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# Synthesis, spectroscopic characterization and biological activity of newly formulated thiazole ring containing Schiff base ligands

## AS Tekale and BN Muthal

**Abstract**
A series of substituted thiazole ring containing Schiff base ligands (L=Ligand=L1, L2, L3, L4) were synthesized by the condensation in between the substituted Ortho hydroxy aldehydes and 2-amino-4-(4-bromophenyl) thiazole. 2-aminothiazole is one of privileged structure which finds applications in number of pharmaceuticals like antiviral, antibacterial, antifungal, antituberculous agents. The 2-aminothiazole nucleus is a recurring scaffold in compounds of pharmaceutical interest. The synthesized compounds have been characterized by Physical parameters. TLC, Fluorescence, UV-Visible, FT-IR, $^{1}$H NMR, $^{13}$C NMR and MS. The biological screening data of the synthesized compounds were also studied.

**Keywords:** Substituted ortho-hydroxy aldehyde, 2-amino-4-(4-bromophenyl) thiazole, characterization: IR, 1H NMR, $^{13}$C NMR, Mass, UV-visible, fluorescence and biological activity

## Introduction
Thiazole is a heterocyclic compound featuring both a nitrogen atom and sulfur atom as part of the aromatic five-membered ring. Thiazole are related compound are called 1,3-azoles (nitrogen and one other hetero atom in a five membered ring). Thiazoles obtained from microbial and marine origins exhibit antitumor and antiviral activities [1, 2]. Heterocyclic compound is highly attractive compound in the research and development of materials for organic chemistry. The first synthesis of the thiazolic ring at the end of the nineteenth century by Rudolf Hantzch in 1887. [3]. Thiazole and its derivatives have been found to be a biological significance. 2-amino substituted thiazole is biologically active compound with broad range of activity and intermediate in the synthesis of Schiff base. Thiazoles are important class of natural and synthetic compound. Thiazole derivatives display a wide range of activities such as antibacterial, antifungal and anti-inflammatory, anti-cancer. [4, 5, 6]. Thiazole and its derivatives have been found to be a biological significance. 2-amino substituted thiazole is biologically active compound with broad range of activity and intermediate in the synthesis of Schiff base. Thiazoles are important class of natural and synthetic compound. Thiazole derivatives display a wide range of activities such as antibacterial, antifungal and anti-inflammatory, anti-cancer. [4, 5, 6].

The numbering system was shown below Fig. 1, for naming derivatives of thiazole. [7, 8].

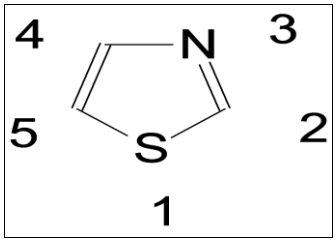



**Fig 1:** Numbering system of thiazole

The synthesis of thiazole derivatives is important for their wide range of biological and pharmaceutical properties. One classical and widely used method is the condensation of 4-Bromo acetophenone with thiourea. thiazole ring are usually introduced into target molecules by use of monohalo aromatic ketone with thiourea [9].

Orthohydroxy aldehydes is a key precursor to a variety chelating agent, some of which are commercially important, Orthohydroxy aldehydes is a common highly functionalized arene that has often been exploited as a precursor to still other chemical. Orthohydroxy aldehydes is converted to chelating ligands by condensation with amines. With ethylenediamine, it condenses to give the ligand salen. Hydroxylamine gives salicylaldoxime. Oxidation with hydrogen peroxide gives catechol (1,2-dihydroxybenzene) (Dakin reaction) [10]. Condensation with diethyl malonate gives a derivative of the heterocycle coumarin [11] via an aldol condensation.

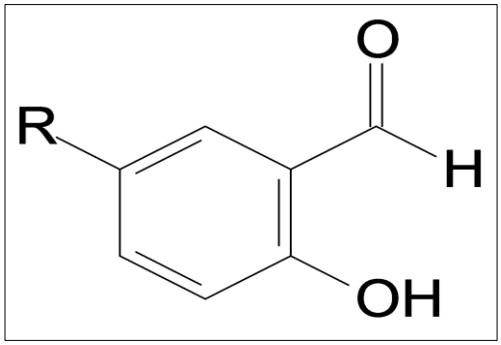



**Fig 2:** Substituted Salicylaldehyde.

The 2-amino-4-(4-bromophenyl) thiazole contains the 2-aminothiazole nucleus which is heterocyclic amine featuring a thiazole core. It can also be considered a cyclic isothiourea. It possesses an odour similar to pyridine and is soluble in water, alcohols and diethyl ether. It is commonly used as a starting point for the synthesis of many compounds including sulfur drugs, biocides, fungicides, dyes and chemical reaction accelerators. 2-Aminothiazole can be used as a thyroid inhibitor in the treatment of hyperthyroidism and has antibacterial activity. Alternatively, its acid tartrate salt can be used. Recent studies using prion-infected neuroblastoma cell lines have suggested that aminothiazole may be used as a therapeutic drug for priondiseases [12]. One known use of 2-Aminothiazole in is in the synthesis of Vosaroxin.

The importance for biological systems of 2-aminothiazole and its derivatives is well known. It is also known that the thiazolic ring is part of B1 vitamin, and of some antibacterial drugs, those contain sulphathiazole. Even a range of penicillin contains in the molecule the hydrogenate thiazolic ring.

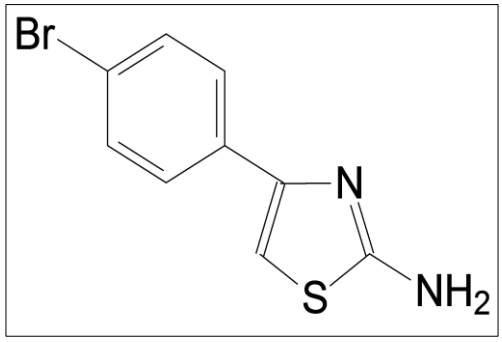
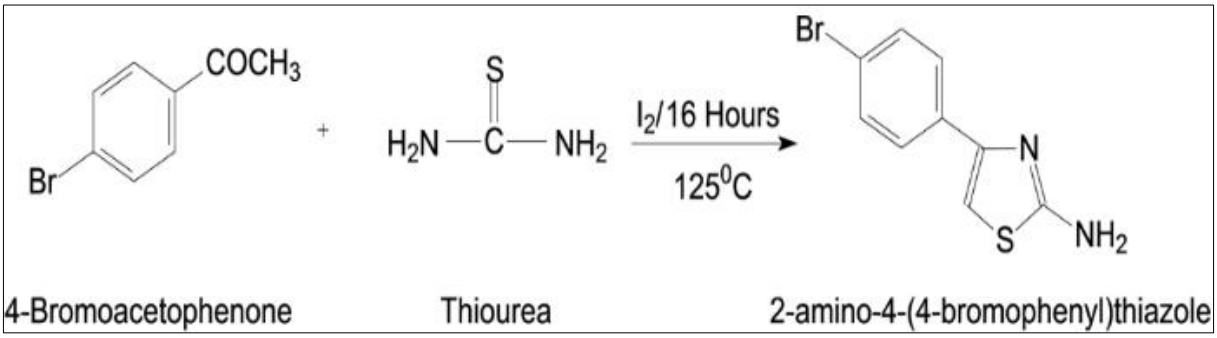



**Fig 3:** amino-4-(4-bromophenyl) thiazole [Derivative of 2-Aminothiazole]

A Schiff base, named after Hugo Schiff, is a compound with a functional group that contains a carbon-nitrogen double bond with the nitrogen atom connected to an aryl or alkyl group, Compounds containing an azomethine group (-CH=N-) are known as Schiff bases. They are usually formed by condensation of a primary amine with a carbonyl compound [13] according to the following scheme:




**Scheme 1:** Genenral reaction of synthesis of Schiff base

Where R1, R2 and R3 may be an aliphatic or an aromatic group. Schiff bases of aliphatic aldehydes and ketones are relatively unstable and readily polymerizable [14-16] while those of aromatic aldehydes and ketones, having an effective conjugation system, are more stable [17-20]. Condensations of amines with aldehydes and ketones have numerous applications which include preparative use, identification, detection and determination of aldehydes or ketones, purification of carbonyl or amino compounds, or protection of these groups during complex or sensitive reactions.

An amino group is found in simple amines and Schiff bases obtained from aromatic amines are known as anils. Schiff bases are generally bi- or tri-dentate ligands capable of forming very stable complexes with transition metals. In chemistry, Schiff bases find a versatile use [21-23]; some of them are the basic units in certain dyes, whereas, some are used as liquid crystals. In organic synthesis, Schiff base reactions are useful in making carbon-nitrogen bonds.

**Biological importance of schiff bases**

Schiff bases appear to be important intermediates in a number of enzymatic reactions involving interaction of an enzyme with an amino or a carbonyl group of the substrate [24]. One of the most prevalent types of catalytic mechanisms in biochemical processes involves condensation of a primary amine in an enzyme, usually that of a lysine residue, with a carbonyl group of the substrate to form imine, or Schiff base.

Stereochemical investigations [25] carried out with the aid of molecular models showed that Schiff bases formed between methylglyoxal and the amino groups of the lysine side chains of proteins can bend back in such a way towards the N atoms of peptide groups that a charge transfer can occur between

these groups and the oxygen atoms of the Schiff bases. In this respect, pyridoxal Schiff bases derived from amino acids have been prepared and studied [26]. Schiff bases derived from pyridoxal and amino acids are considered very important ligands from the biological point of view. Transition metal complexes of such ligands are important enzyme models. The rapid development of these ligands resulted in an enhanced research activity in the field of coordination chemistry leading to very interesting conclusions.

Certain polymeric Schiff bases have been reported which possess antitumor activity [27]. The Schiff bases have the highest degree of hydrolysis at pH 5 and the solubility in water is also highest at this pH. The antitumor activity of the bases towards ascitic tumours increases considerably with a slight increase in water solubility. Another important role of Schiff base structure is in transmination [28]. Tranaminases are found in mitochondria and cytosal of eukaryotic cells. All the tranaminases appear to have the same prosthetic group, i.e., pyridoxal phosphate, which is non-covalently linked to the enzyme protein.

The biosynthesis of porphyrin, for which glycine is a precursor, is another important pathway, which involves the intermediate formation of Schiff base between keto group of one molecule of δ-amino levulinic acid and ε-amino group of lysine residue of an enzyme.

The condensation of primary amines with carbonyl compounds yields Schiff bases [29, 30]. Schiff base with donors (N, O, S, etc.) have structure similarities with neutral biological systems and due to presence of imine group are utilized in elucidating the mechanism of transformation of rasemination reaction in biological system [31]. Thiazole and its derivatives as ligands with potential sulphur and nitrogen bands are interesting and have gained special attention not only the structural chemistry of their multifunctional coordination modes but also of their importance in medicinal and pharmaceutical field. Schiff bases represent an important class of compounds because they are utilized as starting materials in the synthesis of industrial products [32]. The present study describes the synthesis of novel Schiff base derived from the condensation of Orth hydroxy aldehydes with 2-amino-4-(4-bromophenyl) thiazole, which may help in more understanding of the mode of chelation.

## Materials and Methods

All the chemicals and solvents used in studies were of (AR) grade and were dried and purified before use. The purification of synthesized compound was performed by recrystallization with appropriate solvents. [33]. Purity of all the synthesized compound was checked by TLC. Melting points of the synthesized compound were determined by open capillary method and are corrected. [34]. IR spectra were recorded using Nujol with FT-IR Perkin-Elmer model Spectrum One Spectrophotometer, $^1$H NMR spectra were recorded using $CDCl_3$ with Varian-300 spectrometer NMR instrument using TMS as an internal standard. Mass spectra were recorded in NCMS ES+ spectrometer.

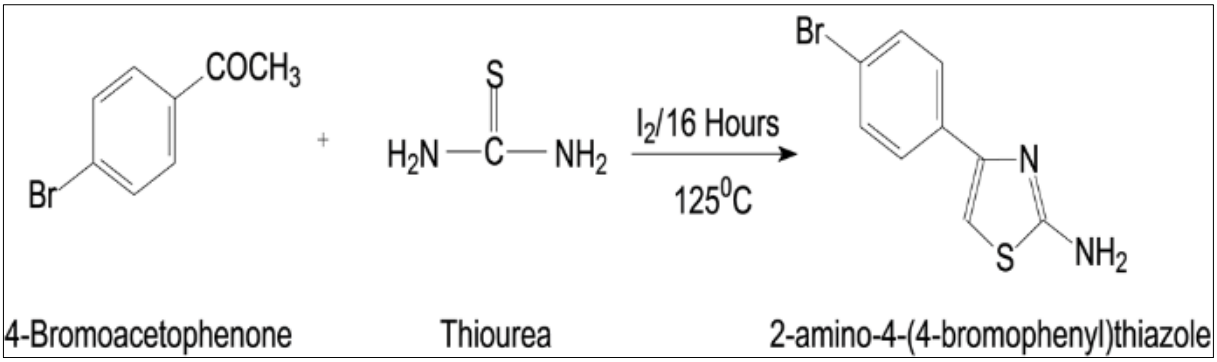
The Schiff bases ligands was filtered and recrystallized from 70% ethanol.

The Purification of Schiff base compounds were tested first by thin layer chromatography [TLC] using different eluents. The best separation was obtained in mixture of [hexane: ethyl acetate] having ratio [7: 3] respectively as eluent. Then, the products were purified by absolute ethanol.

## Experimental work

### Synthesis of 2-amino-4-(4-bromophenyl) thiazole

The 2-amino-4-(4-bromophenyl) thiazole is prepared by [35, 36] the standard methods scheme-1, 1 mmol of 4-bromoacetophenone was added to a 1 mmol alcoholic solution of thiourea in presence of 2 mmol of iodine and reaction mixture was refluxed on water bath for 16 hours at 125 °C, after the reaction time duration the reaction mixture was cooled for few minutes a solid white precipitated will generate. After the product was filtered and recrystallised from 70% ethanol. Yield is 72.91 and melting point is 183 °C-187 °C.

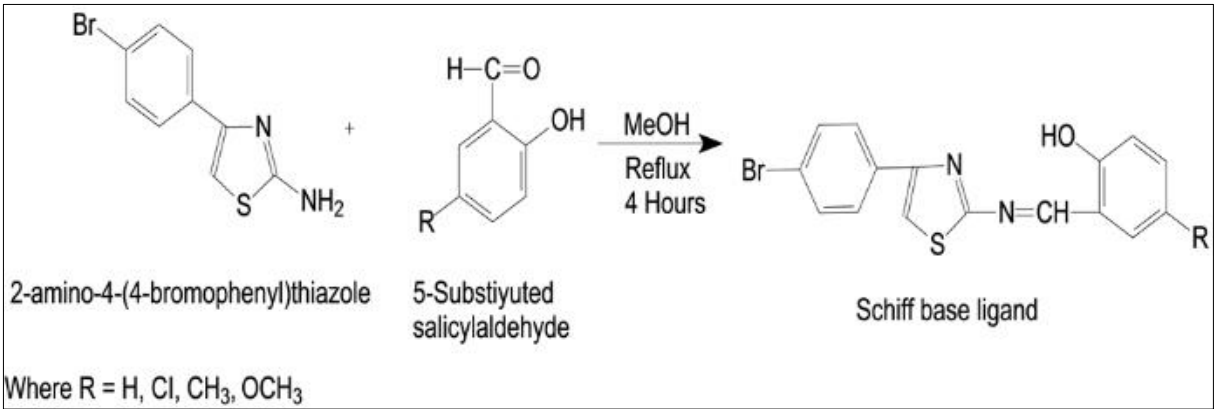



**Scheme 2:** Synthesis of 2-amino-4-(4-bromophenyl) thiazole

### Synthesis of thiazole ring containing Schiff base ligands

The Schiff base ligands [ L1, L2, L3, L4] was synthesised by using following procedure, (Scheme 2) reported by Furniss BS, Hannaford AJ, Smith PWG and Tatchell AR, Vogel's practical organic chem.5$^{th}$Ed.(Longman Scientific Technical, John Wiley and Sons),1989.[35, 36] In a 100 ml round bottom flask a solution of 5-Substiyuted Orth hydroxy aldehydes (1 mmol) in a 25 ml of methanol was dissolved and added to an solution of 2-amino-4-(4-bromophenyl) thiazole (1 mmol) in a 25 ml of methanol and the reaction mixture was refluxed on a water bath for about 4 hours. After completion of reaction time the reaction mixture kept for cooling for few minutes at RT and after cooling a pale yellow coloured crystalline solid was separated out. It was filtered and washed with methanol, and recrystallised from DMF and DMSO and dried under reduced pressure at ambient temperature.

The purity of ligand was checked by TLC, elemental analysis and melting point. It was also characterized by Mass, IR, $^1$H, $^{13}$C, UV, Fluorescence spectral studies. And the Yield was 72.01%.




**Scheme 3:** Synthesis of thiazole ring containing Schiff base ligands

**Physical properties of thiazole derivative**

Analytical data as well as physical parameters of the 2-amino-4-(4-bromophenyl) thiazole and thier derivative or Ligands are presented in below table No. 1. The 2-amino thiazole derivatives or ligands formed by different Orth hydroxy aldehydes possess yellow and brown colours. All the ligands are insoluble in water and soluble in organic solvents such as $CHCI_3$, DMSO and DMF. The yield of the all ligands is nearly corresponding up to 72% and which is shown in the table. No. 3.1 and which is good. The decomposition points of the all ligands are relatively 160 °C-187 °C, Indicating good thermal stability at normal conditions. And on the basis of elemental analysis ligands are assigned with empirical formula. The melting point was recorded on digital melting point apparatus.

**Table 1:** Physical parameters and elemental analysis of all ligands and 2-amino-4-(4-bromophenyl) thiazole

| Sr. No. | Molecular formula of Compound | M.P. in °C | % Yield in GM | Colour And Solubility | Rf | Molecular Weight. | Elemental analysis in % | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | C | H | N | S | O | CI | Br |
| 1 | $C_9H_7N_2SBr$ A | 183-187 | 72.91 | White $CHCI_3$ | 0.83 | 255.13 | 42.36 | 2.76 | 10.97 | 12.56 | - | - | 31.31 |
| 2 | C16H11N2OSBr L1 | 168-170 | 72.01 | Yellow DMF,DMSO,$CHCI_3$ | 0.66 | 359.24 | 53.49 | 3.08 | 7.79 | 8.92 | 4.45 | - | 22.24 |
| 3 | C16H10N2OSCIBrL2 | 170-174 | 67.68 | Pale brown DMF, DMSO $CHCI_3$ | 0.65 | 393.69 | 48.81 | 2.55 | 7.11 | 8.14 | 4.06 | 9.00 | 20.29 |
| 4 | C17H13N2OSBrL3 | 170 | 66.66 | WHITISH, YELLOW DMF,DMSO $CHCI_3$ | 0.64 | 373.27 | 54.70 | 3.50 | 7.50 | 8.58 | 4.28 | - | 21.40 |
| 5 | C17H13N2O2SBrL4 | 162-165 | 67.60 | YELLOW $CHCI_3$ | 0.62 | 389.27 | 52.45 | 3.36 | 7.19 | 8.23 | 8.21 | - | 20.52 |

**Results and Discussion**

**Spectroscopic characterization of 2-aminothiazole derivative and schiff base ligands**

The mass spectra done on a jeol SX-102 spectrometer using argon as the FAB Gas. Elico, SL 191 double beam UV-Vis spectra. Elemental analysis performed on a carlo erba mod 1108 elemental analyser. The FT IR spectrum was recorded on varian 1000 FT IR using KBR pallets. The $^1$H NMR Spectra was recorded on bruker DRX-300.

**$^1$H NMR Spectroscopy**

The $^1$H NMR spectral data of 2-amino-4-(4-bromophenyl) thiazole and their derivatives were recorded in $CDCI_3$ with TMS as an internal standard on the delta (δ) scale. There for in $^1$H NMR spectra, the general $^1$H-NMR spectrum of 2-amino-4-(4-bromophenyl) thiazole shows four siganals. The protons of the $–NH_2$ group appeared as singlet in the region of 4.9 ppm and this chemical shift value for 2-amino-4-(4-bromophenyl) thiazole but this value will be disappeared as in case of their derivatives as because of the condensation between the substituted Orth hydroxy aldehydes and the 2-amino-4-(4-bromophenyl) thiazole. The heteroaromatic (thiazole) protons appeared in the region of 6.7 ppm [37-42]. Whole aromatic protons and which is next to bromine appeared in the range 6.39-7.65 ppm respectively. And in case 2-amino thiazole derivatives of all four ligands L1, L2, L3, L4 Shows the chemical shift at 9.25 ppm because of after condensation there is formation of Azomethien group (-CH=N-) which is showing the singlet, and also shows the chemical shift at 12.12 ppm showing that the all ligands contain Phenolic (-OH) protons which is also shows the singlet. And $^1$H-NMR spectra of 2-amino-4-(4-bromophenyl) thiazole and all ligands L1, L2, L3, L4 shows one more peak at 7.2 ppm due to the solvent $CDCI_3$. For the ligand L3 It shows the characteristic chemical shift peak at 2.3 ppm due to the ($Ar-CH_3$) aromatic methyl protons, And in L4 ligand spectra the chemical shift at 3.8 ppm for the aromatic methoxy group protons ($Ar-O-CH_3$) and which shows the singlet. The chemical shift values for the 2-amino-4-(4-bromophenyl) thiazole and their all ligands are shown in the below table No. 2. [43-47].

**Table 2:** $^1$H-NMR Spectral data of 2-amino-4-(4-bromophenyl) thiazole and their derivatives Ligands.

| Sr. No | Comp. | -NH2 in ppm | Aromatic (Ar-H) In ppm | Hetero aromatic (HetAr-H) in ppm | Azomethien (-H=N-) in ppm | Phenolic (-OH) in ppm | Aromatic methyl (Ar-CH3) | Aromatic methoxy protons (Ar-O-H) |
|---|---|---|---|---|---|---|---|---|
| 1 | A | 4.9 | 6.39-7.65 | 6.7 | - | - | - | - |
| 2 | L1 | - | 6.39-7.7 | | | | - | - |
| 3 | L2 | - | 6.39-7.65 | 6.69 | 9.26 | 12.25 | - | - |
| 4 | L3 | - | 6.29-7.8 | 6.75 | 9.24 | 12.12 | 2.3 | - |
| 5 | L4 | - | 6.39-7.79 | 6.71 | 9.25 | 11.9 | - | 3.8 |

**$^{13}$C NMR Spectroscopy**

The $^{13}$C NMR spectra provide further support for the structural characterization of the Schiff bases. $^{13}$C NMR spectral data of compound have been listed in Table. No. 3.3. The number of signals found corresponds with the presence of magnetically non-equivalent carbon atoms, which were assigned by comparison with literature values. The aromatic carbon present in the structures of 2-amino Thiazole derivatives were assigned by comparing the experimental chemical shifts with those calculated from the incremental method. The $^{13}$C-NMR spectral data of the 2-amino Thiazole derivatives are in accordance with the proposed structures.

The $^{13}$C NMR spectral data of 2-amino-4-(4-bromophenyl) thiazole and their derivatives were recorded in $CDCI_3$ on the delta (δ) scale. Therefore, in $^{13}$C NMR spectra, the general $^{13}$C-NMR spectrum of 2-amino-4-(4-bromophenyl) thiazole shows seven siganals. The carbons of heteroaromatic ring that is (thiazole) appeared in between the region of 131 to 168 ppm Specifically, the $C_2$-carbon at 168 ppm, $C_4$-carbon at 150 ppm and the $C_5$-carbon at 131 ppm respectively, and this chemical shift value for 2-amino-4-(4-bromophenyl)thiazole but this value will be slightly changed as in case of their derivatives as because of the condensation in between the substituted Orth hydroxy aldehydes and the 2-amino-4-(4-bromophenyl)thiazole. [48-52]. And for the all ligands that is L1, L2, L3, L4 the chemical shift value for all carbons of heteroaromatic ring that is (thiazole) appeared in between the region of 128 to 168 ppm. The aromatic carbon and which is next to bromine appeared in the range 133 ppm respectively in case 2-amino thiazole derivatives of all four ligands L1, L2, L3, L4 Shows the chemical shift in between 134 to 135 ppm because of after condensation there is formation of Azomethien group (-CH=N-) which is showing the chemical shift at 169 to 170 ppm and which is absent in the spectra of 2-amino-4-(4-bromophenyl) thiazole. The aromatic carbons of the 2-amino-4-(4-bromophenyl) thiazole shows chemical shift at 130,127 and 121 ppm, and for the ligands the shift in the range of 135 to 113 ppm. The aromatic carbon which is just next to the –OH group i.e. (Phenolic -OH) carbon for the all four ligands L1, L2, L3, L4 shows the signal in the range of 158.5 to 162 ppm, which is absent in the 2-amino-4-(4-bromophenyl) thiazole spectra.

And $^{13}$C-NMR spectra of 2-amino-4-(4-bromophenyl) thiazole and all ligands L1, L2, L3, L4 shows one more 1:1:1 triplate peak at 76 ppm due to the solvent $CDCI_3$. For the ligand L2 It shows the characteristic chemical shift peak at 132.5 ppm due to the (Ar-CI) aromatic methyl carbons, L3 And in L4 ligand spectra the chemical shift at 159.9 and the 54.1 ppm for the aromatic methoxy group carbons (Ar-O-$CH_3$) and which shows the two singnals. [53-57].

The chemical shift values for the 2-amino-4-(4-bromophenyl) thiazole and their all ligands are shown in the below table No. 3.

**Table 3:** $^{13}$C-NMR Spectral data of 2-amino-4-(4-bromophenyl) thiazole and their derivatives Ligands

| Sr. No | Compound | Heteroaromatic (Thiazole) in ppm | Aromatic in ppm | Azomethine (-CH=N-) in ppm | Phenolic (Ar-OH) in ppm | C-Br in ppm | C-CI in ppm | C-$CH_3$ in ppm | C-O-$CH_3$ In ppm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | C2-168 C4-150 C5-131 | 130,127,121 | _ | _ | 133 | _ | _ | |
| 2 | L1 | C2-167.5 C4-149.0 C5-128 | 135,127,126,119,117,115 | 170 | 158.5 | 135 | _ | _ | _ |
| 3 | L2 | C2-164 C4-152 C5-129 | 134,130,128,119,114 | 169 | 160 | 134 | 132.5 | _ | _ |
| 4 | L3 | C2-167 C4-152 C5-128 | 130,129,118,115,113 | 170 | 161.4 | 135 | _ | 53.12 | _ |
| 5 | L4 | C2-168 C4-153 C5-129 | 130,129,119,114,113 | 170 | 162 | 134 | _ | _ | 159.9,54.11 |

**Infra-Red spectroscopy**

The IR spectral data for the following compound was recorded on Thermo nicolet nexus 670 spectrometers.

The structure of the prepared thiazole derivative was refined on the basis of their IR spectra. The IR absorption bands were assigned with account taken of the data given in literature.

In IR spectra, the thiazole derivatives show absorption bands in the range 3428,3281 $cm^{-1}$ assigned for N-H stretching, the absorption bands of the C=N group were observed in the range 1632 $cm^{-1}$ and that for C=C group in the region 1533, 1471 $cm^{-1}$. The absorptions for the C-S- C group was observed at 1067 $cm^{-1}$.

The IR band assignments are given in below Table No. 4 and spectra in Figure in the following figures. The IR band at 1630 $cm^{-1}$ of the free Schiff base ligand is due to the presence of azomethine (HC=N) group.

The absorption band observet at in between 1070-1090 $Cm^{-1}$ due to the (C-S-C) thioether group for all synthesized ligands. The peaks at 3427, 3425, 3423 and 3281, 3281 indicates that presence Of the Phenolic-OH group in the synthesized ligands. [58-62]

**Table 4:** IR spectra for compound A and ligands in $Cm^{-1}$

| Sr. No | Compound code | Phenolic-OH | HC=N | C=C | C-S-C |
|---|---|---|---|---|---|
| 1 | A | - | 1632 | 1533,1471 | 1067 |
| 2 | L1 | 3427 | 1630 | 1533,1471 | 1067 |
| 3 | L2 | 3427 | 1628 | 1470 | 1069 |
| 4 | L3 | 3425, 3281 | 1630 | 1471 | 1080 |
| 5 | L4 | 3423, 3281 | 1630 | 1478 | 1037 |

**Mass Spectroscopy**

In the Mass spectra, the composition of the resulting amino thiazole derivative was determined by Mass and Elemental analysis. The molecular ion peak for the amino thiazole derivative and Schiff base ligands [ L1, L2, L3, L4] was observed at $M^{+2}$ 257, $M^{+2}$ 351, $M^{+2}$ 395, 373, $M^{+2}$ 391 m/z.

**Ultra-Violet and Fluoroscence Spectra**

The UV spectra of all Schiff base compounds were characterised by appearance of three bands in absolute ethanol, the first band appeared in the range (210-225 nm) [C=580-2382) 1 mole $^{-1}$ $cm^{-1}$] which was attributed to the (π-π*) for the aromatic system. The second band appeared in the range 240-250 nm [C= (500-2485) I $moles^{-1}$ $cm^{-1}$] which was attributed to the (π-π*) for the aromatic system. The third band appeared in the range (328-388) nm [C= (305-2344)] $1moles^{-1}cm^{-1}$] which was attributed to the (π-π*) transition of azomethien (CH=N) [63-65].

**Biological Activity**

Health and welfare of human being are closely associated with microorganism. Microbiology is a very important branch among all the biological sciences and now a day's microbiology has become very important to our society. They play essential role in the ecology of life on the earth, some bacteria are very useful on the other hand some are harmful to mankind or animal. For example, some microorganisms are important commercially through their used in the production

of antibiotic i.e., Ampicillin; microorganisms are used in the production of certain foods, like cheese, yoghurt and fermented drinks. Microorganisms are also major tools in the basic research in the biological science; microbial activity is also used to produce the energy such as methane gas for rural consumption. Thus, there is no field of human Endeavour, whether it is in the industry, agriculture, food preparation [66-69].

**Anti-Bacterial Activity**

The newly synthesized thiazoles were screened for their antibacterial activity against bacterial strains by disc diffusion method. The discs measuring 6.25 mm in diameter were punched from Whatman No. 1 filter paper. Batches of 100 discs were dispensed to each screw capped bottles and sterilized by dry heat at 140 °C for an hour. The test compounds were prepared with different concentrations using dimethyl formamide. One millilitre containing 100 times the amount of chemical required in each disc was added to each bottle which contains 100 discs. The discs of each concentration were placed in triplicate in nutrient agar medium seeded with fresh bacteria separately. The incubation was carried out at 37.8 °C for 24 h. Nitrofurazone was used as a standard drug. Solvent and growth controls were kept. The zone of inhibition and minimum inhibitory concentrations [MIC] was noted.

Results of the antibacterial study reveals that the 2-amino-4-(4-bromophenyl) thiazole exhibit strong inhibition activities. Inhibition zones produced by these 2-amino-4-(4-bromophenyl) thiazole were found to be larger than that of ligand, especially for *E. coli* and *B. Subtilis.* However, the ligand, 2-amino-4-(4-bromophenyl) thiazole exhibit moderate antibacterial activity.

**Table 5:** Show the number of different *E.coli* and *B.subtilis*

| Sr. No. | Compound | *E. Coli* | *B. Subtilis* |
|---|---|---|---|
| 1. | A-SM | 2 | 1.4 |
| 2. | L1 | 1.6 | 1.5 |
| 3. | L2 | 1 | 1 |
| 4. | L3 | 1.8 | 1.5 |
| 5. | L4 | 1.6 | 1.8 |

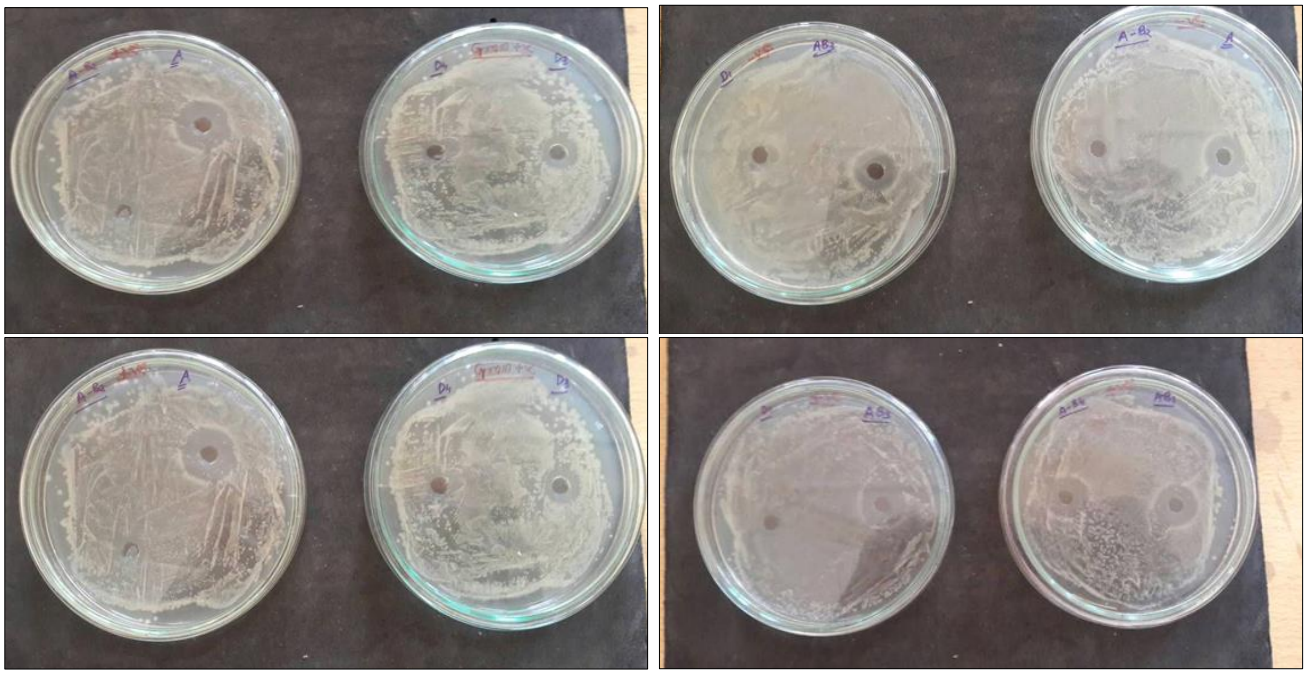


**Fig 4:** Antibacterial Activity of Thiazole Compound and Schiff base ligands

**Anti-Fungal Activity**

Antifungal activity for newly prepared compound was screened by serial plate dilution method. Sabourands agar media was prepared by dissolving peptone (1 g), D-glucose (4 g) and agar (2 g) in distilled water (100 ml) and adjusting the pH to 5.7. Normal saline was used to make a suspension of spores of fungal strain for lawing. A loopful of particular fungal strain was transferred to 3ml saline to get a suspension of corresponding species. A 20ml of agar media was poured in to each of the Petri dishes. Excess of suspension was decanted and the plates were dried by placing in an incubator at 37 °C for 1 h. Using an agar punch well were made on these seeded agar plates and 10 mg/ml of the test compounds in DMSO were added into each well labeled. A control was also prepared for the plates in the same way using solvent DMSO. The petridishes were prepared in triplicate and maintained at 37 °C for 3e4 days. Antifungal activity was determined by measuring the diameter of the inhibition zone. Activity of each compound was compared with Amphotericin B as standard. The minimum inhibitory concentration (MIC) for the Amphotericin B in DMSO was more than 1 mg/ml against the tested species.

The results showed that ligands exhibit moderate activity against all tested fungus A, L1 showed high antifungal activity against *C. Albicans* A, L1, L2, L3, L4 shows good activity against *C. Albicans*. But all the ligand does not show any activity against *Aspergillus Niger*.

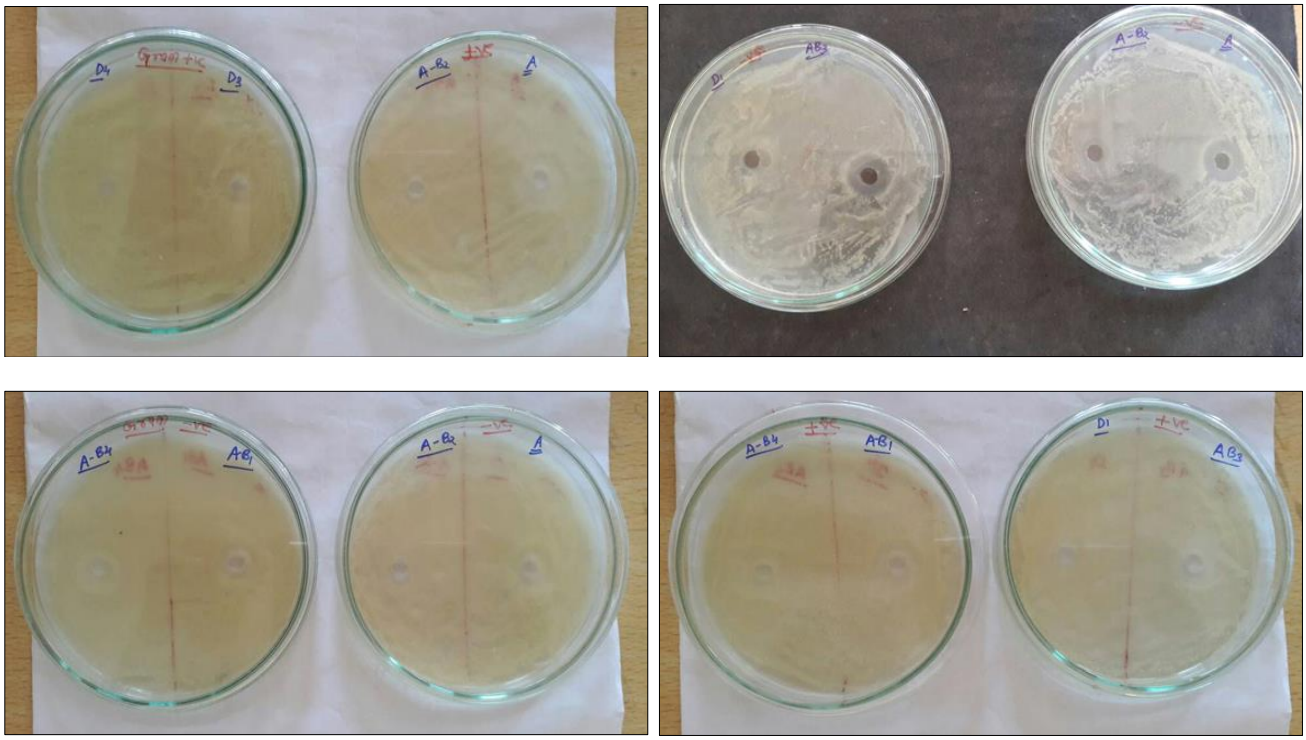


**Fig 5:** Antifungal activity of thiazole compound and schiff base ligands

**Table 6:** Name of ligand and abbreviation

| Sr. No | Name of the Ligand | Abbreviations of Ligands |
|---|---|---|
| 1 | 2-amino-4-(4-bromophenyl)thiazole | A |
| 2 | N-Salicylidene-4-(4'-Bromophenyl)-2-amino thiazole | L1 |
| 3 | 5-chloro-Salicylidene-4-(4'-Bromophenyl)-2-amino thiazole | L2 |
| 4 | 5-methyl-Salicylidene-4-(4'-Bromophenyl)-2-amino thiazole | L3 |
| 5 | 5-methoxy-Salicylidene-4-(4'-Bromophenyl)-2-amino thiazole | L4 |

## Conclusion

All the Schiff base ligands (L1, L2, L3 and L4) are yellow crystalline solids except L2 is pinkish in colour and all synthesized schiff base ligands having sharp melting points.

From the results we found that the synthesis of Schiff base ligands by reacting equimolar amounts of 2-amino-4-(4-bromophenyl) thiazole and R substituted ortho hydroxyl aldehyde in minimum amount of methanol, where (R= H, CI, $CH_3$, $OCH_3$) is convenient and rapid method giving high yield and superior as saves solvent and time of the expected product and this method is faster than the conventional method for the synthesis of Schiff base ligands. The spectral analysis (IR, $^1H$ NMR, $^{13}C$ NMR, Mass, UV-Visible and fluorescence) data confirms the structure proposed for the Schiff base ligands.

From the above spectral data, it is clear that all newly synthesized ligands are tridentate ligands through the phenolic-O, azomethine-N and thiazole-S. The Schiff base ligands are found to be exhibit good antibacterial activity against *B. Subtilis* and *E. Coli* and antifungal against *A. Niger* and *C. Albicans*.

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