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Synthesis of New Class of (β-Lactam, Thiazolidinone) Derivatives

N.A.A. El-Kanzi*
*Chemistry Department, Aswan-Faculty of Science, South Valley University, Aswan- Egypt.
*Chemistry Department, Faculty of Science, Al-Jouf University, sakaka, K.S.A.

Abstract: The reaction of some newly synthesised compound 2, 4-diamino-lH-benz[g]quinolino-5,l0-dione 3-ethyl carboxylate **1** and 2,4-diamino-l ,2,3-trihydropiperpdino[2,3-b]benz[g]-1 ,2,3,4-tetrahydroquinolines-5,6,11-trione **3** ethylcarboxylate **2** with different aromatic aldehyde afforded the corresponding new Schiff bases derivatives **3a-c**, **4a-c**. The cycloaddition reaction of 3a-c, 4a-c with chloroacetyl chloride and thioglycolic acid give new isolated β-Lactams and thiazlidinone derivatives **5a-c**, **7a-c** and **6a-c**, **8a-c**. Compound **1**, **2** undergo hydrolysis by NaOH to give carboxylic compound **9**,**10** which react with different aromatic aldehyde to give new Schiff bases **11a-c** and **12a-c**. The cycloaddition reaction of **11a-c**, **12a-c** with chloroacetylchloride and/or mercaptoacetic acid to give **13a-c**, **15a-c** and **14a-c**, **16a-c**.

Key words: Schiff bases, Isolated β -lactam, Isolated thiazolidinone.

I. INTRODUCTION

Quinoline derivatives are widely used as fungicides[1-3] and antibacterial agents[4-6]. The □-lctam antibiotics continue to represent a major class of clinically very important and commercially valuable therapeutic agents[7-9]. It is also necessary to recognize that after the discovery of pencillin a variety of new class of β-Lactam antimicrobial agents were sequentially introduced on the other hand thiazolidinone compounds have been subject of extensive efforts in the recent past divers biological activities[10] such as bactericidal flmgicidals, insecticidal, tuberoculostatic, be associated with thiazolidinone derivatives. Our interest in preparing of the newly classes of β-Lactam and thiazolidinone derivatives cams as a result to its importance as it was mentioned before. Thus, we have an efficient strategy for the synthesis of new β-Lactam and thiazolidinone derivatives and this is the main subject of our interest studies[11-17].

II. RESUL TS AND DISCUSSION

2,4-Diamino-lH-benz[g]quinoline-5,10-dione-3-ethylcarboxylate **1**was prepared by the cycloaddition reaction of equimolecular amount of urea and ethylcyanoacetate with 1,4-naphthoquinone in ethanol containing piperidine as catalyst. At first our theoretical conception of the obvious cycloaddition reaction led to the formation of; compound **l′** but the experimental evidence that depends on the different types of analysis to the reaction product proves that the cycloaddition reaction leads to the formation of compound **1** through the electronic cyclization according to the suggested mechanism (Scheme 1 illustrate the formation of compound **1**[18].

The structure of the synthesised compound **1** was confirmed by their elemental analysis, IR which revealed carbonyl group of ester at 1745 cm^{-1} and ^{1}H-NMR spectra which revealed the presence of NH group at δ 11.02 and NH_2 group at δ 6.82 and NH_2 group at δ 4.53 and triplet at δ 1.23 assigned for methyl group and quartet at δ 3.55 for CH_2 group, the mass spectrum showed the molecular ion peak (M^+, $C_{16}H_{15}O_4N_3$) at mz 313. The intelligible bases of ^{1}H- NMR leads us to decide that the isolable structural formula which produce from the reaction of appropriate urea and malononitrile with 1,4-naphthoquinone is the structural formula of compound **1**[18] because of the appearance of the signal peak at δ 3.21 as a result of the fusion of 1,4-naphthoquinone with the unsaturated substituted piperidine ring. By using the same pathway we synthesis of new compound **2** by cycloaddition reaction of benz[g]-1,2,3,4-tetrahydroquinoline-4,5,10-trione which was prepared in our laboratory as it has been reported in an earlier publication[19] with equimolar ratio of urea and ethylcyanoacetate in ethanol containing piperidine as catalyst. The structure of compound **2** was confirmed by their elemental analysis, IR and ^{1}H-NMR spectra which revealed the presence of NH group at δ

11.99 and NH_2 group at δ 6.89, NH_2 group at δ 4.56, triplet at δ 1.22 for methyl group, quartet at δ 3.56 for CH_2 group, the mass spectrum showed the molecular ion peak (M^+, $C_{19}H_{20}O_5N_4$) at m/z 384.

The activity of the amino. group at C_2 which due to its adjacent to the carbonyl group of ester group at C_3 with its inflamatory effect prompted us to explore the possibility of synthesis some new Schiff bases through the condensation of both compound **1** and or **2** with different aromatic aldehyde in the presence of piperidine catalyst afforded the corresponding Schiff bases compounds **3a-c**, **4a-c**. The structures of these compounds were confirmed by their elemental analysis, IR, ^{1}H-NMR and mass spectral data [c.f. Tables 1,2,3]. These newly synthesised Schiff bases compounds used for the synthesis of new isolated β-Lactam and isolated thiazolidinone derivatives. Thus compound **3a-c**, **4a-c** react with chloroacetylchloride and or mercaptoacetic acid in the presence of triethylamine to give isolated β-Lactams **5a-c**, **7a-c** and isolated thiazolidinone derivatives **6a-c**, **8a-c** respectively. The structure of these compounds were confirmed by elemental analysis, IR, ^{1}H-NMR and mass spectral data [c.f. Tables 1, 2, 3] Compounds 1,2 undergo basic hydrolysis by boiling with concentrated sodium hydroxide solution acidified by concentrated hydrochloric acid to give compound **9**,**10** which have carboxylic group. Thus, the synthesis of both carboxylic compounds 2,4-diamino 1H-benz[g]quinoline 5,10-dione-3-carboxlic acid **9** and 2,4-diamino-1 ,2,3-trihydropiperidino[2,3-b]-benz[g]1,2,3,4-tetrahydroquinoline-5,6,1l-trione-3-carboxylic acid **10** in isolated forms together with β-Lactam and thiazolidinone were undertaken.

Compounds **9**,**10** reacts with different aromatic aldehyde to give Schiff bases **11a-c**, **12a-c**, respectively which undergo cycloaddition reaction with chloroacetyl chloride and mercapto acetic acid in the presence of triethylamine to give **13a-c**, **15a-c** and **14a-c**, **16a-c** respectively. The structure of these compounds were confirmed by elemental analysis, IR, IH-NMR and mass spectral data [c.f. Tables 1,2,3].

III. EXPERIMENTAL SECTION

All melting points were uncorrected. The IR spectra were recorded on Perkin Elemer 11650 FT. IR spectrometer, ^{1}H-NMR spectra on EM. 39090 MHz NMR spectrometer and mass spectra on MS 5988. Analytical data were determined with CE 440 elemental analyzer. Automatic injector at Cairo University.

Synthesis of 2,4-diamino-lH-benz[g] quinoline-5, 10-dione-3-ethylcarboxylate 1 :

A solution of urea (0.60 g, 0.01 mole) and ethylcyanoacetate (1.13 g, 0.01 mole.) was prepared in citu in ethanol (20 ml) containing (0.5 ml) of piperidine catalyst was treated with 1,4-naphthoquinone (1.58 g, 0.01 mole). The reaction mixture was heated under reflux for 8-10 hr. The solvent was then evaporated under reduced pressure the residue pour on to ice/water acidified by HCl, the solid product so formed was collected by filtration and crystallized from ethanol.

Synthesis of 2,4-diamino-l,2,3-trihydropiperidino [2,3-b]-benz[g]-1,2,3,4-tetra-hydroquinoline-5,6,11-trione-3-ethylcarboxylate 2 :

A solution of urea (0.60 g, 0.01 mole) and ethylcyanoacetate (1.13 g, 0.01 mole) in ethanol (30 ml) containing (0.5 ml) of piperidine catalyst was treated with benz[g]-1,2,3,4tetrahydroquinoline (2.27 g, 0.01 mole). The reaction mixture was heated under reflux for 8-10 hr. (monitored by TLC.). The solvent was then evaporated under reduced pressure. The residue pour on to ice/water acidified by HCl, the solid product so formed was collected by filtration and crystallized from ethanol.

Synthesis of 4-amino-2-arylazamethine 1H-benz[g]quinoline-5,10-dione-3-ethyl-carboxylate 3a-c and 4-amino-2-arylazamethine-l,2,3-trihydropiperidino[2,3-b]-lH-benz[g]-1,2,3,4-tetrahydroquinoline-5,6,11-trione-3-ethylcarboxylate 4a-c:

A solution of 1 (3.13 g, 0.01 mole) and 2 (3.84 g, 0.01 mole) in ethano.1 (30 ml) was treated with different aromatic aldehydes (1.06 g, 1.12 g, 1.51 g, 0.01 mole) respectively in the presence of few drops of piperidine (0.5 ml) as catalyst. The reaction mixture was heated under reflux for 8-9 hr. (monitored by TLC). The solvent was then evaporated under reduced pressure and the residue was treated with ice/water. The solid product was collected and crystallized from the proper solvent (c.f. Table 1).

Synthesis of 4-amino-2-[3-chloro-l-arylazetidin-2-on-4-yl]-1,2,3-trihydropiperi-dino[2,3-b]benz[g]1,2,3,4-tetrahydroquinoline-5,6,11-trione-3-ethylcarboxylate 7a-c and 4-amino-2-[3-aryl-4-thiazolidinon-2-yl]-1,2-,3-trihydropiperidino[2,3-b]-benz[g]-1,2,3,4-tetrahydroquinoline-S,6,11-trione-3-ethylcarboxylate 8a-c:

A solution of **3a-c** (4.01 g, 4.17 g, 4.46 g, 0.01 mole) in dry DMF (30 ml) was treated with chloroacetyl chloride or mercaptoacetic acid in the presence of catalytic amount of triethylamine (0.01 ml). The reaction mixture was heated under reflux for 8-12 hr. (monitored by TLC). The solvent was then evaporated under reduced pressure and the residue treated with ice/water. The solid product was collected by filtration and crystallized from the proper solvent (c.f. Table 1).

Synthesis of 2,4-diamino-1H- benz [g] quinoline-S, 10-dione-3-carboxylic acid 9 and 2,4-diamino-l,2,3..trihydropiperidino[2,3-b]benz[g]-1,2,3,4trihydroquinoline-5,6,11-trione-3-carboxylic acid 10:

A solution of **1** (3.13 g, 0.01 mole) and/or **2** (3.84 g, 0.01 mole) in alkaline sodium hydroxide solution (30 ml) was heated under reflux for 8-10 hr. The solvent was then evaporated under reduced pressure and the residue treated with concentrated hydrochloric acid, the solid product was collected by filtration and crystallized from ethanol.

Synthesis of 4-amino-2-arylazomethine-IH-benz[g]quinoline-5,10-dione-3-carbo-xylic acid 11a-c and 4-ainino-2-arylazomethine-l,2,3-trihydropiperidino [2,3-b]-1H-benz[g] quinoline-5,6, 11- trione-3-carboxylic acid 12a-c:

A solution of **9** (2.85 g, 0.01 mole) and/or **10** (3.56 g, 0.01 mole) in ethanol (30 ml) was treated with aromatic aldehyde (1.06 g, 0.01 mole, 1.12 g, 0.01 mole, 1.51 g, 0.01 mole) respectively in the presence of piperidine (0.5 ml) catalyst. The reaction mixture was heated under reflux for 12-15 hr. (monitored by TLC). The solvent was then evaporated under reduced pressure and the residue was treated with ice/water. The solid product was collected and crystallized horn the proper solvent (c.f. Table 1).

Synthesis of 4-amino-2-[3-chloro-l-arylazetidin-2-on-4-yl]-IH-benz[g]quinoline-5 10-dione-3-carboxylic acid 13a-c and 4-amino-2-[3-chloro-laryl-azetidin-2-on-4-yl]-1,2,3-trihydropiperidino [2,3-b] benz[gk 1,2,3,4-tetrahydroquinoline-5,6 l1-trion-3-carboxylic acid 15a-c:

Asolution of **11a-c** (3.7 g, 3.91 g, 4.20 g, 0.01 mole) in dry DMF (30 ml) was treated with chloroacetyl chloride (1.12 g, 0.01 mole) or mercaptoacetic acid (0.92 g, 0.01 mole) in the presence of triethylamine (0.5 ml) as catalyst. The reaction mixture was heated under reflux for 18-20 hr. (monitored by TLC). The solvent was then evaporated under reduced pressure and the residue was treated with ice/water. The solid product was collected and crystallized from the proper solvent (c.f. Table 1).

Synthesis of 4-amino-2-[3-aryl-4-thiazolidinon-2-yl]-1H-benz[g]quinoline-5,10-dione-3-carboxylic acid 14a-c and 4-amino-2-[3-aryl-4-thiazolidinon-yl]-1,2,3-trihydropiperidino[2,3-b]-benz[g]-1,2,3,4-tetrahydroq uinoline-5,6,11-trione-3-carboxylic acid 16a-c:

A solution of **12a-c** (4.46 g, 4.62 g, 4.91 g, 0.01 mole) in dry DMF (30 ml) was treated with chloroacetyl chloride or mercaptoacetic acid in the presence of triethylamine (0.5 ml) as catalyst. The reaction mixture was heated under reflux for 15-17 hr. (monitored by TLC). The solvent was then evaporated under reduced pressure and the residue treated with ice/water. The solid product was collected and crystallized from the proper solvent (c.f. Table 1).

Table 1: Characterization of Compounds (1 – 16).

Comp.	mp. (°C)	Yield (%)	Solvent of Crystallization	Mol. Formula (Mol. wt.)	Ms (m/z)
1	>300	75	EtOH	$C_{16}H_{15}O_4N_3$ (313.31)	313
2	>300	69	EtOH	$C_{19}H_{17}O_5N_4$ (381.37)	381
3a	>300	79	EtOH/DMF	$C_{23}H_{19}O_4N_3$ (401.42)	401
3b	>300	78	EtOH/DMF	$C_{23}H_{19}O_5N_3$ (417.42)	417
3c	>300	76	EtOH/DMF	$C_{23}H_{18}O_6N_4$(446.42)	446
4a	>300	70	EtOH/DMF	$C_{26}H_{21}O_5N_4$ (469.48)	469
4b	>300	73	EtOH/DMF	$C_{26}H_{21}O_6N_4$ (485.48)	485
4c	>300	75	EtOH/DMF	$C_{26}H_{20}O_7N_5$ (514.48)	514
5a	>300	69	EtOH/DMF	$C_{25}H_{20}O_5N_3Cl$ (477.91)	477
5b	>300	72	EtOH/DMF	$C_{25}H20O6N_3Cl$ (493.91)	493
5c	>300	70	EtOH/DMF	$C_{25}H_{19}O_7N_4Cl$ (522.91)	522
6a	>300	68	EtOH/DMF	$C_{25}H_{21}O_5N_3S$ (475.52)	475
6b	>300	69	EtOH/DMF	$C_{25}H21O6N_3S$ (491.52)	491
6c	>300	71	EtOH/DMF	$C_{25}H_{20}O_7N_4S$ (520.52)	520
7a	>300	70	EtOH/DMF	$C_{28}H_{21}O_6N_4Cl$(544.96)	544
7b	>300	73	EtOH/DMF	$C_{28}H_{21}O_7N_4Cl$(560.96)	560
7c	>300	71	EtOH/DMF	$C_{28}H_{20}O_8N_5Cl$(589.96)	589
8a	>300	66	EtOH/DMF	$C_{28}H_{23}O_6N_4S$ (543.57)	543
8b	>300	67	DMF	$C_{28}H_{23}O_7N_4S$ (559.57)	559
8c	>300	69	DMF	$C_{28}H_{22}O_8N_5S$ (588.57)	588
9	>300	75	EtOH	$C_{14}H_{11}O_4N_3$ (285.26)	285
10	>300	77	EtOH	$C_{17}H_{14}O_5N_4$ (354.32)	354
11a	>300	73	DMF	$C_{21}H_{15}O_4N_3$ (373.38)	373
11b	>300	71	DMF	$C_{21}H_{15}O_5N_3$ (389.37)	389
11c	>300	74	DMF	$C_{21}H_{14}O_6N_4$ (418.37)	418
12a	>300	72	DMF	$C_{24}H_{18}O_5N_4$ (442.43)	442
12b	>300	70	DMF	$C_{24}H_{18}O_6N_4$ (458.43)	458
12c	>300	69	DMF	$C_{24}H_{17}O_7N_5$ (487.43)	487

Table 1: Cont.

Comp.	mp. (°C)	Yield (%)	Solvent of Crystallization	Mol. Formula (Mol. wt.)	Ms (m/z)
13a	>300	68	EtOH/DMF	$C_{23}H_{16}O_5N_3Cl$ (449.86)	449
13b	>300	70	EtOH/DMF	$C_{23}H_{16}O_6N_3Cl$ (465.86)	465
13c	>300	71	EtOH/DMF	$C_{23}H_{15}O_7N_4Cl$ (494.85)	494
14a	>300	67	EtOH/DMF	$C_{23}H_{17}O_5N_3S$ (447.46)	447
14b	>300	69	EtOH/DMF	$C_{23}H_{17}O_6N_3S$ (463.46)	463
14c	>300	66	EtOH/DMF	$C_{23}H_{16}O_7N_4S$ (492.46)	492
15a	>300	72	EtOH/DMF	$C_{26}H_{19}O_6N_4Cl$(518.92)	518
15b	>300	74	EtOH/DMF	$C_{26}H_{19}O_7N_4Cl$(534.92)	534
15c	>300	71	EtOH/DMF	$C_{26}H_{18}O_8N_5Cl$ (563.92)	563
16a	>300	73	EtOH/DMF	$C_{26}H_{20}O_6N_4S$(516.52)	516
16b	>300	69	EtOH/DMF	$C_{26}H_{20}O_7N_4S$ (532.53)	532
16c	>300	70	EtOH/DMF	$C_{26}H_{19}O_8N_5S$ (561.53)	561

Table 2: ^{1}H-NMR Spectral Data of Compounds (1 – 16).

Comp. No.	^{1}H-NMR (DMSO-δ_6)
1	δ 1.23(t, 3H, CH_3), δ 3.55(q, 2H, CH_2) δ 4.53(s, NH_2), δ 6.82(s, NH_2), δ 8.01-7.01(m, 5H, Ar-H^+ and heterocyclic-H^+), δ 11.02(brs, NH).
2	δ 1.22(t, 3H, CH_3), δ 3.56(q, 2H, CH2), δ 4.56(s, NH_2), δ 6.89(s, NH_2), 8.01-7.01(m, 7H, Ar-H^+ and heterocyclic-H^+), δ 11.99(brs, NH).
3a	δ 1.25(t, 3H, CH_3), δ 2.65(q, 2H, CH_2), δ 5.7(s, 2H, NH_2), 8.01-7.01(m, 11H, Ar-H^+ and heterocyclic-H^+), δ 12.11(s, 1H, NH).
3b	δ 1.24(t, 3H, CH_3), δ 2.66(q, 2H, CH_2), δ 5.77(s, 2H, NH_2), 9.2-7.01(m, 10H, OH, Ar-H^+ and heterocyclic-H^+), 12.24(s, 1H, NH).
3c	δ 1.26(t, 3H, CH_3), δ 2.69(q, 2H, CH_2), δ 5.81(s, 2H, NH_2), 8.1-7.01(m, 10H, Ar-H^+ and heterocyclic-H^+), 12.26(s, 1H, NH).
4a	δ 1.29(t, 3H, CH_3), δ 2.59(q, 2H, CH_2), δ 5.79(s, 2H, NH_2), 8.1-7.01(m, 13H, Ar-H^+ and heterocyclic-H^+), 12.22(s, 1H, NH).
4b	δ 1.31(t, 3H, CH_3), δ 2.58(q, 2H, CH_2), δ 5.80(s, 2H, NH_2), 8.1-7.01(m, 12H, OH, Ar-H^+ and heterocyclic-H^+), δ 12.01(s, 1H, NH).
4c	δ 1.28(t, 3H, CH_3), δ 2.61(q, 2H, CH_2), δ 5.82(s, 2H, NH_2), 8.1-7.01(m, 12H, Ar-H^+ and heterocyclic-H^+), δ 12.31(s, 1H, NH).
5a	δ 1.22(t, 3H, CH_3), δ 2.63(q, 2H, CH_2), δ 5.89(s, 2H, NH_2), 8.1-7.01(m, 12H, Ar-H^+ and heterocyclic-H^+), δ 11.97(s, 1H, NH).
5b	δ 1.25(t, 3H, CH_3), δ 2.62(q, 2H, CH_2), δ 5.93(s, 2H, NH_2), 8.1-7.01(m, 11H, OH, Ar-H^+ and heterocyclic-H^+), δ 11.86(s, 1H, NH).
5c	δ 1.26(t, 3H, CH_3), δ 2.64(q, 2H, CH_2), δ 5.98(s, 2H, NH_2), 8.1-7.01(m, 11H, Ar-H^+ and heterocyclic-H^+), δ 11.89(s, 1H, NH).
6a	δ 1.27(t, 3H, CH_3), δ 2.51(s, 2H, CH_2 of thiazolidinone), δ 5.77(s, 2H, NH_2), 2.63(q, 2H, CH_2), 8.1-7.01(m, 11H, Ar-H^+ and heterocyclic-H^+), δ 11.59(s, 1H, NH).
6b	δ 1.28(t, 3H, CH_3), δ 2.51(s, 2H, CH_2 of thiazolidinone), δ 2.65(q, 2H, CH_2) δ 5.79(s, 2H, NH_2), 8.1-7.01(m, 10H, Ar-H^+ and heterocyclic-H^+), δ 11.55(s, 1H, NH).
6c	δ 1.29(t, 3H, CH_3), δ 2.54(s, 2H, CH_2 of thiazolidinone), δ 2.69(q, 2H, CH_2) δ 5.82(s, 2H, NH_2), 8.1-7.01(m, 10H, Ar-H^+ and heterocyclic-H^+), δ 11.46(s, 1H, NH).
7a	δ 1.26(t, 3H, CH_3), δ 2.63(q, 2H, CH_2), δ 5.81(s, 2H, NH_2), 8.1-7.01(m, 13H, Ar-H^+ and heterocyclic-H^+), δ 11.45(s, 1H, NH).
7b	δ 1.25(t, 3H, CH_3), δ 2.65(q, 2H, CH_2), δ 5.83(s, 2H, NH_2), 8.1-7.01(m, OH, 12H, Ar-H^+ and heterocyclic-H^+), δ 10.95(s, 1H, NH).
7c	δ 1.27(t, 3H, CH_3), δ 2.69(q, 2H, CH_2), δ 5.87(s, 2H, NH_2), 8.1-7.01(m,1 2H, Ar-H^+ and heterocyclic-H^+), δ 10.85(s, 1H, NH).

Table 2: Cont.

Comp. No.	^{1}H-NMR (DMSO-δ_6)
8a	δ 1.23(t, 3H, CH_3), δ 2.5(s, 2H, CH_2 of thiazolidinone), δ 2.62(q, 2H, CH_2) δ 5.67(s, 2H, NH_2), 8.1-7.01(m, 13H, Ar-H^+ and heterocyclic-H^+), δ 10.99(s, 1H, NH).
8b	δ 1.24(t, 3H, CH_3), δ 2.51(s, 2H, CH_2 of thiazolidinone), δ 2.64(q, 2H, CH_2) δ 5.68(s, 2H, NH_2), 8.1-7.01(m, 12H, OH, Ar-H^+ and heterocyclic-H^+), δ 10.96(s, 1H, NH).
8c	δ 1.25(t, 3H, CH_3), δ 2.53(s, 2H, CH_2 of thiazolidinone), δ 2.68(q, 2H, CH_2) δ 5.76(s, 2H, NH_2), 8.1-7.01(m, 12H, Ar-H^+ and heterocyclic-H^+), δ 10.98(s, 1H, NH).
9	δ 5.75(s, 2H, CH_2), 9.3-7.01(m, OH, NH_2,5 Ar-H^+), δ 10.5(brs, 1H, NH).
10	δ 5.78(s, 2H, CH_2), 9.5-7.01(m, OH, NH_2, 10H, Ar-H^+), δ 10.65(brs, 1H, NH).
11a	δ 9.26-6.89(m, 11H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 12.26-11.47(brs, 1H, NH).
11b	δ 9.27-6.92(m, 11H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 12.28-11.45(brs, 1H, NH).
11c	δ 9.29-6.94(m, 10H, Ar-H^+, OH, NH2, heterocyclic-H^+), δ 12.3-22.46(brs, 1H, NH).
12a	δ 9.32-6.95(m, 13H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), δ 12.25-11.03(brs, 1H, NH).
12b	δ 9.1-6.78(m, 13H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), δ 12.05-11.01(brs, 1H, NH).
12c	δ 9.12-6.75(m, 12H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), δ 12.03-11.02(brs, 1H, NH).
13a	δ 7.98-6.7(m, 12H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 12.01-11.68(brs, 1H, NH).
13b	δ 7.99-6.79(m, 12H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 11.99-10.56(brs, 1H, NH).
13c	δ 8.01-6.7(m, 11H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 12.01-10.98(brs, 1H, NH).
14a	δ 2.51(s, 2H, CH_2 of thiazolidinone), δ 9.1-6.97(m, 11H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 12.25-11.35(brs, 1H, NH).
14b	δ 2.53(s, 2H, CH_2 of thiazolidinone), δ 9.01-6.99(m, 11H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 12.27-11.26(brs, 1H, NH).
14c	δ 2.55(s, 2H, CH_2 of thiazolidinone), δ 9.03-6.89(m, 10H, Ar-H^+, OH, NH_2, heterocyclic-H^+), δ 12.24-11.28(brs, 1H, NH).

Table 2: Cont.

Comp. No.	^{1}H-NMR (DMSO-δ_6)
15a	δ 9.1-6.78(m, 14H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), δ 12.28-11.05(brs, 1H, NH).
15b	δ 9.12-6.75(m, 14H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), δ 12.31-11.25(brs, 1H, NH).
15c	δ 9.15-6.79(m, 13H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), δ 12.35-11.23(brs, 1H, NH).
16a	δ 2.5(s, 2H, CH_2 of thiazolidinone), δ 9.02-6.93(m, 13H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), 12.22-11.56(brs, 1H, NH).
16b	δ 2.52(s, 2H, CH_2 of thiazolidinone), δ 9.05-6.95(m, 13H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), 12.215-11.55(brs, 1H, NH).
16c	δ 2.55(s, 2H, CH_2 of thiazolidinone), δ 9.03-6.98(m, 12H, Ar-H^+, OH, NH, NH_2, heterocyclic-H^+), 12.26-11.58(brs, 1H, NH).

Table 3: IR Spectral and Elemental Analysis Data.

Comp. No.	IR (υ_{max}/cm^{-1})	Calcd. (Found)				
		C	H	N	Cl	S
1	3400-3100(NH_2, NH), 1745 (C=O ester) 1645 (C=O)	61.34 (61.30)	4.83 (4.78)	13.41 (13.39)	-	-
2	3500-3150(NH_2, NH), 1729 (C=O) 1720 (C=O)	59.84 (59.80)	4.49 (4.29)	14.69 (14.56)	-	-
3a	3500-3100(NH_2, NH), 1730 (C=O), 1715(C=O), 1593(C=N)	68.82 (68.76)	4.77 (4.72)	10.47 (10.44)	-	-
3b	3450-3100(OH, NH_2, NH), 10.07 (C=O), 1690(C=O), 1603(C=N).	88.40 (66.13)	66.18 (4.55)	4.59 (10.02)	-	-
3c	3473-3098(NH_2, NH), 1755(C=O), 1695(C=O), 1609(C=N).	61.88 (61.82)	4.06 (4.01)	12.55 (12.49)	-	-
4a	3350-3063(NH_2, NH), 1725(C=O),1668(C=O), 1600(C=N).	66.52 66.46	4.51 4.08	11.93 11.87	-	-
4b	3400-3050(OH, NH_2, NH), 1730 (C=O), 1670(C=O), 1605(C=N).	64.33 64.19	4.36 4.26	11.54 11.46	-	-
4c	3450-3100(NH_2, NH), 1745(C=O), 1675(C=O), 1610(C=N).	60.70 60.01	3.92 3.88	13.61 13.56	-	-
5a	3400-3100(NH_2, NH), 1728(C=O), 1680(C=O).	62.83 (62.78)	4.22 (4. 1 7)	8.79 (8.73)	7.42 (7.38)	-
5b	3390-3050(OH, NH_2, NH), 1729(C=O), 1685(C=O).	60.80 (60.76)	4.08 (4.05)	8.51 (8.46)	7.18 (7.12)	-
5c	3395-3050(NH_2, NH), 1733(C=O), 1690(C=O).	57.42 (57.36)	3.66 (3.62)	10.74 (10.68)	6.78 (6.73)	-
6a	3400-3150(NH2, NH), 1725(C=O), 1690(C=O).	63.15 (63.09)	4.45 (4.40)	8.84 (8.77)	-	6.74 (6.69)
6b	3450-3100(OH, NH_2, NH), 1730(C=O), 1693(C=O).	61.09 (61.05)	4.31 (4.28)	8.55 (8.00)	-	6.52 (6.48)
6c	3400-3100(NH_2, NH), 1727(C=O), 1691(C=O).	57.69 (57.63)	3.87 (3.84)	10.76 (10.72)	-	6.16 (6.12)
7a	3450-3100(NH_2, NH), 1720(C=O), 1688 (C=O).	61.71 61.69	3.88 3.82	10.28 10.23	6.51 6.48	
7b	3450-3100(OH, NH2, NH), 1725(C=O), 1685(C=O).	59.95 59.91	3.77 3.69	9.99 9.85	6.32 6.15	
7c	3400-3100(NH_2, NH), 1723(C=O), 1684(C=O).	57.01 56.96	3.12 3.09	11.87 11.80	6.02 5.96	
8a	3390-3050(NH_2, NH), 1726(C=O), 1690(C=O).	61.87 61.81	4.26 4.19	10.31 10.27	5.70 5.65	5.70 5.68
8b	3450-3050(OH, NH_2, NH), 1728(C=O), 1693.	60.10 59.98	4.14	10.01		5.73
8c	3400.,3100(NH_2, NH), 1732(C=O), 1695(C=O).	57.14	3.77	11.90		5.45

Table 3: Cont.

Comp. No.	IR (υ_{max}/cm^{-1})	Calcd. (Found)				
		C	H	N	Cl	S
9	3430(OH), 3400-31 00(NH_2, NH), 1570(C=O).	58.95 (58.89)	3.89 (3.86)	14.73 (14.68)	-	-
10	3439(OH), 3400-3100(NH_2, NH), 1568(C=O).	57.63 57.59	3.98 3.93	15.81 15.77	-	-
11a	3450-3100(OH, NH_2, NH), 1625(C=O), 1590(C=N).	67.56 (67.51)	4.05 (4.00)	11.25 (11.19)	-	-
11b	3500-3060(OH, NH_2, NH), 1655(C=O), 1600(C=N).	64.78 64.71	3.88 3.83	10.79 10.71	-	-
11c	3450-3150(OH, NH_2, NH), 1660(C=O), 1610(C=N).	60.29 60.19	3.37 3.31	13.39 14.32	-	-
12a	3500-3150(OH, NH_2, NH), 1715(C=O), 1603(C=N).	65.15 65.08	4.1 3.97	12.66 12.62	-	-
12b	3450-3100(OH, NH_2, NH), 1713(C=O), 1605(C=N).	62.88 62.81	3.96 3.92	12.22 12.09	-	-
12c	3450-3150(OH, NH_2, NH), 1718(C=O), 1609(C=N).	59.14 59.07	3.52 3.47	14.37 14.29	-	-
13a	3450-3050(OH, NH_2, NH), 1626(C=O).	61.41 (61.37)	3.58 (3.52)	9.34(9.29)	7.88 (7.83)	-
13b	3400-3100(OH, NH_2, NH), 1630(C=O).	59.30 59.27	3.46 3.41	9.02 8.98	7.61 7.57	-
13c	3500-3100(OH, NH_2, NH), 1633(C=O).	55.83 55.79	3.06 3.01	11.32 11.29	7.17 7.08	-
14a	3450-3100(OH, NH_2, NH), 1630(C=O).	61.74 (61.68)	3.83 (3.78)	9.39 (9.35)	-	7.16 (7.12)
14b	3400-3050(OH, NH_2, NH), 1625(C=O).	59.61 59.56	3.70 3.67	9.07 8.99		6.92 6.88
14c	3450-3100(OH, NH_2, NH), 1623(C=O)	56.10 55.48	3.27 3.03	11.38 11.27		6.51 6.48
15a	3450-3050(OH, NH_2, NH), 1626(C=O).	60.18 60.01	3.69 3.62	10.80 10.76	6.83 6.79	
15b	3400-3100(OH, NH2, NH), 1630(C=O).	58.38 58.26	3.58 3.51	10.47 10.38	6.63 6.58	
15c	3450-3150(OH, NH_2, NH), 1635(C=O).	55.38 55.28	3.22 3.09	12.42 12.38	6.29 6.18	
16a	3500-3100(OH, NH_2, NH), 1640(C=O).	60.46 60.41	3.90 3.86	10.85 10.80		6.21 5.98
16b	3500-3150(OH, NH_2, NH), 1645(C=O).	58.64 58.59	3.79 3.74	10.52 10.48		6.02 5.99
16c	3450-3100(OH, NH_2, NH), 1650(C=O).	55.61 55.57	3.41 3.39	12.42 12.37		5.71 5.67

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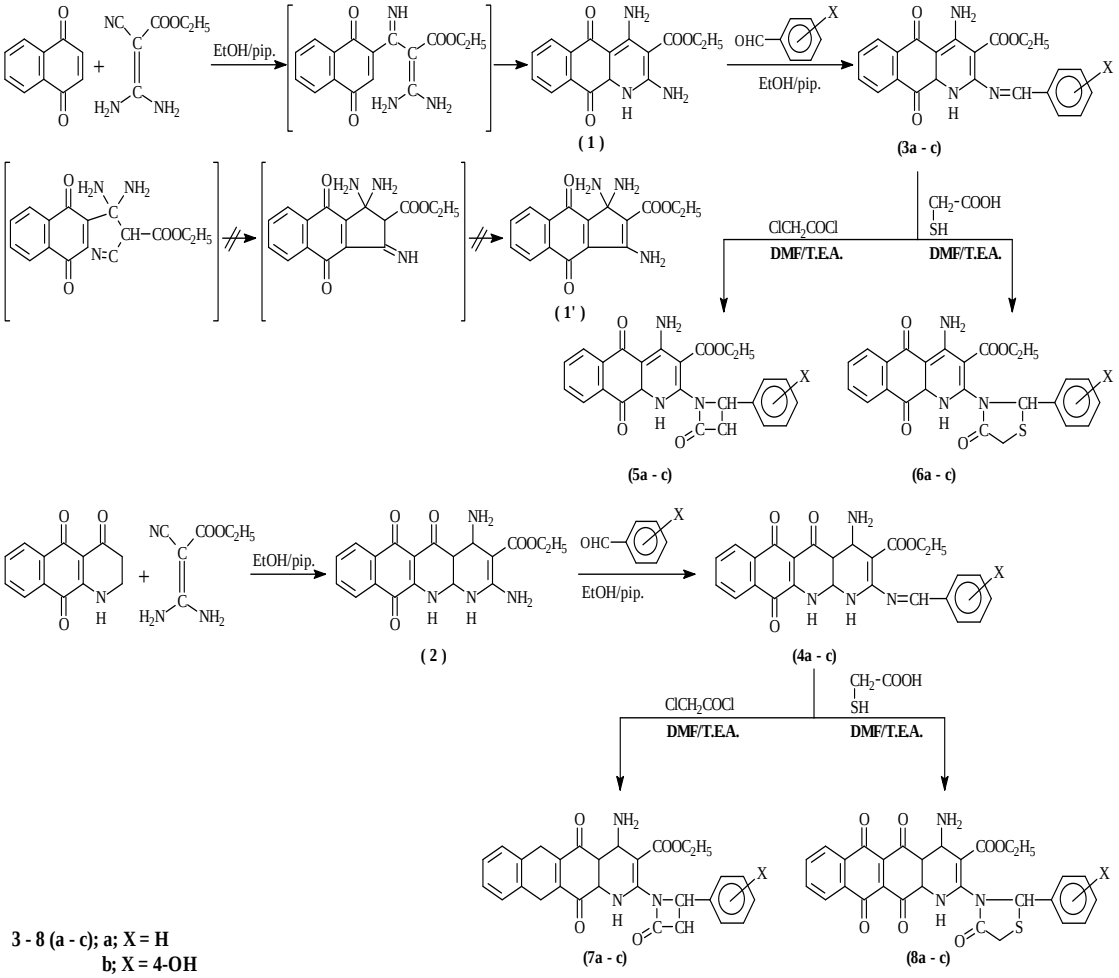
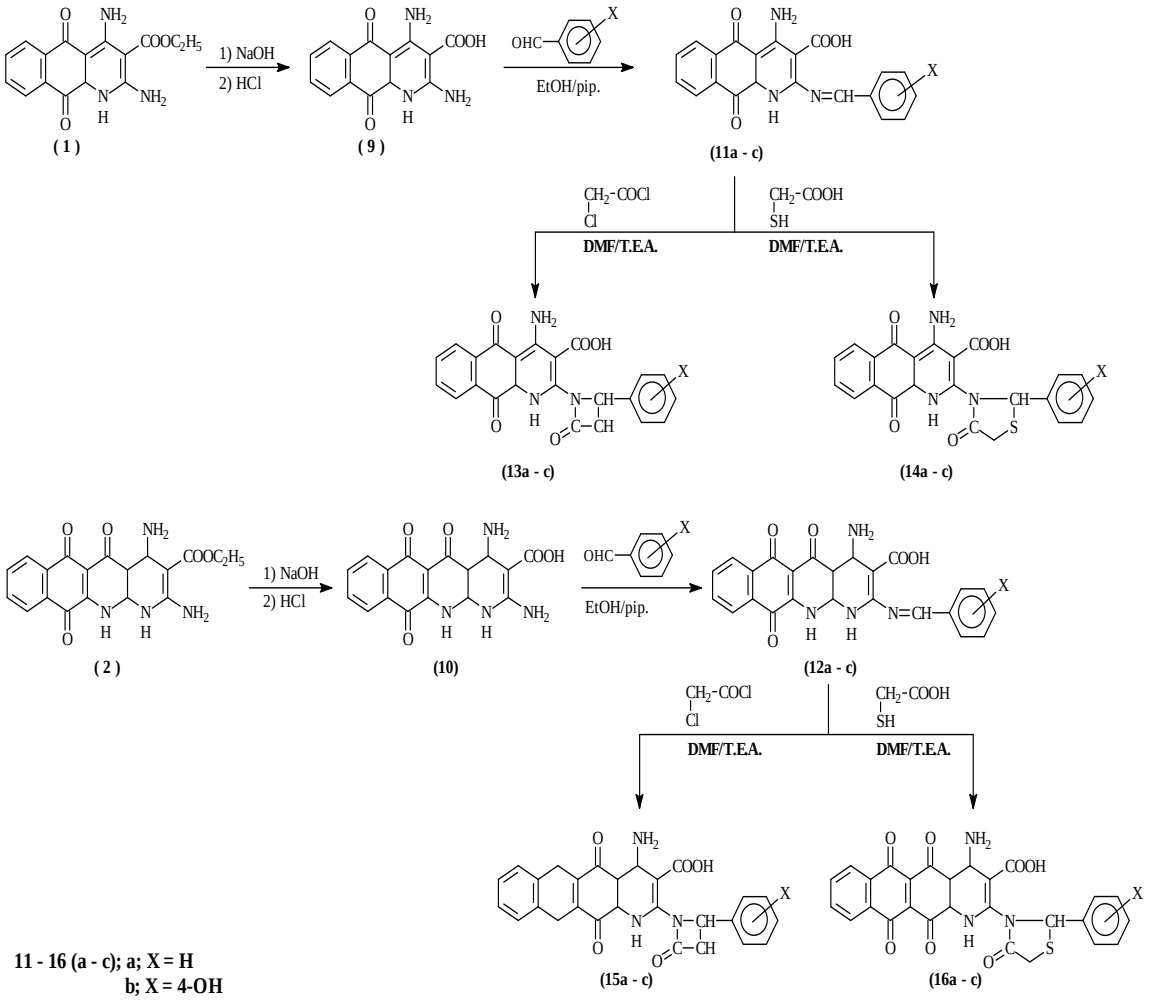


3 - 8 (a - c); a; X = H
b; X = 4-OH
c; X = 4-NO_2

Scheme 1



(1) (9) (11a - c) (13a - c) (14a - c)

(2) (10) (12a - c) (15a - c) (16a - c)

11 - 16 (a - c); a; X = H
b; X = 4-OH
c; X = 4-NO_2

Scheme 2