ISSN: 0067-2904

Synthesis and Characterization of Some Oxazolidine and Thiazolidine Derivatives and Study of their Antioxidants Activity

Wasan K. Damdoom*[1,2], Oday H. R. Al-Jeilawi [1]
[1]*Department of Chemistry, College of Sciences, University of Baghdad, Baghdad, Iraq*
[2] *Department of Pharmaceutical Chemistry, College of Pharmacy, University of Thi-Qar , Nassiriya , Iraq.*

Received: 6/6/2023 Accepted: 9/9/2023 Published: 30/11/2024

Abstract

In this work, the preparation of some new oxazolidine and thiazolidine derivatives has been conducted. This was done over two steps; the first step included the synthesis of Schiff bases **A_1-A_5** in 72-88% yields by the condensation of isonicotinic acid hydrazide and aldehydes. The second step includes the cyclization of derivatives **A_1-A_5** with glycolic acid and thioglycolic acid to obtain the desired products, oxazolidine derivatives **B_1-B_5** (44-60% yields) and thiazolidine derivatives **C_1-C_5** (41-61% yields), respectively. The structure of the prepared compounds was characterized using FT-IR, ^{1}H NMR, and ^{13}C NMR spectroscopy. Some of the produced compounds were tested for antioxidant properties.

Keyword: Antioxidant, Oxazolidine, Schiff bases, Thiazolidine, ^{1}H NMR and ^{13}C NMR spectroscopy.

تحضير و تشخيص بعض مشتقات الاوكسازولدين و الثايوزولدين و دراسة فعاليتها كمضادات للاكسدة

وسن كريم دمدوم [2,1,*] , عدي هادي رؤوف الجيلاوي [1]
[1] قسم الكيمياء، كلية العلوم، جامعة بغداد، العراق
[2] قسم الكيمياء الصيدلانية، كلية الصيدلة، جامعة ذي قار، ذي قار، العراق.

الخلاصة

تم في هذا البحث تحضير بعض مشتقات الأوكسازوليدين والثيازوليدين الجديدة. وقد تم ذلك على خطوتين ; تضمنت الخطوة الأولى تخليق قواعد شيف **A_1–A_5** في حصيلة 72–88% عن طريق تكثيف هيدرازيد حمض الإيزونيكوتينيك واالالديهيدات. تتضمن الخطوة الثانية تحليق المشتقات **A_1–A_5** مع هيدروكسي حامض الخليك ومركبتو حامض الخليك للحصول على النواتج المطلوبة, مشتقات أوكسازوليدين **B_1–B_5** (44–60٪انتاجية) ومشتقات الثيازوليدين **C_1–C_5** (41–61٪ انتاجية)، على التوالي. تم تشخيص تركيب المركبات المحضرة باستخدام مطيافية FT–IR, ^{1}HNMR و^{13}CNMR.تم اختبار بعض المركبات الناتجة لمعرفة خصائصها المضادة للأكسدة.

*Email: wasn.kareem1105d@sc.uobaghdad.edu.iq

1. Introduction

The variety and viability of small heterocyclic compounds in terms of their structure and therapeutic properties fascinate organic and medicinal chemists. The most recent years saw the most research focus on oxazolidinones and thiazolidinones. On the other hand, linezolid is a member of the newly discovered family of antibiotics known as oxazolidinones [1]. Due to the development of novel derivatives with unique features, heterogeneous organic compounds play an increasingly important role in the development of many sectors, including the medical sector. Consequently, they are crucial to our daily lives [2]. Also, they play an important role in a variety of treatments, such as the possibility of using thiazolidine-4-one as a scaffold to create new molecules for medical chemistry [3]. The study of heterocyclic derivatives spans many areas of chemistry, notably organic chemistry, and is particularly attractive to those who are interested in working with both natural and synthetic products [4]. Closing agents are substances that can react with Schiff bases to produce heterocyclic compounds with four, six-, and seven-membered structures in addition to the five. Anthranilic acid, phthalic anhydride, maleic anhydride, and acetyl chloride are a few examples of these elements [5, 6]. Additionally, oxazolidines are bioactive substances that are important intermediates in the production of organic and bioorganic days as well as natural products [7]. Oxazolidinone and its derivatives are one of the most recent types of inhibitors. They are used to treat skin infections and the structure of the skin, where they have long-lasting effects on the mitochondrial activity of megakaryoblast cells [8]. The thiazolidines ring, on the other hand, is a chromophoric structure in several synthetic medicinal compounds and exhibits a wide range of biological activity[9]. Based on the substantial biological benefits of thiazolidine-4-one, including hypoglycemic and antioxidant properties, as a new potential multitarget anti-diabetic medication [10]. Thiazolidine derivatives are one of the most commonly used treatments for Alzheimer's disease because of their broad spectrum of biological action [11]. Additionally, thiazolidine derivatives are used to stop the growth of esophageal cancer cells [12] and have a wide range of pharmacologic activities, such as antimicrobial and antifungal [13]. Our work aims to synthesize new oxazolidines and thiazolidines derived from isonicotinic acid hydrazide using a two-step method. Firstly, condensation between isonicotinic acid hydrazide and aldehydes will be performed to afford the corresponding Schiff base derivatives. Subsequently, cyclization reactions will be performed between the synthesized Schiff bases and glycolic and thioglycolic acids to give the desired oxazolidine and thiazolidine derivatives.

2. Experiment

2.1. Chemical and Methods

A Gallenkamp capillary melting point apparatus was used to measure the open glass capillaries' melting points, which were unadjusted. A Bruker Vance 400 MHz spectrometer was used to record the ^{1}H NMR and ^{13}C NMR spectral data. Using DMSO-d_6 as a reference and tetramethylsilane (TMS) as the internal standard, chemical shifts are reported in ppm downfield. A Shimadzu 8400 FT-IR spectrometer was used to measure the infrared spectral data. TLC sheets (silica gel-covered aluminum sheets) were utilized to monitor the reactions, and the eluent was utilized as a combination of hexane and ethanol and visualized using iodine.

2.2. General producer for the preparation of Schiff bases $\boldsymbol{A_1}$-$\boldsymbol{A_5}$ [14]

To a solution of aromatic aldehydes (0.001 mol) in ethanol (25 mL) and a few drops of glacial acetic acid, isonicotinic acid hydrazide (0.001 mol) was added. The reaction mixture was stirred at room temperature for 4-6 hours. The reaction was monitored by TLC (hexane/ethanol, 3:2). The precipitate was then filtered, washed, and dried. The physical properties of prepared compounds ($\boldsymbol{A_1}$-$\boldsymbol{A_5}$) are shown in Table 1.

*2.2.1. N-(4-(Dimethylamino)benzylidene)isonicotinohydrazide (**A₁**)*

FT-IR (υ, cm^{-1}): 3195 (N-H), 3045 (C-H aromatic), 2977, 2842 (C-H aliphatic), 1664 (C=O amide), 1591(C=N), 1569, 1525 (C=C aromatic); ^{1}H NMR (□H, ppm): 11.79 (1H, s, NH-C=O), 8.78-6.75 (8H, m, Ar-H), 8.32 (1H, s, CH=N), 2.98 (6H, s, N(CH_3)$_2$); ^{13}C NMR (□C, ppm): 161 (C=O amide), 152-112 (Ar-C), 150 (C=N), 43 (CH_3).

*2.2.2. (4-Hydroxy-3-methoxybenzylidene)isonicotinohydrazide (**A₂**)*

FT-IR (υ, cm^{-1}): 3360-3530 (OH), 3240 (N-H), 3028, 3001 (C-H aromatic), 2941, 2829 (C-H aliphatic), 1647 (C=Oamide),1595 (C=N), 1550, 1510 (C=C aromatic); ^{1}H NMR (□H, ppm): 11.93 (1H, s, NH-C=O), 9.66 (1H, s, OH), 8.78-6.86 (7H, m, Ar-H), 8.36 (1H, s, CH=N), 3.84 (3H, s, OCH_3); ^{13}C NMR (□C, ppm): 161 (C=O amide), 150-109 (Ar-C), 148 (C=N), 56 (OCH_3).

*2.2.3. (2-Nitrobenzylidene)isonicotinohydrazide (**A₃**)*

FT-IR (υ, cm^{-1}): 3288 (N-H), 3014,3091 (C-H aromatic), 2908, 2825 (C-H aliphatic), 1679 (C=O amide), 1602 (C=N), 1558, 1519 (C=C aromatic); ^{1}H NMR (□H, ppm): 12.35 (1H, s, NH-C=O), 8.81-7.74 (8H, m, Ar-H), 8.57 (1H, s, CH=N);^{13}C NMR (□C, ppm):162 (C=O amide), 150-121 (Ar-C) 147 (C=N).

*2.2.4. (3-Nitrobenzylidene)isonicotinohydrazide (**A₄**)*

FT-IR (υ, cm^{-1}): 3197 (N-H), 3045, 3014 (C-H aromatic), 2910, 2864 (C-H aliphatic), 1666 (C=O amide), 1618 (C=N), 1581, 1554 (C=C aromatic).

*2.2.5. (Furan-2-ylmethylene)isonicotinohydrazide **(A₅)***

FT-IR (υ, cm^{-1}): 3271 (N-H), 3099, 3053 (C-H aromatic), 2937 (C-H aliphatic), 1650 (C=O amide), 1622 (C=N), 1537, 1475 (C=C aromatic); ^{1}H NMR (□H, ppm): 12.03 (1H, s, NH-C=O), 8.80-6.66 (7H,m,Ar-H),8.35 (1H,s,CH=N); ^{13}C NMR (□C, ppm): 161 (C=O amide), 150-112 (Ar-C), 139 (C=N).

*2.3. General procedure for the synthesis of the N-(4-oxo-2-phenyloxazolidin-3-yl)isonicotinamide derivatives **B₁-B₅** [15]*

A mixture of Schiff base derivatives (A_1-A_5) (1.1 mmol) and glycolic acid (more than 1.1 mmol) was heated at 120-150 °C using an oil bath. The reaction was monitored by TLC (hexane/ethanol, 3:2). When the reaction had completed, the mixture was cooled and neutralized with $NaHCO_3$ (5%). The solid crude material was filtered, washed with distilled water, and recrystallized with a suitable solvent. The physical properties of prepared compounds are shown in Table 2.

*2.3.1. N-(2-(4-(Dimethylamino)phenyl)-4-oxoxazolidin-3-yl)isonicotinamide (**B₁**)*

FT-IR (υ, cm^{-1}): 3180 (N-H), 3014 (C-H aromatic), 2999, 2893 (C-H aliphatic), 1689 (C=O oxazolidine ring), 1662 (C=O amide), 1579, 1560 (C=C aromatic); ^{1}H NMR (□H, ppm): 10.93 (1H, s, NH-C=O), 8.86-7.47 (8H, m, Ar-H), 6.76 (2H, s, CH oxazolidine ring), 4.92-4.91 (2H, s, CH_2 oxazolidine ring), 3.78 (6H, s, N(CH_3)$_2$); ^{13}C NMR (□C, ppm): 170 (C=O oxazolidine ring), 164 (C=O amide),150-112 (Ar-C), 95 (CH oxazolidine ring), 66 (CH_2oxazolidine ring), 49 (NCH_3).

*2.3.2. N-(2-(4-Hydroxy-3-methoxyphenyl)-4-oxoxazolidin-3-yl)isonicotinamide **(B₂)***

FT-IR (υ, cm^{-1}): 3431 (OH), 3172 (N-H), 3087 (C-H aromatic), 2999, 3835 (C-H aliphatic), 1687 (C=O oxazolidine ring), 1674 (C=O amide), 1614, 1566 (C=C aromatic); ^{1}H NMR (□H, ppm): 11.53 (1H, s, NH-C=O), 10.08 (OH), 8.86-7.23 (7H, m, Ar-H), 4.93 (1H, s, CH oxazolidine ring), 4.13 (2H, s, CH_2oxazolidine ring) 3.83 (3H, s, OCH_3); ^{13}C NMR (□C, ppm): 167 (C=O oxazolidine ring), 161 (C=O amide), 149-109 (Ar-C), 92 (CH oxazolidine ring), 72 (CH_2 oxazolidine ring), 56 (OCH_3).

2.3.3. N-(2-(2-Nitrophenyl)-4-oxoxazolidin-3-yl)isonicotinamide ***(B_3)***

FT-IR (υ, cm^{-1}): 3201 (N-H), 3004 (C-H $_{aromatic}$), 2864 (C-H $_{aliphatic}$), 1697 (C=O $_{oxazolidine\ ring}$), 1668 (C=O), 1577, 1552 (C=C $_{aromatic}$); ^{1}H NMR (□$_H$, ppm): 11.72 (1H, s, NH-C=O), 8.98-7.76 (8H, m, Ar-H), 4.92 (1H, s, CH $_{oxazolidine\ ring}$), 4.13-4.07 (2H, s, $CH_{2oxazolidine\ ring}$); ^{13}C NMR (□$_C$, ppm): 174 (C=O $_{oxazolidine\ ring}$), 167 (C=O $_{amide}$), 150-123 (Ar-C), 90 (CH $_{oxazolidine\ ring}$), 61 ($CH_{2oxazolidine\ ring}$).

2.3.4. N-(2-(3-Nitrophenyl)-4-oxooxazolidin-3-yl)isonicotinamide ***(B_4)***

FT-IR (υ, cm^{-1}): 3288 (N-H), 3099 (C-H $_{aromatic}$), 2867 (C-H $_{aliphatic}$), 1699 (C=O $_{oxazolidine\ ring}$), 1668 (C=O $_{amide}$) 1577, 1552 (C=C $_{aromatic}$).

2.3.5- N-(2-(Furan-2-yl)-4-oxooxazolidin-3-yl)isonicotinamide ***(B_5)***

FT-IR (υ, cm^{-1}): 3323 (N-H), 3072 (C-H $_{aromatic}$), 2950, 2906 (C-H $_{aliphatic}$), 1689 (C=O $_{oxazolidine\ ring}$), 1672 (C=O $_{amide}$) 1600, 1566 (C=C $_{aromatic}$).

*2.4. General procedure for the synthesis of N-(4-oxo-2-phenylthiazolidin-3-yl) isonicotinamide derivatives (****C_1-C_5****) [15]*

A mixture of Schiff base derivatives (A_1-A_5) (1.1 mmol) and thioglycolic acid (more than 1.1 mmol) was heated at 120-130 °C using an oil bath. The reaction was monitored by TLC (hexane/ethanol, 3:2). When the reaction had completed, the mixture was cooled and neutralized with $NaHCO_3$ (5%). The solid crude material was filtered, washed with distilled water, and recrystallized with a suitable solvent. The physical properties of prepared compounds are shown in Table 2.

*2.4.1. N-(2-(4-(Dimethylamino)phenyl)-4-oxothiazolidin-3-yl)isonicotinamide (****C_1****)*

FT-IR (υ, cm^{-1}): 3186 (N-H), 3004 (C-H $_{aromatic}$), 2829 (C-H $_{aliphatic}$), 1685 (C=O $_{thiazolidine\ ring}$), 1650 (C=O $_{amide}$), 1604, 1560 (C=C $_{aromatic}$); ^{1}H NMR (□$_H$, ppm): 11.14 (1H, s, NH-C=O), 8.75-7.63 (8H, m, Ar-H), 6.28 (1H, s, CH $_{thiazolidine\ ring}$), 3.78-3.74 (2H, s, CH_2 $_{thiazolidine\ ring}$), 3.11 (6H, s, $N(CH_3)_2$); ^{13}C NMR (□$_C$, ppm): 170 (C=O $_{thiazolidine\ ring}$), 164 (C=O $_{amide}$), 150-121 (Ar-C), 66.82 ($CH_{2thiazolidine\ ring}$), 50.03 (CH_3), 32.72 (CH_2 $_{thiazolidine\ ring}$).

*2.4.2. N-(2-(4-Hydroxy-3-methoxyphenyl)-4-oxothiazolidin-3-yl)isonicotinamide (****C_2****)*

FT-IR (υ, cm^{-1}): 3458 (OH), 3188 (NH), 3004 (C-H $_{aromatic}$), 2904 (C-H $_{aliphatic}$), 1685 (C=O $_{thiazolidine\ ring}$), 1652 (C=O $_{amide}$), 1564, 1512 (C=C $_{aromatic}$).

*2.4.3. N-(2-(2-Nitrophenyl)-4-oxothiazolidin-3-yl)isonicotinamide (****C_3****)*

FT-IR (υ, cm^{-1}): 3226 (N-H), 3099 (C-H $_{aromatic}$), 2981 (C-H $_{aliphatic}$), 1720 (C=O $_{thiazolidine\ ring}$), 1695 (C=O $_{amide}$), 1575, 1521 (C=C $_{aromatic}$); ^{1}H NMR (□$_H$, ppm): 11.12 (1H, s, NH-C=O), 8.74-7.62 (8H, m, Ar-H), 6.27 (1H, s, CH $_{thiazolidine\ ring}$), 3.98 (2H, s, CH_2 $_{thiazolidine\ ring}$); ^{13}C NMR (□$_C$, ppm): 174 (C=O $_{thiazolidine\ ring}$), 167 (C=O $_{amide}$), 150-121 (Ar-C), 57 (CH $_{thiazolidine\ ring}$), 28 ($CH_{2thiazolidine\ ring}$).

*2.4.4. N-(2-(3-Nitrophenyl)-4-oxothiazolidin-3-yl)isonicotinamide (****C_4****)*

FT-IR (υ, cm^{-1}): 3288 (N-H), 3099 (C-H $_{aromatic}$), 2979 (C-H $_{aliphatic}$), 1718 (C=O $_{thiazolidine\ ring}$), 1674 (C=O $_{amide}$), 1589, 1552 (C=C $_{aromatic}$).

*2.4.5. N-(2-(Furan-2-yl)-4-oxothiazolidin-3-yl)isonicotinamide (****C_5****)*

FT-IR (υ, cm^{-1}): 3211 (N-H), 3099(C-H $_{aromatic}$), 2930 (C-H $_{aliphatic}$), 1714 (C=O $_{thiazolidine\ ring}$), 1676 (C=O $_{amide}$), 1596,1558 (C=C $_{aromatic}$); ^{1}H NMR (□$_H$, ppm): 11.14 (1H, s, NH-C=O), 8.75-6.28 (7H, m, Ar-H), 6.13 (1H, s, CH $_{thiazolidine\ ring}$), 4.03-3.99 (2H, s, CH_2 $_{thiazolidine\ ring}$); ^{13}C NMR (□$_C$, ppm):170(C=O $_{thiazolidine\ ring}$),164(C=O $_{amide}$),150-120 (Ar-C),57(CH $_{thiazolidine\ ring}$), 28 ($CH_{2thiazolidine\ ring}$).

Table 1: Physical properties of compounds **A_1-A_5**

Compound	Chemical formula	M.Wt (g/mol)	M.P (°C)	Time (h)	Color	Yield (%)
A1	$C_{15}H_{16}N_4O$	268.32	207-210	3	Yellow	80
A2	$C_{14}H_{13}N_3O_3$	271.28	236-238	4	Pall yellow	75
A3	$C_{13}H_{10}N_4O_3$	270.25	223-225	3	Yellow	88
A4	$C_{13}H_{10}N_4O_3$	270.25	218-220	5	Brown	77
A5	$C_{11}H_9N_3O_2$	215.21	220-223	3	Brown	72

Table 2: Physical properties of compounds **B_1-B_5**

Compound	Chemical formula	M.Wt (g/mol)	M.P (°C)	Time (h)	Color	Recrystallization solvent	Yield (%)
B1	$C_{17}H_{18}N_4O_3$	326.36	118-120	18	Red	Ethanol	55
B2	$C_{16}H_{15}N_3O_5$	329.31	123-126	22	Brown	Ethanol	57
B3	$C_{15}H_{12}N_4O_5$	328.28	128-131	20	Orange	Dioxane	50
B4	$C_{15}H_{12}N_4O_5$	328.28	108-112	22	Brown	Benzene	60
B5	$C_{13}H_{11}N_3O_4$	273.25	166-169	24	Black	Benzene	44

Table 3: Physical properties of compounds **C_1-C_5**

Compound	Chemical formula	M.Wt (g/mol)	M.P. (°C)	Time (h)	Color	Recrystallization solvent	Yield (%)
C1	$C_{17}H_{18}N_4O_2S$	342.42	283-286	20	Orange	Methanol	41
C2	$C_{16}H_{15}N_3O_4S$	345.37	120-123	22	Dark	Ethanol	54
C3	$C_{15}H_{12}N_4O_4S$	344.35	147-150	16	Brown	Ethanol	50
C4	$C_{15}H_{12}N_4O_4S$	344.35	113-116	18	Brown	Benzene	61
C5	$C_{13}H_{11}N_3O_3S$	289.31	255-259	23	Black	Dioxane	55

2.5. Antioxidant activity [16]

2.5.1. Preparation of the solution of DPPH and samples

A solution of DPPH dye (1,1-diphenyl-2-picryl-hydrazyl) (2 mg) in methanol (50 mL) was kept in the dark in an aluminium-coated volumetric flask. The stock solution was prepared by dissolving the samples (12 mg) in DMF (5 mL). Five test tubes at concentrations of 250, 150, 100, 50, and 25 ppm were prepared by diluting the stock solution. Additionally, similar amounts of ascorbic acid (vitamin C) were prepared. The volume of 1 ml of each concentration (250, 150, 100, 50, and 25 ppm) was placed in a test tube, and the tested compound with DPPH solution (1 mL) was incubated at 37 °C for one hour.

2.5.2. Spectrophotometric measurement method

The absorbance of each solution was measured using a spectrophotometer at a wavelength of 517 nm following the conclusion of the incubation. The IC_{50} of the samples was calculated, and the potential scavenging DPPH radicals were identified using Equation 1.

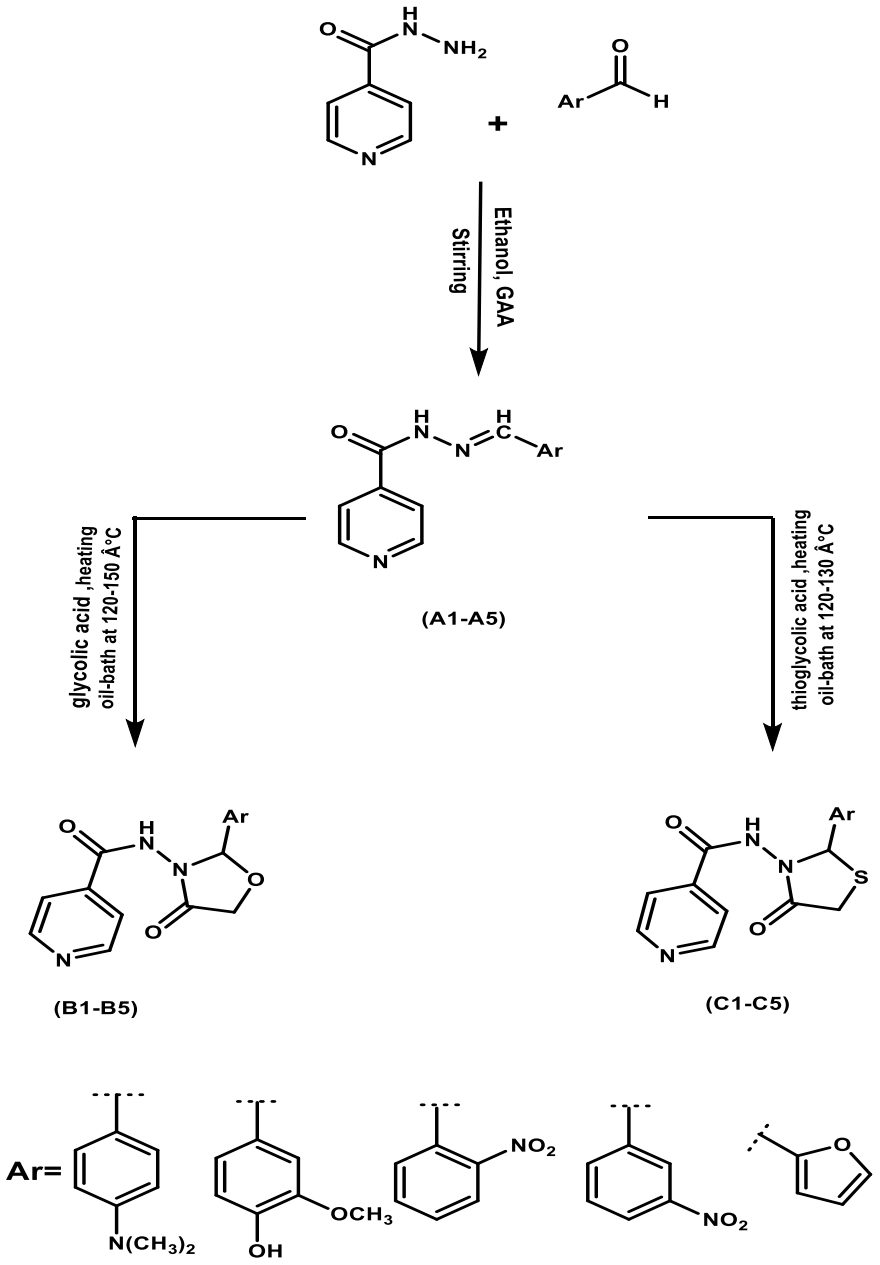
I% = [Abs Blank - Abs Sample] / Abs Blank × 100

Equation 1 - The percentage of inhibitor

3. Results and discussion

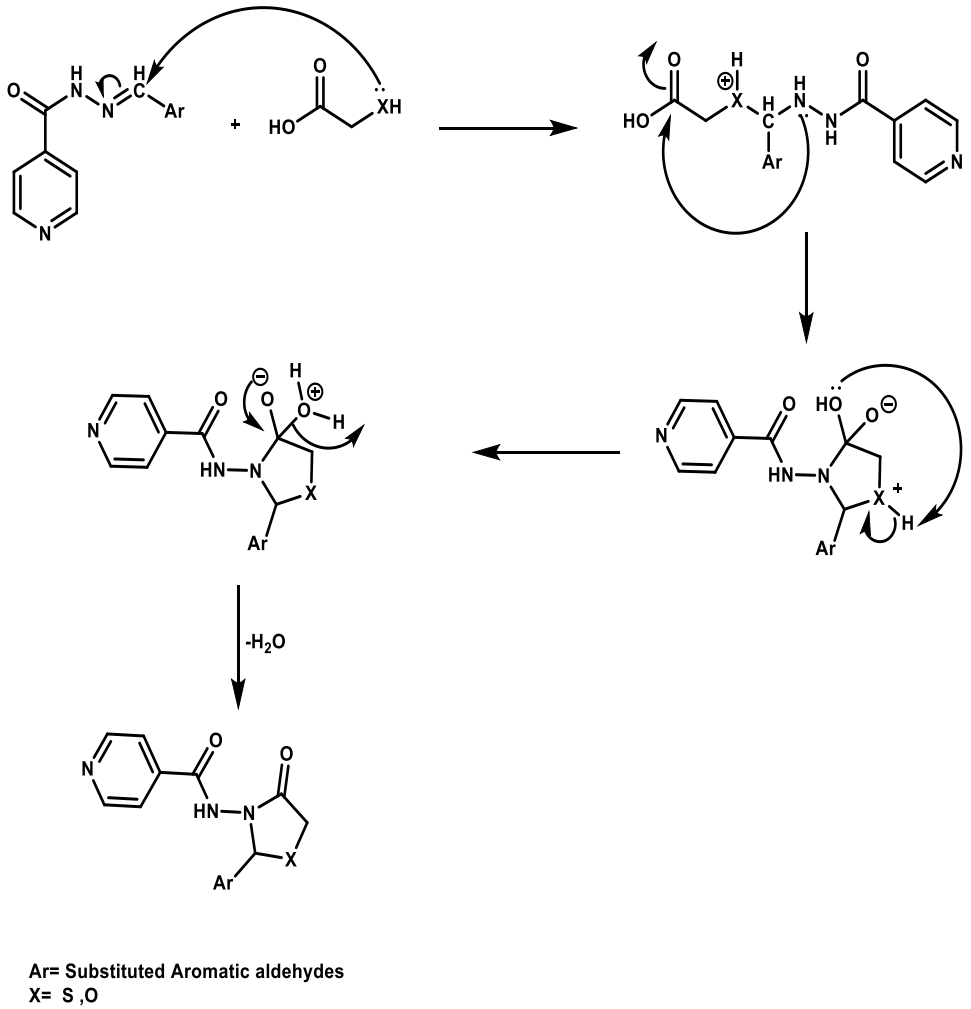
The preparation of oxazolidines **B_1-B_5** and thiazolidines **C_1-C_5** was performed over two steps as shown in Scheme 1. The first step included the synthesis of Schiff bases **A_1-A_5** in yields ranging from 72 to 88% through the reaction of aromatic aldehydes with isonicotinic acid hydrazide. The FT-IR spectra of these derivatives (**A_1-A_5**) showed appearance new absorbance bands at 1591-1622 cm^{-1} due to the imine group (C=N). The ^1H NMR of

compounds **A1**, **A2**, **A3**, and **A5** showed singlet singles for the imine protons (HC=N) at 8.36, 8.32, 8.57, and 8.35 ppm, respectively. The second step in this work included a cycloaddition of derivatives **A1-A5** with glycolic acid and thioglycolic acids to afford the title products, oxazolidines **B1-B5** and thiazolidines **C1-C5**. The FT-IR spectral data of these derivatives showed new appearances belong to the carbonyl of the amide group for the five-membered rings at 1720-1685 cm^{-1}. The ^{1}H NMR analysis data of the products **B1**, **B2**, **B3**, **C1**, **C3** and **C5** showed singlet singles attributed to the CH_2 group of the oxazolidine and thiazolidine derivatives at (4.92-4.91, 4.13, 4.13-4.07, 3.78-3.74,3.98 and 4.03-3.99).The ^{13}C NMR spectra showed signals at (66.9, 72.6, 61.4,32.7,28.8 and 28.8) [17].



Scheme 1: Synthesis of heterocyclic compounds **B1-B5** and **C1-C5**

The mechanism for the preparation of compounds **B1-B5** and **C1-C5** is shown in Scheme 2 [18, 19]



Scheme 2: The mechanism of prepared compounds **B**$_1$-**B**$_5$ and **C**$_1$-**C**$_5$

Thereafter, the antioxidant activities of the synthesized compounds were measured by the DPPH method. In this method, Ascorbic acid (vitamin C) was used as a standard because it contains hydroxyl groups and has a known ability as an antioxidant. The preparation process takes place in the dark due to the effect of light on free radicals and the occurrence of repetition and error in readings. It is very important to know the expression of IC_{50}. The lower the value, the more active the substance in biological aspects, and vice versa[20] . Several concentrations of the tested compounds were employed in order to examine their inhibition capacity. Compounds **B**$_2$ and **C**$_3$ had the highest antioxidant activities, as shown in Table 4.

Table 4: Antioxidant activities of compounds **B_1-B_5** and **C_1-C_5** in terms of their IC_{50} and half-maximal inhibitory concentration

Symbol of compounds	Concentration (ppm)	I%	IC_{50} (mg/mL)	Symbol of compounds	Concentration (ppm)	I%	IC_{50} (mg/mL)
B1	50	20.96	10	C1	50	48.75	3.6
	100	24.3			100	57.08	
	150	25			150	59.3	
	200	26.83			200	60.41	
	250	27.5			250	66.67	
B2	50	40.69	3.7	C2	50	6.8	6.4
	100	45.94			100	25.55	
	150	51.8			150	30.69	
	200	66.11			200	35.55	
	250	80.21			250	44.16	
B3	50	29.61	5.6	C3	50	39.02	3.2
	100	32.77			100	51.52	
	150	34.02			150	77.08	
	200	46.02			200	78.61	
	250	49.72			250	81.52	
B4	50	39.3	3.9	C4	50	29.16	6.8
	100	41.38			100	31.66	
	150	55.41			150	35.97	
	200	60.55			200	36.38	
	250	73.33			250	39.86	
B5	50	19.86	6.9	C5	50	33.61	6.7
	100	20.55			100	34.72	
	150	26.66			150	35.83	
	200	39.02			200	37.77	
	250	39.58			250	39.58	
As.	50	97.16	1.3				
	100	97.65					
	150	97.77					
	200	97.9					
	250	98.14					

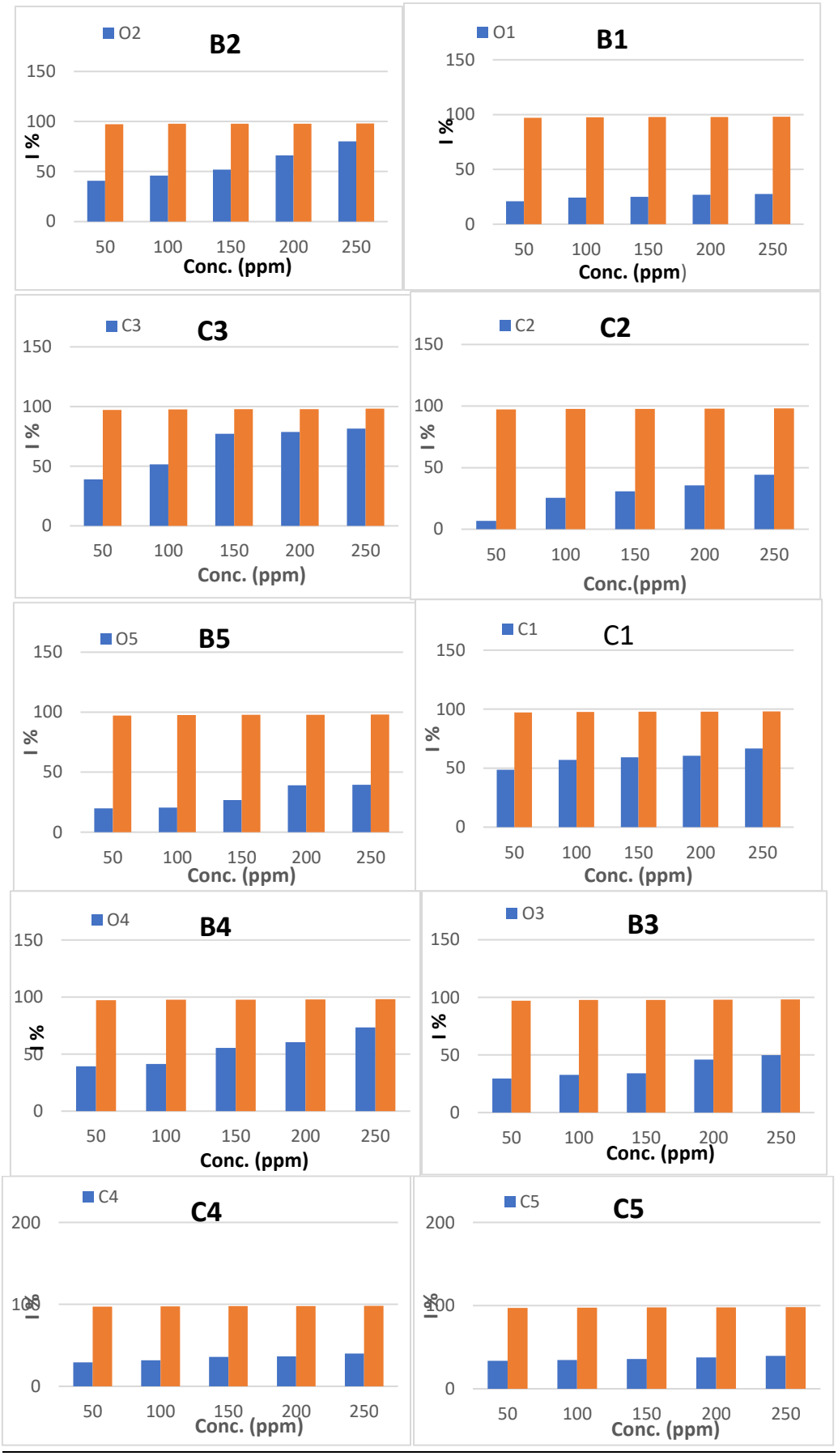


Figure1: A comparison between the tested compounds and ascorbic acid by using different concentrations

4. Conclusion

The synthesis of the thiazolidine and oxazolidine derivatives has been achieved successfully, with yields ranging from (41 to 61%). The prepared compounds were proven by FT-IR, ^{1}H NMR, and ^{13}C NMR spectroscopy. Some of the synthesized compounds were subjected to testing for their antioxidant activities. The findings highlight the potential of the synthesized compounds as valuable candidates for further exploration in the field of antioxidant research.

References

[1] T. Srivastava, W. Haq, and S. Katti, "Carbodiimide mediated synthesis of 4-thiazolidinones by one-pot three-component condensation", *Tetrahedron,* vol. 58, no. 38, pp. 7619-7624, 2002.

[2] N. Shamaya and O. H. Al-Jeilawi, "Organic synthesis of some new compounds derived from furfural and their evaluation as antioxidants", *Journal of Medicinal and Chemical Sciences,* vol. 6, pp. 1065-1076, 2023.

[3] D. Mech, A. Kurowska, and N. Trotsko, "The bioactivity of thiazolidin-4-ones: A short review of the most recent studies", *International Journal of Molecular Sciences,* vol. 22, no. 21, Article no. 11533, 2021.

[4] Z. Turgut, C. Yolacan, F. Aydogan, E. Bagdatli, and N. Ocal, "Synthesis of new pyrazolothiazole derivatives from 4-thiazolidinones", *Molecules,* vol. 12, no. 9, pp. 2151-2159, 2007.

[5] Z. G. Alrecabi, R. Alfraiji and S. Al-Majidi, "Synthesis, identification of some new derivatives of oxazpine, thiazinone and hydroquinazoline and evaluation of antibacterial activity", *Iraqi Journal of Science,* vol. 58, no. 3, pp. 1565-1579, 2017.

[6] N. H. Karam, I. H. R. Tomi, and J. H. Tomma, "Synthesis, characterization and study of the liquid crystalline behavior of four and six heterocyclic compounds", *Iraqi Journal of Science,* vol. 57, no. 3B, pp. 1876-1890, 2016.

[7] O. H. Abid and H. H. Abbass, "Synthesis and characterization of new oxazolidin-4-one derivatives via the reaction of various some imines with glycolic acid", *Journal of University of Anbar for Pure Science,* vol. 11, no. 2, pp. 41-48, 2017.

[8] H. Al-Adhami and S. M. Al-Majidi, "Synthesis, characterization of thiazolidin-4-one, oxazolidin-4-one and imidazolidin-4-one derivatives from 6-amino-1,3-dimethyluracil and evaluation of their antioxidant and antimicrobial agent", *Al-Qadisiyah Journal of Pure Science,* vol. 26, no. 4, pp. 59-72, 2021.

[9] S. Ebrahimi, A. Mobinikhaldei, and H. Eibagi, "An efficient and convenient protocol for the synthesis of thiazolidin-4-ones", *Phosphorus, Sulfur, and Silicon and the Related Elements,* vol. 186, no. 12, pp. 2279-2285, 2011.

[10] S. M. Constantin, F. G. Lupascu, M. Apotrosoaei, A. V. Focsa, I. M. Vasincu, L. G. Confederat, G. Dimitriu, C. E. Lupusoru, S. Routier, and F. Buron, "Antidiabetic effects and safety profile of chitosan delivery systems loaded with new xanthine-thiazolidine-4-one derivatives: in vivo studies", *Journal of Drug Delivery Science and Technology,* vol. 60, pp. 102091, 2020.

[11] H. Genç Bilgiçli, P. Taslimi, B. Akyuz, B. Tuzun, and I. Gulcin, "Synthesis, characterization, biological evaluation, and molecular docking studies of some piperonyl-based 4-thiazolidinone derivatives", Archiv der Pharmazie, vol. 353, no. 1, Article no. 1900304, 2020.

[12] O. S. Aremu, L. Katata-Seru, O. O. Aremu, C. R. Sewani-Rusike, and N. Koorbanally, "Determination of radical scavenging activities of some pyrimidine derivatives", Tropical Journal of Pharmaceutical Research, vol. 19, no. 1, pp. 45-49, 2020.

[13] N. H. Karam, J. H. Tomma, and A. H. AL-Dujaili, "Synthesis and characterization of heterocyclic compounds derived from 4-hydroxy and 4-amino acetophenone", Ibn AL-Haitham Journal For Pure and Applied Science, vol. 26, no. 3, pp. 296-312, 2017.

[14] F. M. Agwom, E. O. Afolabi, K. J. Bot, N. S. Yakubu, I. J. Olaitan, and J. T. Kindala, "In silico studies, comparative synthesis and antibacterial activity of some imine derivatives of isonicotinic hydrazide", Organic and Medicinal Chemistry International Journal, vol. 8, no. 5, pp. 106-113, 2019.

[15] S. J. Gilani, S. A. Khan, O. Alam, V. Singh, and A. Arora, "Thiazolidin-4-one, azetidin-2-one and 1,3,4-oxadiazole derivatives of isonicotinic acid hydrazide: synthesis and their biological evaluation", Journal of the Serbian Chemical Society, vol. 76, no. 8, pp. 1057-1067, 2011.

[16] Q. Oleiwi, O. H. Al-Jeilawi, and S. A. Dayl, "Synthesis, characterization of some thiourea derivatives based on 4-methoxybenzoyl chloride as antioxidants and study of molecular docking", Iraqi Journal of Science, vol. 64, no. 1, pp. 1-12, 2023.

[17] N. Yamsani and R. Sundararajan, "Design, in-silico studies, synthesis, characterization, and anticonvulsant activities of novel thiazolidin-4-one substituted thiazole derivatives", vol. 13, no. 4, 366, 2022.

[18] J. A. Abdullah, B. J. Aldahham, M. A. Rabeea, F. A. Asmary, H. M. Alhajri, and M. A. Islam, "Synthesis, characterization and in-silico assessment of novel thiazolidinone derivatives for cyclin-dependent kinases-2 inhibitors", Journal of Molecular Structure, vol. 1223, 129311, 2021.

[19] U. P. Singh, H. R. Bhat, M. K. Kumawat, and R. K. Singh, "Utilisation of home laundry effluent (hle) as a catalyst for expeditious one-pot aqueous phase synthesis of highly functionalised 4-thiazolidinones," SpringerPlus, vol. 2, no. 1, pp. 1-11, 2013.

[20] S. Phongpaichit, J. Nikom, N. Rungjindamai, J. Sakayaroj, N. Hutadilok-Towatana, V. Rukachaisirikul, and K. Kirtikara, "Biological activities of extracts from endophytic fungi isolated from Garcinia plants," FEMS Immunology and Medical Microbiology, vol. 51, no. 3, pp. 517-525, 2007.