procumbens*; *Annona squamosa*; $LC_{50,}$

1. INTRODUCTION

Mosquitoes are vectors for transmit diseases from one human to another. In general, the diseases are caused by viruses or minute parasites. Dengue is a systemic viral infection transmitted between humans by *Aedes* mosquitoes [1] and most common arthropod-borne infection, at least Dengue effecting average 50 million people every year and endemic in more than 100 countries [2] and presents a foremost challenge for universal public health service. Bhatt et al. (2013) study obviously indicated that the Dengue infection can be reason by any of four Dengue virus serotypes (DENV1 to 4), pass on by *Aedes* mosquitoes and this study suggested that around 400 million infections transpire yearly of which around 100 million are clinical evident [3]. In year 2014 Sophie and Bridget, review clearly shown current understanding of the risk factors associated with poor outcome in dengue. Researchers have reported and screened natural

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New possibility on InZnO nano thin film for green emissive optoelectronic devices

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ABSTRACT

Indium zinc oxide (InZnO) nano thin film was prepared from InZnO nanoparticles (NPs) by thermal evaporation technique. Fourier transform infrared spectroscopy showed the presence of metal-oxide bond. X-ray diffraction pattern revealed the mixed phase structure. The presence of elements In, Zn and O were identified from energy dispersive X-ray analysis. Size of the NPs was found to be 171 and 263 nm by transmission electron microscopy. Scanning electron microscopy image showed the spherical shape uniform morphology with uniform distribution grains. Photoluminescence spectrum exhibited a broad green emission for InZnO nano thin film. The acquired results of structure, smooth morphology and photoluminescence property suggested that the InZnO nano thin film to be a promising material for room temperature green emissive optoelectronic, laser diodes, solar cells and other optical devices.

1. Introduction

The current challenge in nanotechnology is devising a fast, flexible and inexpensive way to develop more reliable and cheaper new nano devices. Nanotechnology is considered to play a key role for a promises breakthrough in such areas like materials and manufacturing, nano electronics, biotechnology, information technology, energy, medicine, healthcare and national security [1]. Lot of research effort is the need of the hour for the development of new class of nanostructured (nanoparticles/thin films) materials. Recently, there has been renewed interest in the preparation of nano-scale mixed oxide composite nano particles and thin films because they exhibit new properties, which make them suitable for new devices [2]. Preparation types, synthesis conditions and properties of coupled metal oxide nanocomposites such as ZnO/TiO_2, ZnO/SnO, ZnO/Co_3O_4, Zn_2TiO_4 and $ZnTiO_3$ and ZnO/Co_3O_4 and TiO_2/SnO_2 core-shell nanocomposites have been reported in literature [3]. When solid nano particles are brought together at ambient temperatures, surface interactions may force them to join, creating a "neck" region [4].

Impressively, semiconductor nano composites have gained significant attention in the last few decades due to their widespread applications [5]. Among semiconductors, recently reported work on In_2O_3 and ZnO based nanowires, nanostructures and nanorods for various applications [5–9]. In combination, indium zinc oxide based materials have been extensively investigated by scientists to find the alternative for indium tin oxide (ITO) [10–15]. In particular, researchers are working on the preparation of InZnO thin films by different techniques to replace ITO in thin film transistors (TFTs), OLED applications [13,16–22] and TCO coating to iso and hetero semiconductor-insulator-semiconductor type solar cells [23]. Thin film technology is an important area, which deals with the thin film form of insulators, semiconductors and metals [24]. Thin film preparation technique plays an important role to obtain a suitable and defect free thin films for electronic and optoelectronic devices. To the best of our knowledge, there is no report on InZnO NPs and their nano thin film to study the photoluminescence behavior by thermal evaporation method. This paper aims to explore the preparation and characterization of InZnO nano thin film (100 nm) from InZnO NPs by thermal evaporation technique

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Thickness and annealing effects on thermally evaporated InZnO thin films for gas sensors and blue, green and yellow emissive optical devices

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ABSTRACT

Indium zinc oxide (InZnO) thin films with thicknesses of 100 nm and 200 nm were deposited on glass plate by thermal evaporation technique. Fourier transform infrared spectra showed a strong metal-oxide bond. X-ray diffraction patterns revealed amorphous nature for as-deposited film whereas poly-crystalline structure for annealed films. Scanning electron microscope images showed a uniform distribution of spherical shape grains. Grain size was found to be higher for 200 nm film than 100 nm film. The presence of elements (In, Zn and O) was confirmed from energy dispersive X-ray analysis. Photoluminescence study of 200 nm film showed a blue, blue-green and blue-yellow emission whereas 100 nm film showed a broad green and green-yellow emissions. Both 100 nm and 200 nm films showed good oxygen sensitivity from room temperature to 400 °C. The observed optical and sensor results indicated that the prepared InZnO films are highly potential for room temperature gas sensor and blue, green and yellow emissive opto-electronic devices.

1. Introduction

Thin film technology is stretching its hands in all directions and their devices coming out of playing a dominant role in all walks of life. Generally, thin films are expected to be faster, smaller and highly performable than traditional thin films in material sciences. In Physics, thin film technology is an important special branch which deals with thin film form of insulators, semiconductors and metals [1,2]. In semiconductors, transparent conducting oxides (TCOs) are usually prepared with thin film technologies and used in opto-electrical devices such as solar cells, displays, opto-electrical interfaces, transparent thin film transistors, light emitting diodes, and semiconductor lasers [3]. The electrical and optical properties are important parameters of a TCO [4]. The electrical/optical properties and their characteristics depend strongly on preparation and growth conditions such as film thickness, dopant type, annealing temperature or heat treatment and deposition condition [5]. Annealing temperature or heat treatment is very effective to improve the electrical and optical properties [6–9]. Also, annealing effect can enhance the film properties, such as crystal quality, electric and luminescence behavior by improvement of crystallinity of the films and increase in grain sizes [10,11]. Poor crystalline quality may cause a reduction in the relaxation time and mobility as a result of increased point defects, grain boundaries and lattice distortion [12,13]. Also, annealing often smoothens the surface of a film and makes its thickness more uniform [14,15]. In addition to that, to enhance the sensitivity of sensors, the sensors have typically been heated to elevated temperatures (200–500 °C) [16].

A unique and key inorganic TCO materials such as ITO, In_2O_3, ZnO, SnO_2, CdO, ternary compounds Cd_2SnO_4, $CdIn_2O_4$, $CdSnO_3$, $ZnSnO_4$, $ZnSnO_3$, $Zn_2In_2O_5$, $Zn_3In_2O_3$ and In_2SnO_4 have attracted

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Fabrication of two-dimensional photonic quasi-crystals with 18- and 36-fold by holography for solar application

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Abstract: Holographic lithography has been widely used to the realisation of complex photonic structures such as photonic crystal and quasi-photonic crystals. Dual-beam multi-exposure holographic technique was adopted for the fabrication of 18-fold and 36-fold sub-microscopic rotational symmetric structures; the fabricated photonic quasi-crystals examined by laser diffraction pattern, optical and scanning electron microscopes. Here, the authors have fabricated photonic quasi-crystals in photoresist and the structure was transformed into metal, the transferred structure in metal could act as a substrate/or back reflector for the thin film solar cell. Further work on concentration of solar light by photonic quasi-crystals is progressing.

1 Introduction

A material with a periodic order was different from conventional crystal due to its atomic arrangement was discovered and named a quasi-crystal [1]. A quasi-photonic crystal (QPC) has a rotational symmetry other than those allowed for crystals, i.e. one-, two-, three-, four- and six-fold symmetries and higher rotational symmetry than conventional photonic crystals (PC). It has a long-range order and the long-range order is non-periodic [2–8].

We have fabricated highly rotational symmetric QPC structures by using holography. Depending on the number of laser beams and their arrangements, one can fabricate different symmetries of two-dimensional (2D) and 3D PC and QPC. For example, multi-beam interference of laser beams with single exposure technique [9, 10]. By using three or four beams interference method, one can create 2D hexagonal or square structures [11–13]. Umbrella such as central and side laser beam multiple interference technique and the 4 + 1 configuration has been proposed for the holographic fabrication of 3D PCs [11, 14–17]. Experimentally, five diffracted laser beams generated by using phase masks [18, 19], flat-top prisms [20, 21], two beam interference, four beam interference, special prism and combined holographic gratings as beam splitter (BS) have been involved in the fabrication of PCs by interference holographic lithography [22]. However, by using two beam multi-exposure interference technique [23, 24] has many advantages over the commonly used multi-beam interference technique; such as experimental simplicity, easy fabrication of different structures with long range and high contrast of structures [25] are few examples.

If number of interfering beams is more than six, one can fabricate QPCs [26, 27]. The 8-fold, 10-fold and 12-fold QPC fabrication technique by holographic method reported by many research groups, but a very few groups [28] recently published 18-fold symmetry. The 18- and 36-fold QPCs by using holography two beams multi-exposure method is elaborated here.

The concept of solar concentration by diffraction grating and periodic structures have been reported [29–34], also the solar light absorbance enhancement and improving efficiency of silicon (Si) solar cell by PC [35–37] have been reported. Another class of high rotational symmetric QPC and its pivotal role of enhancement of Si solar cell were reported [38]. Here, we have adopted a dual-beam multi-exposure technique for the fabrication of 18- and 36-fold QPC structures in photoresist (PR) and in metal. Its advantage over other method is of easy replication and low cost for mass production. Hence, we select this technique for the fabrication of QPC and periodicity gets inspected by laser diffraction pattern, optical and scanning electron microscopy. The fabricated periodic structures transferred to metal and the same is used as substrate for the fabrication of PN junction thin film solar cell. The already published works are generally based on Si solar cell efficiency enhancement. Here, we have selected cadmium telluride (CdTe) solar cell for our work. The absorbance enhancement is mainly due to the higher-order rotational symmetry in QPC structures, which leads to the presence of additional, resonant modes, the broadening of existing modes and the reduction of surface reflectance. Our future work is focusing on QPC fabrication in three different substrates such as glass, metal and polycarbonate. On the basis of these structures, solar light absorbance and efficiency enhancement of the solar cell is progressing.

2 Experimental arrangement

A dual-beam multi-exposure holographic experimental arrangement for the fabrication of 2D PCs structures is shown in Fig. 1. A beam of wavelength 442 nm emitted from 100 mW Helium – Cadmium (He-Cd) laser divided into two by variable density beam splitter (BS) and it is used to control the beam ratio. The separated beams are expanded and spatially cleaned by spatial filter SF1 and SF2. Both expanded and spatially cleaned beams are collimated by using lenses L1 and L2. A double-iris and wave plates are used to select two laser beams of the same profile, same polarisation and same intensity. The collimated laser beams to be interfered at photoresist (PR) which is placed in plate holder PH are guided by two front coated aluminium mirrors M1 and M2. The angle between two laser beams is denoted as θ [39] and could be easily controlled by two mirrors M1 and M2. We have used PR for the formation of QPC structures; PRs are light-sensitive organic polymers, which form imaged relief patterns on exposure and development. The exposed areas of positive PR and unexposed areas of negative PR become soluble and dissolve away during the developmental process [40–42].

In this paper, the AZ-4620 positive PR (8 µm thickness) exposed by He–Cd laser with wavelength of 442 nm for the fabrication of QPC, PR is placed in a rotation stage with stepper motor arrangement for precise control of rotation between exposures. The Uniblitz computer control VCM D1 (model number) shutter driver and LS series model high-speed electronic shutter is used to organise the accurate laser exposures. The

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PREPARATION AND CHARACTERIZATION OF THERMAL EVAPORATED $BATIO_3$ THIN FILMS

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ABSTRACT

Thermal evaporated Barium titanate **(**$BaTiO_3$) thin films were prepared on to well cleaned glass substrates under the vacuum of 2 $x10^{-5}$ torr, using 12A4 Hind Hivac coating unit from the $BaTiO_3$ nanoparticles synthesized by using wet chemical method. The thickness of the film was measured by Quartz crystal monitor. From X-ray analysis, it has been found that the deposited film was polycrystalline in nature. SEM analysis revealed that grains of various sizes having tetragonal shape were uniformly distributed throughout the surface of the film. The dependence of capacitance and loss factor on frequency and temperature were investigated and results are discussed.

Keywords: $BATIO_3$, Nanoparticles, X-ray analysis.

1. INTRODUCTION

$BaTiO_3$ thin films are very promising for a wide range of application such as high dielectric capacitors, insulating surface layer, non-volatile memories with low switching voltage, dynamic random access memory (DRAM), positive temperature coefficient of resistance (PTCR) thermistors, infrared sensors and electro-optics devices due to high dielectric constant, low dielectric loss, low leakage current and low temperature coefficient of dielectric constant. Due to the desirable properties and applications, over the last few decades, synthesis of $BaTiO_3$ nanoparticles and their thin film has attracted great attention. A detailed survey of the literature revealed that even though some work on dielectric properties of $BaTiO_3$ thin films prepared by sol - gel method (Maneeshya *et al*., 2013; Hu *et al*., 2003) , r.f. sputtering (Bhattacharya *et al*., 1993), pulsed laser ablation (Yoon *et al*., 1995) and metal-organic chemical vapour deposition (Tahan *et al*., 1996). So far, there is no report on the preparation of thin films of $BaTiO_3$ on glass substrate by vacuum evaporation method. The present work deals with the characterization of thermal evaporated $BaTiO_3$ thin films.

2. EXPERIMENTAL

2.1. $BaTiO_3$ thin film preparation

Using the conventional 12A4 Hind Hivac coating unit, pure (99.99%) aluminium was evaporated from a tungsten filament onto well-cleaned glass substrates through suitable masks to form the bottom electrode. Prepared $BaTiO_3$ nanoparticles were then evaporated from a molybdenum boat to form the middle dielectric layer. An aluminium top electrode was deposited onto the dielectric through suitable masks to complete the aluminium-$BaTiO_3$ -aluminium (Metal-Insulator-Metal) sandwich structure. A working pressure of 2 $x10^{-5}$ torr was maintained in all the evaporation processes. For the structural and surface analysis, the $BaTiO_3$ films were deposited on pre cleaned glass substrates.

2.2. Measurements

Thickness of the prepared films was measured by using Quartz crystal monitor ("Hind Hivac" Digital Thickness Monitor Model–DTM– 101). The structural aspects of the films were analyzed, using X-ray diffractometer with filtered CuKα radiation (λ = 1.5418 Å). Measurements of series capacitance and the dissipation factor in the frequency range 12Hz- 100KHz were carried out at various temperatures (303-483 K) using digital LCR meter (LCR-819, GW instek, Good will Instrument company Ltd., Taiwan). The dielectric constant ε was evaluated from the capacitance data, known area and thickness of the dielectric films.

3. RESULTS AND DISCUSSION

3.1. EDS Analysis

Energy dispersive spectrum (EDS) was carried out to identify the composition of the $BaTiO_3$ thin films prepared by thermal evaporation. Figures 1 shows the EDS spectrum of the $BaTiO_3$ thin film of thickness 160 nm. High intensity peaks corresponding to Ba and Ti elements were clearly noticed in the EDX pattern of the thin films. From the EDS analysis it was found that $BaTiO_3$ did not contain any impurities.

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Role of hexamine: growth of multiarmed ZnO nanorods and evidence of merging due to lateral growth

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Abstract The role of hexamine in the growth of 1D ZnO nanostructures, so far is only assumed, unpredictable and not well explained. Further, the role of hexamine in the growth of 1D ZnO nanostructure by hydrothermal method, especially at the higher concentrations (0.08 M and above) has not yet been well reported. The present study is designed to investigate the role of hexamine in lateral and vertical side growth of ZnO nanorods with different concentrations (0.08 M and above) of hexamine by keeping the concentration of zinc nitrate hexahydrate at 0.1 M. The influence of hexamine in the hydrothermal growth of ZnO nanorods is studied with various characterization tools. The results show that hexamine strongly influence the morphology of ZnO nanostructure and single rod structure transforming into multiarmed structure with increase in hexamine concentration. The growth mechanism of multiarmed ZnO nanorods with respect to hexamine is effectively investigated and discussed in detail from the basic nucleation theories. Lateral growth and merging of rods on the surface is evidenced at the higher concentration of hexamine.

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1 Introduction

One dimensional (1D) semiconductor nanostructures have received more attention in recent days due to higher surface to volume ratio than 2D and 3D structures. The higher surface area enhances the reactivity, increases the absorption of photons, improves catalytic performance and boosts up sensitivity. 1D structure exhibits greater quantum confinement which improves the quantum transport in an allowed unidirectional state. This unique property also enhances the absorption and emission of photons.

ZnO is an important II–VI semiconductor used in different applications. ZnO is considered as a well-known material because of its multiple properties. It exhibits semiconducting, magnetic, piezoelectric, pyroelectric and lasing properties, among many others [1]. ZnO can be obtained in a wide variety of nanostructures such as nanoparticles, core–shell nanoparticles, tripods, tetrapods, hierarchical structures, nanoflower, nanosheets, vertically aligned nanosheets, nanowires, nanorods, nanotips, nanotubes and complex branched nanostructures [2].

ZnO has higher excitonic binding energy of 60 meV at room temperature. It has the Bohr diameter of the excitons, ~3.6 nm [3]. Due to the formation of strong excitons near band edges in 1D structure, ZnO effectively emits UV laser by recombination of exciton at valence band [1]. Since the ZnO nanostructure is crystallised with high quality, it improves the electron transport by reducing electron hopping steps, thereby enhancing the electron mobility [4]. ZnO nanorods provide higher interfacial area between the donor and the acceptor material by working as electrode which efficiently provides pathways for electron transport. Moreover, the control of 1D structures at nanosize level provide novel and enhanced electrical, mechanical, chemical and optical properties. These special properties of ZnO

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RESEARCH ARTICLE

TOXICITY EFFECT OF THE DETERGENT TIDE ON THE HAEMATOLOGICAL PARAMETERS OF THE FRESHWATER FISH *CIRRHINUS MRIGALA*

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ABSTRACT

The presence of detergent in water accelerates the corrosive action, empedes the filtering, sedimentation and coagulation processes, increases the saturation of water with oxygen and also deteriorates the taste properties of water. Soaps and detergents are one of the common pollutants, which causes pollution of inland water at tremendous pace and with the advent of potent anionic surfactant chemicals. The blood parameters were analysed in the fish, *Cirrhinus mrigala* and the LC50 value was determined when the fish was exposed to detergent tide. The parameters like RBC, Hb, MCV, PCV, Albumin and globulin were decreased and WBC have been increased in the fish.

INTRODUCTION

Blood is the most important and abundant body fluid. Its composition often reflects the total physiological activities. The main route of entry for any pesticide is through the gills. From the gills, it is transported to various parts of the body via the blood stream.

The haematological parameters have been considered as diagnostic indices of pathological conditions in animals. Fish blood can serve as a valuable tool in detecting physiological changes taking place in animal.

Masud *et al*. (2005) in *Cyprinus carpio* following mercuric intoxication. Kumar *et al*., (2006) in *Clarias batrachus* and singh and singh (2007) in *Heteropneustes fossilis*.

The decrease in the RBC, Hb, PCV, MCV concentrations has been reported by Benarjee *et al* (2009) in the fish *Channa punctatus* to the rayon industrial effluents. Afaq *et al* (2010) reported a decrease in Haemoglobin concentration in freshwater teleost *Cirrhinus mrigala* when treated with leather dyes Bismarck brown and acid leather brown.

MATERIALS AND METHOD

Analytical Test for Water Chemistry

The tap water free from contaminants was used as dilution water for the present study. The physico-chemical analysis of water used in the experiments were carried out using the method of APHA (1998).

Physico-chemical parameters of the tap water used for the present study are as follows; Temperature 27.2 ± 0.9 (^{o}C), pH 7.1 ± 0.1, Dissolved O_2 5.9 ± 0.4 (mg/I), Alkalinity 148 ± 0.7 (mg/I), Salinity 0.4 ± 0.1 (ppt), Total Hardness 190 ± 1.9 (mg/I), Calcium 132 ± 1.1 (mg/I), Magnesium 65 ± 0.2 (mg/I).

Procurement and Maintenance

The fingerlings of the freshwater fish, *Cirrhinus mrigala* ranging in weight from 3g to 8g and measuring 4cm to 8cm in length) were procured from "Tamil Nadu Fisheries, Department corporation" Mettur, Salem District. The procured bulk samples of *Cirrhinus mrigala* were transported to the laboratory in well aerated polythene bag and acclimatized to the laboratory conditions under natural photoperiod for one week in large plastic containers at (26 ± 5 ^{o}C). The tank was

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BIOMIMETIC SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES (AGNPS) USING *VINCA ROSEA* AQUEOUS EXTRACT

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ABSTRACT

Biomimetic route for the synthesis of silver nanopartilces with using biological source play a very important role in nanotechnology without any harmful chemical. The present study deals with the synthesis of silver nanopartilces by treating silver nitrate with aqueous extract *Vinca rosea* at room temperature. The effect of the *Vinica rosea* aqueous extract on the formation of silver nanopartilces was characterized by UV-visible spectroscopy (UV-Vis), X-ray Diffraction Spectrum (XRD), Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Analysis (EDX). The UV spectra results show a strong resonance centre and surface of silver nanopartilces (AgNPs) at 461 nm. XRD and SEM studies revealed that the synthesized AgNPs shows spherical in shape with average particles size around 30- 70 nm.

Keywords: *Vinica rosea*, AgNPs, SEM, XRD, UV-Vis, EDX.

1. INTRODUCTION

In the modern material science, nanotechnology plays a remarkable role with its eminent salient features such as manipulating nano-scale structures, engineering of atoms and designing of materials with improved properties (Jain *et al.,* 2009). Nano-scale particles with size range of 1-100 nm and different shapes were commonly synthesized either by top-down or bottom-up strategies. At present development of reliable green chemistry route to synthesis nanoparticles is essential for their potential applications in diverse fields, specifically in biology and medicine (Narayanan and Sakthivel, 2011). The nanoparticles are synthesized through physical, chemical and biological methods (Chen *et al*., 2008). The physical and chemical methods are extremely pricey (Li *et al*., 1999). The biological methods of nanoparticles synthesis would assist to remove ruthless processing conditions, by allowing the synthesis at physiological pH, temperature, pressure, and at the same time, at negligible cost. Huge number of micro organisms have been found competent of synthesizing inorganic nanoparticles composite, either intra or extracellularly. Ranjithkumar *et al*. (2013) reported plant extract based silver nanoparticles and achieved good antibacterial activity against human pathogens. Due to implausible properties, nanoparticles have turned into noteworthy in many fields in the recent years, such as energy, health care, environment, agriculture, etc. (Raveendran *et al*., 2003).

On other hand, nanotechnology is now creating a growing sense of excitement in the life sciences especially biomedical devices and Biotechnological applications (Prabhu *et al*., 2010). It has been reported that silver nanoparticles (SNPs) are non-toxic to humans and most effective against bacteria, virus and other eukaryotic micro-organism at low concentrations and without any side effects (Jeong *et al*., 2005). Moreover, several salts of silver and their derivatives are commercially manufactured as antimicrobial agents (Krutyakov *et al*., 2008). Sharma *et al.* (2009) report suggested in small concentrations, silver is safe for human cells, but lethal for microorganisms**.** Antimicrobial capability of silver nanoparticles allows them to be suitably employed in numerous household products such as textiles, food storage containers, home appliances and in medical devices (Marambio-Jones *et al*., 2010). The objectives of this study were to synthesize silver nanoparticles using *Vinca rosea* aqueous extract.

2. MATERIALS AND METHODS

2.1. Materials

The chemical silver nitrate ($AgNO_3$) was purchased from SD Fine Chemical Pvt. Ltd., Mumbai.

2.2. Plant material

The leaf of *Vinca rosea* was collected from Coimbatore district, Tamilnadu, India. The plant was identified *Vinca rosea* at the Department of Botany,

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Structural and molecular docking studies of biologically active mercaptopyrimidine Schiff bases

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ABSTRACT

Novel Schiff bases derived from the treatment of mercapto-diamino pyrimidine with two different aldehydes are characterized using elemental analysis, single crystal X-ray diffraction and ^{1}H NMR spectroscopy. The pharmacological action of the synthesized compounds *viz.*, antimicrobial, anticancer and antitubercular activities is studied. The Schiff bases show a very good activity against various test pathogens. DNA and β-CD binding interactions of the compounds are studied using UV–Visible absorption and fluorescence spectral measurements. The binding constants of the compounds towards β-CD are in the order of 10^3 to 10^4. Molecular docking is done using MOE program on the 3D structure of the enzymes, *viz.*, human thymidylate synthase complexed with dump and raltitrex, candida albicans N-myristoyltransferasepeptidic inhibitor, catalytic domain of protein kinase pKnb from mycobacterium tuberculosis in complex with mitoxantrone, pare, topoisomerase atpase inhibitor, *E. coli* and lactobacillus casdihydrofolatereductase. The MIC/IC_{50} values of the Schiff bases are compared with the glide scores from the molecular docking studies. The number of hydrogen bonding interactions between the Schiff bases and amino acid residues are also reported.

1. Introduction

Schiff bases exhibit useful biological properties such as antiinflammatory, analgesic, antimicrobial, anticonvulsant, antitubercular, anticancer, antioxidant, anthelmintic, antiglycation and antidepressant activities. Schiff bases are also used as catalysts, pigments and dyes, intermediates in organic synthesis, polymer stabilizers and corrosion inhibitors. Pyrimidine derivatives and heterocyclic annulated pyrimidines continue to attract great interest due to their wide variety of interesting biological activities such as anticancer [1,2], antiviral [3], antitumor [4,5], anti-inflammatory [6,7] and antimicrobial [8,9]. Schiff bases attract much interest both from a synthetic and biological point of view [10,11]. Most of the reports in the literature reveal that Schiff bases derived from various heterocyclic compounds possess good cytotoxic [12,13], anticonvulsant, antiproliferative [14,15], antimicrobial [16,17], anticancer [18] and antifungal activities. They also show activity against gonadotropin releasing hormone receptors as well as herbicidal activity targeting acetohydroxy acid synthase, which catalyze the first common stepin branched-chain amino acid biosynthesis. Furthermore, many pyrimidine-5-carbonitrile derivatives are proved to exhibit potent anticancer as well as antimicrobial activities. Patients with neoplastic disorders are mostly subjected to microbial infections. The co-administration of multiple drugs for treating patients suffering from cancer disease accompanied with microbial infections, which may inflect some added health problems, especially in patients with impaired liver and/or kidney functions. Therefore, the concept of monotherapy by a single drug which possesses dual utility may be advantageous from both therapeutic as well as cost-effective stand points. Consequently, our efforts are devoted to synthesize and investigate innovative pyrimidine analogs with dual function; anticancer/

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Investigation of Thermal and Electrical Conductivity of Chemically Synthesized Polyaniline Co (O-Toluidine) Doped with Hcl

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Abstract-- Polyaniline (PANI) is well known conducting polymer which is prepared by both chemical and electrochemical methods. It finds many applications related to its electrical and electronic properties. Polyaniline and polyaniline copolymers with o-toluidine with various ratios was prepared by chemical oxidatative polymerization method by using $(NH_4)_2S_2O_8$ as oxidant and HCl as dopant. The synthesized polymer was characterized by solubility, conductivity measurements, UV-visible, FT-IR studies. Thermal stability of polymer was investigated by TGA and DSC methods.

Keywords-- *Polyaniline, copolymer, o-toluidine, chemical polymerization, Thermogravimetry.*

I. INTRODUCTION

To meet the growing demand of modern ages newer polymer are being synthesized every day. The end use of polymers depends upon its physical, chemical, thermal and conducting properties. The factor depends upon the properties is structure of polymers. Polyaniline is well known intrinsically conducting polymer [1]. It was prepared by both chemical and electrochemical methods in acidic medium. Polyaniline synthesis and characterization was extensively studied by MacDiarmid et al [2]. The PANI can be synthesized from aniline either by oxidative polymerization or by electro polymerization methods [3, 4].

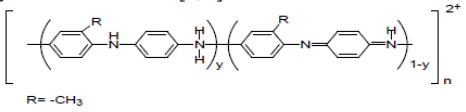

Figure 1: Structure of polyaniline co O-toluidine.

The general structure of polyaniline shown in figure.1 It consists of oxidised and reduced benzenoid and quininoid rings. Oxidation (y values) can be controlled by the dopant concentration and oxidant.Where the value 1 -*y* represents the oxidation state of PANI. The value of *y* can be varied from *y* - 1 (leucoemeraldinebase) to *y* -0 (pernigraniline base). If *y*-0.5, the PANI is referred to as emeraldine base (EB)-form PANI. This EB-form PANI cannot be dissolved in common organic solvents. Polyaniline have so many applications because it have number of attractive properties such that high conductivity, good environmental stability, ease of preparation, doping. PANI is used in batteries, sensors, electro chromic devices, capacitors, photochemical cells, and light-emitting diodes [5, 6, 7, and 8]. The synthesis process and various physical properties and applications of this novel system have been extensively discussed in several recent handbooks [9, 10].

II. EXPERIMENTAL METHODS

A. Materials

1. Aniline (Merck) was doubly distilled 182-185 °C (boiling point 184 °C)
2. O-toluidine (sd fine chemicals) was distilled and the fraction boiling at 200- 201°C was collected and stored in a dark bottle.
3. Ammoniumperdisulpate (sd fine chemicals) AR grade was used as received.
4. Solvents DMSO, NMP, DMF, Acetone (Merck, AR grade) was used as received.

B. Synthesis of Polymers

a. Chemical synthesis of polyaniline copolymers

Polyaniline, poly (O-toluidine) and co-polymer powder were synthesized according to a procedure reported in literature after some modifications.[11-13] In this procedure, 5.0 g (0.054 moles) freshly distilled aniline and o-toluidine dissolved in 250 mL of HCl 1M (0.215 M). The mixture cooled to below 5 °C by using an ice bath. 250 mL of a pre-cooled 0.3 M $NH_4S_2O_8$ solution in HCl, 1M was slowly added under vigorous stirring to monomer solution over a period of 30 minutes. After complete addition of oxidant, the reaction mixture was left stirring for about two hours at low temperature (0-5 °C) and left unstirred overnight at room temperature. The precipitated polymer (dark blue powder) was filtered and washed with copious distilled water and dilute HCl solution until the washing liquid was colorless.. Based on the weight of the monomer used and the product polymer produced, the polymerization yield was found about 80%. The same procedure was repeated for other polymers and co-polymers.

III. RESULTS AND DISCUSSION

Polyaniline and co-polymers of o-toluidine with aniline in various ratios were prepared by using Ammoniumperdisulphate as an oxidant and HCl as dopant. Undoped polymer samples were also prepared by treatment with ammonium hydroxide. The copolymerization of aniline with o-toluidine has been carried out by chemical oxidative polymerization in a similar method as used for the synthesis of poly(o-toluidine)[14].

A. Yield of the polymer:

Yield of the polymer was calculated gravimetrically. Based on the weight of the monomer used and the polymer obtained, the polymerization yield was found to be about 80%. It shows the chemical oxidation polymerization method is fairly good method for the preparation of polyaniline and copolymers.

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Synthesis, Characterization, Single-Crystal XRD, and Biological Evaluation of Nickel(II) Salen Sulfadiazine Complex

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Nickel(II) Salen sulfadiazine complex was prepared and characterised by the spectral studies such as FT-IR, UV-Vis and NMR, and single-crystal XRD. The nickel(II) complex was screened for *in vitro* antimicrobial activities against various test organisms *Aeromonas hydrophila*, *Serratia marcescens*, *Bacillus licheniform*, *Pseudomonas aeruginosa*, *Acinetobacter baumanii*, *Aspergillus niger*, and *Candida albicans* by the well diffusion method and *in vitro* anticancer activity against the human breast cancer cell line HeLa. The NiO obtained by the thermal decomposition of Ni (salen) sulfadiazine complex was characterised using TEM images and their SAED pattern.

Keywords: nickel (II), sulfadiazine, antimicrobial, anticancer, thermal decomposition

Introduction

Schiff bases are condensation products of primary amines with carbonyl compounds, namely aldehyde or ketone, and were first reported by Schiff in 1864.[1] The common structure of these compounds is the azomethine group with a general formula R-CH=N in which alkyl, aryl, cyclo alkyl or heterocyclic groups may be substituted. Several studies[2–4] showed that the presence of a lone pair of electrons in the sp^2 hybridized orbital of nitrogen atom of the azomethine group is of considerable chemical and biological importance. The C=N linkage is essential for biological activity, such as antibacterial, antifungal, anticancer, and antimalarial.[5,6] Schiff bases are generally excellent chelating agents especially when a functional group such as -OH or -SH is present close to the azomethine group so as to form a five- or six-membered ring with the metal ion. Schiff base compounds are very popular ligands because of their easy formation and rich coordination chemistry with a large variety of metal ions.[7,8] Several compounds incorporating piperazinyl guanidine, when condensed with salicylaldehyde, were found to exhibit cardiovascular and vasodepressive activities.[9] The versatility of Schiff base ligands and biological, analytical, and industrial applications of their complexes make further investigations in this area highly desirable.

Sulfadiazine is a sulfonamide with well-known antibacterial activity and used clinically as a topical agent either alone or in combination with other compounds in the treatment of wound and burn infections. Interest in the metal complexes of sulfadiazine is due to its use as pharmaceuticals. At present, the possibility of using metal complexes of sulfadiazine as antimicrobial agents has received some attention. However, the literature on the chemistry of Schiff base complexes derived from sulfa drugs especially their structural characteristics, is rather incomplete.

In continuation of our efforts in the search of antimicrobial agents and to check their cytotoxicity, we have synthesized nickel salen complexes with sulfadiazine and screened them for antimicrobial and cytotoxic activities.

Experimental

Materials and Methods

All chemicals used were of Analar grade. All the reagents, starting materials and solvents were purchased commercially from Sigma-Aldrich and used without any further purification. Apparatus and materials involved in synthesis were

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Color versions of one or more of the figures in this article can be found online at www.tandfonline.com/lsrt.

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Research Article

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Fabrication of two-dimensional photonic quasi-crystals with 18- and 36-fold by holography for solar application

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Abstract: Holographic lithography has been widely used to the realisation of complex photonic structures such as photonic crystal and quasi-photonic crystals. Dual-beam multi-exposure holographic technique was adopted for the fabrication of 18-fold and 36-fold sub-microscopic rotational symmetric structures; the fabricated photonic quasi-crystals examined by laser diffraction pattern, optical and scanning electron microscopes. Here, the authors have fabricated photonic quasi-crystals in photoresist and the structure was transformed into metal, the transferred structure in metal could act as a substrate/or back reflector for the thin film solar cell. Further work on concentration of solar light by photonic quasi-crystals is progressing.

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ORIGINAL ARTICLE

Purified Essential Oil from *Ocimum sanctum* Linn. Triggers the Apoptotic Mechanism in Human Breast Cancer Cells

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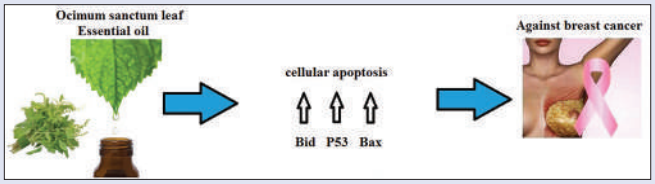
ABSTRACT

Background: Essential oil of *Ocimum sanctum* Linn. exhibited various pharmacological activities including antifungal and antimicrobial activities. In this study, we analyzed the anticancer and apoptosis mechanisms of *Ocimum sanctum* essential oil (OSEO). **Objective:** To trigger the apoptosis mechanism in human breast cancer cells using OSEO. **Materials and Methods:** OSEO was extracted using hydrodistillation of the leaves. Cell proliferation was determined using different concentrations of OSEO. Apoptosis studies were carried out in human breast cancer cells using propidium iodide (PI) and Hoechst staining. **Results:** We found that OSEO inhibited proliferation (IC_{50} = 170 µg/ml) of Michigan cancer foundation-7 (MCF-7) cells in a dose-dependent manner. The OSEO also induced apoptosis as evidenced by the increasing number of PI-stained apoptotic nucleic of MCF-7 cells. Flow cytometry analysis revealed that treatment with OSEO (50–500 µg/ml) increased the apoptotic cells population (16–84%) dose dependently compared to the control. OSEO has the ability to up-regulate the apoptotic genes p53 and Bid and as well as elevates the ratio of Bax/Bcl-2. **Conclusion:** Our findings indicate that OSEO has the ability as proapoptotic inducer and it could be developed as an anticancer agent.

Key words: Apoptosis, breast cancer, essential oil, gene expression, *Ocimum sanctum*

SUMMARY

- OSEO inhibited proliferation of MCF-7 cells with an IC50 of 170 µg/mL
- OSEO at 500 µg/mL increased the population of apoptotic cells by 84%
- OSEO up-regulated the expression of apoptotic genes and as well increased the Bax/Bcl2 ratio.



Abbreviations used: BAX: BAX BCL2-associated X protein; BCL2: B-cell CLL/lymphoma 2; BID: BH3 Interacting domain death agonist; OSEO: Ocimum sanctum essential oil; DMSO: Dimethyl sulfoxide; DMEM: Dulbecco's modified Eagle medium; MCF-7: Michigan cancer foundation-7; RT-PCR: Real Time Polymerase Chain Reaction.

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INTRODUCTION

Breast cancer is the most frequent type of cancer affecting women in Malaysia.[1] The chance of developing breast cancer in Malaysian women is estimated to be about one in nine.[2] The current approach of combating breast cancer includes operation, radiotherapy, hormone remedy, and chemotherapy. Although some of the present treatments have been successful in treating cancer, these always come with vulnerable side effects. Therefore, recent attention has focused on finding natural chemotherapeutic agents to combat breast cancer.

It is widely recognized that the prevention of cancer could be associated with the intake of fresh fruits and vegetables. *Ocimum sanctum* Linn. commonly known as tulsi or holy basil is widely known across South Asia as an aromatic medicinal herb and is distributed and cultivated worldwide.[3,4] *O. sanctum* leaves are categorized as functional foods and have a variety of pharmacological effects such as antimicrobial,[5] hypolipidemic,[6] antioxidant,[7] antibacterial,[8] immunomodulatory, antistress, anti-inflammatory, antiulcer, antidiabetic, hepatoprotective, chemoprotective, cardioprotective, antitussive, radioprotective, memory-enhancing, antiarthritic, antifertility, antihypertensive, anticoagulant, anticataract, anthelmintic, and antinociceptive.[9] On the other hand, the essential oil from the leaves of *O. sanctum* (OSEO) has been evaluated pharmacologically for antimicrobial,[10] anticandidal,[11] and antifungal[12,13] activities. Our recent study on OSEO showed its antimetastatic and anti-inflammatory potentials.[14] However, to the best of our knowledge, there is limited information about the anticancer and apoptosis mechanisms of OSEO. The aim of the present study was to investigate the anticancer and apoptosis activities of OSEO against human breast cancer cells.

MATERIALS AND METHODS

Essential oil extraction

Freshly collected leaves of *O. sanctum* (1 kg) were hydrodistilled for 4 h using Clevenger apparatus for essential oil extraction. Extracted oil

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Synthesis and biological evaluation of new spirooxindoles with embedded pharmacophores†

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A regioselective synthesis of new mono and bisoxindoles containing bis spiro heterocyclic hybrids has been envisaged *via* 1,3-dipolar cycloaddition of azomethine ylides with the dipolarophile (*E*)-3-((2-methoxyquinolin-3-yl)methylene)indolin-2-one, obtained through the base catalyzed condensation of indolin-2-one with substituted 2-methoxyquinoline-3-carbaldehyde. The regiochemistry and stereochemistry of the synthesized products were characterized by 1D and 2D NMR techniques and single crystal X-ray diffraction studies. Many of the compounds were found to show *in vitro* antioxidant, antidiabetic and acetylcholinesterase inhibitory activities.

1. Introduction

Multicomponent strategies are being increasingly considered in synthetic approaches to various diversified spiro-fused systems, which have proved to be ideal targets for the treatment of many neurodegenerative diseases. Alzheimer's disease (AD) is alarmingly common and is rated to be the sixth major disease in the world; the disease causes progressive loss of cognitive ability dementia, and is ultimately fatal.[1] The World Health Organization (WHO) reports that more than 47.5 million people have been affected by AD worldwide.[2] Insulin resistance and chaotic degradation of amyloids suggest that there is a link between diabetes and Alzheimer's disease.[3] The neurotransmitter acetylcholine is reduced by the enzyme acetylcholinesterase (AChE) and arrests impulse transmission by rapid hydrolysis at the synaptic clefts.[4] Human Presequence Protease (hPreP) is responsible for the degradation of acetylcholine into mitochondrial amyloid-β (Ab), a neurotoxic peptide in human neuronal cells.[5,6] Accumulation of Ab within the mitochondrial landscape results in increased free radical production. Literature suggests that an early indicator of AD pathogenesis is increased reactive oxygen species (ROS) production; hence, the exploration of new cholinesterase enzyme inhibitors is still under active pursuit worldwide.[7]

To this end, spirooxindoles with diverse biological activities have gained much interest because of their well-defined three dimensional stereoarchitectures.[8,9] Due to conformational restrictions, the spirocarbon in the structure confers structural rigidity that triggers biological activities.[10] Among these, spiro-pyrrolidinyl oxindoles have been used as potential synthetic intermediates[11] and have shown interesting biological activities, such as anti-inflammatory, anti-diabetic, anti-tumoric,[12] antiviral,[13] antimalarial,[14] antifungal,[15] anti-tubercular and acetylcholinesterase (AChE) inhibitory properties.[16] For example, spirotryprostatin A and B (Fig. 1) are novel inhibitors of microtubule assembly, demonstrate antibiotic properties, and have been studied as anticancer lead compounds,[17] while pteropodine (Fig. 1) functions as a positive modulator of muscarinic M2 and 5-HT2 receptors.[18] Spirooxindole-pyrrolidinyl motifs comprising coerulescine and

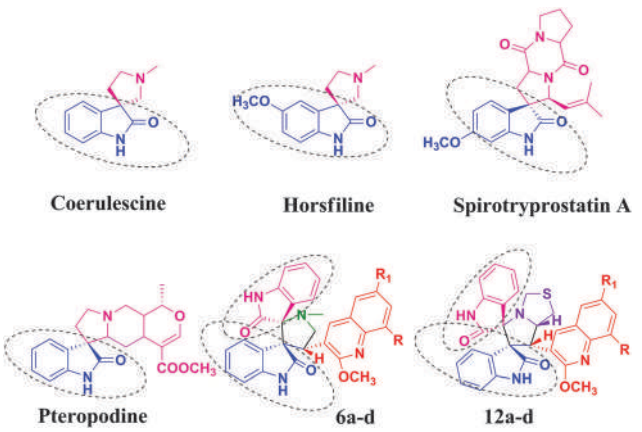

Fig. 1 Biologically active spiro-pyrrolidinyl oxindole core comprising natural products and the designed quinoline-embedded spirooxindole system.

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Enhanced performance of SnO_2-$Mn_{(1-X)}Cu_{(X)}Fe_2O_4$ gas sensors towards carbon dioxide and oxygen

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ABSTRACT

$Mn_{(1-X)}Cu_{(X)}Fe_2O_4$ nanoparticles with different 'X' values (X = 0, 0.5, 1.0) are synthesized initially by the chemical co-precipitation method and followed by equal (1:1) weight percentages of Cu/$MnFe_2O_4$ are combined with SnO_2. XRD parameters of all the materials are well agreed with the standard JCPDS files and confirm the presence of polycrystalline cubic spinel structure for ferrite materials and tetragonal phase for SnO_2. The addition of SnO_2 on copper substituted manganese ferrite increases the crystalline size and decreases the strain values. Morphological analysis for ferrite material depicts the average particle size is linearly decreased with the decrease in Mn^{2+} concentration. Moreover, the addition of SnO_2 on ferrite materials increases the particle size. VSM analysis exhibits superparamagnetic behaviour for all the samples except SnO_2 and $MnFe_2O_4$. The observed M_s values are diluted with the addition of SnO_2 on ferrite materials. Pure SnO_2 shows a weak paramagnetic behaviour and $MnFe_2O_4$ shows a ferromagnetic nature with the $M_R = 0.318$ emu/g and $H_c = 0.0019$ T. EDAX spectrum for SnO_2, $MnFe_2O_4$, $CuFe_2O_4$ and $Mn_{0.5}Cu_{0.5}Fe_2O_4$ shows the observed stoichiometric ratios for all the samples are in accordance with chemical formulas. The gas sensing properties of $MnFe_2O_4$, $Mn_{0.5}Cu_{0.5}Fe_2O_4$, $CuFe_2O_4$ and SnO_2 added Cu/Mn ferrite materials are studied for O_2 and CO_2. SnO_2-$MnFe_2O_4$ and SnO_2-$Mn_{0.5}Cu_{0.5}Fe_2O_4$ samples under gas sensor test shows better response than pure $MnFe_2O_4$ and $Mn_{0.5}Cu_{0.5}Fe_2O_4$ for both O_2 and CO_2. After gas reduction, the material shows almost a pristine behaviour confirms these materials are suitable for gas sensor application. However, in the case of SnO_2-$CuFe_2O_4$ shows a decrease in trend of gas response when compared to pure copper ferrite.

1. Introduction

Development in the miniaturization of technology to develop high performance solid state gas sensors and to reduce the cost of a device is the demand of new era. Tin oxide (SnO_2) semiconductor sensors are widely used gas sensors for the detection of various pollutant and combustible gases such as CO, NO_2, NH_3, BF_3, CH_4, LPG, CO_2, O_2 and H_2 [1,2]. The advantages of these sensors are high sensitivity, simple design and low weight and cost. Nevertheless there still exist some problems with them for example, the poor selectivity and stability. The sensitivity and selectivity of these sensors can be improved by using suitable additives such as ferrite materials. Currently the gas sensing property for individual nano-ferrite materials are analysed by many research groups because of its higher stability and surface to volume ratio [3–5]. But the main drawbacks to utilize these individual ferrite materials are their high density. On the contrary, in applications for gas sensor devices lower density is required [6]. Hence the combination of these SnO_2 and Mn-Cu ferrite may give a solution for this research problem. Moreover, SnO_2 is a wide band gap nonmagnetic semiconductor oxide which is sensitive to oxygen vacancies and ferrites are highly sensitive anisotropic materials to both oxidizing and reducing gases. Hence an attempt has been made to study the gas sensing properties of SnO_2 in combination with ferrite materials, which reports interesting results.

Addition of Cu with $MnFe_2O_4$ nanomaterials also provides new opportunities for enhancing the properties and performances of gas sensors because of their much surface-to-bulk ratio in nano-materials compared to individual Manganese ferrite nanoparticles

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Review Article

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GREEN ROUTE: AN APPROACH FOR SYNTHESIS OF SILVER AND GOLD NANOPARTICLES

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Abstract

The field of nanotechnology and its applications are the most attractive area of research in modern materials science and biomedical sciences. A large number of physical, chemical, biological and hybrid methods are currently employed to synthesize silver, gold and other metal oxide nanoparticles. The problem with chemical and physical methods is that the synthesis is expensive and possible exploitation of toxic chemical substances. Need of the hour is to develop ecofriendly and cost effective methods for nanoparticles preparation. Synthesis of nanoparticles via biological method has been adopted as a feasible alternative in recent times. This mini review provides petite fine points of biologically synthesized nanoparticles such as silver and gold.

Key word: *Nanoparticles, Silver, Gold, Microbes, Plants*

1. INTRODUCTION

Nanotechnology has dramatically developed as an important field of modern research with potential effects in electronic and medicine and they are the particles with a characteristic size range from 1-100 nm. Nanoparticles are at the leading edge of nanoscience and nanotechnology since, the applications of nanosize materials have increased significantly. Nanoscale materials have been used in chronic disease diagnostics, food industry, pharmaceutical, nanoengineering and nanochemistry to enhance the immobilization and activity of catalysts (Wang, 2006). Recently, green synthesis of nanoparticles has received particular interest in various fields ranging from material science to biotechnology (Loza *et al*., 2014; Shanmugavadivu *et al*., 2014). Green synthesis of nanoparticles from plant extracts is an important branch in biosynthesis reaction. Bulk production of metal nanoparticles was synthesized from several microorganisms, such as yeasts, fungi and bacteria. The synthesis of metal nanoparticles from plant extract has drawn attention recently, because of its economical, eco-friendly and single step technique (Huang *et al*., 2007; Ranjithkumar *et al*., 2013).

Metal oxide nanoparticles which have high specific surface area and a high fraction of surface atoms have been studied extensively because of their unique physico chemical characteristics including magnetic, optical, electronics, catalytic, and antibacterial properties (Catauro *et al*., 2004). The properties of many conventional materials change when they formed from nanoparticles because; nanoparticles have a greater surface area per weight than larger particles. This causes them to be more reactive to certain other molecules. Nanoparticles are effectively a bridge between bulk materials and atomic or molecular structures (Buzea *et al*., 2007).

The present review article depicts attention to the present knowledge regarding the possible of green source such as microorganisms and plant extracts for the biosynthesis silver and gold nanoparticles.

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Transparent with wide band gap InZnO nano thin film: Preparation and characterizations

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ABSTRACT

Novel indium zinc oxide (InZnO) thin film of 100 nm thickness was prepared onto pre-cleaned glass plate by thermal evaporation technique from InZnO nanoparticles. The metal oxide (In–O and Zn–O) bond and In, Zn and O elements present in the films were confirmed by Fourier transform infrared spectroscopy and energy dispersive X-ray spectroscopy. The X-ray diffraction patterns revealed the mixed phase of cubic In_2O_3 and wurzite-hexagonal ZnO structure. SEM images showed smooth surface with uniform distribution of grains (201–240 nm) over the entire film surface. High transparency and low absorption obtained from optical study. The band gap energy was evaluated to be about 3.46–3.55 eV by Tauc's plot. The structure, smooth surface and high transparency with wide band gap energy lead the thermally evaporated InZnO nano thin film to be used for transparent layer in optoelectronic devices in the future.

1. Introduction

Transparent Conducting Oxides (TCOs) are technologically important semiconducting materials with fascinating physical, chemical and electrical properties with a wide range of applications commonly found in everyday life. The utility of thin film based TCOs (In_2O_3, SnO_2, ZnO, ITO, FTO, AZO, IGZO, IZO, etc.) have been significantly increased over the last three to four decades [1–7]. TCOs have been touted as the natural successor material for microelectronic devices, which offer great prospects for the most efficient and cost effective utilization of a wide variety of applications [8]. Among the many kinds of TCOs, ITO is a most effective industrial material presently being used in device fabrications. The majority of known TCOs materials are n-type semiconductors where defects such as oxygen vacancies, impurity substitution and interstitials donate electrons to the conduction band providing charge carriers for the flow of electric current [9,10]. The TCOs thin film with higher transparency in the visible region, wide band gap and good electrical conductivity is realized through oxygen vacancies in the lattice (making it metal rich) resulting in excess conduction electrons. These characteristics are required in various applications dealing with transparent heating elements for air craft and car windows, photovoltaic devices, solar cells, gas sensors and transistors. Along with the electrical properties such as resistivity, mobility and conductivity, the optical properties are important parameters of TCOs.

Good optical properties of semiconductor thin films are very important for optical coatings in optoelectronic devices. Optical characterization of thin film gives information about other physical properties such as band gap energy, band structure and optically active defects, which are essential for different applications. The optical properties depend strongly on preparation and growth conditions such as film thickness, dopant type, annealing temperature or heat treatment and deposition condition [11]. In addition to that, crystallinity, smooth surface morphology and uniform film thickness are playing a major role in thin film for optical devices. Impressively, annealing effect can enhance the crystallinity and grain size of the thin film. Optical properties of thin film are significantly affected by annealing temperature due to increase in crystallinity [8]. Also, annealing often smoothens the surface of a film and makes its thickness more uniform [12]. Homogeneous with smooth surface morphology is very important in order to reduce the optical loss by light scattering and the optical transmission deterioration [13]. The improved surface morphology, minimum optical signal transmission loss and less defects/void formations are essential for utilization as optical coating thin film in optical devices.

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Fabrication of two-dimensional photonic quasi-crystals with 18- and 36-fold by holography for solar application

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Abstract: Holographic lithography has been widely used to the realisation of complex photonic structures such as photonic crystal and quasi-photonic crystals. Dual-beam multi-exposure holographic technique was adopted for the fabrication of 18-fold and 36-fold sub-microscopic rotational symmetric structures; the fabricated photonic quasi-crystals examined by laser diffraction pattern, optical and scanning electron microscopes. Here, the authors have fabricated photonic quasi-crystals in photoresist and the structure was transformed into metal, the transferred structure in metal could act as a substrate/or back reflector for the thin film solar cell. Further work on concentration of solar light by photonic quasi-crystals is progressing.

1 Introduction

A material with a periodic order was different from conventional crystal due to its atomic arrangement was discovered and named a quasi-crystal [1]. A quasi-photonic crystal (QPC) has a rotational symmetry other than those allowed for crystals, i.e. one-, two-, three-, four- and six-fold symmetries and higher rotational symmetry than conventional photonic crystals (PC). It has a long-range order and the long-range order is non-periodic [2–8].

We have fabricated highly rotational symmetric QPC structures by using holography. Depending on the number of laser beams and their arrangements, one can fabricate different symmetries of two-dimensional (2D) and 3D PC and QPC. For example, multi-beam interference of laser beams with single exposure technique [9, 10]. By using three or four beams interference method, one can create 2D hexagonal or square structures [11–13]. Umbrella such as central and side laser beam multiple interference technique and the 4 + 1 configuration has been proposed for the holographic fabrication of 3D PCs [11, 14–17]. Experimentally, five diffracted laser beams generated by using phase masks [18, 19], flat-top prisms [20, 21], two beam interference, four beam interference, special prism and combined holographic gratings as beam splitter (BS) have been involved in the fabrication of PCs by interference holographic lithography [22]. However, by using two beam multi-exposure interference technique [23, 24] has many advantages over the commonly used multi-beam interference technique; such as experimental simplicity, easy fabrication of different structures with long range and high contrast of structures [25] are few examples.

If number of interfering beams is more than six, one can fabricate QPCs [26, 27]. The 8-fold, 10-fold and 12-fold QPC fabrication technique by holographic method reported by many research groups, but a very few groups [28] recently published 18-fold symmetry. The 18- and 36-fold QPCs by using holography two beams multi-exposure method is elaborated here.

The concept of solar concentration by diffraction grating and periodic structures have been reported [29–34], also the solar light absorbance enhancement and improving efficiency of silicon (Si) solar cell by PC [35–37] have been reported. Another class of high rotational symmetric QPC and its pivotal role of enhancement of Si solar cell were reported [38]. Here, we have adopted a dual-beam multi-exposure technique for the fabrication of 18- and 36-fold QPC structures in photoresist (PR) and in metal. Its advantage over other method is of easy replication and low cost for mass production. Hence, we select this technique for the fabrication of QPC and periodicity gets inspected by laser diffraction pattern, optical and scanning electron microscopy. The fabricated periodic structures transferred to metal and the same is used as substrate for the fabrication of PN junction thin film solar cell. The already published works are generally based on Si solar cell efficiency enhancement. Here, we have selected cadmium telluride (CdTe) solar cell for our work. The absorbance enhancement is mainly due to the higher-order rotational symmetry in QPC structures, which leads to the presence of additional, resonant modes, the broadening of existing modes and the reduction of surface reflectance. Our future work is focusing on QPC fabrication in three different substrates such as glass, metal and polycarbonate. On the basis of these structures, solar light absorbance and efficiency enhancement of the solar cell is progressing.

2 Experimental arrangement

A dual-beam multi-exposure holographic experimental arrangement for the fabrication of 2D PCs structures is shown in Fig. 1. A beam of wavelength 442 nm emitted from 100 mW Helium – Cadmium (He-Cd) laser divided into two by variable density beam splitter (BS) and it is used to control the beam ratio. The separated beams are expanded and spatially cleaned by spatial filter SF1 and SF2. Both expanded and spatially cleaned beams are collimated by using lenses L1 and L2. A double-iris and wave plates are used to select two laser beams of the same profile, same polarisation and same intensity. The collimated laser beams to be interfered at photoresist (PR) which is placed in plate holder PH are guided by two front coated aluminium mirrors M1 and M2. The angle between two laser beams is denoted as θ [39] and could be easily controlled by two mirrors M1 and M2. We have used PR for the formation of QPC structures; PRs are light-sensitive organic polymers, which form imaged relief patterns on exposure and development. The exposed areas of positive PR and unexposed areas of negative PR become soluble and dissolve away during the developmental process [40–42].

In this paper, the AZ-4620 positive PR (8 µm thickness) exposed by He–Cd laser with wavelength of 442 nm for the fabrication of QPC, PR is placed in a rotation stage with stepper motor arrangement for precise control of rotation between exposures. The Uniblitz computer control VCM D1 (model number) shutter driver and LS series model high-speed electronic shutter is used to organise the accurate laser exposures. The

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A STUDY ON THE FINANCIAL PERFORMANCE OF SELECTED INDIAN CHEMICAL INDUSTRIES A POST MERGER PERFORMANCE ANALYSIS

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Abstract
India has significant presence in production of basic organic and inorganic chemicals, pesticides, paints, dyestuffs and intermediates, petrochemicals, fine and specialty chemicals, cosmetic and toiletry product segments. The Indian chemical sector accounts for 13-14% of total exports and 8-9% of total imports of India. In terms of volume of production, it is the twelfth-largest in the world and the third-largest in Asia, after China and Japan. Despite its large size and significant GDP contribution, Indian chemicals industry represents only around 3% of global chemical. Currently the per capita consumption of products of the Indian chemical industry is one-tenth of the world average, which reflects the huge potential for further growth. The Indian advantage lies in the manufacturing of basic chemicals that are also known as commodity chemicals that account for about 57% of the total domestic chemical sector.

Chemicals are a part of every aspect of human life, right from the food we eat to the clothes we wear to the cars we drive. Chemical industry contributes significantly to improving the quality of life through breakthrough innovations enabling pure drinking water, faster medical treatment, stronger homes and greener fuels. The chemical industry is critical for the economic development of any country, providing products and enabling technical solutions in virtually all sectors of the economy.

1.1 INTRODUCTION

India has significant presence in production of basic organic and inorganic chemicals, pesticides, paints, dyestuffs and intermediates, petrochemicals, fine and specialty chemicals, cosmetic and toiletry product segments. The Indian chemical sector accounts for 13-14% of total exports and 8-9% of total imports of India. In terms of volume of production, it is the twelfth-largest in the world and the third-largest in Asia, after China and Japan. Despite its large size and significant GDP contribution, Indian chemicals industry represents only around 3% of global chemical.

MERGER AND ACQUISITION IN INDIA

The post-war period is regarded as an era of M&A. Large number of M&A occurred in industries like jute, cotton textiles, sugar, insurance, banking, electricity and tea plantation. It has been found that, although there were a large number of M&As in the early post independence period, the anti-big government policies and regulations of the 1960s and 1970s seriously deterred M&As.

1.2 Need of the Study

Corporate India is facing hyper competition both with the domestic market and also in its export markets. In the context of Liberalization and Globalization of the economy, the changes required. In the functioning of corporate need to be vast. It becomes imperative for all the corporations to review their alignment of their everlasting desire for growth and changes. Merger &Acquisition are the inorganic growth strategies which gave got its significance in today's corporate world due to intensively competitive business environment. Merger &Acquisition is considered as one of the strategies for growth.

1.3 Statement of the Problem

The development of industries depends on several factors such as finance, personnel, technology, quality of the product and marketing. Out of these, financial and operating aspects assume a significant role in determining the growth of industries. In this hyper competitive environment one necessity for change and creativity to achieve Merger and acquisition are not totally new to the Indian economy.

1.4 Objectives of The Study

1. To observe the profitability and liquidity position of the selected Industries.
2. To determine the factor influencing the liquidity of the position of Indian Chemical Industries.
3. To determine the value of Total shareholder Return associating with pre and post merger period in selected Indian chemical industries

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CONSUMER PERCEPTION TOWARDS FMCG

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Abstract
Fast Moving Consumer Goods is a classification that refers to a wide range of frequently purchased consumer products including toiletries, soaps, cosmetics, teeth cleaning products, shaving products, detergents, and other non-durables such as glassware, bulbs, batteries, paper products and plastic goods, such as buckets. 'Fast moving' is in opposition to consumer durables such as kitchen appliances that are generally replaced less than once in a year. The category may include pharmaceuticals, consumer electronics and packaged food products and drinks, although these are often categorized separately. The term Consumer Packaged Goods (CPG) is used interchangeably with Fast Moving Consumer Goods (FMCG).

INTRODUCTION

The growth potential for FMCG companies looks promising over the long term horizon, as per the capital consumption of almost all products in the country is amongst the lowest in the world. As per the Consumer Survey by KSA – Techno Park, of the total consumption expenditure, almost 40% and 8% was accounted by groceries and personal care products respectively. Rapid urbanization, increased literacy and rising per capita income are the key growth drivers for the sector.

Around 45% of the population in India is below 20 years of age and the proportion of the young population is expected to increase in the next five years. Aspiration levels, in this age group have been fuelled by greater media exposure, unleashing a latent demand with more money and a new mindset. In this backdrop, industry estimate suggest that the industry could triple in value by 2015.In our view, testing times for the FMCG sector are over and driving rural penetration will be the key to keep-going forward. Due to infrastructure constraints (this influences the cost-effectiveness of the supply chain), companies were unable to grow faster.

STATEMENT OF THE PROBLEM

Fast moving consumer good offers various products under the famous brands the products falling under FMCG sector are having recognitions world at a large. From supermarket or from advertisements on television the brands that make up this sector are the high profile once, which are known and loved by all. The consumers are always in need of buying the products created by FMCG companies. As FMCG industry is bigger and better industry. it has a long history of delivering what consumers want. In this back ground an attempt is made to conduct a research study for building knowledge have. Hence the present study.

REVIEW OF LITERATURE

T. Mamatha (2008) says that consumer behavior is a very complex phenomenon, which needs more efforts to understand, explain and predict. In order to get a clear understanding of the same, every marketer should realize that consumer behavior iin fact, an assumption every marketing manager must make, if he plans to market on any basis other than hit-or-miss. Although some individuals find it difficult to make this 5 assumption, one must agree that behavior is not so erratic or mysterious that it defies explanation.

Study of rural marketing in the present scenario in India (2009) While we all accept that the heart of India lives in its villages and the Indian rural market with its vast size and demand base offers great opportunities to marketers, we tend to conclude that the purse does not stay with them. Nothing can be far from truth. Rural marketing involves addressing around 700 million potential consumers, over 40 per cent of the Indian middle-class, and about half the country's disposable income.

As per concern of my research, it is a detail study of different FMCG products used by rural consumers. It will provide detail information about consumers" preferences towards a good number of FMCG products which is too unique and different from those above researches.

OBJECTIVES

1. To study the purchase pattern and post purchase behavior of consumers.
2. To analyze the problems faced by the consumer while using FMCG

"Application of Enzymes in Processing of Hemp Cotton Fabrics"

R. Umamaheswari and Dr.S. Amsamani

Abstract— *Environmental considerations are now becoming important factors during the selection of consumer goods including textiles all over the world. The acute ecological crisis has caused the environmentalists to 'go back to nature'. In the recent years considerable attention is being given to the development and utilization of natural fibres. Cotton and cotton blended fabrics are subjected to various wet processing treatments to enhance its value. Textile wet processing involves the maximum possibilities of polluting chemicals, and dyestuffs which enhance the quality contain toxic and hazardous substances. Reduction in use of the energy, water and other raw materials along with waste minimization and elimination wherever possible, should be highest priority. Application of biotechnology in textile wet processing opens up new horizon towards environmentally friendly benign technology. The use of enzymes in the chemical processing of textiles is gaining wider recognition because of their non-toxic; eco-friendly and biodegradable characteristics. They are the best alternative of hazardous and corrosive chemicals.*

Hence a study was carried out with the following objectives:

- *Obtain suitable blending composition of hemp cotton yarns.*
- *Convert the yarn into suitable fabric through weaving.*
- *Extract the enzymes from suitable microbial source for desizing.*
- *Subjecting the woven fabric to suitable processing namely desizing.*
- *Evaluate the original and processed samples*

I. INTRODUCTION

Global trends towards sustainable development have bought natural, renewable, bio degradable raw material into focus .There is a strong public perception of anything "Natural" being more eco-friendly than something synthetic or manmade and this certainly extends to the fibers and yarns employed in clothing (Wilson - 2009).Hemp fibers are very versatile, as they provide superior durability. Hemp textiles are extremely versatile – they are used in the production of clothing, shoes, apparel, canvas, rugs and upholstery.

The main environmental impacts of the textile chain derive from so called ' Wet processing' mainly implemented by the textile finishing industry. These phases in wet processing fabrics with chemical of liquor both often requires several washing , rinsing and dry steps , generating significant waste water (Patel 2008).

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