KONGUNADU ARTS AND SCIENCE COLLEGE

(Autonomous)

Coimbatore – 641 029

COLLABORATIVE ACTIVITIES

FOR

RESEARCH, FACULTY EXCHANGE & STUDENT EXCHANGE

Academic Year 2018-2019

SHAPE CONTROLLED SYNTHESIS OF DEXTRAN SULFATE STABILIZED SILVER NANOPARTICLES: BIOCOMPATIBILITY AND ANTICANCER ACTIVITY

SHARMILA. C[a*], PRABHAVATHI. V[a], DINESH. M[b], RANJITH KUMAR. R [c], CHANDAR SHEKAR. B[d*]

[a]*Department of Physics, PSGR Krishnammal College for Women, Coimbatore-641004, Tamil Nadu. India.*

[b]*Biology Division, Department of Applied Sciences, Higher College of Technology, Muscat-133, Sultanate of Oman.*

[c]*Department of Biotechnology, Kongunadu Arts and Science College, G.N Mills, Coimbatore-641 029, Tamil Nadu, India.*

[d]*Department of Physics, Kongunadu Arts and Science College, G.N Mills, Coimbatore-641 029, Tamil Nadu, India.*

***Corresponding Authors (Email)**: sharmilakshu@gmail.com, sharmilac@psgrkcw.ac.in

ABSTRACT

Three Dimensional button, flower and sphere shaped microstructure of silver nanoparticles dispersed in dextran sulfate matrix were synthesized using silver nitrate, trisodium citrate and dextran sulfate. Three different amount of dextran sulfate (2 drops, 10 drops and 15 drops) were added to each 10ml of silver nanoparticles to make three different solution mixtures, which was then subjected to different characterization techniques. The XRD study of flower shaped dextran sulfate stabilized silver nanoparticles showed a diffraction pattern corresponding to face centered cubic structure of Ag crystals. The FESEM image shows a well defined three dimensional button shaped microstructure for 2 drops of dextran sulfate, flower shaped microstructure for 10 drops of dextran sulfate and sphere shaped microstructure for 15 drops of dextran sulfate. Based on the morphological structure of the synthesized nanoparticle the absorption property was discussed, the absorption band varied from 429 nm to 434 nm. The nanoparticles prepared using dextran sulfate of high concentration (15 drops) shows a blue shift in absorbance spectra, indicating smaller size of AgNPs with high absorbance property. The results reveal that the surface morphology affects the absorption behavior of the nanoparticles. The results of cytotoxicity assay against human vero cell lines revealed that flower shaped dextran stabilized AgNPs shows ≥ 90% cell viability indicating the biocompatibility of the nanoparticles. The In-vitro anticancer activity of the synthesized Ag-DS nanoparticles against human breast cancer cell line MCF-7, was studied. The results of the present study indicated that the Ag-DS nanoparticles can be a potent anticancer agent.

Synthesis and Characterization of Porous Calcium Oxide Nanoparticles (CaO NPS)

A.S.Balaganesh, R. Sengodan, R. Ranjithkumar, B. Chandarshekar

Abstract: ***Calcium oxide nanoparticles (CaO NPs) gain great value in the areas of energy storage and drug delivery systems. Due to good porosity it finds its part in storage systems and its biocompatibility earns it a good value in drug delivery and gene transfection. In this present work, calcium oxide nanoparticles are prepared by means of simple precipitation method. Thus prepared particles are subjected to morphological, size and structural analyses. The X-ray diffraction studies revealed the polycrystalline nature of CaO nanoparticles. The SAED pattern confirms the polycrystalline nature. Transmission electron microscope shows that the size of the particles varies between 80 nm to 190 nm which is in good agreement with particle size analysis results.***

Keywords: CaO NPs, Precipitation, XRD, TEM

I. INTRODUCTION

Application in various fields like catalysis, optoelectronics, sensors and environmental remediation [1–3] made nanoparticles a substantial one in production. Calcium oxide (CaO) is one of the promising metal oxide having many applications such as catalyst [4], dopant added to modify the electric and dielectric properties [5], remediation agent for toxic wastes [6, 7], for CO_2 capture [8–10], desulfurization of flue gas and emission control agent in pollution [11], purification of hot gases [12] etc. Calcium oxide is a high volume chemical, finds applications in numerous industries. In addition, calcium oxide is plenty in nature, inexpensive and easy to produce. Compounds and substances such as citric acid, glucose and certain dyes are purified using calcium oxide, before further refinement [13, 14].

Calcium oxide is used for balancing out acidic soil and is used in areas where rainfall washes the calcium from the soil. Calcium oxide finds its part in electronics as a desiccant in LEDs [13]. Drugs have grown beyond therapeutic agents to growth factors and have

Revised Version Manuscript Received on December, 2018.

A.S.Balaganesh, Nanotechnology Research Lab, Department of Physics, Kongunadu Arts and Science College,Coimbatore, Tamilnadu, India.

R. Sengodan, Department of Science and Humanities, Physics division, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India.

R. Ranjithkumar, Department of Biotechnology, Kongunadu Arts and Science College, Coimbatore, Tamilnadu, India.

B. Chandarshekar, Nanotechnology Research Lab, Department of Physics, Kongunadu Arts and Science College, Coimbatore, Tamilnadu, India

turned more quantized. Calcium oxide nanoparticles with its nano structures are very feasible to the applications in Drug Delivery Systems [15]. It is also used industrially as a dehydrating agent in the creation of steel, an absorbent, as a water softener, as a potential hydrogen regulator for waste water and in fertilizers [16]. The properties and applications of nanoparticles depends on their size and morphology [5]. The effects on the size, shape, uniformity and properties of the nanoparticles are by high temperature and nature of solvents [17–19]. Solution-phase methods provide a large degree of control over the nanoparticles prepared [5]. CaO nanoparticles are prepared by various methods such as sol-gel [12], precipitation [18], hydrogen plasma-metal reaction [11], sonochemical synthesis [5], thermal-decomposition [6] etc.

II. EXPERIMENTALTECHNIQUES

A. Preparation of CaO NPs

Initially, 3g of calcium hydroxide ($Ca(OH)_2$) was dissolved in 12.5 ml of ethyleneglycol and stirred vigorously and then 1 g of sodium hydroxide (NaOH) was added into the mixture. The solution was left to settle down for 5 hours after 10 minutes of sonication. The precipitate was filtered and obtained precipitate has been repeatedly washed with deionized water for 5 times and then calcined in 100°C, subsequently. Finally, calcium oxide nanoparticles of different size were obtained by calcining at 800°C. The chemical reaction can be written as:

$$2Ca(OH)_2 + CH_2OHCH_2OH + 2NaOH \rightarrow 2CaO + 2NaCO_3 + 10H$$

B. Characterization

FTIR analysis was carried out by using [THERMOSCIENTIFIC Nicolet IR10] spectrometer. The XRD was recorded by using [RIGAKU Ultima IV] X-ray diffractometer. The surface morphology of CaO NPs was observed by using [JEOL JSM – 6390LV] scanning electron microscope, composition was analysed by using EDAX [JEOL JSM – 6390LV]. Size, shape and morphology were studied by using Transmission Electron Microscope [JEOL JEM 2100].

III. RESULTS AND DISCUSSION

Figure 1 shows the FTIR spectrum of CaO NPs. The broad absorption band around 1480 cm^{-1} and 3600 cm^{-1} have attribution to the surface of the sample containing water molecules, due to way of handling while spectrum recording [21]. The carbonation of CaO nanoparticles are observed in 1400–1500cm^{-1} broad band and the narrow band around 750$cm^{-1}$is due to C–O bond [6, 11, 17]. The characteristic vibration of

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From

Dr. P. Sundararaj, D. Sc.,
Assistant Professor
Unit of Nematology
Department of Zoology
Bharathiar University (BU),
Coimbatore – 641046.

Coimbatore
11.10.2018

To

The Secretary and Director,
Kongunadu Arts and Science College (KASC),
Coimbatore – 641029.

Respected Madam,

Sub: Collaborative research work between Dept. of Zoology, BU and Dept. of Biotechnology, KASC – reg.

A. Mohankumar, bearer of this letter, pursuing his Ph.D., program under my supervision needs to perform gene expression analysis. In this regard, we wish to make collaboration with Dr. V. Bhuvaneshwari, Assistant Professor and Head, Department of Biotechnology, KASC, Coimbatore. Hence, I request you to provide the necessary facilities for preforming the above. I assure that the help rendered by KASC and Department of Biotechnology, KASC will be duly acknowledged in the research work, and an authorship will be given for the same.

Thanking you

Yours faithfully,

(Dr. P. Sundararaj)

Dr. P. Sundararaj, M.Sc.,M.Phil.,Ph.D.,D.Sc.,
Assistant Professor, Unit of Plant Protection
Department of Zoology
Bharathiar University
Coimbatore - 641 046. India.

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UNIVERSITY OF EXETER

ENVIRONMENT AND SUSTAINABILITY INSTITUTE

Cornwall Campus
Penryn
Cornwall
UK TR10 9EZ

Date: 15th February 2019

To
The Secretary and Director,
Kongunadu Arts and Science College,
G.N.Mills (post),
Coimbatore-641 029,
Tamil Nadu, India

Dear Madam,

I extend my sincere thanks to the Management of Kongunadu Arts and Science College and Dr. K. Muthukumar, Dr. V. Bhuvaneshwari and Dr. R. Amsaveni for their excellent contributions in organizing Indo-UK workshop on Knowledge transfer on the sustainability of the innovative wastewater treatment technologies to India I and II as a part of ESRC – Impact Acceleration Account project. This workshop helped in understanding the Noyyal river-based issues and remediation technologies and knowledge transfer between Indian and UK academics and industries. Dr. K. Muthukumar, Dr. V. Bhuvaneshwari and Dr. R. Amsaveni acted as project partners for this project and shared their research knowledge for collaborative research with University of Exeter. I wish your association in future projects towards socioeconomic aspects of dye effluent industry and its remediation issues.

We look forward for further collaborative research projects.

Yours sincerely,

Dr. Senthilarasu Sundaram
Lecturer, Renewable Energy

T+44(0)1326 259486 | **E**s.sundaram@exeter.ac.uk

University of Exeter
Environment and Sustainability Institute (ESI)

University of Exeter, Penryn, TR10 9FE, Cornwall, United Kingdom
http://www.exeter.ac.uk/esi/people/academicandhonorary/sundaram/

Department of Environmental Studies
पर्यावरणीय अध्ययन विभाग
University of Delhi, Delhi-110 007
दिल्ली विश्वविद्यालय, दिल्ली - ११० ००७

Dr. Vandana Mishra
Assistant Professor (Stage-III)

28 February 2019

Dr. V. Bhuvaneshwari
Head, PG & Research Department of Biotechnology
Kongunadu Arts and Science College
(College of Excellence, UGC)
G. N. Mills, Coimbatore - 641 029

Dear Dr Bhuvaneshwari:

Thank you very much for agreeing to serve as an expert member to participate in an *India-UK Workshop on* **"Knowledge transfer on the sustainability of innovative wastewater treatment technologies to India: Circular Economy concepts & Graphene related technologies"** being organized at the University of Delhi on 06 March 2019. The scientists from University of Exeter (UK), Kongunadu Art and Science College (Tamilnadu), Tamilnadu University of Agriculture, University of Jadavpur (West Bengal) and Indian Institute of Technology (Chennai), industrial partner, and NGOs are jointly organizing the Workshop. We again extend an invitation to you to join in the Workshop and deliver a lecture on "*Reduction in cost using Graphene based nanomembrane for waste water treatment.*" Your participation would be useful to develop strong linkage among institutes and industries from India and UK. The accommodation would be available in the University of Delhi Guest House.

Looking forward to meeting you and having a fruitful interactions.

Thanking you

Sincerely

Vandana

(Vandana Mishra)

Tele: 2766 7725, **Ext.** 1625; **Cell:** 9871260287

पर्यावरणीय अध्ययन विभाग
DEPARTMENT OF ENVIRONMENTAL STUDIES
दिल्ली विश्वविद्यालय
University of Delhi
दिल्ली-११०००७ / Delhi-110007

Ref. No. : DES/..... *Dated.....*

06 March 2019

Attendance Certificate

This is to certify that **Dr V. Bhuvaneshwari**, Department of Biotechnology, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu attended and successfully participated as a collaborator and resource person in the India-UK Workshop on "**Knowledge Transfer on the Sustainability of Innovative Wastewater Treatment Technologies to India: Circular Economy Concepts & Graphene Related Technologies**" organized on 06 March 2019 at the Department of Environmental Studies, University of Delhi.

Vandana

(Dr Vandana Mishra)
(Coordinator)
9871260287

Tel. No. : 011-27667586, 27667125, 27667725 Extn. 1601, Telefax : 011-27667125

Re: Invitation to deliver a lecture

From: Prof.S. Balakumar (balasuga@yahoo.com)

To: bhuvana_bt@yahoo.co.in

Date: Thursday, 14 March, 2019, 11:00 am IST

Dear Dr Bhuvaneswari

Greetings from NCNSNT, Chennai
On behalf of the organisers, it is my pleasure to invite you for the UK-India workshop on wastewater treatment which will be on 15th March 2019 in Madras University and to present "Performance, water quality and enviro-economic investigations on solar distillation treatment of reverse osmosis reject and sewage water".

Look forward to listen your valuable lecture.

Thanks & regards

Bala.....

Prof. S. Balakumar, Ph.D.,FRSC, FASCh,
Director
National Centre for Nanoscience and Nanotechnology,
University of Madras, Guindy Campus, Chennai- 600 025
Phone: 91-44-22202749 (direct) 22202720 (off); Mobile: 9442617848
E-mails: balasuga@yahoo.com; balakumar@unom.ac.in
https://sites.google.com/view/prof-balakumar-research-group/home

Associate Editor,Chemical Papers Journal (springer)
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2.Journal of Processing and Application of Ceramics: (www.tf.uns.ac.rs/publikacije/PAC/)
3.Soft Nanoscience Letters, USA (http://www.scirp.org/journal/snl/)
4. Nanoscience and Nanotechnology-Asia
5. Journal of Materials Nanoscience
Associate Editor, RSC Advances Journal (RSC, UK)- 2015-2018
"Work for the joy of work"

On Thursday, 14 March 2019, 10:53:39 am GMT+5:30, Prof.S. Balakumar <balasuga@yahoo.com> wrote:

Dear Dr Muthukumar
Greetings from NCNSNT, Chennai
On behalf of the organisers, it is my pleasure to invite you for the UK-India workshop on wastewater treatment which will be on 15th March 2019 in Madras University and to present "Performance, water quality and enviro-economic investigations on solar distillation treatment of reverse osmosis reject and sewage water".

Look forward to listen your valuable lecture.

Thanks & regards

Bala.....

Prof. S. Balakumar, Ph.D.,FRSC, FASCh,
Director
National Centre for Nanoscience and Nanotechnology,
University of Madras, Guindy Campus, Chennai- 600 025
Phone: 91-44-22202749 (direct) 22202720 (off); Mobile: 9442617848
E-mails: balasuga@yahoo.com; balakumar@unom.ac.in
https://sites.google.com/view/prof-balakumar-research-group/home

Associate Editor,Chemical Papers Journal (springer)
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2.Journal of Processing and Application of Ceramics: (www.tf.uns.ac.rs/publikacije/PAC/)
3.Soft Nanoscience Letters, USA (http://www.scirp.org/journal/snl/)
4. Nanoscience and Nanotechnology-Asia
5. Journal of Materials Nanoscience
Associate Editor, RSC Advances Journal (RSC, UK)- 2015-2018
"Work for the joy of work"

UNIVERSITY OF MADRAS

[Established under the Act of Incorporation XXVII of 1857 – Madras University Act 1923]
[State University]
NATIONAL CENTRE FOR NANOSCIENCE AND NANOTECHNOLOGY
Maraimalai Campus, Chennai – 600 025, INDIA
Ph: +91-44-22202749(Direct); 22202720 (O); Fax: +91-44-22352494/22353309
Email: balasuga@yahoo.com

Prof. S. BALAKUMAR, *FRSC.*
DIRECTOR

15-03-2019

To whom it may concern

This is to certify that Dr./~~Mr./Mrs.~~ V. BHUVANESHWARI, HEAD IN BIOTECHNOLOGY Kongunadu Arts & Science College, Cbe participated and delivered a lecture at "India-UK Workshop Knowledge Transfer on the Sustainability of Innovative Water Quality Monitoring Technologies to India: Circular Economy, Graphene related technologies" on 15th March 2019 at National Centre for Nanoscience and Nanotechnology, University of Madras, Chennai -25.

Director

KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)

[Re-accredited by NAAC with 'A' Grade - 3.64 CGPA out of 4 (3rd Cycle)
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GNANAMBIKAI MILLS (P.O.), COIMBATORE - 641029. TAMIL NADU, INDIA.

Dr. V. BALASUBRAMANIAM, M.Sc., Ph.D.,
PRINCIPAL

✆ Office : 0422-2642095 Per. : 0422-2647633
Fax. : 0422-2644452
E-mail : principal@kongunaducollege.ac.in
Website : www.kongunaducollege.ac.in

12th February 2019

To
Dr. Senthilarasu Sundaram
Lecturer in Renewable Energy
Environment and Sustainability Institute
University of Exeter
Penryn Campus
Penryn
United Kingdom
TR10 9FE

Letter to Support for UKRI-EPSRC Global Challenges Research Fund (GCRF) Application

Dear Dr. Sundaram,

Hereby I confirm our participation in the proposal entitled "*Remote Sensing and Data-driven models to Improve Water Quality Control Policies*". We are happy to extend our collaboration for this project and as an in-kind contribution we will provide the following:

- Previous archived datasets on local water quality samples in South Indian rivers and ground water wells
- Data for biological samples analysis for the water quality in South Indian context
- Capturing images at local sites with previous incidents of hazardous elements release into the water and environment to help geo-statistical model development in WP3
- We shall also help in the policy advice in WP4 in the context of South Indian rural and urban areas in consultation with local Government, pollution control boards, farmers, common people and other stakeholders
- Two PhD students are currently working on water quality projects in our Institution. We shall provide collaborative supports in WP3 through these two PhD students via jointly co-authored paper, sharing research ideas, tools, and methods to make this project a great success to improve the water quality in our country and especially in South India
- We are happy to travel to Jadavpur University, Kolkata for the planned knowledge transfer workshop forthe invited talks and participate in the discussions to advice the central Government to shape a nationwide uniform water control policy

..2

- We also express our collaborative support with the East Indian (Jadavpur University), Bangladeshi and UK (University of Exeter) partners involved in the project to bring together a geographically distributed water control policies, data monitoring and create global and sustainable impact on similar problems faced by the developing countries.

Finally, I confirm that Kongunadu Arts and Science Collegewill fully support the above-mentioned project towards data collection in South India and participate in the discussion for water control policy and collaborations with other partners. Our Staff Dr. K. Muthukumar and Dr. V. Bhuvaneswari from our institution is having active cooperation with you and will be the contact person for you in this project.

Thanks and regards,

KONGUNADU ARTS & SCIENCE COLLEGE COIMBATORE 641 029

PRINCIPAL

PRINCIPAL
KONGUNADU ARTS & SCIENCE COLLEGE
COIMBATORE-641 029.

✆ : 0424 - 2244101
Fax : 0424 - 2244102
e-mail: vcwprincipal@rediffmail.com
website: vcw.ac.in

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Thindal, Erode - 638 012, Tamilnadu.

Dr.(Mrs.) N. MARAGATHAM, M.Sc., M.Phil., Ph.D., M.A.(G&C), D.A.P., PGDCA
Principal

Erode
14-02-2019

To
The Head of the Department,
Department of Biotechnology,
Kongunadu Arts and Science College,
Coimbatore.

Sir,

Sub : Requisition to visit your laboratary – Reg.

As per the telephonic conversation with you, two of our staff members and II B.Sc. Computer Science students (44 in Nos.) have planned to visit your organization at 10.00 am on 15.02.2019. So, kindly do the needful.

Thank you

14.2.2019

Principal

PRINCIPAL
VELLALAR COLLEGE FOR WOMEN
(AUTONOMOUS)
ERODE - 12.

VELLALAR COLLEGE FOR WOMEN(AUTONOMOUS) ERODE-12

Encl: Students and Faculty Name list

Department of Computer Science

Vellalar College for Women

Students Name list

1 ABINAYA.T
2 ALMASBANU.M
3 ANUSHYA.S
4 BABY SHALINI.R
5 BANUMATHI.R
6 DEEPIKA.M
7 DEEPIKA.M
8 DHARANIPRIYA.B
9 DIVYA.C
10 DIVYA.S
11 DIVYA BHARATHI.S
12 GOKULAPRIYA.M
13 GOMATHI.P
14 HEMALATHA.VT
15 INDHUMATHI.S
16 INDHUMATHI.S
17 KARTHIKA.B
18 KARTHIKA.S
19 KIRUTHIKA.S
20 KRISHNAVENI.K
21 LOGAPRIYA.N
22 NIJITHA.T
23 PAVITHRA.L
24 PAVITHRA.S
25 POOJA.M
26 PRABITHA.K
27 PREETHI.J
28 PRIYADHARSHINI.M
29 SASIKALA.D
30 SHALINI.K
31 SHALINI.V
32 SHARMILA.M
33 SHARMILA DEVI.S
34 SIVA SANKARI.D
35 SONA.MG
36 SOWMIYA.P
37 SOWMIYA.R
38 SWETHA.N
39 THARANI.E
40 VAISALI.G
41 VARSHA.L
42 VIKASHINI.K
43 VINOTHINI.P
44 YUVANA PRITHIYA.S
45 KALPANA S

Faculty Name list

1) Dr. K. SRIDEVI, ASSITANT PROFESSOR

2) MS. R. SUGANYA, ASSITANT PROFESSOR

14.2.2019

TO WHOM IT MAY CONCERN

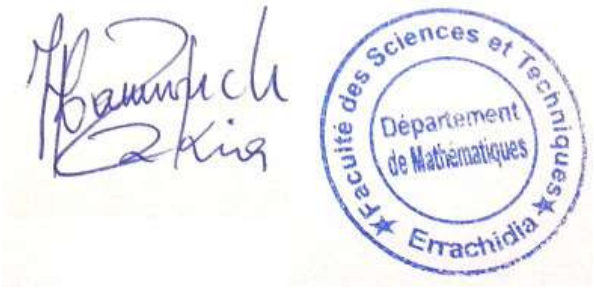
This letter to certify that **Dr.C. Ravichandran**, Assistant Professor, Post Graduate and Research Department of Mathematics, Kongunadu Arts and Science College (Autonomous), Coimbatore, Tamil Nadu, India has been working on joint research works in the area of "Fractional differential equations" since May 2018, so far the following joint paper is developed with his collaboration. One paper entitled "A new investigation on fractional-ordered neutral differential systems with state-dependent delay" is submitted and now under review in the journal **"International Journal of Nonlinear Sciences and Numerical Simulation (Indexed by Science Citation Index Expanded and Scopus - DE GRUYTER Publications)".**

Further any questions or clarifications, you may contact me at z.hammouch@fste.umi.ac.ma (or) mobile phone +212656-188588

Sincerely yours,

Errachidia, 27 th March 2019

Professor Dr. Zakia Hammouch
Head of Research Team : E3MI
Department of Mathematics
Moulay Ismail University, Morocco.
E-mail : z.hammouch@fste.umi.ac.ma
Tel : +212 656 18 85 88



ÇANKAYA UNIVERSITY
DEPARTMENT OF MATHEMATICS

TO WHOM IT MAY CONCERN

This letter to certify that **Dr.C. Ravichandran**, Assistant Professor, Post Graduate and Research Department of Mathematics, Kongunadu Arts and Science College (Autonomous), Coimbatore, Tamil Nadu, India has been working on joint research works in the area of **"Fractional differential equations"** since November 2018, so far the following joint paper is developed with his collaboration. One paper entitled **"New results on existence in the framework of Atangana-Baleanu derivative for fractional integro-differential equations"** is submitted to the journal **"Chaos, Solitons & Fractals (Indexed by Science Citation Index and Scopus - Elsevier Publications)"**.

Further any questions or clarifications, you may contact me at **fahd@cankaya.edu.tr** or mobile phone +905326518721.

Sincerely yours,

ÇANKAYA UNIVERSITY
Faculty of Arts and Sciences
Department of Mathematics
Yukarıyurtçu Mah. Mimar Sinan Cad. No:4
06790, Etimesgut-ANKARA/TURKEY

Professor Dr. Fahd JARAD
Head of the Department
Department of Mathematics,
Cankaya University
Ankara 06790,
Turkey.

COMBINATORICS, GRAPH THEORY AND NETWORK TOPOLOGY (CGANT)
RESEARCH GROUP, THE UNIVERSITY OF JEMBER
JEMBER, EAST JAVA, INDONESIA
Jl. Kalimantan No.37, Krajan Timur, Sumbersari, Kabupaten Jember, Jawa Timur 68121,
Province: East Java, Country: Indonesia, Phone: (0331) 330224

March 22, 2019

Dr. M. Venkatachalam
Assistant Professor of Mathematics
Kongunadu Arts and Science College
Coimbatore – 641 029
Tamil Nadu, India.

TO WHOM IT MAY CONCERN

This letter to certify that **Dr. M. Venkatachalam**, Assistant Professor of Mathematics, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu, India has been working on joint research with the research group **"Combinatorics, Graph Theory and Network Topology"**, the University of Jember, Jember, Indonesia since January 2018, so far the following list of joint papers are developed with his collaboration. One paper entitled "On r-dynamic coloring of the family of tadpole graphs" is accepted by the journal **"Ars Combinatoria (Indexed by SCIE and Scopus)"** and it will be appeared in volume 148, January 2020.

No	Title	Authors
1.	On r-dynamic coloring of the family of tadpole graphs	A.I. Kristiana, G. Nandini, **M. Venkatachalam**, M.I. Utoyo and S. Gowri
2.	On packing coloring of graphs and its operation	Dafik, A.I. Kristiana, **M. Venkatachalam**, I.H. Agustin, and M. Barani
3.	On the r-dynamic chromatic number of Corona Graph by path	A.I. Kristiana, Dafik, T. Deepa, **M. Venkatachalam**, I.H. Agustin, and M.I. Utoyo

4.	On *r*– Dynamic Coloring of Edge Corronation By Path	Dafik, G. Nandini and **M. Venkatachalam**, A.I. Kristiana, Surahmat
5.	On r-dynamic coloring of the line graph of closed helm graphs	**M. Venkatachalam**, S. Gowri, and G. Nandini, Dafik
6.	Local Irregularity vertex coloring of graphs	A.I. Kristiana, Dafik, M.I. Utoyo, Slamin, R. Alfarisi, I.H. Agustin, and **M. Venkatachalam**

Further any questions or clarifications, you may contact me at d.dafik@unej.ac.id or mobile phone +6282113035007.

Sincerely yours,

Professor Dafik
d.dafik@unej.ac.id
Scopus Author ID: 24281263600
Professor, Dean of FKIP the University of Jember, and
The Head of Combinatorics, Graph Theory and Network Topology Research Group
The Department of Mathematics Education Postgraduate
The University of Jember, Jember 68121- Jl. Kalimantan no 37 Kampus Tegal Boto
East Java, Indonesia

RSC Advances

ARTICLE

Impact of Cu doping on the structural, morphological and optical activity of V_2O_5nanorods for photodiode fabrication and its characteristics

R. Thangarasu[a], B. Babu[b], N. Senthil Kumar[c], Mon-Shu Ho[b], O.N. Balasundaram[a,*], T. Elangovan[d]

Received 17th September 2018,
Accepted 18th April 2019

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In this paper, we report the wet chemical precipitation method used to synthesis of pure and Cu doped V_2O_5 nanorods ($Cu_xV_2O_5$where x= 3, 5 and 7 at. %) with different doping concentration, followed by annealed at 600°C and characterized through the several techniques. Indeed, a growth mechanism explained morphological evolution under the experimental condition is also proposed. The XRD patterns revealed that all the studied samples consist of a single V_2O_5 phase and well crystallized with preferential orientation towards (200) direction.The presence of intrinsic defects and internal stress in the lattice structure of $Cu_xV_2O_5$ samples have been substantiated by the detailed analysis of the XRD. Away from this doping level, there has been assessment of identical tiny peaks attributed to the formation of a secondary phase of CuO. SEM images confirmed that the presence of agglomerated particles on the surfaces; the coverage increased with the Cu doping level. XPS spectral analysis show that Cu in V^{5+} matrix exists mainly in the Cu^{2+} state on the surface. The appearance of satellite peaks in the Cu 2p spectra, however, provided definitive evidence for the presence of Cu^{2+} ions in these studied samples as well.Doping induced PL quenching has been observed due to the absorption of energy from the defect emission in the V^{5+} lattice by Cu^{2+} ions. We proposed a cost effective, less complicated and an effective way of synthesizing pure and doped samples in colloidal form deposit by the nebulizer spray technique on p-Si to established junction diodes with enhanced optoelectronic properties.

1 Introduction

Semiconductor based photodiodes have caught the considerable research attention for past few decades and their optoelectronic devices that harvest photon-energy through distinct electronic processes, with the ultra-fast response and high responsively are of tremendous societal reputation in numerous applications as well as optical communication, sensing, motion detection, missile warning and biomedical imaging. All these applications entail very sensitive devices with high rapidly; fast response time and good signal-to-noise ratio is common needed characteristics. Currently, light detection in the UV spectral range still uses Si-based optical photodiodes due to sensitive to visible and infrared radiation, the instinctively in the UV region. It based on the narrow bandgap semiconductors, especially Si (1.1 eV) have been commercialized for light detection for a long period. To avoid these disadvantages, wide-bandgap materials (such as diamond, SiC, III-nitrides and wide-bandgap II–VI materials) are under intensive studies to improve the responsivity and stability of UV photodiodes, because of their intrinsic visible-blindness. Among them, vanadium pentoxide (V_2O_5) is wide direct bandgap materials due to its sensitive and UV photoresponse in the UV region. In recent years much endeavor has been devoted to V_2O_5 owing to its remarkable and unique optoelectronic properties, non-toxicity, high thermal and chemical stability, ability for use in cruel environments, radiation hardness, eco friendliness, low cost, availability etc. It is considered as one of us most important metal oxide materials due to exclusive features and n-type semiconductor. In this metal oxides with d^o electron configuration, such as V_2O_5, containing active sites clever to adsorbing gaseous molecules and catalyze reactions on their surface has concerned noticed in the past years due to their chemical, electronic and catalytic properties and their found application in many technological fields. Hence, it is enlarged most likely studied and it potential industrial applications.[1-4] A number of methods have been implemented for the synthesis of V_2O_5 nanoparticles such as hydrothermal method,[5] solvo-thermal method,[6] thermal decomposition[7] and precipitation[8] and so on. Among these methods, the wet chemical synthesis is a promising one for control of chemical components, low cost, low processing temperature, uniform chemically homogenous films, high yield and scalable process. Still, the properties of V_2O_5 can be doped with metal atoms according to the research attention via doping with various metal atoms to suit specific needs and applications. The metal substitution induced extreme modifies in optical, electrical

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Effect of temperature on gas sensing properties of lithium (**Li**) substituted ($\mathbf{NiFe_2O_4}$) nickel ferrite thin film

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ABSTRACT

In particular, less attention has been paid to lithium substituted nickel ferrite thin films for gas sensing studies. In this work, lithium substituted nickel ferrite thin film was prepared by chemical co-precipitation method. The Rietveld refinement X-ray diffraction (XRD) analysis provides all reflection planes of lithium substituted nickel ferrite thin film and reveals well formation. Scanning electron microscopy (SEM) reports the surface of thin film has needle structure particles and X-ray photoelectron spectroscopy (XPS) depicts the presence of all necessary elements. Brunauer-Emmett-Teller (BET) analysis provides adsorption and desorption rate of sensor film. UV–Vis absorption spectroscopy shows that the film has absorption peak which is in visible region. Transmission electron microscopy (TEM) presents rod structure nanoparticles with huge space and confirms the formation of lithium substituted nickel ferrite thin film from selected area electron diffraction (SAED) pattern. Hydrogen gas sensing tests shows that the optimal sensing temperature was 200 °C and sensor produces 95% reproducibility.

1. Introduction

Hydrogen (H_2) is a green and clean fuel with zero pollutant emissions and no contribution to the greenhouse effect. Additionally, it is abundant and has relatively cheap price. Hydrogen is colorless, tasteless, and odorless, with explosive nature. Moreover, H_2 has a high diffusion coefficient and the smallest molecular size that enables the easily leakage of it in a closed system. Accordingly, detection of hydrogen gas during the leakage, storage and transportation by a sensor device is of importance [1–3]. Nanomaterials have different applications including magnetic and photocatalyst [4–6], hydrogen storage [7,8], optical properties [9], elimination of dye in contaminant water [10] and gas sensing applications [11]. In context of gas sensing applications and among different gas sensors, resistive gas sensors based on binary metal oxides are very popular due to their outstanding sensing properties such as high sensitivity, fast response and low detection limit. However, less attention has been paid to more complex oxides such as ternary oxides with pervoskite or spinel structures. Spinel compounds with general formula of $A^{+2}B^{+3}{}_2O_4$ are built around a closely packed array of O^{2-} ions, with A^{2+} and B^{3+} cations occupying part or all of the tetrahedral and octahedral sites, respectively [12]. Spinel ferrites are the compounds with spinel structure and general formula MFe_2O_4, where M^{+2} is a cation. In particular, the ternary oxides with spinel structure have good potential for different applications [13–15]. However, their sensing abilities need to be study more. In recent years, ferrites have aroused particular interest in the field of gas sensors [16,17], due to their excellent peculiarities, among all the chemical stability. $NiFe_2O_4$ is an inverse spinel in which the Ni^{2+}ions occupy the octahedral sites; $(Fe^{3+})_T$ $[Ni^{2+}Fe^{3+}]_OO_4$. However, the gas sensing properties nickel ferrite towards the reducing gases is rarely reported in pristine [18] or doped form [19,20]. In

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Research articles

Enhancement in magnetic and dielectric properties of the ruthenium-doped copper ferrite(Ru − $CuFe_2O_4$) nanoparticles

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ABSTRACT

Ruthenium-doped copper ferrite(Ru − $CuFe_2O_4$)nanoparticles (NPs) have been synthesized using a simple and cost-effective wet chemical co-precipitation deposition method. The crystallographic scanning electron microscopy images confirm cubic crystal structure and agglomerated-type surface appearance. The crystallite sizes are 6–24 nm in the range. Dielectric measurement analysis estimates the dielectric constant and loss of Ru − $CuFe_2O_4$ NPs. In this connection, dielectric constant and loss are reduced virtue of air annealing for various temperatures. Also, the dielectric loss confirms the relaxation peak. From magnetic measurement results, the coercivity decreases whereas saturation and remanence magnetization are increased. These features have approved the soft magnetic nature in the Ru − $CuFe_2O_4$ NPs.

1. Introduction

In recent time, ferrite materials have endowed their merits in the magnetic resonance imaging, drug delivery, data storage and medical oriented technology applications greatly. In the medical field, the ferrite nanoparticles (NPs) manufactured in the form of capsules can be transferred into a human body to target the cancer cells in presence of the magnetic field [1,2]. They are in the form of soft or hard magnets and are basically temperature dependent. Copper ferrite ($CuFe_2O_4$) attained a majority of concerns in solid state physics, mineralogy, ceramics and metallurgy [3]. By virtue of the phase transition and semiconducting character, the $CuFe_2O_4$ is one of the upper class emerging materials among spinel ferrites family [4,5]. Usually, $CuFe_2O_4$ has two crystallographic spinel structures; high temperature cubic phase followed low temperature tetragonal phase. An ideal inverse configuration of the $CuFe_2O_4$ consists of eight divalent ions placed at octahedral sub-lattice sites and sixteen trivalent ions situated at octahedral and tetrahedral sub-lattice sites [6]. Total magnetic moment of the $CuFe_2O_4$ depends upon uncompensated magnetic moments of eight divalent copper ions located at octahedral sub-lattice sites. The magnetic moment per unit cell i.e. $\mu = 8*1\mu_B = 8\mu_B$, for each copper ions is assumed to be 1 μ_B, where μ_B is the Bohr magnetron, which is responsible for a small energy difference among the copper ions found at octahedral and tetrahedral sites [7]. Here, cation redistribution, a function of annealing temperature can be favored. Compared with the tetragonal crystal structure, cubic crystallographic phase of the $CuFe_2O_4$ results a large magnetic moment [8], enabling researchers to look after into a desired magnetic and dielectric properties in presence of either dopant or substitutional elements. The dielectric constant and loss are crucial quantities while designing the microelectronic devices. In general, ferrites are temperature and frequency dependent and also confirm the sensitivity towards the synthesis methods used [9]. In the last two decades, the dielectric properties of ferrites have been investigated vigorously, but investigations on the rare earth metal-doped ferrites have not been yet addressed completely. The relaxation behavior of ferrites is influenced by the crystal structure and the surface morphology. The dielectric loss is useful for insulation and isolation required in microelectronic circuits. The ferromagnetic $CuFe_2O_4$ holds a wide range of applications owing to its thermal stability [10,11] and electromagnetism which also can be attained on the addition of impurities or dopants [12]. The cation redistribution of copper ferrite using substitution, usually, alters the magnetic and electric properties [13] which are size dependent [14,15]. Trivalent, highly catalytic and electrically active ruthenium (Ru) was considered as dopant in the

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Fabrication and characterization of Ru-doped $LiCuFe_2O_4$ nanoparticles and their capacitive and resistive humidity sensor applications

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ABSTRACT

Polycrystalline ruthenium-doped lithium-copper-ferrite (Ru − $LiCuFe_2O_4$)nanoparticles (NPs) are synthesized using a simple and cost-effective chemical co-precipitation method and annealed at different temperatures for increasing the crystallinity. The transmission and scanning electron microscopy images have confirmed the presence of soft agglomerations and cuboids for the samples annealed at 1100 °C. X-ray photoelectron results along with Raman spectra have collectively demonstrated the presence of Ru in the structure of Ru − $LiCuFe_2O_4$ NPs. The dielectric properties of as-synthesized Ru − $LiCuFe_2O_4$ NPs are investigated using LCR meter where the smaller NPs demonstrates a higher dielectric constant. Also, the results of magnetic measurements of annealed Ru − $LiCuFe_2O_4$ NPs have corroborated a soft magnetic nature due to the pinning sites that endow lower coercivity, remanence and saturation magnetization than that of the pristine one. The variation of permittivity and electrical resistivity with respect to frequency under humidity conditions suggested that this material has a potential to use as capacitive and resistive humidity sensor. The results of this study open the doors for utilization of metal-doped magnetic ferrites for humidity sensing applications.

1. Introduction

Lithium-copper ferrites ($LiCuFe_2O_4$) have received considerable attention due to their unique electrical, dielectric and ferromagnetic properties which, basically, are dependent on the substitution of ions, preparation methods and annealing temperatures [1,2]. Structural and morphological properties of $LiCuFe_2O_4$ can be tuned for improving the permeability and density [3] which are essential to realize data storage devices, gas and humidity sensors, microwave devices and cancer cell treatment etc. [4–6]. Furthermore, elemental substitutions can greatly influence the performance of ferrites on enhancing the electromagnetic performance. In this regards, $LiCuFe_2O_4$ as a well-known ferrite has very interesting properties [7–9]. It is found that the substitution of divalent metallic ions or rare earth ions significantly alters the magnetic properties [10–11]. The rare earth elements were doped in Mn, Mg-Zn, Ni-Zn and Mn-Zn ferrites to induce the soft magnetism [12–14] which eventually demonstrated special and desired physical properties. Among different metals, ruthenium (Ru) has been enormously used as a dopant to improve the magnetic performance. For example, Hoque et al. reported the enhanced magnetic properties of lithium-doped copper ferrite nanoparticles (NPs) as a hard magnetic material with higher coercivity and retentivity than that of undoped one [1]. Wenwei et al. reported the magnetic properties of copper-manganese lithium ferrite with highest specific saturation magnetization and retentivity values close to zero, suggesting a soft magnetic behavior [15]. Lithium-copper ferrite, reported by us previously, also revealed an inferior soft magnetic nature [9]. Raveau et al. reported that Ru doping can effectively induce the ferromagnetism. Arash et al. has reported manganese-

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Kairomones from highly susceptible host to control banana pseudostem weevil, Odoiporus longicollis (Olivier)

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Abstract

Odoiporus longicollis is a threatening pest found among the majority of banana plantations in India. This study was conducted using kairomones to determine a

strategy for controlling the infestation by this pest. The kairomones were isolated by fractionation of headspace volatiles obtained from a highly preferable host, Poovan, and identified as fatty acid derivatives of Tetradecanoic acid and Hexadecanoic acid, which induced more response in female than male pests. 9-Octadecenal is a female-specific volatile and attracts male weevils for the performance of reproduction. Results showed that the host plant volatiles act as kairomones, and behavioral responses in male weevils to 9-Octadecenal, Hexadecanoic acid, and Tetradecanoic acid were recorded as 72.5%, 70%, and 67.5% of attraction, with the average time required to reach the target being 1.48, 1.57, and 2.36 min, respectively. Male and female weevils also exhibited responses of 60%, 55%, 50%, and 47.5% to Nonanal, Ethyl-4-ethoxy benzoate, 2-Decenal, and β-Ocimene, respectively, with the average time to reach the target being 3.10, 2.18, 3.02, and 3.47 min, respectively, for the attraction of the weevil, and it had significantly more attractant ($p < 0.01$). To improve the activity, the volatile blends were mixed in different proportions, which exhibited 77.5% of attraction. A vulnerable host was used as a reference for evaluating which volatile displayed a more attractant property to female weevils for feeding and oviposition; similarly, male weevils were used for attraction to their conspecific females for fecundity development. The semiochemicals characterized in this study could be used as a trap to collect male and female O. longicollis weevils, which could help prevent the development of this

ORIGINAL ARTICLE

EXPLORATION OF DISTINCTIVE MENYANTHES TRIFOLIATA AS GENERATED GREEN NANOPARTICLES: REPORT THEIR LETHAL TOXICITY AGAINST *Aedes Aegypti*

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ABSTRACT

Background: Biofabrication of silver nanoparticles from plant origin provides more resistance against mosquitoes. In the present study, silver nanoparticles (AgNPs) synthesized from the novel plant, *Menyanthes trifoliata* for the control of chikungunya vector, *Aedes aegypti*. **Objective:** The nanoparticles were evaluated for their toxicity of larvae, pupae and insect growth regulatory activity, persistent study against *Aedes aegypti*. **Methods**: Nanoparticles were analyzed with UV-vis spectrophotometry, SEM, XRD, FTIR, and EDAX. The characterization studies confirmed that AgNPs are of size 10-50nm and spherical in shape. The efficacy of plant-synthesized AgNPs was tested against different concentrations ranging from 5-25 µg/mL against L_1 to L_4 larval instars and pupae of *A. aegypti*. **Results**: Observed value of LC_{50} = 8.17, 9.78, 12.96, 16.73 and 20.11 µg/mL; the LC_{90} = 19.57, 24.25, 29.64, 36.95 and 41.81 µg/mL for treated all larval instars and pupae, respectively. The mortality rates were positively correlated with the concentration of AgNPs. Significant ($P<0.05$) changes in larval mortality were also recorded between the period of exposure to all larval instars of A. aegypti. The larval and pupal growth was significantly diminished (IGR activity) by the action of AgNPs and its emergence inhibition EI_{50} and EI_{90} values are 1.87 (10.58) significantly noted against *A. aegypti*. **Conclusion**: The study reported that the toxic nature of AgNPs had a significantly higher impact on the third instars, followed by other stages, and their effect lasted up to a 12-week period. Larval midgut layer strongly disrupted and it's showed in the histology section. These findings reported *M. trifoliata* synthesized AgNPs are rapid, eco-friendly, and novel mosquito control agents.
Keywords: *Menyanthes trifoliate, Silver Nanoparticles, Mortality, Insect growth regulatory, Histology*

1. INTRODUCTION

Diseases transmitted by mosquitoes result in millions of deaths per year worldwide [1]. Vector-borne diseases have resulted in the loss of human economy both in terms of medical care costs and diminished productivity. They are a significant threat to human health, and considerable national and international efforts are required to counter it [2, 3, 4]. *Aedes aegypti* and *Aedes albopictus* are considered as vectors for dengue fever (DF) in Southeast Asia (CDC 001). Over the past 30 years, the incidence and geographical distribution of DF have increased dramatically. About 2.5 billion people worldwide have been estimated to be at risk of DF. Moreover, a hundred million cases arise annually, including 500,000 cases of Dengue Hemorrhagic Fever (DHF) [5]. It should also be noted that synthetic insecticides have reportedly resulted in several ecological issues due to its persistent residual accumulation in the environment, development of resistance in target vectors, and chronic effects on non-target organisms [6].

To overcome these problems, silver nanoparticles (AgNPs) have been studied extensively for their interesting biophysical properties in recent years [7, 8]. Biosynthesis of nanoparticles using plant extracts is currently under research. Compared to other environmentally benign biological processes, the use of plants for nanoparticles synthesis is advantageous as it eliminates the elaborate process of maintaining cell and microbial cultures. In addition, the biosynthesis of nanoparticles would be more useful if the plant extracts are synthesized in a controlled manner for monitoring their size and shape [9, 10, 11, 12].

In the present study, nanoparticles synthesized from *Menyanthes trifoliata* leaf extracts were used to study mosquitocidal and insect growth regulatory activity against *A. aegypti.* This herb contains saponin, menyanthoside, iridoid glycosides, foliamenthin, dihydrofoliamenthin, menthiafolin, and loganin. It also contains pyridine alkaloids including gentianine; coumarins (scopoletin); phenolic acids such as caffeic, protocatechuic, ferulic, sinapic, and vanillic; and flavonoids including rutin and hyperoside. Choleretic action of the herb is attributed to the synergistic action of caffeic and ferulic acids and iridoid glycosides. Scoparone and scopoletin (coumarins isolated from the aerial

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RISK AND RESILIENCE: ADOLESCENT POVERTY AND AGENCIES OF CHANGE IN SWATI SENGUPTA'S *HALF THE FIELD IS MINE*

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Phytochemical Screening of Aqueous Leaf Extract of Sida acuta Burm. F. and its Antibacterial Activity

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ABSTRACT: ***Sida acuta is one of the Indian medicinal plants which belong to the family Malvaceae. The whole plant is reported to have many biological activities such as anthelmintic, antiemetic, demulcent, diuretic, aphrodisiac, stomachic, diaphoretic, antipyretic and wound healing properties. Therefore main aim of the present study is to evaluate the phytochemical constituents and the antibacterial activity of the aqueous extract of Sida acuta. The preliminary phytochemical screening has shown the presence of alkaloids, steriods, flavonoids, phenols, terpenoids, and cardiac glycosides. The maximum zone of inhibition was observed against Bacillus subtilis and Escherichia coli at the maximum tested concentration. The aqueous leaf extract of S. acuta have shown moderate anti-bacterial activity against Staphylococcus aureus and Pseudomonas aeruginosa. From this study, was concluded that, Sida acuta has rich phytochemical compounds, .thus the presence of these secondary metabolites attributed to treat various diseases.***

Keywords: Sida acuta, Aqueous extract, Phytoconstituents, Antibacterial activity.

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1. Introduction

Traditional use of medicine is recognized as a way to learn about the potential for future medicines. Plants are tremendous source for the discovery of new products of medicinal value for drug development. Many compounds are secondary metabolites which generally involved in plant adaptation to environmental stress conditions. Today several distinct chemicals derived from plants are important drugs used in one or more countries in the world. Many of the drugs are simple synthetic modifications or copies of the naturally obtained substances. A vast number of natural, plant-based extracts and chemicals proposed to have beneficial effects are present in India.

Phyto is the Greek word for plants; chemical compounds that arise naturally in plants are called phytochemicals. These phytochemical compounds protect themselves against environmental threats (disease, pollution, insects, etc.,). Plants are used throughout the world traditionally for home remedies over the counter drug products and raw substances for the pharmaceutical, cosmetics industries and represent a substantial proportion of the world drug market. It is therefore significant to establish their quality. Phytochemical evaluation is one of the tools for quality assessment, which includes preliminary phytochemical screening. Use of chromatography for standardization of plant products was introduced by World Health Organization (WHO) and is accepted as a strategy for identification and evaluation of the quality of plant medicines [1].

Natural products from microbial sources have been used as the primary source of antibiotics, but with the increasing recognition of plant-based herbal medicines as an alternative form of human health care industry. The screening of medicinal plants for active compounds has become very popular [2]. A more number of medicinal plants and their purified constituents have shown beneficial therapeutic potentials. Nair and Chanda [3] discussed about the antimicrobial compounds from plants and validate their uses with composition. Thus, these medicinal plants are of extreme importance to the health of individuals and communities. On the other side, the chemical substances in plant produces some physiological action on the individual. The most important of these phytoconstituents of plants are alkaloids, flavonoids, tannins and phenolic compounds [4].

1.1. Sida acuta Burm.f.

Sida acuta Burm.f. (Family of Malvaceae) is an erect perennial shrub found throughout the hotter parts of India and Nepal [5]. It is believed to be originated in Central America and it is considered as a weed in some areas and the whole plant of *Sida acuta* is widely used in traditional medicine [6]. The bark is smooth, greenish, the root is thin, long, cylindrical and very rough; leaves are lance late, nearly glabrous, peduncles equal to the petioles (**Fig. 1**), seeds are smooth and black; the flowers are yellow, solitary or in pairs. In Indian traditional knowledge of medicinal plants, the whole plant is reported to have many biological activities such as anti-microbial, anthelmintic, anti-emetic, demulcent, diuretic, aphrodisiac, stomachic, diaphoretic, anti-pyretic and wound healing properties. The root of *S. acuta* is extensively used as a stomachic, diaphoretic and antipyretic [7]. Scientific research on the leaf of this plant reveals that it possesses many beneficial plant phytochemicals and its leaf extract has a great potential to be used in biological applications.

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Existence results of Hilfer integro-differential equations with fractional order

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The paper is relevance with Hilfer derivative with fractional order which is generalized case of R-L and Caputo's sense. We ensured the solution using noncompact measure and Mönch's fixed point technique. Illustrative examples are included for the applicability of presented technique.

Keywords: Mild solution, Laplace transform, MNC, Mönch's fixed point technique, evolution equation.

Mathematics Subject Classification: 34A12, 46F12, 47H08, 47H10, 47J35.

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FULL PAPER

WILEY Applied Organometallic Chemistry

Organoruthenium (II) complexes featuring pyrazole-linked Schiff base ligands: Crystal structure, DNA/BSA interactions, cytotoxicity and molecular docking

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Half-sandwiched ruthenium (II) arene complexes with piano stool-like geometry with the general formula [(*p*-cymene)RuClL^1] and [(*p*-cymene)RuClL^2] [where L^1 = (*Z*)-N′-((1,3-diphenyl-1*H*-pyrazol-4-yl)methylene)furan-2-carbohydrazide and L^2 = (*Z*)-N′-((1,3-diphenyl-1*H*-pyrazol-4-yl)methylene) thiophene-2-carbohydrazide] were synthesized and characterized. The single crystal X-ray data revealed that the complexes belong to the same crystal system (monoclinic) with octahedral geometry, where the ruthenium atom is surrounded by hydrazone ligand coordinated through ON atoms, one chloride labile co-ligand and the remaining three coordination sites covered by an electron cloud of *p*-cymene moiety. The interaction between the complexes and DNA/bovine serum albumin (BSA) was evaluated using absorption and emission titration methods showing intercalative modes of interaction. The DNA cleavage ability of the complexes was checked by agarose gel electrophoresis method exhibiting the destruction of DNA duplex arrangement. To understand the interaction between ruthenium complex and DNA/BSA molecule, molecular docking studies were performed. *In vitro* cytotoxicity of the complexes was examined by the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay on human lung cancer cell line, A549, and found that at lower IC_{50}, cell growth inhibition has occurred. Similarly, the IC_{50} values of the complexes treated with cancerous cell lines have produced a significant amount of lactase dehydrogenase and nitrite content in the culture medium, which were evaluated as apoptosis-inducing factors, suggesting that the ruthenium (II) arene hydrazone complexes with pyrazole ligands have promising anticancer activities.

KEYWORDS
biomolecular interactions, DNA cleavage, half-sandwiched ruthenium complexes, LDH and NO assay, molecular docking

Transition Metal Chemistry
https://doi.org/10.1007/s11243-018-00303-1

Ruthenium hydrazone complexes with 1:1 and 1:2 metal–ligand stoichiometry: a comparison of biomolecular interactions and in vitro cytotoxicities

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Abstract

Two ruthenium(II) complexes $[Ru^{II}Cl(PPh_3)_2(L)]$ (**1**) and $[Ru^{II}(L)_2]$ (**2**) were synthesized by reacting $[RuCl_2(PPh_3)_3]$ and thiophene-2-carboxylic acid (1-pyridine-2-yl-ethylidene)-hydrazide (**HL**) in methanol–chloroform, and characterized by elemental analysis and spectral and XRD data. The ratio of ligand to metal is 1:1 in the former complex and 2:1 in the latter. Interaction of these complexes with CT-DNA was studied using absorption and emission spectral studies; these show that both the complexes interact with CT-DNA through intercalative modes of interaction. Their BSA-binding activity results indicated the operation of static quenching mechanism and stronger binding of tryptophan residues than tyrosine residues. In vitro cytotoxicity assays against HeLa and MCF-7 cell lines showed better activity of both the complexes compared to the standard drug cisplatin. Overall, the activity of complex **2** with two units of coordinated ligand showed better activity than the other one.

Introduction

Metal-based anticancer agents have attracted the attention of researchers since the discovery of cisplatin. Second-generation alternatives of cisplatin like carboplatin and oxaliplatin have helped many patients to avoid premature death from cancer [1–5]. Platinum-based metal complexes can covalently bind with purines of DNA and inhibit the division of cancer cells [6]. However, the non-specific nature of these drugs induces toxicity leading to several side effects like hair loss, nerve damage, nausea, nephrotoxicity, emetogenesis and neurotoxicity [7]. Another major problem is the limited activity of the drug over cancer cells due to acquired resistance [8]. Due to this, the researcher's interest turned towards non-platinum metal-based compounds that would give better activity and low toxicity [9]. Ruthenium complexes are found to be better candidates and can be more potent than cisplatin. Ruthenium, with similar chemistry to iron, is capable of taking its place in some proteins [10]. It binds tighter and more slowly than iron and has a preference for softer ligands [11]. It also shows various oxidation states under physiological conditions [12]. The low barrier for inter-conversion between these oxidation states allows easy change inside the cell [13]. A set of ruthenium compounds KP1019 (indazolium trans-[tetrachlorobis(1H-indazole)ruthenate(III)]) and NAMI-A [trans-$RuCl_4$(DMSO)(Im)](ImH) have entered into the phase II clinical trials [14]. DNA and protein are the two important biological targets for anticancer drugs. Recently, gene signalling pathways have also been shown to play an important role [15]. Design of DNA and protein targeting metal-based anticancer agents with potential in vitro toxicity has gained prominence in recent times [16, 17].

Relatively slow ligand exchange within ruthenium complexes can be tuned by the use of appropriate ligands. Hydrazones are proven as one of the best among various ligands

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Drug Discovery

Studies on phytochemical screening, Antibacterial potential and Hemostatic activity of *Tridax procumbens*

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Research Article
Open Access

Biosynthesis, characterization and remedical aspect of silver nanoparticles against pathogenic bacteria

Abstract

Silver nanoparticles are multifunctional nanoparticles with effective antibacterial activity. In this present study, the synthesized AgNPs by reduction of silver nitrate during exposure to betel leaf aqueous extract was confirmed by UV-Vis spectrum, the SPR peak observed at 443nm. The characterization of AgNPs was carried out using Fourier transform infrared spectroscopy, X-ray diffraction, Dynamic Light Scattering, Scanning Electron Microscope and Energy-Dispersive Spectroscopy. XRD analysis revealed that the particles were crystalline in nature with face-centered cubic geometry. The distribution of the AgNPs observed that the particles obtained are polydisperse mixtures in the size range from 70 to 80nm by using DLS analysis. SEM image of AgNPs shown that relatively spherical in shape and uniform with high agglomeration were noted. AgNPs coated IVC have shown the greatest antibacterial activity against biofilm producing human pathogens such as ***E. coli, S. aureus, P. aeruginosa, S. epidermidis and K. pneumoniae.***

Keywords: silver nanoparticles, betel leaf, antibiofilm activity, intravascular catheter, pathogens

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Abbreviations: IVC, intravascular catheters; FTIR, fourier transform infrared spectrometer; DLS, dynamic light scattering

Introduction

Bacterial biofilms are widely distributed and play important roles in many environments. Generally, biofilms are bacterial communities in which cells are embedded in a matrix of extracellular polymeric compounds attached to a surface.[1] Bacterial surface components and extracellular compounds in combination with environmental and quorum-sensing signals are crucial for autoaggregation and biofilm development in most bacterial species.[2,3] Rinaudi & Giordano[4] suggested the basic accepted model of biofilm formation, environmental signals trigger the process and flagella are required for the biofilm community to approach and move across the surface. The initial steps of attachment are mediated by outer membrane proteins, pili or lipopolysaccharides. After the formation of microcolonies, the production of quorum-sensing signals is required for the formation of a mature biofilm. Exopolysaccharides provide the architectural form of biofilms and stabilize their 3-dimensional structure.[4] The bacteria gain numerous advantages from living in biofilms, including protection from predation, desiccation and exposure to antibacterial substances.[5] Biofilms contain great implication for public health, since biofilm associated microorganisms exhibit dramatically decreased susceptibility to antimicrobial agents. This may be as a natural outcome of growth or due to transfer extrachromosomal elements to susceptible organisms in the biofilm.[6]

Many urinary tract infections and bloodstream infection are associated with indwelling medical devices and biofilm associated. The most strategy for treating these infections may be deletion and removal of the biofilm contaminated device. Urinary tract infections and bloodstream infection are associated with indwelling medical devices and biofilm associated. The most strategy for treating these infections may be deletion and removal of the biofilm contaminated device. Urinary catheter biofilms may initially be composed of single species, but longer exposures inevitably lead to multispecies biofilms.[7] Intravascular catheters (IVC) are used for the administration of medications, parenteral nutrition, fluids and blood products to monitor hemodynamic status and to provide hemodialysis.[8] Use of IVC for patient care may be associated with increased risk of central line associated bloodstream infection. Mermel (2000) study reported around 80,000 central line associated bloodstream infection occur among patients in US intensive care units each year.[9] Anaissie and co-worker reported that the biofilms may form within three days after catheter insertion.[10]

Nanotechnology is novel approaches to research phenomena at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale.[11] Nanomaterials have nanoscale dimensions about between 1-100nm and frequently exhibit new and significantly chemical, physical and biological changed proprieties[12] and nanoparticles have excellent catalysts, sensor and adsorbents due to their large specific surface area and high reactivity.[13] Several engineered and natural nanoparticles including titanium dioxide,[14] zinc,[15] silver[16] and gold[17] have shown strong antimicrobial properties against human pathogens. Nanobiotechnology has arisen due to assimilation of biotechnology with nanotechnology for emerging biosynthetic and eco-friendly approach for synthesis of nanoparticles.[18] The novel method for synthesizing nanoparticles utilizing biological resource and such a methodology is called as "green chemistry.[19] Shanmugavadivu and co-workers revealed that green synthesis approaches of producing silver nanoparticles using pomegranate peel extract have benefits over the conventional techniques and they own potential antibacterial activity against human pathogens.[20] Antimicrobial activities of nanoparticles are well-known, particularly, silver nanoparticles have been described as the one with the highest level of toxicity for microorganisms and lowest toxicity

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Original research article

Novel mixed cubic-rutile structured In_2O_3-TiO_2 composite nanoparticles (InTiO CNPs): Structure, morphology, photoluminescence and photocatalytic activity

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ABSTRACT

Novel In_2O_3-TiO_2 composite nanoparticles (InTiO CNPs) were prepared by wet chemical and PVA assisted wet chemical methods. The Fourier transform infrared spectroscopy confirms the presence of In—O and Ti—O bond. The X-ray diffraction patterns revealed the pure phase with mixed cubic-rutile structure. The obtained phase transforms from anatase to rutile when calcination temperature increases (above 500 °C) for virgin InTiO CNPs whereas only cubic structure with rutile phase observed for PVA assisted InTiO CNPs even at low temperatures (as-prepared sample). Scanning electron microscopy and Transmission electron microscopy images of virgin CNPs showed an irregular morphology with large grain/particle sizes whereas PVA assisted CNPs showed spherical shape core-shell structured morphology with uniform grain/particle sizes. Particle size was found to be 182.40 nm–192.52 nm for virgin CNPs whereas 28.35 nm–34.76 nm for PVA assisted CNPs. Photoluminescence spectra showed a broad visible emission (violet and blue) with a calculated band gap energy of 2.65 eV. The PVA assisted InTIO CNPs showed a photocatalytic activity against methyl orange even at low irradiations with a degradation rate of 87%. The observed results with uniform morphology, good emission (violet and blue) behaviour with indirect band gap energy and a good photo catalytic activity of the prepared InTiO CNPs could be used for visible emissive thin film based electronic-optoelectronics devices and as a photo catalyst for organic dye degradation.

1. Introduction

Metal oxide semiconductors have attracted the attention of researchers globally because of their electrical and optical (large band gap and high transmittance) properties, which could be used in electronic and optoelectronic devices. In recent years, most of the research work have been involved to developing a new class of metal oxide semiconductor materials. Among all, Al, Ti, Cd, Mg, In and Zn based oxide materials have wide band gap, transparent to visible wavelength and good electrical properties. Many metal oxide semiconductors have uncontrollable high carrier concentration due to oxygen vacancies. The excess free electrons could be suppressed by the formation of stronger metal oxygen bonds such as Ga—O, Al—O, Ti—O, Zr—O and Hf—O. The gallium (Ga), Aluminium (Al), Titanium (Ti), Zirconium (Zr) and Hafnium (Hf) can form stronger bonds with oxygen atoms as compared to other metal atoms [1]. The properties of the materials are influenced by many factors like surface area, particle size, phase composition and preparation

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Structural and thermoelectric properties of Se doped In_2Te_3 thin films

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The Se-Te based chalcogenides exhibit novel property of Phase Change Memory (PCM) which has potential applications in electrical non-volatile memories. These materials are also suitable in thermal to electrical energy conversions and, hence, of potential interest in energy sustainability as thermoelectric devices. In this study, the Se doped In_2Te_3 thin films were prepared by thermal evaporation and were annealed at 250 °C and 300 °C in Argon gas. The X-ray diffraction spectra show that thermal annealing leads to the phase transitions in Se doped In_2Te_3 into binary phases of In_2Se_3 and In_2Te_3. The surface morphology of the films exhibits the grains of spherical nature. Annealing also decreases the energy band gap due to the presence of two phases. From the four probe and photoconductivity measurements, a large contrast in electrical resistance between the amorphous and crystalline states is found with a variation of a few orders of magnitude. The electrical transport properties such as the electrical resistivity, Seebeck coefficient and the power factor were measured in the temperature range from 300 K to 430 K. All the deposited and annealed thin films exhibit n-type conductivity with the Seebeck coefficient ranging from -338 μVK^{-1} to -510 μVK^{-1}. An increase in thermoelectric power of 25% is observed in the 300 °C annealed films in comparison to the as-deposited films. Moreover, the lower Se doped $In_2(Te_{0.96}Se_{0.04})_3$ compound exhibits a better thermoelectric performance compared to the $In_2(Te_{0.90}Se_{0.1})_3$ composition. This study shows the multifunctional nature of Se doped In_2Te_3 both for PCM and thermoelectric applications. https://doi.org/10.1063/1.5057734

I. INTRODUCTION

Metal chalcogenides based phase change materials (PCM) are of technological importance in electronic memory and thermoelectric applications. For the fast-growing new generation, there is a need for faster memory devices with smaller sizes. In addition, these materials find attention in the renewable energy conversion system based on clean energy sources. In case of PCM, thermal stability, repeatability, optical reflectivity and data density need to be improved. In addition to the costs of the materials should be low and easy fabrication steps are necessary. The Se-Te based chalcogenide glasses can be reversibly switched between its amorphous (high resistivity) insulating state and its crystalline (low resistivity) conductive one under different phases and find applications in the field of electronic non-volatile memories,[1] rewritable optical data storage[2] and optoelectronic devices.[3] In addition, thin films of these glasses can be used in phase change memory.[4]

The Se-Te based compounds have attracted much attention as a prime candidate for thermoelectric power and various semiconducting chalcogenides materials have been studied by direct

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Design and Fabrication of Al/Sr:SnO_2/p-Si Schottky Barrier Diode Based on Strontium-doped SnO_2 Thin Film

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Abstract

Strontium (Sr)-doped SnO_2(Sr:SnO_2) insulating thin films of various concentrations were prepared by sol-gel spin-coating technique and were studied by X-ray diffraction (XRD), Field emission scanning electron microscope (FE-SEM), Ultra Violet-visible spectroscopy (UV-vis) and current-voltage (I-V) characteristics. The XRD pattern shows that the line-broadening effect would increase with an increase in Sr concentration and confirms the tetragonal structure of the films. The SnO_2 and Sr-SnO_2 thin films exhibited spherical shape of grains and increase in film surface roughness by the FE-SEM and AFM images. UV-vis analysis exposes that band gap (E_g) value decreases with increase in Sr concentration. DC electrical analysis reveals that the high conductivity of 4 wt.% in Sr:SnO_2 thin film. Schottky barrier diodes (SBDs) were designed and performed for all the films. From the I-V analysis, the barrier height (Φ_B) and ideality factor (n) were calculated for Al/Sr:SnO_2/p-Si SBD, which reveals that the former has increased from 0.855 to 0.898 eV with increase in wt.% of Sr concentration.

Keywords: Schottky barrier diodes, spin-coating, barrier height, Sr-doped SnO_2, dc electrical conductivity

1. Introduction

The interface of the metal-semiconductor structure plays a significant role in electronic devices and has application in semiconductor technology [1]. In general, an insulating layer is placed among the metal/semiconductor interfaces to prevent diffusion between metal and semiconductor, which regulates the charge transport properties [2]. In the state-of-the-art, metal-insulator-semiconductor (MIS) structure based Schottky diode is important due to its high-speed switching, low cut-off voltage and to overcome the degradation-related recombination effect in diodes [3]. Despite its advantages over conventional p-n junction diodes, SBDs suffers from high series resistance, high-density

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Efficient humidity-sensitive electrical response of annealed lithium substituted nickel ferrite (Li–$NiFe_2O_4$) nanoparticles under ideal, real and corrosive environments

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Abstract
The Li–$NiFe_2O_4$ nanoparticles have been prepared via simple cost effective chemical co-precipitation method. X-ray diffraction analysis affirms the cubic spinel structure and particle size is ~32 nm. SEM and TEM analysis were revealed the needle shape of nanoparticles with agglomeration. XPS and FT-IR spectrum confirmed composition and usual behaviour of spinel ferrites. Band gap energy of material is 3.62 eV that imply semiconducting nature. Humidity sensor analysis is carried out three different environments in order to test the influence of medium stress factors on sensors parameters. Under these environments, Li–$NiFe_2O_4$ nanoparticles exhibit well sensing nature. Besides, the material displays high sensitivity at ideal environments and good stability in real environments. The results also show interesting characteristics of the maturing and aging process of humidity sensors.

1 Introduction

In past few years, humidity sensor got a dynamic response to industrial and environmental applications because of moisture monitoring capacity. Mainly, humidity sensor was used by domestic applications. Those are medical field, electronic industry, agriculture, food processing and chemical gas purification etc. In humidity sensor, three types of units were used such as relative humidity (RH), dew/frost point and parts per million (PPM) [1]. Relative humidity measurements were used in our experiments. Relative humidity is defined as ratio of partial pressure of water vapor to saturated vapor at given temperature. Now-a-days, there are some efficient humidity sensor materials are available such as semiconductor [2], ceramic [3], conducting polymers [4] and ferrites [5, 6]. Among these materials, ferrites afford fast response to humidity. Because, the material has specific features like high resistivity, low cost, wide frequency range, temperature dependent, shape and economical [7]. Likewise, ferrites afford an unrivaled flexibility in magnetic and mechanical parameters [8, 9]. In spite of this, ferrite material offers large porosity which is essential humidity sensors [10]. According to literature survey, ferrite is highly favorable material for humidity sensor [11, 12]. Primary requirement of the sensor is to change its electrical conductivity with exposure of humidity to materials, which rely upon on band gap, surface morphology and particle size [13–15]. Nickel ferrite ($NiFe_2O_4$) is a most versatile material for humidity sensing owing to chemical stability, dielectric behaviour and spinel group [16]. Lithium is an alkali and lightest element [17, 18]. It provokes the electrical behaviour and ensures the sudden changes in electrical resistivity, porosity, specific area and particle size.

Bayansal and coworkers has studied the humidity and various gas sensing properties of manganese substituted nickel

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