Synthesis of New 2-Phenylpyrano[3,2-*b*]phenothiazin-4(6*H*)-one Derivatives

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A new synthesis of 2-phenylpyrano[3,2-*b*]phenothiazin-4(6*H*)-one derivatives was reported. First 2,10-diacetyl-3-hydroxyphenothiazine (**2**) was converted into their benzoyloxy esters (**3a**—**3j**) using different aromatic carboxylic acids in the presence of phosphorous oxychloride in pyridine. Benzoyloxy esters were converted into their 1,3-diones (**4a**—**4j**) by using dry KOH in pyridine via Baker-Venkataraman transformation reaction. The 1,3-diones thus obtained were cyclised to pyranophenothiazines (**5a**—**5j**) by refluxing in an acetic acid/HCl mixture.

Keywords acetyl phenothiazine, Baker-Venkataraman transformation, 1,3-diones, pyranones, pyranophenothiazine

Introduction

The phenothiazines, exemplified by chlorpromazine, are the largest and most widely investigated class of neuroleptic agents.[1,2] Phenothiazines form an important class of heterocyclic compounds possessing wide spectrum diverse biological activities like antimicrobial,[3,4] antimalarial,[5] anti-inflammatory,[6] antitubercular,[7,8] antipsychotic,[9] *etc*. The phenothiazines contain an interesting heterocyclic ring skeleton with two carbocyclic/aromatic rings connected to each other via a sulfide and an imino bridge which facilitates several types of reactions, substitution at the nitrogen, electrophilic substitution on the aromatic rings, *N*-oxidation and photochemical reactions,[10,11] *etc*. Due to the increased importance of these heterocyclic compounds, attempts were made during the past few years in the synthesis of new generation of 10*H*-phenothiazines that exert their biological activity through modulation.[12-14]

Chromones constitute one of the major classes of naturally occurring compounds, and interest in their chemistry continues unabated because of their usefulness as biologically active agents.[15,16] Chromones found in the nature are 2-phenyl chromones, called flavones. A considerable number of 3-phenyl chromones are also known, called isoflavones. Some of the biological activities attributed to chromone derivatives include cytotoxic,[17,18] neuroprotective,[19] HIV-inhibitory,[20] antimicrobial,[21,22] antifungal[23] and antioxidant activity.[24] Due to their abundance in plants and their low mammalian toxicity, chromone derivatives are present in large amounts in the diet of humans.[25] Flavones possess vitamin P activity[26] and therefore are used in the treatment of conditions arising from capillary bleeding due to increased capillary fragility.

The synthesis of chromone derivatives is a research field of great interest and long history.[27] In general, chromones are synthesized by the cyclodehydration of 1-(*o*-hydroxyaryl)-1,3-diketones or equivalent intermediates catalyzed by strong acids or strong bases (Vilsmeier-Haack reaction).[28-30] They have been prepared on a large scale by the Allan-Robinson synthesis involving acylation-rearrangement, and subsequent cyclization.[31] This methodology has been followed in the synthesis of chromone derivatives with quaternary ammonium functionalities which show not only activity of cosmetic interest but also for hair sustainability, as well as in the asymmetric synthesis of optically active 4-chromone derivatives.[32,33] In the Baker-Venkataraman synthesis,[34-36] internal Claisen condensation of 2-aryloxy-1-acetylarenes is employed as the key step. More recently, the synthesis of chromone derivatives was accomplished by intramolecular ester carbonyl olefination[37] or Pd-catalyzed regiospecific carbonylative annulation of *o*-iodophenol acetates and acetylenes.[38,39]

The various physiological and biological activities of 2-phenyl chromones and phenothiazines prompted the synthesis of new pyranophenothiazines. Keeping these factors in view it was thought worthwhile to prepare chromones with different substituents in phenyl nucleus and benzenoid nucleus. Also as the part of our research in the synthesis of biological active heterocyclic compound[3,4,40,41] and their cyclization via ring closure reaction, the present work was aimed to synthesize some new chromones with phenothiazine moiety.

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Experimental

All chemicals were purchased from Aldrich and Merck Ltd, Mumbai (India), and were used without further purification. The melting points were determined in open capillaries using a Toshniwal melting point apparatus and are uncorrected. The IR spectra were recorded in the solid state as a KBr suspension on an Perkin-Elmer Spectrum One FT-IR spectrophotometer and ^{1}H NMR and ^{13}C NMR spectra were obtained in $CDCl_3$ on a Brucker 300 MHz instrument using TMS as an internal standard. Mass spectra were recorded on a LCQ Adavantage Thermo Finnigen spectrometer. Elemental analysis was performed on Carlo Erba 1108 analyzer

Synthesis of 2,10-diacetyl-3-hydroxyphenothiazine (2)

To the solution of 10-acetyl 3-methoxy phenothiazine **1** (0.01 mol) in carbon disulphide (50 mL), acetyl chloride (0.02 mol) and anhydrous aluminium chloride (0.025 mol) were added at 0—10 ℃. The reaction mixture was refluxed under stirring for 5 h. Then resulting mixture was distilled off and poured on ice cold dil HCl. The solid thus obtained was filtered and washed with cold alcohol. The yellow solid was crystallized from alcohol to afford **2**. Yield 80%, m.p.170—172 ℃; ^{1}H NMR ($CDCl_3$) δ: 7.58—7.02 (m, 6H, Ar-H), 5.06 (s, 1H, OH), 2.52 (s, 3H, $COCH_3$), 2.10 (s, 3H, $COCH_3$); IR (KBr) v: 1646, 1683 (C=O), 2862, 2936 (CH_2), 3067 (Ar-H); MS m/z (%): 299 [M^+] (45), 256 (100), 213 (20). Anal. calcd for $C_{16}H_{13}NO_3S$: C 64.20, H 4.38, N 4.68; found C 64.13, H 4.46, N 4.59.

General procedure for synthesis of esters 3a—3j

2,10-Diacetyl-3-hydroxyphenothiazine (**2**) (0.005 mol) and benzoic acid (0.005 mol) were dissolved in pyridine (5 mL) and cooled in ice bath. To this cold solution phosphorous oxychloride (0.01 mol) was added slowly with constant stirring. Then the reaction mixture was stirred at room temperature for 3—4 h. The reaction mixture was poured on crushed ice with HCl and crude precipitate was filtered to afford **3a**. Similarly, compounds **3b**—**3j** were synthesized by using different substituted benzoic acid.

2,10-Diacetyl-3-benzoyloxyphenothiazine (3a) Yield 89%, m.p. 134—136 ℃; ^{1}H NMR ($CDCl_3$) δ: 8.18—6.78 (m, 11H, Ar-H), 2.53 (s, 3H, $COCH_3$), 2.11 (s, 3H, $COCH_3$); IR (KBr) v: 1676, 1724, 1735 (C=O), 2866, 2933 (CH_2), 3068 (Ar-H); MS m/z (%): 403 [M^+] (75), 360 (100), 255 (80). Anal. calcd for $C_{23}H_{17}NO_4S$: C 68.47, H 4.25, N 3.47; found C 68.33, H 4.12, N 3.59.

2,10-Diacetyl-3-(2-chlorobenzoyloxy)phenothiazine (3b) Yield 91%, m.p. 164—165 ℃; ^{1}H NMR ($CDCl_3$) δ: 8.10—6.89 (m, 10H, Ar-H), 2.52 (s, 3H, $COCH_3$), 2.10 (s, 3H, $COCH_3$); IR (KBr) v: 1674, 1725, 1734 (C=O), 2867, 2932 (CH_2), 3064 (Ar-H); MS m/z (%): 437 [M^+] (80), 394 (100), 255 (74). Anal. calcd for $C_{23}H_{16}ClNO_4S$: C 63.08, H 3.68, N 3.20; found C 63.23, H, 3.52, N 3.09.

2,10-Diacetyl-3-(3-chlorobenzoyloxy)phenothiazine (3c) Yield 88%, m.p. 147—149 ℃; ^{1}H NMR ($CDCl_3$) δ: 8.14—6.91 (m, 10H, Ar-H), 2.52 (s, 3H, $COCH_3$), 2.11 (s, 3H, $COCH_3$); IR (KBr) v: 1673, 1724, 1735 (C=O), 2868, 2933 (CH_2), 3063 (Ar-H); MS m/z (%): 437 [M^+] (84), 394 (100), 255 (72). Anal. calcd for $C_{23}H_{16}ClNO_4S$: C 63.08, H 3.68, N 3.20; found C 63.21, H 3.55, N 3.03.

2,10-Diacetyl-3-(4-chlorobenzoyloxy)phenothiazine (3d) Yield 89%, m.p. 170—172 ℃; ^{1}H NMR ($CDCl_3$) δ: 8.04—6.79 (m, 10H, Ar-H), 2.51 (s, 3H, $COCH_3$), 2.10 (s, 3H, $COCH_3$); IR (KBr) v: 1675, 1725, 1736 (C=O), 2870, 2934 (CH_2), 3065 (Ar-H); MS m/z (%): 437 [M^+] (86), 394 (100), 255 (74). Anal. calcd for $C_{23}H_{16}ClNO_4S$: C 63.08, H 3.68, N 3.20; found C 63.20, H 3.56, N, 3.09.

2,10-Diacetyl-3-(2-methylbenzoyloxy)phenothiazine (3e) Yield 89%, m.p. 140—142 ℃; ^{1}H NMR ($CDCl_3$) δ: 8.03—6.78 (m, 10H, Ar-H), 2.50 (s, 3H, $COCH_3$), 2.34 (s, 3H, CH_3), 2.10 (s, 3H, $COCH_3$); IR (KBr) v: 1673, 1724, 1735 (C=O), 2869, 2933 (CH_2), 3064 (Ar-H); MS m/z (%): 417 [M^+] (80), 374 (100), 255 (70). Anal. calcd for $C_{24}H_{19}NO_4S$: C 69.05, H 4.59, N 3.36; found C 69.18, H 4.66, N 3.29.

2,10-Diacetyl-3-(4-methoxybenzoyloxy)phenothiazine (3j) Yield 87%, m.p. 194—196 ℃; ^{1}H NMR ($CDCl_3$) δ: 8.04—6.79 (m, 10H, Ar-H), 3.74 (s, 3H, OCH_3), 2.51 (s, 3H, $COCH_3$), 2.08 (s, 3H, $COCH_3$); IR (KBr) v: 1676, 1729, 1739 (C=O), 2867, 2931 (CH_2), 3062 (Ar-H); MS m/z (%): 433 [M^+] (82), 390 (100), 255 (74). Anal. calcd for $C_{24}H_{19}NO_5S$: C 66.50, H 4.42, N 3.23; found C 66.58, H 4.56, N 3.29.

General procedure for synthesis of 1,3-diketones 4a—4j

A mixture of 2,10-diacetyl-3-benzoyloxyphenothiazine (**3a**) (0.001 mol), dry pyridine (5 mL) and powdered KOH (0.002 mol) was stirred for 1 h. After stirring reaction mixture was poured on ice cold water and HCl, the solid thus obtained was filtered and washed with water and recrystallized from aqueous alcohol to give **4a**. Similarly, compounds **4b**—**4j** were synthesized by using various esters **3b**—**3j**.

1-(10-Acetyl-10*H*-3-hydroxyphenothiazin-2-yl)-3-phenylpropane-1,3-dione (4a) Yield 90%, m.p. 216—218 ℃; ^{1}H NMR ($CDCl_3$) δ: 7.78—6.68 (m, 11H, Ar-H), 5.13 (s, 1H, OH), 3.81 (s, 2H, CH_2), 2.10 (s, 3H, $COCH_3$); ^{13}C NMR ($CDCl_3$) δ: 22.0 (CH_3), 52.3 (CH_2), 117.0, 118.3, 118.8, 122.9, 128.9, 129.3, 132.5, 133.1, 134.0, 135.1, 135.8, 136.6, 136.9 (Ar-C), 170.1, 197.6 (C=O); IR (KBr) v: 1616, 1690 (C=O), 2868, 2923 (CH_2), 3065 (Ar-H); MS m/z (%): 403 [M^+] (85), 360 (100), 359 (70). Anal. calcd for $C_{23}H_{17}NO_4S$: C 68.47, H 4.25, N 3.47; found C 68.34, H 4.13, N 3.58.

1-(10-Acetyl-10*H*-3-hydroxyphenothiazin-2-yl)-3-(2-chlorophenyl)propane-1,3-dione (4b) Yield 84%, m.p. 170—172 ℃; ^{1}H NMR ($CDCl_3$) δ: 7.80—6.89 (m, 10H, Ar-H), 5.12 (s, 1H, OH), 3.80 (s, 2H, CH_2), 2.08 (s,

3H, $COCH_3$); ^{13}C NMR ($CDCl_3$) δ: 22.1 (CH_3), 51.7 (CH_2), 117.8, 118.6, 118.9, 122.8, 128.6, 128.9, 132.2, 133.1, 133.7, 135.3, 136.1, 136.9, 137.5 (Ar-C) , 170.3, 197.9 (C=O); IR (KBr) *v*: 1614, 1692 (C=O), 2869, 2930 (CH_2), 3060 (Ar-H); MS *m*/*z* (%): 437 [M^+] (80), 394 (100), 393 (72). Anal. calcd for $C_{23}H_{16}ClNO_4S$: C 63.08, H 3.68, N 3.20; found C 63.26, H 3.56, N 3.29.

1-(10-Acetyl-10*H*-3-hydroxyphenothiazin-2-yl)-3-(3-chlorophenyl)propane-1,3-dione (4c) Yield 78%, m.p. 260—262 ℃; ^1H NMR ($CDCl_3$) δ: 7.84—6.91 (m, 10H, Ar-H), 5.15 (s, 1H, OH), 3.79 (s, 2H, CH_2), 2.10 (s, 3H, $COCH_3$); ^{13}C NMR ($CDCl_3$) δ: 22.5 (CH_3), 52.0 (CH_2), 116.8, 118.1, 118.3, 122.5, 128.1, 129.0, 132.2, 132.3, 133.1, 133.4, 135.4, 136.0, 136.9 (Ar-C), 170.6, 198.0 (C=O); IR (KBr) *v*: 1613, 1694 (C=O), 2868, 2933 (CH_2), 3063 (Ar-H); MS *m*/*z* (%): 437 [M^+] (84), 394 (100), 393 (72). Anal. calcd for $C_{23}H_{16}ClNO_4S$: C 63.08, H 3.68, N 3.20; found C 63.21, H 3.54, N 3.30.

1-(10-Acetyl-10*H*-3-hydroxyphenothiazin-2-yl)-3-(4-chlorophenyl)propane-1,3-dione (4d) Yield 75%, m.p. 250—252 ℃; ^1H NMR ($CDCl_3$) δ: 7.88—6.75 (m, 10H, Ar-H), 5.12 (s, 1H, OH), 3.80 (s, 2H, CH_2), 2.10 (s, 3H, $COCH_3$); ^{13}C NMR ($CDCl_3$) δ: 22.0 (CH_3), 52.4 (CH_2), 116.9, 118.3, 118.7, 122.6, 128.3, 129.3, 132.4, 133.8, 135.4, 136.0, 136.9 (Ar-C) , 170.3, 197.6 (C=O); IR (KBr) *v*: 1617, 1699 (C=O), 2871, 2932 (CH_2), 3065 (Ar-H); MS *m*/*z* (%): 437 [M^+] (88), 394 (100), 393 (70). Anal. calcd for $C_{23}H_{16}ClNO_4S$: C 63.08, H 3.68, N 3.20; found C 63.20, H 3.56, N 3.29.

1-(10-Acetyl-10*H*-3-hydroxyphenothiazin-2-yl)-3-(2-methylphenyl)propane-1,3-dione (4e) Yield 79%, m.p. 161—163 ℃; ^1H NMR ($CDCl_3$) δ: 7.75—6.68 (m, 10H, Ar-H), 5.11 (s, 1H, OH), 3.81 (s, 2H, CH_2), 2.42 (s, 3H, $COCH_3$), 2.08 (s, 3H, CH_3); ^{13}C NMR ($CDCl_3$) δ: 18.3, 22.9 (CH_3), 53.1 (CH_2), 118.0, 118.7, 119.0, 122.9, 128.5, 129.6, 132.6, 133.9, 136.0, 136.8, 138.0 (Ar-C) , 170.1, 197.0 (C=O); IR (KBr) *v*: 1616, 1693 (C=O), 2866, 2930 (CH_2), 3063 (Ar-H); MS *m*/*z* (%): 417 [M^+] (80), 374 (100), 373 (73). Anal. calcd for $C_{24}H_{19}NO_4S$: C 69.05, H 4.59, N 3.36; found C 69.16, H 4.47, N 3.18.

1-(10-Acetyl-10*H*-3-hydroxyphenothiazin-2-yl)-3-(4-methoxyphenyl)propane-1,3-dione (4j) Yield 87%, m.p. 204—206 ℃; ^1H NMR ($CDCl_3$) δ: 7.72—6.79 (m, 10H, Ar-H), 5.18 (s, 1H, OH), 3.81 (s, 2H, CH_2), 3.73 (s, 3H, $COCH_3$), 2.08 (s, 3H); ^{13}C NMR ($CDCl_3$) δ: 22.1 (CH_3), 52.8 (CH_2), 60.2 (OCH_3), 118.0, 118.7, 119.0, 122.9, 128.5, 129.6, 132.6, 133.9, 136.0, 136.8, 138.0 (Ar-C), 170.3, 197.6 (C=O); IR (KBr) *v*: 1616, 1692 (C=O), 2867, 2931 (CH_2), 3062 (Ar-H); MS *m*/*z* (%): 433 [M^+] (82), 390 (100), 389 (76). Anal. calcd for $C_{24}H_{19}NO_5S$: C 66.50, H 4.42, N 3.23; found C 66.34, H 4.34, N 3.16.

General procedure for synthesis of pyranophenothiazines 5a—5j

1-(10-Acetyl-3-hydroxy-10*H*-phenothiazin-2-yl)-3-phenylpropane-1,3-dione (**4a**) (0.05 mmol) was refluxed in acetic acid-HCl mixture (5 mL) for 30 min. Then the reaction mixture was kept at room temperature for 1 h. After cooling the reaction mixture, the solid obtained was filtered, washed with water and recrystallized from aqueous acetic acid to give **5a**. Similarly, compounds **5b**—**5j** were synthesized by using various 1,3-diones **4b**—**4j**.

2-Phenylpyrano[3,2-*b*]phenothiazin-4(6*H*)-one (5a) Yield 85%, m.p. 296—298 ℃; ^1H NMR ($CDCl_3$) δ: 8.23 (s, 1H, NH), 7.38—6.68 (m, 12H, Ar-H); ^{13}C NMR ($CDCl_3$) δ: 108.0, 166.2 (pyrano ring-C), 118.7, 119.3, 120.6, 124.1, 126.4, 128.6, 130.6, 134.1, 136.0, 143.9 (Ar-C), 184.3 (C=O); IR (KBr) *v*: 1360 (C—O—C), 1602 (C=C), 1635 (C=O), 3065 (Ar-H), 3334 (N—H); MS *m*/*z* (%): 343 [M^+] (100), 342 (80). Anal. calcd for $C_{21}H_{13}NO_2S$: C 73.45, H 3.82, N 4.08; found C 73.58, H 3.75, N 4.16.

2-(2-Chlorophenyl)pyrano[3,2-*b*]phenothiazin-4(6*H*)-one (5b) Yield 86%, m.p. 286—287 ℃; ^1H NMR ($CDCl_3$) δ: 8.21 (s, 1H, NH), 7.38—6.58 (m, 11H, Ar-H); ^{13}C NMR ($CDCl_3$) δ: 106.8, 165.4 (pyrano ring-C), 118.9, 119.8, 123.8, 125.1, 129.6, 132.6, 134.5, 138.6, 145.8 (Ar-C), 184.0 (C=O); IR (KBr) *v*: 1355 (C—O—C), 1600 (C=C), 1633 (C=O), 3062 (Ar-H), 3337 (N—H); MS *m*/*z* (%): 377 [M^+] (100), 375 (80). Anal. calcd for $C_{21}H_{12}ClNO_2S$: C 66.75, H 3.20, N 3.71; found C 66.68, H 3.05, N 3.86.

2-(3-Chlorophenyl)pyrano[3,2-*b*]phenothiazin-4(6*H*)-one (5c) Yield 83%, m.p. 296—297 ℃; ^1H NMR ($CDCl_3$) δ: 8.22 (s, 1H, NH), 7.39—6.56 (m, 11H, Ar-H); ^{13}C NMR ($CDCl_3$) δ: 105.9, 165.8 (pyrano ring-C), 118.9, 120.1, 122.8, 125.4, 129.0, 131.3, 136.4, 138.0, 145.5, 148.0 (Ar-C), 184.6 (C=O); IR (KBr) *v*: 1358 (C—O—C), 1605 (C=C), 1636 (C=O), 3064 (Ar-H), 3338 (N—H); MS *m*/*z* (%): 377 [M^+] (100), 375 (84). Anal. calcd for $C_{21}H_{12}ClNO_2S$: C 66.75, H 3.20, N 3.71; found C 66.64, H 3.03, N 3.83.

2-(4-Chlorophenyl)pyrano[3,2-*b*]phenothiazin-4(6*H*)-one (5d) Yield 88%, m.p. 314—316 ℃; ^1H NMR ($CDCl_3$) δ: 8.19 (s, 1H, NH), 7.31—6.59 (m, 11H, Ar-H); ^{13}C NMR ($CDCl_3$) δ: 106.0, 165.9 (pyrano ring-C), 119.2, 120.6, 122.9, 125.6, 129.2, 132.3, 133.0, 137.3, 145.5, 148.0 (Ar-C), 184.9 (C=O); IR (KBr) *v*: 1356 (C—O—C), 1603 (C=C), 1637 (C=O), 3062 (Ar-H), 3339 (N—H); MS *m*/*z* (%): 377 [M^+] (100), 375 (86). Anal. calcd for $C_{21}H_{12}ClNO_2S$: C 66.75, H 3.20, N 3.71; found C 66.62, H 3.11, N 3.86.

2-(2-Methylphenyl)pyrano[3,2-*b*]phenothiazin-4(6*H*)-one (5e) Yield 85%, m.p. 236—238 ℃; ^1H NMR ($CDCl_3$) δ: 8.18 (s, 1H, NH), 7.21—6.56 (m, 11H, Ar-H), 2.38 (s, 3H); ^{13}C NMR ($CDCl_3$) δ: 19.6 (CH_3), 105.6, 165.4 (pyrano ring-C); 119.0, 120.2, 122.5, 125.8, 128.6, 130.2, 133.0, 137.8, 145.0, 147.8 (Ar-C), 184.5 (C=O); IR (KBr) *v*: 1355 (C—O—C), 1604 (C=C), 1634 (C=O), 2980 (C—H), 3063 (Ar-H), 3337 (N—H); MS *m*/*z* (%): 357 [M^+] (100), 356 (82). Anal. calcd for $C_{22}H_{15}NO_2S$: C 73.93, H 4.23, N 3.92; found C 73.82, H 4.31, N 3.78.

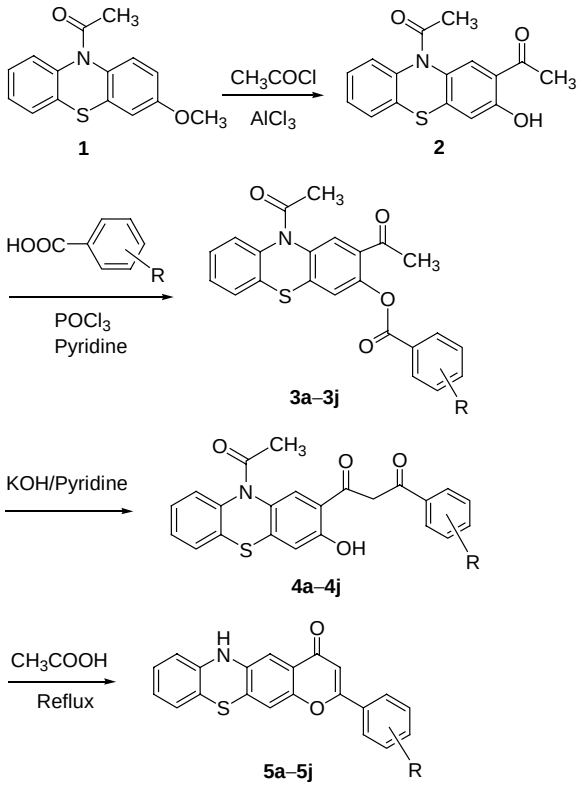
2-(4-Methoxyphenyl)pyrano[3,2-*b*]phenothiazin-4(6*H*)-one (5j) Yield 88%, m.p. 317—318 ℃; ^1H

NMR ($CDCl_3$) δ: 8.18 (s, 1H, NH), 7.18—6.59 (m, 11H, Ar-H), 3.72 (s, 3H, OCH_3); ^{13}C NMR ($CDCl_3$) δ: 59.6 (OCH_3), 105.6, 166.3 (pyrano ring-C), 119.0, 120.2, 124.5, 125.0, 126.9, 131.4, 135.0, 139.8, 146.0, 148.2, 157.8 (Ar-C), 184.9 (C=O); IR (KBr) v: 1359 (C—O—C), 1606 (C=C), 1638 (C=O), 3060 (Ar-H), 3338 (N—H); MS m/z (%): 373 [M^+] (100), 372 (78). Anal. calcd for $C_{22}H_{15}NO_3S$: C 70.76, H 4.05, N 3.75; found C 70.59, H 3.89, N 3.88.

Results and discussion

Compound **2** was obtained by Friedel Crafts acylation and simultaneous demethylation of 10-acetyl 3-methoxy phenothiazine **1**. The further esterification of 2,10-diacetyl-3-hydroxy phenothiazine **2** with various substituted benzoic acid in the presence of phosphorous oxychloride in pyridine at room temperature gave **3a**—**3j**. Compounds **3a**—**3j** were converted into 1,3-diones **4a**—**4j** by Baker-Venkataraman method, *i.e.* 2,10-diacetyl-3-aryoyloxy phenothiazines **3a**—**3j** were treated with powdered KOH in dry pyridine for 1 h. The 1,3-diones thus obtained were cyclised to pyronophenothiazines (**5a**—**5j**) by refluxing in an acetic acid/HCl mixture (Scheme 1).

Scheme 1 Synthesis of 2-phenylpyrano[3,2-*b*]phenothiazin-4(6*H*)-one derivatives



R=**a**: H, **b**: 2-Cl, **c**: 3-Cl, **d**: 4-Cl, **e**: 2-CH_3, **f**: 3-CH_3, **g**: 4-CH_3, **h**: 2-OCH_3, **i**: 3-OCH_3, **j**: 4-OCH_3.

The synthesized compounds were confirmed on the basis of elemental analysis, IR, NMR and mass spectrum. The IR spectra of compound **5a** showed characteristic absorptions at 1360 cm^{-1} due to C—O—C stretch, 1602 cm^{-1} due to C=C stretch, 3065 cm^{-1} due to Ar-H and 3334 cm^{-1} due to N—H stretch. The ^1H NMR spectrum of **5a** showed a singlet at δ 8.23 due to N-H proton. It showed multiplets at δ 7.38—6.68 due to aromatic protons. The ^{13}C NMR spectrum of **5a** showed two peaks at δ 108.0, 166.2 for pyrano ring carbons, ten peaks at δ 118.7, 119.3, 120.6, 124.1, 126.4, 128.6, 130.6, 134.1, 136.0, 143.9 for aromatic carbons and one peak at δ 184.3 for carbonyl carbon. Further evidence for the formation of compound **5a** was obtained by recording the mass spectra. The mass spectrum of compound **5a** showed a molecular ion peak at m/z 343 which is in conformity with the molecular formula $C_{21}H_{13}NO_2S$.

Conclusions

In conclusion, we have developed a simple and efficient method for the synthesis of pyranophenothiazine derivatives. We also believe that the procedural simplicity and efficiency give easy accessibility to the reaction.

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