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# Antioxidant and Antibacterial Evaluation of Novel Azolidine-4-one Derivatives Synthesized from Creatinine

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**Abstract**

In this study, new azolidine-4-one derivatives were synthesized using creatinine as starting materials. Initially, Schiff bases were formed through the reaction of creatinine, acting as a primary amine, with various aromatic aldehydes. This scaffold proved to be valuable for the development of new biologically active molecules. The resulting Schiff bases (1–5) were subsequently reacted with glycine, thioglycolic acid, and glycolic acid in ring-closing reactions to generate new compounds (6–10), (11–15), and (16–20), respectively. The structures of the new compounds were confirmed using the FT-IR and further characterized using $^{1}$HNMR. The biological activities and antioxidant capacity of some synthesized compounds have been studied in vitro with promising results. The new compounds showed improved antioxidant effects compared to the parent compounds.

**Keywords:** Antibacterial evaluation, Antioxidant, Creatinine, heterocyclic, Schiff bases.

# تقييم الفعالية المضادة للأكسدة والمضادة للبكتيريا لمشتقات جديدة من الأزوليدين-4-ون المحضرة من الكرياتينين

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**الخلاصة**

في هذه الدراسة, تم تخليق مشتقات جديدة من ازوليدين-4-ون بأستخدام الكرياتينين كمادة اولية. في البداية, تم تحضير قواعد شف من تفاعل الكرياتينين مع الالديهايدات الاروماتية حيث اثبتت الدراسات ان الهيكل الاساسي للكرياتينين ذات فائدة قيمة في تطور جزيئات جديدة نشطة بيولوجيا. قواعد شف الناتجة( **1-5**) تتفاعل مع كلا من الكلايسين وحامض الثايوكلايكوليك اسيد وحامض الكلايكوليك في تفاعل الغلق الحلقي لإعطاء منتجات جديدة (**6-10**)، (**11-15**)، (**16-20**) على التوالي. تم تأكيد بنية المركبات التي تم تحضيرها باستخدام الطرق الطيفية مثل مطيافية (**FT-IR**) بالاضافة الى مطيافية (**$^{1}$H-NMR**) لبعض المركبات. تم دراسة الأنشطة البيولوجية والفعالية المضادة للأكسدة في المختبر لبعض المركبات المصنعة مع نتائج واعدة. أظهرت المركبات المطورة تأثيرات مضادة للأكسدة جيدة مقارنة مع المركبات الاصلية التي تم استخدامها في التحضير.

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## 1. Introduction

Heterocyclic compounds are a vital class of pharmacologically and therapeutically active chemicals [1]. These compounds are primarily composed of five or six members of carbon rings that include a heteroatom such as nitrogen, oxygen, or sulfur. Such structures have been successfully incorporated into new drugs and therapeutic agents [2]. Creatinine is a five-membered heterocyclic compound containing two nitrogen atoms in its ring in addition to an amine group attached to this ring. It is produced as a metabolic byproduct when creatine is broken down in the human body and subsequently transported to the kidneys [3]. The amount of creatinine can be determined using the serum creatinine test. The normal creatinine level is 1.14 mg/dL in men and 0.93 mg/dL in women [4]. In this study, creatinine was utilized as a primary amine to prepare Schiff bases. A recently published study demonstrated the ability of creatinine derivatives to inhibit the growth of many bacterial species, such as methicillin-resistant Staphylococcus aureus [5]. Schiff bases are known to be pharmacologically active compounds and have wide-ranging uses in food manufacturing [6]. The first synthesis of Schiff bases (imines) was in the 19th century by Hugo Schiff. The common method of their preparation is usually by the reaction of primary amines with aldehydes [7]. The general formula for Schiff bases is RCH = $NR_1$ (where R and $R_1$ are alkyl or aryl) [8]. Schiff bases are most often synthesized regularly by the nucleophilic addition of an $NH_2$ group to the C=O of an aldehyde to form a hemi-amino compound in an azeotropic state with the simultaneous removal of water, which is then dehydrated to generate an imine [9]. The addition of Schiff bases to glycine produces imidazolidine-4-ones [10]. Imidazolidin-4-one is a heterocyclic compound containing a five-membered ring with a nitrogen atom and a carbonyl group in addition to the carbon atom; these compounds are very useful in pharmaceutical fields[11]. Thiazolidinon-4-ones are a type of five-membered heterocyclic molecule prepared by interconvertible substitution of appropriate thiazolidine derivatives or by cyclizing acyclic compounds containing sulfur atoms [12]. This research aims to synthesize novel thiazolidinone derivatives via the cyclization reaction of thioglycolic acid with Schiff bases and evaluate their antioxidant activity and biological efficacy [13]. These compounds are targeted due to their broad-spectrum pharmacological activities, antioxidant, antimicrobial, anti-diabetic effects [14, 15], anticonvulsant, antitumor, antimalarial, and anti-inflammatory effects [16]. Oxazolidine-4-one is also a five-membered heterocyclic molecule that has hetero atoms, oxygen, nitrogen, and a carbonyl group in the ring. The reaction of imine and glycolic acid produces oxazolidine-4-one [17]. The resulting compounds have various biological applications [18].

## 2. Experimental part

### *2.1. Instruments and Materials*

The solvents and starting materials were obtained from Fluka and Sigma-Aldrich. Melting points were measured using a Gallen Kamp capillary melting point meter, while infrared spectra were recorded with SHIMADZU model FTIR-8400S. $^1$H NMR spectra were acquired on a Bruker spectrophotometer model operating at 400 MHz, using DMSO solution and TMS as an internal standard. A LABINCO L81 basic hotplate magnetic stirrer with temperature control was used to conduct the reactions. The TLC technique was used to monitor the progress of the reaction using silica gel layers and different solvents, with iodine vapour employed for spot visualisation.

### *2.2. Methods of the synthesis of compounds*

*Synthesis of Schiff bases derivatives* ***1-5***

A solution of 0.01 mol of aldehyde derivatives in 20 mL of 1,4-dioxane was prepared, to which a few drops of glacial acetic acid was added. Then, 1.13g (0.01mol) of creatinine was

added to the reaction mixture and refluxed for 12 hours. After that, the reaction mixture was cooled, and the resulting precipitate was filtered. All prepared compounds were recrystallized from Benzene[19].

*Synthesis of imidazolidinone derivatives* ***6-10***

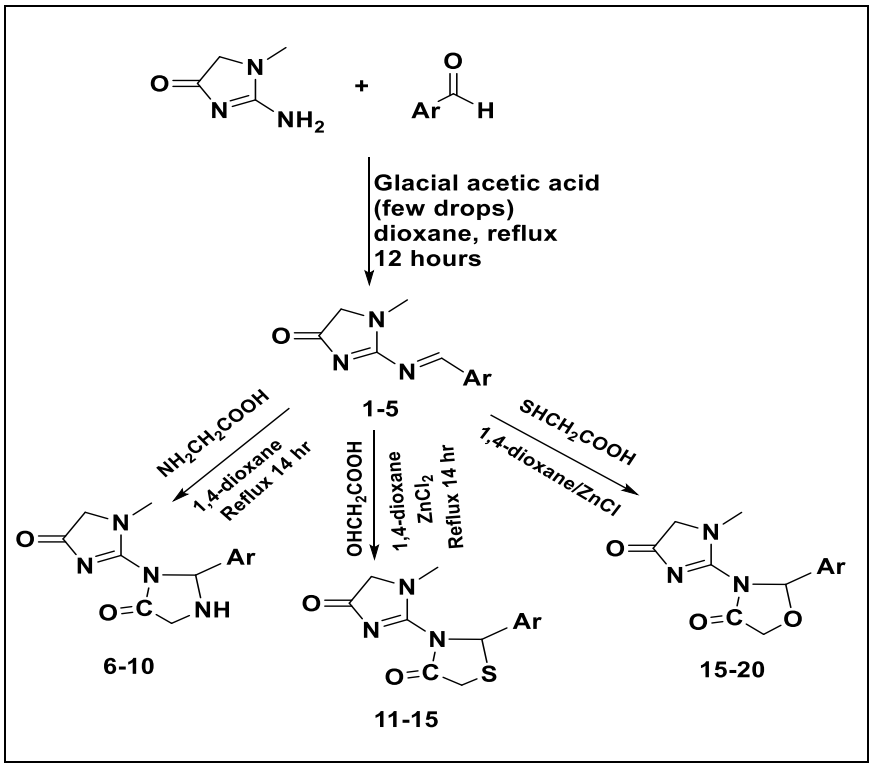
2-aminoacetic acid (0.075g , 0.001mol) was combined in a round-bottomed flask with Schiff bases(**1-5**) (0.001mole) and (10 mL ) 1,4-dioxane. The reaction mixture was heated at 80 °C for 14-16 hours. After cooling, the resulting precipitate was collected. All synthesized compounds recrystallized from ethanol [20].

*Synthesis of thiazolidinone derivatives* ***11-15***

In a round-bottomed flask, Schiff bases **1-5** (0.002 mol), 2- mercapto acetic acid (0.184 mL, 0.002 mol), 10 mL of dry 1,4-dioxane, and anhydrous zinc chloride (0.21g , 0.0016 mol) were added. The mixture was heated at 80°C for 8-10 hours. The reaction mixture was then poured over crushed ice, and the resulting precipitate was filtered and dried. All prepared compounds 11-15 were recrystallized from ethanol [21].

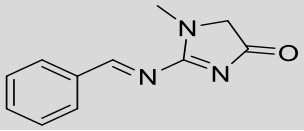
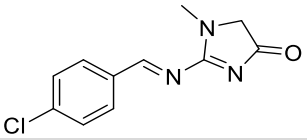
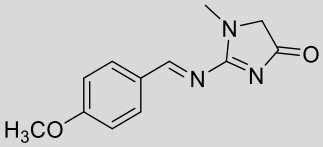
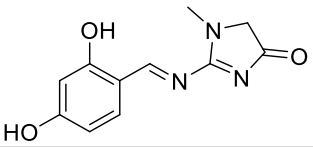
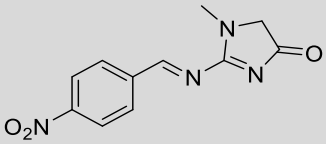
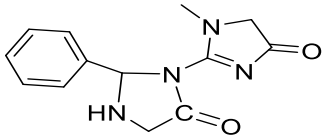
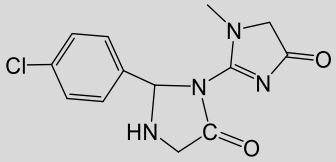
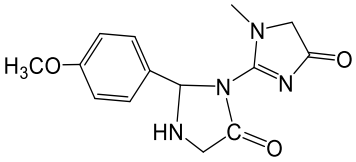
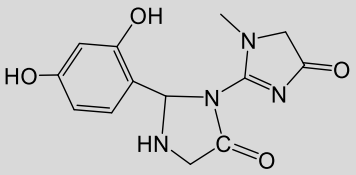
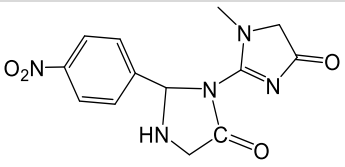
*Synthesis of oxazolidinone derivatives* ***16-20***

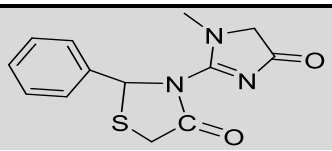
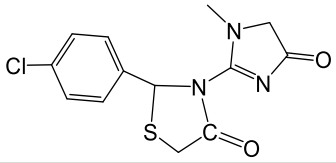
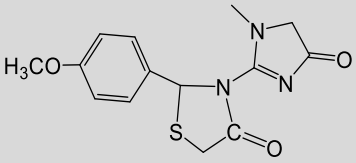
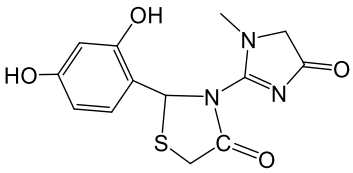
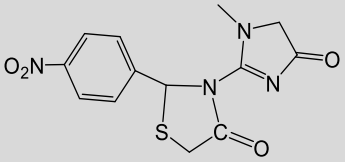
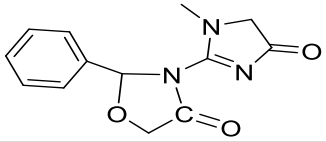
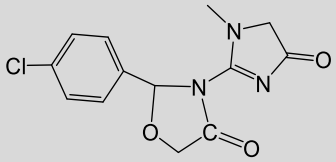
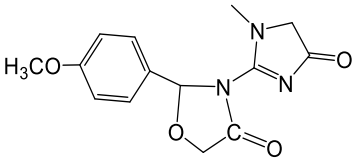
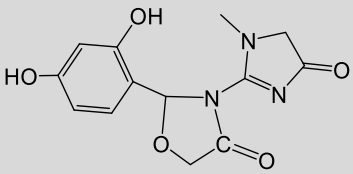
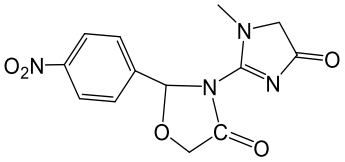
Schiff bases **1-5** (0.002 mol), 10 mL of dry 1,4-dioxane , glycolic acid (0.184 mL, 0.002 mol) and anhydrous zinc chloride (0.21g, 0.0016 mol) were combined and heated at 80 °C for 8-10 hours. Then, the reaction mixture was poured over crushed ice, and the resulting precipitate was filtered. The new compounds (16-20) were recrystallized from ethanol[22].
The physical properties of synthesized compounds ( **1-20** ) are presented in Table 1.




**Scheme 1:** Synthetic rote of synthesized compound **1-20**

**Table1 :** Physical properties of compounds **[1-20]**

| Comp No. | Structure | Molecular formula | M. wt ($g.mol^{-1}$) | Yield (%) | mp(°C) | Color |
|---|---|---|---|---|---|---|
| **1** |  | $C_{11}H_{11}N_3O$ | 201.229 | 73 | 223-225 | Off White |
| **2** |  | $C_{11}H_{10}N_3ClO$ | 235.671 | 85 | 230-232 | white |
| **3** |  | $C_{12}H_{13}N_3O_2$ | 231.255 | 67 | 198-200 | Brown |
| **4** |  | $C_{11}H_{11}N_3O_3$ | 233.227 | 64 | 210-212 | Pale pink |
| **5** |  | $C_{11}H_{10}N_4O_3$ | 246.226 | 82 | 218-220 | Yellow |
| **6** |  | $C_{13}H_{14}N_4O_2$ | 258.281 | 77 | 186-188 | White |
| **7** |  | $C_{13}H_{13}ClN_4O_2$ | 292.723 | 81 | 190-192 | Off White |
| **8** |  | $C_{14}H_{16}N_4O_3$ | 288.307 | 68 | 238-240 | yellow |
| **9** |  | $C_{13}H_{14}N_4O_4$ | 290.279 | 54 | 180-182 | Brown |
| **10** |  | $C_{13}H_{13}N_5O_4$ | 303.278 | 82 | 200-202 | Yellow |

| | | | | | | |
|---|---|---|---|---|---|---|
| **11** |  | $C_{13}H_{13}N_3O_2S$ | 275.326 | 74 | 140-142 | Yellow |
| **12** |  | $C_{13}H_{12}ClN_3O_2S$ | 309.768 | 82 | 148-150 | Shine Yellow |
| **13** |  | $C_{14}H_{15}N_3O_3S$ | 305.352 | 63 | 123 - 125 | Orange |
| **14** |  | $C_{13}H_{13}N_3O_4S$ | 307.324 | 59 | 117-119 | Black |
| **15** |  | $C_{13}H_{12}N_4O_4S$ | 230.323 | 81 | 161-163 | Yellow |
| **16** |  | $C_{13}H_{13}N_3O_3$ | 259.265 | 78 | 108 - 110 | Pale Yellow |
| **17** |  | $C_{13}H_{12}ClO_3N_3$ | 293.707 | 80 | 121 - 123 | Yellow |
| **18** |  | $C_{14}H_{15}N_3O_4$ | 289.291 | 65 | 133-135 | Orange |
| **19** |  | $C_{13}H_{13}N_3O_5$ | 291.263 | 61 | 112-115 | Black |
| **20** |  | $C_{13}H_{12}N_4O_5$ | 304.262 | 77 | 127-129 | Deep Yellow |

*2.3. Biological activity*

The agar diffusion method [23], a simple, fast, and inexpensive technique, is commonly used to evaluate the biological activity of synthesized compounds. This method involves preparing samples of compounds at required concentrations, for example [$10^{-3}$M] [24] for each compound; then, by cotton wab, the microorganisms were spread on Mueller-Hinton agar. The plates were incubated for 24 hrs at 37 °C. The inhibition zone was measured to evaluate the antibacterial activity of the synthetic compounds [25]. The biological activity of the following synthesized compounds (1, 2, 6, 7, 9, 10, 11, 12, 16, 17) was measured using types of bacteria (Gram +ve) such as *Streptococcus*, *Bacillus* and bacteria (Gram -ve) including *Klebsiella, Escherichia coli* as well as using *Candida,* a type of fungus. Ampicillin was used as a reference drug for antibacterial activity, and (Greseofulvin) was used as a reference drug for antifungal activity [26]. Ethanol was used as a solvent; the results are listed in Table 7.

*2.4. Antioxidant activity*

Among the numerous techniques for measuring antioxidant activity, the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay [27] is highly valued owing to its stable free radicals at room temperature, light sensitivity, simplicity, speed, and cost-effectiveness. In the DPPH method, the tested antioxidant compounds react with (2,2-diphenyl-1-picrylhydrazyl) DPPH (purple color) and convert to (2,2-diphenyl-1-picryl hydrazine) (yellow color ) by donating electrons [28]. To prepare the DPPH solution, 4 mg of DPPH was dissolved in 100 mL of ethanol, and the solution was protected from light by wrapping it in aluminum foil. Solutions of the synthesized compounds were prepared at concentrations of 25, 50, and 100 ppm. Then, 1 mL of each compound solution at these concentrations was added to 1 mL of the DPPH solution for further analysis. After one hour of incubation in the dark, the absorbance of each sample was measured using a spectrophotometer at 517 nm. The authoritative reference was ascorbic acid. The following equation was used to find the percentage of scavenging activity of each extract on DPPH radical as % inhibition of DPPH (I %) [30]:

I % = (Absorption blank – Absorption sample) / Absorption blank x 100.

## 3. Results and Discussion

*3.1. Chemistry*

Schiff bases **1-5** were synthesized as shown in Scheme 1 through the reaction of creatinine with substituted aromatic aldehydes. It was observed that aromatic aldehydes substituted with withdrawing groups, such as those in positions **2 and 5**, produced higher yields than those substituted with electron-donating groups. The presence of the withdrawing group as substituted groups on the aromatic aldehyde structure enhanced the nucleophilic addition, whereas electron-donating groups at positions 3 and 4 resulted in decreased yields. Table 1 illustrates the percentage of yields for prepared compounds.

The data of the (FT-IR) spectrum for compounds **1-5** confirmed the appearance of a new band at (1635–1660) $cm^{-1}$ related to the C=N imine group of Schiff bases and disappearance of $NH_2$ band. This is evidence of reaction creatinine and the formation of new products as blogged in table 2. FT-IR data of compounds **6-10** showed that a new band was formed at (3220- 2275) $cm^{-1}$, belonging to the NH group and the disappearance of the imine group, a new band was formed at (1700 –1730) $cm^{-1}$, belonging to C=O ring. These bands are blogged in Table 3, while the FT-IR spectrum of compounds **11-15** revealed the disappearance band of C=N and the appearance of a new band at(630– 650) $cm^{-1}$ due to (C-S) of new cyclic

compounds as shown in Table 4. Compounds **16-20** showed a band at (1186–1280) $cm^{-1}$ related to the (C-O-C) group [31]. These bands and others are blogged in Table 5.

**Table 2 :** FT-IR Data of compounds **1 – 5 (**υ, $cm^{-1}$)

| Comp No. | C-H aliphatic | C=N Schiff bases | C=O cyclic amide | C-H aromatic | C=C aromatic | C=N Creatinine ring | Other bands |
|---|---|---|---|---|---|---|---|
| 1 | 2800 | 1637 | 1689 | 3091 | 1600<br>1585 | 1664 | |
| 2 | 2981 | 1658 | 1699 | 3116 | 1616<br>1546 | 1666 | C-Cl<br>703 |
| 3 | 2962 | 1639 | 1690 | 3178 | 1600<br>1577 | 1668 | |
| 4 | 2931 | 1649 | 1706 | 3076 | 1604<br>1498 | 1689 | -OH<br>3315 |
| 5 | 2921 | 1635 | 1703 | 3062 | 1598<br>1510 | 1675 | $NO_2$<br>1380<br>1560 |

**Table 3 :** Data of FT-IR for compounds **6 – 10 (**υ, $cm^{-1}$)

| Comp No. | υ **C-H** aliphatic | υ C=O cyclic amide | υ C=O ring | N-H | υ C-H aromatic | υ C=C aromatic | υ C=N Creatinine Ring | Other |
|---|---|---|---|---|---|---|---|---|
| 6 | A sym 2952<br>Sym 2883 | 1689 | 1712 | 3272 | 3072 | 1606<br>1552 | 1662 | |
| 7 | A sym 2994<br>Sym 2877 | 1697 | 1728 | 3255 | 3180 | 1598<br>1509 | 1666 | C-Cl<br>671 |
| 8 | A sym 2916<br>Sym 2880 | 1692 | 1717 | 3263 | 3176 | 1598<br>1504 | 1654 | |
| 9 | A sym 2962<br>Sym 2887 | 1680 | 1706 | 3222 | 3031 | 1600<br>1506 | 1668 | -OH<br>3442 |
| 10 | A sym 2950<br>Sym 2883 | 1689 | 1722 | 3271 | 3080 | 1606<br>1502 | 1667 | |

**Table 4 :** FT-IR data of compounds **11 – 15 (**υ, $cm^{-1}$)

| Comp No. | υ **C-H** aliphatic | υ C=O cyclic amide | υ C=O ring | C–S | υ C-H aromatic | υ C=C aromatic | υ C=N Creatinine Ring | other |
|---|---|---|---|---|---|---|---|---|
| 11 | A sym 2974<br>Sym 2914 | 1689 | 1716 | 630 | 3091 | 1598<br>1509 | 1662 | |
| 12 | A sym 2970<br>Sym 2921 | 1704 | 1735 | 646 | 3114 | 1608<br>1581 | 1660 | C-Cl<br>659 |
| 13 | A sym 2970<br>Sym 2835 | 1708 | 1728 | 640 | 3176 | 1598<br>1504 | 1654 | |
| 14 | A sym 2989<br>Sym 2920 | 1703 | 1733 | 644 | 3170 | 1593<br>1546 | 1666 | -OH<br>3369 |
| 15 | A sym 2980<br>Sym 2860 | 1695 | 1747 | 635 | 3080 | 1606<br>1502 | 1667 | |

**Table 5 :** FT-IR data of compounds **16 – 20 (**υ, $cm^{-1}$)

| Comp No. | υ **C-H** aliphatic | υ C=O cyclic amide | υ C=O ring | C-–O-–C | υ C-H aromatic | υ C=C aromatic | υ C=N Creatinine Ring | other |
|---|---|---|---|---|---|---|---|---|
| 16 | A sym 2925 Sym 2848 | 1704 | 1724 | 1234 | 3153 | 1614 1550 | 1660 | |
| 17 | A sym 2962 Sym 2850 | 1706 | 1731 | 1186 | 3070 | 1583 1540 | 1669 | C-Cl 702 |
| 18 | A sym 2958 Sym 2869 | 1692 | 1747 | 1280 | 3184 | 1598 1548 | 1665 | |
| 19 | A sym 2960 Sym 2884 | 1703 | 1725 | 1242 | 3186 | 1542 1521 | 1620 | |
| 20 | A sym 2961 Sym 2850 | 1687 | 1733 | 1207 | 3072 | 1602 1583 | 1664 | |

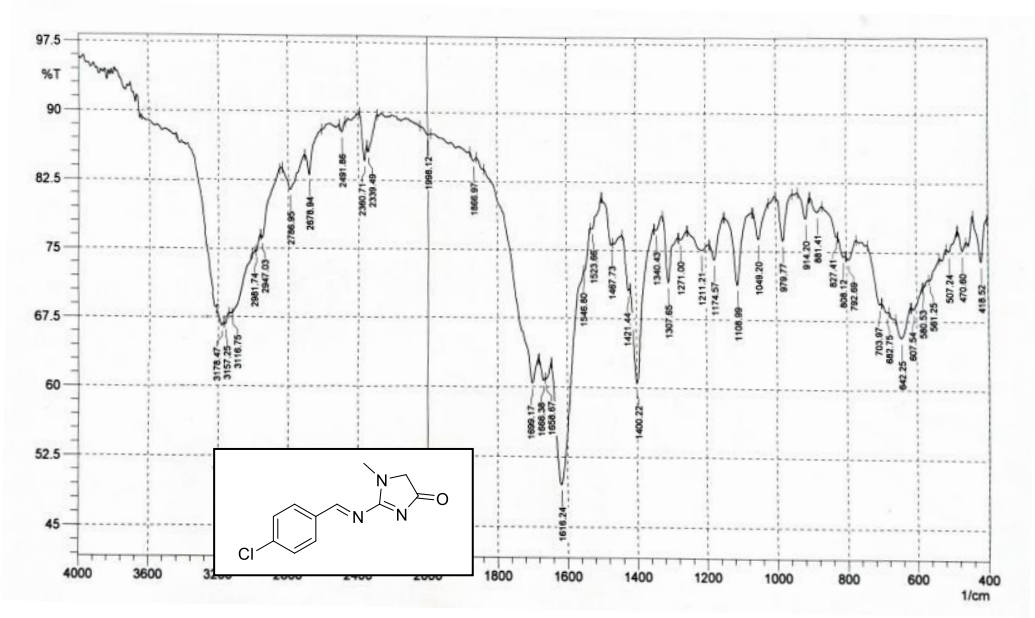



**Figure 1:** FT-IR spectrum for compound **2**

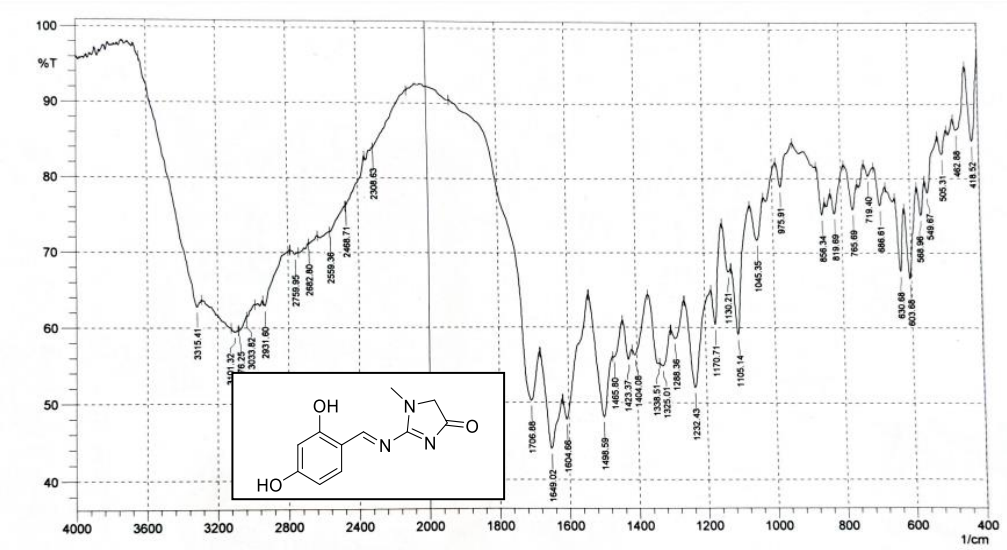



**Figure 2:** FT-IR spectrum for compound **4**

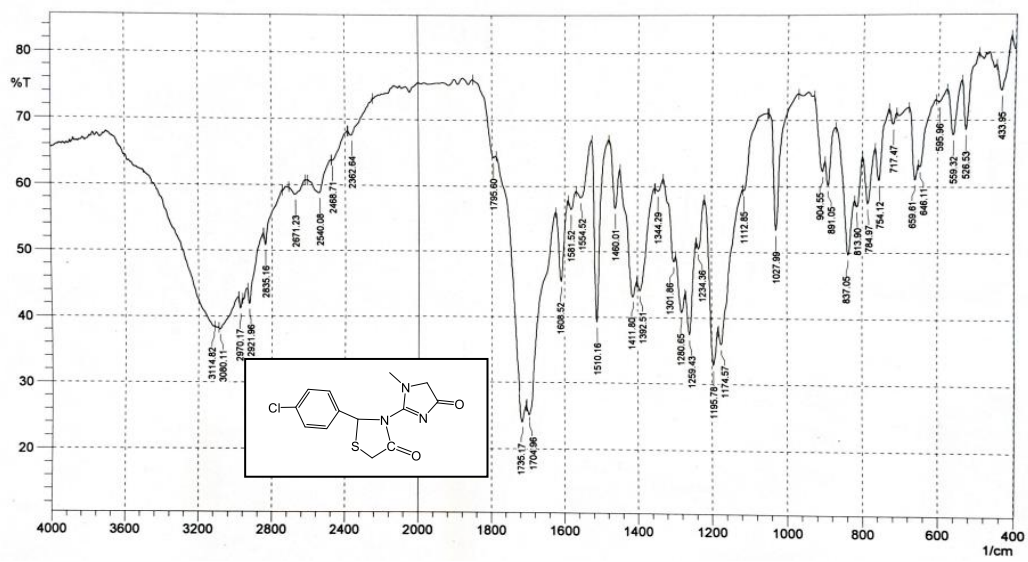



**Figure 3:** FT-IR spectrum for compound **12**

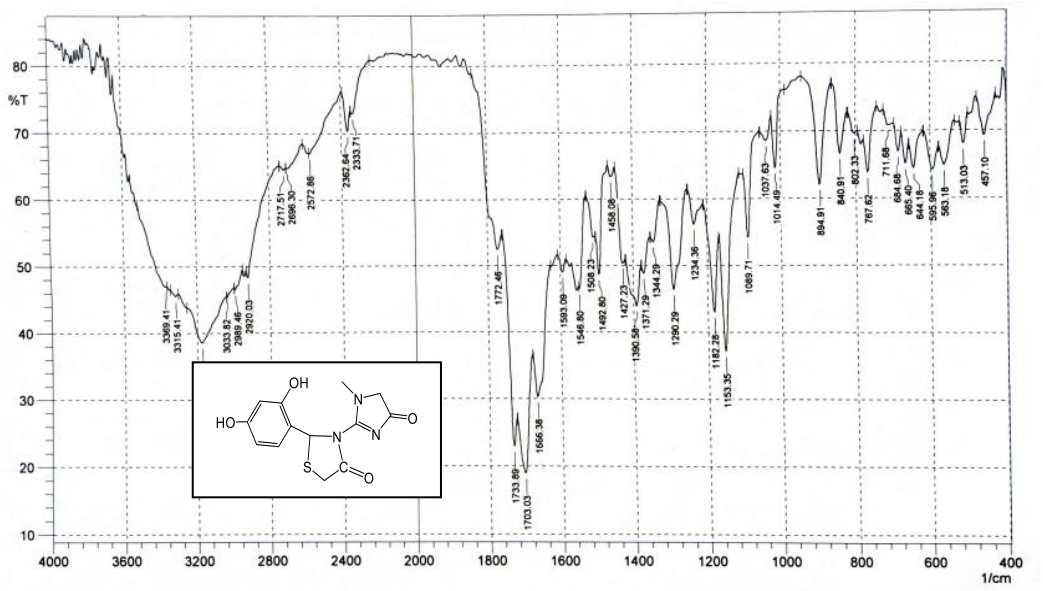
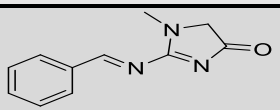
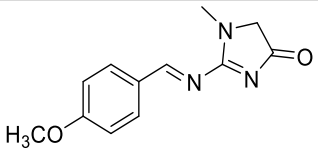
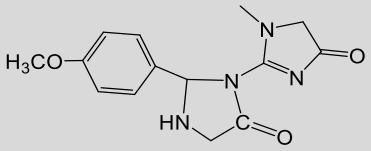
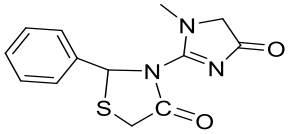
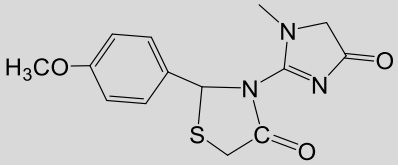
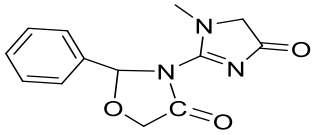
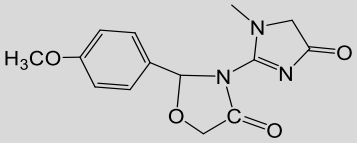



**Figure 4:** FT-IR spectrum for compound **14**

The $^{1}$H NMR spectral data of compounds ( **1, 3, 8, 11 , 13, 16** and **18** ) showed signals at δ (2.5-3.0) ppm due to (s, 3H, N-$\underline{CH_3}$), at δ (3.1- 3.7) ppm due to (s, 2H, -N-$\underline{CH_2}$ ), compound **1, 3** showed δ at ( 7.8- 8.2) ppm belong to (s, 1H , N = $\underline{CH}$-ph ), compound **8** showed δ at (8.1) ppm due to( m ,1H , $CH_2$-$\underline{NH}$ ), compound **11, 13** showed δ at (3,2- 3.8 ) ppm due to (s, 2H, S- $\underline{CH_2}$ ) and compound **16 and 18** showed δ at (2.5- 3.9)ppm belong to(s, 2H,O – $\underline{CH_2}$) [32] all of this are listed in Table 6.

**Table 6:** The $^{1}$H NMR of compounds 1, 3, 8, 11, 13, 16, and 18

| Comp No. | Compound structure | $^{1}$H-NMR spectral data (δ ppm ) |
|---|---|---|
| **1** |  | 8.0 (s, 1H , N = CH-ph ), 7.9 –7.0 ( m ,5 H , C-H aromatic), 1.8 (s, 2H, $CH_2$), 1.3 (s, 3H, N-CH3). |
| **3** |  | 8.2 (s, 1H , N= CH ) 7.9-7.3 (m,4H , C-H aromatic), 3.1(s, 3H , $OCH_3$ ), 2.1 (s, 2H , $CH_2$), 1.7 (s, 3H, N-CH3). |
| **8** |  | 8.1 ( m ,1H , $CH_2$-NH ) 7.9 ( d , 1H , N-CH-Ph) (7.5 – 6.8 ) ( m ,4H , C-H aromatic) 3.2 ( s , 3H , $OCH_3$ ), 2.1 ( s, 2H, $CH_2$ ) 1.9 (d ,2H , $CH_2$-NH ), 1.5 (s, 3H-N-CH3). |
| **11** |  | 7.9 ( s , 1H , N-CH-Ph ) 7.6 – 7.3 ( m, 5H , C-H aromatic) 3.2 (s, 2H, S- $CH_2$ ), 3.1 (s, 2H , $CH_2$ ) 2.6 (s, 3H , N-CH3) |
| **13** |  | 7.8( s , 1H , N-CH-Ph), 7.0 – 7.6 ( m, 4H , C-H aromatic) 3.8 (s, 2H, S- $CH_2$ ), 3.6 (s, 2H , $CH_2$ ) 2.9 ( s , 3H , $OCH_3$ ), 2.7 (s, 3H , N-CH3) |
| **16** |  | 8.0 ( s , 1H , N-CH-Ph ) ; 7.7 – 7.1 ( m, 5H , C-H aromatic), 3.9 (s, 2H, O – $CH_2$ ), 3.7 (s, 2H , $CH_2$ ), 2.5 (s, 3H , N-CH3). |
| **18** |  | 8.1( s , 1H , N-CH-Ph ), 7.3 – 6.6 ( m, 4H, C-H aromatic), 3.6 (s ,3H, $OCH_3$ ), 3.0 (s, 3H , N-CH3), 2.5 (s, 2H, O- $CH_2$ ), 1.2 (s, 2H , $CH_2$ ). |

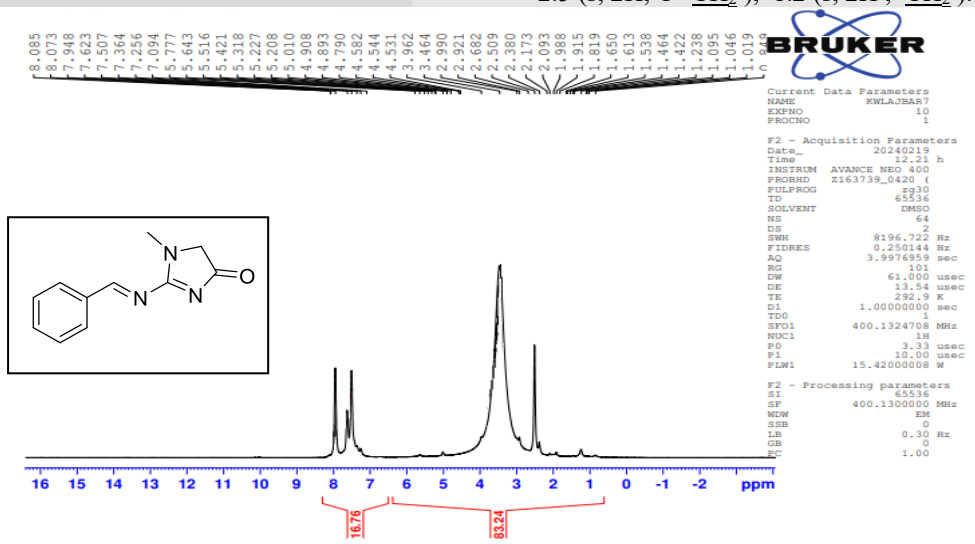



**Figure 5:** $^{1}$H NMR spectrum for compound **1**

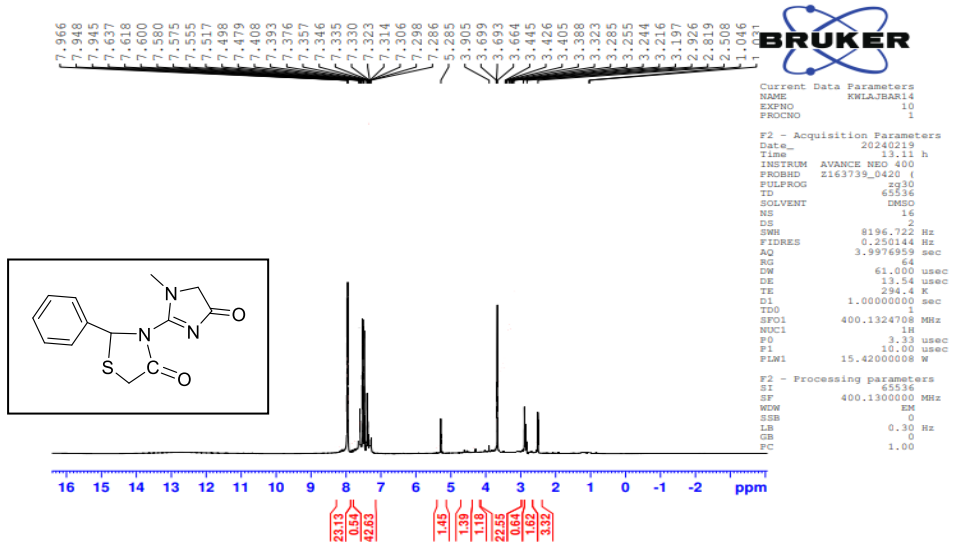



**Figure 6:** $^{1}$H NMR spectrum for compound **11**

*3.2. Biological activity*

Antibacterial activity of the prepared compounds **1-20** was evaluated against types of bacteria(Gram-positive and Gram-negative), *Streptococcus, Bacillus, Escherichia coli, Klebsiella*. The testing was performed using the Agar diffusion method. The inhibition zone is measured by using a metric ruler over the inhibition zone, at its widest diameter, and then measuring from one edge of the zone to the other. It may be helpful to hold the panel up to the light and then use measurements in millimeters. Most synthesized compounds exhibited clear antibacterial effects. Compounds 7 and 9 performed especially well, yielding results similar to the reference agent Ampicillin. Compound **7** showed the greatest activity against bacteria *E. coli, Klebsiella,* while compound **9** showed the strongest effect against *Streptococcus,* and both compounds had a strong effect against other bacteria. It was also noticed that compound **11** was the least effective against most types of bacteria, but had a strong effect against fungi. Also compound **2** produced the strongest effect against fungi that making compound **( 2,11 )** more selective in treating fungi. The reason for the difference in the effectiveness of these compounds may be due to the nature of their steric arrangement or to the effect of the active groups in their molecular structure.

**Table 7:** Biological activities of prepared compounds

| Comp. No. | *Streptococcus (+ve )* | *Bacillus (+ve )* | *Escherichia coli (- ve )* | *Klebsiella (- ve )* | *Candida ( fungus)* |
|---|---|---|---|---|---|
| 1 | 12 | 13 | 12 | 13 | 25 |
| 2 | 15 | 15 | 25 | 15 | 40 |
| 6 | 14 | 17 | 16 | 15 | 25 |
| 7 | 20 | 20 | 30 | 30 | 25 |
| 9 | 23 | 16 | 21 | 23 | 20 |
| 10 | 18 | 15 | 17 | 19 | 27 |
| 11 | 13 | 12 | 12 | 12 | 33 |
| 12 | 14 | 13 | 13 | 14 | 16 |
| 16 | 13 | 13 | 17 | 13 | 20 |
| 17 | 15 | 14 | 18 | 16 | 22 |
| Ampicillin | 18 | 20 | 25 | 20 | / |
| Greseofulvin | / | / | / | / | 34 |

*3.3. Antioxidant activity*

The antioxidant activity was tested by the decrease in absorbance with varying sample concentrations, as it occurs due to the removal of DPPH. The percentage of scavenging activity of each sample on the radical is denoted by DPPH (I%) and can be calculated using the following equation:

**I % = (Absorption blank – Absorption sample) / Absorption blank x 100.**

As shown in Table 8 and Figure 7, several of the synthesized compounds, including 5, 10, and 16, demonstrated significant DPPH scavenging activity at various concentrations (100, 50, and 25 ppm). In contrast, some compounds, such as compound 20, exhibited low activity.

**Table 8 :** The scavenging percentage for some prepared compounds

| Comp. No. | DPPH activity ( % ) | | |
|---|---|---|---|
| | 25 ppm | 50 ppm | 100ppm |
| 1 | 45.1 | 56.4 | 68.6 |
| 3 | 50.34 | 52.75 | 58.08 |
| 5 | 49.12 | 76.92 | 88.08 |
| 6 | 28.68 | 44.59 | 52.26 |
| 8 | 36.7 | 38.55 | 49.67 |
| 10 | 46.45 | 80.83 | 87.36 |
| 11 | 31.56 | 42.51 | 57.15 |
| 16 | 47.22 | 62.14 | 70.11 |
| 18 | 44.71 | 57.36 | 63.28 |
| 20 | 34.82 | 37.48 | 41.62 |
| Vitamin C | 57.55 | 89.66 | 96.5 |

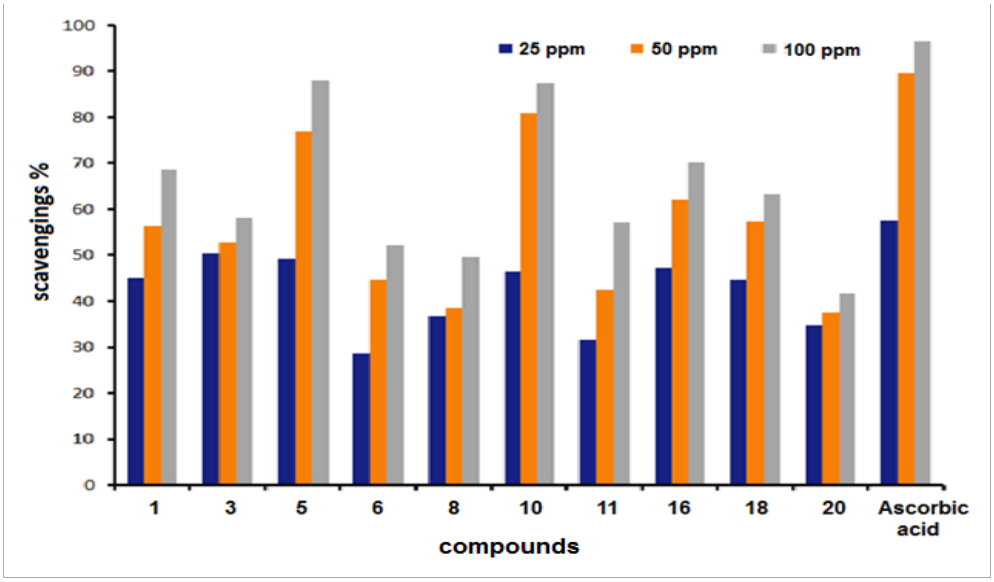



**Figure 7 :** scavenging abilities of the synthesized compounds and ascorbic acid.

## Conclusion

In this study, Schiff bases were synthesized from creatinine and then underwent a ring-closure reaction to obtain new derivatives. Imidazolidine-4-one was formed from the reaction of Schiff bases with glycine, as well as thiazolidine-4-one was obtained from the reaction of the prepared Schiff bases with thioglycolic acid, and oxazolidine-4-one from the reaction of Schiff bases with glycolic acid. FT-IR and $^{1}$H NMR spectroscopy techniques were employed

to characterize the new compounds. Biological activity assessments revealed that these compounds possess notable biological activity and antioxidant effect (in vitro) and have shown promising results in their ability to treat many diseases.

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