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Synthesis of heterocyclic compounds by cyclization of Schiff bases prepared from capric acid hydrazide and study of biological activity

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Abstract

Hydrazides & Schiff's bases are important organic compounds , It is present in most common pharmaceutical compounds and they are used as ligands in the preparation of some complexes in inorganic chemistry due to the presence of pair electrons on the nitrogen atom and the double bond between carbon and nitrogen which give highly effective, The reaction of aldehyde with the acid hydrazide will known as hydrazone. Hydrazone (2) was also prepared in this work from the reaction of the ester of decanoic acid, Where the C=N bond was converted to a tetracyclic ring by reacting with α-chloroacetylchloride to give azetidine (3), Hydrazone (2) was reacted with thioacetic acid to give thiazolidine (4). Also, the imine bond can be cyclized to the oxazepine seven ring heterocyclic by its reaction with phthalic acid or malic anhydride (6, 7), finally the hydrazone was cyclized using sodium azide to give a substituted tetrazole ring (5). The imidazole ring where prepared from the reaction of hydrazone with ethyl acetoacetate (8) in the presence of glacial acetic acid. The imidazole ring contains acidic alpha hydrogen that can be converted to a substituted chalcone on the ring (9). The physical and spectroscopic properties were used to determine the identity of the prepared compounds as infrared spectroscopy and nuclear magnetic resonance spectroscopy. An evaluation of the antibacterial activity of two types of gram-positive and gram-negative bacteria was conducted, and it gave good results.

Keywords: capric acid hydrazide, tetrazole, thiazolidine, oxazepane, azetidine, Schiff's bases

1. INTRODUCTION

Double bond chemistry (C=N)) has an important role in the advancement of chemical sciences for its wide applications in many industrial, biological, analytical, and inorganic pharmaceutical fields[1]. The compounds containing this group were named Schiff's base relative to the Italian scientist (Hugo Schiff), who first attended them in 1864[2]. Schiff's bases have attracted the interest of researchers in the field of medicinal and pharmaceutical chemistry because of their biological efficacy[3]. These compounds have been shown as antibacterial[4], anticonvulsant[5], antidepressant[6], anticancer[7], antihypertensive[8], antipyretic[9], analgesic[10], sedative, hypnotic[11], and anti-HIV drugs[12]. Schiff bases are important organic compounds that contain an Imine bond (C=N) that gives them the unique properties of being strong like double covalent bond[13]. Schiff bases are prepared from a simple condensation reaction between aldehydes or ketones with primary amines[14]. Then, Schiff's bases are also called hydrazone when they result from the condensation of aldehydes or ketones with acid hydrazides[15]. As these compounds should contain an aryl group over nitrogen or carbon to increase its stability and preserve it from cracking or polymerization[16]. The following explanation of the stability of Schiff's bases according to the compounds prepared from them[17]. In other lettuce, Schiff bases are prepared by using acid or base as a catalyst or by heating only without a catalyst and sometimes without heating[18]. Therefore, Schiff's base have attracted the attention of specialized researchers. The researchers[19] were able to prepare ketamines using ethers or phenols by reacting with alkyl or aryl cyanide in the presence of (HCI) and ($ZnCl_2$) as a catalyst [20]. The imine compounds can be converted into several substitutes where the C=N group enters several reactions to give heterocyclic ring compounds where the imine reacts with α-chloroacetylchlorid acid to give azetidine[21], and also with thioglycolic acid to give the thiazolidine ring[22], and also gives the tetrazine ring by reacting the imine with sodium azide[23] and It also gives the Oxazepine ring by reacting with phthalic acid and maleic anhydride[24,25].

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2. EXPERIMENTAL:

All chemicals were purchased from Fluka and BDH Chemical Ltd. The melting points were measured on an Electrothermal 9300 Engineering LTD and are uncorrected. IR spectrum was recorded on Infrared Spectrophotometer Model Tensor 27, Bruker Co., Germany, using KBr discs. The NMR spectrum was recorded on NMR Varian Co. 400 MHz.

2.1. Synthesis of ethyl decanoate (ethyl caprate)(I)

Mix (0.025) mole (4.3 gm) of decanoic acid with (50 ml) of absolute ethanol, add with cooling (5 ml) of concentrated sulfuric acid, and raise the mixture for (4 h), then the solvent is evaporated and the mixture is neutralized with a solution of sodium bicarbonate (20%), then extract the product by shaking it with (20 ml) ether on two times, after which the organic layer is dried using calcium chloride, then the ether is evaporated to give an oily substance with a brown color, its boiling point is (245 °C) with a yield of (94%)[26].

2.2. Synthesis of decanoic acid hydrazide(1)

A mixture consisting of (0.01) (gm2) of ethyl decanoate (A43) and (0.05 mole) (2.5 ml) of aqueous hydrazine was raised in (50 ml) of ethanol for a period of 6 h. The solvent was evaporated under vacuum pressure by half, Then the product is cooled and the formed precipitate is filtered, it is recrystallized using ethanol, to give white needle-shaped crystals its melting point is 91°C with a yield of (88%), Structural formula ($C_{10}H_{22}N_2O$).

Comp.(1) the IR show as : band at (1629) cm^{-1} stretching of (C=O) amide , stretching bands at (3178, 3292, 3317) cm^{-1} to the (NH) group. stretching(CH) aliphatic at (2852-2956) cm^{-1} and bending(CH) aliphatic at (1379,1465) cm^{-1}.

(^{1}H-NMR) show as : (8.9 ppm, s , 1H) NH amide; (4.30 ppm, t , H_2); (1.49 ppm, h, H_2) adjacent to terminal CH_3; (1.27 ppm, q , belongs to 6 symmetrical CH_2 groups); (0.88 ppm , t , CH_3 terminal.)

2.3. Synthesis of (z)-z-(3-bromobenzylidene decanehydrazide(2)

Equivalent weights of decanoic acid hydrazide (0.01 mole) (1.86 gm) are mixed with 0.01 mole substituted benzaldehyde and dissolved in (25 ml) ordinary ethanol, the mixture is raised for (3 h), the mixture is cooled, filtered, then washed with normal cold ethanol after that with water. to crystallized, melting point is 103°C with a yield of (93%) white color, Structural formula ($C_{17}H_{25}BrN_2O$)[27].

Comp. (2) IR. Show as : band at (1630) cm^{-1} stretching (C=N), stretching (C=O) at (1630) cm^{-1}. aromatic (C=C) bands at (1456-1599) cm^{-1}, and (NH) at (3182) cm^{-1}.

(^{1}H-NMR) show as : (0.82 ppm, t , CH_3 Group); (1.22-1.3 ppm, f , due to 6 contiguous CH_2 groups); (2.2 ppm, h ,CH_2 group); (3.35 ppm, t , CH_2 group adjacent to the carbonyl C=O); (11.2 ppm, s , NH. Group); (8.69 ppm, s , N=CH); (7.3-8.1 ppm, m , benzene ring protons).

2.4. Synthesis of N-((2R,3S)-2-(3-bromophenyl)-3-chloro-4-oxoazetidin-1-yl)decanamide(3)

A cooled mixture of (0.001 mol) of one of the hydrazone and (0.002 mol, 0.20 g) of triethylamine dissolved in (20 mL) of dry dioxane is stirred, then added with stirring (0.002 mol, 0.226 g) of α-chloro-acetyl chloride Gradually and in the form of drops for 10 minutes. After completing the addition, stirring continues for (10-12) hours, then the solution is left for 24 hours, then filtered to get rid of the precipitated triethylamine chloride salt, melting point is 97°C with a yield of (57%), white color, Structural formula ($C_{19}H_{26}BrClN_2O_2$).

Compounds (3) IR. Spectra show as : (1685) cm^{-1} (C=O) lactam; (C=O) amide (1670) cm^{-1} ; (C=C) stretch band (1467-1589) cm^{-1} ; (NH) (3182) cm^{-1}.

(^{1}H-NMR) show as: (0.87 ppm, t , terminal CH_3); (1.55 ppm , h , CH_2); (1.23-1.31 ppm, p , 6 symmetrical CH_2);(3.29 ppm, t , CH_2 adjacent the carbonyl group); (8.13 ppm, s , amide NH); (2.61 ppm, s , CH derivatives on the ring); (2.63 ppm , s , CH adjacent to Cl); ((7.94,7.57,7.47,7.37)ppm, m , 4H benzene ring).figure (1) Show the ^{1}HNMR for compound (3)

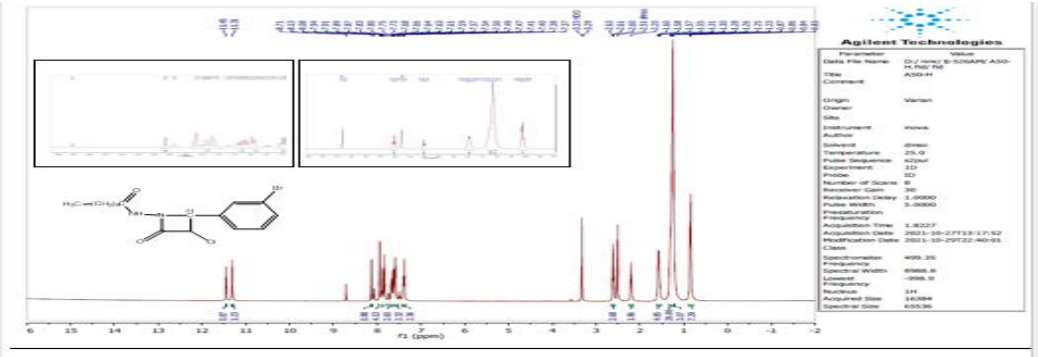


figure (1) Show the ^{1}HNMR for compound (3)

2.5. Synthesis of N-(2-(3-bromophenyl)-4-oxothiazolidin-3-yl)decanamide (4)

A mixture of stoichiometric hydrazone (0.002 mole) and (0.002 mole) (0.18 gm) of thioglycolic acid is dissolved in (25 ml) of absolute ethanol, then (mole of 0.01) (1.36 gm) of anhydrous zinc chloride is added.

The reaction mixture was raised for (8 h) after which the mixture was cooled down, then the formed precipitate was filtered and washed with a solution of (3%) sodium bicarbonate, then recrystallized from (dioxane - water), melting point is 117°C with a yield of (60%), pale white color, Structural formula ($C_{19}H_{27}BrN_2O_2S$).

Compounds (4) IR. as: (1670) cm^{-1} (C=O) thiazolidine ring, (C=O) amide was appeared at (1624) cm^{-1},(935-1086) cm^{-1} stretch of the (C-S-C) group. (C=C) appeared at (1464-1589) cm^{-1}.

(^{1}H-NMR): 0.85 ppm, t , terminal CH_3); (1.58 ppm, h, CH_2 adjacent to terminal CH_3); (1.25 ppm, q, 6 symmetrical CH_2 groups); (3.32 ppm , t , CH_2); (8.71 ppm , s , NH amide); (2.22 ppm, s , CH derivatives on the ring); (2.63 ppm, s , CH_2 adjacent to S atom); ((7.94, 7.59, 7.47, 7.38 ppm, m, 4H benzene ring).

2.6. Synthesis of N-(5-(3-bromophenyl)-4,5-dihydro-1H-tetrazol-1-yl)decanamide (5)

Dissolved (0.001 mole) of one of the hydrazones in (10 ml) of (THF) tetrahydrofuran, then (mole0.001) (0.065 gm) of sodium azide is added, the mixture is heated in a water bath at a temperature of (60-70 C) for a period of h) 10), the resulting solution is filtered and then recrystallized using absolute ethanol, melting point is 116°C with a yield of (71%), Orang color, Structural formula ($C_{17}H_{26}BrN_5O$). [23].

Compounds (5) IR. spectra as: (1514) cm^{-1} stratching (N=N), (3398) cm^{-1} stretching of (NH) ring band, (3122) cm^{-1} (NH) amide (C=O) amide group show in (1670) cm^{-1}.

(^{1}H-NMR) spectrum : (0.85 ppm, t , terminal CH_3); (1.58 ppm , h , CH_2); (1.27 ppm, p , 6 symmetrical CH_2 complexes); (3.33 ppm, t , CH_2 adjacent to the carbonyl group); (8.71 ppm, s, NH amide); (2.20 ppm, s , CH derivatives on the ring); (2.61 ppm, s , cyclic NH); ((7.94,7.83,7.54,7.38 ppm, m , 4H benzene ring). figure (2) Show the ^{1}HNMR for compound (5)

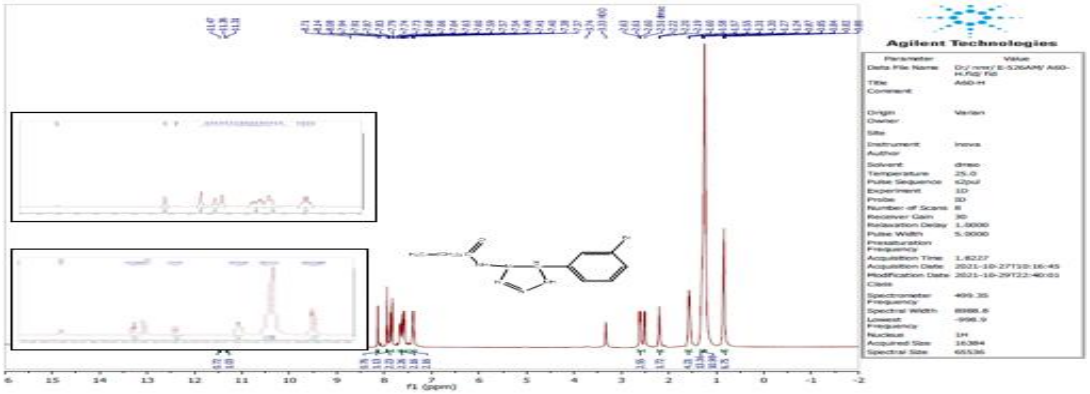


figure (2) Show the ^{1}HNMR for compound (5)

2.7. Synthesis of N-(3-(3-bromophenyl)-4,7-dioxo-4,7-dihydro-1,2-oxazepin-2(3H)-yl)decanamide (6) and N-(4-(3-bromophenyl)-1,5-dioxo-4,5-dihydrobenzo[e][1,2]oxazepin-3(1H)-yl)decanamide (7)

A stoichiometric consisting of (0.001 moles) of one of the prepared hydrazone is mixed with (0.001 moles) of one of the anhydrides in (20 ml) of dry benzene, the reaction mixture is raised for (4 h). in a baker and left in the hood for a few hours until the volatilization of gasoline completes, leaving the sediment alone. The precipitate is taken and recrystallized in ethanol. [28].

Comp(6) : melting point is 98°C with a yield of (85%), yellow color, Structural formula ($C_{21}H_{27}BrN_2O_4$).

Comp(7) : melting point is 93°C with a yield of (71%), pale yellow color, Structural formula ($C_{25}H_{29}BrN_2O_4$).

Compounds (6) IR. spectra as: (1668) cm^{-1} (C=O) lactone; (1690) cm^{-1} (C=O)) lactams; (1620) cm^{-1} (C=O) amide group, (3182) cm^{-1} (NH) amide group, (2852-2920)cm^{-1} (CH) aliphatic.

(^{1}H-NMR) spectrum (0.83ppm, t ,terminal CH_3); (1.59 ppm, h ,CH_2 adjacent to terminal CH_3); (1.24 ppm, p , 6 symmetrical CH_2); (2.61 ppm, t, CH_2 adjacent to the carbonyl group); (8.14 ppm, s , amide NH); (2.20 ppm, s , CH derivatives on the ring); (6.27 ppm , s , H-C=C-H symmetrical); ((8.07,7.74,7.57,7.36) ppm, m , 4H benzene ring).

Compounds (7) IR. spectra as : (1851) cm^{-1} (C=O) lactone, (1764) cm^{-1} (C=O) lactams (3182)cm^{-1} (NH) amide group , (2850-2953) cm^{-1} aliphatic (CH).

(^{1}H-NMR) spectrum as: (0.83 ppm, t , terminal CH_3); (1.58 ppm, h ,CH_2 adjacent to terminal CH_3); (1.23 ppm, q , 6 symmetrical CH_2 groups); (2.61 ppm, t ,

CH_2 adjacent to the carbonyl group); (8.70 ppm, t , NH amide); (2.20 ppm, s , CH on the ring); ((8.17,8.10,8.02,7.96,7.82,7.56,7.46,7.36)ppm, m , 8H two derivatives benzene rings).

2.8. Synthesis of 2-decanoyl-5-methyl-2,4-dihydro-3H-pyrazol-3-one (8)

Mix (0.002 mole) of decanoic acid hydrazide with (0.002 mole) (0.26 gm) of ethyl acetate in 20 ml) of absolute ethanol and 5 drops of glacial acetic acid for a period of (h3) with shaking and stirring from time to time. Then the mixture is cooled, and the formed precipitate is filtered, recrystallized using ethanol, and dried to give a white precipitate with a melting point is 62°C with a yield of (81%), Structural formula ($C_{14}H_{24}N_2O_2$).

Compounds (8) IR. spectra as : (1660) cm^{-1} (C=O) lactone, (1676) cm^{-1} (C=O) amide, (1630)cm^{-1} (C=N) group.

2.9. Synthesis of 4-(3-bromobenzylidene)-2-decanoyl-5-methyl-2,4-dihydro-3H-pyrazol-3-one (9)

Dissolve (0.001mole) (0.25gm) of pyrazole-3-on-decanoic derivative (A75) in (25 ml) of ethanol in a suitable glass flask equipped with a magnetic stirrer, then add to it (10ml) of a 10% KOH solution) with stirring. for (2 min), then added to the mixture (0.001mole) of one of the substituted benzaldehyde dissolved in (10 ml) of absolute ethanol in the form of batches with stirring for a period of (6 h), then cooled and crushed ice was added to it was a solid precipitate formed, filtered and washed With cold water, it is then dried and then recrystallized with ethanol. melting point is 252°C with a yield of (55%), Color is light peach, Structural formula ($C_{21}H_{27}N_2O_2$).

Compounds (9) IR. spectra as : (1650) cm^{-1} (C=O) chalcone, (1662) cm^{-1} (C=C) α,β-unsaturated Carbonyl, (1632)cm^{-1} (C=N) group.

(^{1}H-NMR) spectrum as: (0.85 ppm, t , CH_3); (1.25-1.5 ppm, p , 6 contiguous CH_2 groups); (2.1 ppm, h, CH_2 group adjacent to the terminal CH_3); (3.33 ppm, t , CH_2 group adjacent to the carbonyl C=O); (1.55 ppm, s , CH_3 derivatives on the ring); (2.62 ppm, s , CH=C); (7.37 - 8.16 ppm, m ,benzene rings). figure (3) Show the ^{1}HNMR for compound (9)

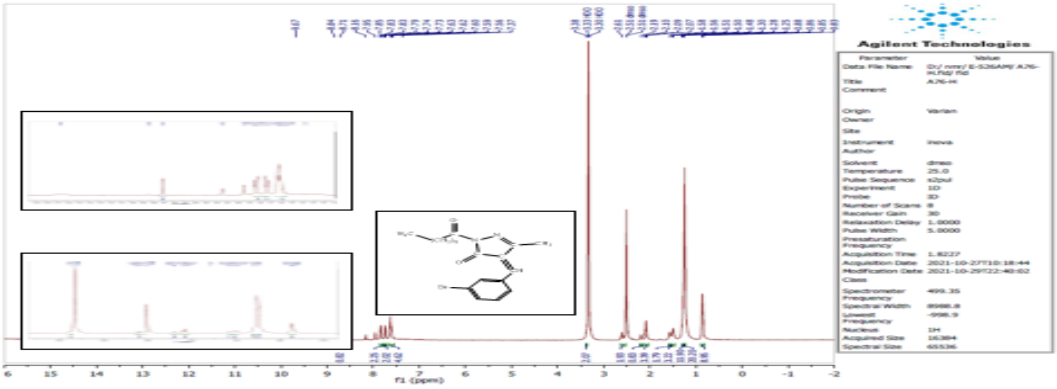


figure (3) Show the ^{1}HNMR for compound (9)

3. BIOLOGICAL EFFICACY

The method of (Levine) and others (190) (1997) was followed, based on the method of (Vandepitte) and others (191) (1991), as they were inoculated (injected) in the middle of the nutrient broth with single colonies of the previously mentioned bacteria and incubated separately. At a temperature of (37 °C) for a period of (18-24 hours), then the bacterial suspension was diluted with physiological solution (normal saline) in comparison with the standard test tube Macfarland No. (1) Macfarland No.1, which contains (108) cells/cm3 of the bacterial suspension. , and spread it on the surface of the usual nutrient agar using soybeans, and the dishes were incubated in the incubator for a period of (30 minutes) to obtain the impregnation.

To study the antibacterial activity of the prepared materials on bacterial growth, discs of filter paper (Whatman No. 1) with a diameter of (6) mm saturated with different concentrations of the materials dissolved in dimethyl sulfoxide were prepared. Then the discs were fixed with sterile forceps and incubated at a temperature of (37°C) for a period of (18-24) hours, after which the inhibition areas were measured and compared with the standard antibiotic (Ciprofloxacin) as control samples (19-20)[29].

The results obtained can be seen in Table (1), where each of the compounds (4,5,9) for *E. Coli* and (4,5,7) for *Staphylococcus aureus* gave a higher biological activity than the antibiotic used as a control agent, while the remaining compounds gave lower values than those obtained from the control agent.

4. RESULTS AND DISCUSSION

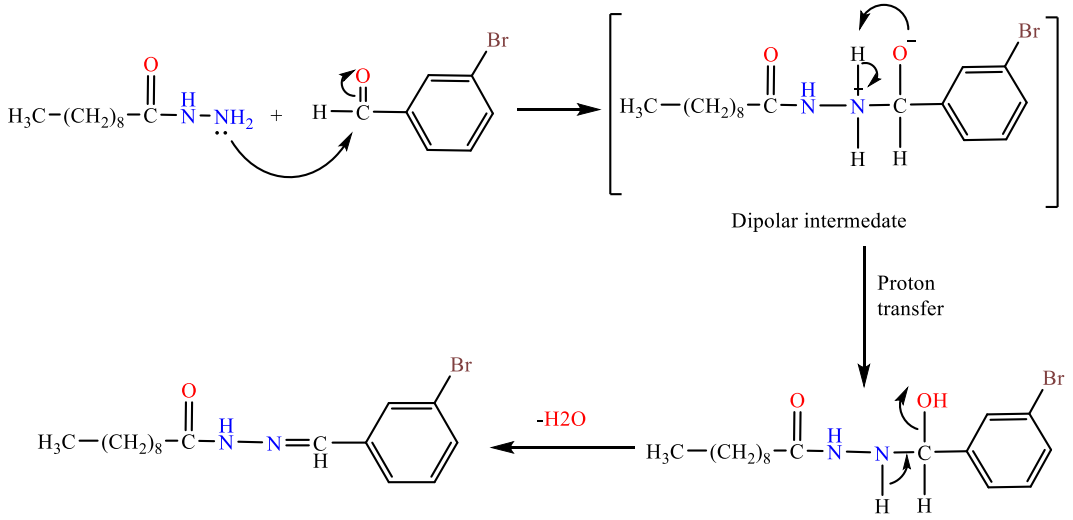
The identity of the prepared hydrazide was determined by infrared spectroscopy, as the spectrum showed a band at (1629) cm^{-1} belonging to the stretching of amide carbonyl ((C=O) and three stretching bands at (3178, 3292, 3317) cm^{-1} to the (NH) group. The spectrum also showed a stretching band belonging to (CH) aliphatic at the range (2852-2956) cm^{-1} and bending (CH) aliphatic at (1379, 1465) cm^{-1}.

As for the bands shown in the (^{1}H-NMR) spectrum, they are: Single bundle at 8.9 ppm due to amide NH; Triple band at 4.30 ppm of CH_2 adjacent to the carbonyl group; A hex bundle at 1.49 ppm returns to CH_2 adjacent to terminal CH_3; A quintuple at 1.27 ppm belongs to 6 symmetrical CH_2 groups; Triple packet at 0.88 ppm back to CH_3 terminal.

The hydrazone was prepared from the densification of decanoic acid hydrazide with substituted benzaldehyde for 3 hours in the presence of conventional ethanol. The reaction mechanism is as follows: (Scheme -1-)

Table (1): The biological activity of the compounds (1-9)

Comp. No.	*E. Coli*	*Staphylococcus aureus*
1	12	10
2	14	20
3	12	16
4	19	22
5	22	23
6	11	13
7	7	22
8	15	12
9	18	18
Ciprofloxacin Control	17	21

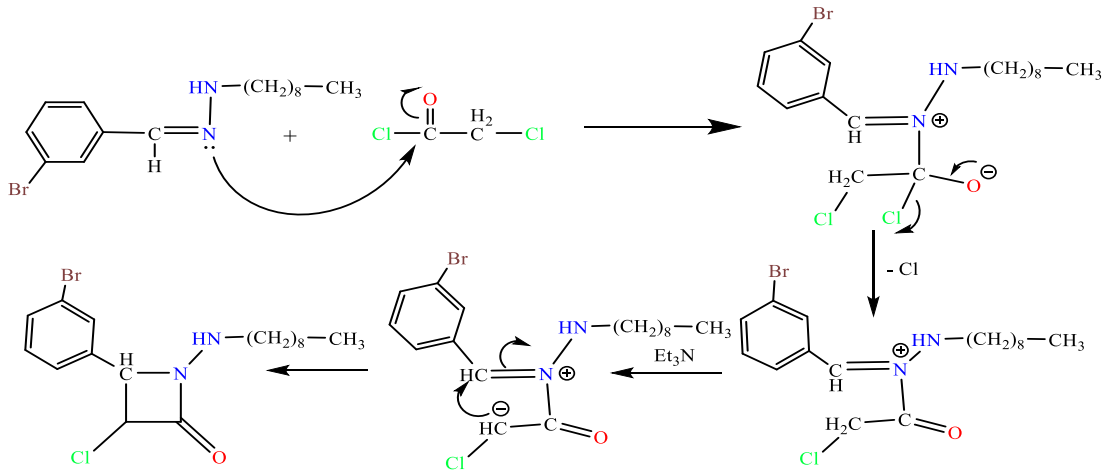


Scheme-1-: Mechanism of preparation of hydrazones (Schiff bases).

The above compounds (2) were diagnosed by infrared spectroscopy, as the spectrum showed distinct bands at the frequency range (1630) cm^{-1} that go back to stretching (C=N), and the absorption bands of stretching (C=O) appeared within the range (1630) cm^{-1}. As for the aromatic (C=C) bands, they appeared in the range (1456-1599) cm^{-1}, which are usually very close to the values of absorption (C=N) as well as the bands that return Stretching of the band vibration (NH) within the range (3182) cm^{-1}.

The proton nuclear magnetic resonance (^{1}H-NMR) spectrum of compound 2 was studied, as it appeared: Triple Pack (0.82 ppm) of CH_3 Group No. 1; Five-pack at (1.22-1.3 ppm) due to 6 contiguous CH_2 groups; Hexagonal package at (2.2 ppm) belongs to CH_2 group No. 2; A triple-band at (3.35 ppm) belongs to the CH_2 group adjacent to the carbonyl C=O; Single package at (11.2 ppm) belonging to the NH. group; Single package at (8.69 ppm) belongs to group N=CH; Multiple bands at (7.3-8.1 ppm) are due to the benzene ring protons.

Hydrazone reacts with α-chloro-acetyl chloride in dry dioxane containing triethylamine to give azetidine-2-one compounds, as α-chloro-chloride acid is added to the reaction mixture slowly with stirring until the reaction is complete. The reaction mechanism is as follows: (Scheme-2-)

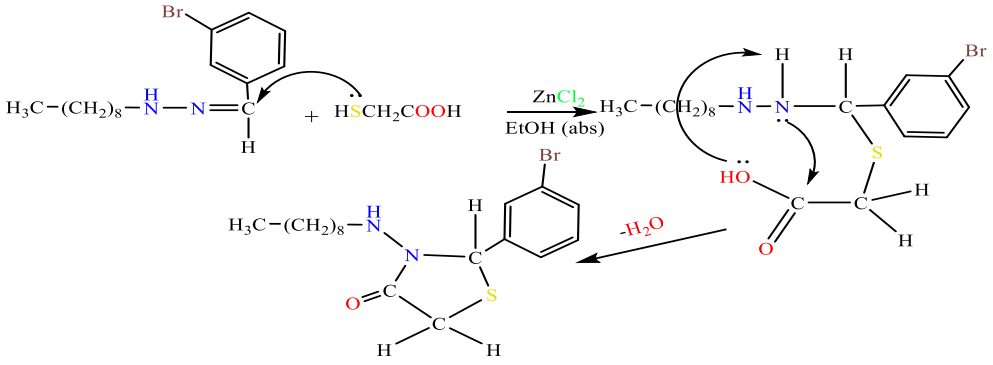


Scheme-2-: Mechanism of preparation of Azitidin-2-one Ring.

The infrared spectrum was used in the diagnosis of compounds (3), and a distinctive spectrum of bands appeared at the range (1685) cm^{-1} due to the (C=O) lactam and stretching (C=O) amide at the range (1670) cm^{-1} The total (C=C) stretch bands appeared at the range (1467-1589) cm^{-1} in addition to (NH) bundles at the range (3182) cm^{-1} with the disappearance of the stretch band (C=N) for Schiff bases.

The proton nuclear magnetic resonance (1H-NMR) spectrum of compound 3 was studied, as it appeared: Triple packet at ppm 0.87 due to terminal CH_3; A hex band at 1.55 ppm back to CH_2 adjacent to terminal CH_3; A pentagonal bundle at 1.23-1.31 ppm due to 6 symmetrical CH_2 complexes; Triple band at 3.29 ppm of CH_2 adjacent to the carbonyl group; Single package at 8.13 ppm due to amide NH; Single packet at 2.61 ppm due to CH derivatives on the ring; A mono pack at 2.63 ppm belongs to CH adjacent to Cl; Split multiple bands at (7.94,7.57,7.47,7.37) due to 4 protons of the derivatives benzene ring.

The above compounds were prepared from condensation of hydrazone with thioglycolic acid using anhydrous zinc chloride in absolute ethanol. The reaction mechanism is as follows:(Scheme-3-)

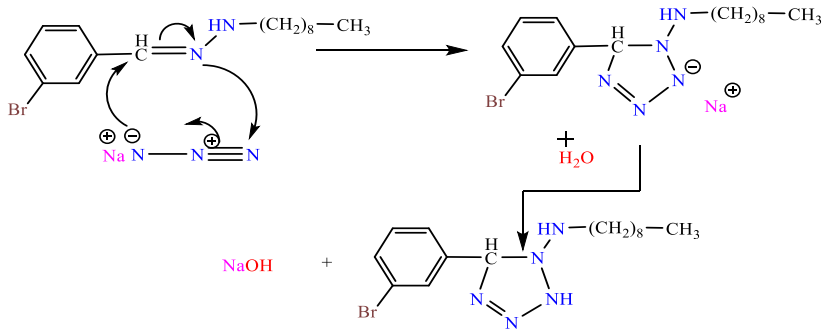


Scheme-3-: Mechanism of preparation of Thiazolidine.

The mechanics are achieved through the nucleophilic attack of the nitrogen atom on the carboxylic carbonyl group in the presence of the ZnCl2 co-factor that works to hold the (OH) group in the carboxylate and then loses a water molecule to give the final product. The thiazolidine-4-one compounds (4) were diagnosed using infrared spectroscopy, as the spectrum showed a firmness at (1670) cm^{-1} belonging to the carbonyl group (C=O) in thiazolidine-4-one, while the amide carbonyl group (C=O) was It appeared at (1624) cm^{-1}, and the spectrum showed at (935-1086) cm^{-1}, which belongs to the stretch of the (C-S-C) group. As for the aromatic double bond absorption spectrum (C=C), it appeared in the range (1464-1589) $cm^{-1,}$ and the disappearance of the band (C=N) that was present in the hydrazones

The proton nuclear magnetic resonance (^{1}H-NMR) spectrum of compound 4 was studied, as it appeared: Triple packet at ppm 0.85 back to terminal CH_3; A hex band at 1.58 ppm returns to CH_2 adjacent to terminal CH_3; A quintuple at 1.25 ppm due to 6 symmetrical CH_2 groups; Triple bundle at 3.32 ppm of CH_2 adjacent to the carbonyl group; Single package at 8.71 ppm due to amide NH; Single packet at 2.22 ppm due to CH derivatives on the ring; A monomer at 2.63 ppm belongs to CH_2 adjacent to S and the carbonyl group; Multiple bands split at ppm (7.94, 7.59, 7.47, 7.38) due to 4 protons of the derivatives benzene ring.

The tetrazole compounds were prepared by reacting sodium azide with hydrazone in the presence of THF as a solvent and sublimation in a water bath (60-70ºC)for 10 hours. The reaction mechanism is as follows:(Scheme-4-)

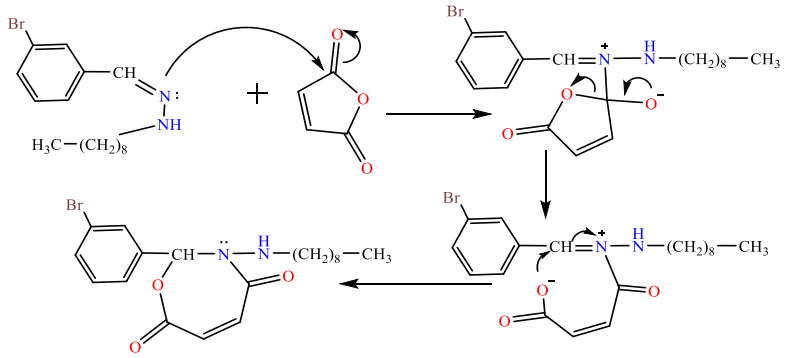


Scheme-4-: Mechanism of preparation of Tetrazol.

Compounds (5) were diagnosed by infrared spectroscopy, as the spectrum showed a band at (1514) cm^{-1} that goes back to the stretching of the band (N=N), and it showed a band at frequency (3398) cm^{-1} that goes back to the stretching of the band The (NH) ring band, as it showed the stretching band at (3122) cm^{-1} which belongs to (NH) amide in addition to the stretch band of the amide (C=O) group which appeared at the frequency (1670) cm^{-1}.

The proton nuclear magnetic resonance (^{1}H-NMR) spectrum of compound 5 was studied, as it appeared: Triple packet at ppm 0.85 back to terminal CH_3; A hex band at 1.58 ppm returns to CH_2 adjacent to terminal CH_3; A pentagonal bundle at 1.27 ppm due to the 6 symmetrical CH_2 complexes; A triple-band at 3.33 ppm belongs to CH2 adjacent to the carbonyl group; Single package at 8.71 ppm due to amide NH; Single packet at 2.20 ppm due to CH derivatives on the ring; Single bundle at 2.61 ppm due to cyclic NH; Split multiple bands at (7.94,7.83,7.54,7.38) ppm of 4 protons of the derivatives benzene ring.

Oxazepine compounds were prepared by reacting hydrazone with maleic anhydride and thermal escalation for 4 hours in the presence of dry benzene. The reaction mechanism is as follows: (Scheme-5-)



Scheme-5-: Mechanism of preparation of Oxazepine.

When diagnosing compounds (6) using the infrared spectrum, stretching bands appeared at (1668) cm^{-1} belonging to the group (C=O) lactone and at (1690) cm^{-1} it returned to the group (C=O)) lactams and at the frequency (1620) cm^{-1} belonging to the (C=O) amide group, as it showed a stretching band at (3182) cm^{-1} belonging to the (NH) amide group, in addition to the stretching bands at the range (2852-2920)cm^{-1} which returns (CH) aliphatic.

The proton nuclear magnetic resonance (^{1}H-NMR) spectrum of compound 6 was studied, as it appeared: Triple packet at ppm 0.83 due to terminal CH_3; A hex band at 1.59 ppm returns to CH_2 adjacent to terminal CH_3; A pentagonal bundle at 1.24 ppm due to the 6 symmetrical CH2 masses; A triple-band at 2.61 ppm belongs to CH_2 adjacent to the carbonyl group; Single package at 8.14 ppm due to amide NH; Single packet at 2.20 ppm due to CH derivatives on the ring; Single band at 6.27 ppm due to H-C=C-H symmetrical; Multiple bands split at (8.07,7.74,7.57,7.36) ppm of 4 protons of the derivatives benzene ring.

Compounds (7) were diagnosed using infrared spectroscopy, as stretching bands appeared at (1851) cm^{-1} belonging to the group (C=O) lactone, and at the frequency (1764) cm^{-1} to the group (C=O) lactams also showed stretching bands at (3182)cm^{-1} belonging to the (NH) amide group in addition to stretching bands at the range (2850-2953) cm^{-1} which belong to aliphatic (CH)

The proton nuclear magnetic resonance (^{1}H-NMR) spectrum of compound 7 was studied, as it appeared: Triple packet at ppm 0.83 due to terminal CH_3; A hex

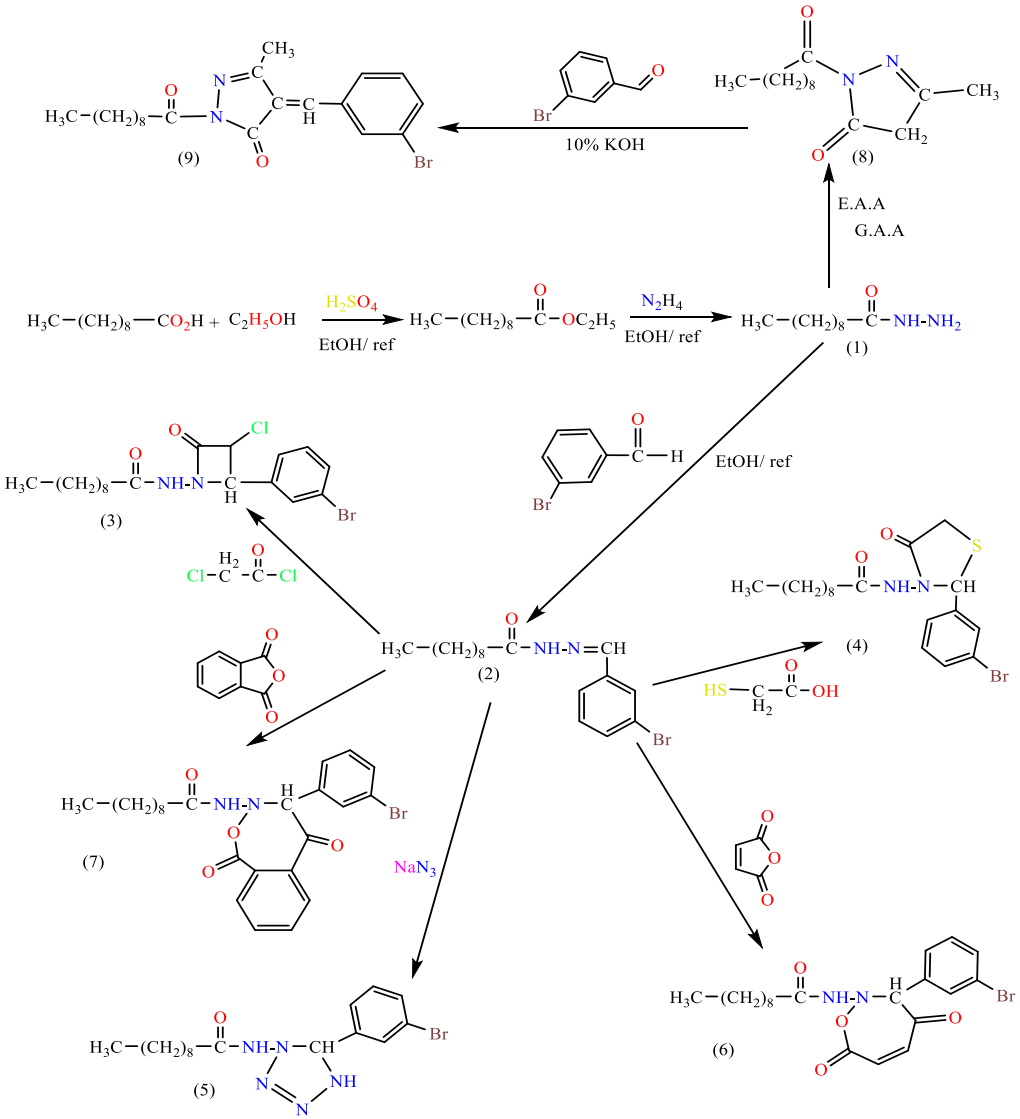
band at 1.58 ppm returns to CH_2 adjacent to terminal CH_3; A quintuple at 1.23 ppm due to 6 symmetrical CH_2 groups; A triple bundle at 2.61 ppm belongs to CH_2 adjacent to the carbonyl group; Single package at 8.70 ppm due to NH amide; Single packet at 2.20 ppm due to CH derivatives on the ring; Split multiple bands at ppm (8.17,8.10,8.02,7.96,7.82,7.56,7.46,7.36) due to 8 protons of two derivatives benzene rings.

Compounds (8) were diagnosed using infrared spectroscopy, as stretching bands appeared at (1660) cm^{-1} belonging to the group (C=O) lactone, and at the frequency (1676) cm^{-1} to the group (C=O) amide also showed stretching bands at (1630)cm^{-1} belonging to the (C=N) group We notice the disappearance of the amine stretch bands, which used to appear above 3200 in hydrazide.

Compounds (9) were diagnosed using infrared spectroscopy, as stretching bands appeared at (1650) cm^{-1} belonging to the group (C=O) chalcone, and at the frequency (1662) cm^{-1} to the group (C=C) α,β-unsaturated Carbonyl also showed stretching bands at (1632)cm^{-1} belonging to the (C=N) group.

The proton nuclear magnetic resonance (^{1}H-NMR) spectrum of compound 9 was studied, as it appeared: Triple band at (0.85 ppm) back to the CH_3; Five bands at (1.25-1.5 ppm) due to 6 contiguous CH_2 groups; A hex band at (2.1 ppm) back to the CH_2 group adjacent to the terminal CH_3; A triple-band at (3.33 ppm) belongs to the CH_2 group adjacent to the carbonyl C=O; Single band at (1.55 ppm) due to CH_3 derivatives on the pentagonal ring; Single-band (2.62 ppm) belongs to CH=C; Multi-bands at (7.37 - 8.16 ppm) due to benzene rings.

All spectroscopic results obtained through infrared spectrometry and nuclear magnetic resonance were in agreement with what was mentioned in the previous literature.



Scheme-6-: Synthesis of heterocyclic compounds (quaternary, pentagonal, seven-ring) (1-9)

5. CONCLUSIONS

The compounds that have been prepared are of great importance, as they are included in most of the known pharmaceutical compositions, and their derivatives also have wide uses in the industrial and medical fields.

Compensators for quaternary, pentagonal, and heterocyclic rings were obtained and gave anti-bacterial activity to gram-negative and gram-negative rings. The identity of the compounds was also determined using NMR and infrared spectroscopy.

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