Synthesis of New Heterocyclic Compounds Derived from Anthrone and Evaluation of Their Biological Activity

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Abstract:

In this research, Schiff bases derived from the reaction of anthrone with different heterocyclic amines have been described. The resulted Schiff base compounds were reacted with various nucleophiles in order to obtain new heterocyclic derivatives. Chemical structures of all products were confirmed by IR, ^{1}H-, ^{13}C-NMR spectral data and elemental analysis. All synthesized compounds were in *vitro* tested against a standard strain of pathogenic microorganism including Gram +ve bacteria (*Staphylococcus aureus*), Gram –ve bacteria (*Escherichia coli*), and fungi (*Candida albicans*).

Keywords: Schiff base, Biological activity, Imidazole, 1,3,4-Thiadiazole

Introduction:

Schiff bases are used as substrates in the preparation of a number of industrial and biologically active compounds *via* closure, cycloaddition and replacement reactions. Moreover, Schiff bases are also known to have biological activities such as antimicrobial, antifungal, antitumor, and as herbicides[1]. Schiff bases have also been employed as ligands for complexation of metal ions[2]. On the industrial scale, they have a wide range of applications such as dyes and pigments[3].

Because of its synthetic utility and broad range of pharmacological activities, the benzimidazole nucleus is an important heterocyclic ring and its synthesis has received much attention. Benzimidazoles can be synthesized by a number of methods, usually involving formation of the N-C-N unit as the key step. One of the formally utilized general routes to benzimidazoles involves the reaction of aldehydes and ketones with *o*-phenylenediamine. Although there are several routes leading to 2-substituted benzimidazoles, a typical procedure involves heating *o*-phenylenediamine with a substituted carboxylic acid in the presence of mineral acid[4,5].2-Substituted benzimidazoles with various types of biological activities, such as antibacterial[6], antiviral[7], antitumor[8] and anti-inflammatory[9], have been reported.

Schiff base of 4-aminoantipyrine and its complexes have a variety of applications in biological, clinical, analytical and pharmacological areas[10]. Studies of a new kind of chemotherapeutic Schiff bases are attracting the attention of biochemists[11]. In addition, pyrazole derivatives have played a crucial part in the development of theory in heterocyclic chemistry and also used extensively in organic synthesis[12,13].

Heterocyclic compounds possessing 1,3,4-thiadiazole ring system show antifungal, bacteriostatic, anthelmintic[14] effect as well as

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depression effect on central nervous system[15]. More recently, researchers reported 1,3,4-thiadiazole derivatives that exhibited analgesic and anti-inflammatory activities[16].

1,3-Thiazolidin-4-one derivatives possess anticonvulsant, hypnotic, anticancer properties and have been reported as novel inhibitors of the bacterial enzyme Mur B which is a precursor acting during the biosynthesis of peptidoglycan[17].

The incorporation of the imidazole nuclei is an important synthetic strategy in drug discovery. Many imidazoles have been prepared as pharmacological agents Azomycine, Clotrimazole, Miconazole, Ergothionine, Clonidine and Moxonidine[18]. One of the most important applications of imidazole derivatives is their used as reline material for treatment of denture stomatities[19].

These observations have encouraged me to synthesis some new products containing the above mentioned heterocyclic moiety hoping to obtain new compounds with potential biological activity.

Experimental:

Instruments

Melting points were determined on GallenKamp melting point apparatus and were uncorrected. The IR spectra of the compounds were recorded on Shimadzu FTIR-8300 spectrometer as KBr disc; results are given in cm^{-1}. ^{1}H-NMR and ^{13}C-NMR spectra were recorded at 300 and 75 MHz, respectively, in DMSO-d_6 for all compounds on a Bruker AMX-400 NMR spectrometer. The chemical shifts are reported in part per million (ppm) downfield from internal tetramethylsilane (TMS) (chemical shift in δ values). Elemental analysis was run using a Perkin-Elmer RE 2400 CHNS analyzer. ^{1}H-, ^{13}C-NMR and elemental analysis were made at Chemistry Department, Georgia State University (Georgia, USA).

Chemicals

Anthrone (10-anthracen-9-one)

This material was supply from Fluka Chemical Company as synthetic material and used directly without further purification.

Synthesis of 1',3'-dihydro-10H-spiro[anthracene-9,2'-benzimidazole] (**1**)

A mixture of anthrone (0.01mol, 1.94g) and *o*-phenylendiamine (0.01mol, 1.08g) in 20ml abs. ethanol was heated under reflux for 24h. Then the solvent was reduced to one third its volume under reduced pressure and then cooled. The solid that separated was recrystallized from chloroform.

Synthesis of anthracen-9(10H)-one thiosemicarbazone (**2**)

Thiosemicarbazide (0.02mol, 0.91g) was added to (0.02mol, 3.88g) of anthrone dissolved in glacial acetic acid (25ml), the reaction mixture was refluxed for 10h. The solid that formed was separated by filtration and recrystallized from ethanol.

Synthesis of 2-(anthracen- 9(10H)-ylidenehydrazono) thiazolidin -4-one (**3**)

To a mixture of compound **2** (0.01mol, 2.99g) and potassium hydroxide (0.01mol, 0.56g) in (20ml) abs. ethanol, chloroacetic acid (0.01mol, 0.95g) was added gradually. The reaction mixture was refluxed for 24h; the solid product was filtered off and recrystallized from acetone to obtain the desired product.

Synthesis of 2-(anthracen-9(10H)-ylidenehydrazono)- 5-bromophenyl-2,3-dihydro-1H-thiazole (**4**)

A mixture of compound **2** (0.01mol, 2.99g) and *p*-bromophenacyl bromide (0.01mol, 1.08g) in (25ml) abs. ethanol was refluxed for 24h; the solvent was reduced under reduced pressure and then cooled. The solid that separated was recrystallized from dichloromethane.

Synthesis of 4-(anthracen-9(10H)-ylideneamino)- 1, 5- dimethyl- 2-phenyl-1,2-dihydro-3H-pyrazol -3-one (**5**)

A mixture of anthrone (0.012mol, 2.33g), 15ml glacial acetic acid and 4-aminoantipyrine (0.012mol, 2.44g) was heated under reflux for 10h. The reaction mixture was filtered off and recrystallized from ethanol.

Synthesis of N-anthracen-9(10H)-ylidenehistidine (**6**)

The same method described for synthesis of compound **5** but used L-histidine (0.012mol, 1.86g) instead of 4-aminoantipyrine.

Synthesis of N-anthracen -9 (10H)-ylidene-4-methylpyridine-2-amine(**7**)

The same method described for synthesis of compound **5** but used 2-amino-4-methyl pyridine (0.012mol, 1.31g) instead of 4-aminoantipyrine.

Synthesis of 4-(anthracen-9(10H)-ylideneamino)-1-methyl- 3- oxo -2-phenyl-2,3-dihydro-1H-pyrazole- 5-carboxylic acid (**8**)

(0.05mol, 17.65g) of compound **5** is added to a solution of (0.05mol, 7.90g) of potassium permanganate and (0.05mol, 5.30g) of sodium carbonate in (25ml) water and the mixture is heated under reflux until the color of the permanganate has disappeared (15h). The reaction mixture was filtered while still hot to get rid of the MnO_2 precipitate. Remove any excess of MnO_2 by addition of a little oxalic acid. The cooled filtrate is acidified with sulphuric acid (20%), the carboxylic acid precipitate is filtered off, washed with a little cold water and used without further purification.

Synthesis of 4-(anthracen-9(10H)-ylideneamino)-5- (1H-benzimidazol-2-yl)-1-methyl-2-phenyl-1,2-dihydro-3H-pyrazol-3-one (**9**)

To (0.01mol, 4.09g) of compound **8**, a mixture of (0.01mol, 1.08g) *o*-phenylenediamine and few drops of conc. hydrochloric acid in (15ml) abs. ethanol was added. Then the mixture was heated under reflux for 24h. After cooling, the crude product was filtered off and recrystallized from chloroform.

Synthesis of 5-[1-(anthracen-9(10H)-ylideneamino) -2- (1H-imidazol- 5-yl)ethyl]-1,3,4-thiadiazol- 2-amine (**10**)(20)

A mixture of compound **6** (0.015mol, 4.97g) and an equivalent amount of thiosemicarbazide in $POCl_3$ (10ml) was refluxed in a water bath for 10-12h. After evaporating under reduced pressure, a solid product was obtained. This was recrystallized from ethanol to afford the desired product.

Synthesis of 2-(anthracen-9(10H)-ylideneamino)-4-carboxylic acidpyridine (**11**)

The same method described for synthesis of compound **8**, but by using compound **7** (0.05mol, 14.20g) as starting.

Synthesis of ethyl 2-(anthracen-9(10H)- ylideneamino) pyridine -4-carboxylate (**12**)

A mixture of the acid **11** (0.01mol, 3.14g), abs. ethanol (10ml), and few drops of conc. sulfuric acid was

refluxed for 10h, the reaction mixture was cooled to room temperature and then in the refrigerator for 5h. The solid product was filtered off washed and recrystallized from ethanol.

Synthesis of 2-(anthracen-9(10H)-ylideneamino)pyridine-4-carbohydrazide (**13**)

A mixture of ester **12** (0.012mol,3.91g) and 80%hydrazine hydrate (0.02mol, 1.50ml) was refluxed for 5h, then abs. ethanol (15ml) was added and refluxed for further 8h. The separated precipitate was filtered and washed with cold water.

Synthesis of 2-(4-(anthracen-9(10H)-ylideneamino)-4-(1,6-dihydro-1,2,4-triazin-5(2 H)-one)pyridine (**14**)

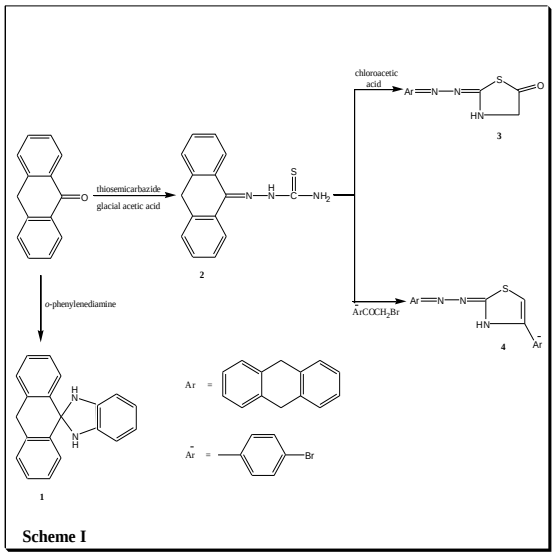
Compound **13** (0.01mol, 3.28g) and chloroacetamide (0.01mol, 0.93g) were mixed together in (20ml) abs. ethanol. The reaction mixture was refluxed for 24h, the solvent was reduced to one third its volume under reduced pressure. The crude product was obtained by filtration, washed with water and recrystallized from chloroform.

Antibacterial and Antifungal studies:

All newly synthesized compounds were tested for their in *vitro* growth inhibitory activity against a standard strain of pathogenic microorganism including Gram-positive bacteria (*Staphylococcus aureus*), Gram-negative bacteria (*Escherichia coli*) and a yeast-like pathogenic fungus (*Candida albicans*). The primary screening was carried out using the agar disc-diffusion method using Müller-Hinton agar medium. Bacteria including *Staphylococcus aureus* and *Escherichia coli were* grown in nutrient broth at 37˚C for 24h. *Candida albicans* was grown in malt broth at 37˚C for 48h. Sterile filter paper disc (5mm) were moistened with the compound solution in dimethylsulphoxide of specific concentration (200µg/disc). The plates were incubated at 37˚C, and the diameter of the growth inhibition zones were measured after 24h in case of bacteria and 48h in case of *Candida albicans.* Antibiotic discs for Streptomycin were additionally tested as positive control.

Results and Discussion:

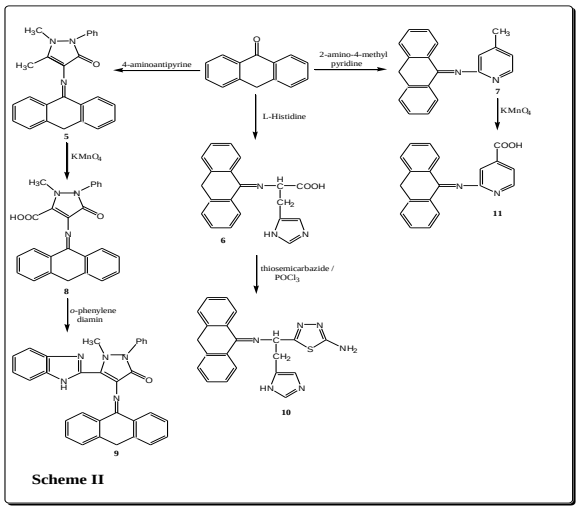
Chemists have reported on the chemical, structural and biological properties of Schiff bases. Schiff bases are characterized by the –N=CH- (imine) group which imports in elucidate the mechanism of transformation in biological system. In this study i reported the synthesis, characterization of some new Schiff bases and study their pharmacological activities. The synthesis pathway leading to compounds (**1-4**) is given in **Scheme I**:



Scheme I

The structures of the new compounds **1-4** were assigned on the basis of their spectral data and elemental analysis. The IR spectra of all compounds were devoid of the band at about 1700cm^{-1} due to the C=O stretching vibration of the conjugated ketones[21]. ^{1}H-NMR spectra of compounds **1-4** showed characteristic bands at δ 8.42-9.32 belonging to –NH and –NH_2 which are further characterized by disappearance with D_2O. Furthermore, ^{13}C-NMR spectra showed multiple signals at δ87.8-100.7, 125.0-140.7 for olefinic carbons and aromatic carbons, respectively. These signals gave a good support for ^{1}H-NMR data.

The IR spectra of Schiff base compounds **5-7** showed characteristic C=N bands at 1600-1630cm^{-1} with a disappearance of ketone C=O stretching vibration,which clearly confirmed that a formation of these compounds had been take place (**Scheme II**).

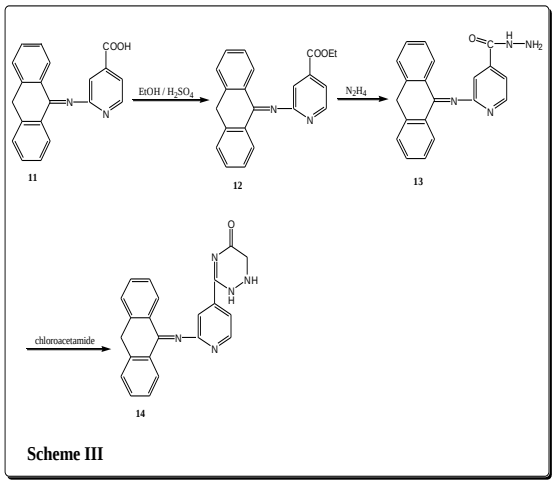


Scheme II

The –CH_3 group of compounds **5** and **7** was oxidized by $KMnO_4$ to afford 4- (anthracen -9 (10H)-ylideneamino)-1-methyl-3-oxo-2-phenyl-2,3-dihydro-1H-pyrazole -5-carboxylic acid (**8**) and 2-(anthracen-9(10H)-ylideneamino)-4-carboxylic acidpyridine (**11**), respectively, **Scheme II**. The IR spectra of compounds **8** and **11** showed characteristic carboxylic acid C=O band at 1705cm^{-1}. ^{1}H-NMR spectra showed characteristic bands at δ 9.89, 9.92ppm, respectively, due –OH group, both disappeared with D_2O exchange. Compounds **8** and **11** display, in addition to other signals, signal at 168.8 and 173.1 ppm due to C=O of carboxylic acid group.

Next, compound **8** condensed with *o*-phenylene diamine to give compounds **9**. The structures of the new compound were assigned on the basis of their spectral data. ^{13}C-NMR spectrum of compound **9** showed characteristic signal at 173.0ppm belonging to C=O of pyrazolone ring. On the other hand, ^{1}H-NMR spectrum of compound **9** displayed doublet at 8.79due to –NH group of benzimidazole ring which further assigned by D_2O exchange. Compound **10** was obtained by the reaction of compound **6** with thiosemicarbazide, **Scheme II**. In the IR spectrum of this compound, the stretching band derived from –OH and C=O of carboxylic acid was absent. In addition, signal derived from NH_2 of 1,3,4-thiadiazole ring, at8.89, was observed which was disappeared by D_2O exchange.

In the last part of this work, compound 17 was synthesized according to Scheme III.



Scheme III

The IR spectra of compounds **12** and **13** showed stretching vibration of C=O of ester and amide group at 1698 and 1645cm^{-1}, respectively. Compounds **12** display in its ^{1}H-NMR spectrum, in addition to other signals, triplet at δ1.68 and quartet at 1.78ppm due to-CH_2CH_3 group, while ^{1}H-NMR spectrum of compound **13** showed two singlet at 8.11 and 8.89ppm due to –$NHNH_2$ group which further characterized by D_2O exchange. Treatment of compound **13** with chloroacetamide produced compound **17**. The structure compound **14** was determined on the basis of its spectral and analytical data. ^{1}H-NMR spectrum showed disappearance of signal at 8.89ppm due to –NH_2 group of acid hydrazide with the appearance of two singlets at δ7.98 and 8.04ppm for two –NH groups of triazine ring, these two signals were disappeared with D_2O exchange. Furthermore, ^{13}C-NMR spectra of compounds **12-14** are in agreement with their IR and ^{1}H-NMR data. Table **2** summarized the physical properties of synthesized compounds and Table **3** summarized the spectral data of synthesized compounds.

Antimicrobial Activity

All new synthesized compounds **1-14** were evaluated for antimicrobial activity against one strain of Gram +ve bacteria (*Staphylococcus aureus*), Gram –ve bacteria (*Escherichia coli*) and a fungus (*Candida albicans*) (**Table 1**)[22].

Table 1: **Antimicrobial activity for compounds** (**1-14**)

Compounds No.	Micro-organism		
	Staphylococcus aureus	***Escherichia coli***	***Candida albicans***
1	++	+	++
2	++	++	++
3	+++	+++	+++
4	+++	+++	+++
5	++	++	++
6	++	+	+
7	+	+	+
8	++	++	++
9	+++	+++	+++
10	+++	+++	+++
11	+++	+++	+++
12	+	+	+
13	+++	+++	+++
14	+++	+++	+++
Streptomycin	+++	+++	+++

\+ = (5-10) mm = slightly active
++ = (11-20) mm = moderately active
+++ = more than 20mm = highly active

In general, all synthesized compounds exhibited good inhibitory activity against tested pathogenic microorganism. Compounds **3**, **4**, **9**, **10**, **11**, **13** and **14** showed higher activity than the others.

Table 2: Physical properties of compounds (1-14)

Comp. No.	M.P (˚C)	Molecular Formula	Yield (%)	Color	Recrystalization solvent
1	180-182	$C_{20}H_{16}N_2$	70	Yellow	Chloroform
2	210-212	$C_{15}H_{13}N_3S$	75	Yellow	Ethanol
3	180-182 dec.	$C_{16}H_{17}N_3OS$	75	White	Acetone
4	60-62	$C_{23}H_{14}N_3SBr$	66	White	Dichloromethane
5	118-120	$C_{23}H_{19}N_3O$	70	Pale Yellow	Ethanol
6	140-142	$C_{20}H_{17}N_3O_2$	70	Yellow	Ethanol
7	92-94	$C_{20}H_{16}N_2$	57	Brown	Ethanol
8	193-195	$C_{23}H_{17}N_3O_3$	60	White	-
9	120-122	$C_{31}H_{23}N_5O$	72	Milky	Chloroform
10	170-172 dec.	$C_{21}H_{18}N_6S$	77	Brown	Ethanol
11	126-128	$C_{20}H_{14}N_2O_2$	60	Gray	Ethanol
12	102-104	$C_{22}H_{18}N_2O$	55	Yellowish-Green	Ethanol
13	188-190	$C_{20}H_{16}N_4O$	75	Light Yellow	-
14	89-91	$C_{22}H_{17}N_5O$	60	White	Chloroform

Table 3: Spectral data of compounds (1-14)

Comp. No.	FT-IR	^{1}H-NMR	^{13}C-NMR	CHN
1	3200(*v*NH), 3080 (*v*CH aromatic) 2800(*v*CH aliphatic), 1550 (*v*C=C), 755 (aromatic *o*-substituted)	2.02(s, 2H, CH_2), 6.54-7.73 (m, 12H, Ar-**H**), 8.62, 8.73(2s, 2H, 2NH) (D_2O exchange, disappear)	20.2(1C, CH_2), 26.2(1C, N-**C**-N), 125.0-140.7(18C, aromatic carbons)	Anal. Calcd: C, 83.33; H, 5.56; N,11.11. Found: C,83.67; H,5.23; N,10.98
2	3330-3200(*v* asym, sym NH_2, NH), 3100 (*v*CH aromatic), 2880 (*v*CH aliphatic), 1620 (*v*C=N), 1550 (*v*C=C), 1330 (*v*C=S), 765 (aromatic *o*-substituted)	1.87(s, 2H, CH_2), 7.34-7.77(m, 8H, Ar-**H**), 8.53(s, 1H, NH) (D_2O exchange, disappear), 9.32(s, 2H, NH_2) (D_2O exchange, disappear).	^{3}C-NMR δ: 22.2(1C, CH_2), 96.9(1C, **C**=N), 100.2(1C, S=**C**-NH_2), 128.0-136.7(12C, aromatic carbons)	Anal. Calcd: C, 67.42; H, 4.87; N, 15.73; S, 11.99.Found: C,67.46; H,4.72; N,15.42; S,11.75
3	3200(*v*NH), 3080(*v*CH aromatic), 2900 (*v*CH aliphatic), 1685(*v*C=O), 1630 (*v*C=N), 1550 (*v*C=C), 760 (aromatic *o*-substituted), 662 (C-S)	2.32(s, 2H, CH_2), 2.65(s, 2H, N-C**H**$_2$), 6.74-7.85(m, 8H, Ar-**H**), 8.51(s, 1H, NH) (D_2O exchange, disappear)	20.1(1C, CH_2), 26.3(1C, **C**H_2 adjacent to carbonyl), 92.3, 94.0(2C, 2**C**=N), 128.8- 133.0(12C, aromatic carbons), 173.2 (1C, C=O)	Anal. Calcd: C, 66.45; H, 4.23; N, 13.68; S, 10.42. Found: C,66.30; H,4.30; N,15.54; S,10.35
4	3270(*v*NH), 3033(*v*CH aromatic), 2855 (*v*CH aliphatic), 1625 (*v*C=N), 1545 (*v*C=C), 847 (aromatic *p*-substituted), 735 (aromatic *o*-substituted), 650 (C-S)	2.14(s, 2H, CH_2), 5.67(1H, S-C**H**=), 6.41-7.78(m, 12H, Ar-**H**), 8.81(s, 1H, NH) (D_2O exchange, disappear)	23.4(1C, CH_2), 87.8, 89.3(2C, **C**=**C**), 100.2, 100.7(2C, 2**C**=N), 133.5-138.1(18C, aromatic carbons)	Anal. Calcd: C, 62.16; H, 3.15; N, 9.46; S, 7.21. Found: C,62.02; H,2.89; N,9.13; S,7.33

Comp.	FT-IR	^{1}H-NMR	^{13}C-NMR	CHN

No.				
5	3080(*v*CH aromatic), 2860 (*v*CH aliphatic), 1683 (*v*C=O), 1625 (*v*C=N), 1580 (*v*C=C)	1.56, 1.81(2s, 6H, $2CH_3$), 2.21(s, 2H, CH_2), 6.04-7.11 (m, 13H, Ar-**H**)	17.2, 17.8(2C, $2CH_3$), 22.5(1C, CH_2), 92.0(1C, **C**-CH_3), 93.4(1C, -N-**C**=C(CH_3)), 95.8(1C, -**C**=N-), 125.6-135.2 (18C, aromatic carbons), 170.1(1C, C=O)	Anal. Calcd: C, 78.19; H, 5.38; N, 11.90. Found: C, 77.90; H, 5.12; N, 11.59
6	3400-3300(b, *v*OH), 3088(*v*CH aromatic), 2830 (*v*CH aliphatic), 1705(*v*C=O), 1620 (*v*C=N)	2.05(s, 2H, CH_2), 2.40(d, 2H, CH_2), 2.87(t, 1H, CH), 5.27, 5.63(2s, 2H, 2=C**H**), 7.05-7.76(m, 8H, Ar-**H**), 8.58 (s, 1H, NH) (D_2O exchange, disappear), 9.49 (s, 1H, OH) (D_2O exchange, disappear)	16.8, 17.4(1C, CH_2), 22.0(1C, -**C**H-), 102.1(1C, -**C**=N), 118.5, 120.3, 122.0 (imidazole carbons), 127.3-133.9 (12C, aromatic carbons), 171.7 (1C, C=O)	Anal. Calcd: C, 72.51; H, 5.14; N, 12.69. Found: C, 72.62; H, 5.05; N, 12.47
7	3100(*v*CH aromatic),2855(*v*CH aliphatic), 1625 (*v*C=N)	1.68(s, 3H, CH_3), 2.02(s, 2H, CH_2), 5.22(d, 1H, pyridine-C_5-**H**), 5.65(d, 1H, pyridine-C_6-**H**), 5.87(s, 1H, pyridine-C_3-**H**), 6.75-7.89(m, 8H , Ar-**H**)	17.5(1C, CH_3), 20.2(1C, CH_2), 94.1, 95.7, 96.3, 98.8, 100.1 (pyridine ring carbons), 103.3 (1C, -**C**=N-), 127.0-134.5 (12C, aromatic carbons)	Anal. Calcd: C, 84.51; H, 5.63; N, 9.86. Found: C, 84.32; H, 5.70; N, 9.76.
8	3400-3320(b, *v*OH), 3089 (*v*CH aromatic), 2850 (*v*CH aliphatic), 1705, 1685(*v*C=O), 1620(*v*C=N)	1.88(s, 3H, CH_3), 2.76(s, 2H, CH_2), 6.55-7.98(m, 13H, Ar-**H**), 9.89 (s, 1H, OH) (D_2O exchange, disappear)	16.1(1C, CH_3), 18.2(1C, CH_2), 110.6, 113.1(2C, **C**=**C**), 115.4(1C, **C**=N), 130.5-137.4(18C, aromatic carbons), 168.8 (C=O)	Anal. Calcd: C, 73.35; H, 4.65; N, 10.27. Found: C, 73.11; H, 4.45; N, 10.32
9	3200(*v*NH), 3050(*v*CH aromatic), 2975 (*v*CH aliphatic), 1670(*v*C=O)	1.82(s, 3H, CH_3), 2.51(s, 2H, CH_2), 6.47-8.00(m, 17H, Ar-**H**), 8.79(s, 1H, NH) (D_2O exchange, disappear)	17.1(1C, CH_3), 18.4(1C, CH_2), 111.3, 113.4(2C, **C**=**C**), 115.5, 117.0(2C, **C**=N), 128.4-135.7(24C, aromatic carbons), 173.0 (1C, C=O)	Anal. Calcd: C, 77.34; H, 4.78; N, 14.55. Found: C, 77.12; H, 4.54; N, 14.33
10	3300-3180(*v* asym, sym NH, NH_2), 3090(*v*CH aromatic) , 2900 (*v*CH aliphatic), 1625(*v*C=N)	1.98(s, 2H, CH_2), 2.15(d, 2H, CH_2), 2.67(t, 1H, C**H**), 5.38, 5.77(2s, 2H, =C**H**), 6.48-7.77(m, 8H, Ar-**H** and imidazole-**H**), 8.15(s, 1H, NH) (D_2O exchange, disappear), 8.89(s, 2H, NH_2) (D_2O exchange, disappear)	17.2, 17.8(2C, $2CH_2$), 21.3(1C, -**C**H-), 105.0(1C, -**C**=N-), 120.2, 121.4, 123.5(imidazole carbons), 129.0-135.5(12C, aromatic carbons), 139.4, 140.5(thiadiazole carbons)	Anal. Calcd: C, 65.28; H, 4.66; N, 21.76, S, 8.29. Found: C, 65.10; H, 4.73; N, 21.54; S, 8.36
11	3376(b, *v*OH), 3100(*v*CH aromatic), 2950 (*v*CH aliphatic), 1620(*v*C=N), 1705 (*v*C=O)	2.02(s, 2H, CH_2), 6.14(s, 1H, =C**H**-), 6.32-6.36(d, 1H, =C**H**), 6.40-6.45(d, 1H, =C**H**), 6.87-7.15(m, 8H, Ar-**H**), 9.92(s, 1H, OH) (D_2O exchange, disappear)	17.6(1C, CH_2), 106.4(1C, **C**=N), 110.7, 112.3, 114.1, 115.0, 117.5(pyridine carbons), 128.3-133.6(12C, aromatic carbons), 173.7(1C, C=O)	Anal. Calcd: C, 76.43; H, 4.46; N, 8.92. Found: C, 76.22; H, 4.52; N, 8.85

Comp. No.	FT-IR	^{1}H-NMR	^{13}C-NMR	CHN
12	3078(*v*CH aromatic), 2823(*v*CH aliphatic), 1620 (*v*C=N), 1698 (*v*C=O)	1.68(t, 3H, CH_3), 1.78(q, 2H, CH_2), 2.05(s, 2H, CH_2), 6.15(s, 1H, =C**H**-), 6.30-6.35(d, 1H, =C**H**), 6.42-6.67(d, 1H, =C**H**), 7.03-7.95(m, 8H, Ar-**H**)	15.5(1C, CH_2), 16.7, 18.3(2C, -**C**H_2**C**H_3), 105.5(1C, **C**=N), 112.4, 113.2, 115.7, 118.0, 121.1(5C, pyridine carbons), 112.4-121.1(6C, olefinic carbons), 130.3-134.8(12C, aromatic carbons), 169.1 (1C, C=O)	Anal. Calcd: C, 80.98; H, 5.52; N, 8.59. Found: C, 80.70; H, 5.67; N, 8.44
13	3300-3200(*v* asym, sym -$NHNH_2$), 3089(*v*CH aromatic), 2967 (*v*CH aliphatic), 1630(*v*C=N), 1645 (*v*C=O)	2.02(s, 2H, CH_2), 5.98(s, 1H, =C**H**-), 6.43-6.55(d, 1H, =C**H**), 6.57-6.63(d, 1H, =C**H**), 7.07-7.77(m, 8H, Ar-**H**), 8.11(s, 1H, NH) (D_2O exchange, disappear), 8.89(s, 2H, NH_2) (D_2O exchange, disappear)	.22(1C, CH_2), 107.3(1C, **C**=N), 110.7, 113.4, 116.0, 117.8, 120.1(5C, pyridine carbons), 110.7-120.1(6C, olefinic carbons), 130.3-137.4(12C, aromatic carbons), 168.2(1C, C=O)	Anal. Calcd: C, 73.17; H, 4.88; N, 17.07. Found: C, 73.00; H, 4.73; N, 16.80
14	3220-3200(*v* asym, sym NH), 3067(*v*CH aromatic) , 2955(*v*CH aliphatic), 1665 (*v*C=O), 1620 (*v*C=N)	2.01(s, 2H, CH_2), 2.55(s, 2H, triazine C**H**$_2$), 6.06, 6.71(s, 1H, =C**H**-), 6.06-6.33(1H, d, =C**H**), 6.37-6.42(d, 1H, =C**H**), 7.11-7.68(m, 8H, Ar-**H**), 7.98, 8.04(2s, 2H, 2NH) (D_2O exchange, disappear)	20.2, 23.7(2C, 2CH_2), 106.3(1C, **C**=N), 112.0, 115.6, 117.8, 119.3, 121.5(5C, pyridine carbons), 122.4, 124.0(2C, triazine carbons), 126.6-134.3(12C, aromatic carbons), 173.3(1C, C=O)	-

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تخليق مركبات حلقية غير متجانسة جديدة مشتقة من الأنثرون وتقيم فعاليتها البايولوجية

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الخلاصة:

تم في هذا البحث تحضير قواعد شف مشتقة من تفاعل الانثرون مع امينات حلقية غير متجانسة. المركبات الناتجة فوعلت مع نيوكليوفيلات مختلفة لانتاج نوع جديد من المركبات غير الحلقية. شخصت المواد جميعاً بواسطة تقنية IR، ^{1}H-NMR ^{13}C ، تم اختيار جميع المركبات المحضرة ضد انواع منتخبة من البكتريا ذات الصبغة الموجبة *(Staphylococcus aureus)* وذات الصبغة السالبة (*Escherichia coli*) وايضاً ضد الفطريات.