RESEARCH ARTICLE

# Synthesis and Characterization of Based on Some New Schiff base from 5-styryl-2-amino-1,3,4-thiadiazole

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**ABSTRACT**

The present study synthesized synthesis and characterization with studying biological activity of based on Schiff based from 5-styryl-2-amino -1,3,4-thiodizole [$C_1$] from the reacting α-phenyl acrylic acid with thiosemicarbazide. Schiff bases [$C_2$-$C_7$] have been synthesized via compound ($C_1$) reaction with a diverse aromatic aldehyde. Moreover, [$C_2$, $C_3$] reaction with distinct anhydrides (malic and succinic anhydride) as well as sodium azide have been given to oxazepine [$C_8$-$C_{10}$] and tetrazole [$C_{11}$-$C_{12}$] respectively. The prepared derivatives were The infrared spectra have been used to prepare the derivatives.

**Keywords:** heterocyclic rings, Schiff bases.

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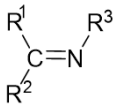
**Source of support:** Nil.

**Conflict of interest:** None

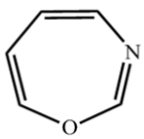
## INTRODUCTION

Developing the synthetic paths for the commonly applied organic compounds using the accessible reagents has been considered a main purpose of organic synthesis. In this regard, Hugo Schiff (1864[1]) has been the first to report the Schiff's basis that exhibited diverse biological activities like anti-fungal,[2] anti-oxidant[3], anti-microbial,[4] an anti-depressant.[5] cytotoxic,[6] anticancer,[7] anti-fungal,[8] and antibacterial.[9] Schiff base, which is usually synthesized in aldehyde (i.e., a ketone) reaction with a primary amine.[10] Occasionally, adding glacial acetic acid functions as an aid factor. A Schiff's base; that is referred to imine, ketimines, azomethine and aldimines).[11]

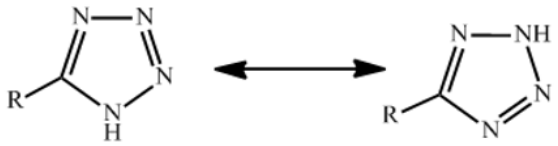


$R^1, R^2$, and $R^3$ = alkyl or aryl

According to the studies, oxazepines have been considered to be one of the classes of the heterocyclic compounds of a 7-membered ring containing 2 hetero-atoms (O and N). Moreover, the location of oxygen atom has been regarded on position (1) and nitrogen atom on (3) position.[12]



Therefore, we examined and documented the synthesizing oxazepine. This material has been prepared by adding pericyliccyclo of the Schiff base or hydrazone to the phthalic, succinic and maleic anhydride.[13] Oxazpines heterocyclic has been shown to possess many types of biological properties like analgesic, antibacterial, anti-depressant, anti thrombotic, and anticancer.[14-18] In addition, tetrazoles are the member of a class of 2 un-saturated five-membered ring aromatic heterocycles that contains one carbon as well as 4 nitrogen atoms 19 onecarbon and four nitrogen atoms.[19]



Tautomerism of Tetrazole Derivatives

Experts in the field showed different utilizations of tetrazoles in gas-generating compositions, medicine, as well as high-energy materialsin coordination chemistry, in agriculture1 and in imaging technology.[20]

## MATERIALS AND METHODS

We chose several companies like Merck, Thomas baker, GCC, Scharlau as well as BDH for supplying the chemicals. Therefore, any purification has not been necessary. The melting points have then been resolute on an electrothermal melting point apparatus from Stuart Germany that have been

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uncorrected. With the completion of purity, reaction of each compound has been tested on an aluminum-coated TLCplates 60 F245 (E. Merck) via the use of the absolute ethanol as a mobile phase and thus it has been imagined under the iodine vapor. Moreover, the infrared spectra resolves have been performed and registered as the KBr disks in ranges between 400 and 4000 $cm^{-1}$ with the use of fourier transform infrared spectroscopy (FTIR) Shimadzu (Japan).

### Synthesis 5-styryl-1,3,4-thiadiazle-2-amino($C_1$)[21]

Mixture (0.01 mol) of α-phenyl acrylic acid with (0.01mol) thiosemicarbazide in (10ml) of $POCl_3$ was Refluxed 4 hours,the excess of $POCl_3$ removed and the residue dissolved in distilled water (50ml) then heated for1hrs. Then the resulting product cooled, filtered, and neutralized with KOH. The precipitate was filtered, dried and recrystallized in ethanol. (m.p 238–240 ºC) solid, violet.

### Synthesis of (Schiff bases) compounds [$C_2$-$C_7$][22]

In this stage, we dissolved a mixture of compound [$C_1$] (2 gm,0.00 8mol) with various aldehydes {4-hydroxy-benzaldehyde, benzaldehyde, 4-Nitro-benzaldehyde, 4-chloro-benzaldehyde, N- Dimethyl-amino benzaldehyde, &4-bromo-benbenzaldehyde} (0.016 mol) in (20 mL) of absolute ethanol with some drops of glacial acetic acid, which has been refluxed for eight to ten hours. The resultant solid has been filtered and purified from absolute ethanol. Table 1 represents physical features of the compounds [$C_2$-$C_7$].

### Synthesis of (oxazepine) compounds [$C_8$-$C_{10}$][23]

A mixture of [$C_2$, $C_4$, $C_6$] (0.001 mol) has been dissolved in 10 mL ethanol with various anhydrides (phathalic anhydride & succinic anhydride) (0.002 mol). It has been refluxed for five hours and checked by T.L.C. Moreover, the mixture of reaction has been cooled, filtered, and purified from ethanol. Table 1 presents the physical features of the compounds [$C_8$-$C_{10}$].

### Synthesis of (tetrazole) compounds [$C_{11}$-$C_{12}$][24]

Schiff base [$C_2$, $C_4$, $C_6$] (0.001mol) has been dissolved in 10 mL of THF and then 0.002 mol, 0.13gm sodium azide has been added. After that, a water bath at 60 to 70 ºC has been used to heat this mixture for ten hours. In the next step, we filtered the reaction mixture and purified the resulting product using absolute ethanol. Table 1 reports the physical features of the compounds [$C_{11}$-$C_{12}$].

## RESULTS AND DISCUSSION

Here, the overall reaction is summarized in Figure 1.

According to the research design, we prepared compound [$C_1$] via reacting in mixture of α-phenyl acrylic acid with thiosemicarbazide in the presence of $POCl_3$. FT-IR spectrum has been used to diagnose the compound structure [$C_1$], which displayed disappearance of the stretching vibration of (OH) group as well as υ (C-O-C) emerged at (1249) $cm^{-1}$. In addition, adsorption band at 3336 and 3275 $cm^{-1}$ belonged to υ ($NH_2$) asymmetric and symmetric. Table 2 presents other bands. According to the results, heating at the reflux of compound [$C_1$] with the equimolar amounts of various carbonyl compounds in absolute ethanol with some drops of glacial acetic acid produced a novel series of Schiff bases. Furthermore, this mechanism involved the amine group's nucleophilc attack on a carbon carbonyl group of aldehyde for forming un-stable compounds accompanied by losing $H_2O$ molecule for giving an imine compound.[25] Figure 2 depicts the respective reaction or mechanism.[2] As seen, FT-IR has been used to characterize the Schiff bases from the [$C_2$-$C_7$] compounds. The spectra indicated the bands' disappearance because of the asymmetric and symmetric $NH_2$ at 3336, 3275 $cm^{-1,}$ and thus the bands' appearance has been caused by υ (CH=N) group. Finally, the FTIR spectra of the compound [$C_2$] demonstrated the adsorption band at 1627 $cm^{-1}$ that belonged to υ (CH=N). Table 2 presents other absorptions of the Schiff-base compounds.

In this step, Schiff base reacted with various anhydrides for giving the oxazepine derivatives. Figure 3 depicts this mechanism[26] for forming oxazepine derivatives. FTIR has been used to characterize oxazepine derivatives from

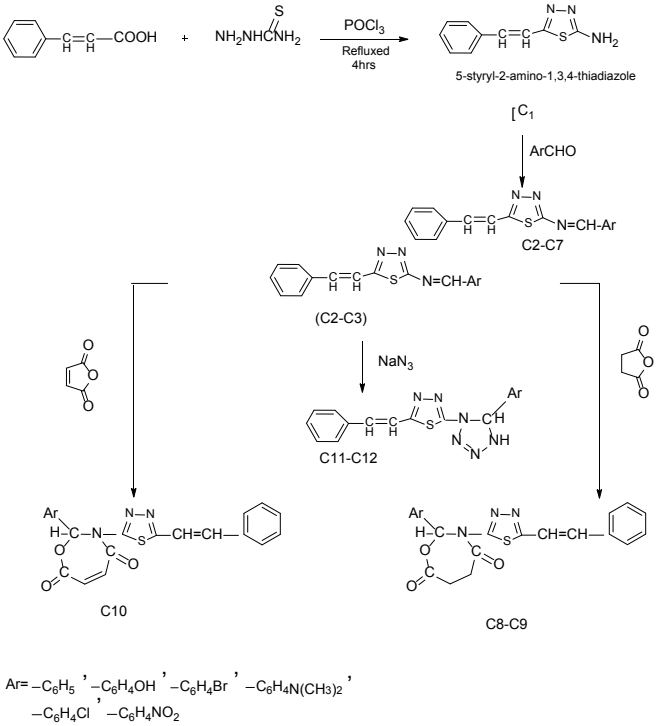



**Figure 1:** Overall reaction is summary

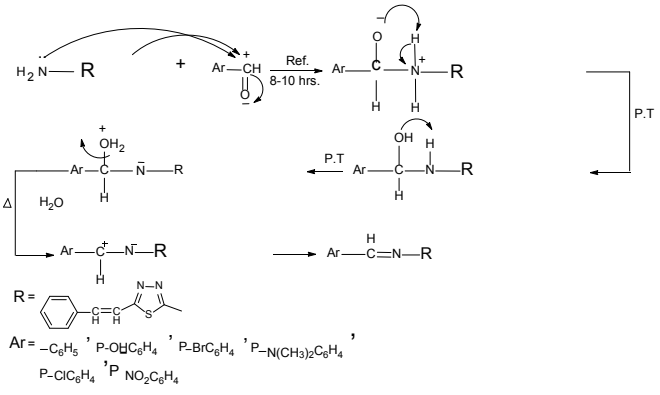
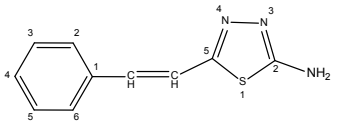
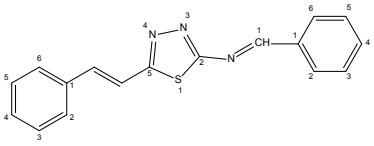
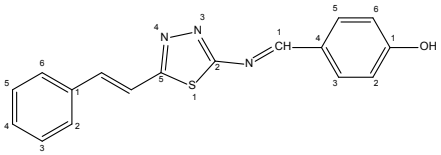
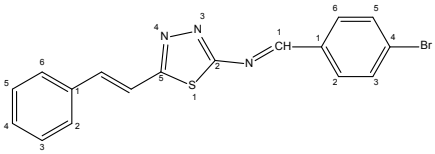
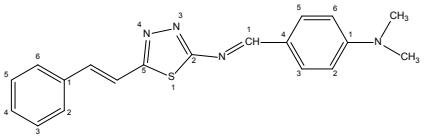
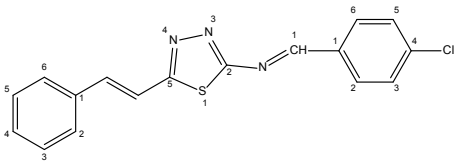
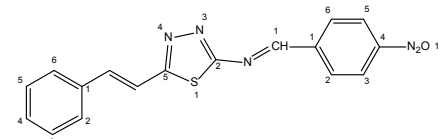
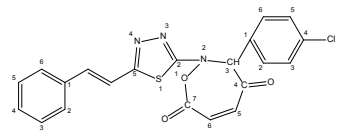
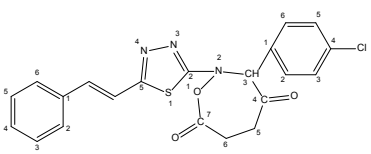



**Figure 2:** The mechanism steps to synthesize the Schiff base

**Table 1:** Physical features of the compounds [$C_2$-$C_7$]

| *Compound No* | *The compound structure* | *Yield %* | *Colour* | *M.p Ć* |
|---|---|---|---|---|
| $C_1$ |  5-styryl-2-amino-1,3,4-thiadiazole | 62 | white | 238–240 |
| $C_2$ |  (*E*)-1-phenyl-*N*-(5-((*E*)-styryl)-1,3,4-thiadiazol-2-yl)methanimine | 58 | white | 188–190 |
| $C_3$ |  4-((*E*)-((5-((*E*)-styryl)-1,3,4-thiadiazol-2-yl)imino)methyl)phenol | 61 | white | 222–224 |
| $C_4$ |  (*E*)-1-(4-bromophenyl)-*N*-(5-((*E*)-styryl)-1,3,4-thiadiazol-2-yl)methanimine | 64 | white | 210–212 |
| $C_5$ |  *N*,*N*-dimethyl-4-((*E*)-((5-((*E*)-styryl)-1,3,4-thiadiazol-2-yl)imino)methyl)aniline | 50 | Dark orange | 242–244 |
| $C_6$ |  (*E*)-1-(4-chlorophenyl)-*N*-(5-((*E*)-styryl)-1,3,4-thiadiazol-2-yl)methanimine | 59 | white | 250–252 |
| $C_7$ |  (1*E*)-1-(4-((λ$^1$-oxidaneyl)diazenyl)phenyl)-*N*-(5-((*E*)-styryl)-1,3,4-thiadiazol-2-yl)methanimine | 52 | Dark yellow | 232–234 |
| $C_8$ |  (*E*)-3-(4-chlorophenyl)-2-(5-styryl-1,3,4-thiadiazol-2-yl)-2,3-dihydro-1,2-oxazepine-4,7-dione | 65 | white | 120–122 |
| $C_9$ |  (*E*)-3-(4-chlorophenyl)-2-(5-styryl-1,3,4-thiadiazol-2-yl)-1,2-oxazepane-4,7-dione | 63 | Pale | 166–168 |

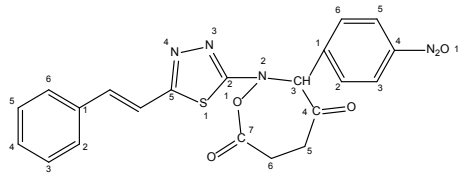
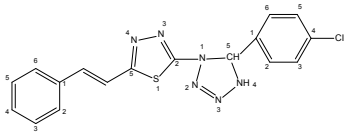
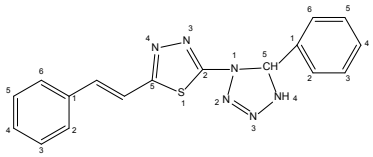
| *Compound No* | *The compound structure* | *Yield %* | *Colour* | *M.p Ċ* |
|---|---|---|---|---|
| $C_{10}$ |  3-(4-((λ¹-oxidaneyl)diazenyl)phenyl)-2-(5-((*E*)-styryl)-1,3,4-thiadiazol-2-yl)-1,2-oxazepane-4,7-dione | 60 | Pale | 124–126 |
| $C_{11}$ |  (*E*)-2-(5-(4-(iodo-λ²-methyl)phenyl)-4,5-dihydro-1*H*-tetrazol-1-yl)-5-styryl-1,3,4-thiadiazole | 62 | Brown | 194–196 |
| $C_{12}$ |  (*E*)-2-(5-phenyl-4,5-dihydro-1*H*-tetrazol-1-yl)-5-styryl-1,3,4-thiadiazole | 50 | Brown | 174–176 |

**Table 2:** Spectral Data of Compounds [$C_1$-$C_{12}$]

| *Comp. NO* | *ν(NH)* | *ν(C-H) aromatic* | *ν(C-H) aliphatic* | *ν(C=O) lactone* | *ν(C=O) lactame,* | *ν(C=N)* | *ν(C-N)* | *ν(C-O-C)* | *Others* |
|---|---|---|---|---|---|---|---|---|---|
| $C_1$ | - | 3209 | 2974 | - | - | - | 1373 | 1249 | *ν($NH_2$):* 3336 *ν(C=C): aromatic* 1504 |
| $C_2$ | - | 3084 | 2976, 2821 | - | - | 1622 | 1350 | 1230 | - |
| $C_3$ | - | 3190 | 2823, 2422 | - | - | 1666 | 1454 | 1288 | *ν(OH):* 3427 |
| $C_4$ | - | 3194 | 2819, 2449 | - | - | 1654 | 1442 | 1292 | *ν(C-Br):* 767 |
| $C_5$ | - | 3100 | 2873,2449 | - | - | 1600 | 1300 | 1091 | - |
| $C_6$ | - | 2985.2980 | 2908, 2819 | - | - | 1655 | 1372 | 1212 | *ν(C-Cl):* 825 |
| $C_7$ | - | 3059 | 2873,2765 | - | - | 1604 | 1300 | 1114 | ν(C-$NO_2$): 1543 |
| $C_8$ | - | 3041 | 2931, 2831 | 1728 | 1635 | - | 1427 | 1249 | ν(C-Cl): 833 |
| $C_9$ | - | 3059 | 2931, 2742 | 1728 | 1693 | - | 1419 | 1203 | *ν(C-NO2):* 1570 |
| $C_{10}$ | - | 3082 | 2978, 2889 | 1720 | 1639 | - | 1400 | 1203 | ν(C-$NO_2$): 1558 *ν(CCl):* 891 |
| $C_{11}$ | 3252 | 3075 | 2924, 2854 | - | - | - | 1373 | 1283 | *ν(N=N-N):*2117, 2052 |
| $C_{12}$ | 3302 | 3084 | 2947, 2843 | - | - | - | 1392 | 1230 | *ν(N=N-N):*2125, 2052 *ν(C-Cl):* 821 |

[$C_8$ –$C_{10}$]. As seen, FTIR spectrum of [$C_8$] implies the vibration appearance of oxazepine, ring at (1693) and (1728) $cm^{-1}$ of ν(C=O) of lactame and Lactone. Furthermore, FTIR spectrum of [$C_9$] showed the vibration appearance of oxazepine, ring at (1693) and (1728) $cm^{-1}$ of ν (C=O) of lactame and Lactone. Table (2) reports other bands.

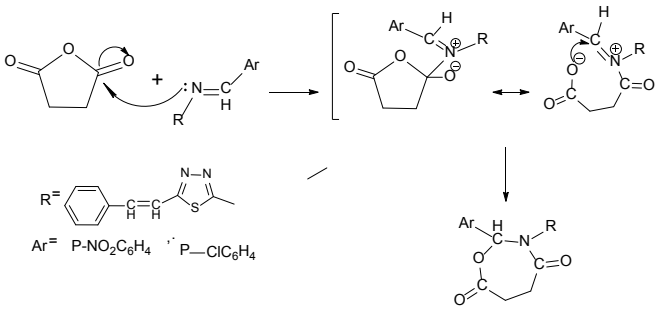


**Figure 3:** The mechanism steps of oxazepine derivatives synthesis.

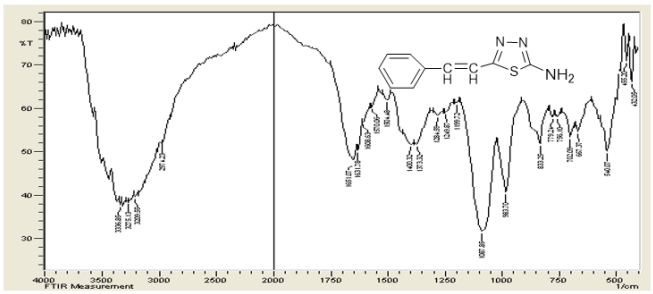


**Figure 1:** The FT-IR spectrum for compound [$C_1$]

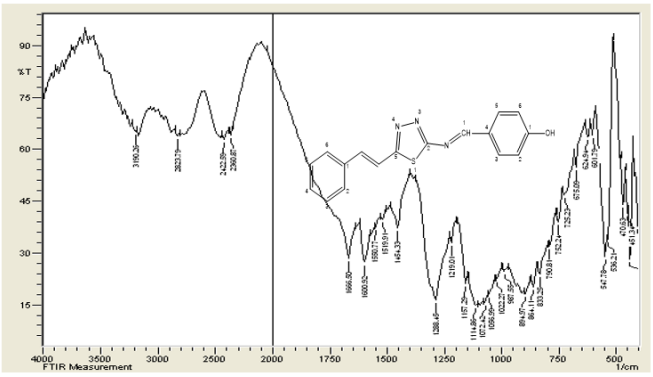


**Figure 2:** The FT-IR spectrum for compound [$C_3$]

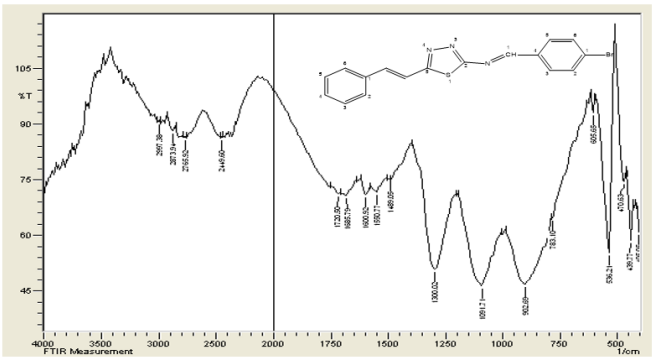


**Figure 3:** The FT-IR spectrum for compound [$C_4$]

Tetrazole compound [$C_{11}$-$C_{12}$] has been introduced as the result of interaction of the Schiff base compound and azide group that involves an attack by the azide group on azomethin in (1,3) that is a di-polar cyclo-addition. Then, we observed a lone pair on (N) atom in azomethine group that eventually forms a (N-N) bond. Figure 4 displays the formation mechanism[27] of Tetrazole derivatives. As seen in the figure, FTIR spectra of the tetrazole compounds adsorption band at (2133-2040) $cm^{-1}$

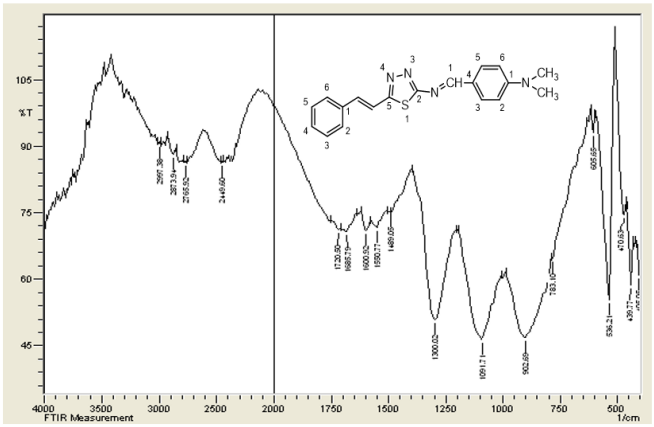


**Figure 4:** The FT-IR spectrum for compound [$C_5$]

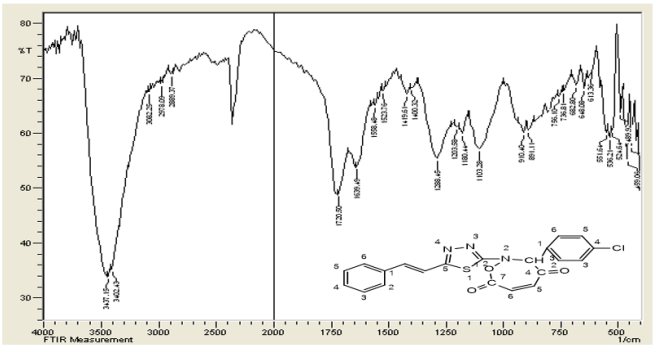


**Figure 5:** The FT-IR spectrum for compound [$C_8$]

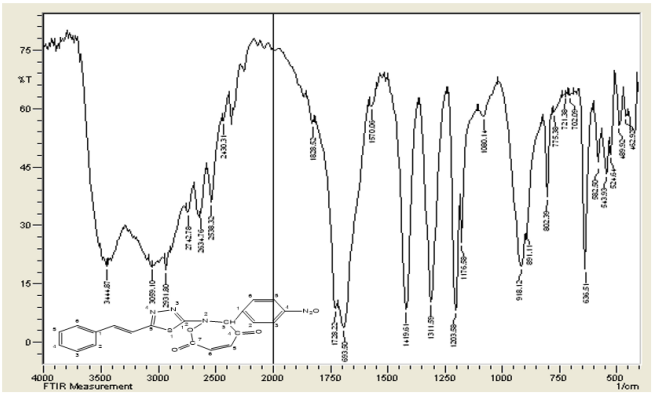


**Figure 6:** The FT-IR spectrum for compound [$C_{10}$]

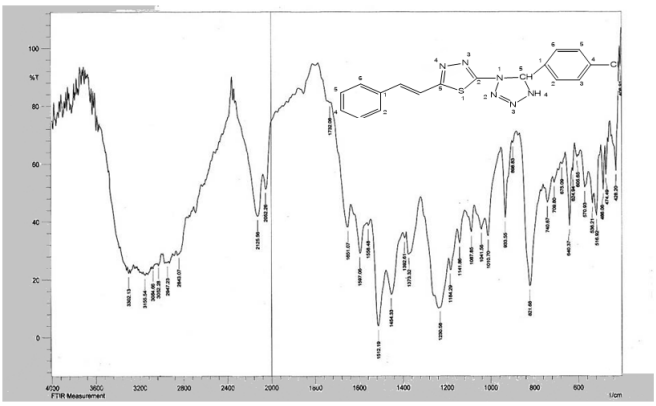


**Figure 7:** The FT-IR spectrum for compound [$C_{13}$]

belong to the (N-N=N) group. Moreover, FTIR spectra of the [$C_{11}$] compound demonstrated the absorption band at (3229) $cm^{-1}$, which belong to $\upsilon$ (NH) at 2117 and 2052 $cm^{-1}$ because of $\upsilon$ (N-N=N). Consequently, FTIR spectra of the [$C_{12}$] compound referred to the adsorption band at 3302 $cm^{-1}$ that is caused by $\upsilon$ (NH) 821 $cm^{-1}$ absorption band that is because of $\upsilon$ (C-Cl) and $\upsilon$ (N-N=N) 2125, 2052. Table 2 reports some other bands.

## REFERENCES:


1. Mishra N, Gound SS, Mondal R, Yadav R, Pandey R. Synthesis, characterization and anti-microbial activities of benzothiazole-imino-benzoic acid ligands and their Co (II), Ni (II), Cu (II), Zn (II) and Cd (II) complexes. Results in Chemistry. 2019 Jan 1;1:100006.
2. Salman SD, Adnan S. Synthesis, characterization of Some New Derivatives of (Oxazpine, Thiazinone and Hydroquinazoline)-Azo group from Amine compounds. Eurasian Chemico-Technological Journal. 2018;20(3):264-76.
3. Ramadan AK, Abid OH. Preparation and Identification of 1, 3-Oxazepine Derivatives from Selected Carboxylic Acid Anhydrides with Imines Derived from 4-methyl aniline. Al-Mustansiriyah Journal of Science. 2018;29(2):93-100.
4. Hussein IA, Narren SF, Hasan IM, Saleh AM. Synthesis and Biological Activities of Some New Derivatives Based on Bis (4, 4'-diamino phenoxy) Ethane Containing Oxazpines, Terazole Rings. Journal of Pharmaceutical Sciences and Research. 2018 Oct 1;10(10):2461-9.
5. Narren SF, Hasan IM, Saleh AM, Saleh SH, Hamzah MO, Hussein IA. Synthesis and Characterization of Some New Derivatives starting from Bis (4, 4'-diamino phenoxy) Ethane. Journal of Pharmaceutical Sciences and Research. 2019 Apr 1;11(4):1269-77.
6. Khan AK, Hamdee MD. New Hydrochlorothiazide Derivatives: Synthesis, Characterization and Anti-Microbial Assessments. Research Journal of Pharmacy and Technology. 2019;12(12):5848-54.
7. Taha NI. Synthesis of 1, 3-Oxazepine Derivatives Derived from 2-(1H- Benzo [d][1, 2, 3] Triazol-1-yl) Acetohydrazide by Using Microwave Irradiation. International Journal of Organic Chemistry. 2017 Jul 21;7(3):219-28.
8. Alrecabi ZG, Alfraiji RA, Al-Majidi SM. Synthesis, Identification of Some New Derivatives of Oxazpine, Thiazinone and Hydroquinazoline and Evaluation of Antibacterial Activity. Iraqi Journal of Science. 2017;58(3C):1565-79.
9. Sallal ZA, Ghanem HT. Synthesis and Identification of New Oxazepine Derivatives bearing Azo group in their structures. Iraqi Journal of Science. 2018 Jan 29:1-8.
10. Mohammed MN. Synthesis and Biological of new Oxazepine-4, 7-dione of pyrazine. InJournal of Physics: Conference Series 2019 Sep (Vol. 1294, No. 5, p. 052074). IOP Publishing.
11. Salman SD, Adnan S. Synthesis, characterization of Some New Derivatives of (Oxazpine, Thiazinone and Hydroquinazoline)-Azo group from Amine compounds. Eurasian Chemico-Technological Journal. 2018;20(3):264-76.
12. Neochoritis CG, Zhao T, Dömling A. Tetrazoles via multicomponent reactions. Chemical reviews. 2019 Feb 1;119(3):1970-2042.
13. Mohammed JH. Biological activities importance of tetrazole derivatives. Eur. Acad. Res. 2016;3(12):12803.
14. Medina FG, Marrero JG, Macías-Alonso M, González MC, Córdova-Guerrero I, García AG, Osegueda-Robles S. Coumarin heterocyclic derivatives: chemical synthesis and biological activity. Natural product reports. 2015;32(10): 1472-507.
15. Ahlam MAl-Azzawi, Ali AR.Synthesis and Antibacterial Screening of New Schiff Bases Based on N-(4-acetophenyl) Succinimide. Journal of Science. 2017; 58(4A) : 1790-1801.
16. Abid OH. Preparation and Identification of Novel 1, 3-Oxazepine Derivatives by Cycloaddition Reactions [2+ 5] of Selected Carboxylic Acid Anhydrides with Imines Derived from 4-methyl aniline. Al-Mustansiriyah Journal of Science. 2018 Nov 17;29(2):93-100.
17. MohammedAbed S, Ghanim HT. Synthesis and Characterization of Some Imidazolidien, tetrazole derivatives.
18. Neochoritis CG, Zhao T, Dömling A. Tetrazoles via multicomponent reactions. Chemical reviews. 2019 Feb 1;119(3):1970-2042.
19. Varala R, Babu BH. A Click Chemistry Approach to Tetrazoles: Recent Advances. InMolecular Docking 2018 Nov 5. Intech Open.
20. Ismael A. Structure and reactivity of novel tetrazole-saccharinates useful as multidentate nitrogen ligands.
21. Iman MH, Synthesis, Characterization with Studying Physical Properties by Free Radical Polymerization of Some New Resins Starting from 5- Styryl-1, 3, 4-Thiadiazol-2-amine.2018,10(11),125-136.
22. Ahlam MAl-Azzawi, Ali AR.Synthesis and Antibacterial Screening of New Schiff Bases Based on N-(4-acetophenyl) Succinimide. Journal of Science. 2017; 58(4A) : 1790-1801.
23. Ahmed A, Sarah M, Anwar H, Ayad H, Emad Y. Antibacterial Study of Some Oxazepine Derivatives. Journal of Al-Nahrain University. 2015; 18 (4) : 22-26.
24. Ibtisam KJ, Iman MM. Synthesis and Characterization of Some New Monemer and Polymers Containing Hetero Cyclic Rings With Study of Their Physical Properties . Baghdad Science Journal.2016;13(2s (Supplement)).
25. Doaa H. Q. Al. Abboodi. Synthesis, Characterization and Biological Activity Study of New Heterocyclic Compounds Derived from 2, 5 Dimercapto 1,3,4 – Thiadiazole. MSc. College of Science for Women: University of Baghdad; 2017.
26. Sallal ZA, Ghanem HT. Synthesis and Identification of New Oxazepine Derivatives bearing Azo group in their structures. Iraqi Journal of Science. 2018 Jan 29:1-8.
27. MohammedAbed S, Ghanim HT. Synthesis and Characterization of Some Imidazolidien, tetrazole derivatives