133

Non-Recurring
Appl. No. BMB/2017/61

No. BT/PR25369/NER/95/1162/2017
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
(NER-BPMC)

Block 2, (6-8th Floors)
CGO Complex, Lodhi Road,
New Delhi- 110 003
Date: 27/9/19

RELEASE ORDER

In continuation of this Department's sanction order of even number dated 27/9/19. sanction of the President is hereby accorded, under Rule18 of the Delegation of Financial Powers Rule, 1978, for the release of Rs. **1471000.00** (Rupees Fourteen Lakhs Seventy One Thousand Only) being the first year release for the project entitled **"Synthesis And Characterization Of Different Chrysin Derivatives Followed By Screening Of Anti-Obesogenic Activity, Anti-Diabetogenic Activity In Vitro: Assessment Of In Vivo Activity With The Lead Compounds",** being implemented by

1. Dr. Mrs Krishna Das Saha, Indian Institute Of Chemical Biology, 4, Raja S. C. Mallick Road, Kolkata - 700032, West Bengal
2. Dr. Utpal Chandra De, Tripura University, Suryamaninagar, Agartala - 799022, Tripura

The detailed break-up is as given below:

SNo	Institute Name	Non Recurring		Total Release Amount (Rs)
		Equipment	Other	
1	Indian Institute Of Chemical Biology	471000.00	0.00	**471000.00**
2	Tripura University	1000000.00	0.00	**1000000.00**

2. The amount of Rs. **1471000.00 /-(Rupees Fourteen Lakhs and Seventy One Thousand Only)** will be directly credited by the Pay & Accounts Officer, DBT in the account as detailed below:

1. Rs.**471000.00/- (Rupees Four Lakhs Seventy One Thousand Only)** to The Director, Indian Institute Of Chemical Biology, 4, RAJA S.C. Mullick Road, Jadavpur, Kolkata - 700032, West Bengal

   Bank Name : State Bank of India
   Branch Name : Jadavpur University Branch
   A/c No. : 30272881915
   IFSC Code : SBIN0000093
   MICR Code : 700002048

2. Rs.**1000000.00/- (Rupees Ten Lakhs Only)** to The Registrar, Tripura University, Suryamaninagar, Agartala - 799022, Tripura

   Bank Name : State Bank Of India
   Branch Name : Tripura University Campus
   A/c No. : 30371209938
   IFSC Code : SBIN0010495
   MICR Code : 799002524

Vaishali

डॉ. वैशाली पंजाबी / Dr. VAISHALI PANJABI
वैज्ञानिक 'ई' / Scientist 'E'
बायोटेक्नोलॉजी विभाग / Dept. of Biotechnology
विज्ञान और प्रौद्यो. मंत्रालय / M/o Science & Tech.
भारत सरकार, नई दिल्ली / Govt. of India, N. Delhi

122/123

Appl. No. BMB/2017/39
Administrative Order

No. BT/PR25104/NER/95/1017/2017
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
(NER-BPMC)

Block 2, 6-8th Floors
CGO Complex, Lodhi Road,
New Delhi- 110 003
Dated: 26/09/19.

ORDER

Sanction of the President is hereby accorded, under Rule 18 of the Delegation of Financial Powers Rules ,1978 , for the implementation of the project entitled: **"Study of induction and mechanisms of Autophagy in EAC cells upon treatment with Theaflavins"** for a period of 3 Year 0 Month at a total cost of Rs. **7097120** (Rupees Seventy Lakhs Ninety Seven Thousand One Hundred and Twenty Only) on the terms and conditions detailed here under:-

2 The Project :

2.1 Title : "Study of induction and mechanisms of Autophagy in EAC cells upon treatment with Theaflavins"

2.2 Details of the Investigatiors:

Project Cordinator

Dr. Debasish Maiti
Associate Professor,
Dept. of Human Physiology, Tripura University
Suryamaninagar,, Agartala, Tripura, 799022

Principal Investigators:

Dr. Debasish Maiti
Associate Professor
Dept. of Human Physiology, Tripura University
Suryamaninagar,, Agartala, Tripura, 799022

Dr. Samiran Saha
Assistant Professor
Biotechnology
Visva Bharati University
Department of Biotechnology,
Siksha Bhavana,
Visva-Bharati, Santiniketan,West Bengal, 731235

CO-PI:

Prof. Durgadas Ghosh
Professor
Dept. of Zoology, Tripura University
Suryamaninagar,, Agartala, Tripura, 799022

Vaishali

डॉ. वैशाली पंजाबी / Dr. VAISHALI PANJABI
वैज्ञानिक 'ई' / Scientist 'E'
बायोटेक्नोलॉजी विभाग / Deptt. of Biotechnology
विज्ञान और प्रोद्यो. मंत्रालय / M/o Science & Tech.
भारत सरकार, नई दिल्ली / Govt. of India, N. Delhi

4/16/

Administrative
App. No. MED/2017/36

No. BT/PR24783/NER/95/851/2017
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
(NER-BPMC)

Block 2, 6-8th Floors
CGO Complex, Lodhi Road,
New Delhi- 110 003
Dated: 28 / 01 /2019

ORDER

Sanction of the President is hereby accorded, under Rule 18 of the Delegation of Financial Powers Rules ,1978 , for the implementation of the project entitled: "**INVESTIGATION OF HYDROPHOBICALLY MODIFIED POLYSACCHARIDES FOR NANODELIVERY OF ANTICANCER DRUGS IN THE TREATMENT OF MULTIDRUG RESISTANCE COLON CANCER**" for a period of 3 Year 0 Month at a total cost of Rs. **6596400** (Rupees Sixty Five Lakhs Ninety Six Thousand Four Hundred Only) on the terms and conditions detailed here under:-

2 The Project :

2.1 Title : **"INVESTIGATION OF HYDROPHOBICALLY MODIFIED POLYSACCHARIDES FOR NANODELIVERY OF ANTICANCER DRUGS IN THE TREATMENT OF MULTIDRUG RESISTANCE COLON CANCER"**

2.2 Details of the Investigatiors:

Project Cordinator

Dr. Pratap Chandra Acharya
Assistant Professor
Department of Pharmacy
Tripura University
Department of Pharmacy, Block-A, Academic building-XI, Tripura University (A Central University), Suryamaninagar, Agartala, Tripura, 799022

Principal Investigators:

Vaidali

Dr. Pratap Chandra Acharya
Assistant Professor
Department of Pharmacy
Tripura University
Department of Pharmacy, Block-A,
Academic building-XI, Tripura
University (A Central University),
Suryamaninagar, Agartala,Tripura,
799022

Dr. Clara Fernandes
Assistant Professor
SPP School of Pharmacy and
Technology Management
Narsee Monjee Institute of
Management Studies, Mumbai
SPP SPTM, SVKM'S NMIMS, V L
Mehta Road, Vile Parle (W) Mumbai,
Mumbai,Maharashtra, 400056

2.3 Objectives:

Overall Objectives:

1. Synthesis, purification and structural characterization of fatty acid based glycolipid derivatives
2. Physicochemical characterization of the glycolipids for its stability and usefulness as a nanocarrier
3. Formulation of the glycolipids in to their nanocarriers
4. Fabrication of developed glycolipid nanocarriers in combination with anticancer drug 5-Flourouracil
5. Investigation of the glycolipid and the drug loaded nanocarrier to overcome the multidrug resistance in colon cancer and its biological effect on colon cancer cells
6. Investigation of the pharmacokinetic and bio-distribution profile of 5-Flourouracil from the nanoformulation

Institute wise Objectives:

Narsee Monjee Institute of Management Studies, Mumbai

1. Fabrication of developed glycolipid nanocarriers in combination with anticancer drug 5-Fiuorouracil
2. Characterization of nanocarriers and mechanism of overcoming the multidrug resistance in colon cancer

Tripura University

1. Synthesis, purification and structural charecterization of fatty acid based glycolipid derivatives
2. Physicochemical characterization of the glycolipids for its stabiliy and usefulness as a nanocarrer.

133

Non-Recurring
Appl. No. BMB/2017/61

No. BT/PR25369/NER/95/1162/2017
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
(NER-BPMC)

Block 2, (6-8th Floors)
CGO Complex, Lodhi Road,
New Delhi- 110 003
Date: 27/9/19

RELEASE ORDER

In continuation of this Department's sanction order of even number dated 27/9/19. sanction of the President is hereby accorded, under Rule18 of the Delegation of Financial Powers Rule, 1978, for the release of Rs. **1471000.00** (Rupees Fourteen Lakhs Seventy One Thousand Only) being the first year release for the project entitled **"Synthesis And Characterization Of Different Chrysin Derivatives Followed By Screening Of Anti-Obesogenic Activity, Anti-Diabetogenic Activity In Vitro: Assessment Of In Vivo Activity With The Lead Compounds",** being implemented by

1. Dr. Mrs Krishna Das Saha, Indian Institute Of Chemical Biology, 4, Raja S. C. Mallick Road, Kolkata - 700032, West Bengal
2. Dr. Utpal Chandra De, Tripura University, Suryamaninagar, Agartala - 799022, Tripura

The detailed break-up is as given below:

SNo	Institute Name	Non Recurring		Total Release Amount (Rs)
		Equipment	Other	
1	Indian Institute Of Chemical Biology	471000.00	0.00	**471000.00**
2	Tripura University	1000000.00	0.00	**1000000.00**

2. The amount of Rs. **1471000.00 /-(Rupees Fourteen Lakhs and Seventy One Thousand Only)** will be directly credited by the Pay & Accounts Officer, DBT in the account as detailed below:

1. Rs.**471000.00/- (Rupees Four Lakhs Seventy One Thousand Only)** to The Director, Indian Institute Of Chemical Biology, 4, RAJA S.C. Mullick Road, Jadavpur, Kolkata - 700032, West Bengal

   Bank Name : State Bank of India
   Branch Name : Jadavpur University Branch
   A/c No. : 30272881915
   IFSC Code : SBIN0000093
   MICR Code : 700002048

2. Rs.**1000000.00/- (Rupees Ten Lakhs Only)** to The Registrar, Tripura University, Suryamaninagar, Agartala - 799022, Tripura

   Bank Name : State Bank Of India
   Branch Name : Tripura University Campus
   A/c No. : 30371209938
   IFSC Code : SBIN0010495
   MICR Code : 799002524

Vaishali

डॉ. वैशाली पंजाबी / Dr. VAISHALI PANJABI
वैज्ञानिक 'ई' / Scientist 'E'
बायोटेक्नोलॉजी विभाग / Dept. of Biotechnology
विज्ञान और प्रौद्यो. मंत्रालय / M/o Science & Tech.
भारत सरकार, नई दिल्ली / Govt. of India, N. Delhi

Ministry of Culture
Government of India

संगीत नाटक अकादेमी Sangeet Natak Akademi

Sangeet Natak Akademi, New Delhi

National Academy of Music, Dance and Drama

(An autonomous body of Ministry of Culture, Government of India)

in collaboration with

Department of Music Tripura University, Agartala (Tripura)

Cordially invites you to

Workshop on Hindustani Vocal Music

Significance of Swara, Raga, Tala & Bandish in Hindustani Music

by

Shrimati Ruchira Kedar, Pune (Maharashtra)

(SNA Ustad Bismillah Khan Yuva Awardee)

&

Workshop on Carnatic Instrumental Music - Mridangam

Aesthetical approach of Tala & Jaati in Carnatic Percussion System

by

Vidwan A. Prem Kumar, Chennai (Tamil Nadu)

(Mridanga Chelvam-Kalaimamani)

5 -8 NOVEMBER 2019

(10:00 hrs to 13:00 hrs and 14:30 hrs to 16:30 hrs daily)

Auditorium 2, Academic Building 11, Tripura University, Agartala

Live Webcast:

https://www.facebook.com/sangeetnatak/

https://www.youtube.com/c/sangeetnatak/

ALL ARE WELCOME

Programme subject to change:

Enq : 8794737173 / 8810613690

Sattriya Kendra, Guwahati

(Centre for Sattriya Dance, Music and Theatre Traditions)

of

Sangeet Natak Akademi, New Delhi

(National Akademi of Music, Dance and Drama)

[an autonomous body of Ministry of Culture, Government of India]

in collaboration with

Department of Music, Tripura University, Agartala

12th Sattriya Sangeet Samaroh

(A festival of Sattriya Music Tradition)

দ্বাদশ সত্রীয়া সঙ্গীত সমারোহ

সত্রীয়া সঙ্গীত পরম্পরাগত উৎসব

18 to 20 September, 2019

Sukanta Academy Auditorium

Agartala, Tripura

Different anisotropic silver nanocrystals show different antibacterial activities – an effect of different prominent crystallographic orientations in different shapes

Sumit Sarkar[1], Biraj Sarkar[2], Sukhendu Mandal[2] and Ratan Das[1,*]

[1]Nano-Physics and Nanotechnology Research Laboratory, Department of Physics, Tripura University, Suryamaninagar 799 022, India
[2]Department of Microbiology, University of Calcutta, Kolkata 700 019, India

The antibacterial activity of silver (Ag) nanoparticles is well established and various researchers have provided different explanations for the same. We have tested the activity of similar-sized anisotropic Ag nanocrystals. Silver nanocubes and nanohexagons were prepared and their antibacterial activity was tested against a few bacteria such as *Bacillus cereus*, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus epidermidis*, *Klebsiella pneumonia*, *Vibrio parahaemolyticus* and *Pseudomonas aeruginosa*. It was found that the two shapes were active against all these bacteria. However, the plot of cell density of different bacterial pathogens against the concentration of silver nanocrystals was found to be different for these two shapes. Moreover, half maximal inhibitory concentration value and minimum bactericidal concentration value were also different for the two shapes. XRD analysis showed that both the nanocrystals were crystalline in nature, but their crystallographic orientation was different. So, it can be inferred from this study that some crystallographic planes are probably more active towards reaction with different bacterial compositions and hence, responsible for stronger antibacterial activity.

Keywords: Antibacterial activity, anisotropic silver nanocrystals, crystallographic planes, half maximal inhibitory concentration, minimum bacterial concentration.

NOWADAYS, nanomaterials have become important in the fast-developing field of nanomedicine. Therefore, knowledge of the properties of nanoparticles and their effect on different microbes is essential for different clinical application purposes. Due to their unique physico-chemical properties, silver nanoparticles (AgNPs) have recently gained considerable attention among researchers[1–3]. AgNPs show high surface reactivity with greater versatility for technological applications, especially in the field of nano-biotechnology. Nonspherical nanoparticles such as hexagons, cubes, triangles, prisms and several types of silver nanocrystals exhibit many important properties, which makes them useful in sensing and imaging, biomedical labelling, photonics and plasmonics among other applications, including medical purposes[4–8].

Antibiotic resistance is a major problem nowadays in medical science and hence, has received considerable attention. Nanotechnology offers several nanomaterials which can be used as nanomedicine; these nanomaterials show better results compared to their respective bulk counterpart. In healthcare, AgNPs are being widely used in nanomedicine, with an annual production of more than 500 tonnes worldwide[9–13].

Many researchers have reported that silver nanocrystals show better antimicrobial activity against multidrug resistant pathogenic microorganisms. Hence, these have been used in different medical devices[2–3,14], and also in different consumer products such as filters, food containers and textiles[15–17]. It is also reported that these nanocrystals show little cytotoxicity[18–20], but mechanisms of this toxicity need further studies.

Recently, AgNPs have been tested against bacteria of Gram-positive as well as Gram-negative type by various researchers and found to be non-toxic at low concentration levels. AgNPs also show inhibition of bacterial growth at very low concentration compared to that of antibiotics, with no report of side effects as of now[21–24].

Interestingly, like size effect on many unique properties of silver nanocrystals, its antimicrobial activity has also been reported to be dependent on size[25–28]. Nevertheless, research on shape-dependent antibacterial activity is on-going.

With the aim to study of shape effect on antibacterial activity, we prepared silver nanohexagons and silver nanocubes of almost the same size, which were tested for their antibacterial activity against seven different types of bacteria. The study showed that antibacterial activity of silver nanocrystals was shape-dependent. Many researchers have reported that anisotropic shapes play a major role in biocidal activity. Pal *et al.*[29] reported that silver nanocrystals of truncated triangular shape showed much better antibacterial efficiency than spherical and

*For correspondence. (e-mail: dasratanphy@gmail.com)

Different anisotropic silver nanocrystals show different antibacterial activities – an effect of different prominent crystallographic orientations in different shapes

Sumit Sarkar[1], Biraj Sarkar[2], Sukhendu Mandal[2] and Ratan Das[1,*]

[1]Nano-Physics and Nanotechnology Research Laboratory, Department of Physics, Tripura University, Suryamaninagar 799 022, India
[2]Department of Microbiology, University of Calcutta, Kolkata 700 019, India

The antibacterial activity of silver (Ag) nanoparticles is well established and various researchers have provided different explanations for the same. We have tested the activity of similar-sized anisotropic Ag nanocrystals. Silver nanocubes and nanohexagons were prepared and their antibacterial activity was tested against a few bacteria such as *Bacillus cereus*, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus epidermidis*, *Klebsiella pneumonia*, *Vibrio parahaemolyticus* and *Pseudomonas aeruginosa*. It was found that the two shapes were active against all these bacteria. However, the plot of cell density of different bacterial pathogens against the concentration of silver nanocrystals was found to be different for these two shapes. Moreover, half maximal inhibitory concentration value and minimum bactericidal concentration value were also different for the two shapes. XRD analysis showed that both the nanocrystals were crystalline in nature, but their crystallographic orientation was different. So, it can be inferred from this study that some crystallographic planes are probably more active towards reaction with different bacterial compositions and hence, responsible for stronger antibacterial activity.

Keywords: Antibacterial activity, anisotropic silver nanocrystals, crystallographic planes, half maximal inhibitory concentration, minimum bacterial concentration.

NOWADAYS, nanomaterials have become important in the fast-developing field of nanomedicine. Therefore, knowledge of the properties of nanoparticles and their effect on different microbes is essential for different clinical application purposes. Due to their unique physico-chemical properties, silver nanoparticles (AgNPs) have recently gained considerable attention among researchers[1–3]. AgNPs show high surface reactivity with greater versatility for technological applications, especially in the field of nano-biotechnology. Nonspherical nanoparticles such as hexagons, cubes, triangles, prisms and several types of silver nanocrystals exhibit many important properties, which makes them useful in sensing and imaging, biomedical labelling, photonics and plasmonics among other applications, including medical purposes[4–8].

Antibiotic resistance is a major problem nowadays in medical science and hence, has received considerable attention. Nanotechnology offers several nanomaterials which can be used as nanomedicine; these nanomaterials show better results compared to their respective bulk counterpart. In healthcare, AgNPs are being widely used in nanomedicine, with an annual production of more than 500 tonnes worldwide[9–13].

Many researchers have reported that silver nanocrystals show better antimicrobial activity against multidrug resistant pathogenic microorganisms. Hence, these have been used in different medical devices[2–3,14], and also in different consumer products such as filters, food containers and textiles[15–17]. It is also reported that these nanocrystals show little cytotoxicity[18–20], but mechanisms of this toxicity need further studies.

Recently, AgNPs have been tested against bacteria of Gram-positive as well as Gram-negative type by various researchers and found to be non-toxic at low concentration levels. AgNPs also show inhibition of bacterial growth at very low concentration compared to that of antibiotics, with no report of side effects as of now[21–24].

Interestingly, like size effect on many unique properties of silver nanocrystals, its antimicrobial activity has also been reported to be dependent on size[25–28]. Nevertheless, research on shape-dependent antibacterial activity is on-going.

With the aim to study of shape effect on antibacterial activity, we prepared silver nanohexagons and silver nanocubes of almost the same size, which were tested for their antibacterial activity against seven different types of bacteria. The study showed that antibacterial activity of silver nanocrystals was shape-dependent. Many researchers have reported that anisotropic shapes play a major role in biocidal activity. Pal *et al.*[29] reported that silver nanocrystals of truncated triangular shape showed much better antibacterial efficiency than spherical and

*For correspondence. (e-mail: dasratanphy@gmail.com)

Received: 17 May 2020 | Revised: 13 September 2020 | Accepted: 24 October 2020

DOI: 10.1002/jobm.202000296

RESEARCH PAPER

Journal of Basic Microbiology

Enhancement of antibacterial activity of synthesized ligand-free CdS nanocrystals due to silver doping

Pijush C. Dey[1] | **Birson Ingti**[2] | **Amitabha Bhattacharjee**[2] | **Manabendra D. Choudhury**[3] | **Ratan Das**[1] | **Siddhartha S. Nath**[4]

[1]Nano-Physics & Nanotechnology Research Lab, Department of Physics, Tripura University, Agartala, Tripura, India

[2]Department of Microbiology, Assam University, Silchar, Assam, India

[3]Department of Life Science and Bioinformatics, Assam University, Silchar, Assam, India

[4]Central Instrumental Lab (CIL), Assam University, Silchar, Assam, India

Correspondence
Ratan Das, Department of Physics, Tripura University (A Central University), Suryamaninagar, Agartala, Tripura 799022, India.
Email: dasratanphy@gmail.com

Abstract

Recently, different nanocrystals have been reported to be the alternative, optimistic, and novel antimicrobial agent against the many antibiotic-resistant bacteria. Here, ligand-free CdS and Ag-doped CdS (Ag/CdS) nanocrystals have been synthesized by chemical methods for the study of the antimicrobial activity on *Escherichia coli* and *Staphylococcus aureus* by Kirby–Bauer diffusion method to see the effect against Gram-positive and Gram-negative bacteria. These prepared nanocrystals have been characterized by transmission electron microscopy (TEM), scanning electron microscopy (SEM), and X-ray diffraction (XRD). TEM and SEM images confirm the spherical morphology of both the sample and the respective XRD patterns indicate polycrystalline nature having a cubic zinc blende structure. Antibacterial activities have been tested with CdS and Ag/CdS, considering concentrations ranging from 10 to 200 μg/ml. After 24 h of incubation, the zone of inhibition (ZOI) is measured for each concentration, which shows that both the nanocrystals are ineffective against *E. coli* but much effective against *S. aureus* at this low concentration range. Furthermore, Ag/CdS nanocrystals have been found to show much more ZOI than CdS. Differences in the antibacterial activity can be due to the presence of different cell wall in *E. coli* and *S. aureus*.

KEYWORDS

Ag/CdS nanocrystals, antimicrobial activity, ligand free, TEM, zone of inhibition

1 | INTRODUCTION

Group II–VI semiconductor nanocrystals recently have attracted considerable attention owing to their unique size-dependent optical and electrical properties resulting from their quantum confinement effect. Their properties can be tuned finely by doping with different suitable material, for important technological purposes including antibacterial activity [1-3]. Nowadays researchers started using different nanomaterials as an antibacterial agent because microorganisms show multiple drug resistance, which has become a critical issue in the field of medical science [4-6], and hence, considerable attention has been given to the utilization of nanomaterials as an antibacterial agent. Because of their high surface to volume ratio and their unique chemical and physical properties, different nanocrystals are coming up as a very good antibacterial agent [7]. These antimicrobial properties of

Abbreviation: Ag/CdS, Ag-doped CdS.

Received: 17 May 2020 | Revised: 13 September 2020 | Accepted: 24 October 2020

DOI: 10.1002/jobm.202000296

RESEARCH PAPER

Journal of Basic Microbiology

Enhancement of antibacterial activity of synthesized ligand-free CdS nanocrystals due to silver doping

Pijush C. Dey[1] | **Birson Ingti**[2] | **Amitabha Bhattacharjee**[2] | **Manabendra D. Choudhury**[3] | **Ratan Das**[1] | **Siddhartha S. Nath**[4]

[1]Nano-Physics & Nanotechnology Research Lab, Department of Physics, Tripura University, Agartala, Tripura, India

[2]Department of Microbiology, Assam University, Silchar, Assam, India

[3]Department of Life Science and Bioinformatics, Assam University, Silchar, Assam, India

[4]Central Instrumental Lab (CIL), Assam University, Silchar, Assam, India

Correspondence
Ratan Das, Department of Physics, Tripura University (A Central University), Suryamaninagar, Agartala, Tripura 799022, India.
Email: dasratanphy@gmail.com

Abstract

Recently, different nanocrystals have been reported to be the alternative, optimistic, and novel antimicrobial agent against the many antibiotic-resistant bacteria. Here, ligand-free CdS and Ag-doped CdS (Ag/CdS) nanocrystals have been synthesized by chemical methods for the study of the antimicrobial activity on *Escherichia coli* and *Staphylococcus aureus* by Kirby–Bauer diffusion method to see the effect against Gram-positive and Gram-negative bacteria. These prepared nanocrystals have been characterized by transmission electron microscopy (TEM), scanning electron microscopy (SEM), and X-ray diffraction (XRD). TEM and SEM images confirm the spherical morphology of both the sample and the respective XRD patterns indicate polycrystalline nature having a cubic zinc blende structure. Antibacterial activities have been tested with CdS and Ag/CdS, considering concentrations ranging from 10 to 200 μg/ml. After 24 h of incubation, the zone of inhibition (ZOI) is measured for each concentration, which shows that both the nanocrystals are ineffective against *E. coli* but much effective against *S. aureus* at this low concentration range. Furthermore, Ag/CdS nanocrystals have been found to show much more ZOI than CdS. Differences in the antibacterial activity can be due to the presence of different cell wall in *E. coli* and *S. aureus*.

KEYWORDS

Ag/CdS nanocrystals, antimicrobial activity, ligand free, TEM, zone of inhibition

1 | INTRODUCTION

Group II–VI semiconductor nanocrystals recently have attracted considerable attention owing to their unique size-dependent optical and electrical properties resulting from their quantum confinement effect. Their properties can be tuned finely by doping with different suitable material, for important technological purposes including antibacterial activity [1-3]. Nowadays researchers started using different nanomaterials as an antibacterial agent because microorganisms show multiple drug resistance, which has become a critical issue in the field of medical science [4-6], and hence, considerable attention has been given to the utilization of nanomaterials as an antibacterial agent. Because of their high surface to volume ratio and their unique chemical and physical properties, different nanocrystals are coming up as a very good antibacterial agent [7]. These antimicrobial properties of

Abbreviation: Ag/CdS, Ag-doped CdS.

NATIONAL MISSION ON HIMALAYAN STUDIES (NMHS)

G.B. Pant National Institute of Himalayan Environment (NIHE)
Kosi-Katarmal, Almora - 263643, Uttarakhand, India

Ref. No.: GBPNI/NMHS-2020-21/MG/ **Date:** 26.06.2020

To,

Er. Vaibhav E. Gosavi
Scientist-C
G.B. Pant National Institute of Himalayan Environment (GBPNIHE)
Kosi-Katarmal, Almora, Uttarakhand-263643

Subject: Approval of the Medium Grant (MG) for the project entitled **"Spring Rejuvenation for Water Security in Himalaya"**

Sir,

I am directed to convey the approval of the Competent Authority for the above-mentioned project at a total cost of **Rs.4,99,90,911/-(Rupees Four Crore Ninety Nine Lakh Ninety Thousand Nine Hundred Eleven Only)** for a period of three years, as per the break-up given below:-

Head	1st year (in Rs.)	2nd year (in Rs.)	3rd year (in Rs.)	Total grant
A. Recurring				
(i) Salary: 01 JRF @ Rs.31,000/- + HRA @ 8% per month for first two years and Rs.35,000/- + HRA @ 8% for third year. 12 JPF/ Project Assistant @ Rs.20,000/-+ HRA @ 8% or minimum Rs.1,800/- per month for for first two years and Rs. 23,000/- + HRA @ 8% per month for third years. 01 Field Assistant @ Rs.12,000/- fix per month for three years.	3684960.00	3684960.00	4174560.00	**11544480.00**
(ii) Travel(Domestic):	1000000.00	980000.00	760000.00	**2740000.00**
(iii)Contingency:	810000.00	790000.00	520000.00	**2120000.00**
(iv)Consumable:	740000.00	740000.00	625000.00	**2105000.00**
(v) Activities & other project cost: Plantation works-78 (ha), Maintenance of plants, Contour Trenching-12985 nos, Recharge pits-383 nos, Impervious check dams-455 nos, R.R. Dry Check dams-780 nos, Vegetation check dams-2600 nos, Mud/ Stone builds/gully plugging-325 nos, Conical ponds-104 nos, Barbed wire fencing-65000 Meters, Upstream Water storage tank-13 nos, Downstream surplus water storage tank- 13 nos, Survey cost, Awareness programme, watch & ward and others and Meetings and Workshops- 13 nos., field monitoring etc.	10747044.00	10747044.00	3259343.00	**24753431.00**
B. Non Recurring				
(i) Equipment: Rain Gauges-36 nos Rs.10.80 lakh, Soil Moisture Sensors-36 nos Rs.43.38 Lakh, Water Level Recorder-12 nos Rs.12.00 Lakh, Laptop/ desktop-1 nos 0.80	6728000.00	0.00	0.00	**6728000.00**

DST/CCP/MRDP/190/2019(G)
Government of India
Ministry of Science & Technology
Department of Science & Technology
(SPLICE- Climate Change Programme)

Technology Bhavan, New Delhi
Dated **22.01.2020**

ORDER

Sub: Research proposal on establishment of a Major R&D Programme titled **"Net ecosystem production and carbon dynamics of forest ecosystems in North East India in relation to altitude and latitude gradient: Implications for carbon sink management"** to be coordinated by Mizoram University, Aizawl - 796004, Mizoram **(PI-Dr. Uttam Kumar Sahoo)** under the National Mission for Sustaining the Himalayan Ecosystem (NMSHE) -Approval of the proposal and release of grants for the first year.

Sanction of the President is hereby accorded to the approval of the above mentioned project at a **total cost of Rs. 1,86,52,640/- (Rupees one crore eighty six lakhs fifty two thousand six hundred forty only)** for a duration of three years. The detailed breakup of the grant for General as well as Capital components and the items of expenditure as approved are given as below:-

General Component **Rs. 1,55,52,640/-**

Capital Component **Rs. 31,00,000/-**

Items of expenditure as approved:

Head	I Yr	II Yr	III Yr	Total
Non- Recurring	**Rs.**	**Rs.**	**Rs.**	**Rs.**
LI -8100 soil CO2 flux unit# (01)	1500000	--	--	1500000
Computer and accessories (01)	100000	--	--	100000
LI -8100 soil CO2 flux unit (01)	1500000	--	--	1500000
Non-Recurring Total (A)	**3100000**	**0**	**0**	**3100000**
Recurring				
Manpower {RA-III (02 Nos.), JRF (02 Nos.), Field Worker (04 Nos.)}	3136320	3136320	3240000	9512640
Consumables	460000	590000	590000	1640000
Travel	500000	700000	700000	1900000
Contingencies	120000	120000	160000	400000
Other Costs	300000	250000	200000	750000
Organizing Workshop	150000	0	0	150000
Sub total	**4666320**	**4796320**	**4890000**	**14352640**
OH charges	400000	400000	400000	1200000
Recurring Total (B)	**5066320**	**5196320**	**5290000**	**15552640**
Grand Total (A+B)	**8166320**	**5196320**	**5290000**	**18652640**

Institution 1: Mizoram University				
Head	I Yr	II Yr	III Yr	Total
Non- Recurring	**Rs.**	**Rs.**	**Rs.**	**Rs.**
LI -8100 soil CO2 flux unit# (01)	1500000	--	--	1500000
Non-Recurring Total (A)	**1500000**	--	--	**1500000**
Recurring				

Research Associate-III (01Nos.) @54000/Month + HRA 8%	699840	699840	699840	2099520
Field Worker-I (01 Nos.) @18000/Month + HRA 8%	233280	233280	233280	699840
Consumables	180000	270000	270000	720000
Travel	150000	250000	250000	650000
Contingencies	30000	30000	40000	100000
Other Costs	75000	75000	50000	200000
Organizing Workshop	150000	0	0	150000
Sub total	**1518120**	**1558120**	**1543120**	**4619360**
OH charges	100000	100000	100000	300000
Recurring Total (B)	**1618120**	**1658120**	**1643120**	**4919360**
Grand Total (A+B)	**3118120**	**1658120**	**1643120**	**6419360**

Institution 2: Assam University				
Head	I Yr	II Yr	III Yr	Total
Non- Recurring	**Rs.**	**Rs.**	**Rs.**	**Rs.**
Computer and accessories (01)	100000	--	--	100000
LI -8100 soil CO2 flux unit (01)	1500000	--	--	1500000
Non-Recurring Total (A)	**1600000**	**--**	**--**	**1600000**
Recurring				
Research Associate-III (01Nos.) @54000/Month + HRA 8%	699840	699840	699840	2099520
Field Worker-I (01 Nos.) @18000/Month + HRA 8%	233280	233280	233280	699840
Consumables	180000	270000	270000	720000
Travel	150000	250000	250000	650000
Contingencies	30000	30000	40000	100000
Other Costs	75000	75000	50000	200000
Sub total	**1368120**	**1558120**	**1543120**	**4469360**
OH charges	100000	100000	100000	300000
Recurring Total (B)	**1468120**	**1658120**	**1643120**	**4769360**
Grand Total (A+B)	**3068120**	**1658120**	**1643120**	**6369360**

Institution 3: Tripura University				
Head	I Yr	II Yr	III Yr	Total
Recurring	**Rs.**	**Rs.**	**Rs.**	**Rs.**
JRF (01 Nos.) @31000/Month + HRA 8% for 1st & 2nd year and SRF (01) @35000/Month + HRA 8% for 3rd year	401760	401760	453600	1257120
Field Worker (01 Nos.) @18000/Month + HRA 8%	233280	233280	233280	699840
Consumables	100000	50000	50000	200000
Travel	100000	100000	100000	300000
Contingencies	30000	30000	40000	100000
Other Costs	75000	50000	50000	175000
Sub total	**940040**	**865040**	**926880**	**2731960**
OH charges	100000	100000	100000	300000
Recurring Total (B)	**1040040**	**965040**	**1026880**	**3031960**

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
(AN AUTONOMOUS INSTITUTE UNDER DST, GOVT. OF INDIA)

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 35

OFFICE ORDER

The Director, IASST is pleased to allow Dr. A R Pal, Associate Professor, PSD to carry out a collaborative research project with Gobinda Gopal Khan, Assistant Professor, Department of Material Science & Engineering, Tripura University on defect engineering of prepared nanostructures by hydrogen plasma treatment.

Material characterization facility available at IASST would be provided during the collaborative work. There will be no other financial liability on the part of IASST.

(D. Goswami)
Registrar

Memo No. IASST/PF/2020-21/ 52-55. Date: 21/04/2020

Copy to:

1. PS to the Director, IASST
2. The Chairman, Academic Committee, IASST
3. Dr. A R Pal, Associate Professor, PSD, IASST
4. Concerned File

(D. Goswami)

DST/NM/NB/2018/203(G) (JMI)

Government of India
Ministry of Science & Technology
Department of Science & Technology

Technology Bhavan
New Mehrauli Road
New Delhi -110 016
Dated: 17/01/2020

ORDER

Subject:	**Financial support for the research project entitled "*In vivo Central Venous Catheters associated biofilm infection surface treatment using nanomaterials NMs to decrease the thrombotic and infection risks*" by Dr. Ashwini Chauhan, Assistant Professor, Department of Microbiology, Tripura University, Tripura-799022 – approval & part release of 1st installment of General grants .**

Sanction of the President is accorded to the above mentioned project at a total cost of **Rs. 23,97,696/- (Twenty Three Lakh Ninety Seven Thousand Six Hundred Ninety Six Only)** for a duration of 3 years with the total grant under "General" expenditure head. The detailed break-up of the grant is given below:

(Amount in Rupees)

Budget Head	1st year	2nd year	3rd year	Total
Manpower-as per DST norms1 JRF @ Rs.31,000(for 2 years)+ Rs 35000(for 1year) + HRA@24% for 3 years	4,61,280	4,61,280	5,20,800	14,43,360
Consumables	1,50,000	1,50,000	1,50,000	4,50,000
National Travel	50,000	50,000	50,000	1,50,000
Contingencies	50,000	50,000	50,000	1,50,000
Sub-total	**7,11,280**	**7,11,280**	**7.70800**	**21,93,360**
Overhead Charges (@10% of Total project cost excluding contingencies)	66,128	66,128	72,080	2,04,336
Total	**7,77,408**	**7,77,408**	**8,42,880**	**23,97,696**

2. The sanction of the President is also accorded to the release of **Rs. 1,00,000/- (One Lakh Only)** to The Registrar, Jamia Milia Islamia(JMI), Central University, Jamia Nagar, New Delhi-110025 being the part release first installment of the grant under 'Grants-in-aid General' for implementation of above mentioned project.

3. This sanction is subject to the condition that the grantee organization will furnish to the Department of Science & Technology, financial year wise Utilization Certificate (UC) in the Performa prescribed as per GFR 2017 and audited statement of expenditure (SE) along with up to date progress report at the end of each financial year duly reflecting the interest earned / accrued on the grants received under the project. This is also subject to the condition of submission of the final statement of expenditure, utilization certificate and project completion report within one year from the scheduled date of completion of the project.

4. The grantee organization will have to enter & upload the Utilization Certificate in the PFMS portal besides sending it in physical form to this Division. The subsequent/final instalment will be released only after confirmation of the acceptance of the UC by the Division and entry of previous Utilization Certificate in the PFMS.

5. Since the grant has been released only under General head through one sanction order the Institute has to furnish SE/UC for the grants released through General head only.

6. The grantee organization will maintain separate audited account for the project and the entire amount of grant will be kept in an interest bearing bank account. For Grants released during F.Y. 2017-18 and onwards, all interests and other earnings, against released Grant shall be remitted to Consolidated Fund of India (through Non-Tax Receipt Portal (NTRP), i.e., www.Bharatkosh.gov.in), immediately after finalization of accounts, as it shall not be adjusted towards future release of grant. A certificate to this effect shall have to be submitted along with Statement of Expenditure/ Utilization Certificate for considering subsequent release of grant/ closure of project accounts.

7. The grant-in-aid being released is subject to the condition that:

a) A transparent procurement procedure in line with the Provisions of General Financial Rules 2017 will be followed by the Institute/Organization under the appropriate rules of the grantee organisation while procuring capital assets sanctioned for the above mentioned project and a certificate to this effect will be submitted by the Grantee organization immediately on receipt of the grant.

b) While submitting Utilization Certificate/Statement of Expenditure, the organization has to ensure submission of supporting documentary evidences with regard to purchase of equipment/capital assets as per the provisions of GFR 2017. Subsequent release of grants under the project shall be considered only on receipt of the said documents.

8. DST reserves sole rights on the assets created out of grants. Assets acquired wholly or substantially out of government grants (except those declared as obsolete and unserviceable or condemned in accordance with the procedure laid down in GFR 2017), shall not be disposed of without obtaining the prior approval of DST.

...contd

9. This project does not provide for any payment of honorarium/ remuneration/ fellowship/ scholarship to the PI.

10. The account of the grantee organization shall be open to inspection by the sanctioning authority and audit (both by C&AG of India and Internal Audit by the Principal Accounts Office of the DST), whenever the organization is called upon to do so, as laid down under Rule 236(1) of General Financial Rules 2017.

11. Due acknowledgement of technical support / financial assistance resulting from this project grant should mandatorily be highlighted by the grantee organization in bold letters in all publications / media releases as well as in the opening paragraphs of their Annual Reports during and after the completion of the project.

12. Failure to comply with the terms and conditions of the Order will entail full refund with interest in terms of Rule 231 (2) of GFR 2017.

13. The expenditure involved is debited to:

Demand No.86: Department of Science & Technology for the year 2019-20:

3425	**Other Scientific Research (Major Head)**
60	**Others**
60.200	**Assistance to Other Scientific Bodes (Minor Head)**
69	**Research and Development**
69.00.31	**Grants-in-aid General for the year 2019-20**
(Nano Mission 3425.60.200.36.00.31)	

14. The amount of **Rs. 1,00,000/- (Rupees One lakh only)** will be drawn by the Drawing and Disbursing Officer, DST and will be disbursed to **The Registrar, Jamia Milia Islamia(JMI), Central University, Jamia Nagar, New Delhi-110025.** The bank details for electronic transfer of funds through RTGS are given below:

1.	Name of the Account Holder	Registrar, Jamia Milia Islamia
2.	Name of the Bank	Indian Bank
3.	Bank Account Number	443259891
4.	IFSC Code	IDIB000J029
5.	MICR Code	110019041

16. As per Rule 234 of GFR 2017, this sanction has been entered at S. No. 131 **NMD** in the register of grants maintained in the Division for the scheme Nano Mission.

17. This issues with the concurrence of IFD Vide their **Dy.No. C/ 5162 / IFD 2019-20 dated 17/01/2020**

नमता पाठक

(Namrata Pathak)
Scientist-F

To,
The Pay & Accounts Officer, DST

Copy forwarded for information and necessary action to:

1. Drawing and Disbursing Officer, DST, Cash Section. (Copy with two spare copies)
2. Integrated Finance Division, DST

3. **Dr. Ashwini Chauhan** Assistant Profeesor Department of Microbiology, Tirupura University, Tirupura-799022	4. **Registrar** Tirupura University, Tirupura-799022
5. **Dr. Manika Khanuja** Assistant Professor Nano Science and Nano Technology, Jamia Milia Islamia (JMI), Central University, Jamia Nagar, New Delhi - 110025	6. **Registrar** Jamia Milia Islamia (JMI), Central University, Jamia Nagar, New Delhi - 110025

7. **The Principal Director of Audit, Scientific Departments, IIIrd floor, AGCR Building, I.P. Estate, New Delhi- 110 002.**

6. Sanction folder (Nano Mission)	7. File copy

नमता पाठक

(Namrata Pathak)
Scientist-F

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
(Formerly WEST BENGAL UNIVERSITY OF TECHNOLOGY)
Main Campus: NH 12, Haringhata, Post Office - Simhat, Police Station – Haringhata, Pin - 741249
City Campus: BF-142, Sector -I, Salt Lake, Kolkata -700 064

No.2.12.14/Regis./MTG(SRC)/2020 Dated: 15.12.2020

To,
Dr. Shaon Ray Chaudhuri,
Associate Professor, Department of Microbiology,
Tripura University, Suryamaninagar, Agartala, Tripura, Agartala, Pin: 799022.

Dear Madam,

With reference to your email addressed to Hon'ble Vice-Chancellor, I am pleased to inform you that your proposal for collaborative work between Microbial Technology Group (Tripura University) and COEETM (Centre of Excellence in Environmental Technology and Management" of MAKAUT, WB has been accepted by the Competent Authority for implementation with respect to working on treatment at the Sewerage Treatment Plant (STP) developed at the Haringhata Campus of the university for nutrient removal (ammonia and nitrate).For expediting the work on the proposal floated by you, a Task Force has been constituted in the manner as noted below:

1. Dr. Indranil Mukherjee - Convenor
2. Dr. Ananta Das
3. Dr. ChabitaSaha
4. Dr. SharadinduChakrabarty
5. Dr. Shaon Roy Chaudhuri

You are requested to proceed for implementation of your proposal in coordination with the Task Force constituted. The working of the Task Force shall be with immediate effect from the date of issuance of this letter.

Thanking you,

With regards,

Dr. ParthaPratimLahiri,
Registrar, MAKAUT, WB.

Journal of Alloys and Compounds 836 (2020) 155535

Contents lists available at ScienceDirect

Journal of Alloys and Compounds

journal homepage: http://www.elsevier.com/locate/jalcom

Band gap engineering of cadmium selenide nanocrystals using 120 MeV Ag^{7+} swift heavy ions, alongside theoretical evidence through PBE+U analysis

Debojyoti Nath [a], Fouran Singh [b], Ratan Das [a, *]

[a] Nano-Physics & Nanotechnology Research Laboratory, Department of Physics, Tripura University, Suryamaninagar, 799 022, India
[b] Inter University Accelerator Center, Aruna Asaf Ali Marg, New Delhi, 110 067, India

ARTICLE INFO

Article history:
Received 2 March 2020
Received in revised form
4 May 2020
Accepted 5 May 2020
Available online 11 May 2020

Keywords:
SHI irradiation
Surface modification
First principle study
Band gap engineering
Charge density

ABSTRACT

The interaction of 120 MeV Ag^{7+} swift ions with the chemically prepared cadmium selenide nanocrystals have been studied in this work through XRD data analysis. Atomic force microscopic study provides the information that with SHI irradiation, average grain size increases and surface modification takes place. Thermal spike model gives an idea about the changes in the lattice structure due to SHI irradiation, which induces lattice geometry reorientation. Such changes in lattice geometry result in modification of band structure as well as density of states of the bands and therefore modification in the band gap of the prepared sample takes place. Theoretical study of the band gap tuning has been performed using first principles based on Quantum espresso Code through PBE + U analysis, which supports the results as obtained from experimental diffuse reflectance spectra and Photoluminescence spectral study. Hence, both the experimental and theoretical study confirm the band gap engineering of CdSe nanocrystals through SHI irradiation.

1. Introduction

Semiconductor nanocrystals of Gr II-VI in the size range of 1–100 nm possess attractive luminescence properties, which are application for different optoelectronics devices [1]. Among them, cadmium selenide is one of the important semiconductor nanocrystals for its versatile applications [2]. These luminescent properties along with other properties can be modified through either doping with suitable dopant [3] or through irradiation of swift heavy ions (SHI), which is found to have the additional advantage of surface modification of the sample [4]. Swift heavy ion (SHI) irradiation method has been used widely in recent times as SHI can induce changes in the material properties at the atomic level through electron-lattice interaction and that depends on the specification of the heavy ion [5]. Such SHI irradiation results in formation of cylindrical ion tracks due to the transfer of energy to the lattice structure, which effects the lattice geometry of the sample [6]. Thermal spike model theoretically explains this phenomenon of ion track formation with modification in the lattice geometry [7]. Depending on the specification of the heavy ion, overlapping of ion tracks takes place, which induces different point defects, defect states, color centers in the material [8].

SHI has been found to be the most effective against modification of the properties of semiconductor nanocrystals, as many authors reported the change of band gap, specially of Gr II-VI semiconductor nanocrystals [9]. Among this group, SHI irradiation effect on CdSe nanocrystal has been studied by only a few authors that are related to the changes in the structural, optical and electrical properties [10]. CdSe exhibits a direct bandgap of 1.74 eV with exciton Bohr radius of 6 nm, which results in better carrier mobility. Therefore, CdSe nanocrystals are of great interest for using it in different luminescence devices especially in LED. Further, SHI irradiation can tune the optical band gap with significant change in the density of charge carriers for suitable purposes, so irradiated sample can be application for better application purposes. Recently, Choudhary et al. [4] has reported about the decrement in the optical gap with the ion irradiation of Ag^{9+} heavy ions. Singh et al. [10] has also studied the effect of Ni^{7+} ions irradiation on the structural and electrical properties of CdSe. Thus, SHI interaction can be utilized in band gap

* Corresponding author.
E-mail address: dasratanphy@gmail.com (R. Das).

https://doi.org/10.1016/j.jallcom.2020.155535
0925-8388/