SOLVENT FREE SYNTHESIS OF SOME 4-OXO-THIAZOLIDINE DERIVATIVES OF PHENOTHIAZINE

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Abstract- *A new series of N-[2-(10H-phenothiazinyl)ethyl]-2-(substituted phenyl)-4-oxo-5-[(substituted phenyl)methylidene]-1-iminothiazolidine, compounds 5(a-m) have been synthesized. by microwave method. The cycloaddition reaction of thioglycolic acid with N-[2-(10H-phenothiazinyl)ethyl]-N'-[(phenyl)methylidene]-hydrazine, compounds 3(a-m) in the presence of anhydrous ZnCl2 afforded new heterocyclic compounds N-[2-(10H-phenothiazinyl)ethyl]-2-(phenyl)-4-oxo-1-iminothiazolidine, compounds 4(a-m). The later product on treatment with several selected substituted aromatic aldehydes in the presence of C2H5ONa undergoes Knoevenagel reaction to yield, compounds 5(a-m). The structure of compounds 1, 2, 3(a-m), 4(a-m) and 5(a-m) were confirmed by IR, 1H NMR, 13C NMR, FAB-Mass and chemical analysis. Compounds 5(a-m) have been screened for their antimicrobial and antitubercular activities, displayed satisfactory results.*

Keywords- *Microwave synthesis, 4-oxo-thiazolidine, phenothiazine.*

I INTRODUCTION

Phenothizine derivatives possess a wide spectrum of pharmacological activity and are clinically used as antbiological [1], antibacterial [2,3], histamine release [4], neuroleptic [5] etc. The successful application in chemotherapy of the phenothiazine derivatives has determined the orientation of our research in this field towards the synthesis of new potential pharmaceutically active products with non traditional way. Phenothiazines are well known as antioxidative [6], antipsychotic agent [7]. Apart from this traditional medical usage in recent years phenothizine derivatives have also been found to possess antimycobacterium activities [8].Thiazolidines are the new class of antimicrobial agent with activity against broad spectrum of grampossitive pathogens. Thiazolidine moiety is key pharmacophore and intermediate for synthesizing pharmaceutically active compounds. Thiazolidine and its analogs constitute the active class of compounds possessing wide spectrum of biological activities, such as antifungal [9], antimicrobial [10], anticonvulsant [11], antibacterial activities [12,13]. Thiazolidines derivatives are well famous for their anti-inflammatory activities [14]. Inflammation remains a common and, all too often poorly controlled clinical problem which can be life threatening in extreme from of allergy, autoimmune diseases and rejection of transplanted organs. Our recent research work based on the synthesis of phenothiazine and thiazolidine ring in single frame, we have been synthesized a new series of compounds 5(a-m) showed in Scheme. The structure of compounds 1, 2, 3(a-m), 4(a-m) and 5(a-m) were confirmed by IR, 1H NMR, 13C NMR, FAB-Mass and chemical analysis. Final products, compounds 5(a-m) were screened for their antimicrobial and antitubercular activities.

II MATERIALS AND METHODS

(a) Experimental

Melting points were taken in open glass capillaries tubes and are uncorrected. Progress of the reaction was monitored by silica gel-G coated TLC plates in MeOH: $CHCl_3$ system (1:9). The spot was visualized by exposing the plate in an iodine vapours chamber. IR spectra were recorded in KBr disc on a Schimadzu 8201 PC, FTIR spectrophotometer (νmax in cm-1) 1H and 13C NMR spectra were measured on a Brucker DRX-300 spectrometer in $CDCl_3$ at 300 and 75MHz respectively using TMS as an internal standard All chemical shifts were reported on δ scale. The FAB-Mass spectra were recorded on a Jeol SX–102 mass spectrometer. Elemental analyses were performed on a Carlo Erba–1108 analyzer. Microwave irradiation was carried out in open glass vessel. Modified synthetic microwave oven (800W) was used for the synthesis of compounds. The experiments were carried out at atmospheric pressure in standard glassware with a reflux condenser fitted through the roof of the microwave cavity. A thermocouple was used to monitor the temperature inside the vessel of the microwave. The analytical data of all the compounds were found to satisfactory. For column chromatographic purification of the products, Merck silica Gel

60 (230-400 Mesh) was used. The reagent grade chemicals were purchased from the commercial sources and further purified before use.

(b) Method for the synthesis of compound 1.

A solid supported mixture of phenothiazine and 1-bromo-3-chloroethane (1:1 mole) was mixed thoroughly in open glass vessel and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 4.30 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH_3OH: $CHCl_3$ (1:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 1.

(c) Method for the synthesis of compound 2.

A solid supported mixture of compound 1 and hydrazine hydrate (1:1 mole) was mixed thoroughly in open glass vessel and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 3.45 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH_3OH: $CHCl_3$ (1:9) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 2.

(d) Method for the synthesis of compounds 3 (a-m).

A solid supported mixture of Compound 2 and selected substituted benzaldehyde (1:1 mole) was mixed thoroughly in open glass vessel in the presence of 2-3 drops of glacial acetic acid and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 3.30-4.30 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH_3OH: $CHCl_3$ (2:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 3(a-m).Method for the synthesis of compound 4(a-m).

A solid supported mixture of compounds 3(a-m) and thioglycolic acid (1:1 mole) was mixed thoroughly in open glass vessel in the presence of $ZnCl_2$ and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 4.00-4.30 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH_3OH: $CHCl_3$ (2:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 4(a-m).

(e) Method for the synthesis of compound 5(a-m).

A solid supported mixture of compounds 4(a-m) and selected substituted benzaldehydes (1:1 mole) was mixed thoroughly in open glass vessel and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 3.45-4.15 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH_3OH: $CHCl_3$ (2:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 5(a-m).

III RESULTS AND DISCUSSION

The reaction of 1-bromo-2-chloroethane with phenothiazine was carried out in the microwave irradiation to afford compound 1. The spectroscopic analyses of compound 1 showed absorption peaks for C-Cl at 770 cm-1 in the IR spectrum. The IR spectrum confirms the formation of compound 1. This fact also supported by the disappearance of NH absorption of the phenothiazine in the IR spectrum at 3436 cm-1. The compound 1 on the reaction with hydrazine hydrate yielded compound 2. In the spectroscopic analyses of compound 2, two absorption peaks found in IR spectrum for NH and NH_2 at 3340 and 3398 cm-1 respectively while absorption of C-Cl has been disappeared. This fact was also supported by 1H and 13C NMR spectra because two signals appeared in the 1H NMR spectrum for NH and NH_2 at δ 8.53 and δ 5.59 ppm respectively. All the facts together were strong evidence for the synthesis of compound 2. Substituted benzaldehydes give the condensation reaction with compound 2 resulting the production of Schiff bases N=CH too k placed which was confirmed by IR, 1H NMR and 13C NMR spectra of compounds 3(a-m). In the IR spectra of compounds 3(a-m) absorption peaks found in the range of 1540-1580 cm-1 while a strong signal appeared in the range of δ 8.56-8.94 and δ 152.7-159.8 ppm in the 1H NMR and 13C NMR spectra for N=CH of compounds 3(a-m) respectively. The facts also supported by the disappearance of the signal of NH_2 in the 1H NMR spectra. The compounds 3(a-m) on reaction with of thioglycolic acid in the presence of $ZnCl_2$ gave the cycloaddition reaction and produced a five membered

thiazolidinone ring, compounds 4(a-m). The compounds 4(a-m) showed a characteristic absorption of the cyclic carbonyl group in the range of 1724-1759 cm-1 in the IR spectra. The 1H NMR spectra of compounds 4(a-m) aroused our attention and clearly indicate the presence of the active methylene group in the thiazolidine ring in the range of δ 3.39-3.69 ppm. The 13C NMR spectra of compounds 4(a-m) also supported the fact that cyclic carbonyl group present a signal appeared in the range of δ 170.5-177.5 ppm. These all fact also supported by the two evidences that are (a) disappearance of N=CH proton and (b) appearance of N-CH proton in the range of δ 5.11-5.21 ppm in the 1H NMR spectra of compounds 4(a-m). The compounds 4(a-m) underwent the Knoevenagel condensation reaction with substituted benzaldehydes in the presence of C_2H_5ONa to afford compounds 5(a-m). In the 1H NMR spectra of the compounds 5(a-m), we have found the disappearance of two methylene protons of compounds 4(a-m) and an appearance of a new signal for C=CH in the range of δ 6.42-6.79 ppm. In the 13C NMR spectra two new signals for C=CH and C=CH appeared in the range of δ 136.8-143.5 and δ 141.8-149.9 ppm respectively in the spectra of the compounds 5(a-m). These all above facts clearly confirmed the synthesis of all final products. Reaction time of compounds 3(a-m), 4(a-m) and 5(a-m) were given in Table 2.

The results of the all described activities (antibacterial, antifungal, and antitubercular) were summarized in Table 1. The results of the antimicrobial screening data revealed that all the compound 5(a-m) showed considerable and varied activity against the selected microorganism. A new series of N-[2-(10H-phenothiazinyl)ethyl]-2-(substituted phenyl)-4-oxo-5-[(substituted phenyl) methylidene]-1-iminothiazolidine, compounds 5(a-m) were prepared and screened for their antimicrobial and antitubercular activity data (as shown in Table 1) revealed that all the synthesized compound 5(a-m) have a structure activity relationship (SAR) because activity of compounds varies with substitution. Nitro group containing compounds (5h, 5i and 5j) showed higher activity than chloro (5c, 5d), or bromo group containing compounds (5e, 5f). Chloro and bromo derivatives also have higher activity than other rested compounds. On the basis of SAR, concluded that the activity of compounds depends on electron withdrawing nature of the substituted groups. The sequence of the activity is following

$NO_2 > Cl > Br > OCH_3 < OH > CH_3$

The investigation of antimicrobial (antibacterial, antifungal and antitubercular) data revealed that the compounds (5c), (5d), (5e), (5f), (5h), (5i) and (5j) displayed high activity in the series, the compounds (5b), (5g) and (5m) showed moderate activity and rest compounds showed less activity against all the strains compared with standard drugs.

- *1-(2-chloroethyl)-10H-phenothiazine (1)*

Yield: 71%, m.p. 162-163°C; Anal. Calcd for $C_{14}H_{12}NSCl$: C,64.23, H,4.62, N,5.35%; found C,64.20, H,4.60, N,5.32%; IR (cm-1): 684 (C-S-C), 770 (C-Cl), 1551 (C=C), 2938, 3029 (CH); 1H NMR (δ): 3.51 (t, 2H, J = 7.60 Hz, CH_2-Cl), 4.01 (t, 2H, J = 7.60 Hz, N-CH_2), 6.31-7.75 (m, 8H, Ar-H); 13C NMR: 46.4 (CH_2-Cl), 49.9 (N-CH_2), 116.3, 121.2, 124.6, 127.5, 138.4, 144.5 (Ar); Mass (FAB): 262M^+.

N-[2-(10H-phenothiazinyl)ethyl]-hydrazine (2)

Yield: 83%, m.p. 147-149°C; Anal. Calcd for $C_{14}H_{15}N_3SCl$: C,57.42, H,5.16, N,14.35%; found C,57.40, H,5.12, N,14.31%; IR: 1232 (C-N), 3340 (NH), 3398 (NH_2); 1H NMR: 3.22 (m, 2H, CH_2-NH), 3.76 (t, 2H, J = 7.58 Hz, N-CH_2), 5.59 (s, NH_2), 8.53 (s, 1H, NH), 6.44-7.73 (m, 8H, Ar-H); 13C NMR: 478.2 (CH_2-NH), 50.9 (N-CH_2), 115.7, 122.3, 124.7, 133.1, 141.6, 148.6 (Ar); Mass (FAB): 299M^+.

N-[2-(10H-phenothiazinyl)ethyl]-N'-[(phenyl)methylidene]-hydrazine (3a)

Yield: 74%, m.p. 148-150°C; Anal. Calcd for $C_{21}H_{19}N_3S$: C,73.01, H,5.54, N,12.16%; found C,72.98, H,5.50, N,12.11%; IR: 1540 (N=CH), 3355 (NH); 1H NMR: 3.26 (m, 2H, CH_2-N), 3.78 (t, 2H, J = 7.60 Hz, N-CH_2), 8.48 (s, 1H, NH), 8.58 (s, 1H, N=CH), 6.60-8.21 (m, 13H, Ar-H); 13C NMR: 44.6 (CH_2-NH), 56.3 (N-CH_2), 153.7 (N=CH), 119.9, 123.6, 127.5, 128.2, 129.8 , 130.3, 132.4, 135.2, 148.7, 152.5 (Ar); Mass (FAB): 345M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(4-chlorophenyl)methylidene]-hydrazine (3b)*

Yield: 75%, m.p. 169-171°C; Anal. Calcd for $C_{21}H_{18}N_3SCl$: C,66.39, H,4.77, N,11.06%; found C,66.33, H,4.72, N,11.01%; IR: 741 (C-Cl), 1565 (N=CH), 3372 (NH); 1H NMR: 3.56 (m, 2H, CH_2-NH), 3.96 (t, 2H, J = 7.65 Hz, N-CH_2), 8.47 (s, 1H, NH), 8.84 (s, 1H, N=CH), 6.79-8.15 (m, 12H, Ar-H); 13C NMR: 48.7 (CH_2-NH), 61.3 (N-CH_2), 158.6 (N=CH), 121.3, 126.6, 127.5, 129.8, 130.7, 132.5, 135.3, 138.3, 145.8, 148.5 (Ar); Mass (FAB): 380M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(3-chlorophenyl)methylidene]-hydrazine (3c)*

Yield: 78%, m.p. 167-168°C; Anal. Calcd for $C_{21}H_{18}N_3SCl$: C,66.39, H,4.77, N,11.06%; found C,66.32, H,4.70, N,11.03%; IR: 745 (C-Cl), 1576 (N=CH), 3368 (NH); 1H NMR: 3.63 (m, 2H, CH_2-NH), 3.90 (t, 2H, J = 7.65 Hz, N-CH2), 8.38 (s, 1H, NH), 8.88 (s, 1H, N=CH), 6.74-8.16 (m, 12H, Ar-H); 13C NMR: 47.8 (CH_2-NH), 52.1 (N-CH_2), 157.9 (N=CH), 116.4, 119.2, 123.4, 124.8, 125.9, 127.3, 130, 132.4, 133.8, 135.1, 139, 147.1, (Ar); Mass (FAB): 380M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(2-chlorophenyl)methylidene]-hydrazine (3d)*

Yield: 75%, m.p. 165-166ºC; Anal. Calcd for $C_{21}H_{18}N_3SCl$: C,66.39, H,4.77, N,11.06%; found C,66.30, H,4.73, N,11.02%; IR: 749 (C-Cl), 1574 (N=CH), 3369 (NH); 1H NMR: 3.59 (m, 2H, CH_2-NH), 3.99 (t, 2H, J = 7.60 Hz, N-CH2), 8.31 (s, 1H, NH), 8.87 (s, 1H, N=CH), 6.73-8.08 (m, 12H, Ar-H); 13C NMR: 48.3 (CH_2-NH), 59.3 (N-CH_2), 159.8 (N=CH), 112.4, 116, 120, 124.1, 126.4, 128, 130.5, 131, 134, 137.8, 141.2, 147.2 (Ar); Mass (FAB): 380M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(4-bromophenyl)methylidene]-hydrazine (3e)*

Yield: 76%, m.p. 160-162ºC; Anal. Calcd for $C_{21}H_{18}N_3SBr$: C,59.43, H,4.27, N,9.90%; found C,59.41, H,4.22, N,9.87%; IR: 636(C-Br), 1578 (N=CH), 3376 (NH); 1H NMR: 3.61 (m, 2H, CH_2-NH), 3.97 (t, 2H, J = 7.60 Hz, N-CH_2), 8.32 (s, 1H, NH), 8.83 (s, 1H, N=CH), 6.69-8.08 (m, 12H, Ar-H); 13C NMR: 48.8 (CH_2-N), 59.2 (N-CH_2), 159.8 (N=CH), 117.2, 124.5, 126.2, 127.4, 129.4, 133, 138.4, 140.3, 145.5, 150 (Ar); Mass (FAB): 424M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(3-bromophenyl)methylidene]-hydrazine (3f)*

Yield: 73%, m.p. 161-163ºC; Anal. Calcd for $C_{21}H_{18}N_3SBr$: C,59.43, H,4.27, N,9.90%; found C,59.40, H,4.25, N,9.85%; IR: 642 (C-Br), 1570 (N=CH), 3360 (NH); 1H NMR: 3.54 (m, 2H, CH_2-NH), 3.91 (t, 2H, J = 7.55 Hz, N-CH_2), 8.42 (s, 1H, NH), 8.79 (s, 1H, N=CH), 6.76-8.16 (m, 12H, Ar-H); 13C NMR: 49.2 (CH_2-N), 61.3 (N-CH_2), 156.6 (N=CH), 114.5, 119, 124.2, 126, 128.4, 129.3, 130.3, 134.2, 137.6, 140.1, 144.3, 151.1 (Ar); Mass (FAB): 424M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(2-bromophenyl)methylidene]-hydrazine (3g)*

Yield: 72%, m.p. 161-162ºC; Anal. Calcd for $C_{21}H_{18}N_3SBr$: C,59.43, H,4.27, N,9.90%; found C,59.48, H,4.35, N,9.84%; IR:, 653 (C-Br), 1580 (N=CH), 3367 (NH); 1H NMR: 3.57 (m, 2H, CH_2-NH), 3.92 (t, 2H, J = 7.60 Hz, N-CH_2), 8.42 (s, 1H, NH), 8.78 (s, 1H, N=CH), 6.73-8.23 (m, 12H, Ar-H); 13C NMR: 47.3 (CH_2-NH), 58.2 (N-CH_2), 155.3 (N=CH), 112.4, 117.1, 121.7, 125.2, 127.5, 129, 133.3, 137.5, 142, 145.3, 149.1, 153 (Ar); Mass (FAB): 424M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(4-nitrophenyl)methylidene]-hydrazine (3h)*

Yield: 76%, m.p. 169-170ºC; Anal. Calcd for $C_{21}H_{18}N_4SO_2$: C,64.59, H,4.64, N,14.34%; found C,64.52, H,4.61, N,14.30%; IR: 844 (C-N), 3346 (NH), 1527 (N=O), 1558 (N=CH); 1H NMR: 3.55 (m, 2H, CH_2-NH), 3.98 (t, 2H, J = 7.55 Hz, N-CH_2), 8.45 (s, 1H, NH), 8.92 (s, 1H, N=CH), 6.74-8.19 (m, 12H, Ar-H); 13C NMR: 48.4 (CH_2-NH), 57.8 (N-CH_2), 158.7 (N=CH), 116, 119.4, 122.4, 124, 126.4, 132.5, 134.6, 137.5, 148.2, 153.1 (Ar); Mass (FAB): 390M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(3-nitrophenyl)methylidene]-hydrazine (3i)*

Yield: 82%, m.p. 170-172ºC; Anal. Calcd for $C_{21}H_{18}N_4SO_2$: C,64.59, H,4.64, N,14.34%; found C,64.52, H,4.62, N,14.31%; IR: 846 (C-N), 1542 (N=O), 1562 (N=CH), 3358 (NH); 1H NMR: 3.61 (m, 2H, CH_2-NH), 3.98 (t, 2H, J = 7.65 Hz, N-CH_2), 8.46 (s, 1H, NH), 8.94 (s, 1H, N=CH), 6.77-8.17 (m, 12H, Ar-H); 13C NMR: 46.6 (CH_2-NH), 59.8 (N-CH_2), 159.6 (N=CH), 114, 118, 121.4, 123.4, 126.2, 128 ,130.3, 132.5, 137.2, 142, 145, 151 (Ar); Mass (FAB): 390M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(2-nitrophenyl)methylidene]-hydrazine (3j)*

Yield: 81%, m.p. 168-169ºC; Anal. Calcd for $C_{21}H_{18}N_4SO_2$: C,64.59, H,4.64, N,14.34%; found C,64.57, H,4.60, N,14.30%; IR: 848 (C-N), 1541 (N=O), 1564 (N=CH), 3354 (NH); 1H NMR: 3.56 (m, 2H, CH_2-NH), 4.01 (t, 2H, J = 7.60 Hz, N-CH_2), 8.38 (s, 1H, NH), 8.93 (s, 1H, N=CH), 6.85-8.22 (m, 12H, Ar-H); 13C NMR: 45.9 (CH_2-NH), 59.4 (N-CH_2), 158.7 (N=CH), 114.2, 118.3, 122, 124.6, 125.4, 127.5, 129.6, 132, 134.5, 138, 147.4, 152 (Ar); Mass (FAB): 390M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(4-methoxyphenyl)methylidene]-hydrazine (3k)*

Yield: 75%, m.p. 158-160ºC; Anal. Calcd for $C_{22}H_{21}N_3SO$: C,70.37, H,5.63, N,11.19%; found C,70.32, H,5.61, N,11.17%; IR: 1542 (N=CH), 2940 (OCH_3), 3358 (NH); 1H NMR: 3.28 (m, 2H, CH_2-N), 3.63 (s, 3H, OCH_3), 3.82 (t, 2H, J = 7.65 Hz, N-CH_2), 8.32 (s, 1H, NH), 8.78 (s, 1H, N=CH), 6.65-7.98 (m, 12H, Ar-H); 13C NMR: 48.5 (CH_2-N), 53.6 (OCH_3), 54.7 (N-CH_2), 154.6 (N=CH), 110.1, 113.5, 116.5, 121, 124.2, 127, 134.4, 145.5, 154.5, 162 (Ar); Mass (FAB): 375M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(4-methylphenyl)methylidene]-hydrazine (3l)*

Yield: 72%, m.p. 149-151ºC; Anal. Calcd for $C_{22}H_{21}N_3S$: C,73.50, H,5.88, N,11.58%; found C,73.45, H,5.82, N,11.52%; IR: 1543 (N=CH), 2920 (CH_3), 3341 (NH); 1H NMR: 2.23 (s, 3H, CH_3), 3.17 (m, 2H, CH_2-N), 3.76 (t, 2H, J = 7.55 Hz, N-CH_2), 8.42 (s, 1H, NH), 8.78 (s, 1H, N=CH), 6.62-7.93 (m, 12H, Ar-H); 13C NMR: 26.8 (CH_3), 47.5 (N-CH_2), 53.8 (CH_2-N), 152.7 (N=CH), 115, 119.6, 121.5, 124.5,

127.8, 130.1, 132.7, 136, 138, 145.3 (Ar); Mass (FAB): 359M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-N'-[(4-hyroxyphenyl)methylidene]-hydrazine (3m)*

Yield: 74%, m.p. 164-166ºC; Anal. Calcd for $C_{21}H_{19}N_3SO$: C,69.77, H,5.29, N,11.62%; found C,69.72, H,5.24, N,11.60%; IR: 3354 (NH), 3474 (OH), 1556 (N=CH); 1H NMR: 3.37 (m, 2H, CH_2-NH), 3.94 (t, 2H, J = 7.50 Hz, N-CH_2), 4.38 (s, 1H, OH), 8.45 (s, 1H, NH), 8.56 (s, 1H, N=CH), 6.52-7.92 (m, 12H, Ar-H); 13C NMR: 47.6 (CH_2-N), 56.3 (N-CH_2), 158.6 (N=CH), 111, 114.9, 118.4, 121.5, 124, 129.5, 133.4, 142.5, 148.6, 157.3 (18C,Ar); Mass (FAB): 361M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(phenyl)-4-oxo-1-iminothiazolidine (4a)*

Yield: 74%, m.p. 154-156ºC; Anal. Calcd for $C_{23}H_{21}N_3S_2O$: C,65.84, H,5.04, N,10.01%; found C,65.81, H,5.01, N,9.95%; IR: 688 (C-S-C), 1737 (CO cyclic); 1H NMR: 3.29 (m, 2H, CH_2-N), 3.45 (s, 2H, S-CH_2), 3.82 (t, 2H, J = 7.60 Hz, N-CH_2), 5.17 (s, 1H, N-CH), 8.41 (s, 1H, NH), 6.55-7.96 (m, 12H, Ar-H); 13C NMR: 37.2 (S-CH_2), 45.3 (CH_2-NH), 57.5 (N-CH_2), 63.5 (N-CH), 172.5 (CO cyclic), 117.5, 120.5, 121.1, 122.6, 123.7, 124.5, 127.2, 131.2, 143.3, 152.5 (Ar); Mass (FAB): 419M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-chlorophenyl)-4-oxo-1-iminothiazolidine (4b)*

Yield: 78%, m.p. 178-180ºC; Anal. Calcd for $C_{23}H_{20}N_3S_2OCl$: C,60.84, H,4.44, N,9.25%; found C,60.82, H,4.41, N,9.20%; IR: 721 (C-S-C), 769 (C-Cl), 1759 (CO cyclic); 1H NMR: 3.31 (m, 2H, CH_2-N), 3.62 (s, 2H, S-CH_2), 3.73 (t, 2H, J = 7.60 Hz, N-CH_2), 5.21 (s, 1H, N-CH), 8.45 (s, 1H, NH), 6.64-8.05 (m, 12H, Ar-H); 13C NMR: 41.3 (S-CH_2), 43.3 (CH_2-NH), 55.6 (N-CH_2), 64.4 (N-CH), 176.5 (CO cyclic), 118.4, 122.4, 125.7, 126.8, 128.4, 131.5, 136.6, 137.6, 147.8, 152.8 (Ar); Mass (FAB): 455M^+

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(3-chlorophenyl)-4-oxo-1-iminothiazolidine (4c)*

Yield: 79%, m.p. 176-177ºC; Anal. Calcd for $C_{23}H_{20}N_3S_2OCl$: C,60.84, H,4.44, N,9.25%; found C,60.81, H,4.40, N,9.23%; IR: 728 (C-S-C), 759 (C-Cl) 1758 (CO cyclic); 1H NMR: 3.35 (m, 2H, CH_2-N), 3.69 (s, 2H, S-CH_2), 3.78 (t, 2H, J = 7.60 Hz, N-CH_2), 5.17 (s, 1H, N-CH), 8.38 (s, 1H, NH), 6.72-8.13 (m, 12H, Ar-H); 13C NMR: 42.8 (S-CH_2), 44.6 (CH_2-NH), 56.3 (N-CH_2), 64.9 (N-CH), 177.5 (CO cyclic), 114.7, 119.3, 123.7, 124.2, 126.3, 128.7, 131.2, 134.5, 139.3, 143.6, 146.7, 149.4 (Ar); Mass (FAB): 455M^+

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(2-chlorophenyl)-4-oxo-1-iminothiazolidine (4d)*

Yield: 78%, m.p. 172-173ºC; Anal. Calcd for $C_{23}H_{20}N_3S_2OCl$: C,60.84, H,4.44, N,9.25%; found C,60.83, H,4.39, N,9.17%; IR: 722 (C-S-C), 774 (C-Cl), 1750 (CO cyclic); 1H NMR: 3.37 (m, 2H, CH_2-N), 3.64 (s, 2H, S-CH_2), 3.84 (t, 2H, J = 7.60 Hz, N-CH_2), 5.16 (s, 1H, N-CH), 8.36 (s, 1H, NH), 6.63-8.12 (m, 12H, Ar-H); 13C NMR: 41.9 (S-CH_2), 45.3 (CH_2-NH), 57.6 (N-CH_2), 64.6 (N-CH), 175.6 (CO cyclic), 118.4, 119.7, 123.3, 125.6, 128.5, 130.2, 132.7, 135.1, 138.7, 142.3, 148.8, 152.4 (Ar); Mass (FAB): 455M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-bromophenyl)-4-oxo-1-iminothiazolidine (4e)*

Yield: 80%, m.p. 168-170ºC; Anal. Calcd for $C_{23}H_{20}N_3S_2OBr$: C,55.42, H,4.04, N,8.42%; found C,5539, H,4.01, N,8.35%; IR: 719 (C-S-C), 752 (C-Cl) 1750 (CO cyclic); 1H NMR: 3.36 (m, 2H, CH_2-N), 3.68 (s, 2H, S-CH_2), 3.81 (t, 2H, J = 7.60 Hz, N-CH_2), 5.18 (s, 1H, N-CH), 8.42 (s, 1H, NH), 6.69-8.18 (m, 12H, Ar-H); 13C NMR: 40.6 (S-CH_2), 43.3 (CH_2-NH), 57.6 (N-CH_2), 65.6 (N-CH), 176.6 (CO cyclic), 112.3, 117.4, 121.5, 127.7, 128.5, 131.2, 134.6, 137.7, 143.6, 147.5 (Ar); Mass (FAB): 498M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(3-bromophenyl)-4-oxo-1-iminothiazolidine (4f)*

Yield: 68%, m.p. 171-173ºC; Anal. Calcd for $C_{23}H_{20}N_3S_2OBr$: C,55.42, H,4.04, N,8.42%; found C,55.36, H,3.97, N,8.38%; IR: 715 (C-S-C), 752 (C-Cl), 1742 (CO cyclic); 1H NMR: 3.34 (m, 2H, CH_2-N), 3.69 (s, 2H, S-CH_2), 3.83 (t, 2H, J = 7.60 Hz, N-CH_2), 5.12 (s, 1H, N-CH), 8.43 (s, 1H, NH), 6.75-8.21 (m, 12H, Ar-H); 13C NMR: 39.9 (S-CH_2), 46.2 (CH_2-NH), 58.5 (N-CH_2), 64.7 (N-CH), 174.8 (CO cyclic), 116.3, 121.8, 122.7, 124.5, 126.8, 129.2, 130.4, 133.7, 138.1, 141.5, 149.2, 151.5 (Ar); Mass (FAB): 498M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(2-bromophenyl)-4-oxo-1-iminothiazolidine (4g)*

Yield: 76%, m.p. 175-178ºC; Anal. Calcd for $C_{23}H_{20}N_3S_2OBr$: C,55.42, H,4.04, N,8.42%; found C,55.37, H,3.98, N,8.36%; IR: 712 (C-S-C), 751 (C-Cl), 1742 (CO cyclic); 1H NMR: 3.32 (m, 2H, CH_2-N), 3.54 (s, 2H, S-CH_2), 3.85 (t, 2H, J = 7.60 Hz, N-CH_2), 5.11 (s, 1H, N-CH), 8.39 (s, 1H, NH), 6.75-8.14 (m, 12H, Ar-H); 13C NMR: 41.2 (S-CH_2), 48.4 (CH_2-NH), 59.8 (N-CH_2), 65.7 (N-CH), 174.4 (CO cyclic), 112.2, 119.4, 122.3, 125.1, 128.2, 132.6, 134.7, 137.8, 139.6, 143.2, 148.8, 155.6 (Ar); Mass (FAB): 498M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-nitrophenyl)-4-oxo-1-iminothiazolidine (4h)*

Yield: 80%, m.p. 174-176ºC; Anal. Calcd for $C_{23}H_{20}N_4S_2O_3$: C,59.46, H,4.33, N,12.05%; found C,59.43, H,4.30, N,12.02%; IR: 698 (C-S-C), 878 (C-NO), 1546 (NO), 1740 (CO cyclic); 1H NMR: 3.41 (m, 2H, CH_2-N), 3.62 (s, 2H, S-CH_2), 3.92 (t, 2H, J = 7.60 Hz, N-CH_2), 5.19 (s, 1H, N-CH), 8.35 (s, 1H, NH), 6.59-8.14 (m, 12H, Ar-H); 13C NMR: 41.6 (S-CH_2), 48.6 (CH_2-NH), 57.5 (N-CH_2), 63 .6 (N-CH), 175.7 (CO cyclic), 110.5, 114.5, 120.4, 123.7, 125.7, 129.3, 135.7, 140.2, 144.5, 154.7 (Ar); Mass FAB): 465M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(3-nitrophenyl)-4-oxo-1-iminothiazolidine (4i)*

Yield: 82%, m.p. 173-175ºC; Anal. Calcd for $C_{23}H_{20}N_4S_2O_3$: C,59.46, H,4.33, N,12.05%; found C,59.42, H,4.28, N,12.00%; IR: 695 (C-S-C), 875 (C-NO), 1541 (NO), 1742 (CO cyclic); 1H NMR: 3.39 (m, 2H, CH_2-N), 3.64 (s, 2H, S-CH_2), 3.92 (t, 2H, J = 7.60 Hz, N-CH_2), 5.21 (s, 1H, N-CH), 8.40 (s, 1H, NH), 6.68-8.24 (m, 12H, Ar-H); 13C NMR: 42.6 (S-CH_2), 47.2 (CH_2-NH), 59.3 (N-CH_2), 63.8 (N-CH), 175.6 (CO cyclic), 116.3, 119.3, 123.2, 127.2, 130.2, 131.6, 132.8, 133.7, 136.5, 143.8, 148.1, 157.2 (Ar); Mass (FAB): 465M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(2-nitrophenyl)-4-oxo-1-iminothiazolidine (4j)*

Yield: 81%, m.p. 172-173ºC; Anal. Calcd for $C_{23}H_{20}N_4S_2O_3$: C,59.46, H,4.33, N,12.05%; found C,59.43, H,4.30, N,12.01%; IR: 692 (C-S-C), 862 (C-NO), 1538 (NO), 1742 (CO cyclic); 1H NMR: 3.40 (m, 2H, CH_2-N), 3.67 (s, 2H, S-CH_2), 3.88 (t, 2H, J = 7.60 Hz, N-CH_2), 5.18 (s, 1H, N-CH), 8.37 (s, 1H, NH), 6.67-8.26 (m, 12H, Ar-H); 13C NMR: 40.6 (S-CH_2), 46.3 (CH_2-NH), 58.7 (N-CH_2), 64.3 (N-CH), 174.6 (CO cyclic), 116.5, 120.3, 123.1, 126.2, 127.3, 131.5, 132.8, 136.5, 139.3, 142.5, 148.9, 152.4 (Ar); Mass (FAB): 465M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-methoxyphenyl)-4-oxo-1-iminothiazolidine (4k)*

Yield: 76%, m.p. 168-170ºC; Anal. Calcd for $C_{24}H_{23}N_3S_2O_2$: C,64.11, H,5.15, N,9.34%; found C,64.07, H,5.11, N,9.30%; IR: 681 (C-S-C), 1062 (C-O), 1724 (CO cyclic), 2962 (OCH_3); 1H NMR: 3.37 (m, 2H, CH_2-N), 3.42 (s, 2H, S-CH_2), 3.85 (t, 2H, J = 7.60 Hz, N-CH_2), 3.56 (s, 3H, OCH_3) 5.12 (s, 1H, N-CH), 8.34 (s, 1H, NH), 6.64-7.99 (m, 12H, Ar-H); 13C NMR: 40.9 (S-CH_2), 44.6 (CH_2-NH), 53.3 (N-CH_2), 56.5 (OCH_3), 62.5 (N-CH), 173.5 (CO cyclic), 112.7, 117.3, 125.2, 128.3, 130.8, 132.2, 136.5, 146.7, 154.2, 161.2 (Ar); Mass (FAB): 449M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-methylphenyl)-4-oxo-1-iminothiazolidine (4l)*

Yield: 78%, m.p. 159-161ºC; Anal. Calcd for $C_{24}H_{23}N_3S_2O$: C,66.48, H,5.34, N,9.69%; found C,66.43, H,5.31, N,9.65%; IR: 675 (C-S-C), 1738 (CO cyclic), 2890 (CH_3); 1H NMR: 2.32 (s, 3H, CH_3), 3.35 (m, 2H, CH_2-N), 3.39 (s, 2H, S-CH_2), 3.77 (t, 2H, J = 7.60 Hz, N-CH_2), 5.14 (s, 1H, N-CH), 8.32 (s, 1H, NH), 6.57-7.90 (m, 12H, Ar-H); 13C NMR: 25.5 (CH_3), 36.5 (S-CH_2), 44.3 (CH_2-NH), 56.5 (N-CH_2), 63.7 (N-CH), 170.5 (CO cyclic); 114.6, 119.5, 122.5, 125.7, 127.2, 131.6, 135.1, 138.3, 142.1, 148.2 (Ar); Mass (FAB): 434M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-hydroxyphenyl)-4-oxo-1-iminothiazolidine (4m)*

Yield: 72%, m.p. 168-169ºC; Anal. Calcd for $C_{23}H_{21}N_3S_2O_2$: C,63.42, H,5.85, N,9.64%; found C,63.38, H,5.80, N,9.59%; IR: 682 (C-S-C), 1750 (CO cyclic), 3494 (OH); 1H NMR: 3.29 (m, 2H, CH_2-N), 3.39 (s, 2H, S-CH_2), 3.83 (t, 2H, J = 7.60 Hz, N-CH_2), 4.37 (s, 1H, OH), 5.15 (s, 1H, N-CH), 8.42 (s, 1H, NH), 6.56-7.92 (m, 12H, Ar-H); 13C NMR: 43.6 (S-CH_2), 43.2 (CH_2-NH), 54.6 (N-CH_2), 65.3 (N-CH), 176.5 (CO cyclic), 112.7, 115.2, 119.1, 123.4, 126.9, 129.5, 133.2, 136.2, 141.2, 158.7 (Ar); Mass (FAB): 436M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(phenyl)-4-oxo-5-[(phenyl)methylidene]-1-iminothiazolidine (5a)*

Yield: 70%, m.p. 144-146ºC; Anal. Calcd for $C_{30}H_{25}N_3S_2O$: C,70.97, H,4.96, N,8.27%; found C,70.92, H,4.93, N,8.25%; IR: 1598 (C=C), 2985 (C=CH); 1H NMR: 3.34 (m, 2H, CH_2-N), 3.82 (t, 2H, J = 7.60 Hz, N-CH_2), 5.10 (s, 1H, N-CH), 6.42 (s, 1H, C=CH), 8.45 (s, 1H, NH), 6.76-8.05 (m, 18H, Ar-H); 13C NMR: 46.6 (CH_2-NH), 58.1 (N-CH_2), 64.3 (N-CH), 136.9 (C=CH), 141.8 (C=CH), 112.3, 115.8, 118.2, 122.3, 124.3, 125.7, 126.2, 129.1, 130.4, 132.2, 134.1, 135.2, 140.5, 147 (Ar); Mass (FAB): 508M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-chlorophenyl)-4-oxo-5-[(4-chlorophenyl) methylidene]-1-iminothiazolidine (5b)*

Yield: 72%, m.p. 158-160ºC; Anal. Calcd for $C_{30}H_{23}N_3S_2OCl_2$: C,62.49, H,4.02, N,7.28%; found C,62.45, H,3.92, N,7.26%; IR: 762 (C-Cl), 1631(C=C), 3016 (C=CH); 1H NMR: 3.39 (m, 2H, CH_2-N), 3.85 (t, 2H, J = 7.60 Hz, N-CH_2), 5.22 (s, 1H, N-CH), 6.79 (s, 1H, C=CH), 8.56 (s, 1H, NH), 6.58-8.15 (m, 16H, Ar-H); 13C NMR: 46.1 (CH_2-NH), 55.4 (N-CH_2), 66.7 (N-CH), 140.5 (C=CH), 147.8 (C=CH), 111.8, 112.6, 115.2, 116.6, 118.4, 119.1, 123.8, 126.2, , 129.1, 131.2, 133.2, 135.2, 137.5, 148.5 (Ar); Mass (FAB): 577M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(3-chlorophenyl)-4-oxo-5-[(3-chlorophenyl) methylidene]-1-iminothiazolidine (5c)*

Yield: 76%, m.p. 154-156ºC; Anal. Calcd for $C_{30}H_{23}N_3S_2OCl_2$: C,62.49, H,4.02, N,7.28%; found C,62.47, H,3.97, N,7.21%; IR: 761 (C-Cl), 1630 (C=C), 3015 (C=CH); 1H NMR: 3.40 (m, 2H, CH_2-N), 3.89 (t, 2H, J = 7.60 Hz, N-CH_2), 5.21 (s, 1H, N-CH), 6.74 (s, 1H, C=CH), 8.49 (s, 1H, NH), 6.62-8.09 (m, 16H, Ar-H); 13C NMR: 45.6 (CH_2-NH), 58.3 (N-CH_2), 67.2 (N-CH), 143.5 (C=CH), 146.9 (C=CH), 115.2, 117.9, 117.8, 120.5, 122.8, 123.1, 124.5, 125.4, 127.6, 128.4, 130.4, 131.2, 133.3, 136.2, 137.1, 142.5, 147.2, 152.1 (Ar); Mass (FAB): 577M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(2-chlorophenyl)-4-oxo-5-[(2-chlorophenyl) methylidene]-1-iminothiazolidine (5d)*

Yield: 69%, m.p. 150-152ºC; Anal. Calcd for $C_{30}H_{23}N_3S_2OCl_2$: C,62.49, H,4.02, N,7.28%; found C,62.42, H,3.95, N,7.22%; IR: 759 (C-Cl), 1626 (C=C), 3012 (C=CH); 1H NMR: 3.41 (m, 2H, CH_2-N), 3.90 (t, 2H, J = 7.60 Hz, N-CH_2), 5.24 (s, 1H, N-CH), 6.78 (s, 1H, C=CH), 8.48 (s, 1H, NH), 6.79-8.14 (m, 16H, Ar-H); 13C NMR: 47.9 (CH_2-NH), 58.2 (N-CH_2), 64.6 (N-CH), 141.5 (C=CH), 145.8 (C=CH), 113.5, 114.3, 117.8, 119.2, 121.1, 122.3, 123.4, 126.7, 128.3, 129.1, 130.4, 132.2, 134.2, 135.7, 138.1, 140.5, 146.5, 159.2 (Ar); Mass (FAB): 577M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-bromophenyl)-4-oxo-5-[(4-bromophenyl) methylidene]-1-iminothiazolidine (5e)*

Yield: 75%, m.p. 149-151ºC; Anal. Calcd for $C_{30}H_{23}N_3S_2OBr_2$: C,54.14, H,3.48, N,6.31%; found C,54.11, H,3.42, N,6.25%; IR: 752 (C-Cl), 1611 (C=C), 2997 (C=CH); 1H NMR: 3.43 (m, 2H, CH_2-N), 3.95 (t, 2H, J = 7.60 Hz, N-CH_2), 5.19 (s, 1H, N-CH), 6.78 (s, 1H, C=CH), 8.44 (s, 1H, NH), 6.72-8.03 (m, 16H, Ar-H); 13C NMR: 46.4 (CH_2-NH), 58.7 (N-CH_2), 67.5 (N-CH), 140.8 (C=CH), 146.8 (C=CH), 112.4, 114.6, 117.2, 118.2, 122.3, 125.4, 126.5, 127.2, 129.4, 131.5, 134.1, 137.3, 143.5, 147.4 (Ar); Mass (FAB): 665M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(3-bromophenyl)-4-oxo-5-[(3-bromophenyl) methylidene]-1-iminothiazolidine (5f)*

Yield: 78%, m.p. 157-159ºC; Anal. Calcd for $C_{30}H_{23}N_3S_2OBr_2$: C,54.14, H,3.48, N,6.31%; found C,54.09 H,3.44, N,6.28%; IR: 750 (C-Cl), 1583 (C=C), 2984 (C=CH); 1H NMR: 3.40 (m, 2H, CH_2-N), 3.93 (t, 2H, J = 7.60 Hz, N-CH_2), 5.17 (s, 1H, N-CH), 6.64 (s, 1H, C=CH), 8.50 (s, 1H, NH), 6.77-8.18 (m, 16H, Ar-H); 13C NMR: 44.2 (CH_2-NH), 56.7 (N-CH_2), 66.1 (N-CH), 141.9 (C=CH), 146.8 (C=CH), 112.3, 113.8, 115.6, 117.1, 118.1, 121.4, 122.3, 125.5, 127.1, 129.5, 130.4, 133.1, 135.5, 136.6, 139.5, 141.3, 145.7, 150.4 (Ar); Mass (FAB): 665M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(2-bromophenyl)-4-oxo-5-[(2-bromophenyl) methylidene]-1-iminothiazolidine (5g)*

Yield: 86%, m.p. 158-159ºC; Anal. Calcd for $C_{30}H_{23}N_3S_2OBr_2$: C,54.14, H,3.48, N,6.31%; found C,54.08, H,3.40, N,6.24%; IR: 740 (C-Cl), 1592 (C=C), 2982 (C=CH); 1H NMR: 3.38 (m, 2H, CH_2-N), 3.85 (t, 2H, J = 7.60 Hz, N-CH_2), 5.13 (s, 1H, N-CH), 6.71 (s, 1H, C=CH), 8.51 (s, 1H, NH), 6.78-8.18 (m, 16H, Ar-H); 13C NMR: 47.2 (CH_2-NH), 57.7 (N-CH_2), 68.1 (N-CH), 139.8 (C=CH), 146.8 (C=CH), 112.3, 114.4, 115.6, 117.2, 118.2, 120.5, 122.5, 124.5, 125.3, 127.7, 128.2, 130.5, 132.5, 135.3, 136.4, 143, 148.4, 152.2 (Ar); Mass (FAB): 665M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-nitophenyl)-4-oxo-5-[(4-nitrophenyl) methylidene]-1-iminothiazolidine (5h)*

Yield: 80%, m.p. 154-155ºC; Anal. Calcd for $C_{30}H_{23}N_5S_2O_5$: C,60.28, H,3.87, N,11.17%; found C,60.23, H,3.84, N,11.12%; IR: 874 (C-NO), 1530 (N=O), 1585 (C=C), 3019 (C=CH); 1H NMR: 3.44 (m, 2H, CH_2-N), 3.94 (t, 2H, J = 7.60 Hz, N-CH_2), 5.20 (s, 1H, N-CH), 6.70 (s, 1H, C=CH), 8.54 (s, 1H, NH), 6.89-8.27 (m, 16H, Ar-H); 13C NMR: 47.4 (CH_2-NH), 58.3 (N-CH_2), 68.8 (N-CH), 140.3 (C=CH), 149.6 (C=CH), 113.5, 115.6, 117.4, 119.8, 121.5, 123.9, 126.7, 128.2, 129.5, 132.2, 135.8, 137.3, 146.4, 148.7 (Ar); Mass (FAB): 598M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(3-nitrophenyl)-4-oxo-5-[(3-nitrophenyl) methylidene]-1-iminothiazolidine (5i)*

Yield: 82%, m.p. 167-158ºC; Anal. Calcd for $C_{30}H_{23}N_5S_2O_5$: C,60.28, H,3.87, N,11.17%; found C,60.24, H,3.85, N,11.12%; IR: 862 (C-NO), 1505 (N=O), 1592 (C=C), 3008 (C=CH); 1H NMR: 3.41 (m, 2H, CH_2-N), 3.93 (t, 2H, J = 7.60 Hz, N-CH_2), 5.12 (s, 1H, N-CH), 6.68 (s, 1H, C=CH), 8.45 (s, 1H, NH), 6.88-8.25 (m, 16H, Ar-H); 13C NMR: 46.8 (CH_2-NH), 55.6 (N-CH_2), 67.5 (N-CH), 140.3 (C=CH), 145.5 (C=CH), 112.8, 114.2, 115.7, 117.2, 118.7, 119.2, 120.2, 123.4, 123.4, 126.3, 128.9, 130.4, 133.6, 136.5, 139.3, 144.8, 147.7, 151.4 (Ar); Mass (FAB): 598M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(2-nitrophenyl)-4-oxo-5-[(2-nitrophenyl) methylidene]-1-iminothiazolidine (5j)*

Yield: 78%, m.p. 151-153ºC; Anal. Calcd for $C_{30}H_{23}N_5S_2O_5$: C,60.28, H,3.87, N,11.17%; found C,60.21, H,3.85,

N,11.14%; IR: 878 (C-NO), 1502 (N=O), 1586 (C=C), 2989 (C=CH); 1H NMR: 3.37 (m, 2H, CH_2-N), 3.85 (t, 2H, J = 7.60 Hz, N-CH_2), 5.17 (s, 1H, N-CH), 6.72 (s, 1H, C=CH), 8.42 (s, 1H, NH), 6.91-8.26 (m, 16H, Ar-H); 13C NMR: 46.5 (CH_2-NH), 58.5 (N-CH_2), 66.7 (N-CH), 140.6 (C=CH), 145.8 (C=CH), 113.7, 116.4, 119.2, 121.5, 123.6, 124.6, 125.7, 127.4, 128.4, 130.2, 132.2, 133.4, 134.7, 136.8, 141.5, 144.2, 146.5, 151.5 (Ar); Mass (FAB): 598M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-methoxyphenyl)-4-oxo-5-[(4-methoxyphenyl)methylidene]-1-iminothiazolidine (5k)*

Yield: 74%, m.p. 147-148ºC; Anal. Calcd for $C_{32}H_{29}N_3S_2O_3$: C,67.69, H,5.14, N,7.40%; found C,67.65, H,5.11, N,7.38%; IR: 1095 (C-O), 1595 (C=C), 2968 (OCH_3), 2998 (C=CH); 1H NMR: 3.31 (m, 2H, CH_2-N), 3.70 (s, 6H, 2×OCH_3), 3.84 (t, 2H, J = 7.60 Hz, N-CH_2), 5.12 (s, 1H, N-CH), 6.69 (s, 1H, C=CH), 8.40 (s, 1H, NH), 6.65-8.02 (m, 16H, Ar-H); 13C NMR: 44.2 (CH_2-NH), 54.1 (N-CH_2), 65.0 (N-CH), 57.4 (2×OCH_3), 137.5 (C=CH), 146.8 (C=CH), 112.7, 114.7, 117.3, 119.2, 121.3, 123.7, 124.5, 126.2, 127.8, 132.9, 136.1, 137.3, 144.4, 148.8 (Ar); Mass (FAB): 568M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-methylphenyl)-4-oxo-5-[(4-methylphenyl) methylidene]-1-iminothiazolidine (5l)*

Yield: 76%, m.p. 142-143ºC; Anal. Calcd for $C_{32}H_{29}N_3S_2O$: C,71.74, H,5.45, N,7.84%; found C,71.71, H,5.40, N,7.83%; IR: 1578 (C=C), 2888 (CH_3), 2984 (C=CH); 1H NMR: 2.34 (s, 6H, 2×CH_3), 3.29 (m, 2H, CH_2-N), 3.80 (t, 2H, J = 7.60 Hz, N-CH_2), 5.10 (s, 1H, N-CH), 6.49 (s, 1H, C=CH), 7.37 (s, 1H, NH), 6.72-7.94 (m, 16H, Ar-H); 13C NMR: 25.5 (2×CH_3), 45.6 (CH_2-NH), 54.3 (N-CH_2), 63.5 (N-CH), 136.8 (C=CH), 143.5 (C=CH), 114.5, 117.3, 118.7, 119.1, 121.5, 123.4, 125.8, 128.5, 131.4, 133.2, 138.8, 141.5, 146.7, 148.3 (Ar); Mass (FAB): 536M^+.

- *N-[2-(10H-phenothiazinyl)ethyl]-2-(4-hydroxyphenyl)-4-oxo-5-[(4-hydroxyphenyl)methylidene]-1-iminothiazolidine (5m)*

Yield: 78%, m.p. 157-158ºC; Anal. Calcd for $C_{30}H_{25}N_3S_2O_3$: C,66.76, H,4.66, N,7.78%; found C,66.72, H,4.64, N,7.75%; IR: 1610 (C=C), 2988 (C=CH), 3489 (OH); 1H NMR: 3.27 (m, 2H, CH_2-N), 3.75 (t, 2H, J = 7.60 Hz, N-CH_2), 4.22 (s, 2H, 2×OH), 5.16 (s, 1H, N-CH), 6.58 (s, 1H, C=CH), 8.44 (s, 1H, NH), 6.69-8.06 (m, 16H, Ar-H); 13C NMR: 43.7 (CH_2-NH), 55.7 (N-CH_2), 64.1 (N-CH), 140.2 (C=CH), 149.9 (C=CH), 113.4, 115.4, 116.3, 118.2, 119.4, 121.2, 123.2, 127.5, 128.5, 132.8, 136.3, 143.2, 148.7, 153.6 (Ar); Mass (FAB): 540M^+.

IV CONCLUSION

In conclusion, we have developed a simple, efficient and solvent free method for the synthesis of compounds 1, 2, 3(a-m), 4(a-m) and 5(a-m) having phenothiazine nucleus. We also believe that the procedural simplicity, the efficiency and the easy accessibility of the reaction partners gives access to a wide array of heterocyclic frameworks equipped with a pendant phenothiazine unit. The application of microwave irradiation is used for carrying out chemical transformations of all above compounds, which are safe with higher chemical yields, pollution free and eco-friendly for syntheses.

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