

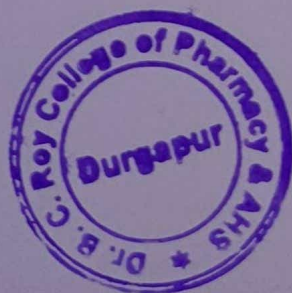
MEMORANDUM OF  
UNDERSTANDING (MOU)

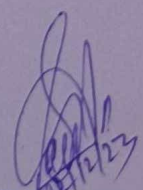
BETWEEN

Dr. B.C. Roy College of Pharmacy & Allied  
Health Sciences, Durgapur

&

SHRM Biotechnologies Pvt Ltd, Kolkata



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

# MEMORANDUM OF UNDERSTANDING ("MoU")

## BETWEEN

Dr. B.C. Roy College of Pharmacy & Allied Health Sciences, an existing College established under the Maulana Abul Kalam Azad University of Technology, having its Campus at Dr. Meghnad Saha Sarani, Bidhan Nagar, Durgapur-713206 represented by its Director Dr. Subrata Chakraborty, patronized by Dr. B.C. Roy Engineering College Society, having his office at Bidhan Nagar, Durgapur hereinafter referred to as First Party.

## AND

SHRM BIOTECHNOLOGIES PVT LTD, an Biotechnology based company having its office at Humaipur, PO: Abdalpur, (Poddar House), Madhyamgram Kolkata – 700 155 represented by its Founder Mr. Kunal Vora, son/daughter of Mr. Vijay Vora, hereinafter referred to as **Second Party**.

### PREAMBLE :

#### A. WHEREAS

- I) BIRAC / DST / Other Agencies such as Government of West Bengal, through its Department of Higher Education, Science and Technology & Biotechnology has number of schemes on "Research and Development Programmes" which is being implemented throughout the State of West Bengal with an aim to sustainable Socio Economic Development in the field of Science and Technology. New technology will be introduced through these schemes.
- II) Dr. B.C. Roy College of Pharmacy & Allied Health Sciences (hereinafter referred as BCRCPAHS) being the First Party herein is an existing College well set up with different departments and has been established with an object to provide instruction, teaching, training and research in various branches and specialized fields of study of Pharmaceutical Technology and any other related fields of Study including the imparting of Skills that have employment potentiality, amongst others;
- III) SHRM BIOTECHNOLOGIES (hereinafter referred as SHRM Biotech), being the Second Party herein is a Biotech / Life Science Company engaged in providing the much-needed technical training in Biotechnology to aspiring students over the last several years, with an aim to generate a more aware and trained biotechnology workforce. Apart from that the company is also into Product development and R&D.



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

*Shubrata Chakraborty*



## B. AND WHEREAS

- I) On the basis of such experience BCRCPAHS Proposed SHRM Biotech for their support to promote the works of biotechnology in the State.
  - II) BCRCPAHS, provides for collaboration with other organization in India and abroad to develop specific educational and research programmes, training programmes etc.
  - III) SHRM Biotech is also interested to work on scientific research programme on Development and on such proposal of BCRCPAHS, SHRM Biotech has agreed for such collaboration in the endeavors to promote biotechnology in the State of West Bengal & India through an extensive research.
- C. The Parties hereto recognizing the importance of research and development in the Rural / urban Areas of the State of West Bengal by clubbing their respective efforts, by pooling their respective expertise and resources for utilization of specific approved project as per the guidelines prescribed by the BIRAC / DST / Higher Education Department, Science & Technology and Biotechnology Branch, Government of West Bengal or other agencies.

NOW, THEREFORE, in consideration of the mutual promises made herein and of good and valuable consideration, the receipt and sufficiency of which both BCRCPAHS and SHRM hereby acknowledge and agreed to sign a memorandum of understanding (MOU).

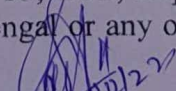
### I) SCOPE OF THE MOU

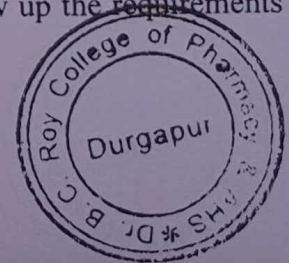
This MOU details the modalities and general conditions regarding collaboration between BCRCPAHS and SHRM Biotech for utilization of specific approved project as per the guidelines prescribed by BIRAC / DST / the Higher Education Department, Science & Technology and Biotechnology Branch, Government of West Bengal (any other agencies), in the State of West Bengal.

### II) SCOPE AND TERMS OF INTERACTIONS

Both the Parties, BCRCPAHS and SHRM Biotech shall encourage interactions between the Scientists, Research fellows, faculty members and students of both the organizations through the following arrangements:

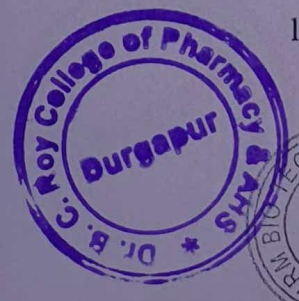
- a) The entire layout, project would be carried under the joint name of BCRCPAHS and SHRM Biotech
- b) BCRCPAHS shall be responsible and/or at liberty to submit the proposal of Project to the BIRAC, DST, Department of Biotechnology, Higher Education, Government of West Bengal or any other funding agencies and shall follow up the requirements

  
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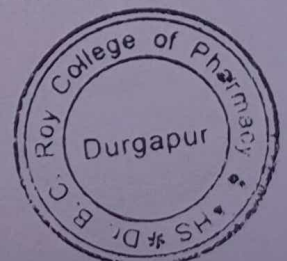
of the Government including any renewal in that regard; SHRM Biotech can help BCRCPAHS in the process of project submission.

- c) The Principal Investigator would be from BCRCPAHS and Co-investigator from SHRM Biotech
- d) The fund allocation will be divided in bipartite manner (50%) to BCRCPAHS and SHRM Biotech during project applications to BIRAC / DST or Dept. Of Biotechnology, Higher Education, Government of West Bengal and the funds would accordingly be sanctioned for purchase of consumables, Machineries, other expenses etc.
- e) All expenses from the project fund as per allocation will be handle separately by either of the parties, however this may be aided by a joint discussion between both the parties.
- f) Prior to sanction of Project Fund, BCRCPAHS and SHRM Biotech shall be at liberty to reimburse all amount paid/expensed for the said project from their allocated funds separately.
- g) The allocated sanctioned fund in bipartite fashion will be separately allocated to respective bank accounts of BCRCPAHS and SHRM Biotech by BIRAC/DST/DBT/Dept. of Higher Education as per project application. ~~Or, the fund would be solely credited in the account of BCRCPAHS, and then the 50% of the fund would be then transferred to SHRM Biotech.~~ The utilization of fund by either party in its own allocation will be carried out independently, however keeping in view with the aim and objective of the project. Thus either party will be liable to provide the utilization certificate of the individual fund whenever required.
- h) Preliminary both parties shall engaged equal number of employees for the said Project and whose salaries would be disbursed from said sanctioned fund as per the Government Prescribed Rules in that regard;
- i) Both the parties shall nominate at least one person each who shall co-ordinate with each other and will be named as Project Co-ordinators;
- j) The infrastructure, Biotech/ Life Science Laboratory of either party will be used by the persons of either side who are undergoing the Projects. and shall be at liberty to access carry out the project work by using the infrastructure of the other.
- k) After the entire project is over the all the machineries, Instruments, Apparatus, Chemicals & Reagents purchased from the sanctioned and allocated fund of either party shall be the property of BCRCPAHS & SHRM Biotech respectively.
- l) After successful completion of the research work both the parties shall jointly shall submit the Research Work before the concerned department of BIRAC / DST



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*Shauacharya*



Government of West Bengal and shall apply for the Patent of the Technology jointly.

- m) Any Publication, Commercialization in respect of research work would be in the joint name and any expenses incurred in that regard shall be made by the parties equally;
- n) Neither of the supervisors will publish the work carried out under this MOU without knowledge of the other.
- o) Either of the parties if wants to sell it's share rights, then the other party would be entitled to get the 1<sup>st</sup> choice at a fair market price which would be evaluated by joint valuer / arbitrator to be appointed by both the parties;
- p) The technologies derived out from the project would be the property of the parties of equal share.
- q) If any of the activities mentioned above, wherever financial aspects are involved, amount, payment conditions, etc. would be spelt out clearly before starting the activity and subject to approval of both the parties.

### III) SHARING OF FACILITIES

- a. BCRCPAHS and SHRM Biotech shall make provisions to share their respective important R&D facilities in order to promote academic and research interaction in the areas of cooperation.

### IV) CO-ORDINATION OF THE PROGRAMME INCLUDING FINANCIAL ARRANGEMENTS

- a. The collaborative programme between BCRCPAHS and SHRM Biotech shall be coordinated by a coordination committee having equal representation of both the parties.
- b. Financial arrangements or fund allocations for each specific collaboration will be decided on a case-to-case basis and brought on record in each case after due approval from heads of both the parties.

### V) EFFECTIVE DATE AND DURATION OF MOU

- a. This MOU shall be effective from the date of its approval by competent authorities at both ends.
- b. The duration of the MOU shall be for a period of 36 - 60 months from the effective date.



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

*(Signature)*  
Bhattacharya



- c. The MOU may be extended for further period on mutually agreeable terms and conditions.

## VI) TERMINATION

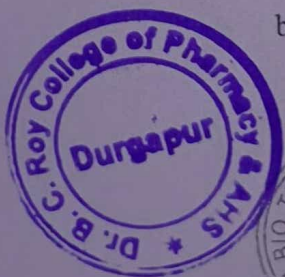
- a. The MOU may be terminated by a prior notice of not less than Three months by either party. However, termination of the MOU will not in any manner affect the interests of the faculty/scientists who have been admitted to pursue a project programme under the MOU.
- b. Notwithstanding anything contained in this Memorandum, SHRM Biotech and BCRCPAHS reserves its right to terminate this Memorandum immediately and without any notice, if either of the party commits any or more of the following:
- i. Contravenes any of the Clauses or conditions of this Memorandum or any statutory provisions
  - ii. Suppresses and / or falsifies any facts.
  - iii. Acts in any manner detrimental to any of the party's interests.
  - iv. Is convicted by a competent Authority of any offence.
  - v. Makes any commitment on behalf of the either of the party without the express written sanction of either of the party save as provided for elsewhere in this agreement and
  - vi. Fails to tender a true and correct account of either party's goods and property, if any entrusted to it.
  - vii. It is agreed that no consequential cost of whatsoever manner shall be payable by the BCRCPAHS to the SHRM Biotech on termination of this Memorandum for any one or more of the events arising out of the above reasons by both the parties.

## VII) INTELLECTUAL PROPERTY RIGHT

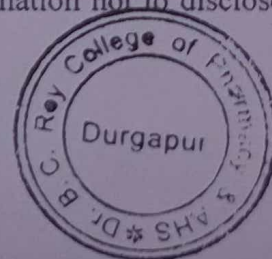
Rights regarding publications, patents, royalty, ownership of software/design/product developed etc. under the scope of this MOU, shall be decided by the two parties by mutual consent.

## VIII) CONFIDENTIALITY

- a. During the tenure of the MOU both BCRCPAHS and SHRM Biotech will maintain strict confidentiality and prevent disclosure of all the information and data exchanged under the scope of this MOU for any purpose other than in accordance with this MOU.
- b. Both BCRCPAHS and SHRM Biotech shall bind their respective personnel who come into possession or knowledge of any confidential information not to disclose



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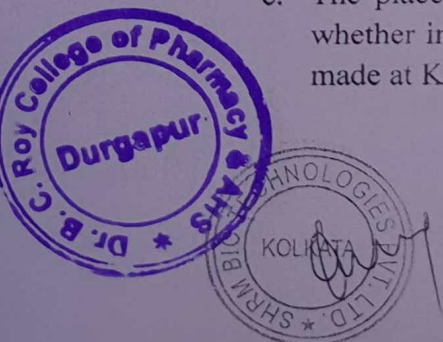


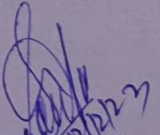
the same to third parties without written approval of the disclosing party or use such confidential information for any use other than intended under this MOU.

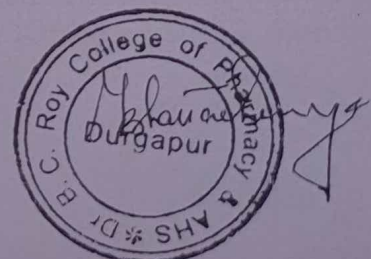
- c. Both BCRCPAHS and SHRM Biotech shall put in place adequate and reasonable measures to keep and store confidential information secure so as to prevent any unauthorized use.
- d. CONFIDENTIAL INFORMATION shall mean any proprietary information, data or facts belonging to PARTIES collectively or severally, disclosed by the disclosing party under this MOU or any subsequent MOU and/or agreement, whether in writing, verbal or electronically, irrespective of the medium in which such information is stored, which is marked confidential or with any other words having similar meaning by the disclosing party, or specifically agreed to be kept confidential by the parties, or declared or identified so by the disclosing party before such disclosure or during the discussions. However confidential information shall not include any data or information which:
- i. is or becomes publicly available through no fault of the receiving party,
  - ii. is already in the rightful possession of the receiving party prior to its receipt of such data or information;
  - iii. is independently developed by the receiving party without reference to the confidential information of the disclosing party
  - iv. is rightfully obtained by the receiving party from a third party or is in the public domain
  - v. is disclosed with the written consent of the party whose information it is, or
  - vi. is disclosed pursuant to court order or other legal compulsion, after providing prior notice to the disclosing party.

## IX) RESOLUTION OF DISPUTES

- a. Any dispute arising or touching the construction, meaning or the effect of this Memorandum or any Clause herein contained or as to the rights / liabilities of the parties hereto and/or the breach, termination or invalidity thereof, shall be settled by arbitration in accordance with the provisions of the Arbitration and Conciliation Act, 1996 and any amendment thereto.
- b. The ARBITRAL TRIBUNAL shall be composed of JOINT arbitrator to be appointed by the both entities BCRCPAHS and SHRM Biotech.
- c. The place of arbitration shall be at Kolkata, West Bengal, and any award made, whether interim or final, shall be deemed for all purposes between the Parties to be made at Kolkata.



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



- d. The arbitral proceeding shall be conducted in the English language and any award or awards shall be rendered in English.
- e. The procedural law of the arbitration shall be Indian law. The award of the arbitral tribunal shall be final and conclusive and binding upon the Parties and the Parties shall be entitled to enforce the award.
- f. The Arbitrator shall have the right to proceed summarily and to make interim awards.

#### X) MISCELLANEOUS

- a. The headings and sub-headings are inserted for convenience only and shall not affect the construction of this MOU.
- b. Both BCRCPAHS and SHRM Biotech shall not, during the term of this Agreement directly or indirectly, solicit or offer employment or engagement to any of the personnel of other party without the prior consent in writing of that other party.

#### XI) INDEMNIFICATION

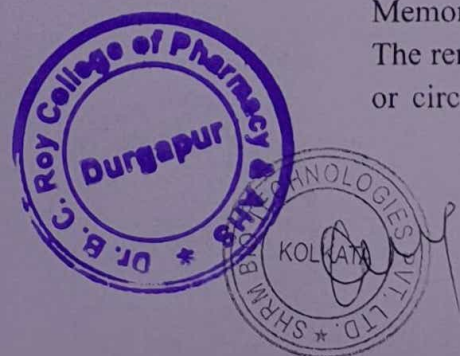
The Parties hereto agree to keep each other and all their respective officials, promoters, employees, men, agents and assigns indemnified from any or all the payments, claims, loss and liabilities, whatsoever incidental or direct arising out of their conduct or conduct of any of their men, agents, employees and or representatives, either singly or severally for any reason whatsoever.

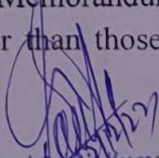
#### XII) NOTICE

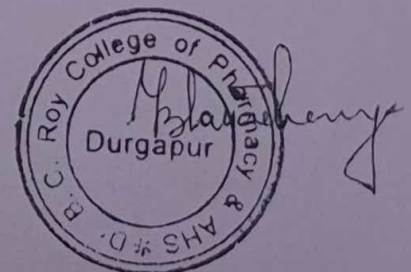
- a. Unless otherwise expressly mentioned herein all notices to be served hereunder by any of the parties on the other shall be deemed to have been served if served by hand or sent by registered post with acknowledgment due at the address of the other party mentioned hereinabove or hereafter notified in writing and irrespective of any change of address or return of the cover sent by registered post without the same being served.
- b. None of the parties shall raise any objection as to the service of the notice deemed to have been served as aforesaid.

#### XIII) SEVERABILITY

- a. If any provision of this Memorandum or the application there of to any person or circumstance shall be invalid, prohibited or unenforceable to any extent for any reason including by reason of any law or regulation or government policy, this Memorandum shall be considered divisible as to the extent of such provision only. The remainder of this Memorandum and the application of such provision to persons or circumstances other than those as to which it is held invalid or unenforceable



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





shall not be affected thereby and each provision of this Memorandum shall be valid and enforceable to the fullest extent permitted by law.

- b. Any invalid or unenforceable provision of this Memorandum shall be replaced with a provision, which is valid and enforceable and most nearly reflects the original intent of the unenforceable provision.

#### XIV) MODIFICATION

Any modification to this memorandum shall be valid if the same is in writing and the same has been signed by both the parties.

#### XV) COMPLETE DOCUMENT

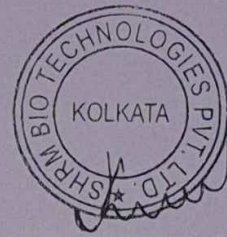
This Memorandum is the Complete Document with regards to the subject contained herein and supersedes all previous communications, either oral or written, in this regard.

IN WITNESS whereof the parties have signed this Memorandum of Understanding on the day, month and year first hereinabove written.



*M. Shauaacharya*  
7.9.2019

BCRCPAHS



*[Signature]*  
7/9/19

SHRM BIOTECH

#### Witnesses:

Signature *[Signature]*

Signature *[Signature]*

Name Dr. S. Chandra

Name DR. PRADIP KR MAZUMDER

Father's Name Debabrata Chandra

Father's Name SK Mazumder

Address Dr. B. C. Roy College of Pharmacy & AHS  
Bidhan Nagar, Durgapur  
713206

Address B/2/4 Golf Links Kol-95

*[Signature]*  
22/2/20  
Prof. (Dr.) Samir Kumar Samanta  
M. Pharm., Ph.D (J.U.)  
Principal  
Dr. B. C. Roy College of Pharmacy & AHS  
Durgapur, West Bengal-713206



**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**)

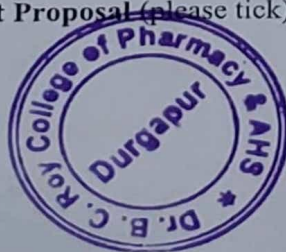
**3. Key words(ten maximum):**


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)**



  
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গবেষণা ফর্ম (2)

গবেষণা ফর্ম I Iংল I(2)

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

Souen Bara

(Name and signature of the PI with official seal)

Date..... 16/9/22  
Place..... Durgapur



Roy  
16/9/22

(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.

Roy  
16/9/22

(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. Rupak Roy

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



Date 24.09.2022  
Place Kolkata

KUNAL VORA

Kunal Vora  
24/9/2022

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



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Printed 22/7

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

গবেষণা মূল (2)

গবেষণা মূল (2)

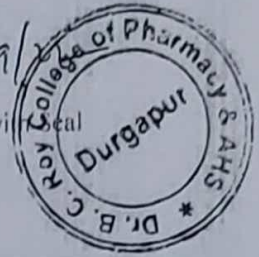
implementing organization as per above mentioned terms and conditions.

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 be at the sole discretion of DSTBT, GoWB.

Soumitra Borra 16/9/22

Name and Signature of Principal Investigator with Seal



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

Date... 16.09.2022

Place... Durgapur.

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



Dr. Apurva Roy. 27.09.2022  
Name & Signature of the Co (PI)-3  
with official seal



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



## 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

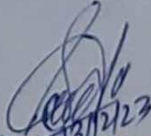
*Total Duration :*

36

*Estimated Cost :*

2497000



  
13/10/22  
Prof. (Dr.) Samir Kumar Samanta  
M. Pharm., Ph.D (J.U.)  
Principal  
Dr. B. C. Roy College of Pharmacy & AHS  
Durgapur, West Bengal-713206

**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

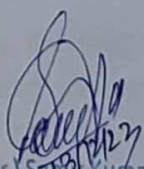
**Email-ID :**

souvik\_basak1@yahoo.com

**D.O.B :**

09-12-1981



  
Prof. (Dr.) Sandip 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<br>ID : 2530/ASOP/M/OTH/22  | Same Institute same Department |
| 2. Co-Principal Investigator (Co-PI) Registration<br>ID : 2500/SCINT/M/OTH/22 | Other Institute                |
| 3. Co-Principal Investigator (Co-PI) Registration<br>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 :

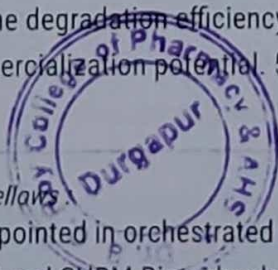
- 1) Isolation, characterization, immobilization of plastic degrading microbe/s from dumping ground/ soil.
- 2) Engineering of microbe (directed evolution/ recombineering) to improve its plastic degradation efficiency
- 3) Design and develop bioreactor for efficient plastic degradation with further commercialization 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

Justification for engaging research fellows

The research fellow would be appointed in orchestrated work in between three labs: Dr. B.C. Roy College of Pharmacy & AHS, CSIR-CMERI and SHRM Biotechnologies Pvt Ltd Kolkata. Continuous monitoring of



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microbial growth, its engineering, immobilization and exploitation inside bioreactor is extremely important together with maintaining purity of the strain. Isolation of any novel degradation by product also requires continuous 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 acceptable 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 recombinering 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 degradation evaluation against plastic, characterization, immobilization, characterization of plastic degradation 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 the 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://bioresources.bioprocessing.springeropen.com/article>



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*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

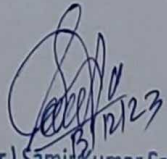
*Supporting File :*

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