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GOVERNMENT OF WEST BENGAL

DEPARTMENT OF SCIENCE &TECHNOLOGY AND BIOTECHNOLOGY

VIGYAN CHETANA BHAVAN

DD-26/B,SECTOR I, SALT LAKE, KOLKATA-700064

Call for Proposal 2022-23

Proposal at a Glance

1. **Title of the project:**

Efficient Biodegradation of Plastic with Engineered Microbes from Soil Samples in West Bengal-A Step Forward to Alleviate Plastic Pollution

2. **Name of Principal Investigator (PI) and Co-PI(s) and their Online Registration ID number(s):**

Principal Investigator: Dr. Souvik Basak, Associate Professor, Department of Pharmaceutical Chemistry, Dr. B. C Roy College of Pharmacy & Allied Health Sciences, Durgapur-713206, WB, India **(Online Registration ID: 2497/ASOP/M/OTH/22)**

Co-Principal Investigator (I): Dr. Abhik Si, Associate Professor, Associate Professor, Dr. B. C Roy College of Pharmacy & Allied Health Sciences, Durgapur-713206, WB, India **(Online Registration ID: 2530/ASOP/M/OTH/22)**

Co-Principal Investigator (II): Dr. Rupak Roy, Research Scientist, SHRM Biotechnologies Pvt. Ltd., Kolkata, WB, India **(Online Registration ID: 2500/SCINT/M/OTH/22)**

Special Mentor: Dr. Kulbhushan Samal, Scientist, Environmental Engineering Group, CSIR-Central Mechanical Engineering Research Institute (CMERI, CSIR), Durgapur, WB, India **(Online Registration ID: 2498/SCINT/M/OTH/22)**

3. **Key words(ten maximum):**

Plastic Degradation, Environment, Microbe, Engineering, Isolation, Immobilization, Mutation, Reactor, Novel Carbon Material, Bioprocess

4. **Broad Subject area of the Project Proposal as per Advertisement:**

Broad Subject Area: Environment, Ecology and Climate Change
Sub Area: Plastic Waste management and Biodegradable plastic

5. **Type of Project Proposal** (please tick)

Prof. (Dr.) Samir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS
Durgapur, West Bengal-713206

Dr. B. C. Roy College of Pharmacy & AHS Durgapur

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FORMAT FOR SUBMISSION OF DETAILED R&D PROJECT PROPOSALS (2022-23)

(TO BE FILLEDBYTHEAPPLICANT)

A. Particular about the Project Proposal

1. Title of the project: **Efficient Biodegradation of Plastic with Engineered Microbes from Soil Samples in West Bengal-A Step Forward to Alleviate Plastic Pollution**

2. **Keywords (ten maximum)**

Plastic Degradation, Environment, Microbe, Engineering, Isolation, Immobilization, Mutation, Reactor, Novel Carbon Material, Bioprocess

3. **Type of Project Proposal** (please tick)

- [x] Research and technology development
- [x] Joint/Collaborative programmes with other organizations
- [ ] Studies, Survey and Documentation related to Science& Technology
- [ ] Lab to land pilot scale demonstration projects
- [ ] Development of tools for training programmes and awareness development
- [ ] Solutions of Problems of Different Line Departments and Industries

4. **Subject Category of Project** (Please refer to the list of broad category of subject areas under the Scheme):
Broad Subject Area: Environment, Ecology and Climate Change
Sub Area: Plastic Waste management and Biodegradable plastic

5. **A brief description of how the project proposal will help the State of West Bengal in the fulfilment of its socio-economic objectives (in 300 words) [to be attached separately]**
Ans. Attached as Annexure A

6.

7. **Duration**(number of months): 36 months

8. **Total estimated cost**(In Rupees and in Words):

01/12/23
Prof. (Dr.) Samir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS
Durgapur, West Bengal-713206

Dr. B. C. Roy College of Pharmacy & AHS * Durgapur

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are shared by DSTBT-GoWB with any other line Department(s) for the benefit of the people of the State.

Saurin Bora

(Name and signature of the PI with official seal)

Date 16/9/22
Place Durgapur

16/09/22

(Signature of the Head of the Institution with official seal)

Dr. Abhik Si.

Abhik

Name and Signature of the Co-PI (1) with official Seal

Date 16.09.2022.
Place Durgapur.

16/09/22

(Signature of the Head of the Institution with official seal)

Prof. (Dr.) Subhabrata Ray
Principal, M. Pharm, Ph. D.
Dr. B. C. Roy College of Pharmacy & A.H.S.
Bidhannagar, Durgapur-713206,
Paschim Bardhaman, West bengal, India

Name and Signature of the Co-PI (2) with official seal

Date
Place

(Signature of the Head of the Institution with official seal)

DR. RUPAK ROY.

Name and Signature of the Co-PI (3) with official seal

Date 24.09.2022
Place Kolkata

KUNAL VORA

24/9/2022

(Signature of the Head of the Institution with official seal)

Dr. B. C. Roy College of Pharmacy & AHS Durgapur

Prof. (Dr.) Samir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS

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implementing organization as per above mentioned terms and conditions.

9. I/We undertake that the UC and audited SOE along with Progress Report will be submitted in time failing which DSTBT may stop release of further installment.

10. I/We accept the term that the decision for rejection of the project submitted, at any stage, will beat the sole discretion of DSTBT, GoWB.

Soumen Bose 16/9/22

Name and Signature of Principal Investigator with Seal

Dr. B. C. Roy College of Pharmacy & AHS Durgapur

Name and Signature of Co-Investigator(s) with Seal

Date...16.09.2022.........

Place...Durgapur....

Dr. Abhik Si - Abhik 16/09/22.

Dr. B. C. Roy College of Pharmacy & AHS Durgapur

Dr. Rupak Roy. 23.09.2022

Name & Signature of the Co(PI)-3 with official seal

KOLKATA

Dr. B. C. Roy College of Pharmacy & AHS Durgapur

Prof. (Dr.) Samir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal

Department of Science & Technology and Biotechnology, Government of West Bengal

VigYan Sathi
Digital Platform

Your Online R & D Application Submit is Successful.

Note : Please save your R & D Application ID to check the Application status later.

Application Number sent to your registered email ID(souvik_basak1@yahoo.com).
Please check your inbox
(If not received in inbox please check in spam section and make it as "Not Spam").

Your R & D Application ID is - 0949/RND/EECC/Nil/Oct-2022/1/1, Date- 15-10-2022

R & D Proposals

1. Project Proposal Details:

Date :
15-10-2022

Project Name :
Efficient Biodegradation of Plastic with Engineered Microbes from Soil Samples in West Bengal-A Step Forward to Alleviate Plastic Pollution

Broad Subject Area :
Environment, Ecology and Climate Change

Institution Name :
Dr. B.C. Roy College of Pharmacy & Allied Health Sciences

Total Duration :
36

Estimated Cost :
2497000

Dr. B. C. Roy College of Pharmacy & AHS Durgapur

Prof. (Dr.) Sudhir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS

Project Summary (300 words) :

The project deals with plastic remediation by engineered microbes and finally designing a bioreactor meant for commercialization. Herein, plastic powders would be charged inside bioreactor for degradation. The soluble monomers generated thereby would be tested for competence as value added material.

2. Bank Details of Applicant Institution :

Bank Name :
Axis Bank

Branch :
City Centre. Durgapur

Account Holder Name :
DR. B.C. ROY COLLEGE OF PHARMACY AND ALLIED HEALTH SCIENCES

Account Number :
213010100114950

IFSC Code :
UTIB0000213

Account Type :
Savings

PAN/TAN No :
AAABD0204F/CALD04032A

3. Principal Investigator Details :

Name :
Souvik Basak

Designation :
Associate Professor

Mobile No. :
9051226973

Email-ID :
souvik_basak1@yahoo.com

D.O.B :
09-12-1981

Dr. B. C. Roy College of Pharmacy & AHS * Durgapur

Prof. (Dr.) Sanat Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS
Durgapur, West Bengal-713206

Organization Name :
Individual

Department :
PHARMACEUTICAL SCIENCES

4. Co-Principal Investigator (Co-PI) Details :

1.	*Co-Principal Investigator (Co-PI) Registration ID :* **2530/ASOP/M/OTH/22**	Same Institute same Department
2.	*Co-Principal Investigator (Co-PI) Registration ID :* **2500/SCINT/M/OTH/22**	Other Institute
3.	*Co-Principal Investigator (Co-PI) Registration ID :* **2498/SCINT/M/OTH/22**	Other Institute

What factors Contributed to further research ? :
since ordinary biodegradations are very slow, we have proposed this project to improve the efficiency of biodegradation significantly with certain engineered immobilized biocatalysts capable of degrading specific plastics. With the help of CMERI, CSIR, Durgapur and SHRM Biotechnologies Pvt Ltd., Kolkata, we would finally design and construct a bioreactor for efficient plastic degradation which would be a pilot one, ready for commercial upgradation to Govt. of WB.

Objective :
1) Isolation, characterization, immobilization of plastic degrading microbe/s from dumping ground/ soil. 2) Engineering of microbe (directed evolution/ recombineering) to improve its plastic degradation efficiency 3) Design and develop bioreactior for efficient plastic degradation with further commercialization initiative 4) Isolation of any valuable by product/ material generated by the degradation- plastic recycling

Novelty :
1) Isolation of plastic degradation microbe from local dumping ground of biomedical waste. 2) Design a novel iron oxide superparamagnetic nanoparticle coupled with unsaturated polymer based grafting as immobilization network 3) Introduction of directed evolution (mutation) and/or recombinant DNA engineering to further improve the degradation efficiency 4) Design and development of novel bioreactor for biodegradation having commercialization potential. 5) Isolation of any novel biomaterial

Dr. B. C. Roy College of Pharmacy & AHS, Durgapur

Prof. (Dr.) Samir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS

Justification for engaging research fellows :
The research fellow would be appointed in orchestrated work in between three labs: Dr. B.C. Roy College

microbial growth, its engineering, immbilization and exploitation inside bioreactor is extremely important together with mainting purity of the strain. Isolation of any novel degrdation by product also requires continuos attempt. A research fellow has the time and opportunity to meet all the demand

Whether any PhD degree may be awarded from this project ? If Yes, from which area and which university? :
Yes, the scope, opportunity and outcomes of the work should be accetable for completing PhD dissertations for any fellow. The area would be in Durgapur and the University may be Maulana Abul Kalam Azad University of Technology, WB

Justification of purchase of instruments and equipments :
The project requires recombineering and lots of DNA and protein isolation. Thus we suggest we may purchase a cooling centrifuge (benchtop) which is not available in any of the collaborating institutes.

Proposed major instruments/equipments for purchase :
Cooling centrifuge (Benchtop)

Year wise expects Progress/ Output. :
Year 1 Microbe isolation, basic degrdation evaluation against plastic, characterization, immobilization, characterization of plastic degrdation by FT-IR, DSC, TGA etc. Year 2 1) Microbial engineering by directed evolution, mutant screening and isolation, acute and chronic toxicity studies in animals, evaluation of mutant performance for plastic degradation 3) Recombinant DNA engineering Year 3 1) Bioreactor design and process optimization- towards commercialization 2) Isolation-novel materials

Why taking up this research? :
There is a dearth of proper technology to alleviate plastic pollution in India or may be around he globe. The technology available adopts either obnoxious methods to emit secondary pollutants or the technology needs high end costing. The available biobased methods are even slower to degrade plastics and unworthy of commercialization. In this research we would fabricate a green, faster and novel bio-reactor based plastic cleaning program worthy of commercialization

Links of previous such work /research taken place. :
1) https://pubs.acs.org/doi/10.1021/acssuschemeng.9b06635 2) https://www.frontiersin.org/articles/10.3389/fmicb.2020.580709/full 3) https://link.springer.com/article/10.1007/s11356-020-11501-9 4) https://www.sciencedirect.com/science/article/pii/S2214785320345508 5) https://pubs.acs.org/doi/10.1021/acssuschemeng.9b06635 6) https://www.primescholars.com/abstract/nanoparticles-accelerated-invitro-biodegradation-of-ldpe-a-review-88767.html 7) https://bioresourcesbioprocessing.springeropen.com/artic

Dr. B. C. Roy College of Pharmacy & AHS Durgapur

Prof. (Dr.) Samir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS

How this present work is unique from the others such work done in this area so far. :

1) Use of novel immobilization of the isolated microbe to improve efficiency of biodegradation using SPION and grafting pi-pi e-cloud based copolymerizing network. 2) Directed evolution or mutant construction for development of novel biocatalyst. 3) Use of recombinant DNA technology to rationally engineer the mutant for improving degradation efficiency. 4) Isolation of any novel carbon biomaterial from the degradation media. 5) Design and development of the corresponding bioreactor

Supporting File :

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Dr. B. C. Roy College of Pharmacy & AHS Durgapur

Prof. (Dr.) Samir Kumar Samanta
M. Pharm., Ph.D (J.U.)
Principal
Dr. B. C. Roy College of Pharmacy & AHS
Durgapur, West Bengal-713206