Journal of Pharma Research
Available online through
www.jprinfo.com

Research Article
ISSN: 2319-5622

Synthesis and Antimicrobial Evaluation of some Novel Schiff Bases containing 1, 3, 4-Oxadiazole ring

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Received on: 08-10-2012; Revised on: 11-10-2012; Accepted on: 11-10-2012

ABSTRACT

The synthesis of benzylidene-(5-phenyl-[1,3,4]-oxadiazol-2-yl)amine (5) has been achieved by the reaction of Benzaldehyde(1) with Semicarbazide(2), it affords a Semicarbazone (3) which on fusion with glacial acetic acid and sodium acetate gives 5-phenyl-[1,3,4]-oxadiazol-2-yl-amine (4) which upon reaction with substituted Benzaldehyde gives benzylidene-(5-phenyl-[1,3,4]-oxadiazol-2-yl)amine derivative(5). All the synthesized compounds have been supported by spectral analysis. The antimicrobial activity of synthesized compounds has also been evaluated.

Keywords: *Semicarbazide, Benzaldehyde, 1, 3, 4-oxadiazoles.*

INTRODUCTION

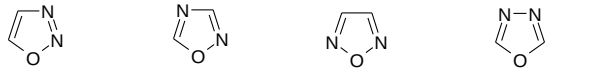
Heterocyclic chemistry is the chemistry branch dealing exclusively with synthesis, properties and applications of heterocycles. The IUPAC recommends using the Hantzsch-Widman nomenclature to name heterocyclic compounds.

Heterocyclic compounds are organic compounds containing at least one atom of carbon and at least one element other than carbon, such as sulfur, oxygen or nitrogen within a ring structure. These structures may comprise either simple aromatic rings or non-aromatic rings. Some examples are pyridine (C_5H_5N), pyrimidine ($C_4H_4N_2$) and dioxane ($C_4H_8O_2$).

Heterocyclic compounds contain molecules, whose atoms are arranged in a ring, the ring contained with two or more chemical elements. They have wide applications in agricultural, medical, textile and polymer industry and dye wastewater treatment applications. The compounds like imidazoles, purines, pyrroles, oxazoles, diazepines, triazepines and pyrimidines etc. have wide applications in manufacturing agricultural pesticides and in medical applications like for anticancer, antiviral, tranquilizer and photodynamic therapy. The compounds like pyridocarbazoles, thienocarbazoles, phenothiazines are used as the nonlinear optical materials. Thiazoles, thiophenes, pyrazoles, carbazoles and indoles compounds have wide applications in textile and polymer industry. They are used as dyes, optical brighteners, and photochromic compound. Dyes and azo and anthraquinone have wide applications in wastewater treatment [1-4].

1, 3, 4-Oxadiazoles: [5]

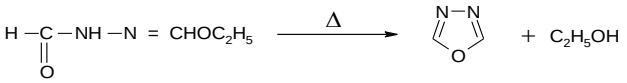
Compounds having a five membered ring containing one oxygen and two nitrogen atoms are called Oxadiazoles or in the older literature furadiazoles.[9] Four types of oxadiazole are known namely 1,2,3-, 1,2,4-, 1,2,5- and 1,3,4-oxadiazoles. Out of these 1, 3, 4-oxadiazoles are found to be most potent biologically.



1,2,3-oxadiazole 1,2,4-oxadiazole 1,2,5-oxadiazole 1,3,4-oxadiazole

Physical properties of 1, 3, 4-Oxadiazoles:

1,3,4-oxadiazole[10], is a liquid boils at 150°C. It was first prepared by Ainsworth in 1965 by the thermolysis of ethylformate formyl hydrazone at atmospheric pressure.



Thermodynamic Aspects:

1,3,4-oxadiazole (b.p. 150°C) and its lower alkyl derivatives are liquids at room temperature whereas aryl derivatives are solids (2-phenyl- and 2,5-diphenyl-1,3,4-oxadiazole melting at 34–35°C and 138°C, respectively). In general, melting points increase in the series: Δ^2-1,3,4-oxadiazoline-5-thiones < Δ^2-1,3,4-oxadiazolin-5-ones < 2-amino-1,3,4-oxadiazoles (Δ^2-1,3,4-oxadiazolin-5-one and 2-amino-1,3,4-oxadiazole melting at 120 and 156°C, respectively).

Lower-alkyl-substituted 1,3,4-oxadiazoles are soluble in water, solubility decreasing with increasing molecular weight. 1,3,4-oxadiazole is aromatic, having an estimated resonance energy of 167.4 kJ mol^{-1}. The ring is stable to heat, a property which has been exploited in the production of heat-resistant poly-1,3,4-oxadiazoles.PE (Photo Electron) spectroscopy has been used to identify gas phase conformations of 1, 3, 4-oxadiazolidines. The ring adopts a half-chair conformation.

Spectral Data of 1, 3, 4-Oxadiazoles:

UV spectra of substituted 1,3,4-oxadiazoles are similar to those of similarly substituted benzenes, particularly in the case of 2-pheyl- and 2,5-diphenyl-1,3,4-oxadiazole (λ_{max}(EtOH): 247.5 nm, log ε 4.26, and 280 nm, log ε 4.44 respectively). However no absorption above 200 nm is shown by 1,3,4-oxadiazole itself and calculated values for its long wavelength absorption are in the region of 200 nm compared with λ_{max} 260 nm for benzene. 2-methyl- and 2-ethoxycarbonyl-1,3,4-oxadiazole, and Δ^2-1,3,4-oxadiazoline-5-thione have the following λ_{max} (log ε) values respectively: 206 nm (2.62) methanol, 243 nm (3.2) and 260 nm (4.12) (ethanol).

The IR spectra of 1,3,4-oxadiazole are generally characterized by bands at 1640-1560 ($\nu_{C=N}$), 1070-1090 (ν_{C-O}) and 970 cm^{-1}. Typically for 2-substituted Oxadiazoles are bands at 3140 ((ν_{CH}), 1640-1560 ($\nu_{C=N}$), 1120-1100 (probably ring deformation) and 645-635 cm^{-1}. Microwave spectra and X-ray diffraction show the following structural parameters for 1, 3, 4-oxadiazole ring.

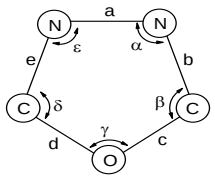


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Table No. 1: Microwave spectra and x-ray diffraction data

Bond length (pm)	A	b	c	d	e
	139.9	1297	134.8	134.8	129.7
Angle (°)	α	β	γ	δ	ε
	105.6	113.4	102.0	113.4	105.6

1A° = 100 p

Applications of 1, 3, 4-Oxadiazoles:

1, 3, 4-oxadiazoles have a wide variety of uses, in particularly as biologically active compounds in medicine and in agriculture, as dyestuffs, UV absorbing and fluorescent materials, heat-resistant polymers and scintillators.

Schiff base: [6]

A Schiff base (or azomethine), named after Hugo Schiff, is a functional group that contains a carbon-nitrogen double bond with the nitrogen atom connected to an aryl or alkyl group—but not hydrogen. Schiff bases are of the general formula $R_1R_2C=N-R_3$, where R_3 is an aryl or alkyl group that makes the Schiff base a stable imine. A Schiff base derived from an aniline, where R_3 is a phenyl or substituted phenyl, can be called an *anil*.

Schiff bases derived from aromatic amines and aromatic aldehydes have a wide variety of applications in many fields, *e.g.*, biological, inorganic and analytical chemistry. Application of many new analytical devices requires the presence of organic reagents as essential compounds of the measuring system. They are used, *e.g.*, in optical and electrochemical sensors, as well as in various chromatographic methods, to enable detection of enhance selectivity and sensitivity.

Among the organic reagents actually used, Schiff bases possess excellent characteristics, structural similarities with natural biological substances, relatively simple preparation procedures and the synthetic flexibility that enables design of suitable structural properties.

Schiff bases are widely applicable in analytical determination, using reactions of condensation of primary amines and carbonyl compounds in which the azo-methine bond is formed (determination of compounds with an amino or carbonyl group); using complex formation reactions (determination of amines, carbonyl compounds and metal ions); or utilizing the variation in their spectroscopic characteristics following changes in pH and solvent (pH of solvent polarity indicators).

Unfortunately, most Schiff bases are chemically unstable and show a tendency to be involved in various equilibria, like tautomeric interconversions, hydrolysis, or formation of ionized species. Therefore, successful application of Schiff bases requires a careful study of their characteristics.

MATERIAL AND METHODS

The chemicals used for the experimental work were commercially procured from various chemicals units like Sigma Aldrich Germany, Qualigens Mumbai, S.D.fine chemical Mumbai, E.Merck Bombay, Loba chemicals Bombay and Samar chemical India.

The solvents and reagents were of AR grade and some were LR grade purified before the use. The silica G (60-120 mesh) used for analytical chromatography (TLC) was obtained from Merck India ltd. Mumbai.

The commercially available grade of solvents and reagents were found to be of adequate purity.

Identification and characterization:

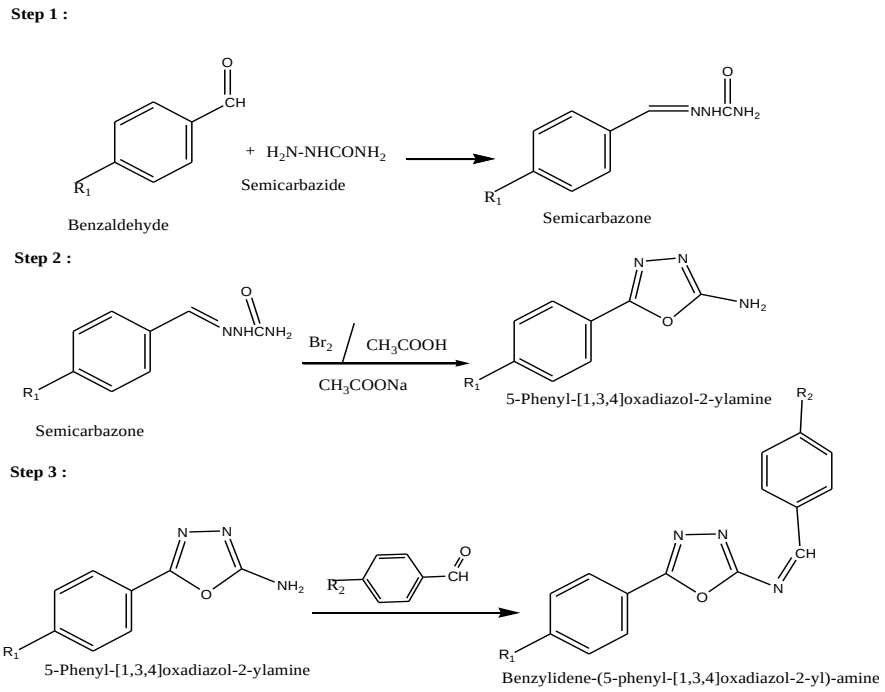
The compound synthesized were identified and characterized by following methods such as:

Melting point determination:

The melting point of organic compound was determined by thiel's melting point tube (capillary tube method) and m.p. apparatus. The determination of melting is the most important and easy way of differentiating the physical constant of one compound from other.

Thin layer chromatography (TLC):

TLC is an important method for synthetic chemistry to infer the formation of the compound based on the R_f value since different compound will have different R_f values. It also help in the confirming the reaction. The solvent used was chloroform-methanol (6:1). Iodine chamber was used for visualization of the spots.



Scheme 1

Synthesis of the compound:

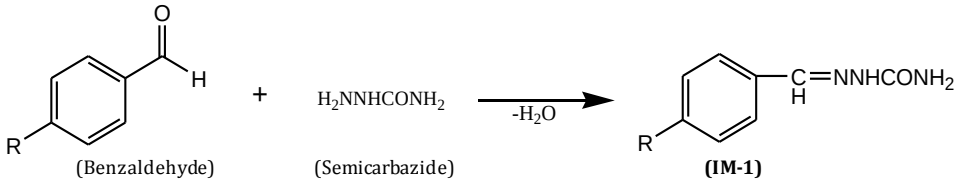
Was consisted of following 3 steps:

Step-1: Preparation of Semicarbazone (IM-1): [7]

Semicarbazide HCl (0.01mol) and crystallized sodium acetate (0.02 mol) was dissolved in 8-10 ml of water, aldehyde (0.01 mol) was added and shaken well. If the mixture was turbid, alcohol (acetone free) was added until a clear solution was obtained; the mixture was shaken for few minutes and allow standing. Crystals were filter off, washed with a little cold water and recrystallized from water or from methanol or ethanol either alone or dilute with water.

Table No. 2: Quantity of Benzaldehyde taken

Sl. No	Benzaldehyde	Mol. Wt.	Quantity taken (mol)
1	4-Chloro Benzaldehyde	197.5	0.01
2	4-DiMethyl Benzaldehyde	206	0.01
3	4-Nitro Benzaldehyde	208	0.01



(Benzaldehyde) (Semicarbazide) **(IM-1)**

Scheme 2

Table No. 3: Physical Properties of Semicarbazone (IM-1)

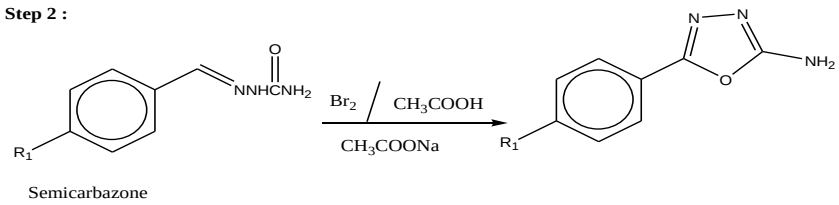
Sl.No.	R	Yield (%)	M.P. (°C)
1	-Cl	67	232-234
2	$-N(CH_3)_2$	71	234-235
3	$-NO_2$	78	209-212

Step-2: Preparation of 5-Phenyl-[1, 3, 4] oxadiazol-2-ylamine (IM-2): [8]

Semicarbazone (0.01 mol) and sodium acetate (0.02 mol) were dissolved in 30-40 ml of glacial acetic acid taken in a round bottomed flask equipped with a separating funnel for the addition of bromine. Bromine (0.7 ml in 5 ml of glacial acetic acid) was added slowly to it, while stirring magnetically. After 30 min of stirring, the solution was poured on crushed ice. The resulting solid was separated, dried, and recrystallized from ethanol.

Table No. 4: Quantity of Semicarbazone (IM-1) taken

Sl.No	Semicarbazone	Mol.Wt.	Quantity taken (mol)
1	Semicarbazone of chlorobenzaldehyde	207.5	0.01
2	Semicarbazone dimethylbenzaldehyde	251.5	0.01
3	Semicarbazone of nitrobenzaldehyde	253.5	0.01



Semicarbazone

(IM-2)

Scheme 3

Table No. 5: Physical Properties of 5-Phenyl-[1,3,4]oxadiazol-2-ylamine (IM-2)

Sl. No.	R	Yield (%)	M.P. (°C)
1	-Cl	67	202-204
2	$-N(CH_3)_2$	76	211-213
3	-NO2	74	186-188

Step-3: Preparation of Benzylidene - (5-phenyl-[1,3,4]oxadiazol-2-yl)-amine:

A mixture of product (0.01mol) and benzaldehyde (0.01mol) was refluxed with ethanol (10ml) for 2hrs. The resultant solution was cooled and solid was separated and filtered, recrystellised from petroleum ether.

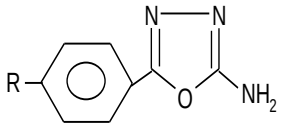
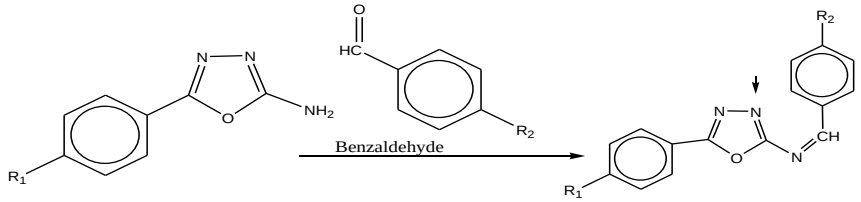


Table No. 6: Quantity of 5-Phenyl-[1, 3, 4] oxadiazol-2-ylamine (IM-2) taken

Sl. No	R	Mol. Wt.	Quantity taken (g)
1	-Cl	194	1.94
2	$-NO_2$	253.5	2.535

Step - 3



(IM-2) **(IM-3)**

Scheme 4

Table No. 7: Physical Properties of IM-3

Sl.No.	R_1	R_2	Yield (%)	M.P. (°C)
1	-Cl	-Cl	62	272-274
2	-Cl	$-NO_2$	69	232-235
3	$-NO_2$	$-NO_2$	62	220-225

Table No. 8: Synthesized Compounds

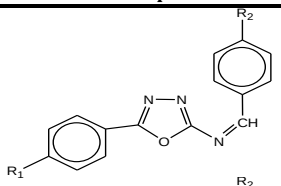
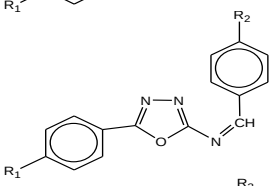
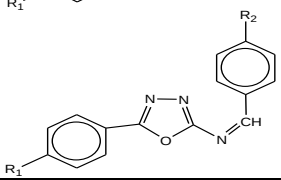
Sl. No	Code	R_1	R_2	Final compound	Molecular formula	Molecular weight
1	CP-1	Cl	Cl		$C_{14}H_{21}O_1N_3Cl_2$	327
2	CP -2	Cl	NO_2		$C_{14}H_{21}O_3N_4Cl$	318.5
3	CP -3	NO_2	NO_2		$C_{14}H_{21}O_5N_5$	339

Table No. 9: Physical properties of compounds synthesized

S.No	Comd.	Yield (%)	Color	m.p.(^{0}C)	R_f
1	CP -3	42	Whitish	251	0.39
2	CP -4	54	Cream	257	0.42
3	CP -7	63	Grayish	268	0.61

Solubility: - Approximate 100 mg of synthesized compounds taken in two ml of solvent. The solubility of synthesized compounds is shown in table-10.

Table No. 10: Solubility profile of synthesized compounds

Sl. No	Comd.	H_2O	Hot H_2O	Et OH	C_6H_5	$CHCl_3$	CCl_4	5%NaOH	5%HCl
3	CP -1	-	-	+	+	++	+	-	-
4	CP -2	-	-	++	+	+	+	-	+
7	CP -3	-	-	+	-	+	+	+	-

Where (-) Insoluble, (+) slightly soluble, (++) sparingly soluble, (+++) Sol

Identification & Characterization of Synthesized Compounds:

The purity of the compounds was ascertained by thin layer chromatography (TLC) on microplates using silica-gel-G as stationary phase, chloroform-methanol (6:1) as solvent system and iodine vapours as detecting agent. Melting points were determined by open capillary method and are uncorrected.

Title compounds were characterized by following analysis:

IR spectra recorded on Shimadzu CORPN, JAPAN, IR-PRESTIGE 21 FTIR Spectrophotometer.

Interpretation of IR Spectra:

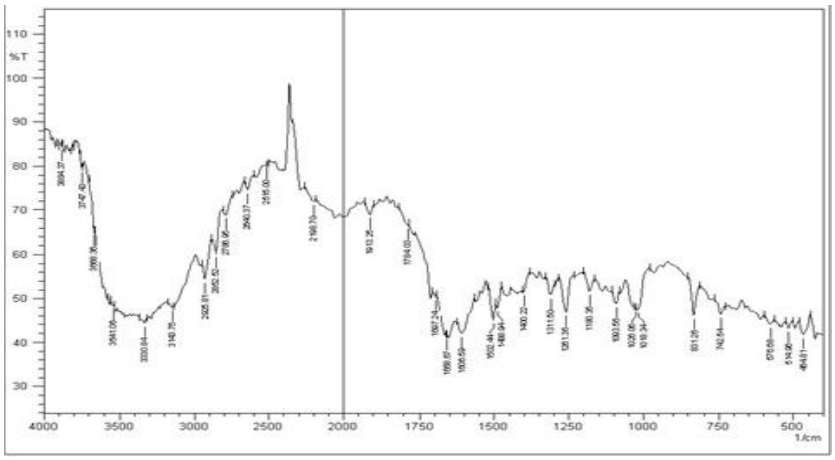


Fig. 1: IR spectra of compound 1

Compound Name : (4-Chloro-benzylidene)-[5-(4-chloro-phenyl)-[1, 3, 4] oxadiazol-2-yl]-amine.
TLC (R_f value) : 0.39

Table No. 11: IR spectra results for Compound1

Wave number (cm^{-1})	Vibration	May be due to
1089.71	C-O str	1,3,4-oxadiazole nucleus
1694.60	C=N str	1,3,4-oxadiazole nucleus
1487.01	C=C str	Aromatic ring
1780.17	C=O str	Amide group
3286.48	N-H str	Amide group
1374.19	C-H def	Disubstituted (para) aromatic ring
742.54	Ar-Cl str	Substituted aromatic ring
2852.52	C-H	Methyl group

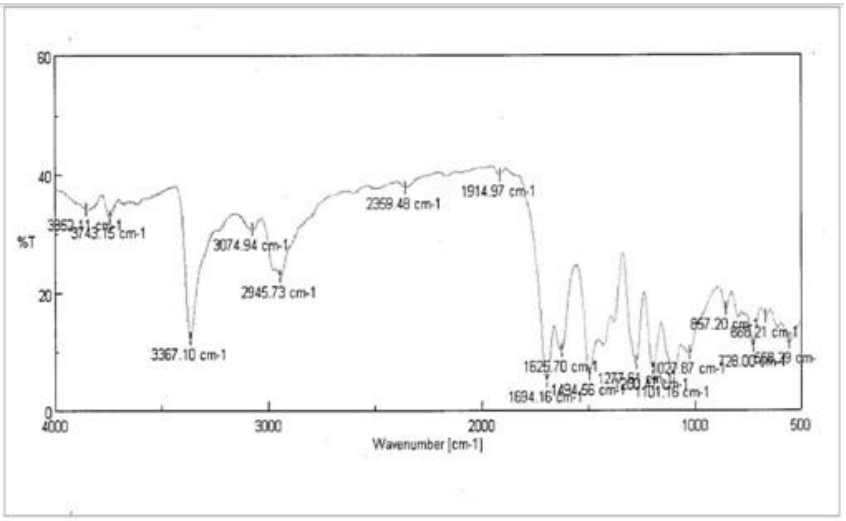


Fig. 2: IR spectra of compound 2

Compound Name : [5-(4-Chloro-phenyl)-[1, 3, 4] oxadiazol-2-yl]-(4-nitro-benzylidene)-amine
TLC (R_f value) : 0.42

Table No. 12: IR Spectra results for compound 2

Wave number (cm^{-1})	Vibration	May be due to
1091.63	C-O str	1,3,4-oxadiazole nucleus
1694.60	C=N str	1,3,4-oxadiSazole nucleus
1598.88 & 1487.01	C=C str	Aromatic ring
1625.96	C=O str	Amide group
3367	N-H str	Amide group
857.19	C-H def	Disubstituted (para) aromatic ring
744.47	Ar-Cl str	Substituted aromatic ring

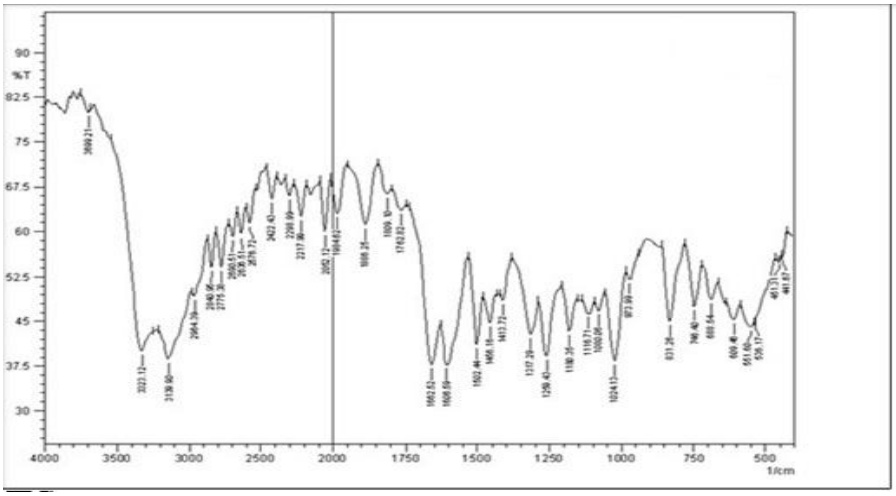


Fig. 3: IR spectra of compound 3

Compound Name : (4-Nitro-benzylidene)-[5-(4-nitro-phenyl)-[1,3,4] oxadiazol-2-yl]-amine
TLC (R_f value) : 0.61

Table No. 13. IR Spectra results for compound 3

Wave number (cm^{-1})	Vibration	May be due to
1024.12	C-O str	1,3,4-oxadiazole nucleus
1683.60	C=N str	1,3,4-oxadiazole nucleus
1024.12	C-O str	Aromatic ring
3116.75	N-N str	Secondary amine
3322.12	N-H str	Amide group
833.19	C-H def	Disubstituted (para) aromatic ring
1744.47	Ar-Cl str	Substituted aromatic ring

Microbiological Evaluation of Synthesized Compounds: [9-11]

The method used for the present study was disc diffusion technique and following strains of pathogenic microorganism were procured from MTCC, Institute of Microbial Technology, Chandigarh and Microbiology lab, Dept of biotechnology, Guru Ghasidas Vishwavidyalaya, Bilaspur.

Disc diffusion technique:

This method provides only qualitative or semi qualitative information on the susceptibility of given micro organism to a given antibiotic. This is performed by applying commercially available filter paper disc impregnated with specific quantities of the drug, on the surface of agar plates, over which a culture of the microorganism has been treated. After 18 h of incubation the size of a clear zone of inhibition around the disc is determined this is related to the activity of the drug and against the test strain

List of Microbiological Strains Used For Antimicrobial: Evaluation:

(i) *Escherichia coli* (MTCC-443)
(ii) *Staphylococcus aureus* (MTCC-96)

Escherichia coli:

Escherichia coli are facultative anaerobic Gram –ve rods. Although E. coli is part of the normal flora of the intestinal tract; certain strains can cause a moderate to severe gastroenteritis in human and animal. Enteroinvasive strains invade the epithelial cells of the large intestine and cause diarrhea in older children and adults. Enterotoxigenic strains produce one or both of two different toxins. A heat stable toxin and a heat liable toxin. Both toxins cause diarrhea in adults and infants.

Staphylococcus aureus:

Staphylococcus aureus facultative anaerobic Gram (+ve) cocci. Some of the virulence factors produced by human strains of *S.aureus* are: - the α-toxin, the pantonventine factor, protein A, and coagulase. Other factor includes the δ-toxin, which damage tissue cells by its action as a phospholipase and lipase.

The major pathogen of this genus is *S.aurus*, the causative agent of many suppurative processes ranging from localized diseases which can occur anywhere in the body to fatal septicemias and pneumonias. S.aurus occurs in the nasopharynx, on normal skin and in the intestines. Infections occur when staphylococci enter the body through breaks, cuts, and abrasion in the skin or mucus membrane. *S.aurus* causes localized infections in which the characteristic lesion is walled off 'fort' the abscess-a cavity filled with pus cells dead tissue and bacteria.

Experimental Procedure:

Preparation of test sample:

Solution of the synthesized compounds were prepared in DMF (N, N Dimethyl formamide) having the concentrations of 256, 128, 64, 32, 16, 8, 4, 2, 1 µg/ml.

The concentration of Ciprofloxacin and (256, 128, 64, 32, 16, 8, 4, 2, 1 µg/ml) was to equate their activity with that of the compound synthesized.

Sterilization:

The sterilization of media, culture, tube, Petri dishes, and other materials was done by autoclaving them at 15 lb/sq inch pressure for 20 minutes in an autoclave.

Composition of media used:

1. Nutrient Agar Media:

Peptone	6gm
Pancreatic digest of casein	4gm
Yeast extracts	1.5gm
Dextrose	1gm
Agar	15gm
Distilled water	1000 ml q.s.

2. Nutrient Broth Medium:

Beef extract	2.5gm
Peptone	2.5gm
Sodium chloride	1.25gm
Distilled water	1000ml q.s.

Media preparation:

All additives were weighted separately by physical balance. All weighted additives were added in suitable containers. Dissolved with the aid of heat with stirring. The pH was adjusted to 8.0-8.4 with 5M NaOH. Boiled for 10 minutes. Then pH was adjusted to 7.2-7.4. Sterilized by autoclave, using 15 lb pressure at 115ºC for thirty minutes. About 10

ml of the molten media was transferred aseptically in previously sterilized petri-dishes. The petri-dishes were then incubate for 24h to conform the absence of environmental microbes.

Stock culture:

Cultures were grown on the agar slants nutrient broth by incubating them for 24 h at 37^{0}C. Known species of microorganism maintained in the laboratory for various tests and studies. By means of a transfer loop, a portion of the mixed culture is placed on surface of a an agar medium and streaked across the surface. This manipulation "thins out" the bacteria on the agar surface so that some individual are separated from each other to provide isolated colonies. Strain can be maintained periodically preparing a fresh stock culture from the previous stock culture. The culture medium, the storage temperature, and time interval at which the transfers are made vary with the species and must be ascertained beforehand. The temperature and the type of the medium chosen should support a slow rather than a rapid rate of growth so that the time interval between transfers can be as long as possible.

Incubation:

For antibacterial activity, the culture tubes and seeded Petri dishes were incubated in an electrically heated incubator at 37^{0}C for 24 h. The incubation for antifungal activity was performed at room temperature (25±2^{0}C) for 48 h.

Stock Culture Incubation:

The bacteria were subcultured on the nutrient agar broth. The incubation of bacteria was prepared by transferred a loopful of corresponding organism from the stock culture in to the sterile broth and incubated for 24 h. In the case of fungi the same procedure was adopted using Saboraud's media and kept asides at room temperature for 48 h.

Inoculation of agar plates (Lawn culture):

The nutrient agar media for respective microbes were prepaired, sterilized and 20 ml of the required media was transferred aseptically to each sterilized Petri dish. One ml of 24 h broth culture of bacteria at 37^{0}C or one ml of 48 h broth culture of fungi at room temperature were then transferred to the dishes aseptically and spread thoroughly by a spreader over the agar plate. Then they were allowed to set.

Measurement of Activity:

(i) Agar plates were prepared.
(ii) Agar plates were inoculated with the selected test organism as lawn Culture.
(iii) Plates are allowed to dry for 5 min.
(iv) Disc was first dipped in methanol and allows drying. After that disc were placed on the agar plate impregnated with different concentration of antibiotics (256-1 µg/ml).
(v) The dishes with the bacteria culture were incubated at 37^{0}C for 24 h.
(vi) The zone of inhibition was measured on the plates by the vernier scale.
(vii) The concentration of antibiotic versus diameter of zone of inhibition result was tabulated.
(viii) The MIC was determined by plotting concentration of the compoundand their respective zone of inhibition in http://www.agardiffusion.com Web tool [12].

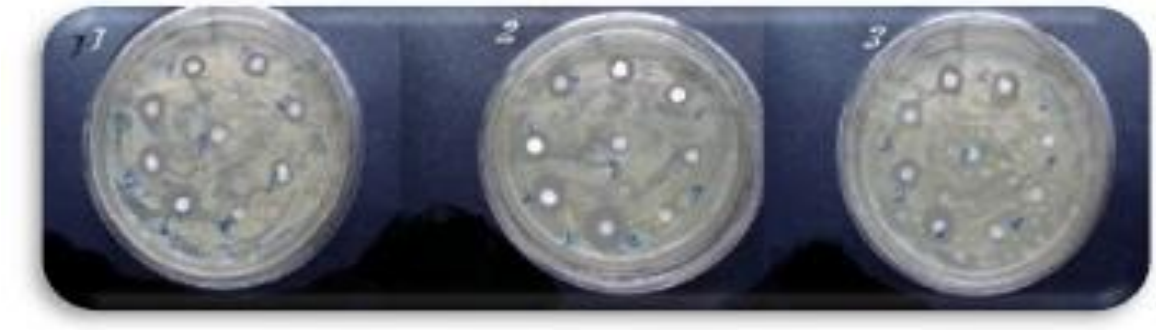


Fig. 4: microbilogical activity (zone of inhibition) shown by synthesized compounds

RESULTS AND DISCUSSION

Table No. 14: MIC of compounds for *Escherichia coli*

Compounds	Zone of inhibition (diameter) in mm									MIC in µg ml^{-1}
	256 µg ml^{-1}	128 µg ml^{-1}	64 µg ml^{-1}	32 µg ml^{-1}	16 µg ml^{-1}	8 µg ml^{-1}	4 µg ml^{-1}	2 µg ml^{-1}	1 µg ml^{-1}	
CP-1	6	6	5	4	-	-	-	-	-	6.51
CP-2	6	5	5	-	-	-	-	-	-	3.45
CP-3	6	7	4	-	-	-	-	-	-	12.409
Ciprofloxacin	15.8	14.2	12.1	11.9	9.2	8.6	8.1	7.7	7.2	0.799

Table No. 15: MIC of compounds for *Staphylococcus aureus*

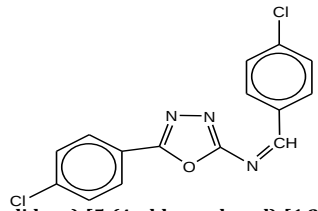
Compounds	Zone of inhibition (diameter) in mm									MIC in µg ml^{-1}
	256 µg ml^{-1}	128 µg ml^{-1}	64 µg ml^{-1}	32 µg ml^{-1}	16 µg ml^{-1}	8 µg ml^{-1}	4 µg ml^{-1}	2 µg ml^{-1}	1µg ml^{-1}	
CP-1	6	7	4	-	-	-	-	-	-	12.409
CP-2	7	6	5	-	-	-	-	-	-	15.39
CP-3	6	5	5	-	-	-	-	-	-	3.453
Ciprofloxacin	15.9	14.2	12.3	11.6	10.5	9.4	8.7	7.8	7	0.66

Compounds with the structure of -C=N- (azomethine group) are known as Schiff bases, which are usually synthesized from the condensation of primary amines and active carbonyl groups. Schiff bases are important class of compounds in medicinal and pharmaceutical field. They are well known for their antimicrobial properties by virtue of toxophoric C=N linkage in them.

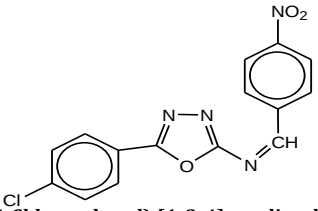
The rapid emergence of drug resistance in the treatment of microbial disease emphasizes worldwide need for newer antimicrobial activity.

Table 16: compounds effectiveness on strains

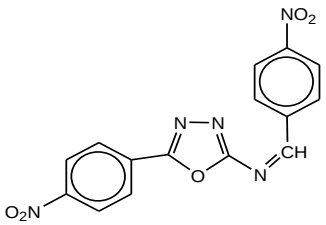
Sl. No	Microbes	Most active compounds
1	*Escherichia coli*	CP-1, CP-2
2	*Staphylococcus aureus*	CP-3



(4-Chloro-benzylidene)-[5-(4-chloro-phenyl)-[1,3,4]oxadiazol-2-yl]-amine (CP-1)



[5-(4-Chloro-phenyl)-[1, 3, 4] oxadiazol-2-yl]-(4-nitro-benzylidene)-amine (CP-2)



(4-Nitro-benzylidene)-[5-(4-nitro-phenyl)-[1,3,4]oxadiazol-2-yl]-amine (CP-3)

The structure of compounds with significant antimicrobial activity has been found to possess chloro and nitro(s). A study of the structures of all the compounds showing appreciable activity shows that all the compounds have either –Cl or $–NO_2$ group in one or both of the aromatic rings. Thus it can be said at this juncture that –Cl and/or $–NO_2$ groups imparts toxicity to the synthesized compounds.

CONCLUSION

A novel series of Schiff bases containing 1, 3, 4-oxadiazole ring were synthesized and their antimicrobial activity was evaluated using disc diffusion method. Antimicrobial potential of synthesized compounds were evaluated against *Escherichia coli*, *Staphylococcus aureus*,. Majority of the compounds were found to possess a broad spectrum of antimicrobial activities against all the pathogenic microorganisms. A study of the structures of all the compounds showing appreciable activity shows that all the compounds have either –Cl or $–NO_2$ group in one or both of the aromatic rings. Thus it can be said at this juncture that –Cl and or $–NO_2$ groups imparts toxicity to the synthesized compounds.

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Source of support: Nil, Conflict of interest: None Declared