1.1 Introduction

Chemistry of heterocycles is one of the important branches of chemical sciences. Considerable part of modern researches is based on heterocycles. Different pharmacophores are arranged on heterocyclic scaffolds to provide effective and selective drugs. Therefore heterocycles are important in designing of new bioactive compounds[1]. Improvisation in synthetic protocol is always sought for these scaffolds[2].

Tuberculosis (TB) is an infectious disease. It has created severe health issues worldwide. It is considered among the prime cause of death due to infectious diseases[3]. W.H. Organization reports that about 33% of the global population is affected by *Mycobacterium tuberculosis* every year and about 2 million deaths occurs. TB is declared as ‘global emergency’ by WHO[4]. Multidrug and extensively drug resistant MDR- and XDR-TB are emerging as new challenge for pharmaceutical chemists[5].

The occurrences of microbial and fungal infections and diseases caused by multidrug-resistant pathogenic bacteria have increased remarkably[6, 7]. Microbial infections stand at second position after heart attack leading to death. The ineffectiveness of the available anti-malarial drugs and resistance to insecticides have created havoc of malaria due to drug-resistant malarial parasites. The need for new low-cost antimalarial drugs is the focus of current pharmaceutical research.

Quinoline derivatives are key structures in bio-active molecules occurring in nature and number of pharmaceutically active compounds[8, 9]. 1,3,4-Oxadiazoles annulated heterocycles are significantly bioactive. They have extensively attracted attention because of their applications such as antibacterial [10], antitubercular [11], antitumor [12], antifungal [13], anti-inflammatory [14], antimalarial [15].

Pyrazole derivatives are important as they exhibit biological activities. They have extensively contributed in the field of pharmaceutical chemistry and pesticides. They exhibit various bioactivity including analgesic [16], anticancer [17], anti-convulsant [18], antibacterial, anti-inflammatory [20], hypoglycemic [21], antifungal, antituberculous [22], antimycobacterial [19], antimalarial [23] and antioxidant properties. Pyrazolopyrimidinone is one of the important nitrogenous heterocyclic
moieties in many drugs [24]. Fluorine derivated heterocycles plays vital role in improving pharmacodynamic and pharmacokinetic properties of drugs molecules [25, 26].

Herein we have successfully attempted to synthesize some 5-(phenylthio)pyrazole based polyhydroquinoline derivatives, quinoline annulated 1,3,4-oxadiazole derivatives, Pyrazole clubbed imidazole moiety and pyrazole based triazolopyrimidine derivatives to construct novel structural motifs with diverse biological potencies. The compounds synthesized under the project were characterized via different spectroscopic techniques. They were also tested for in vitro biological potency. Improvement of biological profiles via hybrid structural motifs in one framework was our intention which is being honestly reflected in our presented work.

1.2 Pyrazole (1,2-Diazole)

Pyrazole is an azole class of heterocycles having five member ring structure. Two nitrogen atoms are located at adjacent positions with the alternate double bond (Figure 1.1). During synthesis of antipyretic drug, its structure was invented by Knorr [27, 28].

![Figure 1.1 Structure of 1H-Pyrazole and its tautomeric structure](image)

### 1.2.1 Natural occurrence of Pyrazole

Pyrazole containing alkaloids withasomnine was isolated by Akira and Morimoto et al.[29] from *Withaniasomnifera*. Many of the naturally occurring remedies possess varieties of diversified pharmacological potencies such as antidiabetic[30], antiviral[31], antiviral[32], antitumor[33, 34], antimicrobial[35], antileishmanial[36], antianlgesic[37], anti-inflammatory[38]. Some important natural products having pyrazole core are put on view in Figure 1.2 below.
1.2.2 Pyrazole History and Synthetic Methods

Knorr[27] synthesised pyrazole compound in 1833 by condensation of 1,3-dicarbonyl compounds and hydrazines. This classical method is a direct and easier method leading to pyrazole (Scheme 1.1). Pyrazole and pyrazole based derivatives are valuable for synthesis of antipyretic drugs.

\[
\begin{align*}
\text{1,3-dicarbonyls} & \quad \text{Hydrazines} \\
R_1^1 & \quad R_3^1 \equiv \text{H, -CH}_3 \\
\rightarrow & \\
\text{Pyrazole derivatives} \\
\end{align*}
\]

Scheme 1.1 Synthesis of Pyrazole (Given by Knorr)

Another synthetic method leading to pyrazole consists of reaction between diazomethane and acetylenes (Scheme 1.2) which was developed in 1898 by Pechmann [39].

\[
\begin{align*}
\text{Acetylene} & \quad \text{Diazomethane} \\
\rightarrow & \\
\text{Pyrazole} \\
\end{align*}
\]

Scheme 1.2 Synthesis of Pyrazole (Given by Pechmann)
L. Knorr [40] heated phenyl hydrazine and ethyl acetocacetate to produce phenyl-3-methyl-5-pyrazolone. Pyrazole nucleus having carbonyl function is known as Pyrazolone (Figure 1.3) owing to wide spectrum of biological actions, much research has been attracted to the pyrazole and pyrazole substituted heterocycles.

![Pyrazolone](image)

**Figure 1.3** 1-phenyl-3-methyl-5-pyrazolone
1.2.3 Pyrazole as Pharmacological Agents

The pyrazole moiety is present in many pesticides and drugs molecules [41-47]. Some examples are put on view in Figure 1.4:

![Chemical structures of various pyrazole compounds](image)

**Figure 1.4** Drugs and pesticides having pyrazole nucleus
1.2.4 1H-Pyrazole-4-Carbaldehyde

Pyrazole having aldehydic functional group *i.e.* 1H-pyrazole-4-carbaldehyde and derivatives enjoy their importance as drug intermediates. Pyrazole derivatives being presented in this thesis are synthesized from 1-aryl-5-chloro-3-methyl-1H-pyrazole-4-carbaldehyde. The Biological and synthetic aspects of 1H-pyrazole-4-carbaldehydes are presented below.

1.2.4.1 Synthesis of Pyrazole-4-Carbaldehyde derivatives

Synthesis of 1-aryl-5-chloro-3-methyl-1H-pyrazole-4-carbaldehyde *via* Vilsmeier-Haack synthesis of 3-methyl-1-phenyl-pyrazol-5(4H)-one (Scheme 1.3) was reported in 1966 [48].

![Scheme 1.3 Vilsmeier-Haack reaction of 3-methyl-1-phenyl-pyrazol-5(4H)-one](image)

E.B. Rusanov and his coworkers [49] reported non-symmetric 1,3,4-trisubstituted pyrazoles via Vilsmeier–Haack reaction of schiff base prepared from the corresponding ketone and substituted hydrazines (Scheme 1.4).

![Scheme 1.4 Reaction of acetone N-alkylhydrazones with Vilsmeier-Haack reagent.](image)

Andrew and team [50] reported one-pot regioselective synthesis of trisubstituted-1H-pyrazoles. It involves three-step tandem type reactions, which have been significantly utilised in synthesis of varieties of different pharmacologically active pyrazoles based drugs (Scheme 1.5).
1.2.4.2 Reactions of Pyrazole-4-Carbaldehyde derivatives

Siddiqui and his team mates[51] developed zirconia based heterogeneous catalyst to check its catalytic efficiency for substituted pyrazolic chalcones. The catalyst activity was reported to be prominent and gave good yield at normal reaction parameters (Scheme 1.6).

**Scheme 1.6** Heterogeneous catalyst based synthesis of novel pyrazolic chalcones

H. Kiyani [52] synthesized pyrazolyl-1,3-diazabicyclo[3.1.0]hex-3-ene via one-pot multicomponent synthesis of ((2S,3R)-3-(4-nitrophenyl)aziridin-2-yl)(phenyl)methanone, 5-chloro-3-methyl-1-phenyl-1H-pyrazole-4-carbaldehyde and ammonium acetate. The synthesized pyrazole based compounds showed photochromic properties (Scheme 1.7).
Zhou Y. L. et al. [53] synthesized (E)-3-(3-methyl-5-phenoxy-1-phenyl-4,5-dihydro-1H-pyrazol-4-yl)-1-(p-substituted)prop-2-en-1-one and characterized the chalcone structure by crystallography and spectroscopic techniques (Scheme 1.8).

F. M. Liu and his teammates [54] synthesized novel pyrazole-substituted-[1,2,4]-oxadiazolo-[5,4-d]-[1,5]-benzothiazepine derivatives via cycloaddition of substituted-benzohydroximinoyl chlorides and substituted-pyrazolo[1,5]benzothiazepines using triethylamine (Et$_3$N). The synthesized benzothiazepines were characterized via crystallographic and spectroscopic methods (Scheme 1.9).
Prajapati et al. [55] prepared substituted fused pyrazole derivatives by cyclization of Knoevenagel product using anhydrous zinc chloride and toluene as a reaction medium. The product was formed from pyrazole carbaldehyde and malononitrile (active methylene). The product was analyzed by spectroscopic techniques (Scheme 1.10).

C. Sangani et al. [56] designed novel library of pyrazole-quinoline-pyridine hybrids. The target was achieved through multicomponent cyclocondensation approach starting from pyrazole carbaldehyde. The compounds were characterized by spectroscopic technique. All compounds were screened for their antimicrobial and anticancer potency (Scheme 1.11).
N. Khalifa and his teammates[57] synthesized novel biologically active substituted pyrazolyl thiazolidinone derivatives using three step reaction. The synthesized compounds were characterized by spectral techniques and showed good antimicrobial potencies (Scheme 1.12).

R. Dixit and her team[58] reported L-Proline promoted preparation of pyrazole quinazolines analogues via one-pot multicomponent reaction using isatioc...
anhydride, various amino derivatives and substituted diphenyl pyrazole-carbaldehyde. The compounds were screened for their antitubercular and antibacterial potency (Scheme 1.13).

![Scheme 1.13 Biologically active pyrazole-quinazoline derivatives](image)

S. Jarsania and his team mates[59] reported the facile route to novel pyrazolo[3,4-d]pyrimidines and characterized the products spectroscopically. The compounds were tested for their antitubercular and antibacterial potency (Scheme 1.14).

![Scheme 1.14 Antibacterial active pyrazolo[3,4-d]pyrimidines derivatives](image)

P. Kalaria et al. [60] synthesized novel library of bipyrazolyl thiazolones using molecular hybridization method. All the synthesized derivatives were characterized by different spectroscopic techniques and elemental analysis. They were evaluated for their in vitro antibacterial activity against two Gram-Ve and two Gram+Ve bacteria as well as E. coli FabH using Penicillin G and Kanamycin B as the standards. Molecular docking study was also performed for the synthesized derivatives (Figure 1.5).
V. M. Shah and his teammates [61] reported differently substituted 5-imidazolinones a, azomethines b, sulfonamides c and formazans d derivatives of pyrazole-4-carbaldehyde via multicomponent reaction and evaluated for their antimicrobial potency (Figure 1.6).

N. Desai and his teammates [62] reported facile route to fluoro substituted pyrazole based thiazolidinone derivatives and characterized spectroscopically. The compounds were screened for their in vitro antimicrobial activity (Scheme 1.15).
Ozair Alam et al.[63] reported pyrazole based benzene sulphonamide derivatives having thiazolidinedione core moiety. These molecules were tested for antidiabetic potency. Molecular docking study was performed to check the binding capacity of the prepared agent (ligand) with the corresponding receptor (Scheme 1.16).

Scheme 1.15 Biologically active pyrazole based thiazolidinone

Scheme 1.16 Synthesis of biologically active thiazolidinedione based sulphonamide derivatives
1.3 Quinoline

Quinoline is a double-ring nitrogen containing aromatic structure in which pyridine ring is fused with the benzene ring at two adjacent carbon atoms (Figure 1.7). In 1834, it was obtained from coal tar[64]. Later, it was isolated from cinchonine by heating with strong alkali [65].

![Molecular structure of quinoline](image1)

**Molecular formula:** C\(_9\)H\(_7\)N  
**Molecular weight:** 129.16 gm/mol

**Figure 1.7 Structure of Quinoline**

Quinoline is weak tertiary base. It is yellowish oil with hygroscopic nature. It has less solubility in cold water but more solubility in almost all organic solvents and hot water. Quinoline and derivatives represent an important class of heterocycles occurring naturally as well as synthetically. They have pivotal applications in biologically active products occurring in nature as well as synthetic [8, 9, 66, 67].

1.3.1 Natural occurrence of Quinoline

A series of alkaloids obtained from cinchona bark are the main source of quinoline nucleus. Quinine, cinchonidine, quinidine and cinchonine are the compounds obtained from cinchona bark. All are stereoisomers of each others. Quinine [68] is white crystalline solid bitter in taste. Quinidine is the stereoisomer of quinine.

![Structure of cinchona based alkaloids](image2)

**Figure 1.8 Structure of cinchona based alkaloids**

Chinconidine is the stereoisomer of cinchonine. It has many pharmacological potency such as antimalarial, antipyretic, analgesic and anti-inflammatory. Quinine
was the first quinoline based compound used for effective treatment of *Plasmodium falciparum*. Following figure 1.8 shows the different chinchona based alkaloids. Some of the natural products having quinoline core are put on view in figure 1.9. They are pharmacologically active [69-75].

![Chemical structures of quinoline derivatives](image)

**Figure 1.9** Some therapeutically active quinoline moieties
1.3.2 Quinoline synthesis

Quinoline is synthesized from aniline by various reactions given by different scientists are put on view in scheme 1.17.

Apart from all the above reactions, quinoline can also be synthesized from substituted anilines / compounds other than anilines as the starting material, which are listed below in Scheme 1.18-1.23.

**Scheme 1.17** Synthesis of quinoline starting from aniline

Apart from all the above reactions, quinoline can also be synthesized from substituted anilines / compounds other than anilines as the starting material, which are listed below in Scheme 1.18-1.23.

**Scheme 1.18** Meth-Cohn synthesis
(II) 

\[
\begin{align*}
\text{CHO} & \quad \text{O} \\
\text{NH}_2 & \quad \text{R}_1 \\
\text{TFA, Reflux} & \\
\text{substituted quinoline}
\end{align*}
\]

**Scheme 1.19** Friedlander synthesis

(III) 

\[
\begin{align*}
\text{NH} & \quad \text{O} \\
\text{R} & \\
\text{H}_2\text{SO}_4 \quad \text{Reflux} & \\
\text{substituted quinolone}
\end{align*}
\]

**Scheme 1.20** Knorr quinoline synthesis

(IV) 

\[
\begin{align*}
\text{N} & \quad \text{O} \\
\text{H} & \\
\text{KOH} & \\
\text{substituted quinoline}
\end{align*}
\]

**Scheme 1.21** Pfitzinger reaction

(V) 

\[
\begin{align*}
\text{COOH} & \quad \text{R} \\
\text{NH}_2 & \quad \text{R}_1 \\
\text{substituted quinoline}
\end{align*}
\]

**Scheme 1.22** Niementowski quinoline synthesis

(VI) 

\[
\begin{align*}
\text{O} & \quad \text{CH}_3 \\
\text{NH} & \quad \text{R}_1 \\
\text{O} & \quad \text{CH}_3 \\
\text{NaOH} & \\
\text{substituted quinoline}
\end{align*}
\]

**Scheme 1.23** Camps quinoline synthesis
### 1.3.3 Quinoline derivatives as Pharmacological Agents

The quinoline scaffold plays critical role in variety of pharmacologically active quinoline substituted derivatives[76-83]. Some of them are put on view in figure 1.7 below.

**Figure 1.7** Presence of quinoline moiety in pharmacological active agents
1.3.4. Synthesis of 2-chloroquinoline-3-carbaldehyde

Nitrogen containing heterocycles possess number of medicinal applications [84-87]. 2-Chloroquinoline-3-carbaldehyde has very important role as an intermediate in many heterocycles and in drug synthesis. It is synthesized from acetanilide using Vilsmeier-Haack reagent, halomethyleneiminium salt (Scheme 1.24). This reagent is prepared from DMF and POCl$_3$ [88, 89]. This reagent is very much useful for introduction of carbaldehyde (-CHO) group into arenic and heteroarenic compounds [90].

(Quinoline) Meth-Cohn Synthesis

![Scheme 1.24 Meth-cohn synthesis of quinoline.]

A. Romero [91] synthesized 2-chloroquinoline-3-carbaldehyde by using Vilsmeier-Haack reaction of substituted acetanilides. Phosphorus pentachloride was employed as chlorinating agent in lieu of phosphorous oxychloride (Scheme 1.25).

![Scheme 1.25 Synthesis of substituted-2-chloroquinoline-3-carbaldehyde derivative using PCl$_5$.]

R = -H, 6-CH$_3$, 7-CH$_3$, 8-CH$_3$, 6-OCH$_3$, 7-OCH$_3$, 6-Br, 7-Cl, 6-NO$_2$

1.3.4.1 Reactions 2-chloroquinoline-3-carbaldehyde

N. Saravanan et al. [92] synthesized quinolo-oxepane derivatives via intramolecular dipolar cycloaddition between $\alpha$,$\beta$-unsaturated ester and azomethine ylides. The synthesized oxepane derivatives showed stereo selectivity at its bridge carbons (Scheme 1.26).
A. Romero and his team mates[93] developed diverse 2-trifluoromethylsubstituted-benzo[b,1,8]naphthyridin-4(1H)-ones in comparable yields from 3-acetyl derivatives of 2-chloroquinolines (Scheme 1.27).

S. Karad and his team mates[94] synthesized novel library of 2-morpholino quinoline based oxadiazoles to check their diversified potencies such as antitubercular, cytotoxic, antimicrobial and antimalarial. They also performed molecular docking to check pharmacodynamic and pharmacokinetic property of prepared compounds (Scheme 1.28).
A. Deshmukh[95] and his team mates reported substituted phenyl-(4-(tetrazolo[1,5-\(a\)])quinolin-4-ylmethoxy)phenyl)thiazolidin-4-ones via one pot condensation from 2-chloroquinoline-3-carbaldehyde (Scheme 1.29).

Radhey sinh et al. [96] developed an inexpensive regent (FeCl\(_3\).6H\(_2\)O) for the successive conversion of o-arylethynylquinonylmethanol into disubstituted-1H-pyrano[4,3-\(b\)]quinolines via dig-cyclisation. The developed reagent was especially capable to convert starting material into product (Scheme 1.30).
S. D. Bunge[97] and his team mates reported ultrasound promoted reaction of quinoline-3-carbaldehydes and 2-oxoquinoline-3-carbaldehyde to produce quinoline-imidazolium derivatives using 1-butyl-3-methylimidazolium chloride [BMIM][Cl] under mild conditions (Scheme 1.31).

M. Shiri et al. [98] reported mild and organocatalysed based synthesis of dihydrobenzo[b][1,8]-naphthyridine and substituted-pyrano[2,3-b]quinoline derivatives.

Scheme 1.30 Synthesis of FeCl₃.6H₂O promoted pyrano[4,3-b]quinolines

Scheme 1.31 Synthesis of ultrasound promoted quinoline-imidazolium derivatives in presence of [Bmim]Cl⁺
The compounds were prepared from 6-substituted-aminouracils, chloroquinoline-3-carbaldehydes and 3-methyl-1H-pyrazol-5(4H)-one or dimedone under organocatalyst (Scheme 1.32).

G. Ladani and his team mates[99] synthesized quinolino-oxadiazole derivatives in excellent yield via halo-amine coupling reaction. The compounds were evaluated for antitubercular, antimicrobial, cytotoxic and antimalarial potency (Scheme 1.33).

C. Gill [100] reported quinazolinone derivatives via halo-amine cross coupling reaction which exhibited biological activity. The compounds were tested for their antibacterial and antifungal potency (Scheme 1.34).

V. Ramesh[101] and his team mates synthesized rhodanine analogues benzo[h]quinoline and 2-chloroquinoline scaffolds and checked their anticancer potency (Scheme 1.35).
P. Miniyar et al. [102] synthesized chloroquinoline based pyrazoline derivatives and tested for antimicrobial potency (Scheme 1.36).

N. Desai et al. [103] synthesized quinolinoimidazole derivatives using microwave as well as conventional methods. They have studied antimicrobial potency of the prepared compounds (Scheme 1.37).
M. Shaharyar and Mazumder[104] reported quinoline and benzimidazole containing oxadiazole ring using Chloramine-T as the cyclising reagent. The compounds were tested for their anticancer potency (Scheme 1.38)

Scheme 1.38 Synthesis of Quinoline containing oxadiazole derivatives as an anticancer agents

1.4 Outline of current work

In above consideration, we attempted to prepare some 5-(phenylthio)pyrazole based polyhydroquinoline derivatives, quinoline annulated 1,3,4-oxadiazole derivatives, pyrazole clubbed imidazole moiety and pyrazole based triazolo pyrimidine derivatives to build up new structural motifs with diverse biological potencies. The synthesized compounds were characterized by elemental analysis and spectroscopic methods viz. $^1$H NMR, $^{13}$C NMR, IR, mass spectrometric techniques and elemental analysis. They are also tested for their in vitro pharmacological activity. The development of fusion technique through the arrangement of diverse pharmacophores in one skeleton has led to products with interesting biological profiles, which is being reflected in our work.

The proposed thesis will be divided in five chapters and brief detail of the work is as follows.

Chapter 1: General introduction

This chapter of General Introduction represents the active moieties covered in the entire thesis. Literature survey covers pyrazole and quinoline containing medicinally important natural and synthetic compounds. Different synthetic approach for their preparation and medicinal applications are briefly summarized.
Chapter 2: Synthesis, characterization and pharmacological screening of 5-(phenylthio) pyrazole based polyhydroquinoline core nucleus

This chapter comprises of new polyhydroquinoline derivatives. The compounds were prepared by one-pot three-component cyclocondensation under conventional method. The library of compounds was tested for their \textit{in vitro} antimalarial potency against \textit{Plasmodium falciparum}, antibacterial potency against a panel of pathogenic strains of bacteria and fungi. They were tested for antitubercular potency against \textit{Mycobacterium tuberculosis} H37Rv strain. \textit{In silico} molecular docking study and \textit{in silico} pharmacokinetics evaluation have been carried out. All the sixteen compounds differ in substitutational variations as shown in Scheme I.

\textbf{Scheme I}

$\text{Synthesis of substituted 2-amino-4-((5-(4-substitutedphenylthio)-3-methyl-1-phenyl-1H-pyrazol-4-yl))-1-(substitutedphenyl)-7,7-dimethyl-5-oxo-1,4,5,6,7,8 \ hexahydro quinoline-3-carbonitrile 8a-p (i) DMF, } K_2 CO_3 \text{, Reflux 2 hr (ii) Methanol, Acetic acid, reflux 0.5-1 hr (iii) Piperidine, Ethanol, Reflux for 1-3 hr.}$
Chapter 3: Iodobenzene diacetate catalyzed Tetrazolo[1,5-a]quinoline based 1,3,4-oxadiazole scaffolds and their biological Screening

This chapter covers synthesis of a novel series of quinoline nucleus clubbed with 1,3,4-oxadiazole scaffolds in a good yield. The reaction was performed using iodobenzene diacetate (IBD) in dichloromethane. The titled compounds were tested for their preliminary \textit{in vitro} antibacterial potency against a panel of pathogenic strains of bacteria and fungi; antituberculosis potency against \textit{Mycobacterium tuberculosis} H37Rv strain, antimalarial potency against \textit{Plasmodium falciparum} and \textit{in vitro} antioxidant potency by ferric-reducing antioxidant power measurement. All the eighteen compounds have substitutional variations as shown in Scheme II.

\begin{ Scheme II}

\begin{center}
\begin{align*}
\text{Scheme II} \\
\begin{array}{c}
\begin{array}{c}
\text{1a-c} \quad + \quad \text{NaN}_3 \\
\quad \text{EtOH, AcOH} \\
\quad 2\text{-3 hr, Reflux} \\
\quad \rightarrow \\
\text{3a-c} \\
\text{MeOH, AcOH, 0.5-1 hr} \\
\end{array}
\end{array}
\end{align*}
\end{center}

\begin{center}
\begin{align*}
\begin{array}{c}
\begin{array}{c}
\text{4a-e} \\
\quad \text{NH}_2 \\
\quad \text{R}_1 = \text{H, -CH}_2\text{-OCH}_3 \\
\quad \text{4a'}-\text{b'} \\
\quad \text{NH}_2 \\
\quad \text{O} \\
\quad \text{X= N, Y= CH} \\
\quad \text{4b'}_1 \\
\quad \text{X= CH, Y= N} \\
\end{array}
\end{array}
\end{align*}
\end{center}

\begin{center}
\begin{align*}
\begin{array}{c}
\text{5a-l} \\
\text{DCM, IBD,} \\
\text{stirred at RT, 20min.} \\
\text{6a-l} \\
\text{5m-r} \\
\text{6m-r} \\
\end{array}
\end{align*}
\end{center}

\end{Scheme II}

Synthesis of 7-substituted tetrazolo [1,5-a]quinoline incorporating 1,3,4-oxadiazole nucleus (6a-r).
Chapter 4: Microwave assisted synthesis of fluoro substituted 5- (phenylthio) Pyrazole clubbed imidazole moiety: Characterization and their biological evaluation

This chapter represents synthesis of novel analogues of fluoro substituted 5-(phenylthio)-pyrazole clubbed imidazole moiety under microwave irradiation method. The titled compounds were tested for their preliminary in vitro antibacterial potency against a panel of pathogenic strains of bacteria and fungi; antituberculosis potency against Mycobacterium tuberculosis H37Rv strain, antimalarial potency against Plasmodium falciparum and in vitro antioxidant potency by ferric-reducing antioxidant power measurement. All the eighteen compounds have substitutional variations as shown in Scheme III.

Scheme III

![Scheme III](image)

Synthesis of 5-((4-substitutedphenyl)thio)-3-methyl-1-phenyl-4-(1,4,5-tris(substitutedphenyl)-1H-imidazol-2-yl)-1H-pyrazole


This chapter represents synthesis of new analogues of fluoro substituted (phenylthio)-substituted-triazolo[4,3-a]pyrimidine derivatives. The titled compounds
were tested for their preliminary *in vitro* antibacterial potency against a panel of pathogenic strains of bacteria and fungi; antituberculosis potency against *Mycobacterium tuberculosis* H37Rv strain, antimalarial potency against *Plasmodium falciparum* and *in vitro* antioxidant potency by ferric-reducing antioxidant power measurement. All the twenty compounds have substitutional variations as shown in Scheme IV.

![Scheme IV](image)
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