

## Preliminary Communication

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A novel synthetic approach to 11-substituted dibenzo[*b,f*][1,4]oxazepines

**Abstract:** A novel protocol for the synthesis of 11-substituted dibenzo[*b,f*][1,4]oxazepines is reported. Seven compounds were designed as analogs of the antipsychotic drug loxapine and antidepressant amoxapine. The key transformations include generation of a carbamate intermediate using phenyl chloroformate which avoids the use of harmful phosgene, a microwave-induced transformation of the carbamate intermediate into various urea derivatives, and a subsequent phosphorous oxychloride-induced cyclocondensation. The simple reactions and wide substrate scope enhance the practical application of this methodology.

**Keywords:** amoxapine; dibenzo[*b,f*][1,4]oxazepine; loxapine.

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Dibenzo[*b,f*][1,4]oxazepine derivatives possess diverse pharmacological activity [1–6]. Loxapine **1** and amoxapine **2** (Figure 1) are agents used for their antipsychotic and antidepressant action, respectively [7]. Both **1** and **2** bear the 11-substituted dibenzo[*b,f*][1,4]oxazepine scaffold.

We report a new method for synthesis of seven fused 11-substituted dibenzo[*b,f*][1,4]oxazepines, namely compounds **19–25** (Scheme 1). The compounds were designed as analogs of **1** and **2**.

2-(4-Chlorophenoxy)aniline (**3**) was synthesized according to a reported method [8]. Previously reported synthetic approaches [9, 10] to 11-substituted dibenzo[*b,f*][1,4]oxazepines using **3** involve treating **3** with toxic phosgene or triphosgene to afford intermediate 1-(phenoxy)-2-isocyanatobenzene. We decided to avoid the use of

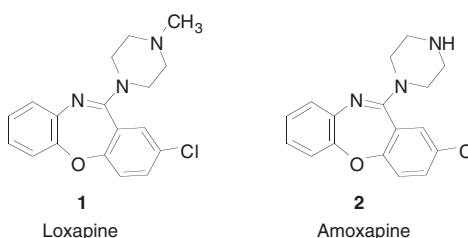


Figure 1 Structures of loxapine and amoxapine.

phosgene or triphosgene by treating **3** with phenyl chloroformate under mild conditions, which afforded carbamate **4** in 98% yield. Compound **4** was heated with amines **5–11** in a microwave reactor to yield the respective urea derivatives **12–18**. The yields of these transformations ranged from 79% to 96%. A phosphorous oxychloride-induced cyclocondensation of **12–18** furnished the target dibenzo[*b,f*][1,4]oxazepines **19–25**, respectively, in yields ranging from 4% to 38%.

In conclusion, we have developed a novel methodology for synthesis of 11-substituted dibenzo[*b,f*][1,4]oxazepines. The simplicity of the experiments, wide substrate scope, and avoidance of toxic phosgene, makes this methodology a useful addition in the collection of 11-substituted dibenzo[*b,f*][1,4]oxazepine syntheses.

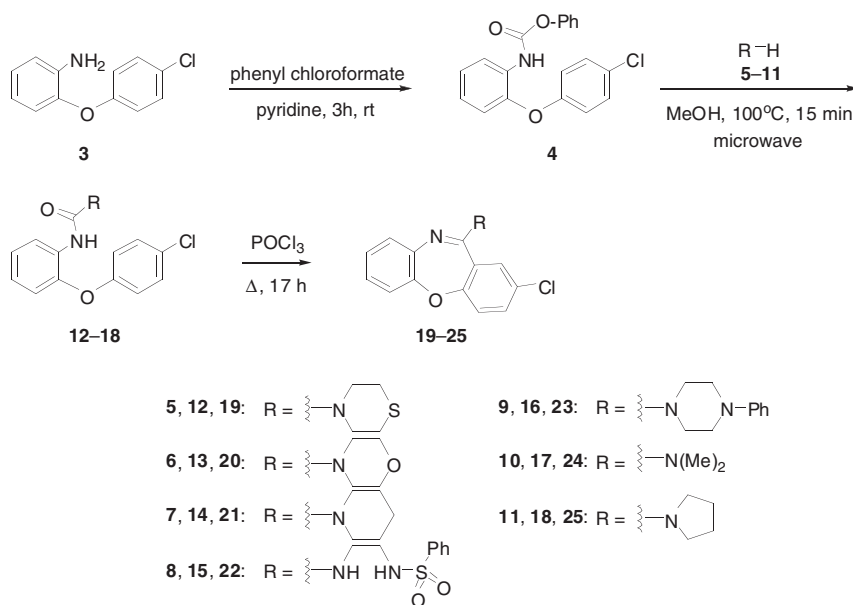
## Experimental

**Phenyl [2-(4-chlorophenoxy)phenyl]carbamate (4)** A solution of 2-(4-chlorophenoxy)aniline (2.00 g, 9.10 mmol) and pyridine (0.83 mL, 10.0 mmol) in ethyl acetate (170 mL) at 0°C was treated dropwise with phenyl chloroformate (1.22 mL, 10.0 mmol).

The resultant mixture was stirred for 3 h at room temperature. The solvent was removed under reduced pressure, and the residue was purified by silica gel flash chromatography eluting with 2% to 5% ethyl acetate-hexanes to afford phenyl [2-(4-chlorophenoxy)phenyl]carbamate **4** (3.02 g, 98%): <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.26 (1H, bs), 7.56 (1H, bs), 7.41 (2H, t, *J* = 7.8 Hz), 7.35 (2H, d, *J* = 9.0 Hz), 7.31–7.30 (1H, m), 7.26 (1H, t, *J* = 7.2 Hz), 7.21 (2H, d, *J* = 7.8 Hz), 7.17 (1H, t, *J* = 7.8 Hz), 7.04 (1H, t, *J* = 7.2 Hz), 7.01 (2H, d, *J* = 8.4 Hz), 6.89 (1H, d, *J* = 8.4 Hz); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 155.2, 151.7, 150.7, 145.3, 130.2, 129.6, 129.2, 126.5, 126.0, 124.8, 123.9, 121.8, 121.1, 120.1, 118.0. ESI-HRMS. Calcd for C<sub>19</sub>H<sub>15</sub>ClNO<sub>3</sub>, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 340.0735. Found: *m/z* 340.0733.

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Scheme 1 Synthesis of 19–25.

## General procedure for synthesis of carboxamides 12–18

A solution of phenyl [2-(4-chlorophenoxy)phenyl]carbamate **4** (0.45 g, 1.3 mmol) in methanol (4.5 mL) was treated with amine (2.0 mmol). The mixture was heated at 100°C for 15 min in a Biotage Initiator<sup>®</sup> microwave reactor. The solvent was removed under reduced pressure, and the residue was purified by flash chromatography on silica gel eluting with 5% to 50% ethyl acetate-hexanes to afford the title compound as an oil.

**N-[2-(4-Chlorophenoxy)phenyl]thiomorpholine-4-carboxamide (12)** Yield 82%; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.17 (1H, d, *J* = 8.4 Hz), 7.30 (2H, d, *J* = 9.0 Hz), 7.15 (1H, t, *J* = 7.2 Hz), 6.97 (1H, t, *J* = 9.0 Hz), 6.93 (2H, d, *J* = 9.0 Hz), 6.86–6.85 (2H, m), 3.72 (4H, t, *J* = 4.8 Hz), 2.58 (4H, t, *J* = 4.8 Hz); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 155.5, 154.0, 144.9, 131.1, 130.1, 128.9, 125.0, 123.1, 121.0, 119.3, 118.6, 47.2, 27.1. ESI-HRMS. Calcd for C<sub>17</sub>H<sub>18</sub>ClN<sub>2</sub>O<sub>2</sub>S, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 349.0773. Found: *m/z* 349.0768.

**N-[2-(4-Chlorophenoxy)phenyl]morpholine-4-carboxamide (13)** Yield 92%; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.19 (1H, d, *J* = 7.8 Hz), 7.28 (2H, d, *J* = 8.4 Hz), 7.12 (1H, t, *J* = 7.8 Hz), 6.96–6.91 (4H, m), 6.83 (1H, d, *J* = 7.8 Hz), 3.66 (4H, t, *J* = 4.8 Hz), 3.38 (4H, t, *J* = 4.8 Hz); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 155.4, 154.6, 145.1, 131.0, 130.1, 128.9, 124.9, 123.1, 121.0, 119.5, 118.3, 66.5, 44.2. ESI-HRMS. Calcd for C<sub>17</sub>H<sub>18</sub>ClN<sub>2</sub>O<sub>3</sub>, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 333.1001. Found: *m/z* 333.0995.

**N-[2-(4-Chlorophenoxy)phenyl]piperidine-1-carboxamide (14)** Yield 84%; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.19 (1H, d, *J* = 8.4 Hz), 7.25 (2H, d, *J* = 9.0 Hz), 7.09 (1H, t, *J* = 7.8 Hz), 6.90–6.89 (4H, m), 6.83 (1H, d, *J* = 7.8 Hz), 3.33 (4H, t, *J* = 5.4 Hz), 1.57–1.56 (2H, m), 1.50–1.49 (4H, m); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 155.7, 154.5, 144.8, 131.7, 130.0, 128.6, 125.0, 122.6, 121.0, 119.2, 118.6, 45.3, 25.7, 24.5. ESI-HRMS. Calcd for C<sub>18</sub>H<sub>20</sub>ClN<sub>2</sub>O<sub>2</sub>, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 331.1208. Found: *m/z* 331.1206.

**N-[2-[3-(2-(4-Chlorophenoxy)phenyl)ureido]ethyl]-benzenesulfonamide (15)** Yield 95%; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.05 (1H, d, *J* = 8.4 Hz), 7.73 (2H, d, *J* = 7.8 Hz), 7.49–7.46 (2H, m), 7.38 (2H, t, *J* = 7.8 Hz), 7.12 (2H, d, *J* = 8.4 Hz), 7.00 (1H, t, *J* = 7.8 Hz), 6.87 (1H, t, *J* = 7.8 Hz), 6.78 (2H, d, *J* = 9.0 Hz), 6.73 (1H, d, *J* = 7.8 Hz), 6.05–6.01 (2H, m), 3.24–3.23 (2H, m), 2.95 (2H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 156.3, 155.5, 145.4, 139.3, 132.9, 131.1, 129.8, 129.3, 128.5, 127.0, 124.6, 122.8, 120.7, 119.8, 118.3, 43.8, 39.8. ESI-HRMS. Calcd for C<sub>21</sub>H<sub>21</sub>ClN<sub>3</sub>O<sub>4</sub>S, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 446.0936. Found: *m/z* 446.0928.

**N-[2-(4-Chlorophenoxy)phenyl]-4-phenylpiperazine-1-carboxamide (16)** Yield 96%; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.26 (1H, d, *J* = 7.8 Hz), 7.31–7.27 (4H, m), 7.16 (1H, t, *J* = 7.8 Hz), 7.04 (1H, bs), 6.99–6.95 (3H, m), 6.91–6.87 (4H, m), 3.57 (4H, t, *J* = 5.4 Hz), 3.15 (4H, t, *J* = 5.4 Hz); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 155.6, 154.5, 151.0, 145.2, 131.2, 130.2, 129.4, 128.9, 125.0, 123.1, 121.2, 120.5, 119.5, 118.6, 116.6, 49.2, 44.1. ESI-HRMS. Calcd for C<sub>23</sub>H<sub>23</sub>ClN<sub>3</sub>O<sub>2</sub>, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 408.1474. Found: *m/z* 408.1466.

**3-[2-(4-Chlorophenoxy)phenyl]-1,1-dimethylurea (17)** Yield 79%; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.21 (1H, d, *J* = 7.8 Hz), 7.19 (2H, d, *J* = 8.4 Hz), 7.05 (1H, t, *J* = 8.4 Hz), 6.87–6.84 (4H, m), 6.78 (1H, d, *J* = 7.8 Hz), 2.85 (6H, s); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 155.6, 155.2, 144.6, 131.7, 130.0, 128.5, 125.0, 122.6, 120.7, 119.1, 118.6, 36.3. ESI-HRMS. Calcd for C<sub>15</sub>H<sub>16</sub>ClN<sub>2</sub>O<sub>2</sub>, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 291.0895. Found: *m/z* 291.0894.

**N-[2-(4-Chlorophenoxy)phenyl]pyrrolidine-1-carboxamide (18)** Yield 80%; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.31 (1H, d, *J* = 8.4 Hz), 7.28–1.26 (2H, m), 7.13 (1H, t, *J* = 7.8 Hz), 6.94–6.91 (2H, m), 6.85 (1H, d, *J* = 8.4 Hz), 6.77 (1H, bs), 3.37 (4H, t, *J* = 6.6 Hz), 1.92–1.90 (4H, m); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 155.7, 153.7, 144.4, 131.6, 130.0, 128.6, 125.1, 122.5, 120.5, 119.1, 118.7, 45.9, 25.7. ESI-HRMS. Calcd for C<sub>17</sub>H<sub>18</sub>ClN<sub>2</sub>O<sub>2</sub>, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 317.1052. Found: *m/z* 317.1047.

**General procedure for synthesis of 2-chloro-11-substituted dibenzo[*b,f*][1,4]oxazepines 19–25** A solution of carboxamide 12–18 (1 mmol) in phosphorus oxychloride (33.0 mL) was heated at reflux for 17 h. The phosphorus oxychloride was removed under reduced pressure and the residue was neutralized with ice water and ammonium hydroxide and extracted with dichloromethane. The extract was concentrated under reduced pressure, and the residue was purified by silica gel flash chromatography eluting with 10%–50% ethyl acetate-hexanes to afford the title compound.

**2-Chloro-11-thiomorpholinodibenzo[*b,f*][1,4]oxazepine (19)** Yield 24% from 12; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 7.39 (1H, dd, *J* = 9.0 Hz and 2.4 Hz), 7.29–7.28 (1H, m), 7.19 (1H, t, *J* = 8.4 Hz), 7.13–7.07 (3H, m), 6.99 (1H, t, *J* = 7.2 Hz), 3.85 (4H, bs), 2.74 (4H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 159.4, 158.8, 151.9, 140.1, 132.8, 130.5, 129.0, 127.2, 126.0, 125.2, 124.8, 123.0, 120.2, 50.1, 27.2. ESI-HRMS. Calcd for C<sub>17</sub>H<sub>16</sub>ClN<sub>2</sub>OS, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 331.0667. Found: *m/z* 331.0661.

**2-Chloro-11-morpholinodibenzo[*b,f*][1,4]oxazepine (20)** Yield 9% from 13; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 7.40 (1H, dd, *J* = 8.4, 1.8 Hz), 7.32 (1H, d, *J* = 2.4 Hz), 7.20–7.15 (2H, m), 7.11–7.08 (2H, m), 7.01 (1H, t, *J* = 7.2 Hz), 3.83 (4H, bs), 3.53 (4H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 159.6, 159.2, 152.0, 132.9, 130.5, 129.2, 127.3, 126.0, 125.0, 123.0, 120.3, 66.9, 48.3. ESI-HRMS. Calcd for C<sub>17</sub>H<sub>16</sub>ClN<sub>2</sub>O<sub>2</sub>, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 315.0895. Found: *m/z* 315.0890.

**2-Chloro-11-piperidinodibenzo[*b,f*][1,4]oxazepine (21)** Yield 9% from 14; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 7.37 (1H, dd, *J* = 9.0, 3.0 Hz), 7.31 (1H, d, *J* = 3.0 Hz), 7.18 (1H, d, *J* = 8.4 Hz), 7.14 (1H, dd, *J* = 7.8, 1.8 Hz), 7.10–7.06 (2H, m), 6.96 (1H, td, *J* = 7.8, 1.8 Hz), 3.47 (4H, bs), 1.70 (6H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 159.5, 159.3, 152.0, 140.7, 132.4, 130.0, 129.2, 127.2, 125.9, 125.7, 124.2, 122.7, 120.1, 48.6, 26.0, 25.0. ESI-HRMS. Calcd for C<sub>18</sub>H<sub>18</sub>ClN<sub>2</sub>O, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 313.1103. Found: *m/z* 313.1102.

**N-{2-[(2-Chlorodibenzo[*b,f*][1,4]oxazepin-11-yl)amino]ethyl}benzenesulfonamide (22)** Yield 38% from 15; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 8.77 (1H, bs), 8.37 (1H, bs), 7.62–7.58 (3H, m), 7.41 (2H, t, *J* = 7.8 Hz), 7.29 (2H, d, *J* = 9.0 Hz), 7.19–7.16 (1H, m), 7.02–6.99 (3H, m), 5.00 (1H, bs), 3.68 (4H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 156.2, 147.4, 144.3, 136.5, 134.0, 132.9, 131.9, 129.9, 129.6, 129.3, 128.3, 127.6, 126.5, 125.4, 123.2, 119.7, 118.7, 49.7, 47.0. ESI-HRMS. Calcd for C<sub>21</sub>H<sub>19</sub>ClN<sub>3</sub>O<sub>3</sub>S, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 428.0831. Found: *m/z* 428.0824.

**2-Chloro-11-(4-phenylpiperazino)dibenzo[*b,f*][1,4]oxazepine (23)** Yield 9% from 16; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 7.41 (1H, dd, *J* = 8.4, 2.4 Hz), 7.38–7.37 (1H, m), 7.31 (2H, t, *J* = 7.2 Hz), 7.22–7.19 (2H, m), 7.13–7.10 (2H, m), 7.03–6.99 (3H, m), 6.92 (1H, t, *J* = 7.2 Hz), 3.70 (4H, bs), 3.32 (4H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 159.6, 159.1, 152.0, 151.3, 140.2, 132.8, 130.5, 129.4, 129.3, 127.3, 126.0, 125.1, 124.9, 122.9, 120.5, 120.3, 116.7, 49.5, 47.6. ESI-HRMS. Calcd for C<sub>23</sub>H<sub>21</sub>ClN<sub>3</sub>O, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 390.1368. Found: *m/z* 390.1360.

**2-Chloro-11-(dimethylamino)dibenzo[*b,f*][1,4]oxazepin-11-amine (24)** Yield 4% from 17; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 7.37 (1H, dd, *J* = 8.4, 2.4 Hz), 7.30 (1H, d, *J* = 2.4 Hz), 7.18 (1H, d, *J* = 8.4 Hz), 7.16 (1H, dd, *J* = 7.8, 1.8 Hz), 7.10–7.06 (2H, m), 6.95 (1H, td, *J* = 7.8, 1.2 Hz), 3.07 (6H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 159.4, 159.1, 151.8, 140.8, 132.3, 130.2, 129.4, 127.2, 125.9, 125.3, 124.0, 122.7, 120.1, 39.7. ESI-HRMS. Calcd for C<sub>15</sub>H<sub>14</sub>ClN<sub>2</sub>O, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 273.0790. Found: *m/z* 273.0787.

**2-Chloro-11-(pyrrolidino)dibenzo[*b,f*][1,4]oxazepine (25)** Yield 7% from 18; <sup>1</sup>H NMR (600 MHz, CDCl<sub>3</sub>) δ 7.36–7.34 (2H, m), 7.18–7.15 (2H, m), 7.10–7.06 (2H, m), 6.93–6.91 (1H, m), 3.64 (2H, bs), 3.49 (2H, bs), 2.03 (2H, bs), 1.90 (2H, bs); <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 158.8, 157.1, 151.8, 141.3, 132.0, 130.0, 128.8, 127.2, 126.3, 126.0, 123.4, 122.4, 120.2, 49.2, 25.7. ESI-HRMS. Calcd for C<sub>17</sub>H<sub>16</sub>ClN<sub>2</sub>O, [M<sup>+</sup>+H<sup>+</sup>]: *m/z* 299.0946. Found: *m/z* 299.0943.

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## References

- [1] Olajos, E. J.; Salem, H. Riot control agents: pharmacology, toxicology, biochemistry and chemistry. *J. Appl. Toxicol.* **2001**, *21*, 355–391.
- [2] Klunder, J. M.; Hargrave, K. D.; West, M. A.; Cullen, E.; Pal, K.; Behnke, M. L.; Kapadia, S. R.; McNeil, D. W.; Wu, J. C.; Chow, G. C.; et al. Novel nonnucleoside inhibitors of HIV-1 reverse-transcriptase. 2. Tricyclic pyridobenzoxazepinones and dibenzoxazepinones. *J. Med. Chem.* **1992**, *35*, 1887–1897.
- [3] Smits, R. A.; Lim, H. D.; Stegink, B.; Bakker, R. A.; de Esch, I. J.; Leurs, R. Characterization of the histamine H<sub>4</sub> receptor binding site. Part 1. Synthesis and pharmacological evaluation of dibenzodiazepine derivatives. *J. Med. Chem.* **2006**, *49*, 4512–4516.
- [4] Li, R.; Farmer, P. S.; Wang, J.; Boyd, R. J.; Cameron, T. S.; Quilliam, M. A.; Walter, J. A.; Howlett, S. E. Molecular geometries of dibenzothiazepinone and dibenzoxazepinone calcium antagonists. *Drug Des. Discov.* **1995**, *12*, 337–358.
- [5] Hallinan, E. A.; Hagen, T. J.; Tsybalov, S.; Husa, R. K.; Lee, A. C.; Stapelfeld, A.; Savage, M. A. Aminoacetyl moiety as a potential surrogate for diacylhydrazine group of SC-51089, a potent PGE<sub>2</sub> antagonist, and its analogs. *J. Med. Chem.* **1996**, *39*, 609–613.
- [6] Hallinan, E. A.; Hagen, T. J.; Tsybalov, S.; Stapelfeld, A.; Savage, M. A. 2,4-Disubstituted oxazoles and thiazoles as latent pharmacophores for diacylhydrazine of SC-51089, a potent PGE<sub>2</sub> antagonist. *Bioorg. Med. Chem.* **2001**, *9*, 1–6.
- [7] Ban, T. A.; Wilson, W. H.; McEvoy, J. P. Amoxapine – a review of literature. *Int. Pharmacopsychiatry* **1980**, *15*, 166–170.
- [8] Wen, F.; Zhang, H.; Yu, Z. Y.; Jin, H.; Yang, Q. A.; Hou, T. P. Design, synthesis and antifungal/insecticidal evaluation of novel nicotinamide derivatives. *Pestic. Biochem. Physiol.* **2010**, *98*, 248–253.
- [9] Wagh, B. S.; Patil, B. P.; Jain, M. S.; Harak, S. S.; Wagh, S. B. Synthesis and evaluation of antipsychotic activity of 11-(4-aryl-1-piperazinyl)-dibenz [b,f][1,4] oxazepines and their 8-chloro analogues. *Heterocycl. Commun.* **2007**, *13*, 165–172.
- [10] Schmutz, J.; Kunzle, F.; Hunziker, F.; Gauch, R. Ueber in 11-Stellung Amino-Substituierte Dibenzo[*b,f*]-1,4-Thiazepine Und -Oxazepine. 9. Über Siebengliedrige Heterocyclen. *Helv. Chim. Acta* **1967**, *50*, 245–254.