



Preparation, Characterization, Anti-cancer and Antibacterial Evaluation of New Schiff base and Tetrazole Derivatives

Yuosra Khalaf Alasadi¹, Fawzi Hameed Jumaa², Mohammed Ghanam Mukhlif³, Safa Mahmood Shawkat²

¹ Department of Chemistry, College of Education for Pure Science, Tikrit University, Tikrit-Iraq

² Department of Chemistry, College of Education for Women, Tikrit University, Tikrit - Iraq

³ General Directorate of Education in Anbar, Ministry of Education, Iraq

ARTICLE INFO.

Article history:

-Received: 20 / 11 / 2022

-Accepted: 7 / 12 / 2022

-Available online: 26 / 4 / 2023

Keywords: Anticancer, Schiff base, Tetrazole, Anti-bacterial, Azo

Corresponding Author:

Name: Yuosra Khalaf Alasadi

E-mail: ysrakhalaf78@tu.edu.iq

Fawzi.99883@tu.edu.iq

mohammed.g.mukhlif@tu.edu.iq

Safa.m.shawkt@tu.edu.iq

Tel:

©2022 COLLEGE OF SCIENCE, TIKRIT UNIVERSITY. THIS IS AN OPEN ACCESS ARTICLE UNDER THE CC BY LICENSE
<http://creativecommons.org/licenses/by/4.0/>



ABSTRACT

This work involved the synthesis of tetrazole derivatives 4,4'-(((sulfonfylbis(4,1-phenylene))bis(diazene-2,1-dil))bis(2-(1-(4-R)phenyl)-4),5-Dihydro-1H-tetrazol-5-yl(phenol) (where R = OH or OCH₃) through the reaction of the substituted amine in THF as a solvent, with sodium azide. FT-IR ¹H-NMR Spectrophotometric methods were used to characterize the prepared compounds, the antibacterial activity against four types of bacteria have been studied where it has been proven that tetrazole compounds are more effective than the compounds from which it was derived, and the anticancer activity measured against MCF-7 strains of human breast cells of the synthesized compounds.

1. Introduction

Schiff bases Compounds containing the imine group were first described by Hugo Schiff as compounds resulting from the condensation reaction of aldehydes with ketones in the presence of primary amines in 1864. Usually, heat, acids, or bases will accelerate this reaction and consequently leads to an increase in the yield product of Schiff base [1]. Schiff bases are used as ligands to generate metal complexes with various structures or as intermediates in the production of amino acids [2,3]. Aliphatic aldehydes are unstable and undergo fast polymerization, while aromatic aldehydes, especially those with a conjugated system, form stable Schiff bases [4].

Recent years have witnessed an increase in interest in Schiff base compounds from which ligands can be prepared for metal complexes, allowing a wide range of compounds and their effectiveness, especially biological ones [5]. Hydrazone compounds (one type of Schiff bases) have shown a high selectivity for

several anticancer drugs by acting as drug carrier systems [6].

Tetrazoles, are heterocyclic organic compounds with high biological activity because they contain four nitrogen atoms and one carbon atom [7]. These compounds possess biological activity and are also of great importance in the field of medicine [8], pharmacology, industry, agriculture and explosives [9]. This ring was first discovered in 1885 [10]. The reason for its high efficiency is due to the four nitrogen atoms, which have four free double electrons and are classified as an electronegative compound [11].

Recently, several methods have been found to synthesis of tetrazole rings from amides. One of the most recent methods for this preparation is the reaction of sodium azide with Schiff bases [12]. There are also other methods, including preparing compounds using microwave [13] and ultrasound

[14]. Imidoyl chloride is produced using chlorinating agents and subsequently reacted with an azide to form unsubstituted tetrazole [15]. Tetrazole can also be synthesized from nitrile and an azide source using a type of reaction known as efflux [16]. Also, tetrazole derivatives were prepared by reacting hydrazones with sodium azide [17]. The tetrazole compounds possess three geometric isomers, which gave them great importance as antibiotics and a great range of effectiveness [18,19].

2. Experimental

The chemicals used in this work were used without further purification. The end point of the reactions was determined for the prepared compounds, and the purity of the prepared compounds was tested using thin layer chromatography TLC.

A Shimadzu FT-IR 8400S spectrophotometer was used to record FT-IR spectra at the range (400–4000 cm⁻¹) by KBr disk. The NMR spectra, a Varian device (400 MHz) was used using (DMSO-d₆) as a solvent.

2.1 Synthesis of Schiff bases [F1, F2].

The Schiff bases [F1,F2] compounds were prepared according to the literature[20,21], and the physical properties are shown in Table (1).

2.2 Synthesis of tetrazole [F3, F4] [22, 23]:

sodium azide (0.004 mol, 0.26 g) was added to 0.002 mole of one of the prepared Schiff bases [F1, F2] in THF 30ml. The solution was refluxed on water-bath for (6-8) h. at 80 °C, and the precipitate was filtered. It was recrystallized with ethanol. The physical properties are shown in Table 1.

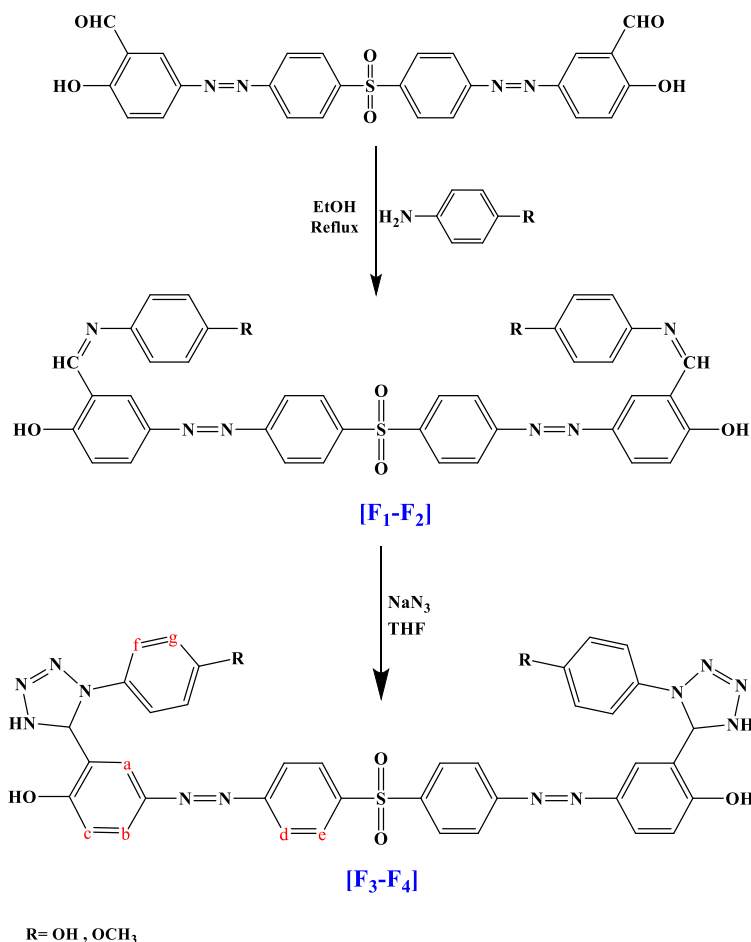
Table 1. Physical properties of prepared compounds [F₁-F₄]

Comp. No.	R	Molecular Formula/ M.Wt (g/mol)	Color	M.P (°C)	T. Ref. (hours)	Yield (%)	R _f MeOH
F ₁	OH	C ₃₈ H ₂₈ N ₆ O ₆ S / 696.74	Orange	128-130	7	85	0.89
F ₂	OCH ₃	C ₄₀ H ₃₂ N ₆ O ₆ S / 724.79	Light yellow	235-237	8	73	0.61
F ₃	OH	C ₃₈ H ₃₀ N ₁₂ O ₆ S / 782.80	Yellow	Gummy	8	70	0.73
F ₄	OCH ₃	C ₄₀ H ₃₄ N ₁₂ O ₆ S / 810.85	White	240-242	6	80	0.65

3. Results and Discussion

The research included the synthesis of Schiff bases [F1, F2] and tetrazole [F3, F4] as in (Scheme 1) and

spectroscopy methods such as FT-IR and ¹H-NMR were used to validate the structure of synthesized compounds.



Scheme 1. Prepared compounds [F₁-F₄]

3.1 Characterization of Schiff bases derivatives [F₁,F₂]:

IR spectra of compounds [F₁,F₂] showed the bands at (3336,3442) cm⁻¹ attributed to the OH groups, The disappearance of the band at (1730) cm⁻¹ attributed to the $\nu(\text{C=O})$ aldehyde group [24], and the emergence of a new frequency at (1650,1654) cm⁻¹ attributed to the azomethine group $\nu(\text{C=N})$ [25] was evidence on the preparation of the Schiff base.

The stretching band at (3035,3091) cm⁻¹ belongs to the aromatic (CH) group; also, two bands at (1585,1580) cm⁻¹, (1488,1483) cm⁻¹ refer to $\nu(\text{C=C})$ aromatic, further the azo (N=N) group displayed at (1442,1431) cm⁻¹. The $\nu(\text{S=O})$ and $\nu(\text{N-N})$ stretching bands displayed at (1392,1374) cm⁻¹ and (1024,1064)

cm⁻¹ [26], respectively. Other bands are listed in Table 2.

The ¹HNMR spectrum of compound [F₁] in Figure (1) showed two singlets signals at δ (10.38ppm, 1H, 10.21ppm, 1H) due to the OH group, and at δ (9.26ppm, 1H) refer to (CH=N) group, the singlet at δ (8.30ppm, 1H) attributed to (H_a), the appearance of two doublets at δ (8.14ppm, 2H), (7.58ppm, 2H) with coupling constant (³J=7.21Hz), attributed to (H_b, H_c) respectively, the two doublets at δ (8.21ppm, 2H, 8.03ppm, 2H) with coupling constant (³J=5.27Hz), attributed to (H_d, H_e) respectively, and the spectrum showed two doublets at δ (7.23ppm, 2H, 7.01ppm, 2H) with coupling constant (³J=8.97Hz), attributed to (H_g, H_f) respectively.

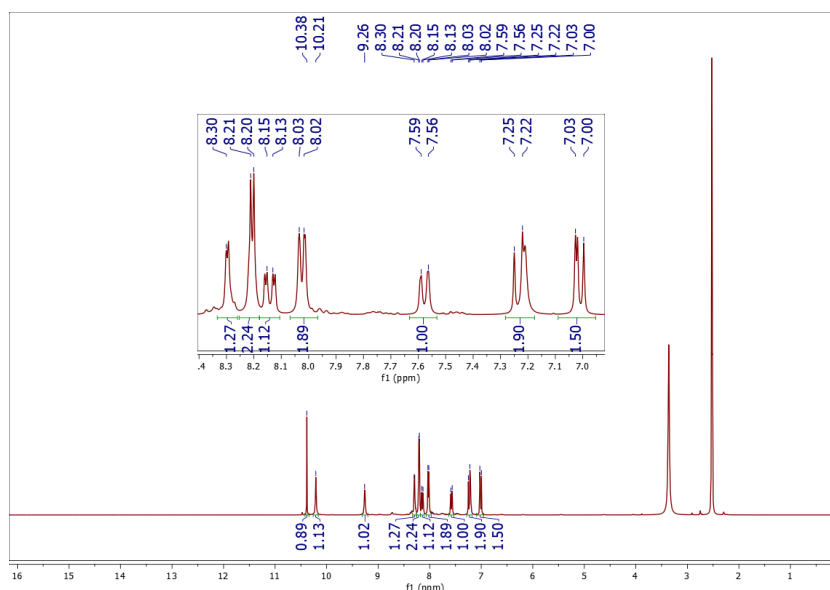


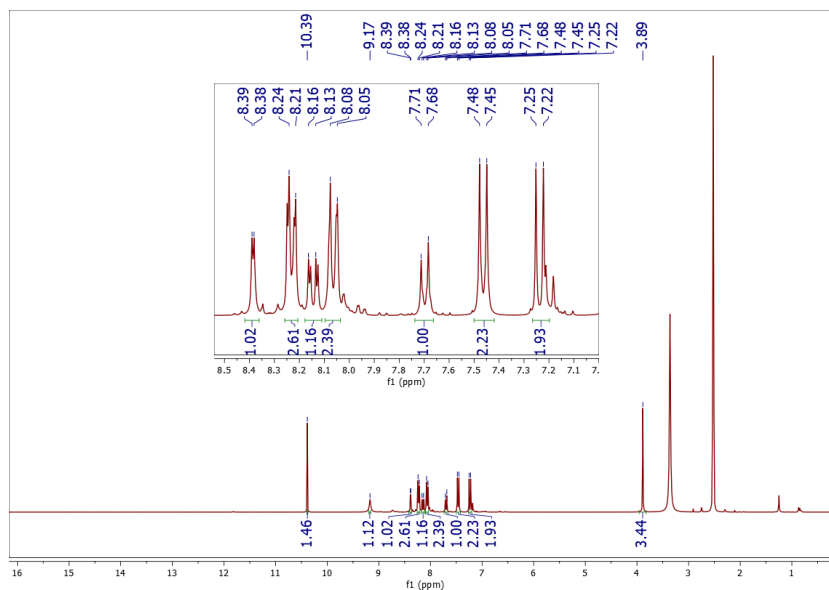
Fig. 1: H-NMR Spectrum of [F₁] compound

Table 2. FT-IR data of prepared compounds [F₁-F₄] (cm⁻¹)

Comp. No.	R	$\nu\text{O-H}$ $\nu\text{N-H}$	$\nu\text{C-H}$ Ar.	ν S=O	$\nu\text{C=O}$ C=N	ν C=C	ν N=N	$\nu\text{C-N}$ $\nu\text{N-N}$	Others
F ₁	OH	3336	3035	1392	---- 1650	1585 1488	1442	1168 1024	-----
F ₂	OCH ₃	3442	3091	1374	---- 1654	1580 1483	1431	1140 1064	$\nu(\text{OCH}_3)$ 2979, 2832 & $\nu(\text{O-C})$ 1284
F ₃	OH	3406 3213	3016	1385	----	1582 1491	1420	1145 1036	-----
F ₄	OCH ₃	3446 3222	3074	1375	----	1585 1483	1436	1108 1068	$\nu(\text{OCH}_3)$ 2929, 2850 & $\nu(\text{O-C})$ 1282

The spectrum of compound [F₂] in Figure (2) displayed two peaks at δ (10.39ppm, 1H) and δ (9.17ppm, 1H) referring to protons of OH and (CH=N) groups, respectively. The appearance of a peak at δ (8.39ppm, 1H) attributed to (H_a), the appearance of two doublets at δ (8.15ppm, 2H, 7.70ppm, 2H) with coupling constant (³J=8.67Hz), attributed to (H_b, H_c) respectively. The appearance of

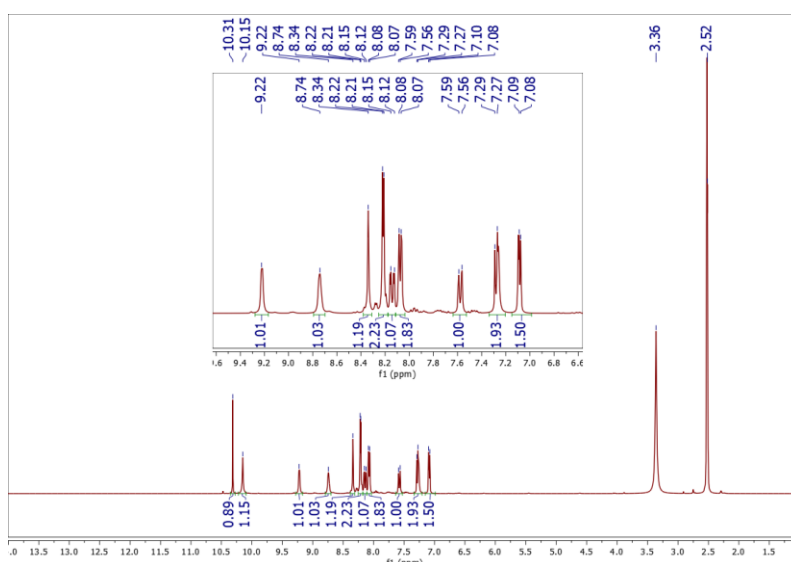
two doublets at δ (8.23ppm, 2H, 8.06ppm, 2H) with coupling constant (³J=8.53Hz), attributed to (H_d, H_e) respectively, and the appearance of two doublets at δ (7.46ppm, 2H, 7.24ppm, 2H) with coupling constant (³J=8.68Hz), attributed to (H_g, H_f) respectively, the appearance of a singlet at δ (3.98ppm, 3H) attributed to the proton of (OCH₃) group.

Fig. 2: ^1H -NMR Spectrum of $[\text{F}_2]$ compound

3.2 Characterization of tetrazole derivatives $[\text{F}_3, \text{F}_4]$:

The IR spectra of the compounds $[\text{F}_3, \text{F}_4]$ showed the disappearance of the $(\text{C}=\text{N})$ band and the presence a band at $(3406, 3446) \text{ cm}^{-1}$, $(3213, 3222) \text{ cm}^{-1}$ due to the (OH) and (NH) groups respectively [26], the spectra displayed at $(3075, 3016) \text{ cm}^{-1}$ refer to the $\nu(\text{CH-Aromatic})$ group, the band showed at $(1582, 1585) \text{ cm}^{-1}$, $(1491, 1483) \text{ cm}^{-1}$ attribute to $\nu(\text{C}=\text{C})$ groups. Also, a band at $(1420, 1436) \text{ cm}^{-1}$ belongs to the $(\text{N}=\text{N})$ group [24], The $\nu(\text{S}=\text{O})$ and $\nu(\text{N}-\text{N})$ stretching bands displayed at $(1385, 1375) \text{ cm}^{-1}$ and $(1036-1068) \text{ cm}^{-1}$ respectively [26]. Other bands are listed in Table 2.

^1H NMR spectrum of compound $[\text{F}_3]$ in figure (3) showed two singlets signal at $\delta(10.31\text{ppm}, 1\text{H}, 10..15\text{ppm}, 1\text{H})$ due to the OH group, and a peak at $\delta(9.22\text{ppm}, 1\text{H})$ attributed to $(\text{CH}=\text{N})$ group, the peak at $\delta(8.74\text{ppm}, 1\text{H})$ attributed to the proton of (NH) group, the appearance of a singlet at $\delta(8.34\text{ppm}, 1\text{H})$ attributed to (H_a) , the appearance of two doublets at $\delta(8.14\text{ppm}, 2\text{H}, 7.58\text{ppm}, 2\text{H})$ with coupling constant ($^3J=7.83\text{Hz}$) attributed to (H_b, H_c) respectively, the appearance of two doublets at $\delta(8.22\text{ppm}, 2\text{H}, 8.08\text{ppm}, 2\text{H})$ with coupling constant ($^3J=6.34\text{Hz}$), attributed to (H_d, H_e) respectively, the appearance of two doublets at $\delta(7.28\text{ppm}, 2\text{H}, 7.09\text{ppm}, 2\text{H})$ with coupling constant ($^3J=6.06\text{Hz}$), attributed to (H_g, H_f) respectively [25].

Fig. 3: ^1H -NMR Spectrum of $[\text{F}_3]$ compound

^1H NMR spectrum of the compound $[\text{F}_4]$ in figure (4) showed a singlet signal at $\delta(10.43\text{ppm}, 1\text{H})$ attributed to the OH group, and a peak at $\delta(9.28\text{ppm}, 1\text{H})$ attributed to $(\text{CH}=\text{N})$ group, and the singlet at $\delta(8.73\text{ppm}, 1\text{H})$ attributed to (NH) proton, the

appearance of a singlet at $\delta(8.40\text{ppm}, 1\text{H})$ attributed to (H_a) , the appearance of two doublets at $\delta(8.14\text{ppm}, 2\text{H}, 7.75\text{ppm}, 2\text{H})$ with coupling constant ($^3J=8.69\text{Hz}$) attributed to (H_b, H_c) respectively, the two doublets at $\delta(8.21\text{ppm}, 2\text{H}, 8.06\text{ppm}, 2\text{H})$ with

coupling constant ($^3J=7.90\text{Hz}$), attributed to (H_d , H_e) respectively, the two doublets at $\delta(7.48\text{ppm}$, 2H, 7.27ppm, 2H) with coupling constant ($^3J=8.68\text{Hz}$),

attributed to (H_g , H_f) respectively, the singlet at $\delta(3.98\text{ppm}$, 3H) attributed to the proton of (OCH_3) group [25,26].

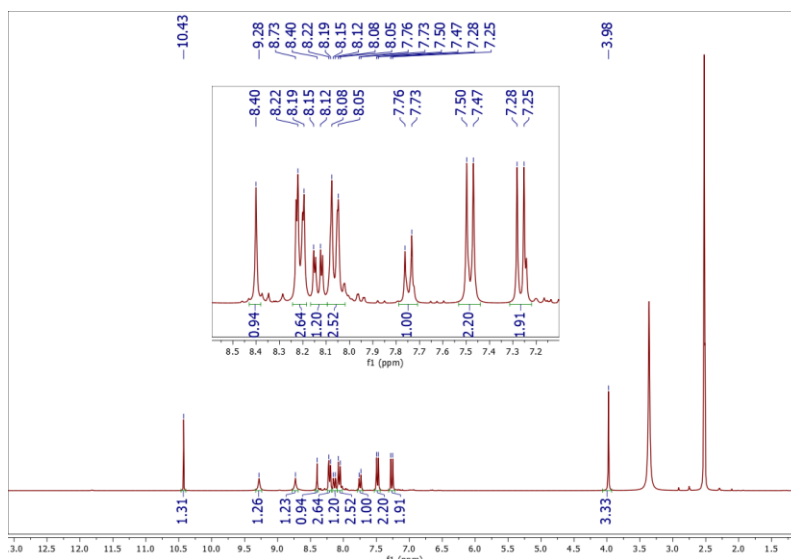


Fig. 4: ^1H -NMR Spectrum of $[\text{F}_4]$ compound

3.3 Anticancer for $[\text{F}_3]$ and $[\text{F}_4]$:

The activity of the prepared compounds (F_4 , F_3) was measured as inhibiting cell growth against the breast-cell line (MCF-7) and the results were compared with cisplatin. The effect of two compounds on the development of MCF-7 after 24 hours was studied and recorded, and the calculated IC values (refer to Tables 3 and 4) shown in (Fig. 5) were recorded. Compounds $[\text{F}_3]$, $[\text{F}_4]$ have IC_{50} values ($52.14 \pm 1.72 \text{ mM}$) and ($12.18 \pm 1.05 \mu\text{M}$) respectively, with the activity of the two compounds measured less than cisplatin ($4.46 \pm 0.04 \mu\text{M}$). The result displayed the reticence of the growth of tumour cells according to the concentration of the two compounds, as the compound $[\text{F}_3]$ showed the least inhibition result on the proliferation of cancer cells while the compound $[\text{F}_4]$ showed the highest inhibition effect due to the presence of methoxide groups in the structure, which increases the cytotoxic activity[27-29].

Table 3: viability (%) of $[\text{F}_3]$, $[\text{F}_4]$ comp.

Concentration (μM)	Cell viability (%)	
	F_3	F_4
0.000	100	100
0.100	91.77	93.32
1.000	86.31	80.1
10.00	72.36	53.13
100.0	52.26	25.65
200.0	25.83	11.71
400.0	8.67	5.38

Table 4: IC_{50} value of $[\text{F}_3]$, $[\text{F}_4]$ against (MCF-7) cell line related to cisplatin

Compound	IC_{50} value (μM)
F_3	52.14 ± 1.72
F_4	12.18 ± 1.05
Cis-platin	4.46 ± 0.04

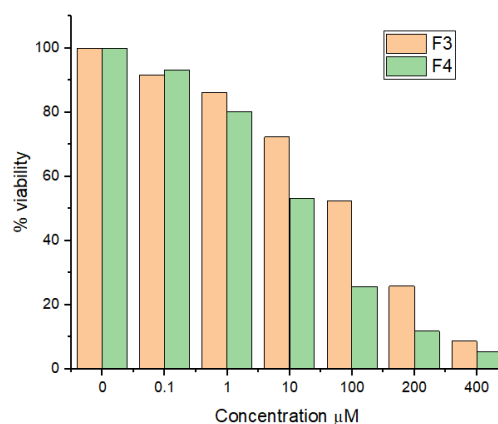


Fig. 5: %viability of (MCF-7) cell after treated with $[\text{F}_3]$, $[\text{F}_4]$ (P value = 0.005 in each case)

3.4 Antibacterial Activity

The tetrazoles showed antibacterial activity more than the Schiff bases derived from them. The compounds $[\text{F}_3]$, $[\text{F}_4]$ showed higher activity against *Pseudomonas aeruginosa* at the lowest inhibitory concentration, and compound $[\text{F}_4]$ gave higher activity against *E. coli* and *Staphylococcus aureus*, while compound $[\text{F}_3]$ gave the highest inhibition against *Streptococcus faecalis* at the lowest inhibitory concentration.

Table 5: Inhibitory activity of some complexes prepared on four types of positive and negative bacteria (the diameter of inhibition is measured in mm)

Comp.	Concentration mg/ml	<i>Pseudomonas aeruginosa</i> -	<i>Escherichia coli</i> -	<i>Staphylococcus aureus</i> +	<i>Streptococcus faecalis</i> +
F1	0.01	8	10	20	16
	0.001	6	7	16	13
	0.0001	3	5	11	10
F2	0.01	5	15	17	13
	0.001	2	11	14	12
	0.0001	1	8	12	10
F3	0.01	10	14	23	17
	0.001	9	11	18	15
	0.0001	7	8	15	12
F4	0.01	13	16	22	13
	0.001	11	14	19	12
	0.0001	7	11	17	11

Conclusions

The correctness and validity structures of the produced compounds were determined using spectroscopic methods and physical measures. At laboratory temperatures, these chemicals do not decompose or alter the color. In comparison to cis-

platin, the compounds [F₃] and [F₄] have limited activity against human breast cell lines (MCF-7). The antibacterial study also showed a clear inhibitory activity of tetrazole derivatives [F₃] and [F₄], higher than compounds [F₁] and [F₂] on the bacterial species studied.

Reference

- [1] S. Hugo, Mitteilungen aus dem Universitätslaboratorium in Pisa: eine neue Reihe organischer Basen, Justus Liebigs Annalen der Chemie 131.1 (1864): 118-119.
- [2] B. Ahmed, B. M. Yamin, Y. O. Ben Amer, G. SH Ghaith, A. A. Almughery, A. Zarrouk, and I. Warad., Crystal interaction, Hirshfeld surface analysis, and spectral analysis of new Dithiocarbazate Schiff bases derivative (LH) and its neutral cis-Cu (L) 2 complex., Journal of Molecular Structure 1224 (2021): 129207.
- [3] A. A. Irzoqi, M. M. Salih, H. M. Jirjes, and M. K. Mensoor., Synthesis, Characterization, and Antibacterial Activity of Complexes of Hg (II) with Mixtures of 3-Hydrazonoindolin-2-one and Diphosphine, or Diimine Ligands., Russian Journal of General Chemistry 90, no. 6 (2020): 1069-1073.
- [4] L. Z. Qiao, P. Xie, M. Zhi Rong, and M. Qiu Zhang., Catalyst-free dynamic exchange of aromatic Schiff base bonds and its application to self-healing and remolding of crosslinked polymers., Journal of Materials Chemistry A 3, no. 39 (2015): 19662-19668.
- [5] D. A. Hussein, F. H. Jumaa, H. K. Salih, Preparation, Characterization, Biological Evaluation and Assess Laser Efficacy for New Derivatives of Imidazolidin-4-one. International Research Journal of Multidisciplinary Technovation, 3(4), (2021) 41-51.
- [6] S. Zhaoqing, Q. Li, and L. Mei., pH-Sensitive nanoscale materials as robust drug delivery systems for cancer therapy., Chinese Chemical Letters 31, no. 6 (2020): 1345-1356.
- [7] D. Sanchari, S. Karim, S. Banerjee, M. Saha, K. D. Saha, and D. Das., Designing of novel zinc (II) Schiff base complexes having acyl hydrazone linkage: study of phosphatase and anti-cancer activities., Dalton Transactions 49, no. 4 (2020): 1232-1240.
- [8] L. V. Myznikov, , A. Hrabalek, and G. I. Koldobskii., Drugs in the tetrazole series., Chemistry of Heterocyclic Compounds 43, no. 1 (2007).
- [9] Y. Manju, S. Sharma, and J. Devi., Designing, spectroscopic characterization, biological screening and antioxidant activity of mononuclear transition metal complexes of bidentate Schiff base hydrazones., Journal of Chemical Sciences 133, no. 1 (2021): 1-22.
- [10] L. V. Myznikov, J. Roh, T. V. Artamonova, A. Hrabalek, G. I. Koldobskii., Drugs in the tetrazole series. Chemistry of Heterocyclic Compounds, 43(1), (2007)1-9.
- [11] R. Satyajit, S. Kumar Das, H. Khatua, S. Das, and B. Chattopadhyay., Road Map for the Construction of High-Valued N-Heterocycles via Denitrogenative Annulation., Accounts of chemical research 54, no. 23 (2021): 4395-4409.
- [12] C. Ajay, and A. Dömling., Convergent Three-Component Tetrazole Synthesis., (2016): 2383-2387.
- [13] P. Jigar, S. Jain, P. K. Jain, D. Kishore, and J. Dwivedi., Greener approach toward synthesis of biologically active s-Triazine (TCT) derivatives: A recent update., Journal of Heterocyclic Chemistry 58, no. 11 (2021): 2049-2066.
- [14] S. J. Khudhair, Q. MA Hassan, A. M. Jassem, H. A. Sultan, A. Dhumad, and C. A. Emshary., An efficient ultrasound-assisted CH₃COONa catalyzed synthesis of thiazolidinone molecule: Theoretical and nonlinear optical evaluations of thiazolidinone-Schiff

- base derivative., *Optical Materials* 133 (2022): 112917.
- [15] J. Sameer, R. B. Mane, K. R. Pulagam, V. Gomez-Vallejo, J. Llop, and C. Rode., The microwave-assisted synthesis of 5-substituted 1 H-tetrazoles via [3+ 2] cycloaddition over a heterogeneous Cu-based catalyst: application to the preparation of 13 N-labelled tetrazoles., *New Journal of Chemistry* 41, no. 16 (2017): 8084-8091.
- [16] M. J. Azarnia, K. Azizi, M. S. Jalali, and A. Heydari., Choline Azide: New Reagent and Ionic Liquid in Catalyst-Free and Solvent-Free Synthesis of 5-Substituted-1H-Tetrazoles: A Triple Function Reagent., *ChemistrySelect* 3, no. 1 (2018): 116-121.
- [17] R. A. Manoj, K. Banik, V. Deshpande, G. Padmavathi, N. K. Roy, G. Sethi, L. Fan, A. P. Kumar, and A. B. Kunnumakkara., Magnolol: a neolignan from the magnolia family for the prevention and treatment of cancer., *International Journal of Molecular Sciences* 19, no. 8 (2018): 2362.
- [18] H. Fahmi, Z. P. Demko, L. Noodleman, and K. B. Sharpless., Mechanisms of tetrazole formation by addition of azide to nitriles., *Journal of the American Chemical Society* 124, no. 41 (2002): 12210-12216.
- [19] J. Peter, and S. B. Baylin., The epigenomics of cancer., *Cell* 128, no. 4 (2007): 683-692.
- [20] Y. Jie, Y. Xu, M. Jiang, D. Zou, G. Yang, L. Shen, and J. Zou., Photochemical property of two Ru (II) compounds based on 5-(2-pyrazinyl) tetrazole for cancer phototherapy by changing auxiliary ligand., *Journal of Inorganic Biochemistry* 193 (2019): 124-129.
- [21] C. Bruce, and T. G. Roberts., Chemotherapy and the war on cancer., *Nature Reviews Cancer* 5, no. 1 (2005): 65-72.
- [22] A. Mohammed, M. A. Toma, A. H. Dalaf, E. Q. Abdullah, and H. K. Salih., Synthesis and characterization of new azo dyes based on thiazole and assess the biological and laser efficacy for them and study their dyeing application., *Egyptian Journal of Chemistry* 64, no. 6 (2021): 2903-2911.
- [23] A. M. Mezher, M. Q. Jabbar, A. H. Dalaf, and H. K. Salih., Application of biological activity of oxazepine and 2-azetidinone compounds and study of their liquid crystalline behavior., *Materials Today: Proceedings* 43 (2021): 2040-2050.
- [24] S. D. Salman, S. Adnan., *Eurasian Chemico-Technological Journal*, 20(3), (2018), 264-276.
- [25] W. A. Fadlallah, M. B. Hussein, and M. M. Mohammed., Synthesis, characterization of Schiff bases derived from salicylaldehyde with some amino acids by a new developed method., *Sch. Int. J. Chem. Mater. Sci* 4 (2021): 46-53.
- [26] H. A. Soliman, A. Kalmouch, H. M. Awad, and N. A. M. Abdel Wahed., Synthesis of new tetrazole derivatives and their biological evaluation., *Russian Journal of General Chemistry* 88, no. 8 (2018): 1726-1733.
- [27] Z. T. Tryfon, A. L. Chandgude, and A. Dömling., Multicomponent reactions, union of MCRs and beyond., *The Chemical Record* 15, no. 5 (2015): 981-996.
- [28] E. Łukowska-Chojnacka, and A. Kowalkowska., Gizińska, M.; Koronkiewicz, M.; Staniszevska, M. Synthesis of tetrazole derivatives bearing pyrrolidine scaffold and evaluation of their antifungal activity against *Candida albicans*., *Eur. J. Med. Chem* 164 (2019): 106-120.
- [29] K. G. Şeker, E. K. Akkol, Y. Genç, H. Bardakçı, Ç. Yücel, and E. Sobarzo-Sánchez., Combretastatins: an overview of structure, probable mechanisms of action and potential applications., *Molecules* 25, no. 11 (2020): 2560.

تحضير وتشخيص وتقييم الفعالية المضادة للسرطان والمضادة للبكتيريا لقواعد شيف جديدة ومشتقات التترازول

يسرى خلف الاسدي¹، فوزي حميد جمعة²، محمد غمام مخلف³، صفا محمود شوكت²

¹ قسم الكيمياء، كلية التربية للعلوم الصرفة، جامعة تكريت، تكريت، العراق

² قسم الكيمياء، كلية التربية للبنات، جامعة تكريت، تكريت، العراق

³ المديرية العامة للتربية في الانبار، وزارة التربية والتعليم، العراق

الملخص

تضمن هذا البحث تحضير مشتقات تترازول 4,4'-(((سلفوناييل بس(1,4-فيناييلين))بس(دايازين-2،1-دايل))بس(2-1-4-معوض(R)فينيل)-4،5-ثنائي هيدرو-1H-تترازول-5-ايل(فينول) (حيث R = OH أو OCH₃) من خلال تفاعل معوضات الأمين في THF كمذيب مع أزيد الصوديوم. تم استخدام الطرق الطيفية FT-IR و ¹H-NMR لتشخيص المركبات المحضرة، وتمت دراسة الفعالية المضادة للبكتيريا ضد أربعة أنواع من البكتيريا حيث تم إثبات أن مركبات التترازول أكثر فعالية من المركبات التي تم اشتقاقها منها، كما تم قياس النشاط المضاد للسرطان ضد MCF-7 من خلايا الثدي البشرية للمركبات المحضرة.