Synthesis of novel nitrogen containing naphtho[2,1-*b*]furan derivatives and investigation of their anti microbial activities

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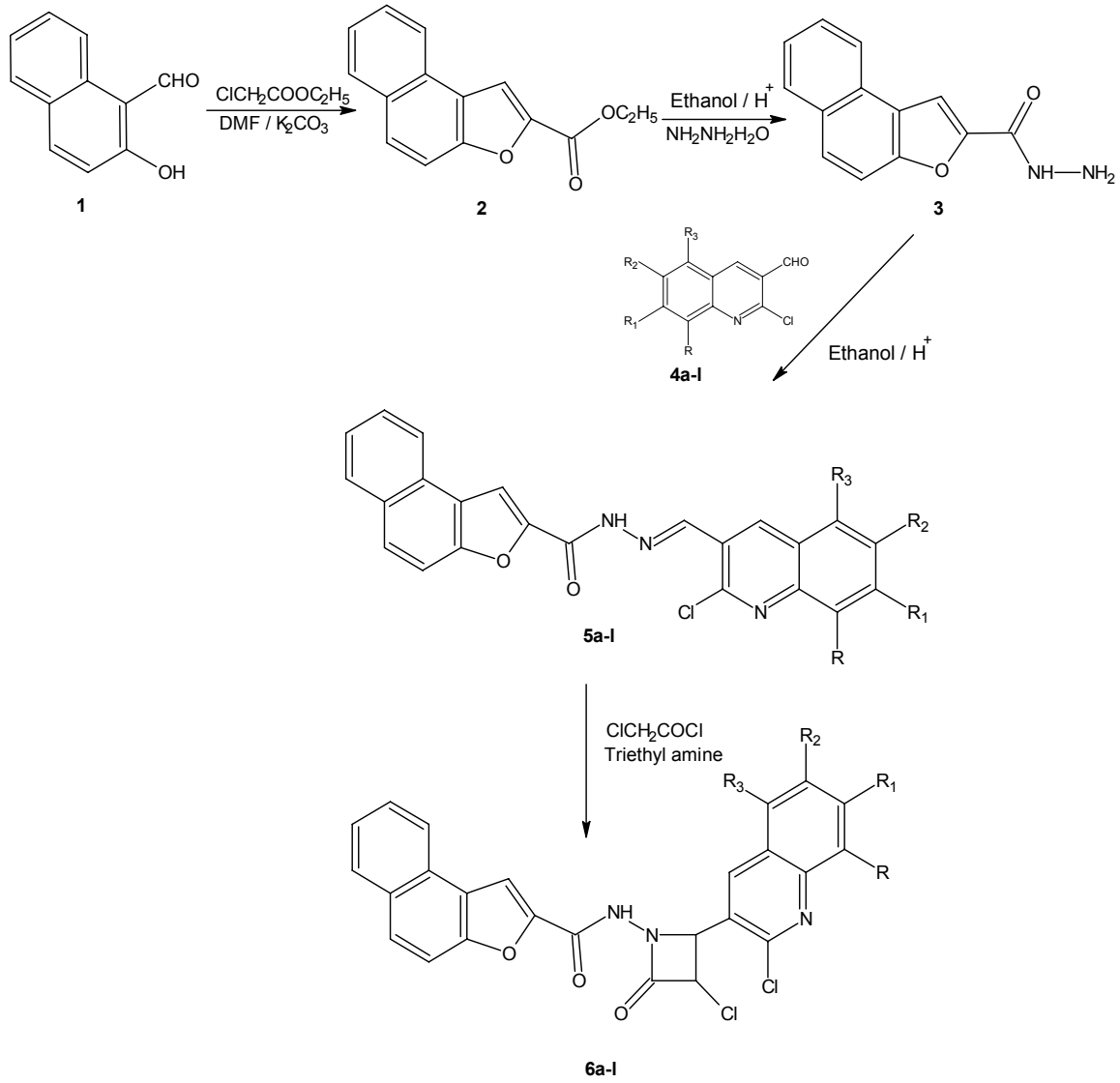
Abstract
Ethyl naphtho[2,1-*b*]furan-2-carboxylate has been prepared from 2-hydroxy-1- naphthaldehyde **1** and ethyl chloroacetate, which on further treatment with hydrazine hydrate gave naphtha[2,1-*b*]furan-2-carbohydrazide **3**. The resulting compound **3** was treated with substituted aldehydes of 2-chloro-3-formylquinolines to give the Schiff base, which on treatment with chloro acetyl chloride gave the title compounds. The structure of the compounds has been confirmed by elemental analysis and spectral studies. The synthesized compounds were screened for their antibacterial and antifungal activities.

Keywords: Naphtho[2,1-*b*]furan-2-carbohydrazide, 2-chloro-3-formylquinoline, Schiff base azetidinones, antibacterial, antifungal activity

Introduction

Naphthofurans possess a broad range of biological activities that are constituents of important natural products.[1-3] These plant extracts are being used for traditional medicines,[4-11] and some of them for example mansonone D,[12] Dunnione,[13] etc are also vital biologically active agents. Naphthofurans fused or coupled with nitrogen heterocycles do not occur in nature. Even the synthesis of naphthofurans coupled or fused with nitrogen heterocycles are not reported so for, except some reports of such compounds from our laboratory.[14-18] Since the discovery of penicillin, azetidinone based heterocycles have been an important class of drugs with wide therapeutic activities[19-24] and the heterocycles containing quionolines moieties also maintain wide range of biological activities.[25-28] Hence, with these observation we examine the feasibility

and efficiency of an approach to synthesis naphthofuran coupled with both quinolines and azetidinone[29] nucleus, which turns to exhibit significant antimicrobial activities.



	R	R_1	R_2	R_3					
a.	**H**	**H**	**H**	**H**	**b.**	**H**	**H**	**CH_3**	**H**
c.	**H**	**CH_3**	**H**	**H**	**d.**	**CH_3**	**H**	**H**	**H**
e.	**H**	**H**	**OCH_3**	**H**	**f.**	**H**	**OCH_3**	**H**	**H**
g.	**OCH_3**	**H**	**H**	**H**	**h.**	**H**	**H**	**Br**	**H**
i.	**H**	**H**	**Cl**	**H**	**j.**	**H**	**Cl**	**H**	**H**
k.	**H**	**OCH_3**	**OCH_3**	**H**	**l.**	**H**	**OCH_3**	**OCH_3**	**OCH_3**

Scheme 1. General procedure of *N*-[3-chloro-2-(2-chloroquinolin-3-yl)-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide 6a-l.

Results and Discussion

Ethyl naphtho[2,1-*b*]furan-2-carboxylate **2** was prepared from 2-hydroxy-1-naphthaldehyde on reacting with ethyl chloroacetate in potassium carbonate and DMF in acceptable yields. The identity of the product was determined by IR and ^{1}H NMR spectral studies. The IR spectrum of compound **2** revealed a sharp strong absorption band above 1718 cm^{-1} due to the presence of the ester function in the structure. The ^{1}H NMR spectra substantiated the results of the IR analysis. The characteristic signals of an ester moiety confirm the presence of ester group in the structure by resonating as quartet and triplet for CH_2 and CH_3 at δ 4.45 ppm (J= 7 Hz) and δ 1.35 ppm (J= 7 Hz) respectively. The aromatic protons resonate as multiplets at δ 7.60-8.50 ppm, in particular the proton at C5 & C6 resonate as triplets at δ 7.60 ppm (J=7 Hz) and δ 7.70 ppm (J=7 Hz) respectively. C10 and C11 resonate as doublet at δ 7.90 ppm (J=9 Hz), & δ 8.45 ppm (J=8 Hz), C3 resonate at δ 8.50 ppm as singlet and C4 & C7 at δ 8.05-8.15 ppm as a double doublet (J=8 Hz) of naphthofuran confirms the structure. Also, its mass spectra revealed a molecular ion peak at m/z 240 (M^+) corresponding to the molecular formula $C_{15}H_{12}O_3$. Thus compound **2** was reacted with hydrazine hydrate under acidic condition in ethanol at reflux temperature to obtain naphtho[2,1-*b*]furan-2-carbohydrazide **3** in good yields. The structure of **3** was confirmed by IR, NMR and mass spectral analysis. The IR spectrum of **3** showed the absence of ester stretching frequency, instead it gave a band at 1657 cm^{-1} for carbonyl group and showing two sharp bands in the region of 3300-3400 cm^{-1} due to $-NH_2$ group and at 3100-3400 cm^{-1} for -NH frequencies. ^{1}H NMR spectrum of compound **3** exhibited no peak corresponds to ester instead it shows signals at δ 10.12 ppm and δ 4.62 ppm for -NH and -NH_2 (D_2O exchangeable) of hydrazide respectively. The structure was further confirmed by recording its mass spectra. It gave the molecular ion peak at m/z 226 (M^+) corresponds to molecular formula $C_{13}H_{10}N_2O_2$.

To prepare Schiff bases **5a-l**, the compound **3** was treated with various aromatic aldehydes of 2-chloro-3-formyl quinolines **4a-l** in presence of catalytic amount of acetic acid in absolute ethanol. The IR spectrum of **5a** exhibit absorption band at 1602 cm^{-1} due to -C=N and amide stretching frequency remain at 1655 cm^{-1}. ^{1}H NMR of **5a** exhibits multiplets at δ 7.65-8.55 ppm for 12 protons. Whereas imine protons found to resonate at δ 8.63 ppm and -NH (D_2O exchangeable) protons appeared at δ 12.21 ppm.

Finally, to obtain the title compounds *N*-[3-chloro-2-(2-chloroquinolin-3-yl)-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamides **6a-l**, the compounds **5a-l** were made to react with chloro acetyl chloride and triethylamine in dioxane. The structural analyses of the newly synthesized molecule **6a-I** were confirmed by IR, ^{1}H NMR and mass spectral investigations. The IR spectra of the compound **6a** revealed two sharp strong absorption bands at 1657 cm^{-1} and 1709 cm^{-1} for carbonyl group in azetidinone ring and amide group respectively. Further, ^{1}H NMR spectrum exhibited multiplets in the region at δ 7.60-8.90 ppm for 12 aromatic protons. Two protons present in azetidinone ring i.e. N-CH-C and C-CH-Cl are found to resonate as doublets at δ 1.8 ppm and δ 2.5 ppm respectively. The structure was further confirmed by its Mass spectral studies. It gave molecular ion peak at m/z 476 (M^+) corresponds to molecular formula

$C_{25}H_{15}Cl_2N_3O_3$ (scheme-1). Similarly, all these compounds were purified by column chromatography and characterized on the basis of spectral studies. The spectral details of all the synthesized compounds are given in appropriate place and are in agreement with the assigned structures.

The present protocol describes a simple and efficient method for the synthesis of azetidinones by different Schiff bases of naphtho[2,1-*b*]furans. It has been demonstrated that cyclocondensation of schiff bases with chloroacetyl chloride in triethyl amine revealed with fairly high yields in a relatively short reaction time and easy work-up procedures. These conditions enable this method to be good protocol for the synthesis of 2-azetidinone based heterocycles.

Experimental Section

General Procedures. All the reagents were obtained commercially and used with further purification. The melting points were determined on a Kofler hot-stage apparatus and are uncorrected; IR spectra were recorded with a FT Bruker spectrometer in KBr optics. ^{1}H NMR spectra were recorded on a Varian VXR-400 (400 MHz) spectrometer in DMSO-d_6 solutions. The chemical shifts were expressed in the ppm (δ scale) downfield from TMS. Microanalysis was determined on a Fisons EA 1108 instrument. Silica gel Merck (60-120 mesh) and DC-Alufolien 60 F254 were normally used for column and TLC Chromatography respectively.

Evaluation of antimicrobial activity

The *in vitro* antimicrobial activity was carried out against 24 hr old cultures of two bacteria and two fungi by cup-plate method.[30] Compounds **6a-l** (except 6b, 6d, 6f, 6g, and 6j) has been tested for their antibacterial activity against *Pseudomonas aerugenosa* and *Staphylococcus aureus* and antifungal activity against *Aspergillus niger* and *Candida albicans*. Nutrient agar and potato dextrose agars were used to culture the bacteria and fungus respectively. The compounds were tested at a concentration of 0.005 mol / ml in DMF solution. The solution of Chloramphenicol (2 mg/ ml) and Flucanazole (2 mg/ ml) were prepared in sterilized water and used as standards for comparison of antibacterial and antifungal activities respectively. The compounds were tested at varied concentration. The minimum inhibition concentration was found to be 0.001mol/ ml in DMF against all organisms. Inhibition was recorded by measuring the diameter of the inhibition zone at the end of 24 h for bacteria at 28^{0}C and 48 h for fungus at 35^{0}C. Each experiment was repeated thrice and the average of the three independent determinations was recorded. The protocols were summarized in (Table 1). The compounds **6c** and **6e** showed promising activity against *P. aerugenosa* and **6i**, **6l** and **6k** against *S. aureus*. The compounds **6c** and **6l** against *A. niger* and **6c** and **6i** against *C. albicans* exhibited significant activity.

Table 1. Antimicrobial activity of the compounds **6a-l**

	Antibacterial activity Zone of inhibition in mm		Antifungal activity Zone of inhibition in mm	
Compd.	*P.aerugenosa*	*S. aureus*	*A. niger*	*C. albicans*
6a	14	14	13	14
6c	15	14	20	18
6e	18	15	-	16
6h	-	15	16	-
6i	15	18	17	16
6k	-	16	15	15
6l	15	16	18	16
Chloramphenicol	22	24	-	-
Flucanazole	-	-	25	26

Control (DMF) (-) - No activity.
Highly active (inhibition zone > 12 mm);
Moderately active (inhibition zone 9-12 mm);
Slightly active (inhibition zone 6-9 mm);
Inactive - inhibition zone < 6 mm).

Ethyl naphtha[2,1-*b*]furan-2-carboxylate 2. A mixture of 2-Hydroxy naphthaldehyde **1** (1.72 g, 10 mmol), ethyl chloroacetate (1.22 g, 10 mmol) anhydrous potassium carbonate (25 g) in 25 ml of dimethyl formamide was heated under reflux for 24 h. After completion of the reaction (TLC), the reaction mixture was poured into ice-cold water. The resultant product separated was filtered off and recrystallized from ethyl acetate gave **2** in 80-90% yields.

Naphtho[2,1-*b*]furan-2-carbohydrazide 3. The compound **2** (2.2 g, 10 mmol) with hydrazine hydrate (99%), (0.50 g, 10 mmol) under acidic condition in absolute ethanol (30 ml) were refluxed for 2-3 hrs. After the completion of reaction as evidenced by TLC, the reaction mixture was poured onto crushed ice; the solid mass thus separated out was filtered, washed with water and dried to gave the desired compounds **3** in 80-85% yields.

***N*'-[2-Chloroquinolin-3-yl]methylene]naphtho[2,1-*b*]furan-2-carbohydrazide 5a-l.** Naphtho [2,1-*b*]furan-2-carbohydrazide (0.01 mol) **3,** 2-chloro-3-formylquinoline **4a** (0.01 mol) were taken in ethanol with catalytic amount of acetic acid (20 ml) and heated to refluxed for 3-4 hrs. After conclusion of the reaction (TLC), the reaction mixture was poured onto crushed ice; the solid mass thus separated out was filtered, washed with water and dried to give the desired compounds **5a** in 70-75% yields.

***N*-[3-Chloro-2-(2-chloroquinolin-3-yl)-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide 6a-l. General Procedure.** In a typical example, chloroacetyl chloride (0.01 mol) in 5 ml of dioxane cooled to 0^{o}C, to this triethyl amine (0.01mol) in 5ml dioxane was added. To this Schiff's base **5** (0.01mol) in 5ml dioxane was added and refluxed for 6 hrs. After the

completion of the reaction (monitored by TLC), the reaction mixture poured into ice-cold water to get solid, which was filtered and dried. Thus crude product obtained was purified by column chromatography on silica gel {eluent: ethyl acetate: petroleum-ether (bp 40 ^{o}C-60 ^{o}C)=1:9}.

***N*-[3-Chloro-2-(2-chloroquinolin-3-yl)-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6a).** Brown solid, (67%), mp 242-243^{o}C, MS: (M^+) 476; Anal.Calcd for $C_{25}H_{15}Cl_2N_3O_3$: C 63.04, H 3.17, N 8.82. Found: C 63.25, H 3.15, N 8.79. IR (KBr, cm^{-1}): 784 (C-Cl), 1657 (C=O azetidinone), 1709 (C=O), 3420 (N-H); ^{1}H NMR (δ, DMSO): 1.84 (d, 1H, N-CH-C), 2.52 (d, 1H, C-CH-Cl), 7.21-9.25 (m, 12H, Ar-H), 10.45 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.12, 110.23, 112.57, 122.43, 124.16, 126.56, 127.23, 129.51, 130.37, 147.42, 152.43, 157.90, 166.85.

***N*-[2-(6-Methyl-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6b).** Brown solid, (72%), mp 243-245^{o}C, MS: (M^+) 490; Anal.Calcd for $C_{26}H_{17}Cl_2N_3O_3$: C 63.69, H 3.49, N 8.57. Found: C 63.65, H 3.45, N 8.65. IR (KBr, cm^{-1}): 786 (C-Cl), 1656 (C=O azetidinone), 1706 (C=O), 3422 (N-H); ^{1}H NMR (δ, DMSO): 1.13 (s, 3H, CH_3), 1.82 (d, 1H, N-CH-C), 2.54 (d, 1H, C-CH-Cl), 7.23-9.29 (m, 11H, Ar-H), 10.41 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 36.28, 41.11, 110.25, 112.47, 122.46, 124.26, 126.58, 127.13, 128.59, 130.47, 147.62, 152.33, 157.50, 167.15.

***N*-[2-(5-Methyl-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6c).** Brown solid, (73%), mp 241-244^{o}C, MS: (M^+) 490; Anal.Calcd for $C_{26}H_{17}Cl_2N_3O_3$: C 63.69, H 3.49, N 8.57. Found: C 63.70, H 3.45, N 8.62. IR (KBr, cm^{-1}): 785 (C-Cl), 1655 (C=O azetidinone), 1708 (C=O), 3423 (N-H); ^{1}H NMR (δ, DMSO): 1.13 (s, 3H, CH_3), 1.81 (d, 1H, N-CH-C), 2.53 (d, 1H, C-CH-Cl), 7.23-9.29 (m, 11H, Ar-H), 10.42 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 36.53, 41.32, 110.53, 112.67, 122.13, 123.96, 126.26, 126.63, 129.55, 130.47, 146.92, 152.41, 157.90, 166.84.

***N*-[2-(4-Methyl-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6d).** Brown solid, (72%), mp 243-245^{o}C, MS: (M^+) 490; Anal.Calcd for $C_{26}H_{17}Cl_2N_3O_3$: C 63.69, H 3.49, N 8.57. Found: C 63.65, H 3.45, N 8.65. IR (KBr, cm^{-1}): 786 (C-Cl), 1653 (C=O azetidinone), 1705 (C=O), 3421 (N-H); ^{1}H NMR (δ, DMSO): 1.14 (s, 3H, CH_3), 1.83 (d, 1H, N-CH-C), 2.55 (d, 1H, C-CH-Cl), 7.21-9.35 (m, 11H, Ar-H), 10.43 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 36.23, 41.21, 110.35, 112.47, 123.46, 124.16, 126.38, 127.13, 129.59, 130.46, 147.72, 152.33, 157.50, 167.35.

***N*-[2-(6-Methoxy-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6e).** Brown solid, (65%), mp 245-247^{o}C, MS: (M^+) 506; Anal.Calcd for $C_{26}H_{17}Cl_2N_3O_4$: C 61.67, H 3.38, N 8.30. Found: C 63.65, H 3.45, N 8.25. IR (KBr, cm^{-1}): 784 (C-Cl), 1657 (C=O azetidinone), 1709 (C=O), 3420 (N-H); ^{1}H NMR (δ, DMSO): 3.82 (s, 3H, OCH_3), 1.81 (d, 1H, N-CH-C), 2.53 (d, 1H, C-CH-Cl), 7.23-9.27 (m, 11H, Ar-H), 10.43 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.22, 55.39, 110.35, 112.67, 123.43, 124.16, 126.26, 127.35, 128.61, 130.35, 147.45, 151.93, 157.50, 166.75.

***N*-[2-(5-Methoxy-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6f).** Brown solid, (68%), mp 246-247^{o}C, MS: (M^+) 506; Anal.Calcd for

$C_{26}H_{17}Cl_2N_3O_4$: C 61.67, H 3.38, N 8.30. Found: C 63.63, H 3.42, N 8.28. IR (KBr, cm^{-1}): 785 (C-Cl), 1655 (C=O azetidinone), 1708 (C=O), 3423 (N-H); ^1H NMR (δ, DMSO): 3.63 (s, 3H, OCH_3), 1.83 (d, 1H, N-CH-C), 2.55 (d, 1H, C-CH-Cl), 7.23-9.29 (m, 11H, Ar-H), 10.42 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.32, 56.23, 110.53, 112.67, 122.13, 123.96, 126.26, 126.63, 129.55, 130.47, 146.92, 152.41, 157.90, 166.84.

***N*-[2-(4-Methoxy-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6g).** Brown solid, (65%), mp 245-247°C, MS: (M^+) 506; Anal.Calcd for $C_{26}H_{17}Cl_2N_3O_4$: C 61.67, H 3.38, N 8.30. Found: C 63.65, H 3.45, N 8.25. IR (KBr, cm^{-1}): 786 (C-Cl), 1653 (C=O azetidinone), 1705 (C=O), 3421 (N-H); ^1H NMR (δ, DMSO): 3.75 (s, 3H, OCH_3), 1.82 (d, 1H, N-CH-C), 2.53 (d, 1H, C-CH-Cl), 7.21-9.35 (m, 11H, Ar-H), 10.43 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.21, 56.14, 110.35, 112.47, 123.46, 124.16, 126.38, 127.13, 129.59, 130.46, 147.72, 152.33, 157.50, 167.35.

***N*-[2-(6-Bromo-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6h).** Brown solid, (68%), mp 255-257°C, MS: (M^+) 555; Anal.Calcd for $C_{25}H_{14}BrCl_2N_3O_3$: C 54.08, H 2.54, N 7.57. Found: C 53.98, H 2.45, N 7.65. IR (KBr, cm^{-1}): 784 (C-Cl), 1657 (C=O azetidinone), 1709 (C=O), 3420 (N-H); ^1H NMR (δ, DMSO): 1.83 (d, 1H, N-CH-C), 2.55 (d, 1H, C-CH-Cl), 7.21-9.25 (m, 11H, Ar-H), 10.45 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.12, 110.23, 112.57, 122.43, 124.16, 126.56, 127.23, 129.51, 130.37, 147.42, 152.43, 157.90, 166.85.

***N*-[2-(6-Chloro-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6i).** Brown solid, (72%), mp 253-255°C, MS: (M^+) 510; Anal.Calcd for $C_{25}H_{14}Cl_3N_3O_3$: C 58.79, H 2.76, N 8.23. Found: C 58.98, H 2.75, N 8.15. IR (KBr, cm^{-1}): 785 (C-Cl), 1655 (C=O azetidinone), 1708 (C=O), 3423 (N-H); ^1H NMR (δ, DMSO): 1.81 (d, 1H, N-CH-C), 2.54 (d, 1H, C-CH-Cl), 7.23-9.29 (m, 11H, Ar-H), 10.42 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.32, 110.53, 112.67, 122.13, 123.96, 126.26, 126.63, 129.55, 130.47, 146.92, 152.41, 157.90, 166.84.

***N*-[2-(5-Chloro-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-Carboxamide (6j).** Brown solid, (75%), mp 252-252°C, MS: (M^+) 510; Anal.Calcd for $C_{25}H_{14}Cl_3N_3O_3$: C 58.79, H 2.76, N 8.23. Found: C 58.95, H 2.79, N 8.25. IR (KBr, cm^{-1}): 786 (C-Cl), 1653 (C=O azetidinone), 1705 (C=O), 3421 (N-H); ^1H NMR (δ, DMSO): 1.84 (d, 1H, N-CH-C), 2.53 (d, 1H, C-CH-Cl), 7.21-9.35 (m, 11H, Ar-H), 10.43 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.21, 110.35, 112.47, 123.46, 124.16, 126.38, 127.13, 129.59, 130.46, 147.72, 152.33, 157.50, 167.35.

***N*-[2-(5,6-Dimethoxy-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6k).** Bown solid, (72%), mp 265-267°C, MS: (M^+) 536; Anal.Calcd for $C_{25}H_{19}Cl_2N_3O_5$: C 60.46, H 3.57, N 7.83. Found: C 60.42, H 3.55, N 7.85. IR (KBr, cm^{-1}): 785 (C-Cl), 1655 (C=O azetidinone), 1708 (C=O), 3423 (N-H); ^1H NMR (δ, DMSO): 1.82 (d, 1H, N-CH-C), 2.52 (d, 1H, C-CH-Cl), 3.75 (s, 3H, OCH_3), 3.83 (s, 3H, OCH_3),7.21-9.35 (m, 10H, Ar-H), 10.43 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.21, 56.53, 110.35, 112.47, 123.46, 124.16, 126.38, 127.13, 129.59, 130.46, 147.72, 152.33, 157.50, 167.35,

***N*-[2-(5,6,7-Trimethoxy-2-chloroquinolin-3-yl)-3-chloro-4-oxoazetidin-1-yl]naphtho[2,1-*b*]furan-2-carboxamide (6l).** Brown solid, (73%), mp 268-269^{o}C, MS: (M^{+}) 566; Anal.Calcd for $C_{28}H_{21}Cl_2N_3O_6$: C 59.38, H 3.74, N 7.42. Found: C 60.01, H 3.76, N 7.45. IR (KBr, cm^{-1}): 784 (C-Cl), 1657 (C=O azetidinone), 1709 (C=O), 3420 (N-H); ^{1}H NMR (δ, DMSO): 1.82 (d, 1H, N-CH-C), 2.53 (d, 1H, C-CH-Cl), 3.63 (s, 3H, OCH_3), 3.70 (s, 3H, OCH_3), 3.83 (s, 3H, OCH_3), 7.23-9.29 (m, 9H, Ar-H), 10.42 (s, 1H, CONH), ^{13}C NMR (DMSO) δ: 41.32, 56.31, 110.53, 112.67, 122.13, 123.96, 126.26, 126.63, 129.55, 130.47, 146.92, 152.41, 157.90, 166.84,

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