SUMMARY

A brief description of the chapters of the thesis entitled **"Design and Synthesis of N, O & S Containing Heterocyclic Molecular Hybrids as Biodynamic Agents"** is described below:

The thesis has been divided in to four chapters

Chapter 1: Synthesis and Antimalarial Activity Evaluation of *N*-Substituted 4-Aminoquinoline-Pyrimidine Hybrids.

Chapter 2: Synthesis and Anti-Tubercular Activity of Imidazo[1,2-*a*]pyridine-Triazole and Imidazo[1,2-*a*]pyridine-Amidoether Hybrids.

Chapter 3: Synthesis of Imidazopyridine-Oxadiazole Molecular Hybrids as Anti-Tubercular Agents.

Chapter 4: Synthesis of Substituted Benzothiazole Hydrazono-Amidoether Hybrids as Anti-Tubercular Agents.

.

CHAPTER 1

Synthesis and Antimalarial Activity Evaluation of *N*-Substituted 4-Aminoquinoline-Pyrimidine Hybrids

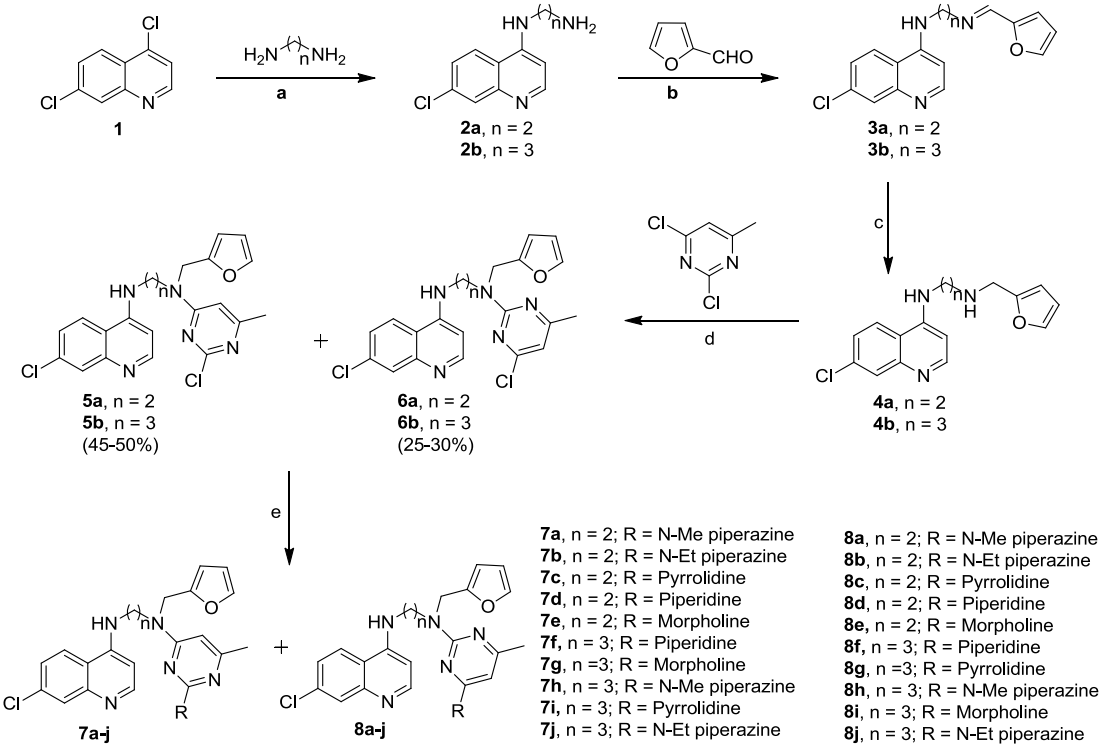
Malaria a life threatening disease, caused by bite of a Plasmodium parasite infected female anopheles mosquito, is still a major public health challenge inspired of continuous drug discovery. Tropical and subtropical climate region are majorly affected areas by malaria, where the parasite can sustain easily. According to WHO world Malaria report 2017, there is an estimated (or 445 thousand) deaths in 2016 globally compared to 446 thousand death in 2015, caused by malaria. African region was the extensively affected area with 91% of global malarial deaths followed by South-East Asia region for 6% according to WHO 2016. Fifteen countries which contributed for 80% of global malaria deaths in 2016 were of sub-Saharan Africa Region, except for India. In comparison to 2010, all regions recorded reductions in mortality in 2016, except for Eastern Mediterranean Region, where mortality rates remained unchanged during this period. The largest decline was observed in South-East Asia (44%), Africa (37%) and the America (27%). However, between 2015 and 2016, mortality rates remained intact in South-East Asia, Western Pacific area and Africa, while it increased in the Eastern Mediterranean region and America. Amongst the five malaria causing plasmodial species *viz., P. falciparum, P.ovale, P. vivax, P.malariae and P.knowlesi, P. falciparum* is the most common and virulent, responsible for more than 90% malarial deaths. To overcome the problem of drug-resistance, several efforts have been made previously including the use of combination therapy, development of analogs of the existing drugs as well as the incorporation of drug resistance reversers. The concept of 'hybrid' drug was put

forward in which two or more pharmacophores are covalently hybridized in an anticipation that such molecules will concurrently act on the parent targets and show better efficacy and pharmacokinetics than the combination of drugs. Our research group has successfully implemented this concept and developed rational molecular hybrids as anticancer, antimicrobial and antimalarial agents and demonstrated that the molecular hybridization approach can lead to the identification of highly potent molecules. In order to study the effect of structural modifications at the linker chain of the 4-aminoquinoline-pyrimidine hybrids on their pharmacokinetic behavior and antimalarial activity, we thought to substitute the terminal free -NH of diamine linker with appropriate aryl/hetero-aryl functionality through a simple reductive amination strategy with an appropriate aldehyde. On literature survey, it was found that the furan moiety is a part of various antimalarial agents and this scaffold was also known to enhance the antimalarial activity and pharmacokinetic behaviour, when present in conjunction with 4-aminoquinolines through appropriate spacers. Furthermore, assimilation of an intramolecular hydrogen-bonding moiety in the side chain of 4-aminoquinolines has been proposed to improve the antimalarial activity. Hence, with these perspectives, furan moiety was introduced in the form of furfuryl group in the aminoquinoline-pyrimidine hybrids (Scheme 1.1).

In the present study, we report the synthesis, antiplasmodial activity and cytotoxicity of 4-aminoquinoline-furfuryl-pyrimidine and 4-aminoquinoline-pyridin-pyrimidine hybrids. In addition, heme binding studies and molecular docking with the reported crystal structure of Pf-DHFR-TS were performed to determine their possible mode of action. Also, ADME properties of the best active compounds were predicted to assess the pharmacokinetic behaviour of the synthesized hybrids.

Antiplasmodial activity evaluation of 4-aminoquinoline-furfuryl-pyrimidine hybrids

The antimalarial activity was determined by measuring plasmodial LDH activity as described in the literature. All the synthesized hybrids were evaluated for the *in vitro* antimalarial activity against CQ-sensitive (D6 clone) and CQ-resistant (W2 clone) strains of *P. falciparum* using choroquine and artemisinin as reference drugs.



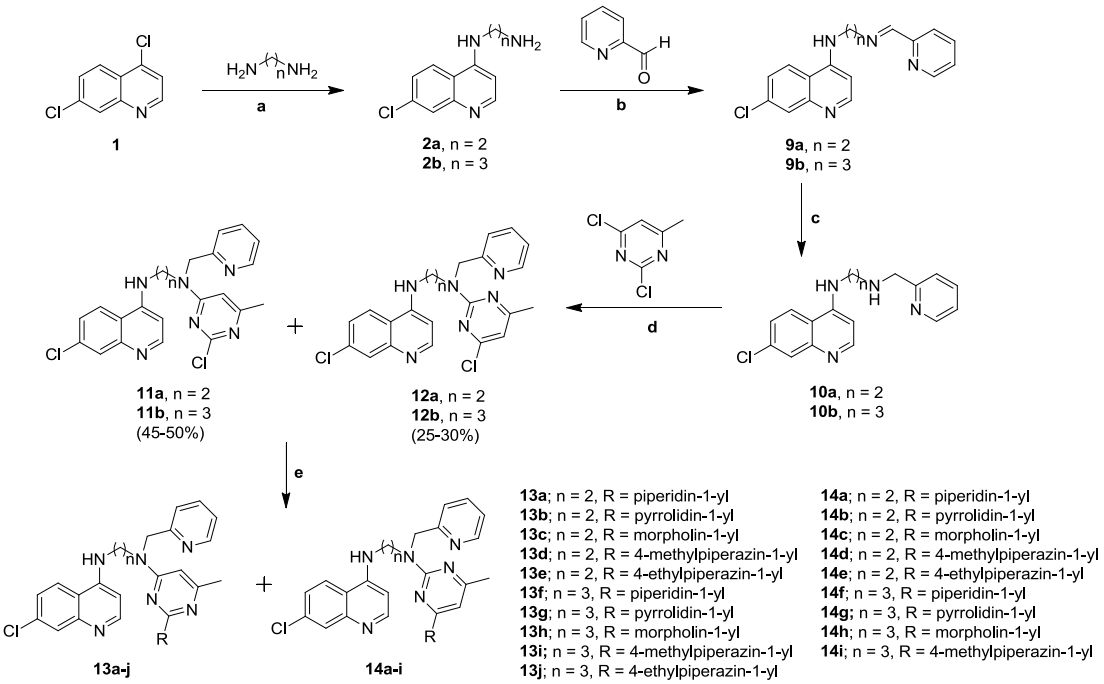
Scheme 1.1: Reaction conditions: (a) Neat, 110–120 ^{o}C, 5 h, 88–90%; (b) MeOH, RT, 12-16 h, 80-85%; (c) MeOH, $NaBH_4$, RT, 5-6 h, 85-88%; (d) Triethylamine, THF, 60 ^{o}C, 12 h, 70-80%; (e) Secondary amines, DMF, K_2CO_3, 120 ^{o}C, 10-12h, 55-86%.

Most of the hybrids showed potent antimalarial activity against both the strains of *P. falciparum*. Out of twenty four synthesized compounds, ten compounds (**7a**, **7b**, **7f**, **7i**, **7j**, **8a**, **8b, 8d**, **8e**, **8j**) with IC_{50} values ranging from 0.038–0.044 µM, displayed better activity than artemisinin (IC_{50} = 0.045 µM), when tested against CQ-sensitive (D6 clone) strain of *P. falciparum*. While all the compounds except compounds **5b** and **6b** exhibited better activity (IC_{50} values ranging from 0.039–0.257 µM) than CQ

(IC_{50} = 0.317 μM) when tested against CQ-resistant (W2 clone) strain of *P. falciparum*. For a particular amine substituted 4-aminoquinoine-pyrimidine hybrids, the structure activity relationship (SAR) study demonstrated no obvious trend of activity with increasing or decreasing carbon chain from C2 to C3 but changing the amino groups for a particular carbon chain length, C2 (**7a-7e** and **8a-8e**), C3 (**7f-7j** and **8f-8j**), changes the activity significantly. In general, compounds having methyl or ethyl piperazines moieties at the pyrimidine nucleus (**7a**, **7b**, **7h**, **7j**, **8a**, **8b**, **8h**, **8j**) were found to be more active than their morpholine, pyrrolidine and piperidine counterparts. The two sets of regio-isomers (hybrids **7a–7j** *vs*. **8a–8j**) exhibited almost similar activity against both the strains of *P. falciparum* which indicate that the point of attachment of pyrimidine nucleus to 4-aminoquinoline nucleus *via* a carbon chain linker may not have a great impact on determining the antimalarial activity pattern. Most of the compounds showed good values of resistance index (RI), the ratio of the IC_{50} value against the CQ-resistant strain to the IC_{50} value against the CQ-sensitive strain. The low value of resistance index indicates the activity of a compound regardless of the susceptibility of the parasite strain, whereas the large value indicates the loss of activity due to the drug resistance. Thus a drug molecule should have a smaller resistance index. In the present study, resistance index for chloroquine was found to be 28.81, whereas tested compounds have RI values in the range from 0.775 to 5.58 as show. In fact some compounds such as **7a**, **7b**, **7h**, **7j**, **8a**, **8h** and **8j** have resistance index value near to one suggesting that these molecular hybrids are highly effective against *P. falciparum* strains resistant to parent antimalarial drugs such as chloroquine. Cytotoxicity was also determined against Vero cell lines. All the compounds showed no toxicity upto 10 μM, the highest

concentration tested, which is very high as compared to their concentrations (IC_{50}) responsible for their antimalarial activity.

Pyridin ring is also present in many antimalarial compounds and these compounds show potent antimalarial activity. In order to study the effect of -*NH* functionalization on aminoquinoline-pyrimidine hybrids, 2-substituted pyridin ring was also introduced to the hybrids as discussed as discussed in previous section (Scheme 1.2).



Scheme 1.2: Reaction conditions: (a) Neat, 110–120 ^{o}C, 5 h, 75–85%; (b) MeOH, RT, 12-16 h, 80-85%; (c) MeOH, $NaBH_4$, RT, 5-6 h, 85-88%; (d) Triethylamine, THF, 60 ^{o}C, 12 h, 70-80%; (e) Secondary amines, DMF, K_2CO_3, 120 ^{o}C, 10-12h, 55-86%.

Antiplasmodial activity evaluation of 4-aminoquinoline-pyridin-pyrimidine hybrids

The antimalarial activity results indicated that all the compounds displayed potent antimalarial activity with IC_{50} values in the range 0.027-1.661 µM against CQ-sensitive (D6) strain and IC_{50} values in the range 0.039-1.443 µM against CQ-resistant (W2) strain *of P. falciparum*. Compound **13d** was found to be active against D6 strain of *P. falciparum* with IC_{50} value 0.027 µM and selectivity index >351. Out of all compounds,

13 compounds (**11b**, **13b**, **13d**, **13e, 13g, 13i, 13j, 14c-e, 14g-i**,) showed better activity than CQ against W2 strain. When the activity of these compounds was compared with artemisinin (ART), compounds **13d** showed comparable activity to ART & CQ against D6 sensitive strain & resistant (W2) strain. The regio-isomeric intermediates, **11a** and **12a** containing ethylene diamine linker showed better activity against the sensitive strain (IC_{50} = 0.233 µM & 0.369 µM respectively) as compared to activity against resistant strain. In case of regio-isomeric intermediates **11b** and **12b,** containing three carbons linker exhibited better antimalarial activity against resistant strains as compared to the activity against the sensitive strain, Interestingly, when the chlorine atoms of the regio-isomers **11a** and **12a** were replaced by various cyclic amines, the activity of all the resulting aminoquinoline-pyridin-pyrimidine (**13a-13e** and **14a-14e**) hybrids against both sensitive and resistant strains got improved with the exception of two compounds, **13e** and **14a** which showed little decline in the activity against the resistant strain. Similarly compounds **13f-13j** and **14f-14i** showed improved activity as compared to their corresponding intermediate regio-isomers **11b and 12b** against both the strains with the exception of three compounds **13f**, **13h** and **14f** which displayed weaker activity against CQ-resistant strain than their corresponding intermediates.

On comparing the effect of cyclic amino substitution on the antimalarial activity, it was observed that the compounds in which -Cl group was replaced with 4-methyl piperazine (**13d, 14d**) and 4-ethyl piperazine (**13e, 14e**) were found to show better activity than the compounds in which -Cl group was replaced with piperidine (**13a, 14a**), pyrrolidine (**13b, 14b**) and morpholine (**13c, 14c**) moieties. No obvious trend of antimalarial activity was found on comparison of the activity of regio-isomeric intermediates (**11a, 11b,** and **12a, 12b**) and their derivatives (**13a-13j**, **14a-14i**), differing in the point of attachment with pyrimidine ring. Compounds with ethylene diamine linker (**13a-13e** and **14a-14d)** were

found to be more active than the compounds with propylene diamine linker (**13f-13j** and **14f-14i**) against CQ-sensitive strains, whereas no particular trend was observed when compared activity against the resistant strain. Cytotoxicity was also determined against VERO cell lines. All the compounds except **12a**, compounds were found to be non-cytotoxic upto 10 μM, that is too high as compared to their corresponding IC_{50} values.

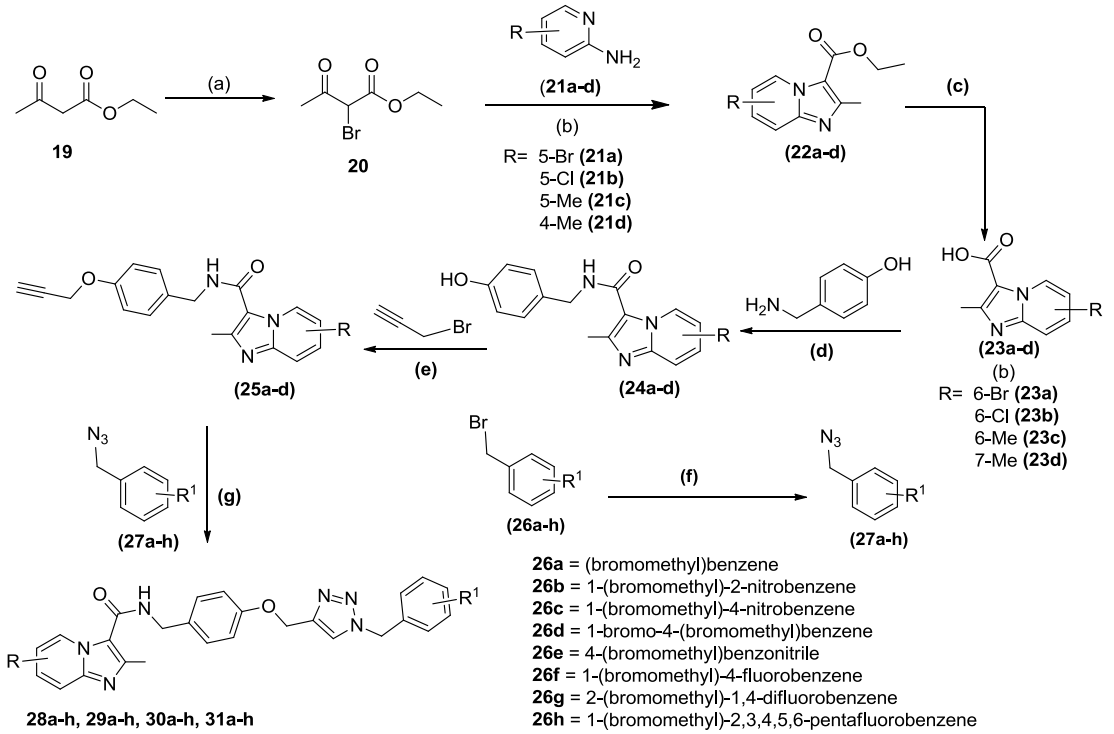
CHAPTER 2

Synthesis and Anti-Tubercular Activity of Imidazo[1,2-*a*]pyridine-Triazole and Imidazo[1,2-*a*]pyridine-Amidoether Hybrids

Tuberculosis (TB), a leading infectious airborne disease commonly caused by *Mycobacterium tuberculosis*, which belongs to class Mycobacterium, different strains of mycobacteria that cause tuberculosis are *M. bovis*, *M. africanum*, *M. microti*, *M. avium* and *M. leprae*. In 1882, the German specialist Robert Koch was the primary microbiologist to report the effective disengagement of the causative specialist of Mycobacterium tuberculosis, who later got Nobel Prize for this disclosure in 1905. Albeit basically an aspiratory pathogen, *M. tuberculosis* can cause disease all through the body. In addition, TB has a dynamic spectrum of symptoms, ranging from asymptomatic disease to causing severe affects to lungs (pulmonary tuberculosis). Further, TB can likewise contaminate other parts of the body (additional pulmonary tuberculosis) for example, bones, stomach, brain, skin, digestive tract, spinal cord, lymph nodes, central nervous system (CNS), urogenital system. Extra-Pulmonary tuberculosis establishes 15-20% of all the dynamic instances of tuberculosis. People suffering from dynamic aspiratory tuberculosis generally spit, sneeze or cough. Immediately after infecting by *Mycobacterium tuberculosis*, patient does not show any observable symptoms and this stage is known as latent tuberculosis. About 10% of the people infected with inactive tuberculosis pollutions fall sick and develop symptoms due to less immunity. The side

effect of tuberculosis includes a chronic cough with blood tinged sputum, chest pain, fever, night sweats, and weight decrease. The number of individuals infected with TB and the deaths detailed each year is immensely high. As indicated by the World Health Organization (WHO) worldwide report 2018, TB has caused around 6.4 million new cases and among them 1.3 million deaths were observed in HIV-negative people and 3,00,000 extra deaths from TB among HIV-positive people were observed in 2017. The best estimate is that 10 million people created TB disease, 5.8 million men, 3.2 million ladies, and 1.0 million kids. The first-line anti-TB drugs such as isoniazid (INH), ethambutol (EMB), rifampicin (RIF) and pyrazinamide (PZA) have lost their relevance due to the development of MDR, XDR and TDR TB infections more recently. The currently available TB treatment regimens have long-term therapy duration (6-12 months) and often results in poor patient compliance. Moreover, the increasing cases of drug-resistant TB (DR-TB), multidrug-resistant TB (MDR-TB, resistant to at least two front-line drugs such as RIF and INH), extensively drug resistant TB (XDR-TB) and the recently cases of totally drug-resistant (TDR) towards currently accessible standard drugs has worsen the situation in recent decades. On the other hand, the second-line anti-TB drugs such as PAS, cycloserine, amikacin, ethionamide and capreomycin are less effective and more toxic. Therefore, To tackle the problem of drug-resistant TB, many researchers are now shifting from single-enzyme approach towards whole cell phenotypic High Throughput Screening (HTS) approach and recently, imidazo[1,2-*a*] pyridine is identified as a potent anti-tubercular agent against both replicating *Mtb* H37Rv and multi- and extensively drug-resistant (XDR) *Mtb* strains.[5-9] The initial HTS hit (1)[5] has been suitably modified by various research groups. These efforts led to the identification of pre-clinical anti-TB candidate Q203 Mode of action studies conducted on the imidazo[1,2-*a*]pyridines have revealed that these compounds act as inhibitors of *MTb*

glutamine synthetase, *MTb* pantothenate synthetase and of β subunit of the cytochrome bc1 complex encoded by the gene qcrB. So we combined biologically active triazole, amidoether with imidazo [1,2-*a*]pyridine etc. play an important role in the development of new anti-tubercular agents. Many scientists around the globe have been working on these compounds for their possible use as anti-TB agents. We designed a new set of imidazo[1,2-*a*]pyridine-triazole and imidazo[1,2-*a*]pyridine-imidoether hybrids as anti-TB agents (Scheme 2.1 and 2.2 respectively).



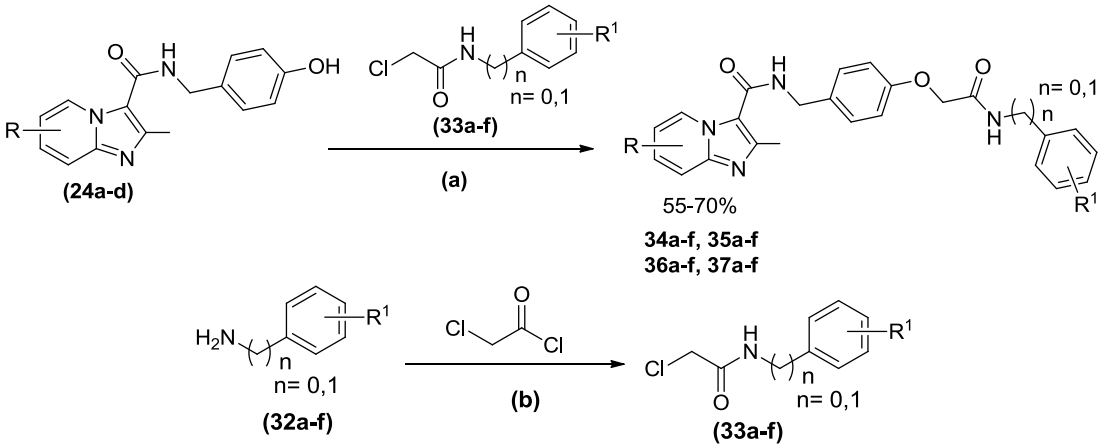
28a; R = 6-Br, R^1 = H
28b; R = 6-Br, R^1 = 2-nitro
28c; R = 6-Br, R^1 = 4-nitro
28d; R = 6-Br, R^1 = 4-bromo
28e; R = 6-Br, R^1 = 4-cyano
28f; R = 6-Br, R^1 = 4-floro
28g; R = 6-Br, R^1 = 2,5-difluoro
28h; R = 6-Br, R^1 = 2,3,4,5,6-pentafluoro

29a; R = 6-Cl, R^1 = H
29b; R = 6-Cl, R^1 = 2-nitro
29c; R = 6-Cl, R^1 = 4-nitro
29d; R = 6-Cl, R^1 = 4-bromo
29e; R = 6-Cl, R^1 = 4-cyano
29f; R = 6-Cl, R^1 = 4-floro
29g; R = 6-Cl, R^1 = 2,5-difluoro
29h; R = 6-Cl, R^1 = 2,3,4,5,6-pentafluoro

30a; R = 6-Me, R^1 = H
30b; R = 6-Me, R^1 = 2-nitro
30c; R = 6-Me, R^1 = 4-nitro
30d; R = 6-Me, R^1 = 4-bromo
30e; R = 6-Me, R^1 = 4-cyano
30f; R = 6-Me, R^1 = 4-floro
30g; R = 6-Me, R^1 = 2,5-difluoro
30h; R = 6-Me, R^1 = 2,3,4,5,6-pentafluoro

31a; R = 7-Me, R^1 = H
31b; R = 7-Me, R^1 = 2-nitro
31c; R = 7-Me, R^1 = 4-nitro
31d; R = 7-Me, R^1 = 4-bromo
31e; R = 7-Me, R^1 = 4-cyano
31f; R = 7-Me, R^1 = 4-floro
31g; R = 7-Me, R^1 = 2,5-difluoro
31h; R = 7-Me, R^1 = 2,3,4,5,6-pentafluoro

Scheme 2.1: Reaction conditions: (a) Et_2O, NBS, NH_4OAc, RT, 6 h, 95%; (b) EtOH, Reflux, 12 h, 60-65%; (c) EtOH/H_2O (3:1 v/v), RT, 12 h, (45-50%); (d) DMF, EDC-HCl, HOBt, NEt_3, 60 ^oC, 2-4 h, 80-85%; (e) DMF, K_2CO_3, RT, 12 h, 55-60%; (f) K_2CO_3, NaN_3, DMF, 50 ^oC, 4-5 h, 80-90%; (g) DMF, $CuSO_4.5H_2O$, Sodium L-ascorbate, 60 °C, 12h, 45-56%;



32a = Aniline
32b = 4-methoxy aniline
32c = 4-nitroaniline
32d = *p*-toluidine
32e = 4-ethylaniline
32f = (4-methoxyphenyl)methanamine

(33a) 2-chloro-*N*-phenylacetamide
(33b) 2-chloro-*N*-(4-methoxyphenyl)acetamide
(33c) 2-chloro-*N*-(4-nitrophenyl)acetamide
(33d) 2-chloro-*N*-(*p*-tolyl)acetamide
(33e) 2-chloro-*N*-(4-ethylphenyl)acetamide
(33f) 2-chloro-*N*-(4-methoxybenzyl)acetamid

34a; R = 6-Br, n = 0, R^1 = Ph
34b; R = 6-Br, n = 0, R^1 = 4-OMe
34c; R = 6-Br, n = 0, R^1 = 4-NO_2
34d; R = 6-Br, n = 0, R^1 = 4-Me
34e; R = 6-Br, n = 0, R^1 = 4-Et
34f; R = 6-Br, n = 1, R^1 = 4-OMe

35a; R = 6-Cl, n = 0, R^1 = Ph
35b; R = 6-Cl, n = 0, R^1 = 4-OMe
35c; R = 6-Cl, n = 0, R^1 = 4-NO_2
35d; R = 6-Cl, n= 0, R^1 = 4-Me
35e; R = 6-Cl, n = 0, R^1 = 4-Et
35f; R = 6-Cl, n = 1, R^1 = 4-OMe

36a; R = 6-Me, n = 0, R^1 = Ph
36b; R = 6-Me, n = 0, R^1 = 4-OMe
36c; R = 6-Me, n = 0, R^1 = 4-NO_2
36d; R = 6-Me, n = 0, R^1 = 4-Me
36e; R = 6-Me, n = 0, R^1 = 4-Et
36f; R = 6-Me, n = 1, R^1 = 4-OMe

37a; R = 7-Me, n = 0, R^1 = Ph
37b; R = 7-Me, n = 0, R^1 = 4-OMe
37c; R = 7-Me, n = 0, R^1 = 4-NO_2
37d; R = 7-Me, n = 0, R^1 = 4-Me
37e R = 7-Me, n = 0, R^1 = 4-Et
37f; R = 7-Me, n = 1, R^1 = 4-OMe

Scheme 2.2: Reaction conditions: (a) K_2CO_3, KI, RT, 10-15h, 55-70%; (b) Et_3N, DCM, 0 ^oC, 6-10 h, 70-90%

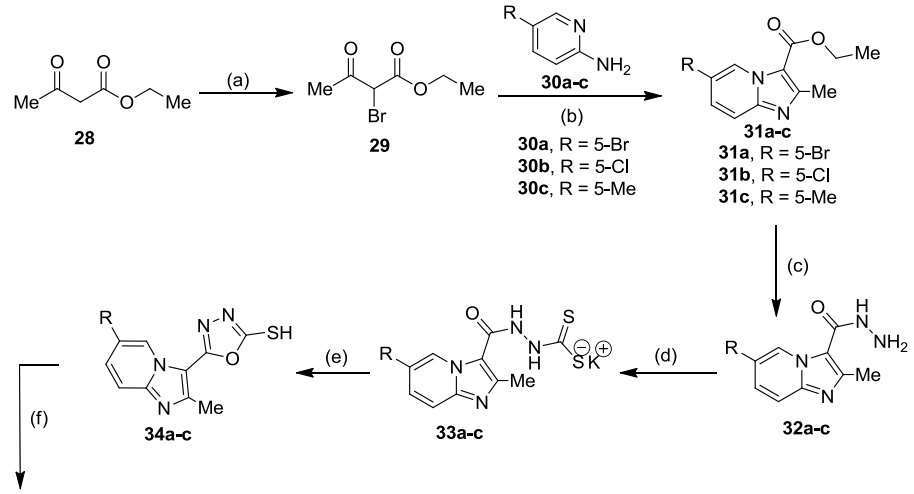
Anti-TB activity of imidazo[1,2-*a*]pyridine-triazole and imidazo[1,2-*a*]pyridine-imidoether hybrids

All the synthesized compounds were screened for their *in-vitro* antimycobacterial activity against Mtb H37Rv strain and isoniazid was used as the reference drug. Most of the compounds showed minimum inhibitory concentration (MIC_{99}) above 50 µM.

CHAPTER 3

Synthesis of Imidazopyridine-Oxadiazole Molecular Hybrids as Anti-Tubercular Agents

In this chapter, imidazopyridine-oxadiazole molecular hybrids derivatives were designed as possible anti-tubercular agents. This design was based on the literature procedures that propose fictionalization of imidazopyridine-oxadiazole (Scheme 3.1).



35a, R^1 = benzyl
35b, R^1 = 4-nitrobenzyl
35c, R^1 = 4-bromobenzyl
35d, R^1 = 4-florobenzyl
35e, R^1 = 2-nitrobenzyl
35f, R^1 = 2,5-difluorobenzyl
35g, R^1 = 2,3,4,5,6-pentafluorobenzyl
35h, R^1 = 4-cyanobenzyl
35i, R^1 = methyl 4-methylbenzoate
35j, R^1 = 1-methyl naphthalene
35k, R^1= ethyl
35l, R^1 = propyl
35m, R^1 = butyl
35n, R^1 = 3-methylbutyl
35o, R^1 = pentyl
35p, R^1 = hexyl
35q, R^1 = heptyl
35r, R^1 = octyl
35s, R^1 = geranyl
35t, R^1 = prop-1-yne

36a, R^1 = benzyl
36b, R^1 = 4-nitrobenzyl
36c, R^1 = 4-bromobenzyl
36d, R^1 = 4-florobenzyl
36e, R^1 = 2-nitrobenzyl
36f, R^1 = 2,5-difluorobenzyl
36g, R^1 = 2,3,4,5,6-pentafluorobenzyl
36h, R^1 = 4-cyanobenzyl
36i, R^1 = methyl 4-methylbenzoate
36j, R^1 = acetophenone
36k, R^1 = ethyl
36l, R^1 = propyl
36m, R^1 = butyl
36n, R^1 = 3-methylbutyl
36o, R^1 = pentyl
36p, R^1 = hexyl
36q, R^1 = heptyl
36r, R^1 = octyl
36s, R^1 = geranyl
36t, R^1 = prop-1-yne

37a, R^1 = benzyl
37b, R^1 = 4-nitrobenzyl
37c, R^1 = 4-bromobenzyl
37d, R^1 = 4-florobenzyl
37e, R^1 = 2-nitrobenzyl
37f, R^1 = 2,5-difluorobenzyl
37g, R^1 = 1-methyl naphthalene
37h, R^1 = 4-cyanobenzyl
37i, R^1 = methyl 4-methylbenzoate
37j, R^1 = ethyl
37k, R^1 = propyl
37l, R^1 = butyl
37m, R^1 = 3-methylbutyl
37n, R^1 = pentyl
37o, R^1 = hexyl
37p, R^1 = heptyl
37q, R^1 = octyl
37r, R^1 = geranyl
37s, R^1 = prop-1-yne

Scheme 3.1: Reaction conditions: (a) Et_2O, NBS, NH_4OAc, RT, 6 h, 95%; (b) EtOH, Reflux, 12 h, 65-70%; (c) $NH_2NH_2.H_2O$, EtOH, Reflux, 12 h, 49-55%; (d) EtOH, CS_2/KOH, 0 ^oC, 3h, 62-65%; (e) EtOH, Reflux, 12 h, 71-74%; (f) Na_2CO_3, R^1Br, THF, RT, 12 h, 39-64%.

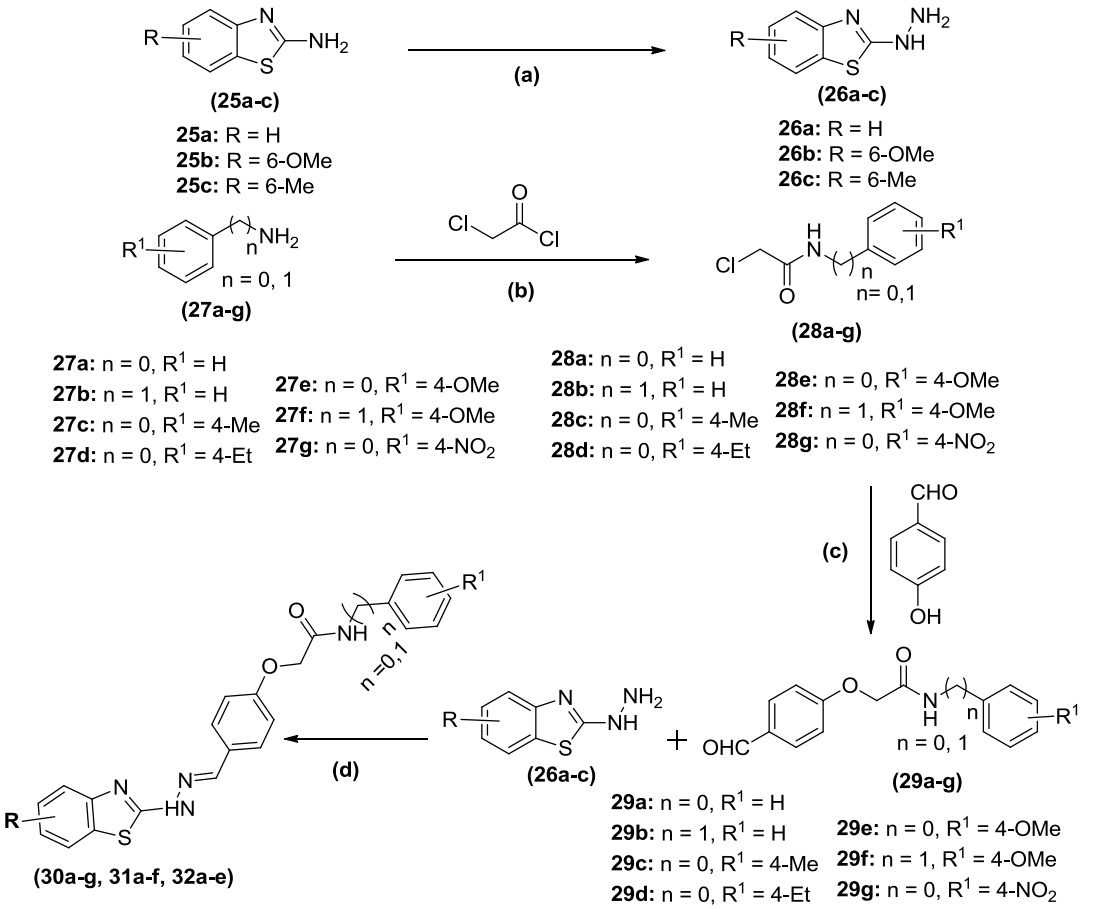
Anti-TB activity of imidazopyridine-oxadiazole molecular hybrids

All the synthesized compounds were screened against H37Rv strains. These compounds were grouped in three different categories (**35a-35t, 36a-36t and 37a-37s**) based on substitution at C-6 position of imidazo[1,2-*a*]pyridine. First group **35a-35t** has Br at C-6 position, while second group **36a-36t** and third group **37a-37s** has chlorine and methyl group respectively at C-6 position of imidazo[1,2-*a*]pyridine. Among all the tested compounds most of the compounds were found to be inactive up to 50 μM concentration except compounds **35n-35q** (MIC_{99} = 3.12-12.5 μM), **36o-36q** (MIC_{99} = 12.5 μM) and **37m-37q** (MIC_{99} = 12.5-50 μM).

CHAPTER 4

Synthesis of Substituted Benzothiazole Hydrazono-Amidoether Hybrids as Anti-Tubercular Agents

In this chapter, Substituted benzothiazole hydrazono-amidoether derivatives were designed as possible anti-tubercular agents. This design was based on the literature procedures that propose functionalization of benzothiazole hydrazono-amidoether hybrids (Scheme 4.1).



Scheme 4.1: Reaction conditions: (a) Ethylene glycol, $NH_2NH_2.H_2O$, HCl, Reflux 6-8h, 85%; (b) DCM, K_2CO_3, RT, 6h, 85-90%; (c) Acetone, K_2CO_3, KI, RT, 10-12h, 80-85%; (d) EtOH, 60 ^oC, 10-12 h, 60-70%.

Anti-TB activity of substituted benzothiazole hydrazono-amidoether derivatives

In vitro anti-TB activity of Substituted Benzothiazole Hydrazono-Amidoether derivatives is under evaluation.