

## (十六) 2,6,7-Substituted-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]-quinolin-3-one phenylhydrazone ( 219-240 ) 之合成

### 2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (219)之合成

取化合物 27 (2.01g, 0.01mole)及 phenylhydrazine (2.16g, 0.02mole)置於 30ml 之絕對酒精後再加入 1ml 冰醋酸(glacial acetic acid)並迴流 6 小時再以減壓濃縮至乾。殘餘物溶於苯 (50ml) 中並用 2 % 稀鹽酸及水依次萃取, 取苯層以無水硫酸鎂乾燥並過濾最後以減壓濃縮至乾。殘餘物以管柱層析法用溶媒(chloroform)沖提, 再以乙醇做再結晶得到化合物 219 (1.11g, 38.4%), mp: 140-141。光譜數據如下: MS  $m/z$ : 290.3; IR (KBr)  $\text{cm}^{-1}$ : 3334.0 ( $\text{C}_3=\text{N}-\text{NH}-$ ), 1655.0 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 306 (4.11);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 5.29 (2H, s, H-2), 6.63 (1H, t,  $J=7.2$  Hz, H-4'), 6.89 (2H, d,  $J=7.6$  Hz, H-2', H-6'), 7.16 (2H, t,  $J=7.8$  Hz, H-3', H-5'), 7.38 (1H, t,  $J=8.0$  Hz, H-6), 7.48 (1H, d,  $J=7.7$  Hz, H-8), 7.68 (1H, t,  $J=7.7$  Hz, H-7), 8.18 (1H, d,  $J=8.0$  Hz, H-5), 12.07 (1H, s,  $\text{C}_3=\text{N}-\text{NH}-$ );  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 74.84 (C-2), 99.50 (C-3a), 111.02 (C-2', C-6'), 117.69 (C-4'), 118.30 (C-4a), 124.04 (C-8), 124.34 (C-6), 126.21 (C-5), 129.36 (C-3', C-5'), 132.67 (C-7), 137.31 (C-1'), 138.54 (C-8a), 145.84 (C-3), 168.56 (C-9a), 171.84 (C-4).

### 7-Methyl-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (220)之合成

取化合物28 ( 2.15g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料, 比照化合物219的合成法及處理步驟, 得化合物220 (1.22g, 40.2%), mp: 153-155。光譜數據如下: MS  $m/z$  305.0; IR (KBr)  $\text{cm}^{-1}$ : 3318.6 ( $\text{C}_3= \text{N}-\text{NH}-$ ), 1636.1 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 306 (4.24);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 2.40 (3H, s,  $\text{C}_7-\text{CH}_3$ ), 5.27 (2H, s, H-2), 6.62 (1H, t,  $J= 7.2$  Hz, H-4'), 6.88 (2H, d,  $J= 8.2$  Hz, H-2', H-6'), 7.11-7.22 (4H, m, H-6, H-8, H-3', H-5'), 8.04 (1H, d,  $J= 8.2$  Hz, H-5), 12.07 (1H, s,  $\text{C}_3=\text{N}-\text{NH}-$ );  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 21.44 ( $\text{C}_7-\text{CH}_3$ ), 74.82 (C-2), 99.24 (C-3a), 110.97 (C-2', C-6'), 117.60 (C-4'), 117.73 (C-8), 121.82 (C-4a), 125.85 (C-6), 126.16 (C-5), 129.35 (C-3', C-5'), 137.30 (C-1'), 138.60 (C-7), 143.15 (C-8a), 145.85 (C-3), 168.43 (C-9a), 171.68 (C-4).

### 7-Ethyl-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (221)之合成

取化合物29 ( 2.29g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料, 比照化合物219的合成法及處理步驟, 得化合物221 (1.36g, 42.6%), mp: 133-135。光譜數據如下: MS  $m/z$  319.1; IR (KBr)  $\text{cm}^{-1}$ : 3395.8 ( $\text{C}_3= \text{N}-\text{NH}-$ ), 1643.9 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 306 (4.24);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 1.21 (3H, t,  $J= 7.6\text{Hz}$ ,  $\text{C}_7-\text{CH}_2\text{CH}_3$ ), 2.67 (2H, q,  $J=7.6\text{Hz}$ ,  $\text{C}_7-\text{CH}_2\text{CH}_3$ ), 5.27 (2H, s, H-2), 6.63 (1H, t,  $J=7.4$  Hz, H-4'), 6.88 (2H, d,  $J= 8.4$  Hz, H-2', H-6'), 7.11-7.26 (4H, m, H-3', H-5', H-6, H-8), 8.07 (1H, d,  $J= 8.6$  Hz, H-5), 12.07 (1H, s,  $\text{C}_3=\text{N}-\text{NH}-$ );  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 15.20 ( $\text{C}_7-\text{CH}_2\text{CH}_3$ ), 28.35 ( $\text{C}_7-\text{CH}_2\text{CH}_3$ ), 74.82 (C-2), 99.26 (C-3a), 110.98 (C-2', C-6'), 116.53 (C-8), 117.60 (C-4'), 122.05 (C-4a), 124.68 (C-6), 126.26 (C-5), 129.34 (C-3', C-5'), 137.39 (C-1'), 138.62 (C-8a), 145.86 (C-3), 149.13 (C-7), 168.46 (C-9a), 171.77 (C-4).

### 7-methoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (222)之合成

取化合物30 ( 2.31g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物222 (1.36g, 42.3%) , mp : 150-152 。 光譜數據如下 : MS *m/z*: 321.1; IR (KBr)  $\text{cm}^{-1}$ : 3380.3 ( $\text{C}_3=\text{N}-\underline{\text{NH}}$ -), 1651.6 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 305 (4.01);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 3.83 (3H, s,  $\text{C}_7\text{-OCH}_3$ ), 5.25 (2H, s, H-2), 6.63 (1H, t,  $J=7.2$  Hz, H-4'), 6.84-6.89 (3H, m, H-8, H-2', H-6'), 6.96 (1H, dd,  $J=8.9, 2.4$  Hz, H-6), 7.15 (2H, t,  $J=8.0, 2.4$  Hz, H-3', H-5'), 8.06 (1H, d,  $J=8.9$  Hz, H-5), 12.05 (1H, s,  $\text{C}_3=\text{N}-\underline{\text{NH}}$ -);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$  : 55.82 ( $\text{C}_7\text{-OCH}_3$ ), 74.84 (C-2), 99.86 (C-3a), 100.50 (C-8), 110.96 (C-2', C-6'), 113.10 (C-6), 117.53 (C-4a), 117.77 (C-4'), 127.95 (C-5), 129.33 (C-3', C-5'), 138.69 (C-1'), 139.04 (C-8a), 145.91 (C-3), 162.70 (C-7), 168.59 (C-9a), 171.54 (C-4).

### 7-Ethoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (223)之合成

取化合物31 ( 2.45g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物223 (1.29g, 38.5%) , mp : 148-150 。 光譜數據如下 : MS *m/z* 335.3; IR (KBr)  $\text{cm}^{-1}$ : 3334.0 ( $\text{C}_3=\text{N}-\underline{\text{NH}}$ -), 1620.7 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 305 (4.00);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 1.41 (3H, t,  $J=7.0$ ,  $\text{C}_7-\text{OCH}_2\text{CH}_3$ ), 4.22 (2H, q,  $J=7.0$  Hz,  $\text{C}_7-\text{OCH}_2\text{CH}_3$ ), 5.30 (2H, s, H-2), 6.60 (1H, t,  $J=6.6$  Hz, H-4'), 6.90 (2H, d,  $J=8.4$  Hz, H-2', H-6'), 7.16 (2H, t,  $J=7.8$  Hz, H-3', H-5'), 7.29 (2H, d,  $J=4.8$  Hz, H-6, H-8), 7.72 (1H, t,  $J=4.8$  Hz, H-5), 12.08 (1H, s,  $\text{C}_3=\text{N}-\underline{\text{NH}}$ -);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$  : 14.62 ( $\text{C}_7-\text{OCH}_2\text{CH}_3$ ), 64.93 ( $\text{C}_7-\text{OCH}_2\text{CH}_3$ ), 74.79 (C-2), 99.92 (C-3a), 111.04 (C-2', C-6'), 113.95 (C-8), 117.25 (C-4'), 117.69 (C-4a), 124.26 (C-6), 125.09 (C-5), 127.70 (C-8a), 129.35 (C-3', C-5'), 138.48 (C-1'), 145.84 (C-3), 147.87 (C-7), 168.65 (C-9a), 171.82 (C-4).

### 7-Chloro-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (224)之合成

取化合物32 ( 2.35g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物224 (1.38g, 42.6%) , mp : 155-157 。 光譜數據如下 : MS *m/z*:  $\text{M}^+$  324.9, ( $\text{M}+2$ ) $^+$  326.9; IR (KBr)  $\text{cm}^{-1}$ : 3380.3 ( $\text{C}_3=\text{N}-\underline{\text{NH}}$ -), 1605.3 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 309 (4.31);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 5.30 (2H, s, H-2), 6.64 (1H, t,  $J=7.0$  Hz, H-4'), 6.88 (2H, d,  $J=8.2$  Hz, H-2', H-6'), 7.15 (2H, t,  $J=8.0$  Hz, H-3', H-5'), 7.38-7.44 (2H, m, H-6, H-8), 8.14 (1H, d,  $J=8.4$  Hz, H-5), 11.94 (1H, s,  $\text{C}_3=\text{N}-\underline{\text{NH}}$ -);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$  : 75.11 (C-2), 99.91 (C-3a), 111.04 (C-2', C-6'), 117.49 (C-4'), 117.80 (C-8), 122.82 (C-6), 124.59 (C-4a), 128.24 (C-5), 129.36 (C-3', C-5'), 137.01 (C-7), 137.98 (C-1'), 138.06 (C-8a), 145.71 (C-3), 168.86 (C-9a), 171.08 (C-4).

### 7-Fluoro-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (225)之合成

取化合物33 ( 2.19g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物225 (1.16g, 37.6%) , mp : 137-138 。 光譜數據如下 : MS *m/z*: 308.9; IR (KBr)  $\text{cm}^{-1}$ : 3388.0 ( $\text{C}_3=\text{N}-\underline{\text{NH}}$ -), 1628.4 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 305 (4.09);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 5.27 (2H, s, H-2), 6.63 (1H, t,  $J=7.2$  Hz, H-4'), 6.98 (2H, d,  $J=7.4$  Hz, H-2', H-6'), 7.12-7.26 (4H, m, H-6, H-8, H-3', H-5'), 8.18 (1H, dd,  $J=8.8, 6.2$  Hz, H-5), 11.94 (1H, s,  $\text{C}_3=\text{N}-\underline{\text{NH}}$ -);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$  : 75.09 (C-2), 99.51 (C-3a), 104.04 ( $J=25.7$  Hz, C-8), 111.00 (C-2', C-6'), 112.64 ( $J=22.6$  Hz, C-6), 117.72 (C-4'), 120.96 (C-4a), 129.10 (C-8a), 129.33 (C-3', C-5'), 138.08 (C-1'), 138.65 ( $J=12.5$  Hz, C-5), 145.74 (C-3), 161.85 (C-7), 168.97 (C-9a), 171.12 (C-4).

### 7-Bromo-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (226)之合成

取化合物34 ( 2.80g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物226 (1.57g, 42.4%) , mp : 140-141 。 光譜數據如下 : MS *m/z*:  $\text{M}^+$  368.9, ( $\text{M}+2$ ) $^+$  371.0; IR (KBr)  $\text{cm}^{-1}$ : 3318.6 ( $\text{C}_3=\text{N}-\underline{\text{NH}}$ -), 1605.3 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 309 (4.31);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 5.30 (2H, s, H-2), 6.64 (1H, t,  $J=7.2$  Hz, H-4'), 6.88 (2H, d,  $J=8.6$  Hz, H-2', H-6'), 7.16 (2H, t,  $J=8.4$  Hz, H-3', H-5'), 7.53 (1H, dd,  $J=8.6, 1.8$  Hz, H-6), 7.61 (1H, d,  $J=1.8$  Hz, H-8), 8.07 (1H, d,  $J=8.6$  Hz, H-5), 11.97 (1H, s,  $\text{C}_3=\text{N}-\underline{\text{NH}}$ -).

### 6-Methyl-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (227)之合成

取化合物35 ( 2.15g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物227 (1.27g, 41.8%) , mp : 158-160 。 光譜數據如下 : MS *m/z* 305.3; IR (KBr)  $\text{cm}^{-1}$ : 3442.1 ( $\text{C}_3=\text{N}-\underline{\text{NH}}$ -), 1643.9 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 309 (4.28);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 2.39 (3H, s,  $\text{C}_6-\text{CH}_3$ ), 5.27 (2H, s, H-2), 6.63 (1H, t,  $J=7.2$  Hz, H-4'), 6.88 (2H, d,  $J=7.6, 1.1$  Hz, H-2', H-6'), 7.16 (2H, t,  $J=7.8$  Hz, H-3', H-5'), 7.36 (1H, d,  $J=8.2$  Hz, H-8), 7.49 (1H, dd,  $J=8.2, 2.0$  Hz, H-7), 7.96 (1H, d,  $J=1.2$  Hz, H-5), 12.10 (1H, s,  $\text{C}_3=\text{N}-\underline{\text{NH}}$ -);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$  : 20.83 ( $\text{C}_6-\text{CH}_3$ ), 74.82 (C-2), 99.37 (C-3a), 110.97 (C-2', C-6'), 117.61 (C-4'), 118.02 (C-8), 123.87 (C-4a), 125.72 (C-6), 129.35 (C-3', C-5'), 133.75 (C-5), 133.80 (C-7), 135.04 (C-8a), 138.59 (C-1'), 145.86 (C-3), 168.16 (C-9a), 171.72 (C-4).

### 6-Ethyl-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (228)之合成

取化合物36 ( 2.29g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物228 (1.31g, 41.3%) , mp : 148-150 。 光譜數據如下 : MS *m/z*: 319.1; IR (KBr)  $\text{cm}^{-1}$ : 3395.8 ( $\text{C}_3=\text{N}-\underline{\text{NH}}$ -), 1643.9 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 305 (3.83);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 1.22 (3H, t,  $J=7.6$  Hz,  $\text{C}_7-\text{CH}_2\text{CH}_3$ ), 2.72 (2H, q,  $J=7.6$  Hz,  $\text{C}_7-\text{CH}_2\text{CH}_3$ ), 5.29 (2H, s, H-2), 6.63

(1H, t, J=7.2 Hz, H-4'), 6.89 (2H, d, J= 8.2 Hz, H-2', H-6'), 7.15 (2H, t, J=7.2 Hz, H-3', H-5'), 7.40 (1H, d, J= 8.4 Hz, H-8), 7.55 (1H, dd, J=8.4, 1.8 Hz, H-7), 8.00 (1H, d, J=1.8Hz, H-5), 12.11 (1H, s, C<sub>3</sub>=N-NH-); <sup>13</sup>C-NMR (DMSO-*d*<sub>6</sub>) δ : 15.74 (C<sub>7</sub>-CH<sub>2</sub>CH<sub>3</sub>), 27.92 (C<sub>7</sub>-CH<sub>2</sub>CH<sub>3</sub>), 74.83 (C-2), 99.37 (C-3a), 110.98 (C-2', C-6'), 117.61 (C-4'), 118.19 (C-8), 123.96 (C-7), 124.44 (C-4a), 129.34 (C-3', C-5'), 132.82 (C-5), 135.31 (C-8a), 138.62 (C-1'), 139.99 (C-6), 145.89 (C-3), 168.22 (C-9a), 171.79 (C-4).

#### 6-Methoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (229)之合成

取化合物37 ( 2.31g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物229 (1.28g, 39.8%) , mp : 148-150 。 光譜數據如下 : MS *m/z*: 321.1; IR (KBr) cm<sup>-1</sup>: 3334.0 (C<sub>3</sub>= N-NH-), 1625.1 (C<sub>4</sub>=O); UV λ<sub>max</sub> nm (MeOH) (log ε): 310 (4.25); <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>) δ : 3.84 (3H, s, C<sub>6</sub>-CH<sub>2</sub>CH<sub>3</sub>), 5.28 (2H, s, H-2), 6.63 (1H, t, J=7.2 Hz, H-4'), 6.90 (2H, d, J= 7.8 Hz, H-2', H-6'), 7.16 (2H, t, J=7.8 Hz, H-3', H-5'), 7.30 (1H, dd, J= 8.8, 2.8 Hz, H-7), 7.43 (1H, d, J= 8.8, Hz, H-6), 7.59 (1H, d, J= 2.8 Hz, H-5), 12.11 (1H, s, C<sub>3</sub>=N-NH-); <sup>13</sup>C-NMR (DMSO-*d*<sub>6</sub>) δ : 55.70 (C<sub>6</sub>-OCH<sub>3</sub>), 74.86 (C-2), 99.11 (C-3a), 106.61 (C-7), 111.01 (C-2', C-6'), 117.68 (C-4'), 119.64 (C-5), 122.14 (C-8), 125.01 (C-4a), 129.37 (C-3', C-5'), 131.21 (C-8a), 138.53 (C-1'), 145.84 (C-3), 156.33 (C-6), 167.68 (C-9a), 171.23 (C-4).

#### 6-Ethoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (230)之合成

取化合物38 ( 2.45g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物230 (1.21g, 36.4%) , mp : 143-145 。 光譜數據如下 : MS *m/z*: 335.3; IR (KBr) cm<sup>-1</sup>: 3380.3 (C<sub>3</sub>= N-NH-), 1643.9 (C<sub>4</sub>=O); UV λ<sub>max</sub> nm (MeOH) (log ε): 309 (4.42); <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>) δ : 1.35 (3H, t, J= 7.0 Hz, C<sub>6</sub>-OCH<sub>2</sub>CH<sub>3</sub>), 4.10 (2H, q, J=7.0 Hz, C<sub>6</sub>-OCH<sub>2</sub>CH<sub>3</sub>), 5.27 (2H, s, H-2), 6.63 (1H, t, J=7.2 Hz, H-4'), 6.89 (2H, d, J= 7.6 Hz, H-2', H-6'), 7.15 (2H, t, J=7.4 Hz, H-3', H-5'), 7.27 (1H, dd, J= 8.8, 2.8 Hz, H-7), 7.40 (1H, d, J= 9.0 Hz, H-8), 7.56 (1H, d, J=2.8 Hz, H-5), 12.12 (1H, s, C<sub>3</sub>=N-NH-); <sup>13</sup>C-NMR (DMSO-*d*<sub>6</sub>) δ : 14.81 (C<sub>6</sub>-OCH<sub>2</sub>CH<sub>3</sub>), 63.72 (C<sub>6</sub>-OCH<sub>2</sub>CH<sub>3</sub>), 74.80 (C-2), 99.05 (C-3a), 107.16 (C-7), 110.99 (C-2', C-6'), 117.62 (C-4'), 119.64 (C-5), 122.41 (C-8), 125.00 (C-4a), 129.34 (C-3', C-5'), 131.18 (C-8a), 138.55 (C-1'), 145.85 (C-3), 155.54 (C-6), 167.64 (C-9a), 171.22 (C-4).

#### 6-Chloro-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (231)之合成

取化合物39 ( 2.35g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物231 (1.28g, 39.3%) , mp : 200-202 。 光譜數據如下 : MS *m/z*: M<sup>+</sup> 324.9, (M+2)<sup>+</sup> 326.9; IR (KBr) cm<sup>-1</sup>: 3380.3 (C<sub>3</sub>= N-NH-), 1643.9 (C<sub>4</sub>=O); UV λ<sub>max</sub> nm (MeOH) (log ε): 309 (4.30); <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>) δ : 5.29 (2H, s, H-2), 6.61 (1H, t, J=7.2 Hz, H-4'), 6.89 (2H, d, J= 8.4 Hz, H-2', H-6'), 7.16 (2H, t, J=7.4 Hz, H-3', H-5'), 7.48 (1H, d, J= 8.2 Hz, H-5), 7.70 (1H,

ddd,  $J = 8.8, 2.4, 0.8$  Hz, H-6), 8.07 (1H, dd,  $J = 2.4, 0.4$  Hz, H-8), 11.93 (1H, s,  $C_3=N-NH-$ );  $^{13}C-NMR$  (DMSO- $d_6$ )  $\delta$ : 75.11 (C-2), 99.91 (C-3a), 111.08 (C-2', C-6'), 117.89 (C-4'), 120.45 (C-8), 125.20 (C-6), 125.36 (C-4a), 128.95 (C-5), 129.40 (C-3', C-5'), 132.52 (C-7), 135.91 (C-8a), 137.96 (C-1'), 145.71 (C-3), 168.72 (C-9a), 170.51 (C-4).

#### 6-Fluoro-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (232)之合成

取化合物40 (2.19g, 0.01mole) 及phenylhydrazine (2.16g, 0.02mole)為原料, 比照化合物219的合成法及處理步驟, 得化合物232 (1.27g, 41.3%), mp: 153-155。光譜數據如下: MS  $m/z$ : 308.9; IR (KBr)  $cm^{-1}$ : 3334.0 ( $C_3=N-NH-$ ), 1643.9 ( $C_4=O$ ); UV  $\lambda_{max}$  nm (MeOH) (log  $\epsilon$ ): 309 (4.37);  $^1H-NMR$  (DMSO- $d_6$ )  $\delta$ : 5.29 (2H, s, H-2), 6.64 (1H, t,  $J=7.2$  Hz, H-4'), 6.89 (2H, d,  $J=7.6$  Hz, H-2', H-6'), 7.16 (2H, t,  $J=8.4$  Hz, H-3', H-5'), 7.51-7.58 (2H, m,  $J=8.6$  Hz, H-6, H-8), 7.81 (1H, dd,  $J=9.4, 2.6$  Hz, H-5), 11.98 (1H, s,  $C_3=N-NH-$ ).

#### 6-Bromo-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (233)之合成

取化合物41 (2.80g, 0.01mole) 及phenylhydrazine (2.16g, 0.02mole)為原料, 比照化合物219的合成法及處理步驟, 得化合物233 (1.54g, 41.7%), mp: 145-146。光譜數據如下: MS  $m/z$ :  $M^+$  368.9,  $(M+2)^+$  371.0; IR (KBr)  $cm^{-1}$ : 3384.5 ( $C_3=N-NH-$ ), 1605.3 ( $C_4=O$ ); UV  $\lambda_{max}$  nm (MeOH) (log  $\epsilon$ ): 311 (3.82);  $^1H-NMR$  (DMSO- $d_6$ )  $\delta$ : 5.29 (2H, s, H-2), 6.65 (1H, t,  $J=7.0$  Hz, H-4'), 6.86 (2H, d,  $J=8.4$  Hz, H-2', H-6'), 7.16 (2H, t,  $J=7.4$  Hz, H-3', H-5'), 7.41 (1H, d,  $J=8.6$  Hz, H-8), 7.81 (1H, dd,  $J=8.6, 2.2$  Hz, H-7), 8.21 (1H, d,  $J=2.2$  Hz, H-5), 11.92 (1H, s,  $C_3=N-NH-$ );  $^{13}C-NMR$  (DMSO- $d_6$ )  $\delta$ : 75.01 (C-2), 99.93 (C-3a), 111.04 (C-2', C-6'), 116.85 (C-6), 117.87 (C-4'), 120.64 (C-8), 125.68 (C-4a), 128.27 (C-5), 129.38 (C-3', C-5'), 135.16 (C-7), 136.21 (C-8a), 137.92 (C-1'), 145.67 (C-3), 168.68 (C-9a), 170.39 (C-4).

#### 6,8-Dimethoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (234)之合成

取化合物42 (2.61g, 0.01mole) 及phenylhydrazine (2.16g, 0.02mole)為原料, 比照化合物219的合成法及處理步驟, 得化合物234 (1.35g, 38.4%), mp: 174-175。光譜數據如下: MS  $m/z$ : 351.3; IR (KBr)  $cm^{-1}$ : 3380.3 ( $C_3=N-NH-$ ), 1643.9 ( $C_4=O$ ); UV  $\lambda_{max}$  nm (MeOH) (log  $\epsilon$ ): 310 (4.13);  $^1H-NMR$  (DMSO- $d_6$ )  $\delta$ : 3.83 (3H, s,  $C_8-OCH_3$ ), 3.92 (3H, s,  $C_6-OCH_3$ ), 5.24 (2H, s, H-2), 6.63 (1H, t,  $J=7.3$  Hz, H-4'), 6.87-6.91 (3H, m, H-7, H-2', H-6'), 7.12-7.19 (3H, m, H-5, H-3', H-5'), 12.14 (1H, s,  $C_3=N-NH-$ ).

#### 6,7-Dimethoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (235)之合成

取化合物43 (2.61g, 0.01mole) 及phenylhydrazine (2.16g, 0.02mole)為原料, 比照化合物219的合成法及處理步驟, 得化合物235 (1.45g, 41.5%), mp: 165-167

。光譜數據如下：MS  $m/z$ : 351.3; IR (KBr)  $\text{cm}^{-1}$ : 3410.0 ( $\text{C}_3=\text{N-NH-}$ ), 1656.1 ( $\text{C}_4=\text{O}$ ), UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 309 (4.21);  $^1\text{H-NMR}$  ( $\text{DMSO-}d_6$ )  $\delta$ : 3.85 (6H, s,  $\text{C}_6\text{-OCH}_3$ ,  $\text{C}_7\text{-OCH}_3$ ), 5.26 (2H, s, H-2), 6.61 (1H, t,  $J=7.2$  Hz, H-4'), 6.88 (3H, m, H-8, H-2', H-6'), 7.14 (2H, t,  $J=8.4$  Hz, H-3', H-5'), 7.53 (1H, s, H-5), 12.19 (1H, s,  $\text{C}_3=\text{N-NH-}$ ).

#### 6,7-Dichloro-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (236)之合成

取化合物44 ( 2.70g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物236 (1.27g, 35.3%) , mp : 180-181

。光譜數據如下：MS  $m/z$ :  $\text{M}^+$  359.2,  $(\text{M}+2)^+$  361.1,  $(\text{M}+4)^+$  363.2; IR (KBr)  $\text{cm}^{-1}$ : 3388.6 ( $\text{C}_3=\text{N-NH-}$ ), 1643.9 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 314 (4.23);  $^1\text{H-NMR}$  ( $\text{DMSO-}d_6$ )  $\delta$ : 5.30 (2H, s, H-2), 6.65 (1H, t,  $J=6.8$  Hz, H-4'), 6.88 (2H, d,  $J=8.4$  Hz, H-2', H-6'), 7.16 (1H, t,  $J=7.3$  Hz, H-3', H-5'), 7.63 (1H, d,  $J=1.2$  Hz, H-8), 8.23 (1H, d,  $J=1.2$  Hz, H-5), 11.87 (1H, s,  $\text{C}_3=\text{N-NH-}$ ).

#### 6,7-Dimethyl-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (237)之合成

取化合物45 ( 2.29g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物237 (1.31g, 41.1%) , mp : 192-194

。光譜數據如下：MS  $m/z$ : 319.2; IR (KBr)  $\text{cm}^{-1}$ : 3340.3 ( $\text{C}_3=\text{N-NH-}$ ), 1643.9 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 309 (4.12);  $^1\text{H-NMR}$  ( $\text{DMSO-}d_6$ )  $\delta$ : 2.30 (3H, s,  $\text{C}_6\text{-CH}_3$ ), 2.31 (3H, s,  $\text{C}_7\text{-CH}_3$ ), 5.25 (2H, s, H-2), 6.62 (1H, t,  $J=7.2$  Hz, H-4'), 6.87 (2H, d,  $J=7.4$  Hz, H-2', H-6'), 7.15 (2H, t,  $J=7.9$  Hz, H-3', H-5'), 7.21 (1H, s, H-8), 7.91 (1H, s, H-5), 12.13 (1H, s,  $\text{C}_3=\text{N-NH-}$ );  $^{13}\text{C-NMR}$  ( $\text{DMSO-}d_6$ )  $\delta$ : 19.35 ( $\text{C}_6\text{-CH}_3$ ), 20.05 ( $\text{C}_7\text{-CH}_3$ ), 74.69 (C-2), 99.12 (C-3a), 110.91 (C-2', C-6'), 117.51 (C-4'), 118.23 (C-4a), 122.00 (C-8), 126.13 (C-5), 129.35 (C-3', C-5'), 133.18 (C-8a), 135.51 (C-6), 138.81 (C-1'), 142.42 (C-7), 145.91 (C-3), 168.10 (C-9a), 171.71 (C-4).

#### 6,7-Methylenedioxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenylhydrazone (238)之合成

取化合物46 ( 2.45g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物238 (1.25g, 37.3%) , mp : 180-181

。光譜數據如下：MS  $m/z$ : 335.3; IR (KBr)  $\text{cm}^{-1}$ : 3334.1 ( $\text{C}_3=\text{N-NH-}$ ), 1659.3 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 309 (4.40);  $^1\text{H-NMR}$  ( $\text{DMSO-}d_6$ )  $\delta$ : 5.26 (2H, s, H-2), 6.15 (2H, s,  $-\text{OCH}_2\text{O-}$ ), 6.21 (1H, t,  $J=7.0$  Hz, H-4'), 6.85-6.90 (3H, m, H-8, H-2', H-6'), 7.14 (2H, t,  $J=8.0$  Hz, H-3', H-5'), 7.49 (1H, s, H-5), 12.14 (1H, s,  $\text{C}_3=\text{N-NH-}$ );  $^{13}\text{C-NMR}$  ( $\text{DMSO-}d_6$ )  $\delta$ : 74.86 (C-2), 97.38 ( $-\text{OCH}_2\text{O-}$ ), 98.92 (C-3a), 102.63 (C-8), 103.10 (C-5), 110.97 (C-2', C-6'), 117.56 (C-4'), 118.88 (C-4a), 129.33 (C-3', C-5'), 133.94 (C-8a), 138.61 (C-1'), 145.70 (C-6), 145.88 (C-3), 151.78 (C-7), 167.62 (C-9a), 170.81 (C-4).

### 2-Methyl-7-methoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenyl-hydrazone (239)之合成

取化合物51 ( 2.45g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物239 (1.29g,38.7%) , mp : 245-246 。 光譜數據如下 : MS  $m/z$ : 334.8; IR (KBr)  $\text{cm}^{-1}$ : 3318.6 ( $\text{C}_3=\text{N-NH-}$ ), 1659.3 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 309 (4.50);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 1.59 (3H, d,  $J=6.4$  Hz,  $\text{C}_2\text{-CH}_3$ ), 3.84 (3H, s,  $\text{C}_7\text{-OCH}_3$ ), 5.55 (1H, q,  $J=6.4$  Hz,  $\text{C}_2\text{-H}$ ), 6.66 (1H, t,  $J=7.2$  Hz, H-4'), 6.87-6.92 (4H, m, H-6, H-8, H-2', H-6'), 7.17 (2H, t,  $J=7.4$  Hz, H-3', H-5'), 7.70 (1H, d,  $J=9.6$  Hz, H-5), 12.11 (1H, s,  $\text{C}_3=\text{N-NH-}$ ).

### 2-Methyl-6-methoxy-4-oxo-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3-one phenyl-hydrazone (240)之合成

取化合物52 ( 2.45g , 0.01mole ) 及phenylhydrazine (2.16g, 0.02mole)為原料 , 比照化合物219的合成法及處理步驟 , 得化合物240 (1.21g, 36.3%) , mp: 263-264 。 光譜數據如下 : MS  $m/z$ : 334.8; IR (KBr)  $\text{cm}^{-1}$ : 3334.1 ( $\text{C}_3=\text{N-NH-}$ ), 1643.9 ( $\text{C}_4=\text{O}$ ); UV  $\lambda_{\text{max}}$  nm (MeOH) ( $\log \epsilon$ ): 309 (4.06);  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  : 1.61 (3H, d,  $J=6.6$  Hz,  $\text{C}_2\text{-CH}_3$ ), 3.81 (3H, s,  $\text{C}_6\text{-OCH}_3$ ), 5.59 (1H, q,  $J=6.6$  Hz,  $\text{C}_2\text{-H}$ ), 6.68 (1H, t,  $J=7.3$  Hz, H-4'), 6.90 (2H, d,  $J=7.6$  Hz, H-2', H-6'), 7.13-7.22 (3H, m, H-5, H-3', H-5'), 7.30 (1H, dd,  $J=9.2, 2.6$  Hz, H-7), 7.39 (1H, d,  $J=9.2$  Hz, H-8), 12.31 (1H, s,  $\text{C}_3=\text{N-NH-}$ ).