CHAPTER-6

MICROBIAL STUDY OF NOVEL QUINAZOLINE, BENZIMIDAZOLE AND TRIAZOLE DERIVATIVES

Chapter-6:

MICROBIAL STUDY OF NOVEL QUINAZOLIN, BENZIMIDAZOLE AND TRIZOLE DERIVATIVES

6. [A]. GENERAL:

The science dealing with the study of the prevention and treatment of diseases caused by micro-organisms is known as medical microbiology. Its sub-disciplines are virology (study of viruses), bacteriology (study of bacteria), mycology (study of fungi), phycology (study of algae) and protozoology (study of protozoa). For the treatment of diseases inhibitory chemicals employed to kill micro-organisms or prevent their growth, are called antimicrobial agents.

Microorganisms, especially bacteria, are becoming resistant to more and more antimicrobial agents. Bacteria found in hospitals appear to be especially resilient, and are causing increasing difficulty for the sickest patients–those in the hospital. Currently, bacterial resistance is combated by the discovery of new drugs. However, microorganisms are becoming resistant more quickly than new drugs are being made available; thus, future research in antimicrobial therapy may focus on finding how to overcome resistance to antimicrobials, or how to treat infections with alternative means, such as species-specific phages.

The chemical substance which is inhibiting the growth of microorganism is known as antimicrobial agent. Although a wide range of chemicals have these properties if a sufficiently high concentration is used, the term is restricted to those compounds that are effective at concentration which is suitable for practical applications[1]. It is suitable to subdivide antimicrobial agents into various groups according to the action and purposes for which they are employed. Subdivision can be based upon the group of microorganisms affected. Thus, antimicrobial agents which inhibit the growth of bacteria are called bacteriostatic or bactericidal and antimicrobial agents, which inhibit the growth of fungi are called fungistatic or fungicidal[1].

A wide range of techniques are available for the antibacterial assay. The principle of all these tests is similar, viz. the preparation of concentration gradient of

the compound in a nutrient medium and observation of the growth of the microbial cultures, when the medium is seeded with the microorganism and incubated. Various variables are involved in sensitivity and assay tests, such as the size of the inoculums, the nature the culture medium, the presence of the antibacterial agents, concentration of the agar in the medium, the time of incubation and composition of the antibacterial agents[1].

Functional groups play a vital role in a vast number of biological processes. Biochemists have begun to investigate the molecular details of enzymes and other biologically active compounds. The organic chemists on the other hand, have solely begun to recognize the similarities between compounds they work with, and biologically important compounds containing Functional group. These two trends have merged into active research i.e. bioorganic chemistry. This discipline is rapidly bridging the gap between traditional organic chemistry and biochemistry.

Biochemistry has evaluated to the point where biological processes can be understood and explained in terms of molecules and electrons. Organic chemistry has developed concepts, theories and techniques that are both sophisticated and general enough to be applied to such functional groups phenomena as biological processes. There are of course a few exceptions to these notations, for example it has been known for more than a century that blood contains group. Micronutrients required for the growth are supplied in proper amounts via natural processes under normal conditions. Unfortunately, techniques were not accurate enough to establish the correlation between the presence of a micronutrient and its biological effect. This is one of the reasons why the recognition of the essentiality of some trace elements has been delayed so long.

A general realization of the importance of a biological orientation in all fields of human endeavor has aroused interest in many organic chemists to study biological systems. Thus, organic chemists have begun to study that mimic, known as biological phenomena. The presence of functional group in biological matter approaching their detection limits has intrigued biologist for generation, though efforts to ascertain their functional significance have often been frustrated. The remarkable acceleration of the rate of progress in this field is the result of conjoint advances in many disciplines.

Nutritional and metabolic experiments can now be monitored both by advanced methods of analysis and through suitable control of contaminations. Major progress in isolating and characterizing the composition, structure and function of metalloenzymes has immensely aided the delineation of the molecular basis of the

biological role of functional group. Simultaneously, the emerging knowledge has opened a new direction to experiments in biochemistry, physiology, pathology, nutrition and medicine and the resultant understanding of metallobiochemistry has given hope that metals have played unrecognized roles in disease.

6. [B]. STUDIES ON ANTIMICROBIAL ACTIVITY:

In recent years, nitrogen heterocyclic's have gained importance on account of their varied types of biological activities. Various indoles are known to possess biological activities[2, 3]. The isatin chemistry with its diverse biological properties like anticonvulsant[4], antibacterial [5], antifungal [6], antitubercular [7], antiviral [8] and anti-HIV [9] has received importance in recent years. Indole-2, 3-dione have also been reported to oxidase inhibitor, tribulin[10]. Hydrazides of several nitrogen containing heterocyclic derivatives were reported as potential antitubercular agents[11]. The structural modification with pharmacologically active grouping has shown excellent results in pharmacology. Anti-inflammatory[12,13], Antihypertensive[14-16], Anticonvulsant[17-19] ,Antimicrobial[20-26], antiviral[27-31] and Antineoplastic[32] activities of certain substituted isatin derivatives have been reported in literature.

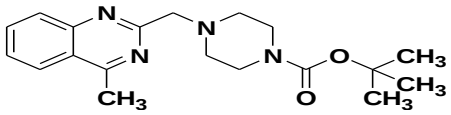
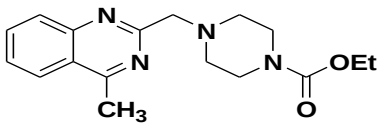
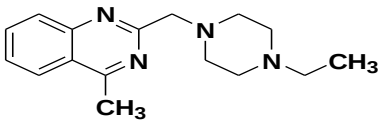
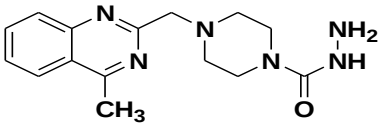
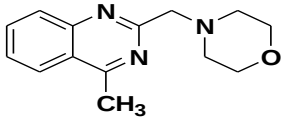
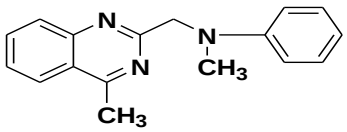
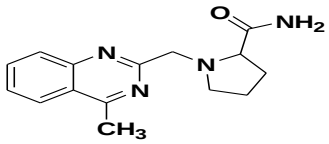
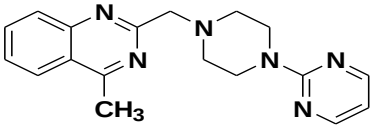
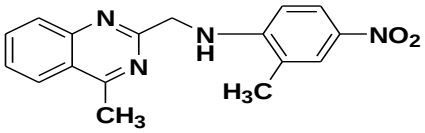
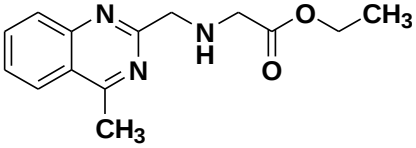
6. [C]. PRESENT WORK:

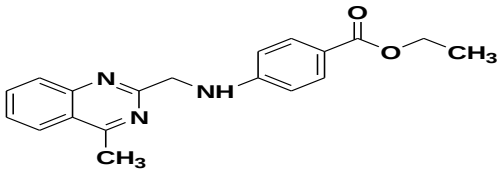
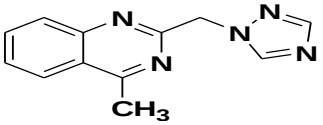
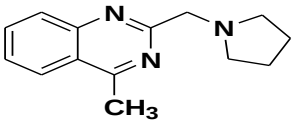
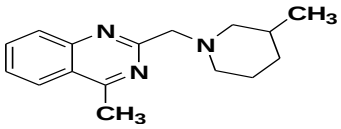
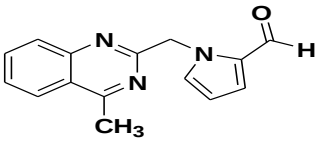
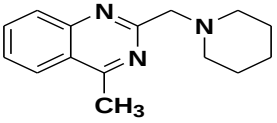
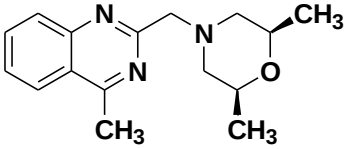
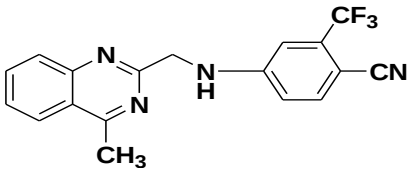
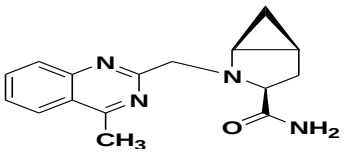
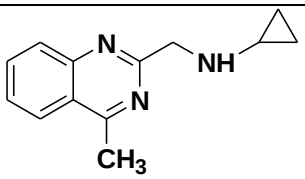
Brief survey of the literature cited above on the antimicrobial activities of Isatin and their derivatives are active against various microbial cultures.

An attempt has been made to evaluate the antimicrobial activities of the synthesized Compounds of against the bacterial strains such as *E.coli* and *B. subtillis* and Yeast strains such as *S.Cerevisiae* and fungal strains such as *A.niger* following the literature procedures.

As all fifty nine compound name and structure are arrange in below Table 1, 2, 3, 4 and it's discuss the activity of the *E.coli, B. subtillis, S.Cerevisiae* and *A.niger.*

TABLE: 1

Sr. No	Name	Structure
1	DJP/D102	
2	DJP/D103	
3	DJP/D104	
4	DJP/D105	
5	DJP/D106	
6	DJP/D107	
7	DJP/D108	
8	DJP/D109	
9	DJP/D110	
10	DJP/D111	

11	DJP/D112	
12	DJP/D113	
13	DJP/D114	
14	DJP/D115	
15	DJP/D116	
16	DJP/D117	
17	DJP/D118	
18	DJP/D119	
19	DJP/D120	
20	DJP/D121	

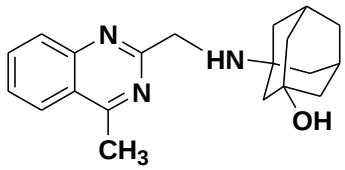
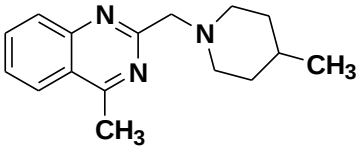
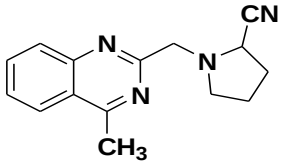
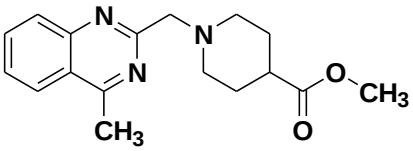
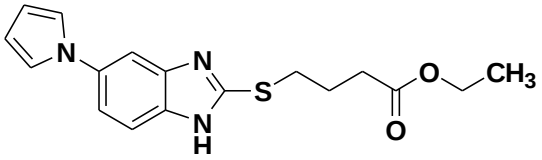
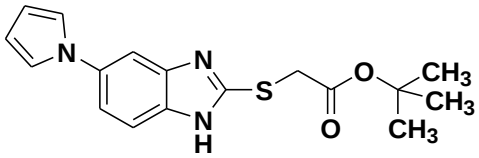
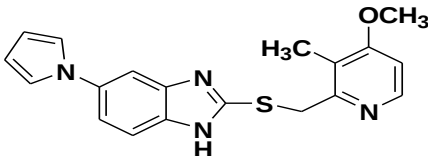
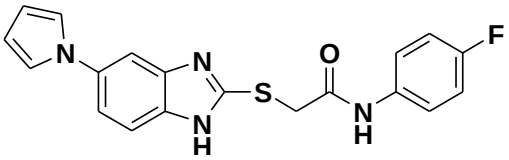
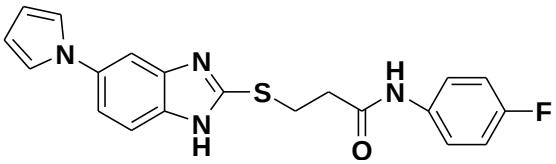
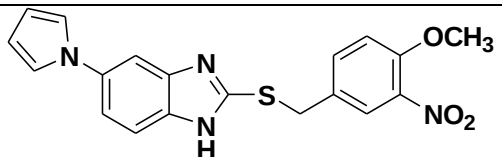
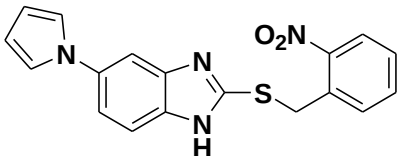
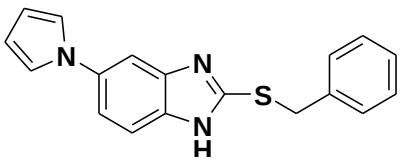
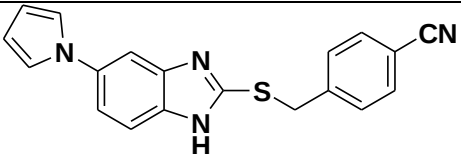
21	DJP/D122	
22	DJP/D123	
23	DJP/D124	
24	DJP/D125	

TABLE: 2

Sr. No	Name	Structure
1	DJP/D131	
2	DJP/D132	
3	DJP/D133	
4	DJP/D134	
5	DJP/D135	
6	DJP/D136	
7	DJP/D137	
8	DJP/D138	
9	DJP/D139	

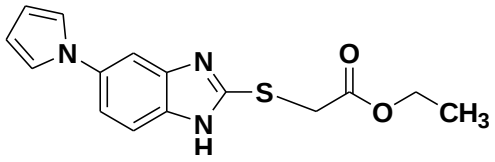
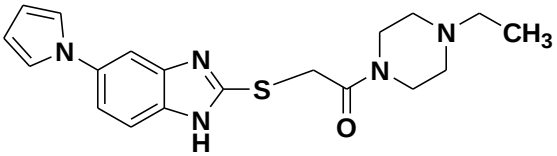
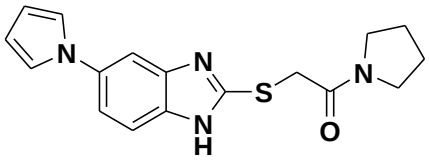
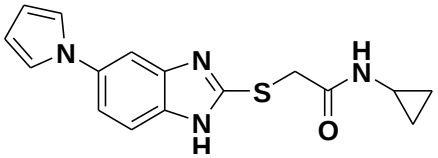
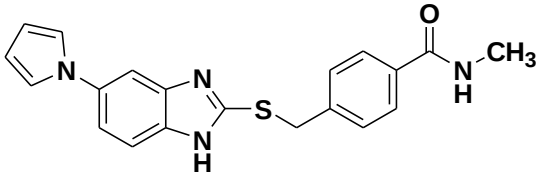
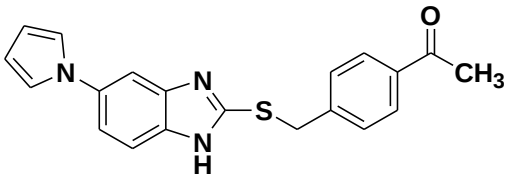
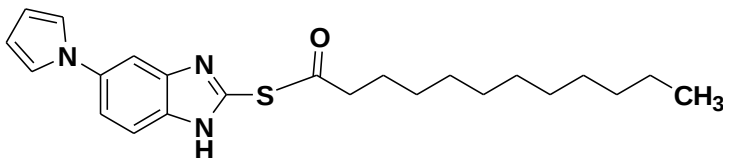
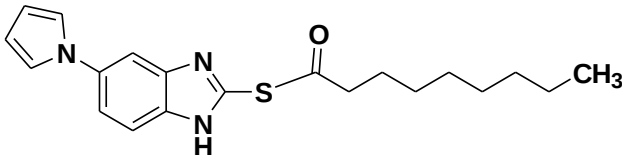
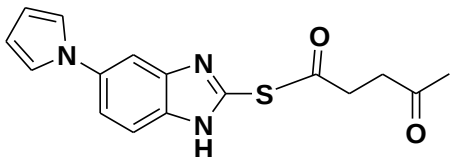
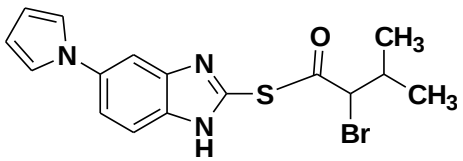
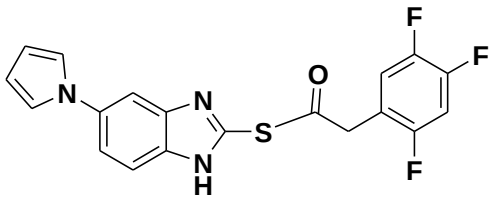
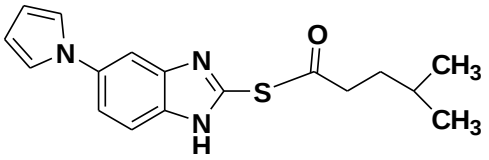
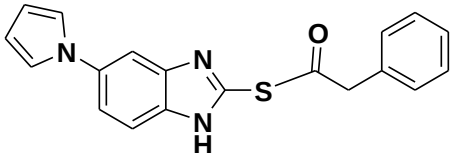
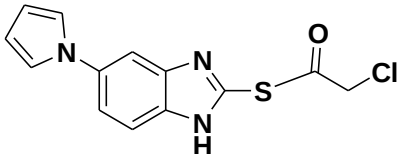
10	DJP/D140	
11	DJP/D141	
12	DJP/D142	
13	DJP/D143	
14	DJP/D144	
15	DJP/D145	

TABLE: 3

Sr. No	Name	Structure
1	DJP/D146	
2	DJP/D147	
3	DJP/D148	
4	DJP/D149	
5	DJP/D150	
6	DJP/D151	
7	DJP/D152	
8	DJP/D153	

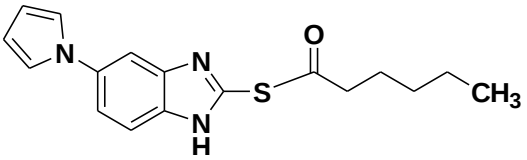
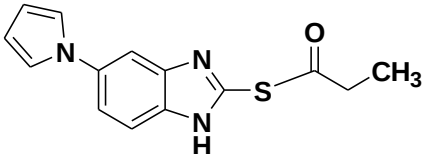
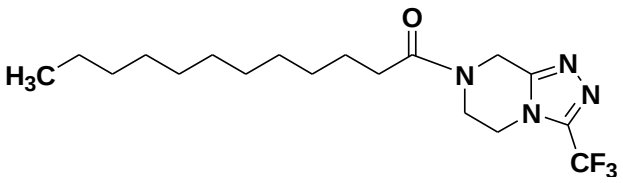
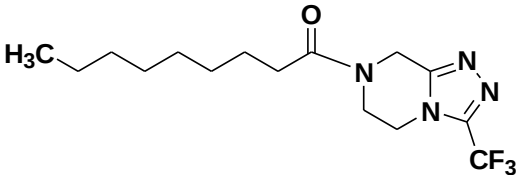
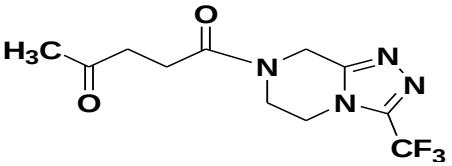
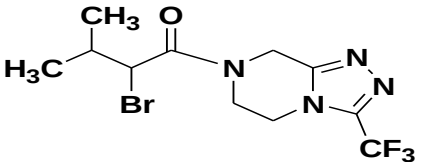
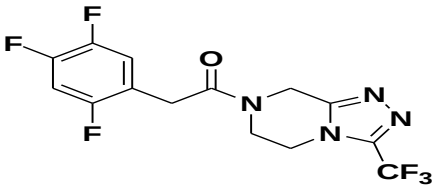
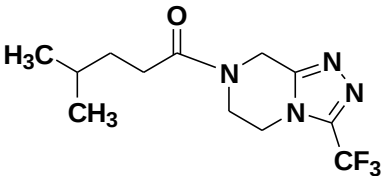
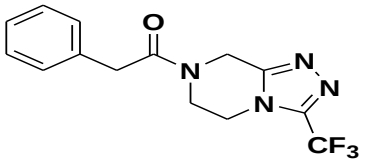
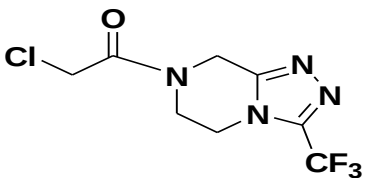
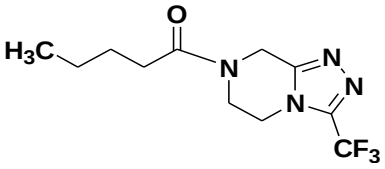
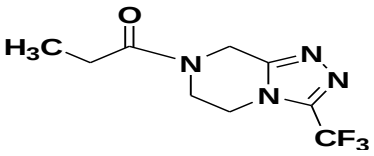
9	DJP/D154	
10	DJP/D155	

TABLE: 4

Sr. No	Name	Structure
1	DJP/D156	
2	DJP/D157	
3	DJP/D158	
4	DJP/D159	
5	DJP/D160	
6	DJP/D161	
7	DJP/D162	
8	DJP/D163	

9	DJP/D164	
10	DJP/D165	

6. [D]. EXPERIMENTAL:

6. [D]. 1 MATERIALS:

All materials used in the present study were of the analytical grade.

(1) N-broth i.e. Nutrient broth medium (Titan Biotech Ltd., Delhi).

(2) Sabouraud's dextrose broth medium (Titan Biotech Ltd., Delhi).

(3) Antibacteriological grade Agar-Agar (Qualigens-Glaxo, Mumbai).

6. [D]. 2 MICROORGANISMS:

Bacterial [*Escherichia coli, Bacillus subtilis* and *S. aureus*] and fungal [*A.niger*] and yeast [*S. cerevisiae*] cultures were tested with all 59 compounds.

The effect of all 59 compounds in the growth media were investigated by standard microbiological parameters. Concentration of the test compounds were kept constant (500 ppm) during all the experiments. The bacterial, fungal and yeast cultures were maintained on Nutrient-agar, Potato dextrose-agar and YEDP culture-tubes (slants) respectively and were sub cultured every fortnight and stored at 0-5°C temperature.

6. [D]. 3 MEDIA COMPOSITION:

For the growth and test for the bacterial cultures, N-broth medium containing ingredients (gm l^{-1}), distilled water, pH = 7.3 ± 0.2, was prepared and sterilized at 15 psi steam pressure for 15 minutes in autoclave. For the preparation of the culture-tubes, 3.0 g agar-agar powder and 2.5 g N-broth medium were added in 100 ml distilled water.

For the growth and test for fungal cultures, Sabouraud's dextrose broth medium containing ingredients (gl^{-1}), for the preparation of the culture-tubes, 3.0 g agar-agar powder and 3.0 g Sabouraud's dextrose broth medium were added in 100 ml distilled water. For the growth of yeast cultures following composition of the medium were used.

Composition of the medium for Rhodotorula minuta:

Glucose	-	2.0 g
Peptone	-	1.25 g
KH_2PO_4	-	0.5 g
$MgSO_4.\ 7H_2O$	-	0.2 g
Distilled water	-	100 ml.

Composition of the medium for P. stipitis MGYP:

Malt extract	-	0.5 g
Glucose	-	1.0 g
Yeast extract	-	0.5 g
Peptone	-	0.3 g
Distilled water	-	100 ml.

6. [E]. INOCULUM PREPARATION:

6. [E]. 1. BACTERIAL CULTURES:

A loopful of cell mass from pregrown culture-tube (slant) was inoculated into a sterile N-broth-tubes containing 15 ml medium and incubated at 37°C for 24 hours to get sufficient cell density (i.e. 1×10^8 cells/ml).

6. [E]. 2. FUNGAL CULTURES:

Well sporulated culture-tube of fungal culture was used for preparation of spore suspension. About 5.0 ml of sterile distilled water containing few drops of Tween-80 solution was added to the culture-tube (slant) and growth was scraped with sterile nichrome wire-loop and collected in sterile tube. Spore suspension thus obtained was inoculated in the inoculum medium as 5% (v/v) and incubated at room temperature on rotary shaker for 40 hours for the fungal cultures.

6. [E]. 3. YEAST CULTURES:

A well pregrown slant of yeast culture was used for preparation of inoculum. 5.0 ml of sterile distilled water containing few drops of twin-80 solution was added to the slants and growth was scrapped with sterile nichrome wire loop and collected in sterile tube. Inoculum thus obtained was inoculated in the test medium as 5% (v/v) and incubated at room temperature on rotary shaker (200 rpm) for 40 hours for yeast cultures.

6. [E]. 4. ANTIBACTERIAL ASSAY:

Antibacterial assay was carried out by agar cup method which is based on the principle that the chemical substance in solution can diffuse though the agar seeded with test culture and produce concentration gradient. Microbial growth is inhibition within a defined area giving rise to zone of inhibitory concentration of the particular chemical agent against a specific test organism.

For the agar cup diffusion method, the test compound containing the ligand with metal complexes and bacterial and fungal and yeast culture was introduce into the well created by cork borer (0.85 cm) in the solidified nutrient agar potato dextrose agar and Saboiraud's dextrose agar medium respectively contained in the Petri plates. The test compound was introduced into the well and the plates were incubated at 28°C, 30°C and 36°C for, yeast fungal and bacterial culture. Microbial growth was determined by measuring the diameter of the zone of inhibition. The degree of effectiveness was measured by determining the diameter of the zone of inhibition caused by the compound. Effectively was classified in to three zones on the bases of the diameter of zone of inhibition:

+ + +	:	Excellent active
+ +	:	Moderate active
+	:	Feebly active
-	:	Inactive

6. [F]. RESULTS AND DISSCUSSION:

Most of the compounds were moderate active against microorganisms the results are as follows: TABLE: 1.1, 2.1, 3.1 and 4.1

TABLE: 1.1

ANTIBACTERIAL ACTIVITY OF THE DJP/D102 to DJP/D124 (CONTROL-DMF)

Compounds	*E.coli*	*B.subtillis*	*S.aureus*	*S.Cerevisiae*	*A.niger*
DJP/D102	+	++	++	+	++
DJP/D103	++	+	++	++	+
DJP/D104	+	+	+	++	+
DJP/D105	+	++	+	+	++
DJP/D106	+	+	+	++	+
DJP/D107	+	+	++	++	+
DJP/D108	++	++	+	+	+
DJP/D109	++	+	+	+	++
DJP/D110	+	+	++	+	++
DJP/D111	+	++	+	+	++
DJP/D112	+	+	+	++	+

DJP/D113	++	++	+	+	+
DJP/D114	++	+	+	+	++
DJP/D115	+	++	++	+	++
DJP/D116	++	+	+	++	+
DJP/D117	+	++	+	+	+
DJP/D118	++	+	+	++	++
DJP/D119	++	++	+	+	+
DJP/D120	+	++	++	+	++
DJP/D121	++	+	+	++	+
DJP/D122	+	++	++	+	++
DJP/D123	+	+	++	+	++
DJP/D124	++	++	+	+	+
DJP/D125	+	++	++	+	++

6. [F]. 1. Result Discussion of (DJP/D102 to DJP/D124):

- ✓ The **DJP/D102** compounds are feebly active against *E. coli and S. cerevisiae* when moderately active against *E. coli*, *B. subtillis S. aureus* and *A. niger*.
- ✓ The **DJP/D103** compounds are feebly active against *B.subtillis* and *A. niger*. When moderately active against *E. coli, S. aureus S. cerevisiae.*
- ✓ The **DJP/D104** compounds are feebly active against *S. aureus, E. coli, B. subtillis* and *A. niger* when moderately active against *S. cerevisiae.*
- ✓ The **DJP/D105** compounds are feebly active against *E.coli, S. aureus. and S. cerevisiae* when moderately active against *A. niger* and *B. subtillis*.
- ✓ The **DJP/D106** compounds are feebly active against *S. aureus, E. coli, B. subtillis* and *A. niger* when moderately active against *S. cerevisiae.*
- ✓ The **DJP/D107** compounds are feebly active against *E. coli, B. subtillis and A. niger* when moderately active against *S. aureus*, *S. cerevisiae*.
- ✓ The **DJP/D108** compound are feebly active against *S.aureus, S. cerevisiae* and *A. niger* when moderately active against *E. coli*, *B. subtillis*.
- ✓ The **DJP/D109** compounds are feebly active against *B. subtillis*, S. *aureus* and *S. cerevisiae* when moderately active against *E. coli* and *A. niger*.
- ✓ The **DJP/D110** compounds are feebly active against *E. coli, B. subtillis* and *S. Cerevisiae and* when moderately active against S. *aureus* and *A. niger*.
- ✓ The **DJP/D111** compounds are feebly active against S. *aureus* and *E. coli* and *S. cerevisiae* when moderately active against *B. subtillis, A. niger*.
- ✓ The **DJP/D112** compounds are feebly active against *S. aureus, E. coli, B. subtillis* and *A. niger* when moderately active against *S. cerevisiae*
- ✓ The **DJP/D113** compound are feebly active against *S.aureus, S. cerevisiae* and *A. niger* when moderately active against *E. coli*, *B. subtillis*.
- ✓ The **DJP/D114** compounds are feebly active against *B. subtillis*, S. *aureus* and *S. cerevisiae* when moderately active against *E. coli* and *A. niger*.
- ✓ The **DJP/D115** compound are feebly active against *E. coli, S. cerevisiae* and when moderately active against, *B. subtillis, S.aureus and A. niger.*
- ✓ The **DJP/D116** compound are feebly active against *B. subtillis, S.aureus, A. niger* and when moderately active against *E. coli, S. cerevisiae*
- ✓ The **DJP/D117** compounds are feebly active against *S. aureus, E. coli, S. cerevisiae* and *A. niger* when moderately active against *B. subtillis.*

- ✓ The **DJP/D118** compounds are feebly active against *B. subtillis, S. aureus,* and *A. niger* when moderately active against *E. coli, S. cerevisiae.*
- ✓ The **DJP/D119** compound are feebly active against *S.aureus, S. cerevisiae* and *A. niger* when moderately active against *E. coli*, *B. subtillis*.
- ✓ The **DJP/D120** compound are feebly active against *E. coli, S. cerevisiae* and when moderately active against, *B. subtillis*, *S.aureus and A. niger.*
- ✓ The **DJP/D121** compound are feebly active against *B. subtillis, S.aureus, A. niger* and when moderately active against *E. coli*, *S. cerevisiae*
- ✓ The **DJP/D122** compounds are feebly active against *E. coli and S. cerevisiae* when moderately active against *E. coli*, *B. subtillis S. aureus* and *A. niger*.
- ✓ The **DJP/D123** compounds are feebly active against *E. coli*, *B. subtillis* and *S. Cerevisiae and* when moderately active against S. *aureus* and *A. niger*.
- ✓ The **DJP/D124** compound are feebly active against *S.aureus, S. cerevisiae* and *A. niger* when moderately active against *E. coli*, *B. subtillis*.
- ✓ The **DJP/D125** compound are feebly active against *E. coli, S. cerevisiae* and when moderately active against, *B. subtillis, S.aureus and A. niger.*

TABLE: 2.1

ANTIBACTERIAL ACTIVITY OF THE DJP/D131 to DJP/D145

(CONTROL-DMF)

Compounds Code	*E.coli*	*B.subtillis*	*S.aureus*	*S.cerevisiae*	*A.niger*
DJP/D131	++	+	++	+	++
DJP/D132	+	+	++	++	+
DJP/D133	++	++	+	++	+
DJP/D134	+	++	+	++	++
DJP/D135	+	+	+	++	+
DJP/D136	+	++	+	++	+
DJP/D137	++	++	+	+	++
DJP/D138	++	+	++	+	++
DJP/D139	++	+	++	+	++
DJP/D140	+	++	++	+	++
DJP/D141	++	+	++	+	++
DJP/D142	+	+	++	+	++
DJP/D143	+	++	+	++	++
DJP/D144	++	+	++	+	++
DJP/D145	+	+	+	++	+

6. [F]. 2. Result Discussion of (DJP/D131 to DJP/D145):

- ✓ The **DJP/D131** compounds are feebly active against B. subtillis, S. cerevisiae when moderately active against S. aureus and E. coli, and A. niger
- ✓ The **DJP/D132** compounds are feebly active against E. coli, B. subtillis and A. niger when moderately active against S. aureus, S. cerevisiae.
- ✓ The **DJP/D133** compounds are feebly active against S.aureus and A.niger when moderately active against E. coli, B. subtillis and S. cerevisiae.
- ✓ The **DJP/D134** compound are feebly active against S. aureus, S. aureus and A. niger when moderately active against B. subtillis, E. coli and S. cerevisiae
- ✓ The **DJP/D135** compounds are feebly active against S. aureus, E. coli, B. subtillis and A. niger when moderately active against S. cerevisiae.
- ✓ The **DJP/D136** compound are feebly active against E. coli, S. aureus and A. niger when moderately active against B. subtillis, and S. cerevisiae
- ✓ The **DJP/D137** compounds are feebly active against S. aureus and S. cerevisiae when moderately active against E. coli, B. subtillis and A. niger.
- ✓ The **DJP/D138** compounds are feebly active against B. subtillis, S. cerevisiae when moderately active against S. aureus and E. coli, and A. niger
- ✓ The **DJP/D139** compounds are feebly active against S. aureus and S. cerevisiae when moderately active against E. coli, B. subtillis and A. niger.
- ✓ The **DJP/D140** compounds are feebly active against E. coli and S. cerevisiae when moderately active against E. coli, B. subtillis S. aureus and A. niger.
- ✓ The **DJP/D141** compounds are feebly active against B. subtillis, S. cerevisiae when moderately active against S. aureus and E. coli, and A. niger
- ✓ The **DJP/D142** compounds are feebly active against E. coli, B. subtillis and S. Cerevisiae and when moderately active against S. aureus and A. niger.
- ✓ The **DJP/D143** compound are feebly active against S. aureus, S. aureus and A. niger when moderately active against B. subtillis, E. coli and S. cerevisiae
- ✓ The **DJP/D144** compounds are feebly active against B. subtillis, S. cerevisiae when moderately active against S. aureus and E. coli, and A. niger
- ✓ The **DJP/D145** compounds are feebly active against S. aureus, E. coli, B. subtillis and A. niger when moderately active against S. cerevisiae.

TABLE: 3.1

ANTIBACTERIAL ACTIVITY OF THE DJP/D146 TO DJP/D155 (CONTROL-DMF)

Compounds Code	*E.coli*	*B.subtillis*	*S.aureus*	*S.serevisiae*	*A.niger*
DJP/D146	++	+	++	++	+
DJP/D147	+	++	+	+	++
DJP/D148	+	+	++	++	+
DJP/D149	+	+	++	+	++
DJP/D150	++	++	+	+	+
DJP/D151	++	+	+	++	+
DJP/D152	++	+	+	++	++
DJP/D153	+	++	+	+	++
DJP/D154	+	++	++	+	++
DJP/D155	+	++	++	+	++

6. [F]. 3. Result Discussion of (DJP/D146 to DJP/D155):

- ✓ The **DJP/D146** compounds are feebly active against B.subtillis and A. niger. When moderately active against E. coli,S. aureus S. cerevisiae.
- ✓ The **DJP/D147** compounds are feebly active against E.coli, S. aureus. and S. cerevisiae when moderately active against A. niger and B. subtillis.
- ✓ The **DJP/D148** compounds are feebly active against E. coli, B. subtillis and A. niger when moderately active against S. aureus, S. cerevisiae.
- ✓ The **DJP/D149** compounds are feebly active against E. coli, B. subtillis and S. Cerevisiae and when moderately active against S. aureus and A. niger.
- ✓ The **DJP/D150** compound are feebly active against S.aureus, S. cerevisiae and A. niger when moderately active against E. coli, B. subtillis.
- ✓ The **DJP/D151** compound are feebly active against B. subtillis, S.aureus, A. niger and when moderately active against E. coli, S. cerevisiae
- ✓ The **DJP/D152** compounds are feebly active against B. subtillis, S. aureus, and A. niger when moderately active against E. coli, S. cerevisiae.
- ✓ The **DJP/D153** compounds are feebly active against E.coli, S. aureus. and S. cerevisiae when moderately active against A. niger and B. subtillis.
- ✓ The **DJP/D154** compounds are feebly active against E. coli and S. cerevisiae when moderately active against E. coli, B. subtillis S. aureus and A. niger.
- ✓ The **DJP/D155** compound are feebly active against E. coli, S. cerevisiae and when moderately active against, B. subtillis, S.aureus and A. niger.

TABLE: 4.1

ANTIBACTERIAL ACTIVITY OF THE DJP/D156 to DJP/D165 (CONTROL-DMF)

Compounds	*E.coli*	*B.subtillis*	*S.aureus*	*S.serevisiae*	*A.niger*
DJP/D156	++	++	+	++	++
DJP/D157	+	++	++	+	++
DJP/D158	++	++	+	++	++
DJP/D159	++	+	++	+	++
DJP/D160	+	++	+	++	+
DJP/D161	+	+	++	++	+
DJP/D162	+	+	+	++	+
DJP/D163	++	+	++	+	++
DJP/D164	+	++	++	+	++
DJP/D165	++	+	++	+	++

6. [F]. 4. Result Discussion of (DJP/D156 to DJP/D165):

- ✓ The **DJP/D156** compounds are feebly active against *B. subtillis and A. niger* when moderately active against *E. coli*, *S. cerevisiae* and *S. aureus*.
- ✓ The **DJP/D157** compounds are feebly active against S. *aureus and S. cerevisiae* when moderately active against *E. coli*, *B. subtillis*, *A. niger*.
- ✓ The **DJP/D158** compounds are feebly active against S. *aureus* when moderately active against *E. coli, B. subtillis, A. niger* and *S. cerevisiae*..
- ✓ The **DJP/D159** compounds are feebly active against *B. subtillis and S. cerevisiae* when moderately active against *E. coli, A. niger* and *S. aureus.*
- ✓ The **DJP/D160** compounds are feebly active against *E. coli, S. aureus,* and *A. niger* when moderately active against *B. subtillis and S. cerevisiae.*
- ✓ The **DJP/D161** compounds are feebly active against E. coli, B. subtillis and A. niger when moderately active against S. aureus, S. cerevisiae.
- ✓ The **DJP/D162** compounds are feebly active against S. aureus, E. coli, B. subtillis and A. niger when moderately active against S. cerevisiae.
- ✓ The **DJP/D163** compounds are feebly active against B. subtillis, S. cerevisiae when moderately active against S. aureus and E. coli, and A. niger
- ✓ The **DJP/D164** compounds are feebly active against E. coli and S. cerevisiae when moderately active against E. coli, B. subtillis S. aureus and A. niger.
- ✓ The **DJP/D165** compounds are feebly active against B. subtillis, S. cerevisiae when moderately active against S. aureus and E. coli, and A. niger

REFERENCES:

1. Goodman L.S. "*The Pharmacological Basic of Therapeutics"*, 4th *Edn*, MacMillan, Landon, **1970**.
2. Clara T and Harod G.W. *Proc.Soc .Exptl. Bio.Med.***1945**, 59,183.
3. Wright J.B. *J.Am. Chem.Soc.* **1949**,71,1028.
4. Karali N and Gursoy A. *Farmaco,* **1994**, 49(12), 819.
5. Daisely R.W and Shah V.K. *J.Pharm.Sci*.**1984**, 73(3), 407.
6. Maysinger D, Morvin M and Saric M.M. *Pharmazie,* **1984**, 35(1), 14.
7. Tran V.H, Nguyen Q.D, Le N.V and Le T.T. *Tap Chi DOue Hoc* .**2000**, 8, 15.
8. Logar J.C, Fox M.P, Morgan J.H, Makhon A.M, Pfau C.J. *J Gen Virol*.**1975**,28,271.
9. Sridhar S.K, Pandeya S.N and De Clercq E, *Boll Chim.Farmaco*.**2001**, 140(5), 302.
10. Glover V, Halket J.M, Watkins P.J, Clow A, Goodwin P.L and Sandler M.J. *Neurochem*.**1988**, 51(2), 656.
11. Bernstein J, Jambor W.P, Lott W.A, Pansy F, Steinberg B.A and Yele H.C. *Am .Rev Tubere*. **1953**,67,366.
12. Kitaura Y, Ito F, Stevens R.W, Asai N. *Eur.Pat.Appl.***1987**,EP 249,407(C.A 108,112438d)
13. Agarwal S, Pande A, Saxena V.K and Chowdhury S.R. *Indian Drugs*.**1985**, 22,633.
14. Stringer O.D, Weinstock J and Wilson J.W. *Eur.Pat.Appl.* **1986**.EP 167,288 (C.A 107 236508a)
15. Eriksson H.E and Florvall L.G. *Acta Pharm. Suec*.**1976**, 13, 79.
16. Nadler G, Martin M and Zimmermann R. *Eur.Pat.Appl.***1986** EP 351,213 (C.A 113 59233h)
17. Bhattcharya S.K and Chakrabarti A. *Indian J Exp Biol*. **1998**, 36,118.
18. Popp F.D and Parson R. *Abstr. Pap.Am.Chem.Soc*.**1982**, 183, 67.
19. Watjen F, Nielsen E.O, Drejer J and Jensen L.H. *Bioorg.Med.Chem.Lett*.**1933**, 3,105.
20. Atta r.ehman Ijaz A.S, Choudhary M.I and Amtul Z. *J.Chem.Soc.Pak*.**1997**, 19,230.
21. Dilber S, Saban M, Gelineo A, Arsenijevic L, Bogavac M and Pavlov S.*Pharmazie*.**1990**,45,800.

22. Movrin M and Medic.aric M. *Eur.J.Med.Chem.***1978**, 13,309.
23. Pandeya S.N, Yogeeswari P, Sriram D, de Clercq E, Pannecouque C and Witvrouw M. *Chemotherapy*.**1999**,45,192.
24. Nofal Z.M, Mandour A.H and Nassar M.I. *Egypt.J.Chem*.**1990**, 33,509.
25. Abbady M, Awad I.M.A and Kandeel M.M. *Indian J.Chem.SectB*.**1998**, 27B, 90.
26. Gupta A.K.S and Gupta A.A. *Eur.J.Med.Chem*.**1983**, 18,181.
27. Mahmoud A, M, Abdelrahman A.E, Elnaggar G.M and Elsherief H.A. *Indian J.Chem*.**1984**, 22B, 379.
28. Pandeya S.N, Usha L, Pandey A and Bajpai S.K. *Indian J.Heterocycl.Chem*.**1997**, 6,313.
29. Prakash D and Prasad S.M. *J. Indian Chem.Soc*. **1988**,65,673.
30. Tiwari I.C and Shyam R. *Curr.Sci*.**1977**, 46,619.
31. Varma R.S and Khan I.A. *Pol J Pharmacol Pharm*.**1977**, 29,549.
32. Movrin M. and Medic. aric M. *Eur.J.Med.Chem*.**1978**, 13,309.