AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

A comparative study of organic compounds prepared of 2-amino-4-chloro-6-methyl pyrimidine: the role of the active groups in inhibiting bacterial growth.

[Rawaa Naeamah Abdullah]

Ministry of Education, General Directorate of Education of Al-Qadisiyah,Iriq

Corresponding author: rawaa.naeamah.abdullah@ec.edu.iq

Abstract

Step 1: Two substances (2-amino-4-chloro-6-methylpyrimidine and 4-aminoacetophenone) reacted in an acidic median to produce compound (1), which is the first Schiff base.Step 2: Compound (1) reacted with 4-nitrobenzaldehyde to produce compound (2), which is the second Schiff base.Step 3: Compound (2) reacted with chloroacetyl chloride to obtain the final compound, a complex derivative of the azitidine-2-one double-ring (known as a beta-lactam).These compound were Identificatione by infrared spectroscopy (infrared) and (NMR) . The biological effectiveness of the ready combination was tested as antibacterial agents contra two common kind of bacteria S. aureus (gramme-positive) and E. coli (gramme-negative). After that I ٭m study the effect of derivative on Acetylcholine activity in serum Rate Resulting 96.42% and cancer cells were also studied .

Key words : *Schiff bases ,β-lactam , Cholinesterase enzyme ,Cancer Cell*

INTRODUCTION

Schiff bases were prepared by Hugo Schiff (after whom they were later named) in 1864[1]. They are compounds containing the azomethine group (C=N).In recent years,[2]. Schiff bases have gained considerable attention as pharmaceutical agents due to the biological activity exhibited by some of them[3]. Some are used as antibacterial agents, others have anti-spasmodic effects on cardiac blood vessels,[4] and still others have anti-tuberculosis activity[5,6]. Many Schiff bases also have antifungal activity and are used as

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

intermediates in organic synthesis and as corrosion inhibitors[7,8]. Beta-lactams are amide rings named for the nitrogen atom attached to the β-lactam carbon bearing the carbonyl group[9]. Their systematic name is Azetidin-2-one. Beta-lactams are of great biological importance,[10] as they are antibiotics used to treat infections, such as penicillins, cephalosporins, carbapenems, and monobactams[11-13]. Therefore, these drugs are called beta-lactam antibiotics, and they are also known as antibacterial, antifungal, and anti-inflammatory drugs[14-16].

Instruments

Infrared spectra were recorded using KBr discs By using a device Japan shimadzu FT-IR / 8400S the NMR spectra were recorded at the university of Basra/Iraq using a Bruker 500 MHz Spectro photometer, All chemicals and solvents used were of highest purity from (Fluka, Aldrich).

Materials and methods

preparation methods Schiff base compound (1)

Equal moles of the compound (2-amino-4-chloro-6-methylpyrimidine 0.0069 mol, 1 g) were mixed with (4-aminoacetophenone 0.0069 mol, 0.94 g) in (25 ml) of ethyl alcohol. The mixture was heated by sublimation for (4 hours), after adding drop of (CH_3COOH). The mix was then cool and left for (24 hours) while the reaction was monitored by TLC. The precipitate was then filtered, and to purify the precipitate, it was re-crystallized with ethyl alcohol. The crystals were left to dry, and then the yellow precipitate was weighed at (95%) and its melting point was measured, which was approximately (C^0 167-165), (Rf = 0.33).

preparation methods Schiff base compound (2)

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

Equal moles of the prepared compound (Compound 1) (0.0038 mol, 1 g) were mixed with 4-nitrobenzaldehyde (0.0038 mol, 0.58 g). 25 mL of absolute ethanol was added, stirring continuously until dissolved for 20 minutes.Two drops of (CH_3COOH) *were then add as a catalyst. The mix was heat to 78°C for 6 h. The response was then monitored by (TLC) using a mobile phase of benzene-methanol in a 1:4 (V:V) ratio The solution was cooled and left to stand for 24 hours. The precipitate was filtered, recrystallized with ethyl alcohol, and weighed. The precipitate was yellow and had a concentration of 92%. Its melting point was in the range of 127-130°C (Rf = 0.24).*

Preparation of the beta-lactam derivative(3)

Compound (2) was mixed with 0.001 mol (1 g) of 4-nitrobenzaldehyde (0.0025 mol) and 0.006 Mol of trimethylamine (0.21 .ML) in 25 mL of 1,4-dioxane with continuous stirring until dissolved for 15 minutes. Then, 0.0024 mol of chloroacetyl chloride solution (8 mL) was added to this cooled mixture in the form of drops at 10°C for 11 h. The reaction was followed up by(TLC)purification using the mobile phase (benzene-methanol) at a ratio of (1-4)(V:V). The precipitate was filtered and recrystallized with ethyl alcohol, and the percentage was calculated as (71%), (Rf=0.32)

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

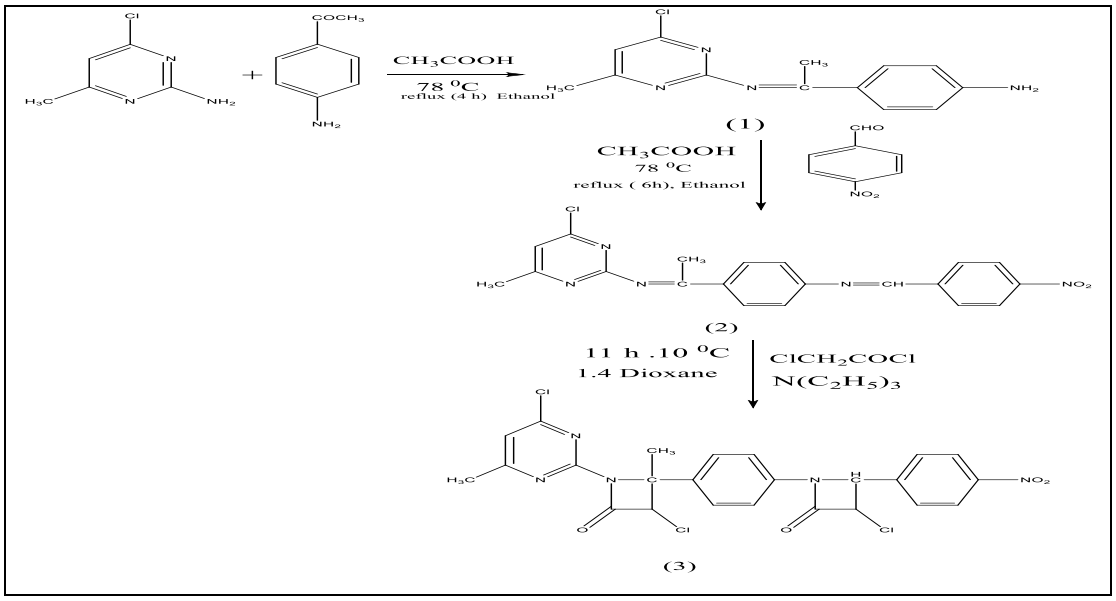
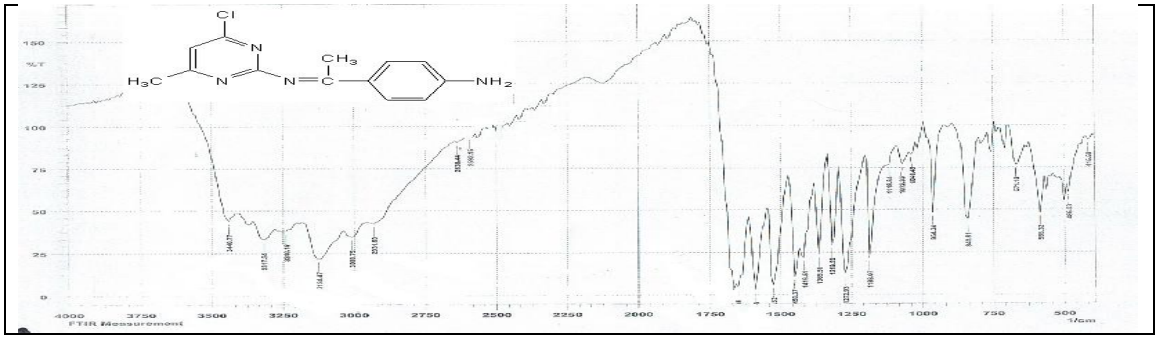


Diagram (1) Preparation of beta-lactam derivative

Outcomes and analysis

ComP.(1): ***E)-4-(1-,((4-chloro;-6-methyl .pyrimidin-2-yl)' imino) ,ethyl) .anilin***

The FT-IR data of comp. (1) Showed band at 3317 cm^{-1} for (NH), 3008 Cm^{-1} for (Ar-H), 1558 cm^{-1} (C = N) inside Pyrimidin ring, 1674 cm^{-1} for (C=N) Shiff base, 2931 cm^{-1} for (C-H) for (CH3), 1512 cm^{-1} due to aromatic (C=C), 802 cm^{-1} for (C-Cl) as presented in Figures 1

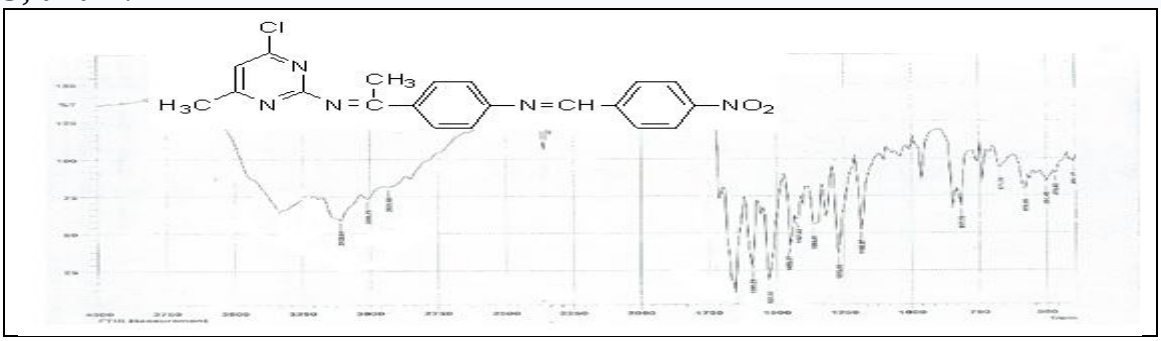


Fig(1): Infrared Spectra Of derivative (1)

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

Compound 2: (1E)-.N-(4-.chloro-6-methyl. pyrimidin-2-yl)-1-(4-((4-nitro . benzylidene).amino) phenyl) ,ethan-1-imino

The infrared datum of comp. (2) appear squad at, 1527 cm^{-1} due to aromatic (C=C), 1512 cm^{-1} for (NO_2). The ^1H NMR (DMSO) spectrum data of com (2) show δ: 0.9 (S, 3H, N=C-CH_3), 2 .3(S, 3H, CH_3 pyrimidine), 6.3-8.3 (M, 9H, Ar-H), 8.5 (S, 1H, CH). The C^{13}-NMR (DMSO) spectral datum of com (2) show δ: 26(C_{20}), 18(C_{19}), 55(C_{21}, C_{22}) 155 (C_2), 120(C_5), 124(C_{12}), 161(C_1), 18(C_{19}), 150(C_{16}), 129-142 (C- arom) as given in number 2, 3, and 4.



Fig(2): Infrared Spectra Of derivative (2)

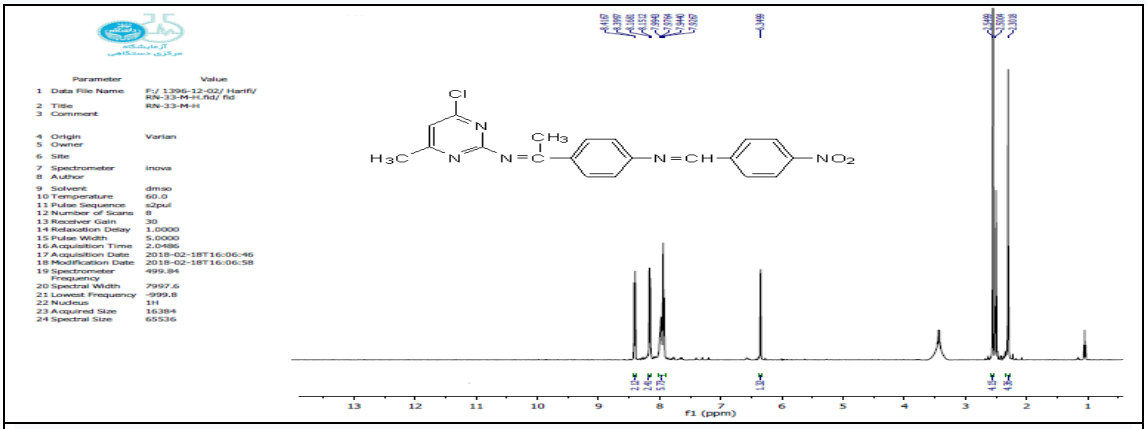
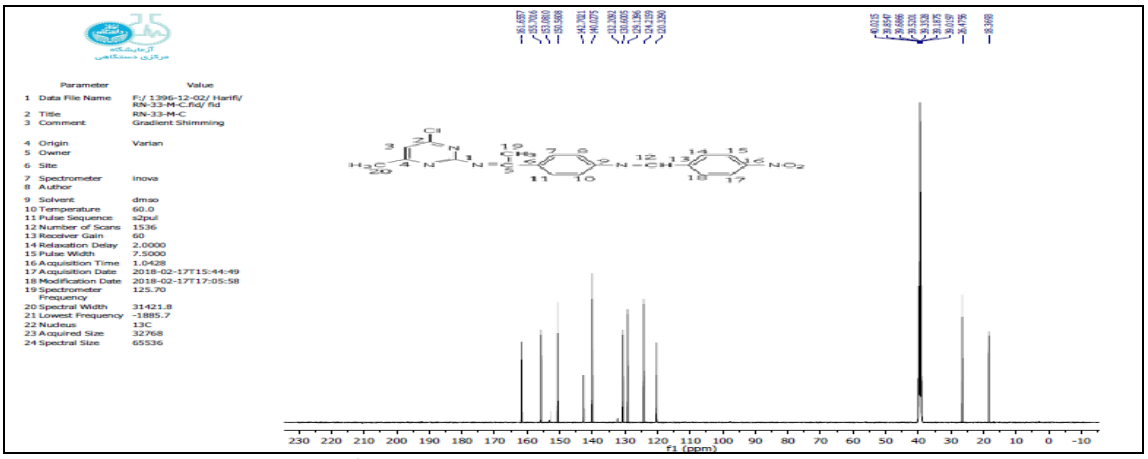


Fig (3) 1H- NMR Shows Spectroscope Of subaltern (2)

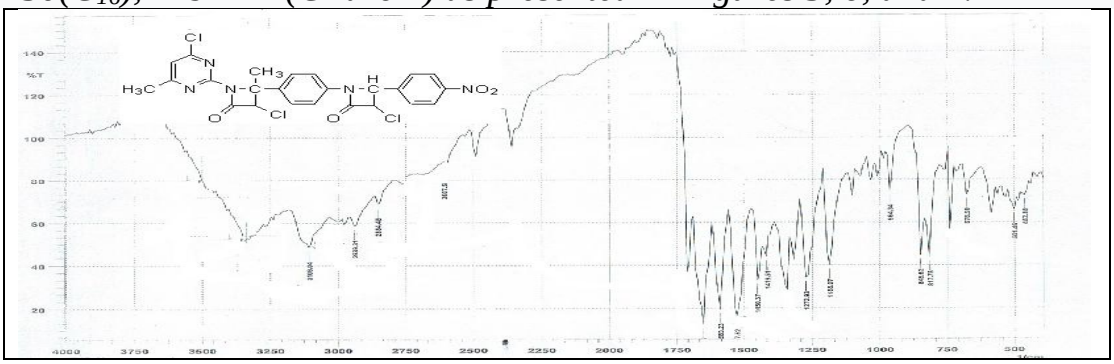
AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals



Fig(4):^{13}C- NMR Shows Spectrometer Of subaltern (2)

Com3:3-chloro,-4-(4-(2-(4-nitrophenyl).-4-oxoazetidin,-1-yl) phenyl).-1-(4- Chloro-6-methyl. pyrimidin-2-.yl)-4- methyl ,azetidin-2-one

The infrared datum of com. (3) appear squad at, 3007 Cm^{-1} for (Ar-H), 1586 cm^{-1} (C = N) inside Pyrimidine ring, 2917cm^{-1} for (C-H) for (CH3), 1527 cm^{-1} due to aromatic (C=C), 1512 cm^{-1} for (NO2),802cm^{-1} for (C-Cl). The ^{1}H NMR (DMSO-d^{6}) spectral appear of com (3) offering δ: 1.1(S, 3H, N=C-CH3), 1.3(S, 3H, CH$_3$ pyrimidine), 7.9-8.4 (M, 9H, Ar-H), 2.2 (S, 1H, CH). The C^{13}-NMR (DMSO-d^{6}) spectral appear of com (3) effering δ: 153(C$_{20}$), 18.5(C$_{23}$), 192-196(C$_7$, C$_{16}$) ,155 (C$_2$), 120(C$_5$), 124(C$_{12}$), 161(C$_1$), 18(C$_{19}$), 150(C$_{16}$), 129-142 (C- arom) as presented in Figures 5, 6, and 7.



Fig(5): Infrared Spectra Of derivative (3)

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

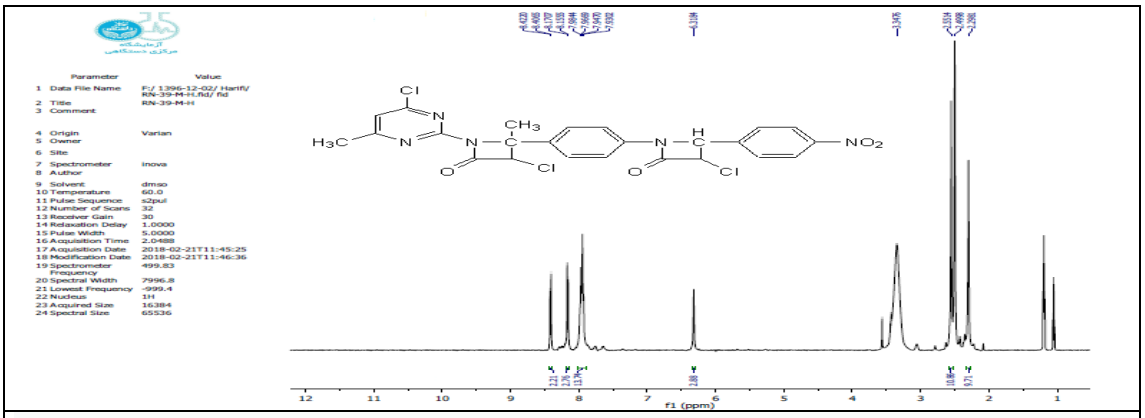
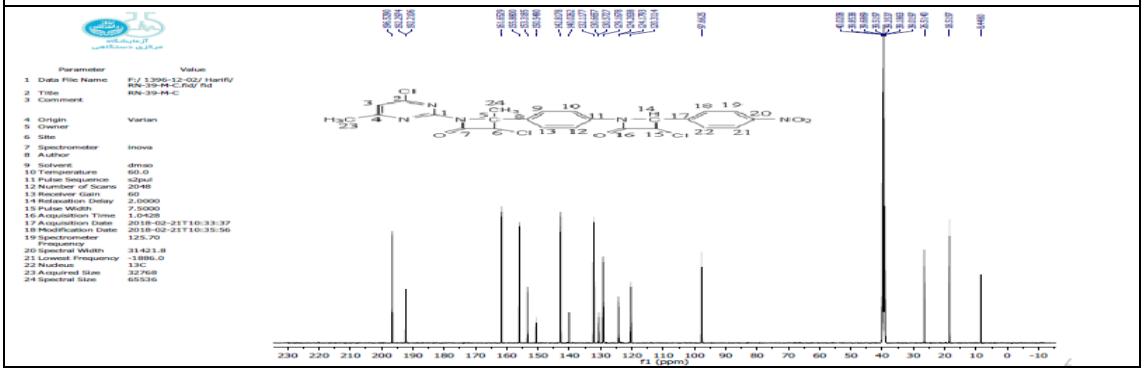


Fig (6) 1H- NMR Shows Spectroscope Of derivative (3)



Fig(7):^{13}C- NMR Shows Spectrometer Of derivative (3)

Biological Activity

The biological activity of the compound was studied, and this study included the use of two types of pathogenic bacteria identified in the laboratory and isolated using microscopic and biochemical tests. These two bacteria are the Gram-negative bacteria (Escherichia coli) and the Gram-favorable bacteria (S. aureus). These types of bacteria are considered to be the cause of many diseases.

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

Tab (1): biological action for complex (1-3)

Comp. no	E. Coli	القطر رقما بـ mm	S. aureus	القطر رقما بـ mm
Am	+++	31	+++	26
Ce	+++	36	-	0
dmso	-	0	+++	25
1-	+++	28	-	0
2-	-	0	-	0
3-	+++	28	-	0

- = No inhibition = inactive, +++ = (More of 20) mm = Good active, Am=Amoxicillin , Ce= Cephalexin , DMSO= Dimethyl Sulfoxide

Figure (8) biological effectiveness of the intended combination contra E. coli bacteria

Figure (9) biological effectiveness of the intended combination contra Staphyl ococcus aureus bacteria

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

Effect of the beta-lactam derivative on the activity of cholinesterase (Ch.E.) enzyme in human blood serum:

At the start of the study, the beta-lactam derivative was dissolved use DMSO as a solvent (this solvent has no effect on the activity of the enzyme under study). A standard solution was prepared, and the concentrations of the compound ranged from 4.5 x 10^{-2} to 4.5 x 10^{-5}.The effect of this derivative on the activity of human serum cholinesterase was studied. The optimal inhibition rate was 96.49%, determined by measuring enzyme activity once without the inhibitor and again with it. One milliliter of the inhibitor was added and mixed with 1.25 liters of buffer solution, following the procedure described above.

Table (2): Effect of the derivative (beta-lactam) as an inhibitor

(M) C	µmol/ml/3min	inhibitor %
None	8.23	0.0
$4.5x10^{-2}$	0.2942	96.42
$4.5x10^{-3}$	15.739	91.23
$4.5x10^{-4}$	1.471	82.12
$4.5x10^{-5}$	2.942	64.25

treating from carcinoma dungeon for Beta-lactam:

next present the carcinoma dungeon educated in textile educated dishes, mingled resolution of β-lactam were prepared. One milligram of β-lactam was dissolved in 50 microliters of dmso setting, and then the volume was increased to 1000 microliters by

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

mixing it with a culture medium free of bovine serum. A series of diluted settling were prepared, starting with 320, 160, 80, 40, 20, and 10 micrograms/mL. next present the settling, the culture plate containing the cancer cells in the holes was removed, and dungeon viability was examined using an inverted light microscope to confirm that these cells were readiness for therapy. Under sterilized stipulation, the obsolete culture medium was removed, while the culture holes were washed once with a neutral phosphate buffer solution to remove any remaining archaic culture medium and dead cells. thereafter, 200 microliters of the prepared concentrations were added to each hole (at a rate of three replicates per concentration). (Number of cells in the holes: 200 x 10³ = 200,000) .

Table (3): Effect of the derivative (beta-lactam) on Hep-G2 liver cancer cell lines and comparison with normal cell lines

Conc. (µg/ml)	Cancer Cell Line %	Normal Cell Line %
320	93.44	90.23
160	83.31	62.40
80	83.40	45.94
40	69.74	2.67
20	29 .54	1.23
10	26.56	1.28

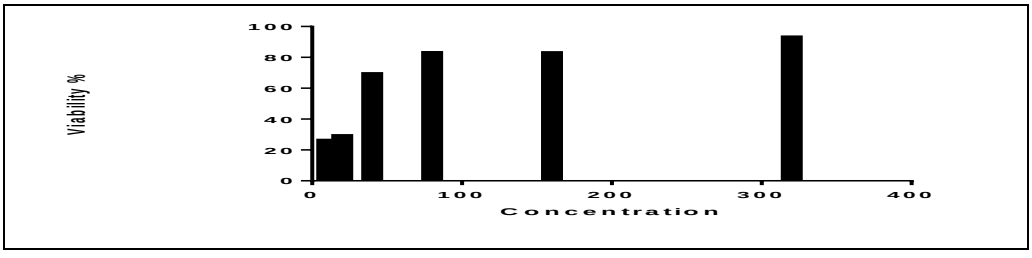


Figure (10) presentation the proportion of cells that stay alive (infected) against diverse centered on a liver cancer cell line, and also shows the significant difference between those concentrations.

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

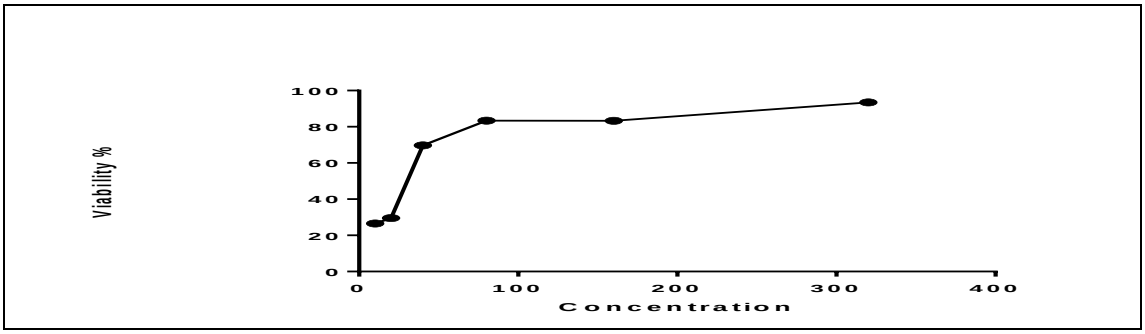


Figure (11) presentation the maximum centered of the treatment that eliminates half (IC50) of infected

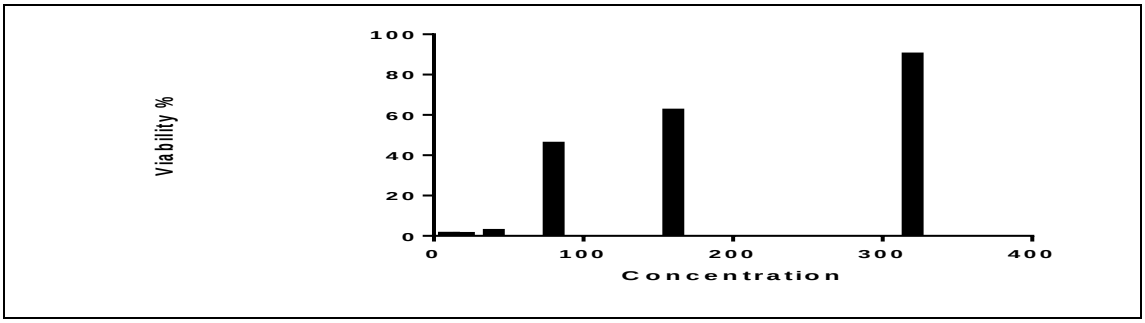


Figure (12) presentation the proportion of cells that stay viable (normal) against diverse centered on a liver cancer cell line, and also shows the significant difference between those concentrations.

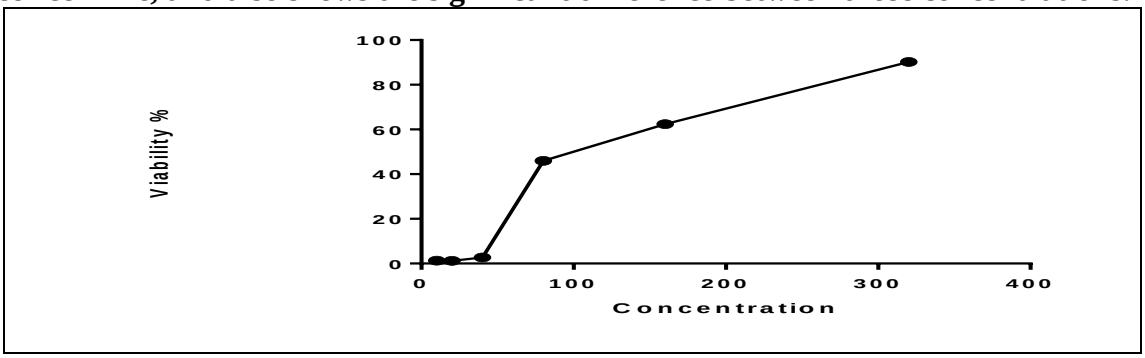


Figure (13) shows the maximum concentration of the treatment that eliminates half the cells (IC50) of normal cells

AL-QADISIYAH JOURNAL OF CHEMISTRY
VOL(1) , NO(2) , 2026
ISSN: 3135-4084
Al-Qadisiyah Journal of Chemistry
Iraqi Academic Scientific Journals

Conclusions

In this study schiff base derivatives and beta-lactam compounds were prepared and it was found that such compounds have significant biological activity, as antibiotics for many diseases therefore, the biological activity of these compounds was studied .good stability is observed in the prepared compounds (Schiff bases and beta-lactams).

Reference

1 . El-ajaily, M.M.,Maihub, A.A.,Mahanta,U.K.,Badhei , G.Mahapatra, R.K.and Das,p.K.Mixed ligand complexes containing schiff bases and their biological activitites : ashort review Rasayan J.Chem, **11**(1). 166-174(2018).

2 . Brzy By lski p , Huczynski A , pytak ,Brzezinski B and Bartl F " Biological Broperties of Schiff Bases and Azo Derivatives of phenols , Curr .Org . Chem , **13**(2) .48-124 (2009).

3 .Anushal.P,PManichandrika,zebaBegum,NSubhangi,IRjPBS. **3**(2)..P 53 (2016).

4. Wisam Obaid Salman . Mahmood Shakir Magtoof " Synthesis and Characterizaition of Plscyclic Beta – Lactams as Blood Cholestrol inhibltors " , J. Thi – Qar . Sci ,**4**.(3) .123 (2014).

5. Moyen Rachel , Ahombo Gabirel , Ngulmbi Etienne Ontsira Nino Esther , Niama Rock Fabien . Yala Gatsiele Claudette and Louembe Delphin " Activity of beta – Lactam Antibiotics and Production of beta – Lectamases in bacteria isolated from Wound in Fections in Brazzaville , Congo " Afri ,J, Micro Rese . **8**(23) , 2290-2294 (2014).

6 .Huda A.Hassan, Ruwaidah S.Saeed , Dheefaf F.Hassan"Synthesis of Novel Heterocyclic compounds via schiff bases " Ir.Nat.j.chem. **5**(6).406-407(2014).

7 .Mohanad y.Saleh"Synthesis and antibacterial evaluation of 2-(chloro/ethyl thio /seleno) -1,8-naphthyridine-3-azetidine derivatives " Diy.j.pur.scie. **13**(3). 105-111 (2017).

8. P.G. Cozzi" Metal Salen Schiff Base complexes incatalysis Practical As Pects " Chem. SOC.Reviews .**33**(7). 410-421 (2004) .

9.Karen Bush . George A.Jaco By "Afunctional classification Scheme for Beta-lactamases and Its antimicrorbial agents and chemotherapy . **39**(6). 1211-1233 (1995).

10. Adnan Kreem Al-Salamy . " detection Of extended spectrum –Beta lactamase enzymes producing E.Coli that isolated from urine " Kufa. J.Vete.Medic .Scie.**3**(1) . 58 (2012).

11.Tougu. Acetyl choline esterase. Mechanism of catalysis and Inhibition Curr.Med . Chem. **1**(2), 161(2001).

12. Adnan Kreem Al- salamy . Detection of extended spectrum- Beta- lactamase enzymes producing E.coli that isolated from urine , Kufa.J.vete. medic. Scie, **3**(1), 58 (2012).

13. Amjed Abbawi saleh" Bio-chemical study on the effect of 4- amidazoldine -4-one compound derived from Naproxen on the effectiveness of choline esterase and some biochemical parametersin rabbit serum Kujss . **12**(3), 2-3(2017)

14. Ehap D.salman . Abbas J.H.Al.saedi, Amel Gh. M.Al- Kazzaz, suhad S . Yahya "the effect of Aqueous Extract and Essential oils of the leaves of Eucaly ptus in Crassate on Beta- lactam Resistant staphylococcus aureus" . Ibn Al-Haitham Jour. Pure , **27**(1), 77 (2014).

15.Mahmood Z.Al- Hasso , subhi H. Khalaf ."Resistance of some Gram Negative Enteric Bacilli Isolated from Lower Respiratory tract Infection to beta- lactam Antibiotics". J.sci, Raf, **6**(24), 67 (2013).

16. Daniela sia, Augusto Villanueva scottl friedman and josep M. LIovet, "Liver cancer cell of origin molecular class and effects on patient prognosis , Gastroenterology, **152**(4), 750 (2017).