CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.centralasianstudies.org/index.php/CAJMNS
Volume: 07 Issue: 02 | April 2026 ISSN: 2660-4159

Article

Study Of The Antibacterial Activity And Stability Towards Laser Irradiation Of New Oxazolidine Compounds Derived From Schiff Bases

Asmaa Badr Saber [1], Rahma Abdel Hamid Hassan Ali[2], Reem Salwan Noman[3]

[1,2] Tikrit university/college of education for pure science/ chemistry department
[3]Department of Chemistry\College of Science\Tikrit University\ Tikrit/ Iraq
* Correspondence: asmaa.b.sabr@tu.edu.iq

Abstract: In this work, previously synthesized Schiff bases are reacted with glycolic acid using ethanol as a solvent to create heterocyclic pentacyclic rings formed from oxazolidines employing Schiff bases as nuclei. Spectroscopic measurements were used to verify the synthesized compounds' activity. Proton nuclear magnetic resonance, infrared spectroscopy, and quantitative elemental analysis (C.H.N.)—physical measures including melting point, color, and product percentage—are a few examples. Two antibiotic-resistant bacterial isolates—Gram-negative Escherichia coli (Gram-ve) and Gram-positive Staphylococcus aureus (Gram+ve)—were used to assess bioavailability, and the results were compared to controls. The antibiotic comparison reagent (control) was amoxicillin, and the results showed that it had good inhibitory activity against both types of bacteria used with high efficacy and selectivity. The laser activity of the generated compounds was assessed using a visible helium-neon laser. Before being physically exposed, each chemical was exposed to radiation for four distinct times (15, 30, 45, and 60 seconds). The changes in the generated molecules are then recorded.

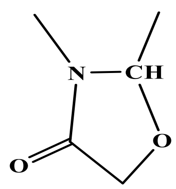
Keywords: Heterocyclic, Oxazolidines, biological activity, laser.

Citation: Ibragimov A. T. Bozorov A. N. and Chundilov K. B. Effects of Fluoride Compounds on Blood Parameters of Calves. Central Asian Journal of Medical and Natural Science 2026, 7(2), 142-146.

Received: 11th Jan 2025
Revised: 26th Jan 2025
Accepted: 8th Feb 2026
Published: 21st Feb 2026

1. Introduction

Compounds with ring structures that contain distinct atoms, such nitrogen, sulfur, or oxygen, are known as heterocyclic compounds. In nature, these substances are found in large quantities. They are used in a wide range of industries, including the medical and industrial sectors [1]. A foreign atom is present in these compounds. Heterocyclic compounds are categorized based on the kind and quantity of atoms in the ring and can contain several heteroatoms. These systems are more stable than thiophenes and furans because they are stable in acids and at moderate temperatures [2]. Oxazolidines are heterocyclic compounds that include nitrogen and oxygen. When they have a carbonyl group at the -4 position, they are referred to as oxazolidine-4-ones. It is usually made by reacting the (C=N) group with glycolic acid hydrazones or Schiff bases [3].



Compounds containing oxazolidines have biological activity. It is necessary because it includes nitrogen and oxygen atoms, and the carbonyl group has high efficiency against malignant disorders and antibacterial activities [4, 5]. Lasers: The two basic processes that are essential to laser function are absorption and emission [6]. It is well known that atoms, ions, and molecules may exist in particular states, each of which has an energy level. The ground state energy level is the energy level that is lower than this. It should be mentioned that an energy level's activity increases with distance from the ground state energy level [7]. The purpose of this work was to create new oxazolidine rings from produced Schiff bases and evaluate their antibacterial efficacy against Staphylococcus aureus and Escherichia coli. Testing these chemicals' stability in the presence of a helium-neon laser was another goal of the investigation.

2. Materials and Methods:

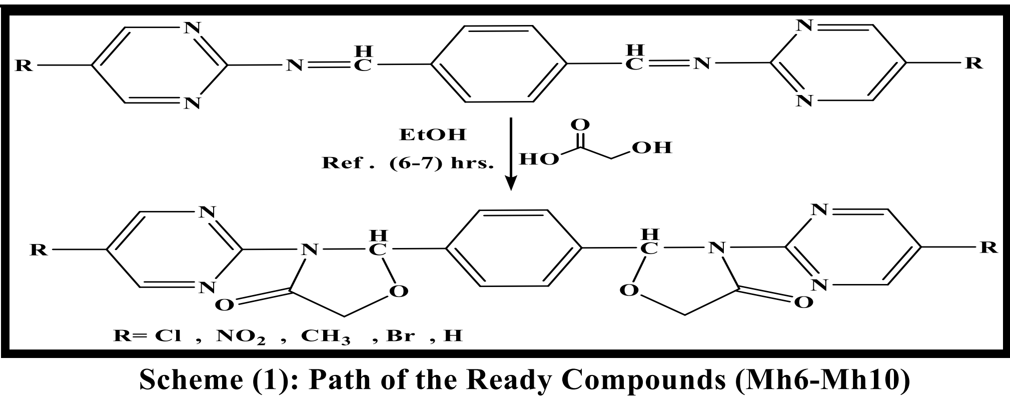
2.1.Chemicals used: Chemicals prepared by Aldrich, BDH Thomas, Fluka, and Merck were used.

2.2. Preparation of Oxazolidine derivatives (Mh_6-Mh_{10}).[8]

After dissolving the previously made Schiff base (0.001 mol) in 30 mL of 100% ethanol, it was combined with glycolic acid (0.002 mol, 0.12 mL) and anhydrous zinc chloride (0.004 g) in 20 mL of ethanol and stirred. Thin layer chromatography (TLC) methods were used to validate the reaction's completion after the mixture was held for six to seven hours. After cooling, the precipitate was filtered, cleaned with cold water, and recrystallized from dioxane. As shown in Table 1

Table (1): Some physical properties of for Prepared compounds (Mh6-Mh10).

Comp. No.	R	Molecular formula	m.p. °C	Yield%	Color
Mh6	4-Cl	$C_{20}H_{14}Cl_2N_6O_4$	243-245	73	Whit
Mh7	4-NO2	$C_{20}H_{14}N_8O_8$	231-233	70	Dark Brown
Mh8	4-CH3	$C_{22}H_{20}N_6O_4$	222-224	76	Light Orange
Mh9	4-Br	$C_{20}H_{14}Br_2N_6O_4$	254-246	75	Yellow
Mh10	4-H	$C_{20}H_{16}N_6O_4$	248-250	71	Light Yellow



Scheme (1): Path of the Ready Compounds (Mh6-Mh10)

2.3. Biological activity study: Mueller-Hinton agar was prepared by dissolving it in one liter of distilled water, heating it and stirring it with a magnetic stirrer, and then autoclaving it at 121 °C and 1.5 bar of pressure to sterilize it. It was placed on a Petri plate, chilled to 50 °C, then frozen at room temperature after two hours. Two colonies of pure bacterial isolates of both Gram-positive and Gram-negative bacteria were transferred from the solid culture medium to test tubes containing five milliliters of distilled water using heat-sterilized holders [9–12]. The tubes were incubated at 30 °C. After 16–20 hours at (37 °C), the turbidity was decreased with a physiological solution until it neared standard values, resulting in a cell count of around 1.5×108 cells/ml. Several of the generated compounds were chemically dissolved using the solvent dimethyl sulfoxide (DMSO). Each solid derivative (0.1) g was dissolved in a medium

(10 ml), and the drug concentrations were (0.1, 0.01, 0.001) mg/ml [13–16]. One milliliter was removed from the solution and nine milliliters of (DMSO) solvent were added in order to achieve a concentration of 0.1 mg/ml of (DMSO). One milliliter of the solution was removed, and nine milliliters of (DMSO) solvent were added to achieve a concentration of 0.01 mg/ml. to create a 0.001 mg/ml solution [17–20].

2.4. Evaluation of various chemicals' laser efficacy [21]

A helium-neon laser (visible laser) was used to measure the laser activity of some of the prepared compounds (Mh6, Mh7, Mh8, Mh9, and Mh10) over four time intervals (15, 30, 45, and 60) seconds. The distance between the beam source and the sample was 10 cm, the power was 1 mW, and the wavelength was 808 nm. The measurements were taken at Tikrit University's College of Science. Following irradiation, physicists in the laser lab examined the created compounds' physical characteristics once again and recorded any changes.

3. Results and discussions

3.1. Characterization of Oxazolidine derivatives (Mh6-Mh10)

The FT-IR spectrum of the prepared compounds showed a band at (1643-1657) cm-1 due to (C=O), a band at (1284-1293) cm-1 due to (C-O), a band at (1220-1229) cm-1 due to (C-N), two bands at (2941-2921) cm-1 and (2901-2879) cm-1 due to aliphatic (CH), and two bands at (1519-1575) cm-1 and (1456-1521) cm-1 due to aromatic (C=C)[22], as in Table 2 and Figures 1 and 2.

Table (2): FT-IR absorption results for Prepared compounds (Mh6-Mh10)

Comp. No.	R	ν(C-H) Arom.	ν(C-H) Aliph.	ν(C-O)	ν(C-N)	ν(C=O)	ν C=N	ν(C=C) Arom	Other
Mh6	4-Cl	3016	2931,2901	1288	1228	1643	1616	1519,1456	ν (C-Cl) 756
Mh7	4-NO_2	3032	2934,2883	1286	1224	1657	1598	1558,1486	ν (N-O)as. sy 1331 Sym.1524
Mh8	4-CH_3	3053	2941,2897	1284	1229	1648	1606	1541,1479	--
Mh9	4-Br	3010	2939,2893	1290	1222	1651	1600	1575,1521	ν (C-Br) 551
Mh10	4-H	3023	2921,2879	1293	1220	1650	1610	1568,1507	--

The ^{1}H-NMR spectrum of the resulting samples confirmed the consumption of the reaction by the deletion of the azimethine associated with Schiff bases. This analysis also revealed characteristic signals associated with (CH_2) at (4.43-3.77) ppm in the synthesized ring. Additionally, a signal believed to be associated with (CH) at (6.32-5.51) ppm was found, along with several signals consistently associated with benzene rings at (8.20-7.19) ppm [23], as shown in Figures 3-7.

Table 3: ^{1}H-NMR Spectral Values of the Compounds

Comp. No.	Chemical Shift (ppm)	Group
Mh6	4.08	CH_2
	5.51	CH
	7.36, 7.91	Ar-CH
Mh7	4.06	CH_2
	6.13	CH
	7.44, 8.20	Ar-CH
Mh8	2.12	CH_3
	4.01	CH_2
	6.02	CH
	7.50, 8.06	Ar-CH
Mh9	4.43	CH_2
	5.93	CH
	7.19-7.79	Ar-CH
Mh10	3.77	CH_2
	6.32	CH
	7.36-8.02	Ar-CH

3.2. Measurement of Elemental Analysis (C.H.N.O.)

To determine if the samples were formed more accurately, this analysis (C.H.N.O.) was used to see if they were proportionate or not. was performed, as shown in Table (4). It was found that the values of the synthesized samples were similar in both theoretical calculations and measurements, and this is considered clear evidence that the samples were seriously synthesized[24, 25].

Table (4): Findings from produced chemicals' elemental analysis (C.H.N.O.)

Comp No.	Molecular Formula	Calculated				Found			
		C%	H%	N%	O%	C%	H%	N%	O%
A 1	$C_{20}H_{14}Cl_2N_6O_4$	50.76	2.98	17.76	13.52	50.56	2.87	17.65	13.43
A 2	$C_{20}H_{14}N_8O_8$	24.86	1.46	10.15	9.93	24.75	1.53	10.04	9.86
A 3	$C_{22}H_{20}N_6O_4$	61.10	4.66	19.43	14.80	61.23	4.52	19.35	14.65
A 4	$C_{20}H_{14}Br_2N_6O_4$	42.73	2.51	14.95	11.38	42.64	2.43	14.81	11.21
A 5	$C_{20}H_{16}N_6O_4$	59.40	3.99	20.78	15.83	59.32	3.88	20.70	15.79

3.3. Evaluation of the Biological Activity of Prepared Compounds

The results of the preparation samples showed a direct relationship between concentration and inhibition; the higher the concentration of the samples, the greater their activity against harmful microbes[26-28]. The study found that the compound [Mh_9] at the highest concentration reached a diameter of 3.5 cm for the inhibition zone, the highest among the samples against Gram-negative bacteria. This may be due to the compound's ability to penetrate the Gram-negative cell membrane and also because it contains an electron-withdrawing bromine group, which increases the compound's activity [29-31]. Against Gram-positive bacteria, the compound [Mh_7] was superior, although all the samples were effective against Gram-positive bacteria. The inhibition strength of this compound reached 3 cm, which is equal to that of the antibiotic. This is attributed to its content of electron-withdrawing chlorine [32-34]. It was noted that the samples containing halogenated groups had the highest activity, confirming that halogenated groups have good activity against microbes, qualifying them as promising future antibiotics. Furthermore, the compound [Mh_7] maintained its activity at low concentrations compared to the antibiotic, indicating that it possesses sufficient energy to act as an antibiotic [35,36]. As in Table 5, Scheme 2 and 3, and Figures 8 and 9.

Table (5): The synthetic chemicals' antibacterial activity (inhibition zone in cm).

Comp. No.	E. Coil Conc. mg/ml			Staph. Aureus Conc. mg/ml		
	0.001	0.01	0.1	0.001	0.01	0.1
Mh6	0.8	1.2	1.9	1.5	2.8	2.8
Mh7	1.5	2.1	2.7	0.4	2.7	3
Mh8	0.9	1.8	1.5	0.6	2	2.5
Mh9	0.8	1.6	3.5	1	1.5	2.4
Mh10	1	1.7	2.4	0.8	2.1	2.3
Amoxicillin	2.1	3.4	4.5	1.4	2.2	3

3.4. Findings from assessing certain produced chemicals' laser activity

In this investigation, several of the produced compounds (Mh6, Mh7, Mh8, Mh9, and Mh10) were exposed to a laser device (He-Ne) for varying durations (15, 30, 45, and 60) in order to determine the laser efficacy. The physical properties (color and melting point) were then examined in the same way as described in Section 2.4 Practical Part, without any changes between each compound again. It was noticed what transpired in the created compounds. It can be observed that the samples retained high stability when exposed for less than a minute, and their physical properties did not change. However, when exposed to radiation for a full minute, the situation changed; the bonds of their molecules broke, resulting in a clear change in color and degree of transparency. These alterations may come from. As seen in Table (6), long-term continuous exposure (60 seconds) to high energy (laser) breaks some of the compound's bonds and may result in the production of new compounds [37,38].

Table (6): The impact of laser beams on some produced compounds (Mh6-Mh10)

	15 S		30 S		45 S		60 S	
Comp No.	**Color**	**M.P (^{0}C)**	**Color**	**M.P (^{0}C)**	**Color**	**M.P (^{0}C)**	**Color**	**M.P (^{0}C)**
Mh6	Whit	243-245	Whit	243-245	Whit	243-245	Light Yellow	226-228
Mh7	Dark Brown	231-233	Dark Brown	231-233	Dark Brown	231-233	Brown	214-216
Mh8	Light Orange	222-224	Light Orange	222-224	Light Orange	222-224	Orange	201-203
Mh9	Yellow	254-246	Yellow	254-246	Yellow	254-246	Light Yellow	243-245
Mh10	Light Yellow	248-250	Light Yellow	248-250	Light Yellow	248-250	Dark Yellow	228-230

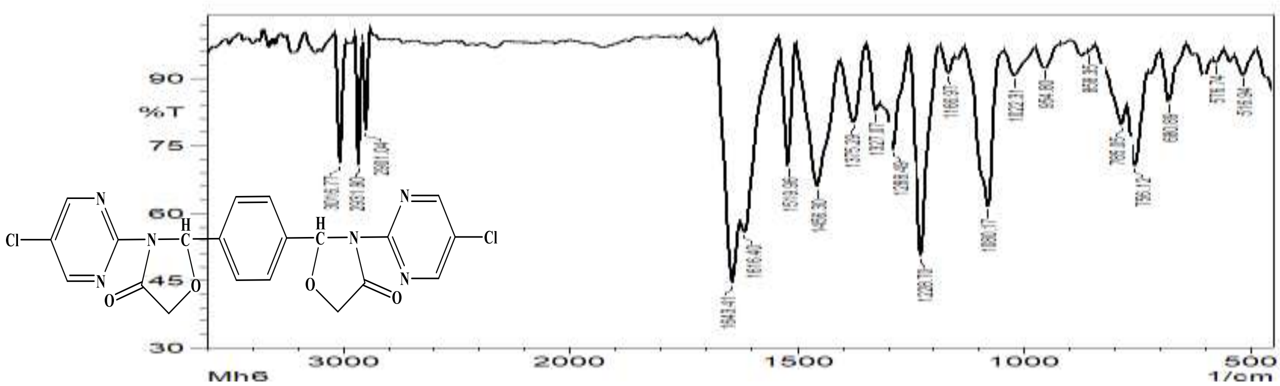


Figure (1): FT-IR spectra of the chemical (Mh6).

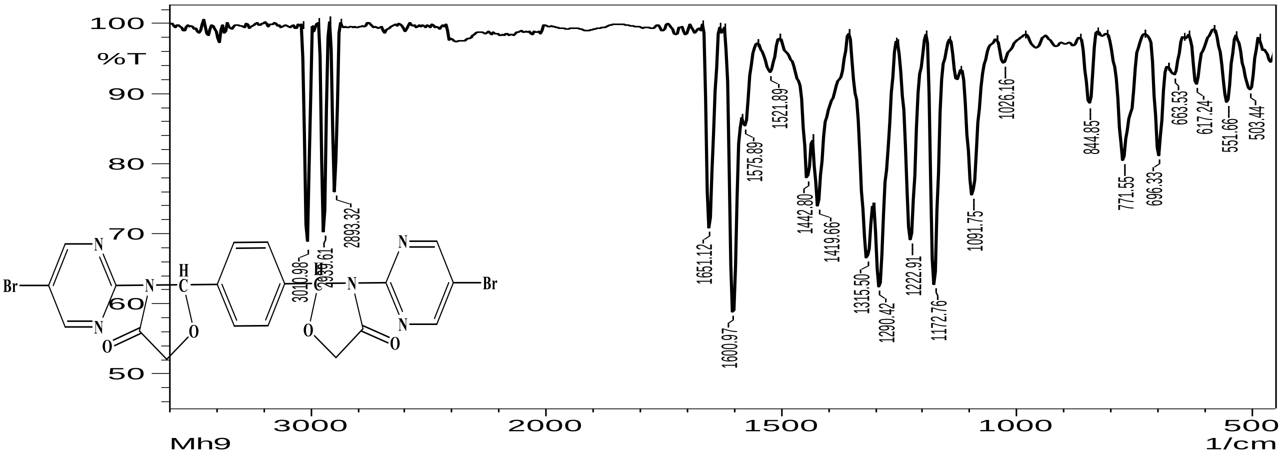


Figure (2): FT-IR spectra of the chemical (Mh9).

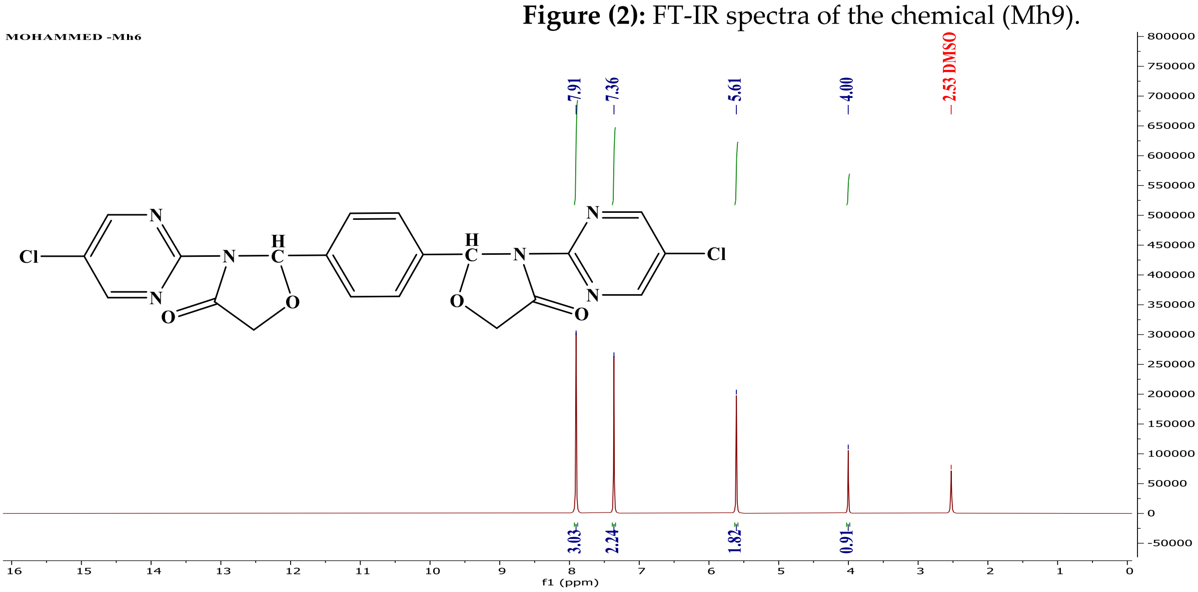


Figure (3): 1-H NMR spectra of the substance (Mh6).

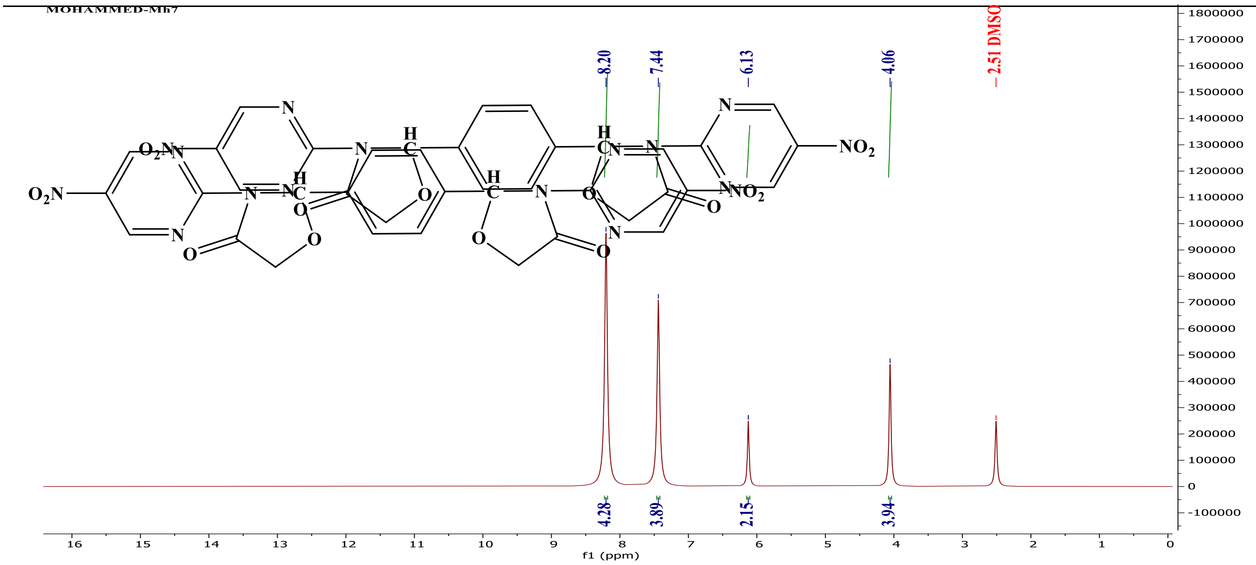


Figure (4): 1-H NMR spectra of the substance (Mh7).

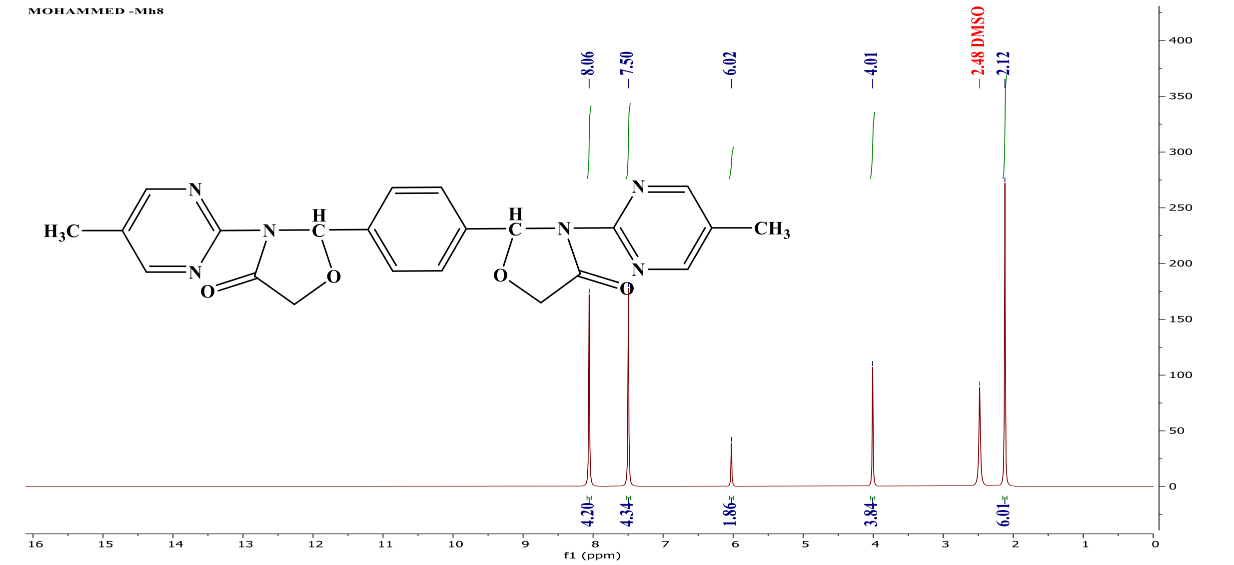


Figure (5): 1-H NMR spectra of the substance (Mh8).

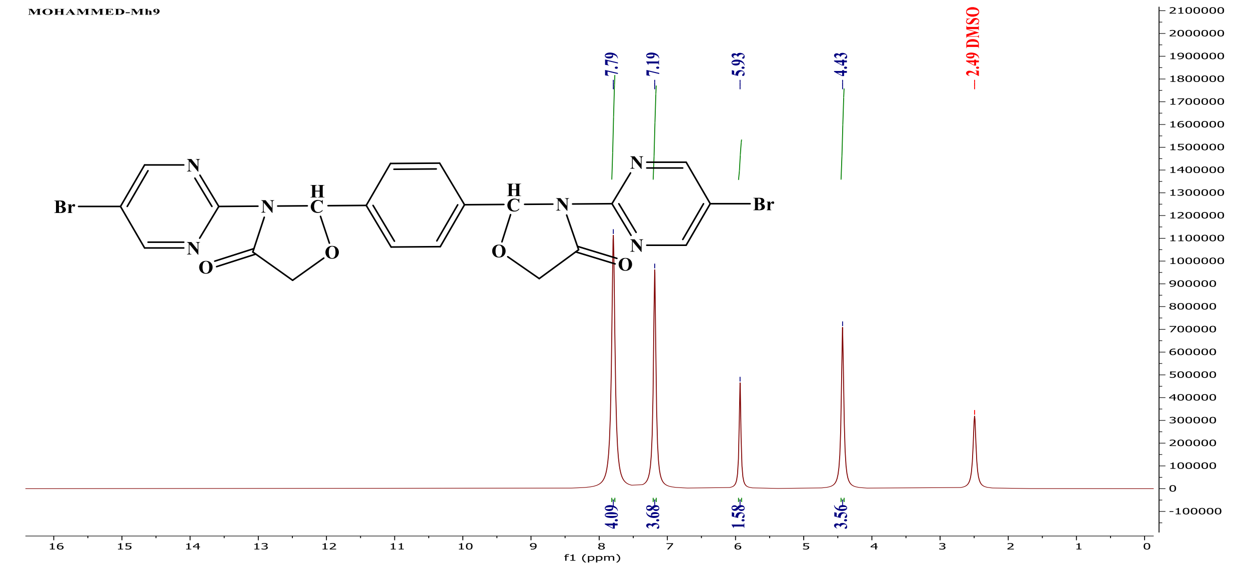


Figure (6): 1-H NMR spectra of the substance (Mh9).

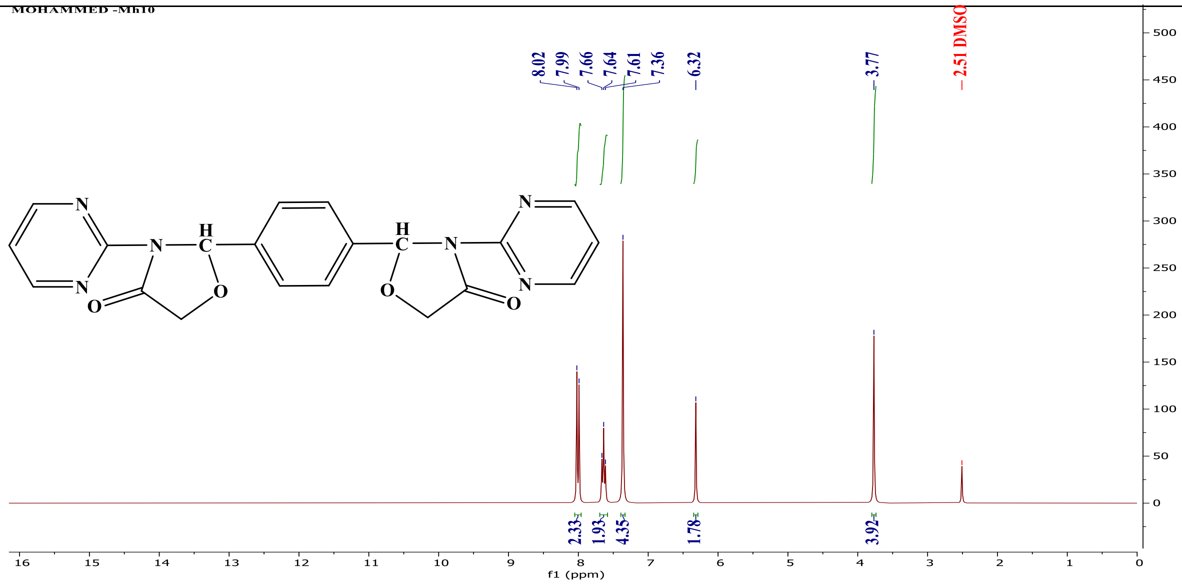
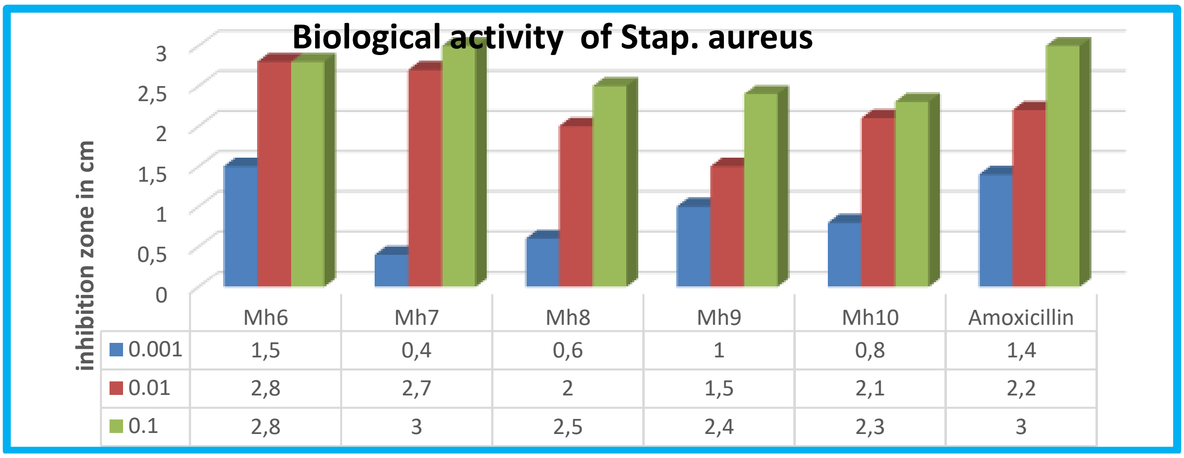
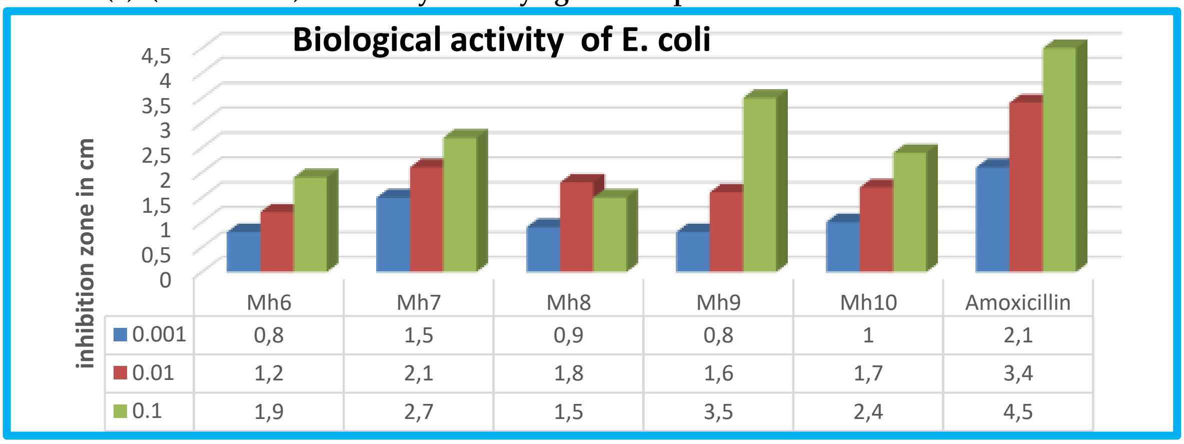


Figure (7): 1-H NMR spectra of the substance (Mh10).



Scheme (2): (Mh6-Mh10) inhibitory efficacy against Staph. aureus



Scheme (3): (Mh6-Mh10) inhibitory efficacy against E. coli

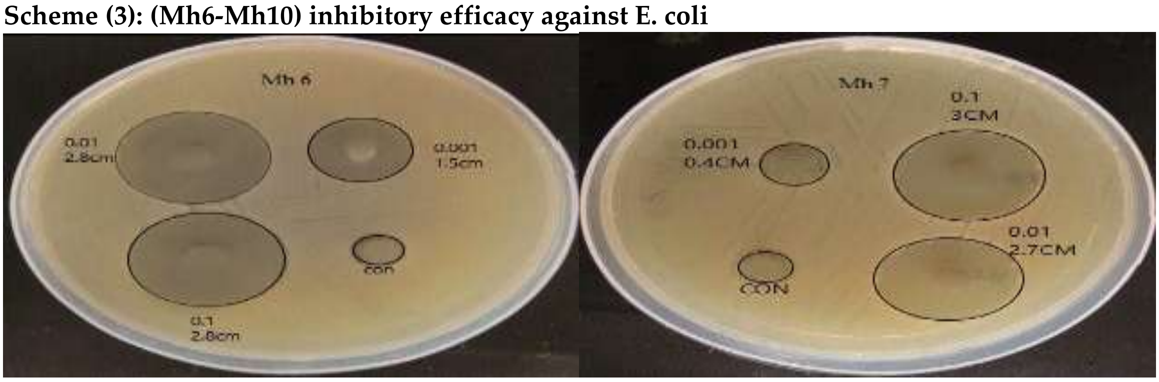


Figure 8: Efficacy of Mh6 and Mh7 against Staph.aureus bacteria.

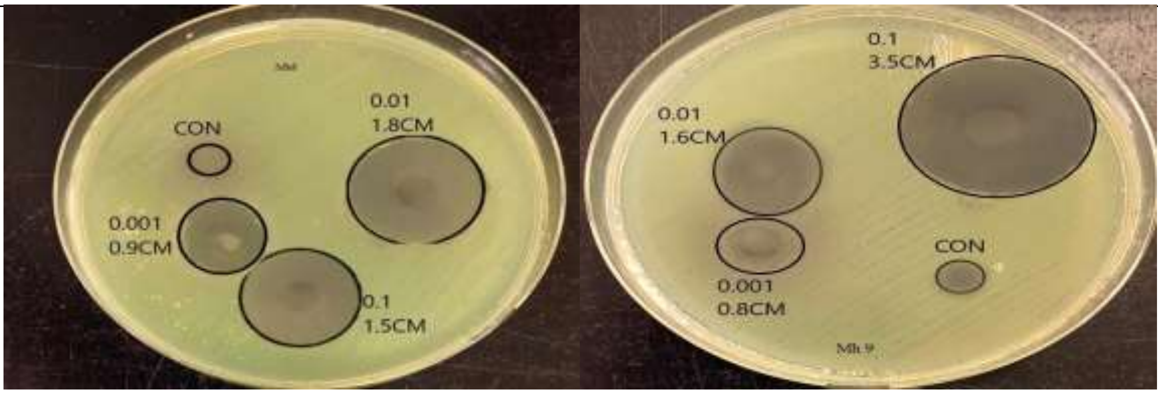


Figure 9: Efficacy of Mh8 and Mh9 against E.Coli bacteria.

4. Conclusions: Five-membered rings created from oxazolidine are always produced when the (C=N) group in Schiff bases or hydrazones reacts with glycolic acid. Proton NMR and infrared spectra of the synthesized compounds demonstrated exceptional purity. Additionally, they demonstrated strong bactericidal action against two different kinds of bacteria, with compound Mh6 exhibiting the greatest activity against positive bacteria at an inhibition rate of 2.8 cm. Compound Mh9, on the other hand, demonstrated the greatest effectiveness against pathogenic bacteria with an inhibition rate of 3.5 cm. The inhibition rate of the medication amoxicillin utilized in the study is comparable to these rates. Additionally, we find that the chemicals' efficacy against these bacteria rises with concentration, peaking at 0.1. Additionally, the synthesized compounds demonstrated excellent stability against helium-neon laser beams for durations ranging from 1 to 45 seconds. They are regarded as stable under typical laboratory settings, which implies that they do not break down or alter their composition under typical circumstances, even if they changed within 60 seconds.

References:

1. Talluh, A. W. A. S., Saleh, M. J., & Saleh, J. N. (2024). Preparation, Characterisation, and Study of the Molecular Docking of Some Derivatives of the Tetrazole Ring and Evaluation of their Biological Activity. *World of Medicine: Journal of Biomedical Sciences*, *1*(7), 15-23.
2. Talluh, A. W. A. S., Saleh, M. J., Saleh, J. N., Al-Badrany, K., & mohammed saleh Al-Jubori, H. (2024). Preparation, characterization, and evaluation of the biological activity of new 2, 3-dihydroquinazoline-4-one derivatives. *EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE*, *4*(4), 326-332.
3. Talluh, A. W. A. S., Saleh, J. N., & Saleh, M. J. (2024). Preparation, Characterization, and Evaluation of Biological Activity and Study of Molecular Docking of Some New Thiazoli-dine Derivatives.
4. Hutchinson, D. K. (2003). Oxazolidinone antibacterial agents: a critical review. *Current topics in medicinal chemistry*, *3*(9), 1021-1042.
5. Abdel-Kader, M. S., Ghorab, M. M., Alsaid, M. S., & Alqasoumi, S. I. (2016). Design, synthesis, and anticancer evaluation of some novel thiourea, carbamimidothioic acid, oxazole, oxazolidine, and 2-amino-1-phenylpropyl-2-chloroacetate derived from L-norephedrine. *Russian Journal of Bioorganic Chemistry*, *42*, 434-440.
6. Saleh, R. H., Rashid, W. M., Dalaf, A. H., Al-Badrany, K. A., & Mohammed, O. A. (2020). Synthesis of some new thiazolidinedione compounds derived from Schiff-based compounds and evaluation of their laser and biological efficacy. *Ann Trop & Public Health*, *23*(7), 1012-1031.
7. Muhammad, F. M., Khairallah, B. A., Saleh, M. J., & Saleh, J. N. (2024). Preparation and Characterization of New Rings of Oxazine Derivatives and Studying Their Biological and Laser Effectiveness and Molecular Docking. *Central Asian Journal of Theoretical and Applied Science*, *5*(4), 190-201.
8. Shaima H. Abdullah et al. (2024). Synthesis, Characterization and Antibacterial Evaluation of Novel Thiazolidine Derivatives, Journal of Radiotherapy, 8(3), 1-9, 9501
9. Khairallah, B. A., Muhammad, F. M., Saleh, J. N., & Saleh, M. J. (2024). Preparation, Characterization, Biological Activity Evaluation, and Liquid Crystallography Study of New Diazepine Derivatives. *World of Medicine: Journal of Biomedical Sciences*, *1*(7), 65-76.
10. Mohammed Jwher Saleh, Jamil Nadhem Saleh, Khalid Al-Badrany, Adil Hussein Dalaf, Reem Suhail Najm, & Abdul Wahed Abdul Sattar Tallulah. (2024). Preparation And Evaluation Of The Biological Activity Of A 2-Amino Pyran Ring Using A Solid Base Catalyst. *Central Asian Journal of Medical and Natural Science*, *5*(4), 130 - 138.
11. Dalaf, A. H., Saleh, J. N., Saleh, M. J., & Talluh, A. W. A. S. (2024). Environmentally friendly synthesis,

bioactivity evaluation and multi-faceted characterization of bis (5-((1H-Imidazol-4-yl) methyl)-3-phenylimidazolidin-4-one) derivatives. *American Journal of Biomedicine and Pharmacy*, *1*(7), 104-114.

12. Saleh, M. J., Saleh, J. N., & Al-Badrany, K. (2024). PREPARATION, CHARACTERIZATION, AND EVALUATION OF THE BIOLOGICAL ACTIVITY OF PYRAZOLINE DERIVATIVES PREPARED USING A SOLID BASE CATALYST. *EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE*, *4*(7), 25-32.
13. Saleh, J. N., & Khalid, A. (2023). Synthesis, characterization and biological activity evaluation of some new pyrimidine derivatives by solid base catalyst AL2O3-OBa. *Central Asian Journal of Medical and Natural Science*, *4*(4), 231-239.
14. Talluh, A. W. A. S. (2024). Preparation, Characterization, Evaluation of Biological Activity, and Study of Molecular Docking of Azetidine Derivatives. *Central Asian Journal of Medical and Natural Science*, *5*(1), 608-616.
15. Al-Tufah, M. M., Jasim, S. S., & Al-Badrany, K. A. (2020). Synthesis and Antibacterial Evaluation of some New Pyrazole Derivatives. *Prof.(Dr) RK Sharma*, *20*(3), 178.
16. Al Rashid, A. A. M., Al Badrany, K. A., & Al Garagoly, G. M. (2020, August). Spectrophotometric determination of sulphamethoxazole drug by new pyrazoline derived from 2, 4-dinitro phenyl hydrazine. In *Materials Science Forum* (Vol. 1002, pp. 350-359). Trans Tech Publications Ltd.
17. Al-Joboury, N. A., Al-Badrany, K. A., Hamed, A. S., & Aljoboury, W. M. (2019). SYNTHESIS OF SOME NEW THIAZEPINE COMPOUNDS DERIVED FROM CHALCONES AND EVALUATION THERE BIOCHEMICAL AND BIOLOGICAL ACTIVITY. *Biochemical & Cellular Archives*, *19*(2).
18. Asmaa Ahmed Mohammed Alrashidy, Omar Adnan Hashem, Kalid Abdul-Aziz ALBadrany. (2024). Spectrophotometric Determination of Vitamin C Using Indirect Oxidation with a New Organic Dye, Journal of Angiotherpay, 8(2), 1-7, 9499
19. Farah M. Muhammad, Bushra A. Khairallah, K. A. Albadrany. (2024). Synthesis, characterization and Antibacterial Evaluation of Novel 1,3-Oxazepine Derivatives Using A Cycloaddition Approach, Journal of Angiotherapy, 8(3), 1-9, 9506
20. Talluh, A. W. A. S., Najm, R. S., Saleh, M. J., & Saleh, J. N. (2024). Synthesis, Characterization, and Evaluation of the Biological Activity of Novel Oxazepine Compounds Derived From Indole-5-Carboxylic Acid. *American Journal of Bioscience and Clinical Integrity*, *1*(8), 10–19.
21. Dalaf, A. H., Saleh, M. J., & Saleh, J. N. (2024). GREEN SYNTHESIS, CHARACTERIZATION, AND MULTIFACETED EVALUATION OF THIAZOLIDINONE DERIVATIVES: A STUDY ON BIOLOGICAL AND LASER EFFICACY. *European Journal of Modern Medicine and Practice*, *4*(7), 155-168.
22. Al-Badrany, K. A., Hamad, A. S., & Al-Juboori, I. K. (2013). Synthesis of Some Mannich and 2, 5-Disubstituted 4-Thiazolidinone Compounds Derived from 4-amino Sulphamethaoxazole. *Kirkuk Journal of Science*, *8*(3).
23. Saleh, M. J., Saleh, J. N., Al-Badrany, K., Yaseen, M. H., Ali, M. H., & Talluh, A. W. A. S. (2025). Preparation and Characterization of Some Oxazolidine-5-one Derivatives and Evaluation of their Biological Activity. *South Asian Research Journal of Natural Products*, *8*(1), 74-84.
24. Ahmed, S. E., Ahmed, Z. A. G., Mustafa, G. S., Saleh, M. J., & Saleh, J. N. (2026). Preparation and Characterization of New Azetidine Rings and Evaluation of Their Biological Activity. *Advanced Journal of Chemistry, Section A*, *9*(1), 146-154.
25. AL-JOBOURY, W. M. R., SULAIMAN, R., SALEH, M., AL-BADRANY, K. A., & SALEH, J. (2025). PREPARATION AND CHARACTERISATION OF AZETIDINE-4-ONE COMPOUNDS AND EVALUATION OF THEIR ANTIBACTERIAL ACTIVITY. *Oxidation Communications*, *48*(4).
26. Saleh, M. J., & Al-Badrany, K. A. (2023). Preparation, characterization of new 2-oxo pyran derivatives by AL2O3-OK solid base catalyst and biological activity evaluation. *Central Asian Journal of Medical and Natural Science*, *4*(4), 222-230.
27. Mahmoud Mehdi Saleh, Jamil Nadhem Saleh, Fahad Farhan Rokan, & Mohammed Jwher Saleh. (2024). Synthesis,Charactarizit and evaluation of bacterial efficacy and study of molecular substrates of cobalt (II) complex[Co (2-(benzo[d]thiazol-2-yloxy) acetohydrazide) (H2O) (Cl2)]. *Central Asian Journal of Medical and Natural Science*, *5*(4), 198 -.
28. Talluh, A. W. A. S., Saleh, M. J., Saleh, J. N., & Al-Jubori, H. M. S. (2024). Synthesis and Characterization of Some New Imine Graphene Derivatives and Evaluation of Their Biological Activity. *Central Asian Journal of Medical and Natural Science*, *5*(4), 272-290
29. Abdul Wahed, A. S. T. (2024). Preparation and Evaluation of Bacterial Activity and Study of the Crystalline Properties of Some 1, 3-Oxazepine-4, 7-Dione Derivatives. *Central Asian Journal of Theoretical and Applied Sciences*, *5*(2), 15-26.
30. Saleh, M. M. Amenah l. Al-Nassiry, Jamil Nadhem Saleh, & Mohammed Jwher Saleh.(2024). Preparation and Diagnosis of New Complexes for Hg (II) With 4-Amino Acetanilide And (Dppp) As A Ligand And Study Of The Bacterial Efficacy And Molecular Docking Of The Prepared Complexes. *Central Asian Journal of Theoretical and Applied Science*, *5*(4), 364-373.

31. Owed, A.I., Al – Jubouri, A.A., & Al-Samarrai, S.Y. (2024). A nano-sensor for copper oxide was manufactured and developed using a new organic precipitant via green chemistry methods. Sensors and Machine Learning Applications.
32. Talluh, A. W. A. S., Saleh, M. J., Saleh, J. N. (2024). Application of infrared and nuclear magnetic resonance spectra in studying the bacterial efficacy of some oxazepane derivatives derived from hydrazones. Sensors and Machine Learning Applications, 3(3). https://doi.org/10.69534/smla/193913
33. Dalaf, A. H., Saleh, M. J., & Saleh, J. N. (2024). Green Synthesis, Characterization and Bioactivity Evaluation of Bis (5-((1H-Imidazol) Methyl)-3-Phenylimidazolidin) Derivatives. *Vital Annex: International Journal of Novel Research in Advanced Sciences (2751-756X)*, *3*(4), 118-128.
34. Saleh, M. J., Saleh, J. N., Al-Badrany, K., Talluh, A. W. A. S., Shannak, Q. A., & Abdulmajeed, A. Z. (2024). Use of Solid Basic Catalysts in the Preparation of Cyclohexenone Derivatives and Evaluation of Their Bacterial Activity. *Vital Annex: International Journal of Novel Research in Advanced Sciences (2751-756X)*, *3*(3), 104-112.
35. Najm, R. S., Saleh, M. J., & Saleh, J. N. (2026). SYNTHESIS AND CHARACTERIZATION OF NEW GRAPHENE NANOCOMPOSITES AND STUDY OF THEIR ANTIBACTERIAL, ANTIFUNGAL AND ANTICANCER ACTIVITY. *Kimya Problemleri*, *24*(3), 333-345.
36. Najm, R. S., AL-Rasheed, A. A., Mohammed, A. S., Garba, B., & Saleh, M. J. (2025). Synthesis, chemical characterization and biological activity evaluation of lamb meat-derived nanocomposite. *Advanced Journal of Chemistry, Section A*, *8*(12), 1890-1903.
37. Talluh, A. W. A. S., Saleh, M. J., & Saleh, J. N. (2026). SYNTHESIS, CHARACTERIZATION, AND EVALUATION OF BIOLOGICAL AND LASER ACTIVITIES OF SOME NOVEL AZETIDINONE DERIVATIVES. *Kimya Problemleri*, *24*(2), 288-295.
38. Sattar Talluh, A. W. A., Saleh, J. N., Saleh, M. J., & Saleh Al-Jubori, H. M. (2024). Preparation and Characterization of New Imidazole Derivatives Derived From Hydrazones and Study of their Biological and Laser Efficacy. *Central Asian Journal of Theoretical and Applied Science*, *5*(4), 202-211.