

## (六) *N*-Substituted benzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]-quinolin-3,4-dione ( 83-97 ) 之合成

### *N*-benzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 83 ) 之合成

取化合物 **32** ( 2.35g , 0.01mole ) 懸著於 DMF 30 ml 中 , 加入無水  $K_2CO_3$  ( 1.38 g , 0.01 mole ) 加熱( 約 70~80 )使之溶解, 加入 benzyl chloride( 11.3g , 0.1mole ) , 反應 1 小時後加冰水, 以  $CHCl_3$  萃取, 取  $CHCl_3$  層, 以無水  $MgSO_4$  乾燥, 減壓濃縮後, 收集沉澱物以短程矽膠管柱層析 (  $CHCl_3/EtOH$  ) 沖提, 再以 MeOH 及  $CHCl_3$  做再結晶, 得白色棉絮狀結晶, 為化合物 **83** ( 2.48g , 76.31 % ), mp: 227-230 。光譜數據如下: MS *m/z*: 325; IR (KBr)  $cm^{-1}$ : 1721.0 (  $C_3=O$  ), 1605.3 (  $C_4=O$  ); UV  $\lambda_{max}$  nm (MeOH) (log  $\epsilon$ ): 249 ( 4.71 );  $^1H$ -NMR (DMSO- $d_6$ )  $\delta$ : 4.95 ( 2H, s, H-2 ), 5.60 ( 2H, s, H-10 ), 7.29-7.38 ( 5H, m, Ar-H ), 7.47 ( 1H, dd,  $J=8.5$  Hz, 1.5 Hz, H-5 ), 7.74 ( 1H, s, H-8 ), 8.18 ( 1H, d,  $J=8.5$  Hz, H-6 ),  $^{13}C$ -NMR (DMSO- $d_6$ )  $\delta$ : 46.53 ( C-10 ), 76.42 ( C-2 ), 100.77 ( C-3a ), 117.10 ( C-8 ), 125.24 ( C-6 ), 125.59 ( C-4a ), 126.84 ( C-13, C-15 ), 128.14 ( C-14 ), 128.82 ( C-5 ), 129.20 ( C-12, C-16 ), 134.81 ( C-11 ), 138.25 ( C-7 ), 139.39 ( C-8a ), 170.72 ( C-9a ), 175.22 ( C-4 ), 191.15 ( C-3 ).

### *N*-*o*-Methylbenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 84 ) 之合成

取化合物 **32** ( 2.35g , 0.01mole ) 和 *o*-methylbenzyl chloride ( 12.7g , 0.1mole ) 為原料, 比照化合物 **83** 的合成法及處理步驟, 得化合物 **84** ( 2.12g , 62.54 % ), mp: 248-250 。光譜數據如下: MS *m/z*: 339; IR (KBr)  $cm^{-1}$ : 1721.0 (  $C_3=O$  ), 1605.3 (  $C_4=O$  ); UV  $\lambda_{max}$  nm (MeOH) (log  $\epsilon$ ): 249 ( 4.75 );  $^1H$ -NMR (DMSO- $d_6$ )  $\delta$ : 2.45 ( 3H, s,  $C_{12}-CH_3$  ), 4.89 ( 2H, s, H-2 ), 5.53 ( 2H, s, H-10 ), 6.67 ( 1H, d,  $J=7.60$  Hz, H-13 ), 7.05-7.31 ( 3H, m, H-14, H-15, H-16 ), 7.48 ( 1H, dd,  $J=8.5$  Hz, 1.8 Hz, H-5 ), 7.56 ( 1H, d,  $J=1.6$  Hz, H-8 ), 8.21 ( 1H, dd,  $J=8.5$  Hz, 2.0 Hz, H-6 );  $^{13}C$ -NMR (DMSO- $d_6$ )  $\delta$ : 18.90 (  $C_{12}-CH_3$  ), 45.20 ( C-10 ), 76.40 ( C-2 ), 100.84 ( C-3a ), 117.00 ( C-8 ), 124.07 ( C-6 ), 125.34 ( C-4a ), 125.54 ( C-15 ), 126.62 ( C-14 ), 127.68 ( C-16 ), 128.82 ( C-13 ), 130.73 ( C-5 ), 132.51 ( C-11 ), 135.48 ( C-12 ), 138.38 ( C-7 ), 139.67 ( C-8a ), 170.77 ( C-9a ), 175.35 ( C-4 ), 191.03 ( C-3 ).

### *N*-*m*-Methylbenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 85 ) 之合成

取化合物 **32** ( 2.35g , 0.01mole ) 和 *m*-methylbenzyl chloride ( 12.7g , 0.1mole ) 為原料, 比照化合物 **83** 的合成法及處理步驟, 得化合物 **85** ( 2.58g , 76.11 % ), mp: 224~226 。光譜數據如下: MS *m/z*: 339; IR (KBr)  $cm^{-1}$ : 1721.0 (  $C_3=O$  ), 1605.3 (  $C_4=O$  ); UV  $\lambda_{max}$  nm (MeOH) (log  $\epsilon$ ): 249 ( 4.81 );  $^1H$ -NMR (DMSO- $d_6$ )  $\delta$ : 2.25 ( 3H, s,  $C_{13}-CH_3$  ), 4.94 ( 2H, s, H-2 ), 5.55 ( 2H, s, H-10 ), 7.08-7.24 ( 4H, m, Ar-H ), 7.46 ( 1H, d,  $J=9.3$  Hz, H-5 ), 7.71 ( 1H, s, H-8 ), 8.71 ( 1H, dd,  $J=8.5$  Hz, 0.9 Hz, H-6 );  $^{13}C$ -NMR (DMSO- $d_6$ )  $\delta$ : 21.18 (  $C_{13}-CH_3$  ), 46.50 ( C-10 ), 76.42 ( C-2 ), 100.80 ( C-3a ), 117.11 ( C-8 ), 123.86 ( C-6 ), 125.22 ( C-4a ), 125.58 ( C-16 ), 127.20 ( C-14 ), 128.81 ( C-12, C-15 ), 129.08 ( C-5 ), 134.75 ( C-11 ), 138.20 ( C-13 ),

138.54 ( C-7 ) , 139.43 ( C-8a ) , 170.72 ( C-9a ) , 175.21 ( C-4 ) , 191.20 ( C-3 ) .

### ***N-p*-Methylbenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 86 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *p*-methylbenzyl chloride ( 12.7g , 0.1mole ) 為原料 , 比照化合物 **83** 的合成法及處理步驟 , 得化合物 **86** ( 2.83g , 83.48 % ) , mp:242-245 。光譜數據如下 : MS *m/z*: 339; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ) , 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 250( 4.53 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 2.25 (3H, s,  $\text{C}_{14}\text{-CH}_3$ ), 4.94 (2H, s, H-2), 5.54 (2H, s, H-10), 7.15 (2H, d,  $J=8.2$  Hz, H-13, H-15), 7.26 (2H, d,  $J=8.1$  Hz, H-12, H-16), 7.45 (1H, dd,  $J=8.5$  Hz, 1.8 Hz, H-5), 7.72 (1H, d,  $J=1.7$  Hz, H-8), 8.16 (1H, d,  $J=8.5$  Hz, H-6) ;  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 20.86 (  $\text{C}_{14}\text{-CH}_3$  ) , 46.34 ( C-10 ) , 76.41 ( C-2 ) , 100.75 ( C-3a ) , 117.15 ( C-8 ) , 125.21 ( C-6 ) , 125.60( C-4a ) , 126.87( C-12, C-16 ) , 128.79( C-5 ) , 129.74( C-13, C-15 ) , 131.75 ( C-11 ) , 137.46 ( C-14 ) , 138.20 ( C-7 ) , 139.36 ( C-8a ) , 170.69 ( C-9a ) , 175.17 ( C-4 ) , 191.14 ( C-3 ) .

### ***N-m*-Methoxybenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 87 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *m*-methoxybenzyl chloride ( 14.3g , 0.1mole ) 為原料 , 比照化合物 **83** 的合成法及處理步驟 , 得化合物 **87** ( 2.05g , 57.75 % ) , mp:243-246 。光譜數據如下 : MS *m/z*: 355; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ) , 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 249( 4.70 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 3.72 (3H, s,  $\text{OCH}_3$  ) , 4.95 (2H, s, H-2), 5.56 (2H, s, H-10), 6.84-6.90 (2H, m, H-14, H-16), 6.96 (1H, s, H-12), 7.26 (1H, t,  $J=8.1$ Hz, H-15), 7.45 (1H, dd,  $J=8.5$ Hz, 1.5Hz, H-5), 7.73 (1H, d,  $J=1.6$ Hz, H-8), 8.16 (1H, d,  $J=8.5$ Hz, H-6) ;  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 46.45 ( C-10 ) , 55.33(  $\text{C}_{13}\text{-OCH}_3$  ) , 76.44( C-2 ) , 100.77( C-3a ) , 112.99( C-14 ) , 113.20 ( C-8 ) , 117.09 ( C-12 ) , 118.70( C-6 ) , 125.24( C-4a ) , 125.56( C-16 ) , 128.79 ( C-15 ) , 130.42 ( C-5 ) , 136.38 ( C-11 ) , 138.22 ( C-7 ) , 139.42 ( C-8a ) , 159.83 ( C-13 ) , 170.71 ( C-9a ) , 175.19 ( C-4 ) , 191.16( C-3 ) .

### ***N-p*-Methoxybenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 88 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *p*-methoxybenzyl chloride ( 14.3g , 0.1mole ) 為原料 , 比照化合物 **83** 的合成法及處理步驟 , 得化合物 **88** ( 2.44g , 68.73 % ) , mp:259~263 。光譜數據如下 : MS *m/z*: 355; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ) , 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 248( 4.85 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 3.70 (3H, s,  $\text{OCH}_3$ ), 4.95 (2H, s, H-2), 5.51 (2H, s, H-10), 6.90 (2H, d,  $J=8.3$ Hz, H-12, H-16), 7.33 (2H, d,  $J=8.4$ Hz, H-13, H-15), 7.45 (1H, dd,  $J=8.5$ Hz, 1.6Hz, H-5), 7.77 (1H, s, H-8), 8.16 (1H, d,  $J=8.5$ Hz, H-6) ;  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 46.02 ( C-10 ) , 55.30 (  $\text{C}_{14}\text{-OCH}_3$  ) , 76.40 ( C-2 ) , 100.76 ( C-3a ) , 114.54 ( C-13, C-15 ) , 117.1 ( C-8 ) , 125.19 ( C-6 ) , 125.60 ( C-4a ) , 126.55 ( C-11 ) , 128.47 ( C-12, C-16 ) , 128.78 ( C-5 ) , 138.19 ( C-7 ) , 139.30 ( C-8a ) , 159.09 ( C-14 ) , 170.68 ( C-9a ) , 175.11 ( C-4 ) , 191.16 ( C-3 ) .

### ***N*-*o*-Fluorobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 89 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *o*-fluorobenzyl chloride ( 13.1g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **89** ( 2.01 g , 58.60 % ) , mp:224~227 。光譜數據如下:MS *m/z*: 343; IR (KBr)  $\text{cm}^{-1}$ : 1721.0(  $\text{C}_3=\text{O}$  ) , 1605.3 (  $\text{C}_4=\text{O}$  ) ; UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 249 ( log  $\epsilon$  =4.62 ) ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.93 (2H, s, H-2), 5.63 (2H, s, H-10), 7.14-7.34 (4H, m, Ar-H), 7.48 (1H, dd,  $J=8.5\text{Hz}$ , 1.8Hz, H-5), 7.75 (1H, d, $J=1.7\text{Hz}$ , H-8), 8.18 (1H, d,  $J=8.5\text{Hz}$ , H-6) ;  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 41.49 ( C-10 ) , 76.49 ( C-2 ) , 100.89 ( C-3a ) , 115.78 ( C-8 ) , 116.19 ( C-13 ) , 116.76 ( C-6 ) , 121.65 ( C-4a ) , 121.92 ( C-11 ) , 125.33 ( C-15 ) , 125.52 ( C-14 ) , 128.56 ( C-16 ) , 128.88 ( C-5 ) , 130.41 ( C-7 ) , 138.37 ( C-8a ) , 139.40 ( C-12 ) , 170.71 ( C-9a ) , 175.36 ( C-4 ) , 191.03 ( C-3 ) .

### ***N*-*m*-Fluorobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 90 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *m*-fluorobenzyl chloride ( 13.1g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **90** ( 2.33 g , 67.93 % ) , mp:238-240 。光譜數據如下:MS *m/z*: 343; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ) , 1614.9 (  $\text{C}_4=\text{O}$  ) , UV  $\lambda_{\text{max}}$  ( MeOH ) nm : 249 ( 4.71 ) ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.93 (2H, s, H-2), 5.61 (2H, s, H-10), 7.14-7.48 (5H, m, Ar-H, H-5), 7.71 (1H, d,  $J=1.6\text{Hz}$ , H-8), 8.17 (1H, d,  $J=8.5\text{Hz}$ , H-6) ;  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 46.01 ( C-10 ) , 76.46 ( C-2 ) , 100.91 ( C-3a ) , 113.76 ( C-8 ) , 114.60 ( C-14 ) , 115.25 ( C-12 ) , 116.92 ( C-6 ) , 122.88 ( C-4a ) , 125.45 ( C-16 ) , 128.84 ( C-15 ) , 131.15 ( C-5 ) , 131.32 ( C-11 ) , 137.70 ( C-7 ) , 138.28 ( C-8a ) , 139.34 ( C-13 ) , 170.75 ( C-9a ) , 175.27 ( C-4 ) , 191.18 ( C-3 ) .

### ***N*-*p*-Fluorobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 91 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *p*-fluorobenzyl chloride ( 13.1g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **91** ( 2.58g , 75.22 % ) , mp:237~241 。光譜數據如下:MS *m/z*: 343; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ) , 1605.3 (  $\text{C}_4=\text{O}$  ) , ; UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 250 ( 4.57 ) ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.94 (2H, s, H-2), 5.58 (2H, s, H-10), 7.18 (2H, t,  $J=8.8\text{Hz}$ , H-13, H-15), 7.44 (3H, m, H-5, H-12, H-16), 7.74 (1H, s, H-8), 8.15 (1H, d,  $J=8.5\text{Hz}$ , H-6) ;  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 45.85 ( C-10 ) , 76.43 ( C-2 ) , 100.84 ( C-3a ) , 115.79 ( C-8 ) , 116.22 ( C-6 ) , 117.02 ( C-4a ) , 125.26 ( C-13 ) , 125.60 ( C-15 ) , 128.83 ( C-12 ) , 129.10 ( C-16 ) , 129.26 ( C-5 ) , 131.04 ( C-7, C-11 ) , 138.29 ( C-8a ) , 139.28 ( C-14 ) , 170.71 ( C-9a ) , 175.19 ( C-4 ) , 191.16 ( C-3 ) .

### ***N*-*o*-Chlorobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 92 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *o*-chlorobenzyl chloride ( 14.7g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **92** ( 2.16g , 60.17 % )，mp:258~262。光譜數據如下:MS *m/z*: 359; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ), 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 249( 4.64 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.90 (2H, s, H-2), 5.59 (2H, s, H-10), 7.04 (1H, d,  $J=7.0\text{Hz}$ , H-16), 7.22-7.61 (5H, m, Ar-H, H-5, H-8), 8.19 (1H, d,  $J=8.5\text{Hz}$ , H-6);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 45.03( C-10 ), 76.52( C-2 ), 100.97 ( C-3a ), 116.70 ( C-8 ), 125.39 ( C-6 ), 125.51 ( C-4a ), 127.35 ( C-15 ), 128.16 ( C-14 ), 128.87 ( C-13 ), 129.85 ( C-16 ), 130.05 ( C-5 ), 131.77 ( C-12 ), 131.97( C-11 ), 138.46( C-7 ), 139.53( C-8 ), 170.76( C-9a ), 175.37( C-4 ), 191.00 ( C-3 ) .

### ***N*-*m*-Chlorobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione( 93 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *m*-chlorobenzyl chloride ( 14.7g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **93** ( 2.38g , 66.30 % )，mp:247~250。光譜數據如下:MS *m/z*: 359; IR (KBr)  $\text{cm}^{-1}$ : 1721.0(  $\text{C}_3=\text{O}$  ), 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 250( 4.48 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.93 (2H, s, H-2), 5.60 (2H, s, H-10), 7.29-7.39 (3H, m, H-14, H-15, H-16), 7.47 (1H, dd,  $J=8.5\text{Hz}$ , 1.7Hz, H-5), 7.52 (1H, s, H-12), 7.72 (1H, d,  $J=1.7\text{Hz}$ , H-8), 8.17 (1H, d,  $J=8.5\text{Hz}$ , H-6);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 45.98( C-10 ), 76.47( C-2 ), 100.95( C-3a ), 116.92 ( C-8 ), 125.31 ( C-6 ), 125.42 ( C-4a ), 125.62 ( C-16 ), 126.88 ( C-14 ), 128.18 ( C-12 ), 128.86 ( C-15 ), 131.05 ( C-5 ), 133.82 ( C-13 ), 137.43 ( C-11 ), 138.31 ( C-7 ), 139.34 ( C-8a ), 170.76 ( C-9a ), 175.29 ( C-4 ), 191.19 ( C-3 ) .

### ***N*-*p*-Chlorobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 94 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *p*-chlorobenzyl chloride ( 14.7g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **94** ( 2.77g , 77.16 % )，mp:251~253。光譜數據如下:MS *m/z*: 359; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ), 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 249( 4.63 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.93 (2H, s, H-2), 5.59 (2H, s, H-10), 7.41 (4H, s, Ar-H), 7.46 (1H, dd,  $J=8.5\text{Hz}$ , H-5), 7.72 (1H, d,  $J=1.7\text{Hz}$ , H-8), 8.17 (1H, d,  $J=8.5\text{Hz}$ , H-6);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 45.92( C-10 ), 76.45( C-2 ), 100.85( C-3a ), 116.96( C-8 ), 125.30( C-6 ), 125.59( C-13, C-15 ), 128.87( C-4a, C-12, C-16 ), 129.12( C-5 ), 132.78( C-14 ), 133.90( C-11 ), 138.34 ( C-7 ), 139.30 ( C-8a ), 170.73 ( C-9a ), 175.23 ( C-4 ), 191.14 ( C-3 ) .

### ***N*-*o*-Nitrobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 95 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *o*-nitrobenzyl chloride ( 15.8g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **95** ( 2.31 g , 62.43 % ) , mp:263~267 。光譜數據如下:MS *m/z*: 370; IR (KBr)  $\text{cm}^{-1}$ : 1721.0(  $\text{C}_3=\text{O}$  ), 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 250( 4.60 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.88 (2H, s, H-2), 5.94 (2H, s, H-10), 7.09 (1H, m, H-16), 7.48 (1H, d,  $J=8.5\text{Hz}$ , H-5), 7.62 (2H, t,  $J=4.2\text{Hz}$ , H-14, H-15), 7.85 (1H, d,  $J=1.1\text{Hz}$ , H-8), 8.20 (1H, d,  $J=8.5\text{Hz}$ , H-6), 8.30 (1H, m, H-13);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 45.71( C-10 ), 76.49( C-2 ), 101.03( C-3a ), 116.99( C-8 ), 125.48( C-6, C-4a ), 126.03( C-13 ), 126.96( C-14 ), 128.77( C-16 ), 129.27 ( C-5 ), 130.37 ( C-11 ), 135.03 ( C-15 ), 138.65 ( C-7 ), 139.65 ( C-8a ), 147.41 ( C-12 ), 170.94 ( C-9a ), 175.62 ( C-4 ), 191.03 ( C-3 ) .

### ***N*-*m*-Nitrobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 96 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *m*-nitrobenzyl chloride ( 15.8g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **96** ( 2.38 g , 64.32 % ) , mp:291-294 。光譜數據如下:MS *m/z*: 370; IR (KBr)  $\text{cm}^{-1}$ : 1713.3(  $\text{C}_3=\text{O}$  ), 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 249( 4.68 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.93 (2H, s, H-2), 5.76 (2H, s, H-10), 7.47 (1H, d,  $J=8.5\text{Hz}$ , H-5), 7.66 (1H, t,  $J=7.8\text{Hz}$ , H-15), 7.73 (1H, d,  $J=6.8\text{Hz}$ , H-16), 7.80 (1H, s, H-8), 8.13~8.21 (2H, m, H-6, H-14), 8.33 (1H, s, H-12);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 45.86( C-10 ), 76.52( C-2 ), 100.99( C-3a ), 116.84 ( C-8 ), 122.14 ( C-6 ), 123.08 ( C-4a ), 125.40 ( C-14 ), 125.64 ( C-12 ), 128.92 ( C-15 ), 130.75 ( C-5 ), 133.16 ( C-16 ), 137.23 ( C-11 ), 138.47 ( C-7 ), 139.34 ( C-8a ), 148.28 ( C-13 ), 170.77 ( C-9a ), 175.40 ( C-4 ), 191.13 ( C-3 ) .

### ***N*-*p*-Nitrobenzyl-7-chloro-2,3,4,9-tetrahydrofuro[2,3-*b*]quinolin-3,4-dione ( 97 ) 之合成**

取化合物 **32** ( 2.35g , 0.01mole ) 和 *p*-nitrobenzyl chloride ( 15.8g , 0.1mole ) 為原料，比照化合物 **83** 的合成法及處理步驟，得化合物 **97** ( 2.75g , 74.32 % ) , mp:293-296 。光譜數據如下:MS *m/z*: 370; IR (KBr)  $\text{cm}^{-1}$ : 1705.6(  $\text{C}_3=\text{O}$  ), 1605.3 (  $\text{C}_4=\text{O}$  ); UV  $\lambda_{\text{max}}$  nm (MeOH) (log  $\epsilon$ ): 249( 4.67 );  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$ : 4.93 (2H, s, H-2), 5.77 (2H, s, H-10), 7.49 (1H, dd,  $J=8.5\text{Hz}$ , 1.8Hz, H-5), 7.63 (2H, d,  $J=8.8\text{Hz}$ , H-12, H-16), 7.74 (1H, d,  $J=1.7\text{Hz}$ , H-8), 8.18-8.22 (3H, m, H-6, H-13, H-15);  $^{13}\text{C-NMR}$  (DMSO- $d_6$ )  $\delta$ : 46.12( C-10 ), 76.51( C-2 ), 100.96( C-3a ), 116.83( C-8 ), 124.19( C-13, C-15 ), 125.42( C-6 ), 125.64( C-4a ), 128.09( C-12, C-16 ), 128.95 ( C-5 ), 138.45 ( C-7 ), 139.36 ( C-11 ), 142.64 ( C-8a ), 147.35 ( C-14 ), 170.77 ( C-9a ), 175.35 ( C-4 ), 191.10 ( C-3 ) .