

ANNEXURES

Annexure IA:

NCBI Resources How To chitrita_chatterjee My NCBI Sign Out

Nucleotide Help

Advanced

GenBank Send to:

Microbacterium radiodurans strain K12016 16S ribosomal RNA gene, partial sequence

GenBank: MF600628.1
[FASTA](#) [Graphics](#)

[Go to:](#)

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 DEFINITION Microbacterium radiodurans strain K12016 16S ribosomal RNA gene, partial sequence.
 ACCESSION MF600628
 VERSION MF600628.1
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 ORGANISM [Microbacterium radiodurans](#)
 Bacteria; Actinobacteria; Micrococcales; Microbacteriaceae; Microbacterium.
 REFERENCE 1 (bases 1 to 708)
 AUTHORS Chatterjee,C., Sarkar Biswas,S. and Bhattacharyya,R.
 TITLE Screening Heavy metal resistance and PGPR like traits of soil bacteria, isolated from Tolly Nullah
 JOURNAL Unpublished
 REFERENCE 2 (bases 1 to 708)
 AUTHORS Chatterjee,C., Sarkar Biswas,S. and Bhattacharyya,R.
 TITLE Direct Submission
 JOURNAL Submitted (07-AUG-2017) LIFE SCIENCES, PRESIDENCY UNIVERSITY, 86/1 COLLEGE STREET, KOLKATA, WEST BENGAL 700073, India
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[rRNA](#)

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- Microbacterium radiodurans strain K12016 16S ribosomal RNA gene, partial sequence Nucleotide
- Bacillus xiamenensis strain 26K018 16S ribosomal RNA gene, partial sequence Nucleotide
- Bacillus xiamenensis strain 1E0018 16S ribosomal RNA gene, partial sequence Nucleotide
- Interference - An Introduction to Genetic Analysis

[See more...](#)

Annexure 1B:

NCBI Resources How To chitrita_chatterjee My NCBI Sign Out

Nucleotide Nucleotide Search Advanced Help

GenBank Send to

Bacillus xiamenensis strain 1E0018 16S ribosomal RNA gene, partial sequence

GenBank: MK353500.1
[FASTA](#) [Graphics](#)

Go to

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 Bacteria; Firmicutes; Bacilli; Bacillales; Bacillaceae; Bacillus.
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 AUTHORS Chatterjee,C., Bhattacharyya,R. and Sarkar Biswas,S.
 TITLE Analyse chromium tolerant mechanisms of soil bacteria isolated from different sewage sites of kolkata
 JOURNAL Unpublished
 REFERENCE 2 (bases 1 to 1403)
 AUTHORS Chatterjee,C., Bhattacharyya,R. and Sarkar Biswas,S.
 TITLE Direct Submission
 JOURNAL Submitted (02-JAN-2019) DEPARTMENT OF LIFE SCIENCES, PRESIDENCY UNIVERSITY, 86/1 COLLEGE STREET, KOLKATA, WEST BENGAL 700073, India
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11

Change region shown

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- Bacillus xiamenensis strain 1E0018 16S ribosomal RNA gene, partial sequen Nucleotide
- Bacillus xiamenensis strain 26K018 16S ribosomal RNA gene, partial sequen Nucleotide
- Microbacterium radiodurans strain K12016 16S ribosomal RNA gene, partial se Nucleotide
- Interference - An Introduction to Genetic Analysis

See more...

Annexure 1C:

NCBI Resources How To chirita chatterjee My NCBI Sign Out

Nucleotide Help

Advanced

GenBank Send to:

Bacillus xiamenensis strain 26K018 16S ribosomal RNA gene, partial sequence

GenBank: MK353157.1

[FASTA](#) [Graphics](#)

[Go to:](#)

LOCUS MK353157 1418 bp DNA linear BCT 08-JAN-2019

DEFINITION Bacillus xiamenensis strain 26K018 16S ribosomal RNA gene, partial sequence.

ACCESSION MK353157

VERSION MK353157.1

KEYWORDS .

SOURCE Bacillus xiamenensis

ORGANISM [Bacillus xiamenensis](#)
Bacteria; Firmicutes; Bacilli; Bacillales; Bacillaceae; Bacillus.

REFERENCE 1 (bases 1 to 1418)
AUTHORS Chatterjee,C., Bhattacharyya,R. and Sarkar Biswas,S.
TITLE Analyse heavy metal tolerant mechanisms of soil bacteria isolated from different sewage sites of kolkata

JOURNAL Unpublished

REFERENCE 2 (bases 1 to 1418)
AUTHORS Chatterjee,C., Bhattacharyya,R. and Sarkar Biswas,S.
TITLE Direct Submission
JOURNAL Submitted (02-JAN-2019) DEPARTMENT OF LIFE SCIENCES, PRESIDENCY UNIVERSITY, 86/1 COLLEGE STREET, KOLKATA, WEST BENGAL 700073, India

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Sequencing Technology :: Sanger dideoxy sequencing
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Annexure 2:

International Journal of Engineering, Science and Mathematics

Vol. 7 Special Issue 4(1), April 2018,

ISSN: 2320-0294 Impact Factor: 6.765

Journal Homepage: <http://www.ijemra.us>, Email: editorijemra@gmail.com

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**Characterize heavy metal tolerant rhizospheric sewage bacteria
isolated from Tolly nullah (with special emphasis on strain
Microbacterium radiodurans K12016)**

Chitrita Chatterjee*
Rabindranath Bhattacharyya**
Shampa Sarkar (Biswas)***

Abstract

Because of rapid industrialization and urbanization, heavy metals are deposited in the environment in frightening quantity. Literature survey manifested, that the heavy metal contaminated soil born microbes can be a potent mode of environmental heavy metal degradation. In the present study, to reveal microbial heavy metal tolerant activity rhizospheric microbes were isolated from sewage sludge of circular canal (Tolly Nullah) and characterize. Microbial heavy metal resistance pattern was checked against four heavy metal salts (Cr₂O₃, CrO₃, CdCl₂ and CoCl₂) individually and in consortium. Plant growth promoting rhizobacterial (PGPR) traits of isolated microbes were evaluated. One interesting isolated strain (*Microbacterium radiodurans* strain K12016), identified by 16s rDNA, shown total tolerance against 100 mM Cr₂O₃ (Cr³⁺) and also mentionable Cobalt and hexavalent Chromium (Cr⁶⁺) tolerance, but didn't produce a significant amount of plant growth promoting IAA whereas the most of the rest isolates produced adequate amount of IAA. 16s rDNA of that particular isolate was analyzed and phylogenetic tree was constructed using the neighbor-joining method to ensure its taxonomic position. Furthermore experimentation and gene study should require to determining heavy metal resistance mechanism of *Microbacterium radiodurans* K12016.

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Keywords:

Heavy Metal tolerance;
Biochemical analysis;
Antibiotic resistance;
Indole Acetic Acid (IAA);
16s rDNA.

Author correspondence:

Chitrita Chatterjee,
PhD Student, Department of Life Sciences,
Presidency University, 86/1 College Street, Kolkata, West Bengal, India
Email: chitrita87@gmail.com; chitrita.rs@presiuniv.ac.in

1. Introduction

As a result of different unrestricted anthropogenic activities, different concerning heavy metals like Chromium (Cr), Lead (Pb), Cadmium (Cd), Cobalt (Co), Nickel (Ni), Iron (Fe) are alarmingly increased in the environment, particularly the areas where waste materials from different industrial sectors, tannery,

Annexure 3A:

Abstracts

International Conference on
The Green Planet: past, present and future
 Organized by
 **CAS Phase VII, Department of Botany
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 **Probir Chatterjee Research Foundation
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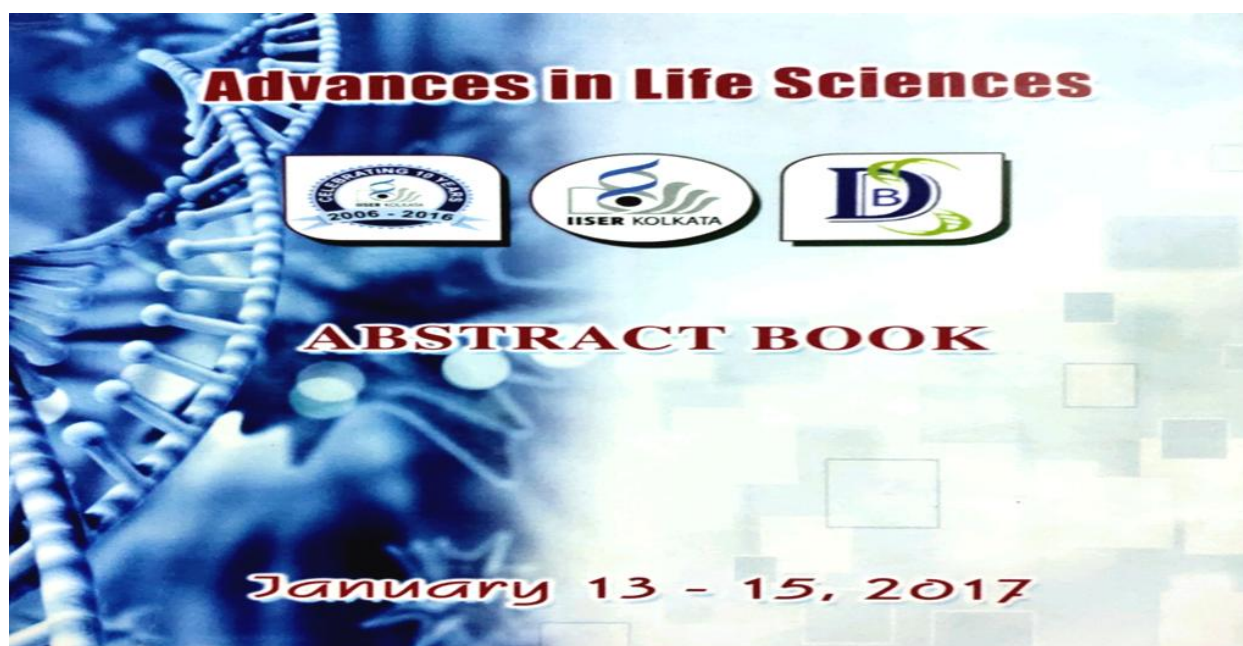
    

PP-T13-15
**Investigation of plant growth promoting traits exhibited by heavy metal tolerant soil bacteria
 retrieved from Tolly Nullah (Kolkata)**

Chitrita Chatterjee, Shampa Sarkar (Biswas) and Rabindranath Bhattacharyya
 Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata (700073), West Bengal,
 INDIA
 E-mail: rabindranath.dbs@presiuniv.ac.in

It is quite important to formulate an efficient strategy to degrade heavy metal in the industrial sewage sludge in Kolkata which are the natural habitat of many heavy metal tolerant microbes. To perceive the bioremediation activity of different soil-borne bacteria, primarily their heavy metal resistance pattern and plant growth promoting activity should be examined. To find their heavy metal resistance pattern twelve soil microbes were isolated initially from sewage sludge of circular canal (Tolly Nullah) which is renowned in Kolkata as 'Adi Ganga'. The heavy metal resistance pattern of five selective microbes against four heavy metal salts (Cr_2O_3 , CrO_3 , CdCl_2 and CoCl_2) in different concentrations (10 NM, 10 μM , 10 millimeter, 50 millimeter and 100 mm) was checked. Plant growth promoting potential of isolated microbes was evaluated by estimating their Indole Acetic Acid (IAA) production and phosphate solubilization capacity. 16s rRNA were sequenced and their evolutionary distances were also calculated. One of the isolated strains showed high susceptibility against 10 mm of CdCl_2 but most of the other salts could not stop bacterial growth at 10 mm concentration. Another fascinating strain (shown similarity with *Microbacterium arboreoscens* as per NCBI BLAST result) revealed total resistance against Cr_2O_3 till 100 mM concentration, the maximum salt concentration used, and produce negligible amount of IAA whereas other four strains produce adequate amount of IAA using L-Tryptophan supplemented media. The overall result revealed that all of the examined strains isolated from the Tolly Nullah soil sludge showed heavy metal resistance up to 10 mM heavy metal concentration and also able to produce plant growth promoting hormone IAA. Thus the isolated soil microbes might convenient candidate for heavy metal bioremediation and plant growth induction at a time. Further work should be needed to identify the genes and their signal transduction pathways in response to heavy metals.

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Annexure 3B:

Poster No- 15

Isolation and partial characterization of heavy metal resistance sewage bacteria from tolly nullah and their potential in the plant growth promotion

Chitrita Chatterjee, Rabindranath Bhattacharyya and Shampa Sarkar (Biswas)

Department of Life Sciences
Presidency University, Kolkata

In the present circumstances, it's quite important to find out a potent technique for degradation of soil accumulated heavy metals. The soil microbes that are present in heavy metal contaminated soil can be a safe mode of heavy metal bioremediation. To reveal microbial bioremediation activity primarily chosen five vigorously grown microbial isolates amongst the microbes isolated from circular canal (Tolly Nullah), identified them biochemically and their heavy metal resistance pattern was checked against four heavy metal salts (Cr_2O_3 , CrO_3 , CdCl_2 and CoCl_2) in different concentrations (10 nM, 10 μM , 10 mM, 50 mM and 100 mM). Biochemical characterization was evaluated by estimating Amylase, Catalase, Gelatinase production and mixed acid fermentation capability. Plant growth promoting potential of isolated microbes was also evaluated because if heavy metal cleaning bacteria helps in plant growth promotion also they can be used easily in bioremediation and cropping at a time. PGPR like traits were measured by estimating Indole Acetic Acid (IAA) production and phosphate solubilization capability. One isolate showed high susceptibility against up to 10 mM of CdCl_2 and other interesting isolate (shown similarity with *Microbacterium arborescens* as per NCBI BLAST result) revealed total resistance against Cr_2O_3 till 100 mM concentration, the maximum salt concentration used, but produce negligible amounts of IAA whereas the rest produce adequate amount of IAA. 16s rRNA of one isolate was sequenced and analyzed. Further experimentation and gene study should be needed to conclude any role of isolated microbes in heavy metal bioremediation and plant growth promotion.

Annexure 3C:

FBSA 2018
 UGC-CPE sponsored International Conference on
**Facets of
 Basic Sciences
 & Applications**
 FEBRUARY 5 - 7, 2018
 Abstracts
 Bijoy Krishna Girls College, Howrah
 5/3 M.G. Road, Howrah - 711 101, West Bengal, India
 www.bkgc.org

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 Botany, Chemistry, Computer Science,
 Electronics, Mathematics, Micro-Biology,
 Physics, Statistics and Zoology**

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**ISOLATION, CHARACTERIZATION AND GENETIC STUDY OF HEAVY METAL
 RESISTANCE SEWAGE BACTERIA FROM TOLLY NULLAH AND THEIR
 POTENTIALITY IN PLANT GROWTH PROMOTION**


CHITRITA CHATTERJEE*, RABINDRANATH BHATTACHARYYA AND SHAMPA
 SARKAR (BISWAS)

Department of Life Sciences
 Presidency University
 86/1 College Street, Kolkata – 700073
 West Bengal, INDIA


Because of rapid industrialization and urbanization, it's become quite important to find out a potent way for degradation of soil accumulated heavy metals. The soil microbes that are present in heavy metal contaminated soil can be a safe mode of heavy metal bioremediation. To reveal microbial bioremediation activity five vigorously grown microbial isolates were chosen amongst the microbes isolated from circular canal (TollyNullah). Isolates were identified and morphologically, biochemically, physiologically characterized and their heavy metal resistance pattern was checked against four heavy metal salts (Cr_2O_3 , CrO_3 , CdCl_2 and CoCl_2) individually and in consortium. Plant growth promoting (PGPR) traits of isolated microbes was also evaluated by estimating Indole Acetic Acid (IAA) production and phosphate solubilization capability because if heavy metal cleaning bacteria helps in plant growth promotion. They can also be used easily in bioremediation and cropping at a time. One interesting isolated strain (*Microbacterium radiodurans* strain K12016), identified by 16s rRNA sequencing, revealed total resistance against Cr_2O_3 upto 100 mM concentration, the maximum salt concentration used, it's also shown considerable resistance against other used heavy metals but produces negligible amounts of IAA whereas the rest produce adequate amount of IAA. So, this strain can be utilized in cleaning environmental heavy metal pollutants. 16s rRNA of that particular isolate was analyzed and phylogenetic tree was constructed using the Maximum Composite Likelihood method to calculate evolutionary distances. In silico analysis of different microbial heavy metal attaching regions and degrading pathways is also helpful to predict bacterial signal transduction in response to heavy metal. Furthermore experimentation and gene study should require to standardizing bacterial heavy metal resistance pattern.

Annexure 3D:

**National Conference on
FUTURE INDIA : SCIENCE AND
TECHNOLOGY**
27th & 28th February, 2019
Jointly organised by

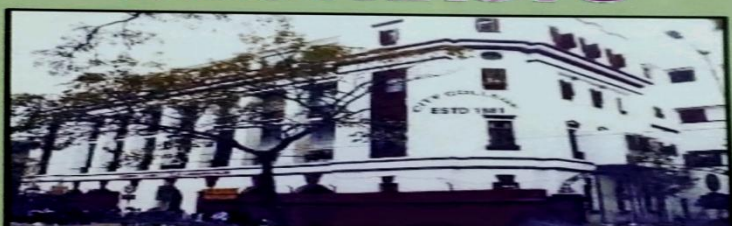


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ABSTRACTS



**Venue: City College
102/1, Raja Rammohan Sarani,
Kolkata – 700 009, West Bengal, India**

Abstract No.: AE-07
Field/ Category of Abstract: Agriculture and Environment Sciences

**The Role of Municipal Sewage Microbes in Chromium
Accumulation and Reduction**

**Chitrira Chatterjee*^{1*}, *Rabindranath Bhattacharyya*², *Shampa Sarkar Biswas*³

¹ Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata
² Associate Professor (Retired), Department of Life Sciences (Microbiology Laboratory), 86/1 College Street, Presidency University, Kolkata
³ Department of Life Sciences, 86/1 College Street, Presidency University, Kolkata

* Corresponding author; e-mail: chitrira.rs@presiuniv.ac.in

The hot and humid climate of Kolkata helps sewage microbes to persist in the heavy metal contaminated environments of different sewage canals. Inspired by previous works on microbial bioremediation, we collected soil samples from three urbanized sewage regions of Kolkata and isolated soil microbe to check their degree of heavy metal resistance and mode of interactions with heavy metal. Soil heavy metal profiling by Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometer shown the soil chromium concentration at three selected municipal sewage regions (Circular Canal, East Kolkata Wetland and Kestopur Khal) varied greatly. The results of microbial heavy metal resistance also revealed that almost all of the isolated bacteria shown considerable resistance against trivalent and hexavalent chromium. One interesting strain of *Microbacterium* (GenBank accession MF600628) isolated from comparatively less chromium containing Circular Canal region shown total resistance against hexavalent chromium individually and in consortia. Chromium absorbance and removal ability of that microbe were investigated using EDXRF, Atomic Absorption Spectroscopy (AAS) and Diphenylcarbazole spectrophotometry method (APHA 23rd Ed.). Higher bioconcentration factor (542458.57) of *Microbacterium radiodurans*K12016 grown in 40 mM (concentration adjacent to MIC) hexavalent chromium supplemented media indicated the bacteria accumulate absorbed heavy metal. The TEM image also supported the finding. The near relative of *Microbacterium* shown the protein interaction with hexavalent Chromium in molecular docking. From experimentation, it could also be predicted that *Microbacterium radiodurans*K12016 and some other isolated *Bacillus* strains (GenBank accession MK353157 and MK353500) have reduced hexavalent chromium to trivalent one. So we inferred that morphologically and biochemically identical soil microbes, residing in the different sewage regions of Kolkata, exhibit a similar trend in heavy metal resistance and mode of action against chromium in which they accumulate the absorbed chromium and reduced them to the non-toxic trivalent form.

A 9

Annexure 3E:

The Role of Heavy Metal Resistance Indole Producing Municipal Sewage Microbes in Plant Heavy Metal Absorption and Accumulation

¹Chitrita Chatterjee, ²Rabindranath Bhattacharyya, ²Shampa Sarkar Biswas

¹Department of Life Sciences, Presidency University, Kolkata, ²Department of Life Sciences, Presidency University, Kolkata

The hot and humid climate of Kolkata helps sewage microbes to persist in the heavy metal contaminated environments of different sewage canals. Chromium resistant sewage microbes isolated from slightly alkaline sewage soil of different municipal sewage, showed Chromium absorption and accumulation. Chromium absorbance capability of microbes was investigated using Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometer and Diphenylcarbazole spectrophotometry method (APHA 23rd Ed.). Molecular characterization of the microbes shown that most of them are different species of *Bacillus* (GenBank accession numbers JN392001–JN3920013, MK353157, MK353500). Only one interesting *Microbacterium* species (GenBank accession MF600628) was identified which shown considerable resistance against hexavalent Chromium. Higher (542458.57) microbial bioconcentration factor of *Microbacterium radiodurans* K12016 grown in 40 mM (concentration adjacent to MIC) hexavalent Chromium supplemented media indicated the bacteria accumulate absorbed heavy metal. The near relative of *Microbacterium* shown the protein–ligand interaction with hexavalent Chromium in molecular docking. But the *Microbacterium* didn't produce a significant amount of Indole compound whereas HPTLC analysis showed most of the other strain isolated from Kestopur and East Kolkata Wetland produce plant growth promoting hormone IAA and IBA. But Plants grown in heavy metal contaminated regions absorb metal from rhizospheric soils; through food chain the absorbed metal reached to human being, magnified and affect human health. Instead of the alarming soil Chromium concentration, the considerably low Plant bioconcentration factor, BCF (East Kolkata Wetland, Circular Canal and Kestopur Khal were 0.036, 0.028 and 0.085) respectively indicated that they couldn't absorb a significant amount of soil metal. Less than one bioconcentration factor also indicates that the plant didn't accumulate absorbed metal within the cell. Then it could be predicted from the analyzed data that the soil microbes play a remarkable role in plant Chromium absorption control.

Keywords: EDXRF; HPTLC; docking; BCF

Annexure 3F:

One-day National Conference on
**Wildlife, Ecology
and Biodiversity
(WEB-2020):**
New vistas in research and conservation
Date: 28th March 2020 (Saturday)
Time: 9:00 am – 6:00 pm
Venue: Shibpur Dinobundhoo Inst. (College)
412/1, G.T.Road (South) Shibpur,
Howrah – 711102
Website: <http://sdbic.ac.in/>



Important Dates:
Online Registration:
01.03.2020 to 25.03.2020
Submission of Abstract:
within 15.03.2020.
Acceptance: 18.03.2020
Submission of Full Paper*:
within 25.03.2020.

Contact:
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Organized by:
Dept. of Zoology, Shibpur Dinobundhoo Institution (College)
In collaboration with
West Bengal Biodiversity Board
(Dept. of Environment, Govt. of West Bengal)
&
Dept. of Zoology, Dr. Kanailal Bhattacharyya College

Abstract under theme: Environmental Economics

***Microbacterium radiodurans* and *Bacillus xiamenensis* isolated from different sewage microbial communities of Kolkata, perform chromium bioremediation and cropping**

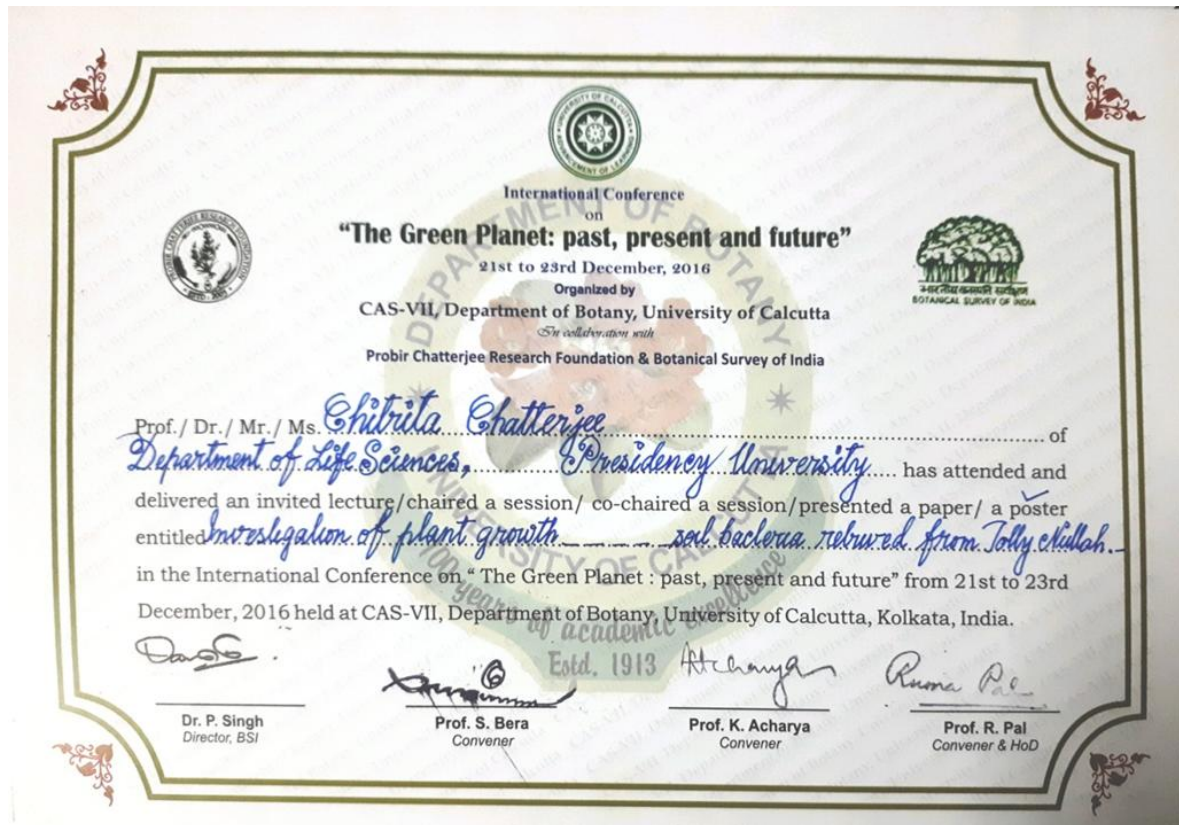
Chitrita Chatterjee*, PhD Student;
Shampa Sarkar (Biswas)**, Assistant Professor;
Rabindranath Bhattacharyya***, Professor (Retired)
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The amount of dissolved oxygen (DO) and chemical oxygen demand (COD) of different sewage sites revealed that Kolkata's sewage sites studied herein are highly polluted with organic materials, but have not yet crossed the borderline, which is why different pollutant tolerant plants, animals, and microbes are still able to grow and survive.

The chromium resistant aerobic microbes isolated from the heavily polluted rhizospheric wetland soils of Kolkata could accumulate absorbed Cr(VI) within their cells and converted them to less hazardous Cr(III). 16S rRNA based analysis exhibited that different species of *Microbacterium* and *Bacillus* were highly abundant in chromium contaminated regions. Sequence comparison study displayed that different geochemically important chromium tolerant and chromium resistant genes which translate numerous stress-induced proteins were native in *Microbacterium* and some species of *Bacillus*. Soil microbes can bind heavy metals in the soil by producing siderophores and microbial acids. Additionally, the microbial isolates were found to produce the plant growth promoting hormones like IBA and IAA which alters the endogenous IAA pool in plants and increases the length and surface area of plant roots.

The isolated chromium removing, eco-friendly strains have a great impact on agro-economic society as they could be applied to eliminate environmental chromium, as well as improve plant growth in heavy metal contaminated, poorly cultivable soil and decrease the risk of metal accumulation and biomagnification by the edible plants that are consumed regularly. Further field application should be required to clarifying their bioremediation and plant interaction strategies.

Annexure 4A:



Annexure 4B:



Annexure 4C:










Bijoy Krishna Girls' College, Howrah
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**UGC-CPE sponsored International Conference on
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Certificate of Participation

Certified that
Ms. Chitrita Chatterjee
 of
Presidency University, Kolkata
 has attended and presented a paper entitled
**"ISOLATION, CHARACTERIZATION AND GENETIC
 STUDY OF HEAVY METAL
 RESISTANCE SEWAGE BACTERIA FROM
 TOLLY NULLAH AND THEIR
 POTENTIALITY IN PLANT GROWTH PROMOTION"**
 in the Conference held on February 5 - 7, 2018










Billandol

 Convenor
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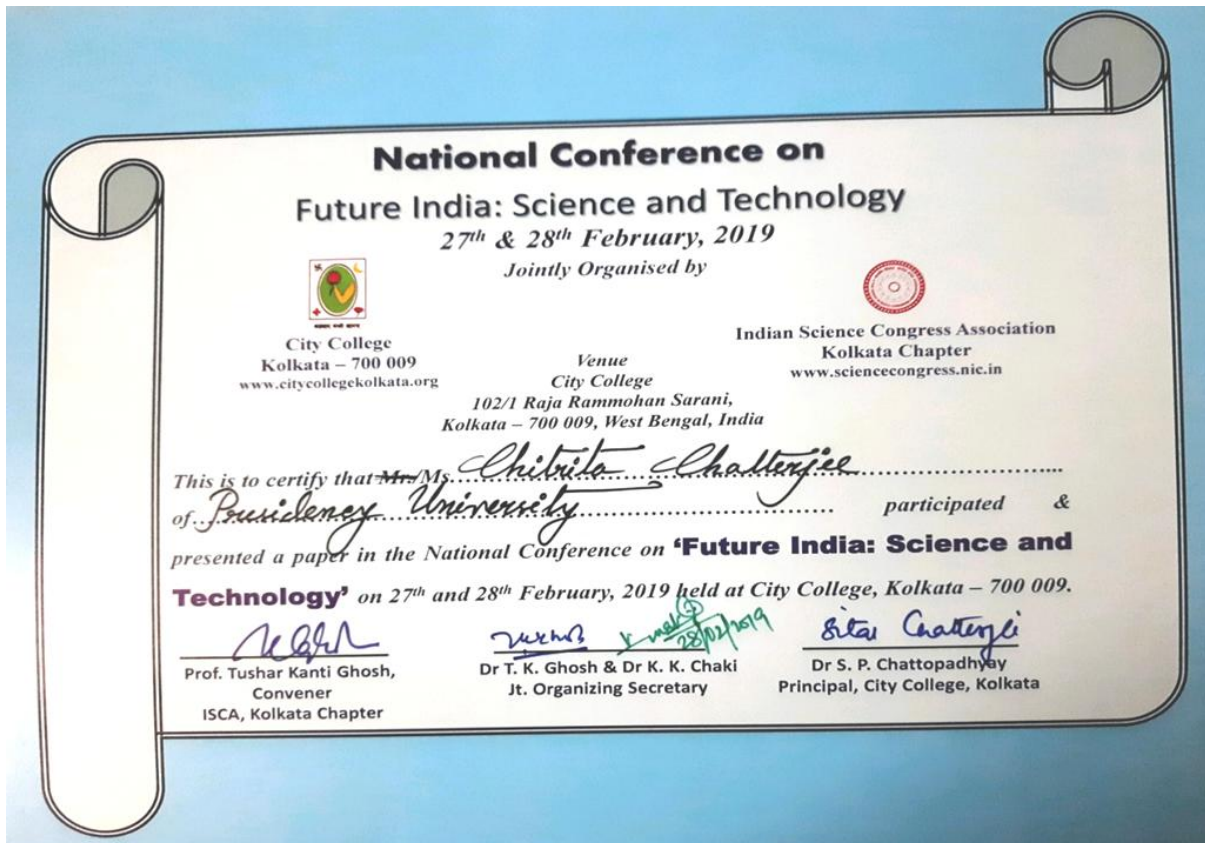
 Coordinator
 IQAC

Sanjita

 Principal BKGCC &
 Conference Chair
 FBSA 2018

Annexure 4D:

Annexure 4E:



Annexure 5:



WEB 2020 <web2020zoology@gmail.com>
to me ▾

Mar 25, 2020, 8:46 PM ☆ ↶ ⋮

Dear Madam,

Thank you for sending the abstract entitled **"Microbacterium radiodurans and Bacillus xiamenensis isolated from different sewage microbial communities of Kolkata, perform chromium bioremediation and cropping"**.

We are to inform you that as per the present situations and Govt. Directives the conference has to be postponed until the situations normalize. We will contact the speakers once our college opens and as they confirm their availability to deliver the talk, we will intimate the revised dates to all participants and paper presenters. Please wait for some time and be safe.

Best regards,

WEB-2020 Organizing Committee

