Progress Report for R&D Projects [Year 2017-2020]*

Section-A: Project Details

A1. Project Title: Design and synthesis of donor–acceptor fragmented chemical libraries for development of new class of antibiotic against MRSA

A2. DBT Sanction Order No. & Date: BT/PR16658/NER/95/242/2015 dated January 6, 2017

A3. Name of Principal Investigator: Dr. Sanjay Pratihar
Name of Co-PI/Co-Investigator: Dr. Santi M. Mandal (Vidyasagar University)

A4. Institute: Tezpur University

A5. Address with Contact Nos. (Landline & Mobile) & Email:
Department of Chemical Sciences
Tezpur University
Assam-784028
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E-mail: spratihar29@gmail.com or spratihar@tezu.ernet.in

A6. Total Cost: 31.75 lakh (2017-18)

A7. Duration: 2017-2020

A8. Approved Objectives of the Project: The main objectives are as follows;

(i) Design the core molecule based on donor-acceptor property for MRSA.
(ii) DFT study on the core molecule with variable electronic substituent to check the donor-acceptor part in the core molecule.
(iii) Methodology development for the synthesis of various molecules against MRSA.
(iv) Application of the methodology for broad substrate scope.
(v) Purification of the synthesized compound using column chromatography or crystallization technique to isolate the molecules
(vi) Characterization of the synthesized molecule with various spectroscopic and analytical techniques.
(vii) Screening of the synthesized compounds step by step.
(viii) Optimize the designing to achieve maximum activity with less toxicity.
(ix) Final screening of the lead compounds.
(x) Toxicity analysis in normal non-carcinoma cell line.
(xi) Understanding the mechanism of action.
(xii) Genomics to proteomics analysis.
(xiii) Biofilm formation and inhibition analysis.
(xiv) Screening for efflux pump inhibition.
(xv) Large scale synthesis of the active molecule for clinical trial and in vivo analysis.

A9. Specific Recommendations made by the Task Force (if any):

Section-B: Scientific and Technical Progress

B1. Progress made against the Approved Objectives, Targets & Timelines during the Reporting Period (1000-1500 words for interim reports; 2500-3500 words for final report; data must be included in the form of up to 3 figures and/or tables for interim reports; up to 7 figures and/or tables for final reports): lengthy reports attached as annexures will not be considered

Methodology developed for the synthesis of different molecules

1. The methodology for the synthesis of various γ-Hydroxy Lactam and bis(indolyl) methane derivatives were established. For γ-Hydroxy Lactam derivatives, we have developed a synthetically attractive approach employing in-situ generated cationic Pd^{II} catalyst using catalytic combination of Pd^{II}/Ag^{I} for amidoalkylation reaction between various γ-hydroxy lactam and C/O/S nucleophile at room temperature. The origin of reactivity in cationic Pd^{II} mainly lies on its coordination ability to both the nucleophile and electrophile, which bring them in close proximity to each other for facile interaction and successive product formation. The synthesized isoindolinone darivatives were also screened for the bioactivity against MRSA and VRSA strain and some of them found to be effective with appreciable MIC value.

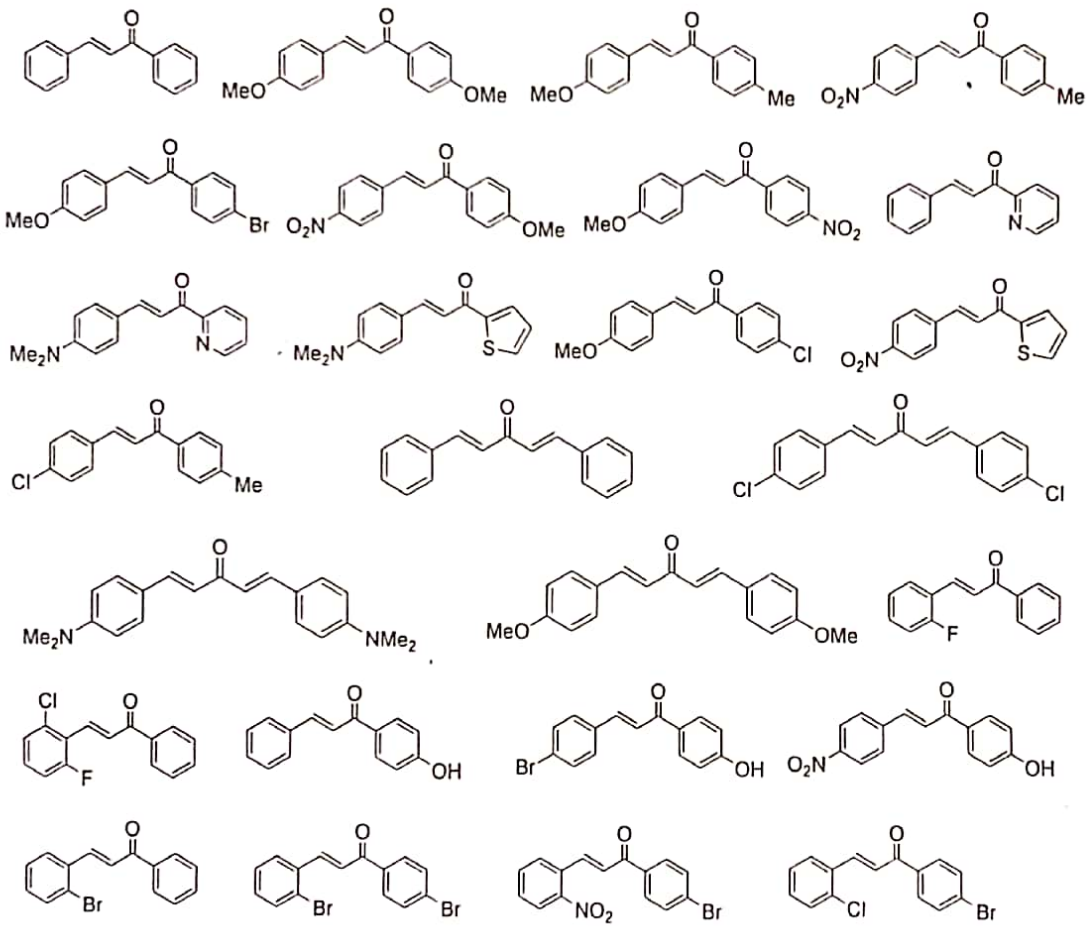
2. In another work, various bis(indolyl) methane (BIM) derivatives were designed and synthesized based on the substituent attached on both the indole and aryl moiety of BIM and mainly categorized into four different classes namely; donor-donor (class A), acceptor-donor (class B), donor-acceptor (class C), and acceptor-acceptor (class D). All the BIM derivatives were synthesized by using Fe(ox)–Fe_3O_4 promoted condensation reaction between aldehydes and indoles and well characterized with spectroscopic and analytical techniques.

3. In this work, a Zn^{II}-Na acetate complex ($C_{32}H_{48}O_{34}Na_8Zn_4$, C-1), in which weakly bound sodium (Na) has been utilized for selective metal exchange with guest metals (Cu^{II}, Ag^{I}) for the synthesis of Cu/Ag/Au loaded ZnO. The morphology, growth, and band gap of the materials are found to be highly dependent upon their metal exchange capacity. Further, we showed the utilization of copper loaded zinc oxide (ZnO-Cu) for its stimuli (O_2/light) responsive switchable performance between its oxidized (**S-2,** containing Cu^{II}) and reduced state (**S-1**, containing Cu^{0}) for selective aerial oxidation of alkyl arenes/heteroarenes to aldehydes/ketones and reduction of nitro arenes/heteroarenes to corresponding amine under visible light. The two states of the catalyst showed its switchable performance as highly active and poorly active catalyst for oxidation and reduction reaction and both reaction could be turned 'off' and 'on' by changing the stimuli (light and O_2/N_2). The inexpensive and reusable photo catalysts (**S-1** and **S-2**)

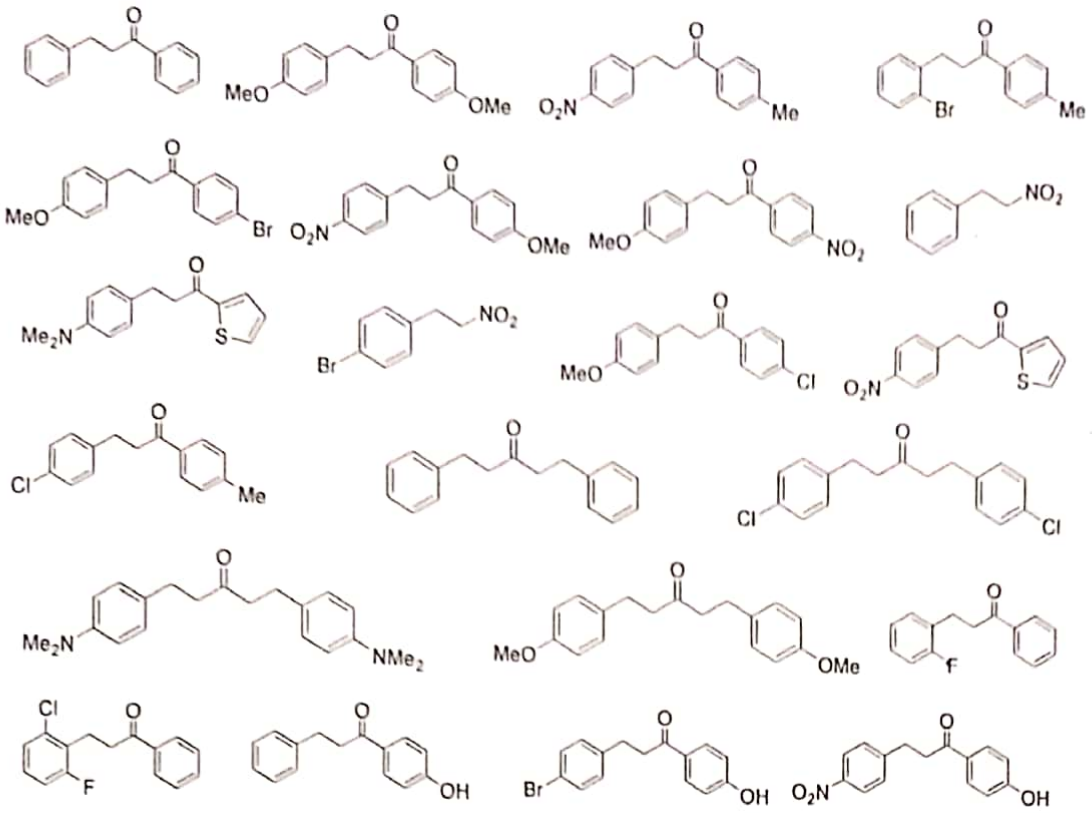
furnishes excellent catalytic activity and chemoselectivity for wide range of substrates for both the reaction and showed its quality performance in a large-scale-set-up for the synthesis of corresponding products in multi-gram scale. Finally, the system was utilized for assisted tandem catalysis for the synthesis of benzyl amines utilizing both oxidation and reduction by stimuli responsive switching between the states of the catalyst. By utilizing this methodology, we have synthesized variety of secondary amines. Currently we are working on the modification of the synthesized compounds and checking their biological activity.

4. By utilizing the ZnO-Cu as photo catalyst we have further synthesized variety of chalcone derivatives starting from two different alcohol/aryl alkane derivatives. These derivatives were further used as reagent for the synthesis of following molecules containing different donor acceptor fragments (Figure 1).

5. **Chalcone derivatives:** Twenty-six (26) different chaconne derivatives have been synthesized by using standard synthetic route. The have been also purified through column chromatography/crystallization and characterized through NMR (^{1}H & ^{13}C) analysis.



6. **Homogenious Ruthenium based catalyst for reduced chalcone:** Homogeneous ruthenium catalysts have been developed for the selective reduction of double bond of the α,β-unsaturated compounds. These compounds have been purified through column chromatography/crystallization and characterized through NMR (^{1}H & ^{13}C) and HR-MS analysis



Reference: M. Dutta, S. M. Mandal, R. Pegu, and S. Pratihar "Pd^{II}/Ag^{I} Catalyzed room temperature Reaction of γ-Hydroxy Lactams: Mechanism, Scope, and antistaphylococcal activity" *J. Org. Chem.* **2017**, 82, 2193-98; S. M. Mandal, R. Pegu, W. L. Porto, O. L. Franco, and S. Pratihar Novel boronic acid derivatives of Bis(indolyl) methane as anti-MRSA agents, *Bioorganic & Medicinal Chemistry Letters* **2017**, *27*, 2135-38; K. Sarmah, U. K. Roy, T. K. Maji, and S. Pratihar *Role of Metal Exchange toward the Morphology and Photocatalytic Activity of Cu/Ag/Au-Doped ZnO: A Study with a Zinc–Sodium Acetate Complex as the Precursor, ACS Appl. Nano Mater., **2018**, 1, 2049–2056*; K. Sarmah, S. Mukhopadhya, T. K. Maji, and S. Pratihar Switchable Bifunctional Bi-state Reusable ZnO-Cu for selective oxidation and reduction reaction, *ACS Catalysis*, **2019,** 9, 732-45: M. Dutta, K. K. Bania, and **S. Pratihar*** *A Remote 'Imidazole'-Based Ruthenium(II) Para-Cymene Pre-catalyst for the Selective Oxidation Reaction of Alkyl Arenes and Alcohols, Chem Asian J. **2020**, 15, 926-32, Special issue: The 2nd International Conference on Organometallics and Catalysis (ICOC-2020).*

Biological activity of the synthesized Molecules

The γ-lactam derivatives were known to be good bioactive core because it is similar to ß-lactam group containing antibiotics with one more number of carbon in the core ring. However, bacteria often develop resistance to ß-lactam antibiotics through the synthesis of ß-lactamases enzyme, which could hydrolyze the ß-lactam ring. Till date, several approaches have been tried to prevent this bacterial resistance. Amongst various approaches, γ-lactams and their analogues may be an alternative and thus various derivatives have been synthesized and tested previously against broad spectrum antibacterial agents. Currently, methiciliin resistant *Staphylococcus aureus* (MRSA) strains are also resistant to other group of antibiotics like vancomycin, which is the second choice of antibiotics next to methicillin for the treatment of complicated skin and skin structure infection including surgical site infections. Towards the search for new classes of antimicrobials to address the emergence of multidrug-resistant MRSA and VRSA, synthesized analogues were tested against both Gram(+)ve and Gram(-)ve bacteria.

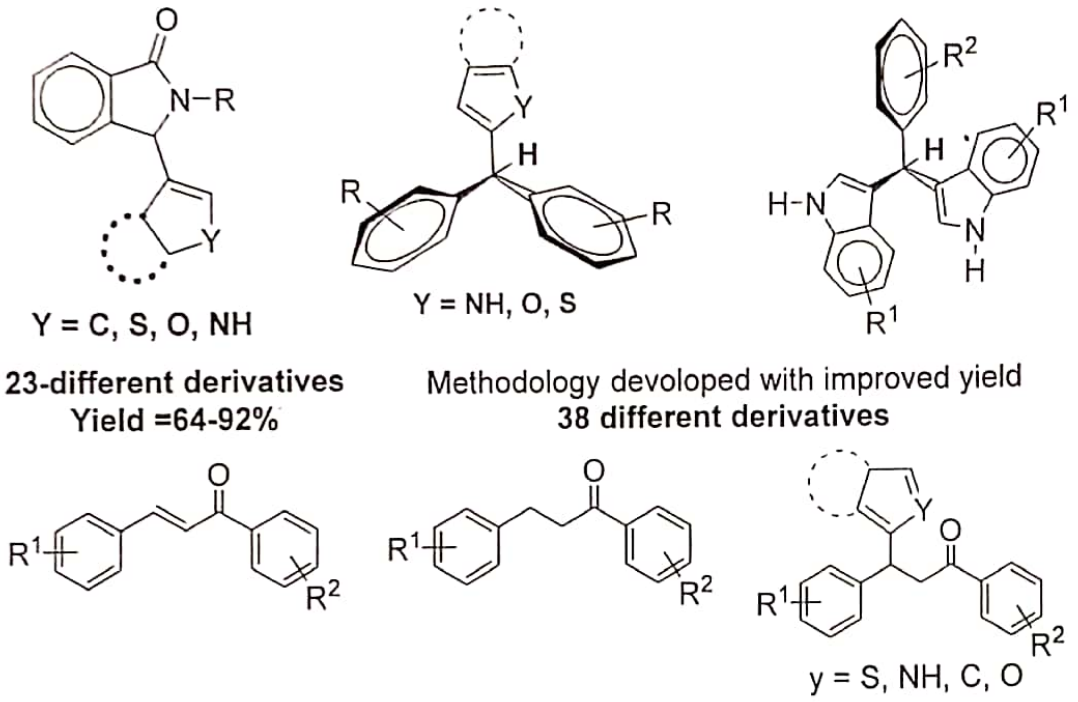


Figure 1. Synthesized compounds against MRSA and VRSA.

Activity against Gram-negative bacteria was very weak compare to Gram-positive bacteria. We have selected *S. aureus* strain, a deadly infectious strain when it develops resistance to both vancomycin and methicillin. Activities of all the synthesized compounds were checked against

control type strain of *S. aureus* as well as pathogenic vancomycin and methicillin resistant *S. aureus* strain. Amongst all synthesized isoindoline derivatives, compound **2d**, **2e** and **2l** were found to be active against all type of strain with an appreciable MIC value. Antibiotics resistant ability was also confirmed with standard antibiotics like; methicillin, vancomycin, tetracycline, levofloxacin and gentamicin. To our delight, comound **2w** was found to be most active and showed comparable activity with levofloxacin with MIC value of 0.48 against control as well as resistant strain (Table 2).

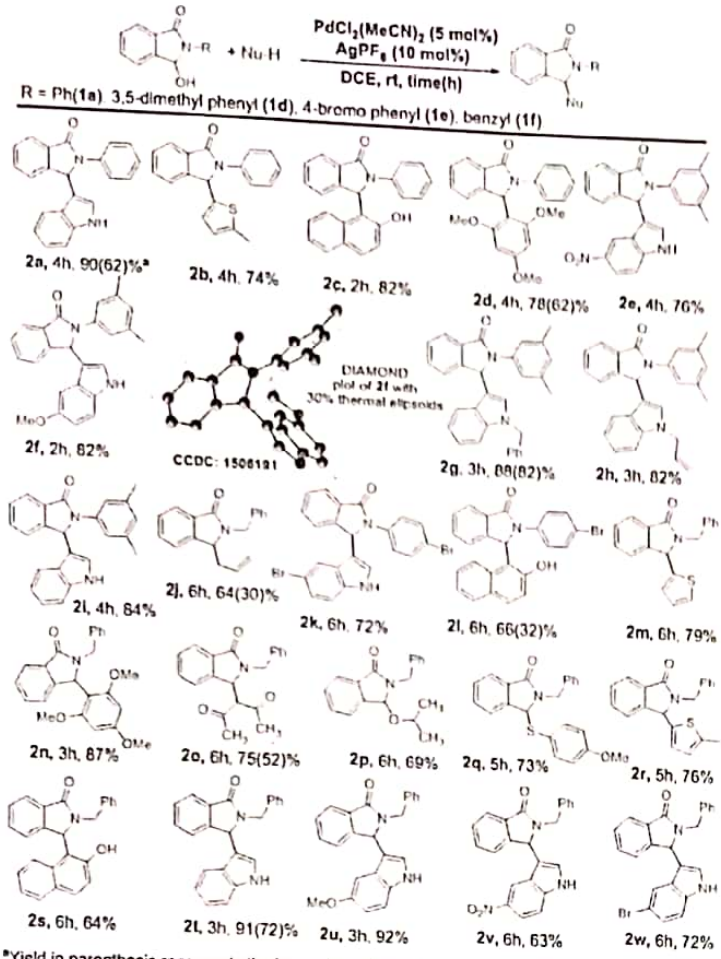


Figure 2. Substrate scope for Pd^{II}/Ag^{I} catalyzed reaction of γ-hydroxy lactam.

Table 2. Effect of isoindolinone derivatives against MRSA and VRSA positive strains

#	S. aureus U07 (VRSA+MRSA+)	*S. aureus* ATCC25923 (Control strain)	S. aureus ATCC43300 (MRSA+ Control)
Vancomycin	31.2	1.95	3.9
Methicillin	125	1.95	31.2

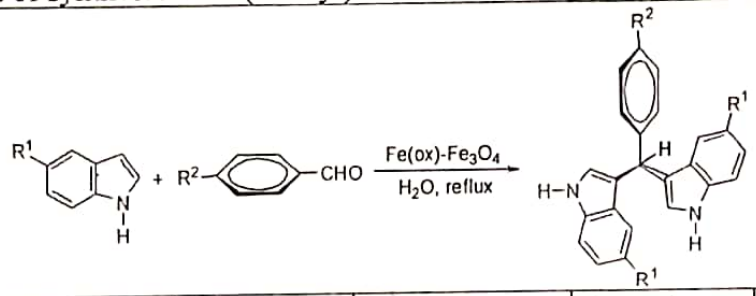
Tetracycline	500	3.9	500
Gentamicin	16	0.975	0.975
Levofloxacin	0.48	0.24	0.24
2c	15.6	7.8	15.6
2d	3.9	1.95	3.9
2e	1.95	0.975	0.975
2k	15.6	7.8	15.6
2l	1.95	0.975	0.975
2w	0.487	0.487	0.487

MIC values (μg. mL^{-1}) were determined *in vitro* against both clinical and control strains

Work Related to bis(indolyl) methane derivatives

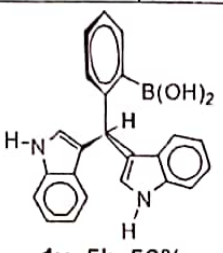
All the synthesized BIMs were tested against both type strains of MRSA (methicillin resistant *S. aureus*) and MSSA (methicillin sensitive *S. aureus*) *Staphylococcus aureus* strain obtained from MTCC, Chandigarh, India as control strain. Compounds are also tested against several clinical isolates as hospital in origin, isolated from admitted patients in hospital (Priyamboda Birla Aravind Eye Hospital, Kolkata, WB, India).

Table 3. List of synthesized bis(indolyl) methane derivatives used for this study.

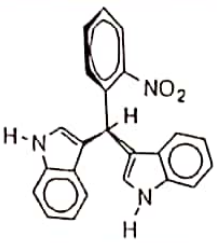


#	Name	R^1	R^2	Time, h	Yield, %
1	**1a**	H	H	5	78
2	**1b**	H	Me	6	68
3	**1c**	H	Br	4	88
4	**1d**	H	NO_2	3	82
5	**1e**	OMe	Br	4	84
6	**1f**	Br	NO_2	6	80
7	**1g**	OMe	Me	6	71
8	**1h**	NO_2	Me	8	68
9	**1i**	NO_2	Br	10	83
10	**1j**	Br	Br	9	58
11	**1k**	Br	Me	8	62
12	**1l**	Br	H	7	65
13	**1m**	OMe	NO_2	4	82

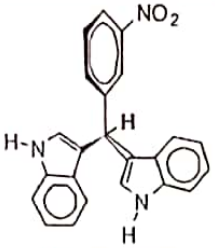
14	**1n**	OMe	OMe	12	56
15	**1o**	NO_2	OMe	10	58
	1p	NO_2	NO_2	7	88
	1q	OMe	H	12	48
	1r	H	NMe_2	14	46
	1s	OMe	NMe_2	14	44
	1t	H	$B(OH)_2$	6	58
	1u	H	CHO	4	87



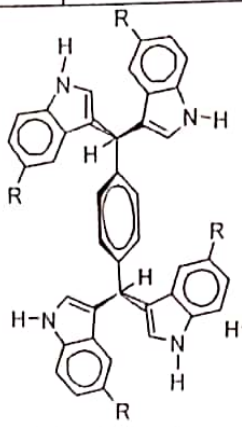
1v, 5h, 56%



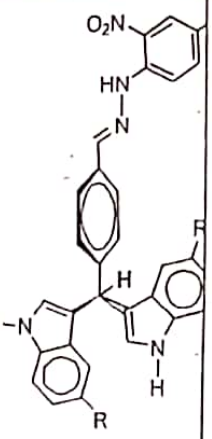
1w, 4h, 92%



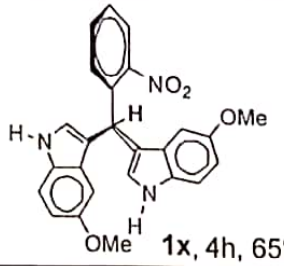
1y, 6h, 67%



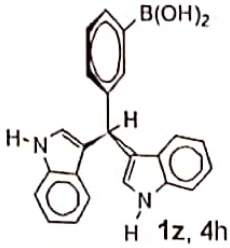
R =H, **2a,** 6h, 65%
R=OMe, **2b,** 10h, 76%
$R=NO_2$, **2c,** 12h, 78%



R =H, **2d,** 6h, 5
R=OMe, **2e,** 6h,



1x, 4h, 65%



1z, 4h, 89%

For screening of the compounds, same concentration (1 μg. mL^{-1}) of all the compounds were used following high throughput screening assay in microtiter 96 well plate to check their activity against MRSA strain. Based on their activity, no compounds were found to be active from class A and C, where electron donor substituent like Me, OMe, NMe_2 were attached to the aryl moiety of BIM derivatives. On the other hand, compound **1j** in class-D shows some activity against MRSA strain and observed MIC value is found to be 31.25. However, replacing one of the bromo substituent at aryl moiety by nitro group in 1f increases its activity against MRSA and almost 50% enhancement in MIC value has been achieved in **1f** compare to **1j**. At the same time higher activity is expected with other member of this group like **1i** or **1p**. However, alteration of substituent at both the moiety in **1i** compare to **1f**, did not show any activity (Table 1). Whereas, no enhancement in activity of **1p** was observed after replacing bromo with nitro in the aryl moiety, which suggest that the structure of the molecule and its substituent plays an important role in the binding process, which directly or indirectly influence its activity. Most of the known antibiotics work against bacteria with different mode of actions and inhibits bacterial cell wall, protein, nucleic acid synthesis or cell membrane functions, and metabolic process. All known antibiotics, which can work through different mode

of action, have different core structure with different mechanism of action. The feasibility of different hydrogen bonding interaction between antibiotic and bacteria's DNA or RNA or cell wall protein will decide its overall activity and its fate in future. In this regard, some of the pioneer work in the binding and mechanistic studies witnessed to the discovery of several new class of antibiotics as well as structural reorganization of old to new generation active antibiotics. Next, the compound **1y** from class C was found to be active (MIC, 7.81) against MRSA, in which nitro group attached with meta position of the aryl moieties. Further, in compound like **1e** and **1m**, in which indole moiety is more electro rich and better donor acceptor interaction between indole and aryl moiety is expected, no significant activity is observed. However, same trends are also observed for compound **1d**, in which nitro attached in the para position of aryl moiety. So, not only its electron density but also its structure and its substituent position are also playing an important role in its activity. The indole N-H and electron withdrawing nitro group is known to be a very good hydrogen bond donor and acceptor respectively. Further, to check the effect of number of indole and aryl moiety, compound **2a-2e** was synthesized and no compound was found to be active against MRSA. Further, cytotoxicity test suggest some toxicity in **1y**, which further drives to fihd alternate electron acceptor group, which may solve the toxicity issue and at the same time it would be active against MRSA.

Towards this search, nitro substituent in **1y** has been replaced with another very good electron acceptor boronic acid and thus compound **1t**, **1v** and **1z** synthesized. Unlike **1y** no toxicity has been observed in **1t**, **1v** and **1z**. All the three boronic acid derivatives of BIM are found to be active against all type of MSSA, MRSA strains and clinical isolates with similar MIC value. We have attempted to check whether our compounds (BIMs) are targeted to leucyl-tRNA synthetase or not. *In silico* analysis was performed with the active compounds and leucyl-tRNA synthetase, the best docking solution for each compound indicated that they bind in a similar position within the leucyl-tRNA synthetase structure, in a pocket between the tRNA and the protein, near to the catalytic and anticodon-binding domains of the enzyme (Figure 3a). The docking solutions showed energies of ~ -350 Kcal.mol^{-1}, in average, presenting close contacts to the tRNA

and the protein, being stabilized by hydrophobic interactions. However, in growth kinetics data revealed that the synthesized compounds are bactericidal rather than bacteriostatic, which suggest that compounds might have another dual target for their bactericidal activity. Aminoacyl-tRNA synthetase inhibitors are in general bacteriostatic agents[6]. Interestingly, compounds showed more specific action to Gram-positive bacteria than Gram-negative which also indicate that may have some specificity against peptidoglycan layer. Therefore, a titration was performed using a ITC200 Systems with the substrate, peptide backbone [$(Ac)_2$-L-Lys-D-Ala-/-D-Ala], a major component of Gram-positive bacterial cell wall. The ITC analysis showed that compound **1z** have binding affinity to peptide backbone of Gram-positive cell wall. The binding isotherm revealed that the binding affinity with peptide (Figure 3b) was exothermic in nature and the interactions are enthalpy wise driven. The binding constant is in good agreement of real interaction between them. The negative free energy of reaction values suggested that these binding interactions are all spontaneous reactions.

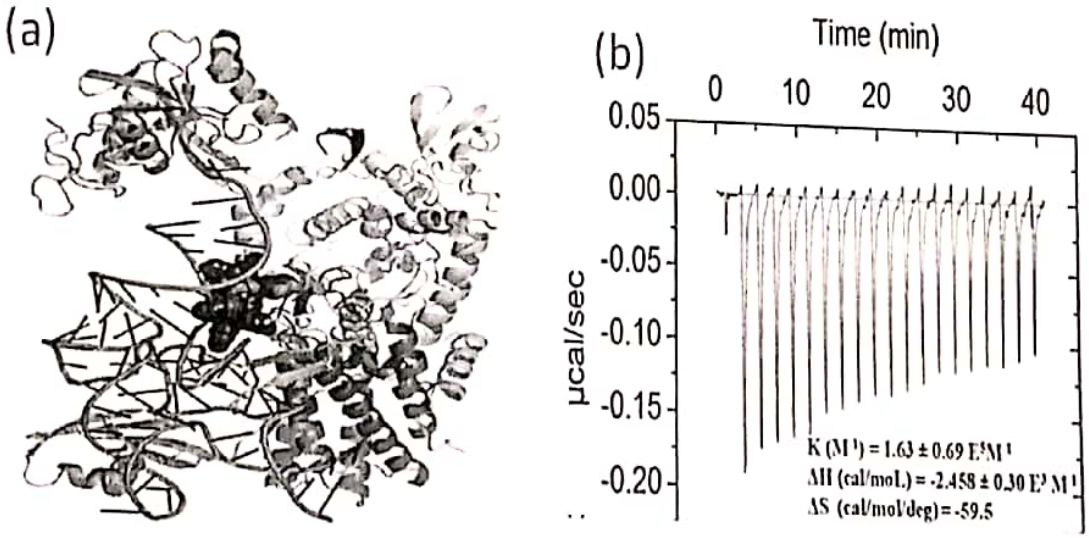


Figure 3. Superposition of the best docking solutions of each bis(indolyl) methane in the leucyl-tRNA synthetase. The enzyme is coloured as follows: editing domain (cyan), catalytic domain (yellow), ZN1 domain (purple), leucine specific domain (pink), anticodon-binding domain (blue) and C-terminal in green. The compounds are showed in spheres coloured in

black (a). ITC based thermo gram plot of substrate, [(Ac)2-L-Lys-D-Ala-/-D-Ala] with compound **1z**. Data derived after fitting the raw heat associated data with nonlinear regression (b).

B2. Summary and Conclusions of the Progress made so far (minimum 100 words, maximum 200 words):

The methodology for the synthesis of various γ-Hydroxy Lactam and bis(indolyl) methane derivatives were established. For γ-Hydroxy Lactam derivatives, we have developed a synthetically attractive approach employing in-situ generated cationic Pd^{II} catalyst using catalytic combination of Pd^{II}/Ag^{I} for amidoalkylation reaction between various γ-hydroxy lactam and C/O/S nucleophile at room temperature. The synthesized isoindolinone darivatives were also screened for the bioactivity against MRSA and VRSA strain and some of them found to be effective with appreciable MIC value.

By utilizing the ZnO-Cu as photo catalyst we have synthesized variety of chalcone derivatives starting from two different alcohol/aryl alkane derivatives. These derivatives were further used as reagent for the synthesis of variety of heterocyclic group containg chalcone and reduced chalcone derivatives. All the synthesized molecules contain different donor-acceptor fragment. Thus we are expecting biological activity of the synthesized derivatives. Currently we are working on that.

In another work, towards the search of a new generation of antibiotics to control Methicillin-resistant *Staphyloccus aureuse* (MRSA), the design and synthesis of various bis indolyl methane (BIM) derivatives based on their different electron donor and acceptor substiuents have been made, in which the activity against MRSA depends on both the nature and position of substiuent at both aryl and indole moieties of BIM. All the BIM derivatives were synthesized by using Fe(ox)–Fe_3O_4 promoted condensation reaction between aldehydes and indoles and well characterized with spectroscopic and analytical techniques The observed mechanistic evidences with lead compound reveals their dual mode of inhibition for both bacterial cell wall and leucyl-tRNA synthetase, which gives a clue for design and further development of new generation antibiotics.

B3. Details of New Leads Obtained, if any:

In our study, we observed The boronic acid derivative of bis(inodyl) methane, in which acceptor boron and donor indole N-H bind both with peptidoglycan layer and in a pocket between the tRNA and the protein, near to the catalytic and anticodon-binding, targeting both

the inhibition of cell wall and leucyl-tRNA synthetase. The work regarding γ-Hydroxy lactam, we observed that comound **2w** was found to be most active and showed comparable activity with levofloxacin with MIC value of 0.48 against control as well as resistant strain. Based on our observation in both the cases, we are presently designing some compounds by putting various substiuents on the active molecules, which will be helpful for future development of new generation antibiotics.

B4. Details of Publications & Patents, if any:

1. K. Sarmah, S. Mukhopadhya, T. K. Maji, and **S. Pratihar*** Switchable Bifunctional Bi-state Reusable ZnO-Cu for selective oxidation and reduction reaction, *ACS Catalysis*, **2019,** 9, 732-45. (Impact Factor: 11.39)
2. K. Sarmah, U. K. Roy, T. K. Maji, and **S. Pratihar*** *Role of Metal Exchange toward the Morphology and Photocatalytic Activity of Cu/Ag/Au-Doped ZnO: A Study with a Zinc–Sodium Acetate Complex as the Precursor, ACS Appl. Nano Mater., 2018, 1, 2049–2056.*
3. M. Dutta, S. M. Mandal, R. Pegu, and **S. Pratihar*** "Pd^{II}/Ag^{I} Catalyzed room temperature Reaction of γ-Hydroxy Lactams: Mechanism, Scope, and antistaphylococcal activity" *J. Org. Chem.* **2017**, 82, 2193-98. (Impact Factor: 4.86, CI: 04)
4. **S. M. Mandal***, R. Pegu, W. L. Porto, O. L. Franco, and **S. Pratihar*** Novel boronic acid derivatives of Bis(indolyl) methane as anti-MRSA agents, *Bioorganic & Medicinal Chemistry Letters* **2017**, *27*, 2135-38. (Impact Factor: 2.42, CI: 06)
5. R Pegu, G Pandit, AK Guha, SK Das, and S Pratihar, *Spectrochim. Acta, Part A*, **2019**, 211, 246-53. (Impact Factor: 2.84)
6. **S. M. Mandal** and S. **Pratihar** *"Antimicrobial formulation/composition to control multi-drug resistant MRSA" (1023/KOL/2015 dated 28-9-2015)*

Section-C: Details of Grant Utilization#

C1. Equipment Acquired or Placed Order with Actual Cost: 25.41 lakh

C2. Manpower Staffing and Expenditure Details: Details attached in the UC and SE

C3. Details of Recurring Expenditure: 30.95 lakh sanctioned amount was utilized.

C4. Financial Requirements for the Next Year with Justifications:

#Grant utilization details (UC&SE, Assets Certificate & manpower details) also required to be submitted separately as per the prescribed format

Manpower:
Consumables: 5.0 lakh (for purchasing of chemicals and glasswere)
Contingency: 0.5 lakh (for the charecterization and analysis)
Travel: 0.5 lakh (for the meeting, interaction and sample analysis)
Overhead charge 1.0 lakh

Total: lakh for next year

Pratihar.

[Signature(s) of the Investigator(s)]

Instructions:

(i) *All the information needs to be provided; otherwise the Progress Report will be treated as incomplete. In case of 'Nil' / 'Not Applicable' information, the same may be indicated.*

(ii) *In case of multicentre project, a combined Progress Report should be submitted incorporating the progress of all components. The Project Co-coordinator/ PI will be responsible for this.*

(iii) **Please indicate the reporting period [i.e. Year 1/2/3/4/5].*

(iv) *Submission of Progress Report by the end of the 11th month of grant sanction is linked with further continuation of the project and timely release of funds for the next year.*

UTILISATION CERTIFICATE

(For 01-04-2019 to 31-03-2020)

(Rs. in Lakhs)

1. Title of the Project/Scheme: **Design and Synthesis of Donor-Acceptor Fragmented Chemical Libraries For Development Of New Class Of Antibiotic Against MRSA**

2. Name of the Organization: Tezpur University

3. Principal Investigator: Prof. T.K. Maji

4. Deptt. of Biotechnology sanction order No. & date of sanctioning the project: BT/PR16658/NER/95/242/2015 Dated January 6, 2017

5. Amount brought forward from the previous financial year quoting DBT letter No. & date in which the authority to carry forward the said amount was given:
   i) Amount: **10,917/-**
   ii) letter No: NA
   iii)date: NA

6. Amount received from DBT during the financial year *(please give No. and dates of sanction orders showing the amounts paid)*: **NIL**

7. Other receipts/interest earned, if any, on the DBT grants: **Rs. 327 /-**

8. Total amount that was available for expenditure during the financial year (SI. Nos. 5,6 and 7): **Rs. 11,244/-**

9. Actual expenditure (excluding commitments) incurred during the financial year (statement of expenditure is enclosed): **NIL**

10. Unspent balance refunded, if any *(Please give details of cheque No. etc.)*: **Rs. 11,244/-**

11. Balance amount available at the end of the financial year: **Rs. 11,244/-**

12. Amount allowed to be carried forward to the next financial year vide letter No. & date : **NA**

1. Certified that the amount of Rs. **NIL** mentioned against col. 9 has been utilized on the project/scheme for the purpose for which it was sanctioned and that the balance of Rs. **11,244** remaining unutilized at the end of the year has been surrendered to Govt. (Vide No.....dated.....)/**will** be adjusted towards the grants-in-aid payable during the next year.

2. Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled/are being fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kinds of checks exercised:

1.
2.
3.
4.
5.

(PROJECT INVESTIGATOR)

(Signed and stamped)

Professor
Department of Chemical Sciences
Tezpur University
Tezpur - 784028

(FINANCE OFFICER)

(Signed and stamped)
Finance Officer
Tezpur University

HEAD OF THE INSTITUTE

(Signed and stamped)
Registrar
Tezpur University

Statement of Expenditure referred to in para 9 of the
Utilization Certificate

Showing grants received from the Department of Biotechnology and the expenditure incurred during the period from 1st April 2019 to 31st March 2020

(Rs. In lakhs)

Item	Unspent balance carried forward from previous year	Grants received from DBT during the year	Other receipts/ interest earned – if any, on the DBT grants	Total of Col. (2+3+4)	Expenditure (excluding commitments) incurred during the year	Balance (5-6)	Remark
1	2	3	4	5	6	7	8
A. Non-Recurring							
Equipments	-1,96,284	0	0	-1,96,284	0	-1,96,284	
B. Recurring							
Human Resource	95,040	0	0	95,040	0	95,040	
Consumables	65,222	0	0	65,222	0	65,222	
Travel	-45,482	0	0	-45,482	0	-45,482	
Contingency	-8,194	0	0	-8,194	0	-8,194	
Overheads (if applicable)	37,500	0	0	37,500	0	37,500	
Interest earned	63,115	0	327	63,442	0	63,442	
Total	10,917	0	327	11,244	0	11,244	

PROJECT INVESTIGATOR
(Signed and Stamped)

Professor
Dept. of Biotechnical Sciences
Tezpur University
Tezpur - 784028

FINANCE OFFICER/CHARTERED ACCOUNTANT
(Signed and Stamped)
Finance Officer
Tezpur University

HEAD OF INSTITUTE/ORGANIZATION
(Signed and Stamped)
Registrar
Tezpur University

UTILISATION CERTIFICATE

(For 01-04-2020 to 05-07-2020)

(Rs. in Lakhs)

1. Title of the Project/Scheme: **Design and Synthesis of Donor-Acceptor Fragmented Chemical Libraries For Development Of New Class Of Antibiotic Against MRSA**

2. Name of the Organization: Tezpur University

3. Principal Investigator: Prof. T.K. Maji

4. Deptt. of Biotechnology sanction order No. & date of sanctioning the project: BT/PR16658/NER/95/2012/2015 Dated January 6, 2017

5. Amount brought forward from the previous financial year quoting DBT letter No. & date in which the authority to carry forward the said amount was given:
   i) Amount: **Rs. 11,244/-**
   ii) letter No: NA
   iii)date: NA

6. Amount received from DBT during the financial year *(please give No. and dates of sanction orders showing the amounts paid)*: **NIL**

7. Other receipts/interest earned, if any, on the DBT grants: **NIL**

8. Total amount that was available for expenditure during the financial year (Sl. Nos. 5,6 and 7): **Rs. 11,244/-**

9. Actual expenditure (excluding commitments) incurred during the financial year (statement of expenditure is enclosed): **NIL**

10. Unspent balance refunded, if any *(Please give details of cheque No. etc.)*: **Rs. 11,244/-**

11. Balance amount available at the end of the financial year: **Rs. 11,244/-**

12. Amount allowed to be carried forward to the next financial year vide letter No. & date : **NA (Refunded to bharatkosh.gov.in on 16/03/2023 with transaction Ref No. 1503230015724)**

1. Certified that the amount of Rs. **NIL** mentioned against col. 9 has been utilized on the project/scheme for the purpose for which it was sanctioned and that the balance of Rs. **11,244** remaining unutilized at the end of the year **has** been surrendered to Govt. (Vide No.....**1503230015724**.....dated.....**16/03/23**.....)/will be adjusted towards the grants-in-aid payable during the next year.

2. Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled/are being fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kinds of checks exercised:

1.
2.
3.
4.
5.

(PROJECT INVESTIGATOR)

(Signed and stamped)

Professor
Department of Chemical Sciences
Tezpur University
Tezpur - 784028

(FINANCE OFFICER)

(Signed and stamped)
Finance Officer
Tezpur University

HEAD OF THE INSTITUTE

(Signed and stamped)
Registrar
Tezpur University

Statement of Expenditure referred to in para 9 of the
Utilization Certificate

Showing grants received from the Department of Biotechnology and the expenditure incurred during the period from 1st April 2020 to 5th July 2020

(Rs. In lakhs)

Item	Unspent balance carried forward from previous year	Grants received from DBT during the year	Other receipts/ interest earned – if any, on the DBT grants	Total of Col. (2+3+4)	Expenditure (excluding commitments) incurred during the year	Balance (5-6)	Remark
1	2	3	4	5	6	7	8
A. Non-Recurring							
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Contingency	-8,194	0	0	-8,194	0	-8,194	
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Interest earned	63,115	0	327	63,442	0	63,442	
Total	10,917	0	327	11,244	0	11,244	

PROJECT INVESTIGATOR
(Signed and Stamped)

Professor
Dept. of Chemical Sciences
Tezpur University
Napaam - 784028

FINANCE OFFICER/CHARTERED ACCOUNTANT
(Signed and Stamped)
Finance Officer
Tezpur University

HEAD OF INSTITUTE/ORGANIZATION
(Signed and Stamped)
Registrar
Tezpur University