Research Article

Synthesis and Antioxidant Study of new1,3-Oxazepin-4,7-dione and1,2,3-Triazole derivatives

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Received: 09.09.19, Revised: 09.10.19, Accepted: 09.11.19

ABSTRACT
A series of new heterocyclic compounds containing 1,3-oxazepinering system wassynthesized by a cycloaddition reaction of Schiff bases with maleic and phthalic anhydrides.Additionally, two new compounds containing 1,2,3-triazole ring system and the bioactive benzene sulfonic acid moiety were designed and synthesized via 1,3-dipolarcycloaddition reaction of 4-azidobenzene sulfonic acid with propiolic acid andacetylacetone. The structure of all the target compounds was confirmed by FT-IT, 1H-NMR, 13C-NMR and mass spectroscopies. Furthermore, the antioxidant activity studyshowed that all the target compounds have a promising antioxidant activity against DPPH.

Keywords: Heterocyclic Chemistry, Schiff base, 1,3-Oxazepine, 1,2,3-Triazole, Antioxidant activity, DPPH.

INTRODUCTION

Free radicals are molecules, atoms or ions with unpaired electronswhich are constantly formed in human body as a results for different processes[1, 2]. High levels of these species can cause damaging to the biomolecules such as proteins, lipids, enzymes and nucleic acid molecules[3, 4]. This may result in many diseases such as cancer, diabetes, autoimmune diseases and others[5, 6].Antioxidants are chemical compounds reduce or neutralize the free radicals thus protecting organisms from the oxidative effect[7,8]. Therefore, there is an increasing interest has been directed towards the synthesis of new compounds can be used as antioxidants[9]. Over the years, heterocyclic compounds have become the most important class of organic compounds in the organic synthesis due to their various unique chemical and biological properties[10-12].It is well known that compounds containing1,3-oxazepine and 1,2,3-triazole ring system (Figure 1) have a wide range of antioxidants applications[13, 14].

1,3-Oxazepine **1,2,3-Triazole**

Figure 1: Structure of 1,3-oxazepine and 1,2,3-triazole ring system.

1,3-Oxazepine ring system is an unsaturated non-aromatic seven-membered heterocyclic ring containstwo heteroatoms (oxygen and nitrogen);oxygen atom is located at 1-position and nitrogen atom at 3-positions[15].Recently, the cycloaddition reaction of imine compounds with cyclic anhydridesis the method choice for the synthesis of 1,3-oxazepine ringsystem contains two carbonyl group at 4- and 7-positions[16]. Among of high nitrogen containing heterocyclic systems, 1,2,3-triazole ring system has played a vital position in the medicinal chemistry[17, 18]. 1,2,3-Triazole ring system is an aromatic five-membered heterocyclic ring composed of adjacent three nitrogen atoms and two carbon atoms[19].In general, 1,4-disubstituted-1,2,3-triazole structure is the most important of compounds containing 1,2,3-triaozle ring system due to its use in different chemical and biological activities[20, 21]. Synthetically, 1,4-disubstituted-1,2,3-triazole ring system can be synthesized via 1,3-dipolarcycloaddition reaction using different starting materials in the presence of variety of catalysts and conditions[22].

Chemicals and Instruments

All starting materials and solvents that wereused in the synthesis of the target compounds were supplied from available sources and were directly used without further purification. FT-IR spectra were recorded on an FT-IR–8400S plus spectrometer operating from (4000–400 cm^{-1}) as a KBr disc. ^{1}H-NMR and ^{13}C-NMR spectra were recorded at 500 MHz and 125 MHz, respectively on Inova spectrometer. The mass spectra (MS) were recorded using MS Model: 5973 Network Mass Selective Detector, with Ion source: Electron Impact (EI) 70eV.

PROCEDURES

General procedure for the synthesis of *p*-substituted Schiff bases (1a-1d)[23]: An alcoholic solution contains *p*-substituted benzaldehyde (10.0 mmol) and three drops of glacial acetic acid was gradually added to a warmedstirred alcoholic solution of 1-mainonaphthalene (10.0 mmol) over five minutes.The reaction mixture was then stirred for further 30 minutes at room temperature before been

filtered to collect the target compounds in a yield 75-83%.

General procedure for the synthesis of 1,3-oxazepine derivatives (2a-2d, 3a-3d):An appropriate Schiff base**1a-1d** (7.14 mmol) and an appropriate cyclic anhydride (7.20 mmol) in dry benzene (50 ml) were refluxed for 24 hours. The solvent wasevaporated on rotary evaporator to dryness and the residue was then triturated in diethyl ether. The solid product was collected under vacuum filtration and dried to give the target compounds as solid products.

2-(Phenyl)-3-(naphthalen-1-yl)-2,3-dihydro-[1,3]oxazepin-4,7-dione (2a): It was prepared by using compound **1a**(1.65 g, 7.14 mmol) and maleic anhydride (0.70 g, 7.20 mmol); Yield (1.7 g, 60%) as a pale yellow solid. FT-IR (KBr disc, cm^{-1}), 3271 (C-H, benzylic), 3051 (C-H, Ar-H), 1712 (C=O, lactone group) and 1635 (C=O, lactam group).^{1}H-NMR (500 MHz, DMSO-d_6): = 6.4-6.7 (dd, 2H, CH=CH), 7.5-8.1 (m, 12H, Ar-H) and 10.49 (s, 1H,-O-CH-N-). HPMS-EI$^+$(m/z): Calc. for $C_{21}H_{15}NO_3$= 329.3, Found=329.0.

2-(4-Nitrophenyl)-3-(naphthalen-1-yl)-2,3-dihydro-[1,3]oxazepin-4,7-dione (2b):It was prepared by using compound**1b** (1.97 g, 7.14 mmol) and maleic anhydride (0.70 g,7.20 mmol);Yield (2.0 g, 73%) as a yellow-brownsolid. FT-IR (KBr disc, cm^{-1}), 3238 (C-H, benzylic), 3078 (Ar-H), 1716 (C=O, lactone group), 1629 (C=O, lactam group) and 1346 (C-NO_2).^{1}H-NMR (500 MHz, DMSO-d_6): = 6.2-6.6 (dd, 2H, CH=CH), 7.0-8.2 (m, 11H, Ar-H) and 10.49 (s, 1H, -O-CH-N-).HPMS-EI$^+$ (m/z): Calc. for $C_{21}H_{14}N_2O_5$= 374.3, Found=374.0.

2-(4-Bromophenyl)-3-(naphthalen-1-yl)-2,3-dihydro-[1,3]oxazepin-4,7-dione (2c):It was prepared by using compound**1c** (2.21 g, 7.14 mmol) and maleic anhydride (0.70 g,7.20 mmol); Yield (1.9 g, 64%) as a dark yellow solid. FT-IR (KBr disc, cm^{-1}), 3277 (C-H-, benzylic), 3051 (C-H, Ar-H), 1712 (C=O, lactone group), 1633 (C=O, lactam group) and 767 (C-Br). ^{1}H-NMR (500 MHz, DMSO-d_6): = 6.4-6.7 (dd, 2H, CH=CH), 7.6-8.1 (m, 11H, Ar-H) and 10.49 (s, 1H, -O-CH-N-). HPMS-EI$^+$ (m/z): Calc. for $C_{21}H_{14}BrNO_3$= 408.2, Found= 408.0.

2-(4-Chlorophenyl)-3-(naphthalen-1-yl)-2,3-dihydro-[1,3]oxazepin-4,7-dione (2d):It was prepared by using compound **1d** (1.89 g, 7.14 mmol) and maleic anhydride (0.70 g, 7.20 mmol); Yield (2.3 g, 87%) as a yellow solid. FT-IR (KBr disc, cm^{-1}), 3273 (C-H, benzylic), 3049 (C-H, Ar-H), 1712 (C=O, lactone group), 1635 (C=O, lactam group) and 765 (C-Cl). ^{1}H-NMR (500 MHz, DMSO-d_6): = 6.4-6.7 (dd, 2H, CH=CH), 7.5-8.1 (m, 11H, Ar-H) and 10.48 (s, 1H, -O-CH-N-).HPMS-EI$^+$ (m/z): Calc. for $C_{21}H_{14}ClNO_3$= 363.7, Found=363.0.

4-(Naphthalen-1-yl)-3-phenyl-3,4-dihydro-2,4-benzoxazepin-1,5-dione (3a): It was prepared by using compound**1a**(1.65 g, 7.14 mmol) and phthalic anhydride (1.06 g,7.20 mmol);Yield (2.3 g, 84%) as a pale purple solid. FT-IR (KBr disc, cm^{-1}), 3282 (C-H, benzylic), 3049 (C-H, Ar-H), 1703 (C=O, lactone group) and 1660 (C=O, lactam group). ^{1}H-NMR (500 MHz, DMSO-d_6): = 7.3-8.2 (m, 16H, Ar-H) and 10.38 (s, 1H,-O-CH-N-). ^{13}C-NMR (125.68 MHz, DMSO-d_6): = 168.3, 167.7, 139.1, 133.8, 132.8, 131.7, 128.7, 127.7, 127.9, 125.5, 123.5, 122.6 and 81.8. HPMS-EI$^+$ (m/z): Calc. for $C_{21}H_{15}NO_3$=379.0, Found=379.0.

4-(Naphthalen-1-yl)-3-(4-nitrophenyl)-3,4-dihydro-2,4-benzoxazepin-1,5-dione (3b):It was prepared by using compound**1b** (1.97 g, 7.14 mmol) and phthalic anhydride (1.06 g, 7.20 mmol); Yield (1.9 g, 62%) as a pale yellow solid. FT-IR (KBr disc, cm^{-1}), 3282 (C-H, benzylic), 3047 (Ar-H), 1703 (C=O, lactone group), 1659 (C=O, lactam group) and 1340 (C-NO_2). ^{1}H-NMR (500 MHz, DMSO-d_6): = 7.3-8.9 (m, 15H, Ar-H) and 10.37 (s, 1H, O-CH-N-). ^{13}C-NMR (125 MHz, DMSO-d_6): = 168.2, 167.6, 141.5, 133.8, 132.5, 131.7, 129.8, 128.4, 127.9, 127.7, 126.6, 125.9, 124.0, 123.5, 122.6, 113.2 and 81.8. HPMS-EI$^+$ (m/z): Calc. for $C_{21}H_{14}N_2O_5$=424.4, Found= 425.0.

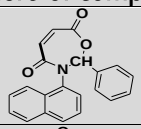
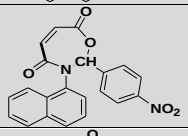
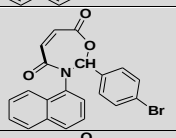
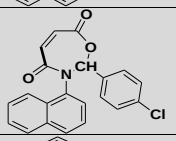
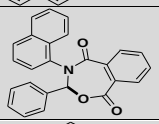
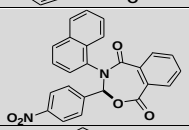
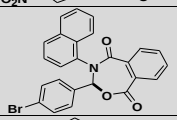
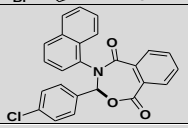
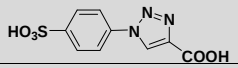
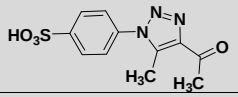
4-(Naphthalen-1-yl)- 3-(4-bromophenyl)-3,4-dihydro-2,4-benzoxazepin-1,5-dione (3c):It was prepared by using compound**1c**(2.21 g, 7.14 mmol) and phthalic anhydride (1.06 g,7.20 mmol); Yield (2.4 g, 73%) as a white solid. FT-IR (KBr disc, cm^{-1}), 3282 (C-H, benzylic), 3049 (Ar-H), 1703 (C=O, lactone group), 1660 (C=O, lactam group) and 767 (C-Br). ^{1}H-NMR (500 MHz, DMSO-d_6): = 7.3-8.2 (m, 15H, Ar-H) and 10.37 (s, 1H, -O-CH-N-). ^{13}C-NMR (125 MHz, DMSO-d_6): = 168.3, 167.6, 139.1, 133.8, 133.7, 131.7, 130.0, 129.5, 128.7, 127.9, 125.9, 125.5, 122.6 and 81.8. HPMS-EI$^+$ (m/z): Calc. for $C_{21}H_{14}BrNO_3$=458.4, Found=459.0.

4-(Naphthalen-1-yl)-3-(4-chlorophenyl)-3,4-dihydro-2,4-benzoxazepin-1,5-dione (3d):It was prepared by usingcompound **1d**(1.89 g, 7.14 mmol) and phthalic anhydride (1.06 g,7.20 mmol); Yield (2.0 g, 67%) as a white solid. FT-IR (KBr disc, cm^{-1}), 3282 (C-H, benzylic), 3049 (Ar-H), 1703 (C=O, lactone group), 1658 (C=O, lactam group) and 767 (C-Cl). ^{1}H-NMR (500 MHz, DMSO-d_6): = 7.3-8.2 (m, 16H, Ar-H) and 10.38 (s, 1H, -O-CH-N-). ^{13}C-NMR (125 MHz, DMSO-d_6): = 168.3, 167.6, 139.1, 133.8, 133.7, 131.7, 131.7, 130.0, 129.5, 128.7, 127.9, 125.9, 125.5, 123.5, 122.6 and 81.8. HPMS-EI$^+$ (m/z): Calc. for $C_{21}H_{14}ClNO_3$=413.8, Found=412.0.

Synthesis of4-azido-benzenesulfonic acid(4a): 4-Amino-benzenesulfonic acid (5.0 g, 28.8 mmol) and sodium carbonate (1.53 g, 14.43 mmol) were dissolved in water (50 ml) followed by the addition of sodium nitrite (3.0 g, 43.3 mmol). The resulting

solution was cooled to below 5.0 °C before being poured into a flask containing crashed ice (25.0 g) and HCl (5.0 ml). To the resulting solution, NaN_3 (2.8 g, 43.3 mmol) was slowly added over 20 minutes with maintaining the temperature below 5.0 °C. The reaction mixture was then stirred for 1.0 hour at the same temperature before being naturalized with conc. HCl. The reaction mixture was evaporated to dryness onthe rotary evaporator. The residue was then dissolved in methanol, filtered and concentrated to give the target product as a pale yellow solid in a yield (4.9 g, 85%). FT-IR (KBr disc, cm^{-1}), 3448 (OH, SO_3H), 3061 (C-H, Ar-H), 2137 (-N_3) and 1593 (C=C, Ar-H).

Table 1: Antioxidant activity values of the synthesized compounds using the DPPH assay.

Com. No.	Structure of compound	A_s	Inhibition %
2a		0.102	60.7
2b		0.054	79.2
2c		0.090	65.3
2d		0.039	85.0
3a		0.037	85.7
3b		0.032	87.6
3c		0.074	71.5
3d		0.035	86.5
4b		0.040	84.6
4c		0.037	85.7
Trolox		0.001	99.6

Synthesis of 1-(4-Sulfo-phenyl)-1H-1,2,3-triazole-4-carboxylic acid (4b): An aqueous solution of sodium ascorbate (0.63 g, 3.26 mmol, was dissolved in water 2.5 ml) was added to a stirred aqueous solution of $CuSO_4.5H_2O$ (0.53 g, 2.17 mmol, was dissolved in water 2.5 ml). To the resulting solution, a mixture of *tert*-butanol:water (15 ml 2:1), propiolic acid (1.9 ml, 32.6 mmol) and compound **4a** (6.5 g, 32.6 mmol) were sequentially added. The reaction mixture was then stirred at 50°C for 24 hours. The reaction mixture was then allowed to cool into room temperature before being worked-up by addition of water (100 ml). The solid precipitatewas collected by vacuum filtration, washed with ether and dried to give the target compound **4b** in a yield (5.9 g, 67%). FT-IR (KBr disc, cm^{-1}), 3500-2500 (OH, SO_3H, COOH), 3136 (Ar-H), 1722 (C=O, COOH), 1695 (C=C, triazolyl ring), 1597 (C=C, Ar) and 1400-

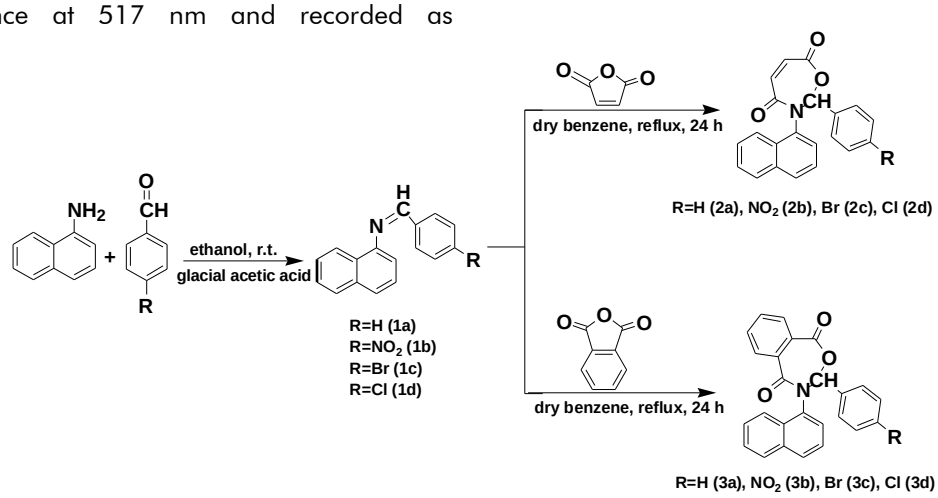
1354 (-N=N-). ^{1}H-NMR (500 MHz, DMSO-d_6): □=7.8-7.9 (dd, 4H, Ar-H), 9.3 (s, 1H, C=CH-triazolyl) and 13.3 (s, 1H, COOH). ^{13}C-NMR (125 MHz, DMSO-d_6): □= 161.5, 148.7, 140.7, 136.0, 127.1 and 120.0.HPMS-EI$^+$ (m/z): Calc. for $C_9H_7N_3O_5S$=269.2, Found =269.0.

Synthesis of 4-(4-Acetyl-5-methyl-[1,2,3]triazol-1-yl)-benzenesulfonic acid (4c):Toa mixture of acetylacetone (5.0 ml, 50.2 mmol) and Et_3N (7.0 ml, 50.2 mmol) in DMF (10 ml),compound **4a**(5.0 g, 25.1 mmol) was added in one portion. The reaction mixture was stirred at60 °Cfor o 24 hours. The formed precipitate was collected by vacuum filtration, washed with ether and dried to give the target compound **4c**in an excellent yield (6.5 g, 92%). FT-IR (KBr disc, cm^{-1}), 3506-2900 (OH, SO_3H), 3068 (Ar-H), 2920 (C-H, aliphatic) and 1600 (C=C, triazolyl ring). ^{1}H-NMR (500 MHz, DMSO-d_6): □= 2.52 (s, 3H, CH_3), 2.63 (s, 3H, $COCH_3$) and 7.5-7.8 (q, 4H, Ar-H). ^{13}C-NMR (125 MHz, DMSO-d_6): □= 193.3, 149.5, 142.8, 137.6, 134.8, 126.9,124.9, 27.6 and 9.7. HPMS-EI$^+$ (m/z): Calc. for $C_{11}H_{11}N_3O_4S$=281.2, Found = 281.0.

Antioxidant assay:The free radical scavenging activity of the synthesized compounds **2a-2d**, **3a-3d**, **4b** and **4c**towards the radicalsof 1,1-diphenyl-2-picryl hydrazyl (DPPH) was measured as described in the literature[24].Practically, all the synthesized compounds were dissolved in DMSO(1.0 mg/ml) to prepare a stock solution. A solution of DPPH (0.1 mM,1.0 ml)was prepared in methanol and added to the tested sample solution (50 µl). The resulted mixture solution was allowed to stand at room temperature for 30 minutes following by measuring the absorbance at 517 nm and recorded as absorbance of sample (A_s) using a BIO–TEK Power Wave Multi well plate reader spectrophotometer. Theabsorbance of methanol solution of DPPH was measured as a control (A_c). Moreover, the radical scavenging activity of Trolox was recorded as a standard.The free radical scavenging activity of the target compounds was calculated as a percentage inhibition of the DPPH radical according tothe equation: DPPH scavenging effect (%) = $[(A_c - A_s)/A_c \times 100]$ where: A_c is the absorbance of the control reaction which equal to 0.26 and A_s is the absorbance of the tested sample.

RESULTS AND DISCUSSION

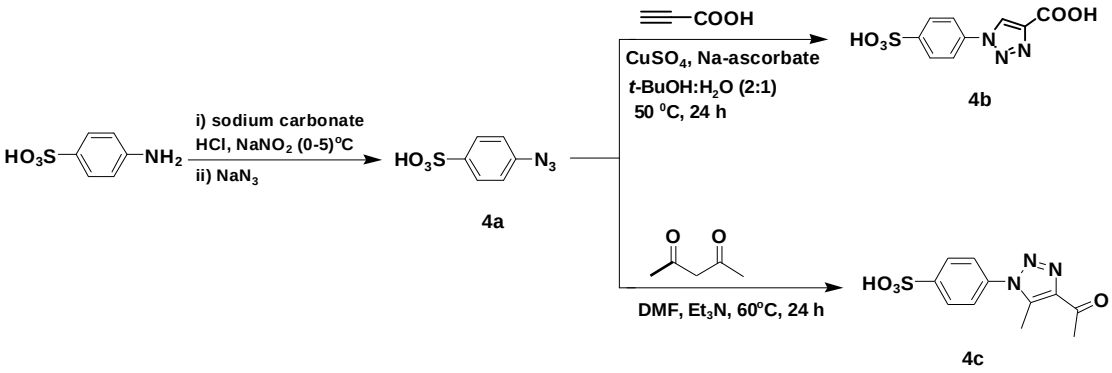
Chemistry: For the synthesis of the target 1,3-oxazepine derivatives **2a-2d** and **3a-3d**, a series ofschiff bases **1a-1d**was designed and synthesized as intermediatecompounds from 1-aminonapththalene as the amine component and a series of*p*-substituted benzaldehyde.Choosing of a series of *p*-substituted benzaldehyde is to investigate the effects of a structural variation of the substituent group on the antioxidants activity on the target 1,3-oxazepines derivatives. Practically, schiff bases **1a-1b** were synthesized via a reaction of 1-aminonaphthalene with *p*-substituted benzaldehyde in ethanol in the presence of few drops of glacial acetic acid as a catalyst according the modified procedure that was described in the literatures[23,25].The synthesized schiff bases **1a-1d** were then refluxed with maleicanhydride or phthalic anhydride in dry benzene for 24 hoursto obtain the target 1,3-oxazepine derivatives**2a-2d** and **3a-3d**, respectivelyas described in Scheme 1.



Scheme 1: Synthesis of 1,3-oxazpine derivatives2a-2d and 3a-3d.

This synthetic pathway highlighted that the reaction had been proceeded smoothly to give the target compounds **2a-2d** and **3a-3d**in a simple work-up with relatively high yield. Importantly,TLC showed that these products are pure enough and not required to purification by column chromatography. The structure of the synthesized 1,3-oxazepines derivatives **2a-2d** and **3a-3d** was verified by FT-IR, ^{1}H-NMR ^{13}C-NMR and GC-MS spectroscopies.Clearly,along with the disappearance of the absorption band of the azomethane group (N=CH) at 1670-1640 cm^{-1}, FT-IR spectra identifying the vibration frequencies of the new functional groupwhich is C=O of the lactone and lactam groups of oxazepine ring system at 1716-1703 cm^{-1} and 1660-1629 cm^{-1}, respectively. Interestingly,FT-IR

spectra also showed that the absorption of the benzylic group (C-H) of oxazepine ring system was appeared at 3282-3238 cm^{-1}. This high wave length can be attributed to linking the carbon atom of this group to the three withdrawing electron systems which is beingnapthyl ring system and two heteroatoms (oxygen and nitrogen) as described for compounds that were reported in the literature[26]. The ^{1}H-NMR spectra that were recorded for the target compounds **2a-2d** and **3a-3d**indicate that all the signals are belonging to the starting material combined with the correct integration of both starting material and the target products. For example, the appearance of a doublet-doublet peak at 6.7-6.2 ppm that belongs to the protons of CH=CH group of maleic anhydride moiety of compounds **2a-2d** and the appearance of a singlet peakof proton of -O-CH-N- groupof oxazepines ring system at10.5-10.3ppmfor compounds**2a-2d** and **3a-3d**along with the disappearance of the singletof proton of azomethane group (N=CH) at 8.7 ppm confirmed the target structures. Beside ^{1}H-NMR results, these structures were also correctly verified in the ^{13}C-NMR. In addition,their mass spectra showed that the calculated values of the ratio m/z being very close to the measured values of m/z.As a variety of pharmaceutical drugs are prepared as benzenesulfonic salts[27], we are interested in the synthesis of new 1,2,3-triazole derivatives containing this bioactive moiety. Currently, two compounds **4b** and **4c** containing this functional group and 1,2,3-triazole ring system was designed. For the synthesis of the target 1,2,3-triaozle derivatives **4b** and **4c**, 4-azidobenzene sulfonic acid **4a** was synthesized a key intermediate compound. This compound will introduce the target benzene sulfonic acid moiety along with azido group that is required the synthesis of 1,2,3-triazole ring system as shown in Scheme 2.



Scheme 2: Synthesis of 1,2,3-triaozle derivatives (4b and 4c).

Compound**4a** was prepared via the reaction of the corresponding diazonium salt with sodium azide following the procedure that was described in the literature[28]. After an investigation work-up, the target compound **4a** was obtained in a relatively high yield.Compound **4a**was characterized by FT-IR spectrum which showed the appearance of the main stretching bands at 2137 cm^{-1}which imputed for -N_3 group beside the characteristics data for the other residual groups.Compound **4a** was then chosen as the azide component in the copper (I) catalyzed azide-alkyne cycloaddition (CuAAC) that also known as "Click Reaction"[29]. Whereas propiolic acid was chosen as the alkyne component to generate 1,4-disubstituted-1,2,3-triaozle derivative **4b**.This synthetic route involved the addition of propiolic acid and compound **4a** to a solution of *tert*-butanol:water (2:1 v/v) containing $CuSO_4.5H_2O$ and sodium ascorbate. The latter is a reducing agent to generate *in situ* Cu (I) species that are required to perform click reaction successfully following the procedure that was described in the literature[30].The target product **4b** was separated by addition of water as pure solid product. The structure of compound **4b**was characterized by FT-IR, NMR, and mass spectroscopies. The FT-IR spectrum showed the main stretching bands at 3500-2500 $cm^{-1}$for OH group and 1722 cm^{-1} for C=O group of COOH along with the disappearance the stretching bands at 2137 cm^{-1} for -N_3 group of compound **4a**. The ^{1}H-NMR spectrum showed a singlet peak at 9.3 ppm that belong to the proton of -C=CH group of triazole ring further to the signals of other groups. In addition, ^{13}C-NMR and mass spectra agreed with ^{1}H-NMR results.After that the efforts were turned to synthesize compounds **4c**. To achieve this aim, compound **4a** was added to a mixture of acetylacetone and triethylamine in DMFand left to stir at 60 °C for 24 hours according to the procedure that was described in the literature[31]. By this synthetic pathway, the target compound **4c** was separated from the reaction mixture as a pure solid product in an excellent yield. This newly synthesized compound **4c** was confirmed by FT-IR, NMR and Mass spectroscopies. FT-IR spectrum showed the disappearance of the stretching band N_3 group of compound **4a** at 2137 cm^{-1}. The ^{1}H-NMR spectra that were recorded for the target compounds **4c**

indicate that all the signals are belonging to the compound **4a**combined with the correct integration of both starting material and the target product**4c**.In addition, the structure of compound **4c** was also confirmedcorrectly by ^{13}C-NMR and Mass spectra.

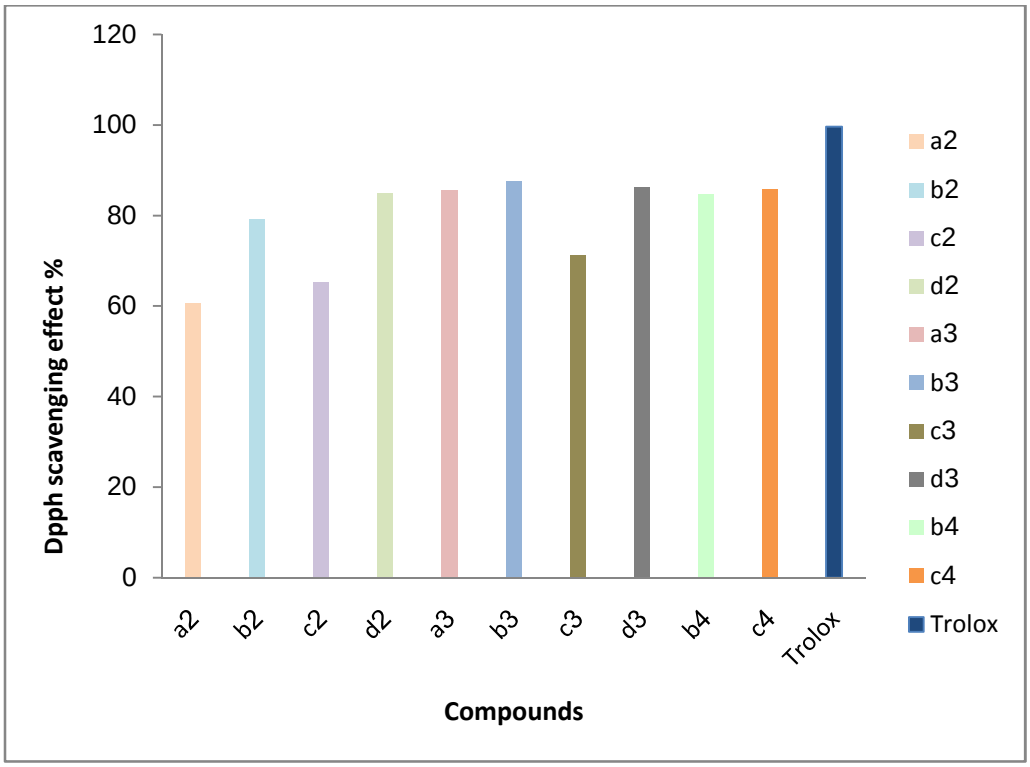


Figure 2: Antioxidant activity of DPPH scavenger radical for compounds 2a-4c.

Antioxidant assay: Antioxidant screening (DPPH radical scavenging activity)

The DPPH assay is commonly used to evaluate the effectiveness of antioxidants agents as a quick, reliable and reproducible parameter to search for the *in vitro* antioxidant activity of pure compounds.All the newly synthesized heterocyclic compounds derivatives were screened for *in vitro* antioxidant against DPPH free radicals in one concentration (500 ppm).According to experimental results, the entire newly synthesized compoundsshowed a good scavenging activity towards DPPH as shown in Table 1 and Figure 2.However, the oxazepine derivatives **3a-3d** that they were prepared using phthalic anhydride showed the higher scavenger activity than compounds**2a-2d**that were prepared using maleic anhydride. This is probably due to the presence of the additional aromatic system that comes from phthalic anhydride moiety thereby leading to increase the stability of the formed free radical of the synthesized compounds **3a-3d**. Furthermore, in both series 1,3-oxazepine derivatives **2a-2d** and **3a-3d**, that compounds substituted with nitro and chloro groups displayed the highest antioxidant activity compared to the standard. Interestingly, both **4b** and **4c**displayed a high scavenging activity towards DPPH with 84.6% and 85.7%, respectively compared to the standard. This higher scavenging activity is probably due to the presence of the benzene sulfonic acidmoiety that attached to 1,2,3-triaozle ring system.

CONCLUSION

In conclusion, aseries ofSchiff basescontaining naphthalene ring system were used successfully as starting materials for the synthesis of 1,3-oxazepine derivatives via a cycloaddition reaction with maleic and phthalic anhydrides. Interestingly, new two 1,2,3-traizole derivatives containing benzene sulfonic acid moiety were synthesized in a simple synthetic routevia 1,3-dipolarcycloaddition reaction of *p*-azidobenzene sulfonic acid with propiolic acid andacetylacetonein the presence of different conditions. Importantly, all the synthesized heterocyclic compounds displayed a promising antioxidant activity against DPPH.

ACKNOWLEDGMENT

The authors would like to thank the department of Chemistry/College of Science/AL-Muthanna University for the facilities during this work.

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