

## SUPPORTING INFORMATION FOR

### **Facile access to regio- and stereoselective synthesis of highly functionalized spiro[indoline-3,2'-pyrrolidines] incorporating pyrene moiety: An experimental and theoretical study**

Essam M. Hussein<sup>a,b</sup>, Ziad Moussa<sup>c</sup>, Nizar El Guesmi<sup>a,c</sup>, Saleh A. Ahmed<sup>\*a,b</sup>

<sup>a</sup> Chemistry Department of Chemistry, Faculty of Applied Science, Umm Al-Qura University,  
21955 Makkah, Saudi Arabia

<sup>b</sup> Department of Chemistry, Faculty of Science, Assiut university, 71516 Assiut, Egypt

<sup>c</sup> Department of Chemistry, Faculty of Science, Taibah University, P.O. Box 30002, Almadinah  
Almunawarrah, Saudi Arabia

<sup>d</sup> Département de chimie, Faculté des Sciences de Monastir, Avenue de l'Environnement,  
5019 Monastir, Tunisia

Correspondence may be addressed to:

Saleh A. Ahmed: E-mail address: [saahmed@uqu.edu.sa](mailto:saahmed@uqu.edu.sa), [saleh.a.ahmed@aun.edu.eg](mailto:saleh.a.ahmed@aun.edu.eg),  
[saleh\\_63@hotmail.com](mailto:saleh_63@hotmail.com)

Tel./Fax: + 966 530435760

1D NMR Spectra are provided for all new compounds: **22-33**. 2D NMR spectra are provided for **22, 24, 26, 27, 32, 33**.

## Table of Contents:

page

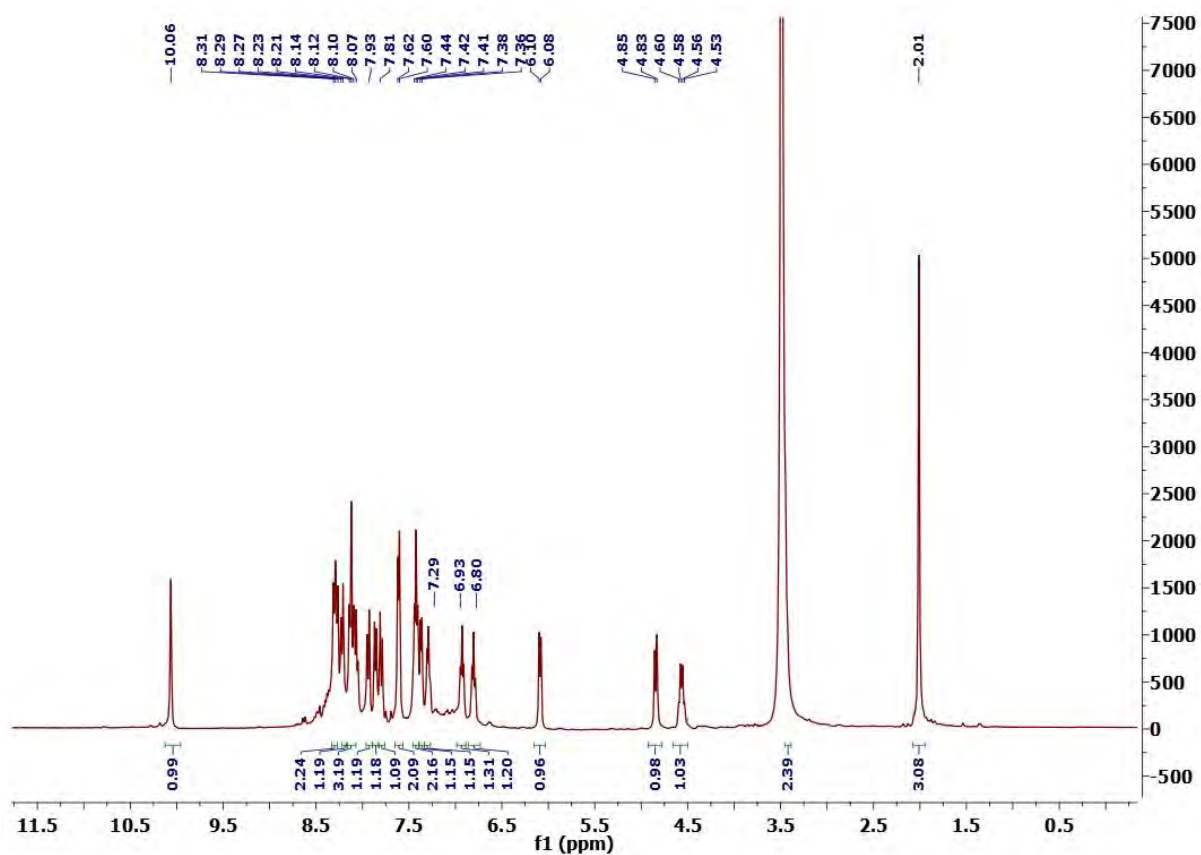
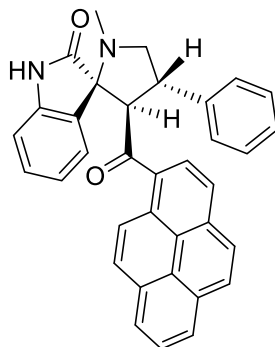
<b><sup>1</sup>H NMR spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S6</b>
<b>DEPT-90 NMR spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S7</b>
<b>DEPT-135 NMR spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S8</b>
<b><sup>13</sup>C NMR spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S9</b>
<b><sup>1</sup>H-<sup>1</sup>H-COSY spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S10</b>
<b><sup>1</sup>H-<sup>13</sup>C-HSQC spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S11</b>
<b><sup>1</sup>H-<sup>13</sup>C-HMBC spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S12</b>
<b><sup>1</sup>H-<sup>1</sup>H ROESY spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S13</b>
<b><sup>1</sup>H-<sup>1</sup>H TOCSY spectrum of (3S,3'R,4'S)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)</b>	<b>S14</b>
<b><sup>1</sup>H NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S15</b>
<b>DEPT-90 NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S16</b>
<b>DEPT-135 NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S17</b>
<b><sup>13</sup>C NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S18</b>
<b><sup>1</sup>H-<sup>1</sup>H-COSY NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S19</b>
<b><sup>1</sup>H-<sup>13</sup>C-HSQC NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S20</b>
<b><sup>1</sup>H-<sup>13</sup>C-HMBC NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-</b>	<b>S21</b>

<b>methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	
<b><sup>1</sup>H-<sup>1</sup>H ROESY NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S22</b>
<b>HSQC-TOCSY NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S23</b>
<b>TOCSY NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)</b>	<b>S24</b>
<b><sup>1</sup>H NMR spectrum of (3S,3'R,4'S)-4'-(4-chlorophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (23)</b>	<b>S25</b>
<b><sup>13</sup>C NMR spectrum of (3S,3'R,4'S)-4'-(4-chlorophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (23)</b>	<b>S26</b>
<b><sup>1</sup>H NMR spectrum of (3S,3'R,4'S)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)</b>	<b>S27</b>
<b><sup>13</sup>C NMR spectrum of (3S,3'R,4'S)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)</b>	<b>S28</b>
<b><sup>1</sup>H-<sup>1</sup>H-COSY NMR spectrum of (3S,3'R,4'S)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)</b>	<b>S29</b>
<b><sup>1</sup>H-<sup>13</sup>C-HSQC NMR spectrum of (3S,3'R,4'S)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)</b>	<b>S30</b>
<b><sup>1</sup>H-<sup>13</sup>C-HMBC NMR spectrum of (3S,3'R,4'S)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)</b>	<b>S31</b>
<b><sup>1</sup>H NMR spectrum of (3S,3'R,4'S)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)</b>	<b>S32</b>
<b>DEPT-135 NMR spectrum of (3S,3'R,4'S)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)</b>	<b>S33</b>
<b><sup>13</sup>C NMR spectrum of (3S,3'R,4'S)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)</b>	<b>S34</b>
<b><sup>1</sup>H-<sup>1</sup>H-COSY NMR spectrum of (3S,3'R,4'S)-4'-(4-cyanophenyl)-1'-</b>	<b>S35</b>

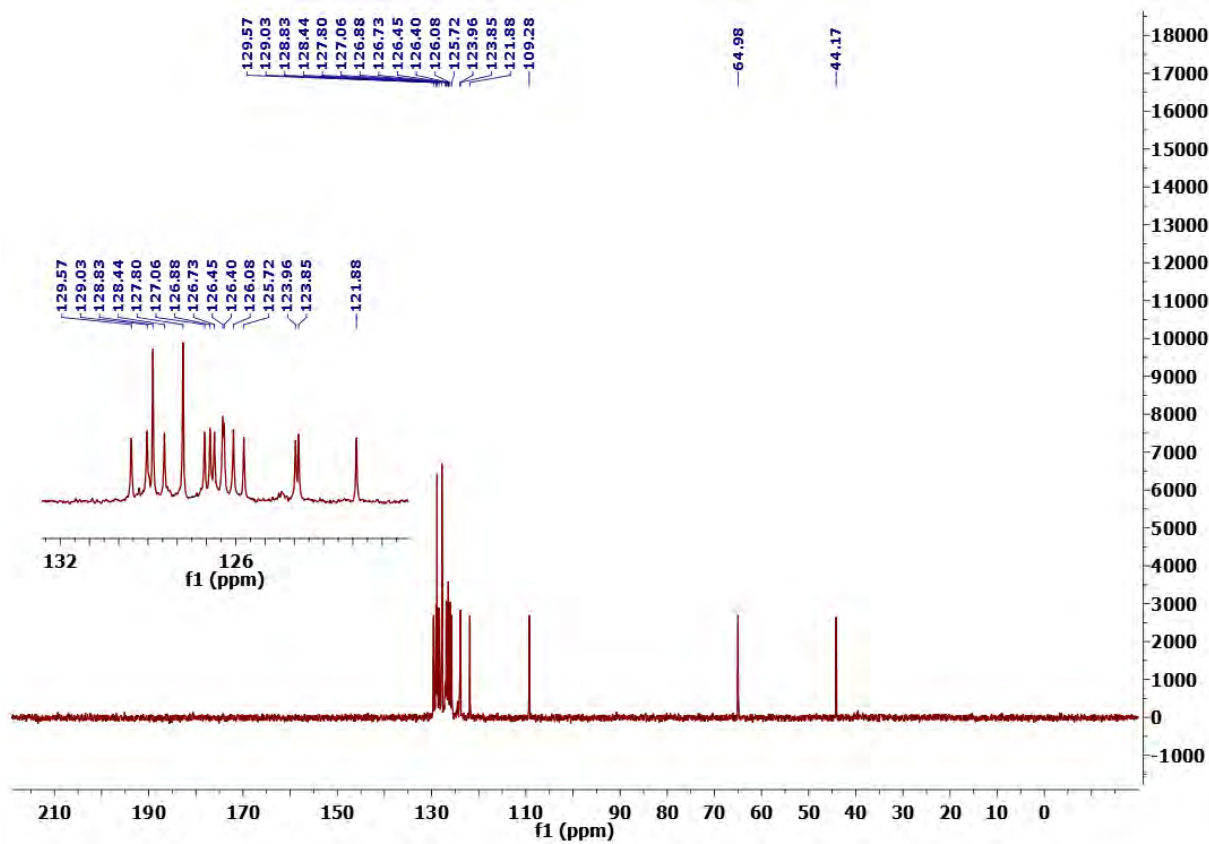
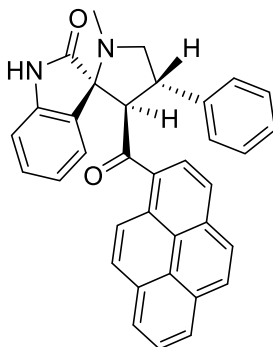
methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)	
<sup>1</sup> H- <sup>13</sup> C-HSQC NMR spectrum of (3S,3'R,4'S)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)	S36
<sup>1</sup> NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S37
DEPT-90 NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S38
<sup>13</sup> C NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S39
<sup>1</sup> H- <sup>1</sup> H-COSY NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S40
<sup>1</sup> H- <sup>13</sup> C-HSQC NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S41
<sup>1</sup> H- <sup>13</sup> C-HMBC NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S42
<sup>1</sup> H- <sup>1</sup> H ROESY NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S43
TOCSY NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C <sub>40</sub> H <sub>27</sub> N <sub>3</sub> O <sub>4</sub> )	S44
<sup>1</sup> H NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C <sub>41</sub> H <sub>27</sub> N <sub>3</sub> O <sub>2</sub> )	S45
DEPT-90 NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C <sub>41</sub> H <sub>27</sub> N <sub>3</sub> O <sub>2</sub> )	S46
<sup>13</sup> C NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C <sub>41</sub> H <sub>27</sub> N <sub>3</sub> O <sub>2</sub> )	S47

(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C <sub>41</sub> H <sub>27</sub> N <sub>3</sub> O <sub>2</sub> )	
<sup>1</sup> H- <sup>1</sup> H-COSY NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C <sub>41</sub> H <sub>27</sub> N <sub>3</sub> O <sub>2</sub> )	S48
<sup>1</sup> H- <sup>13</sup> C-HSQC NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C <sub>41</sub> H <sub>27</sub> N <sub>3</sub> O <sub>2</sub> )	S49
<sup>1</sup> H- <sup>13</sup> C-HMBC NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C <sub>41</sub> H <sub>27</sub> N <sub>3</sub> O <sub>2</sub> )	S50

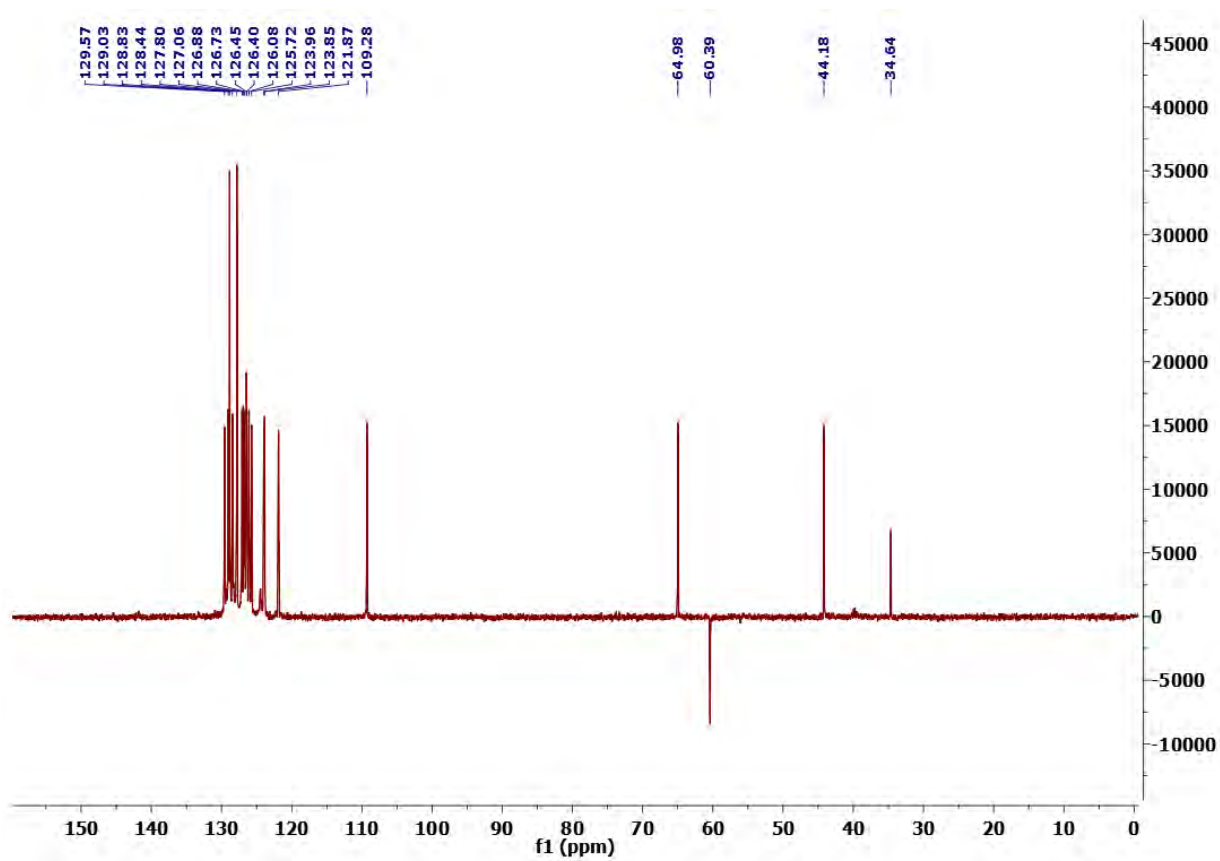
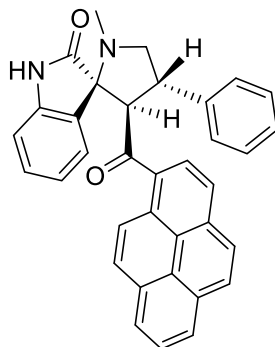
$^1\text{H}$  NMR spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)



DEPT-90 NMR spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)

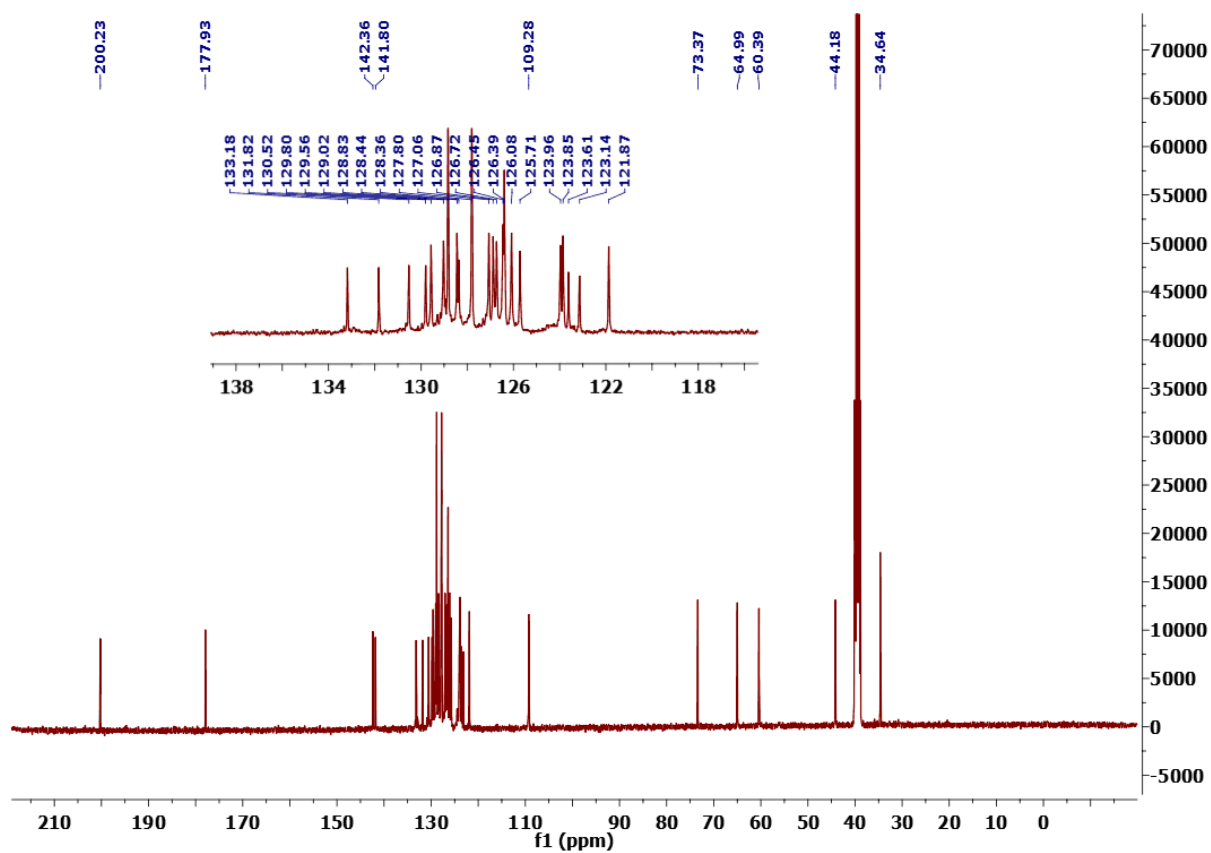
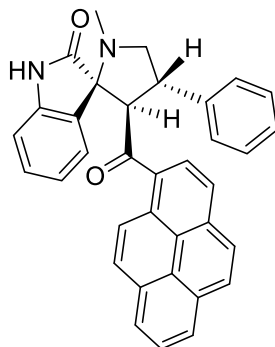


DEPT-135 NMR spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)

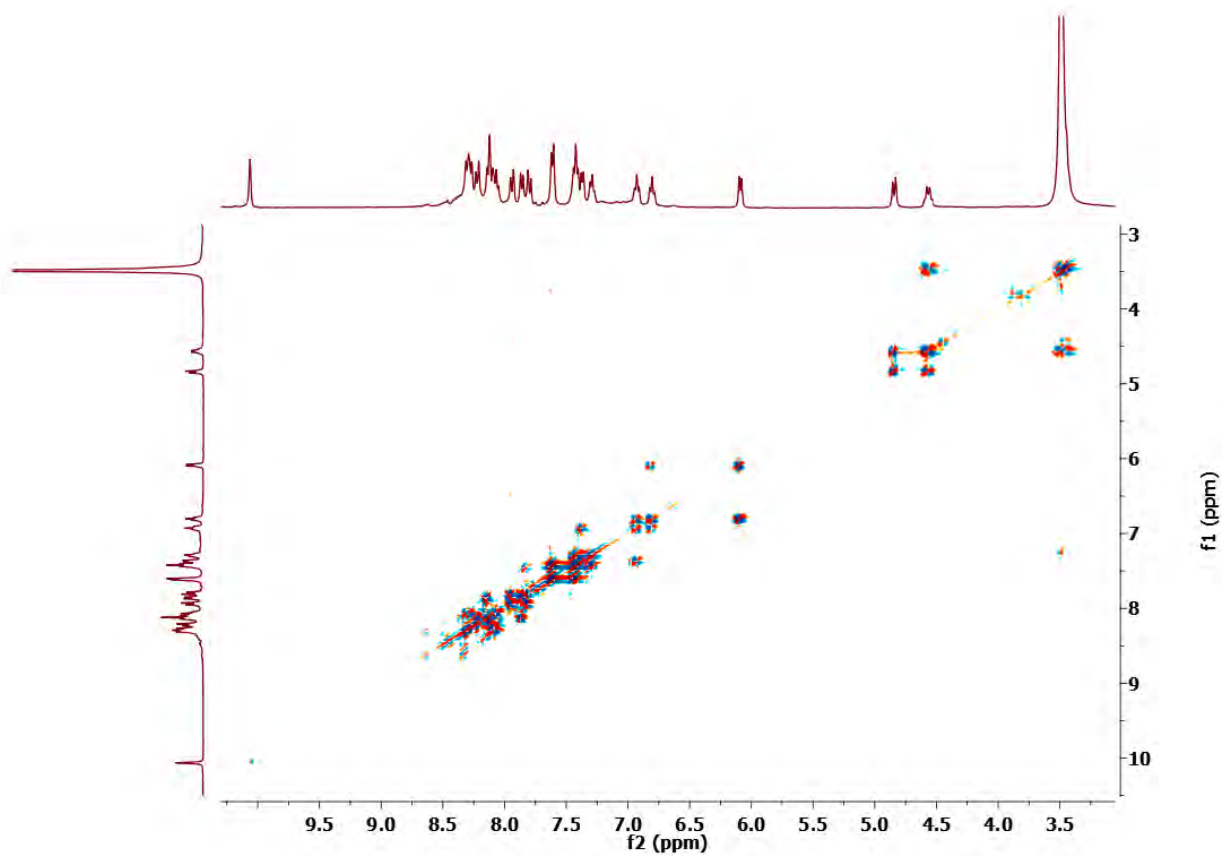
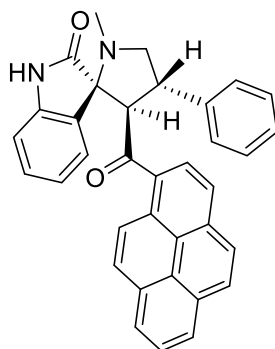




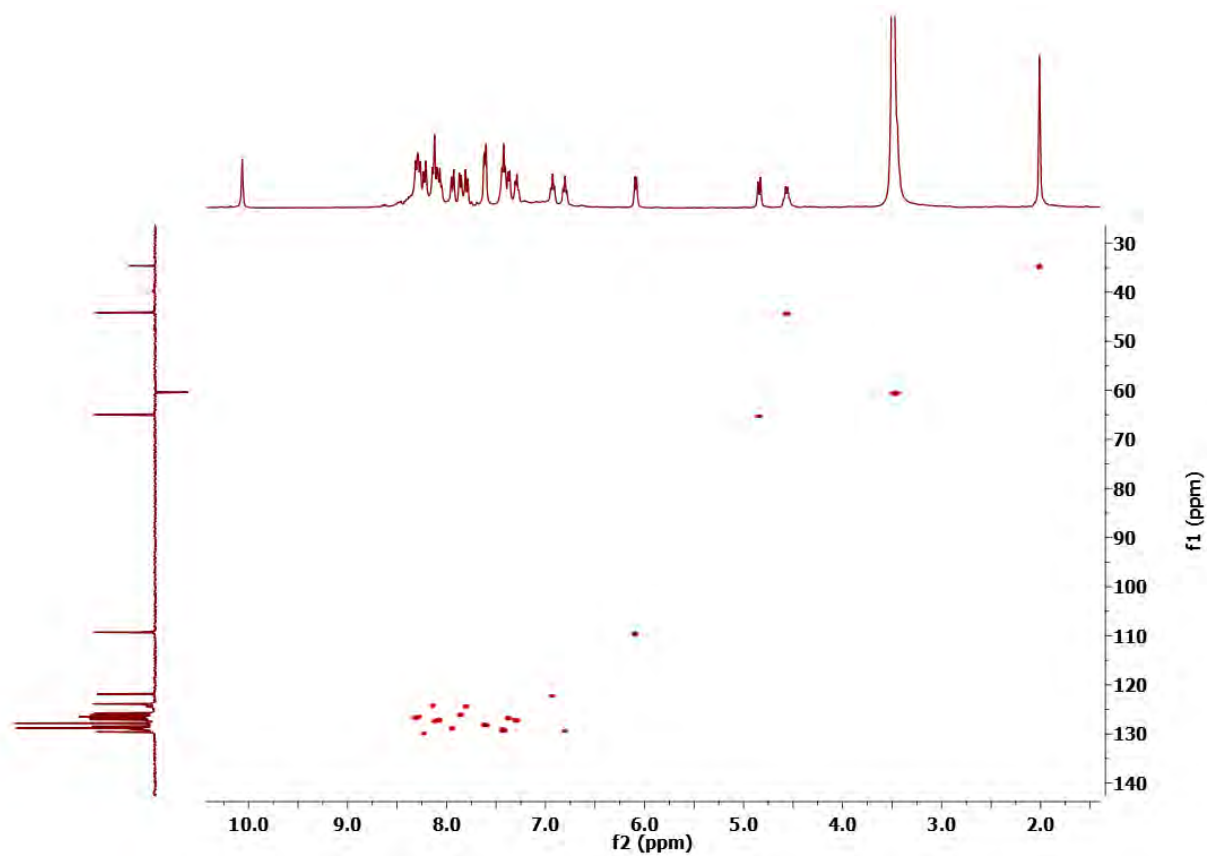
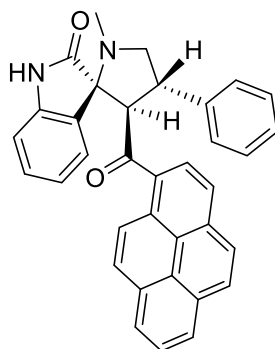
<sup>13</sup>C NMR spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)



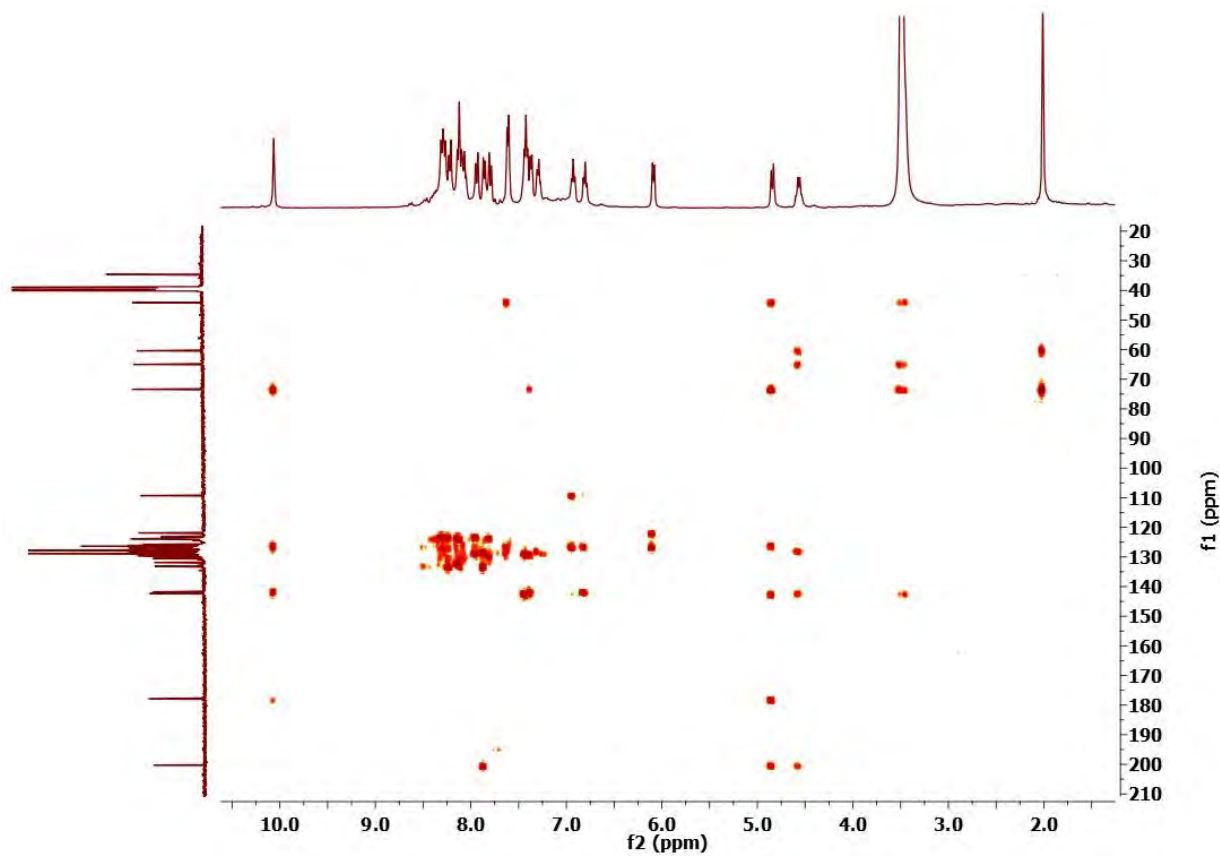
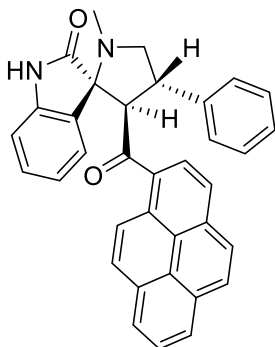
$^1\text{H}$ - $^1\text{H}$ -COSY spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)



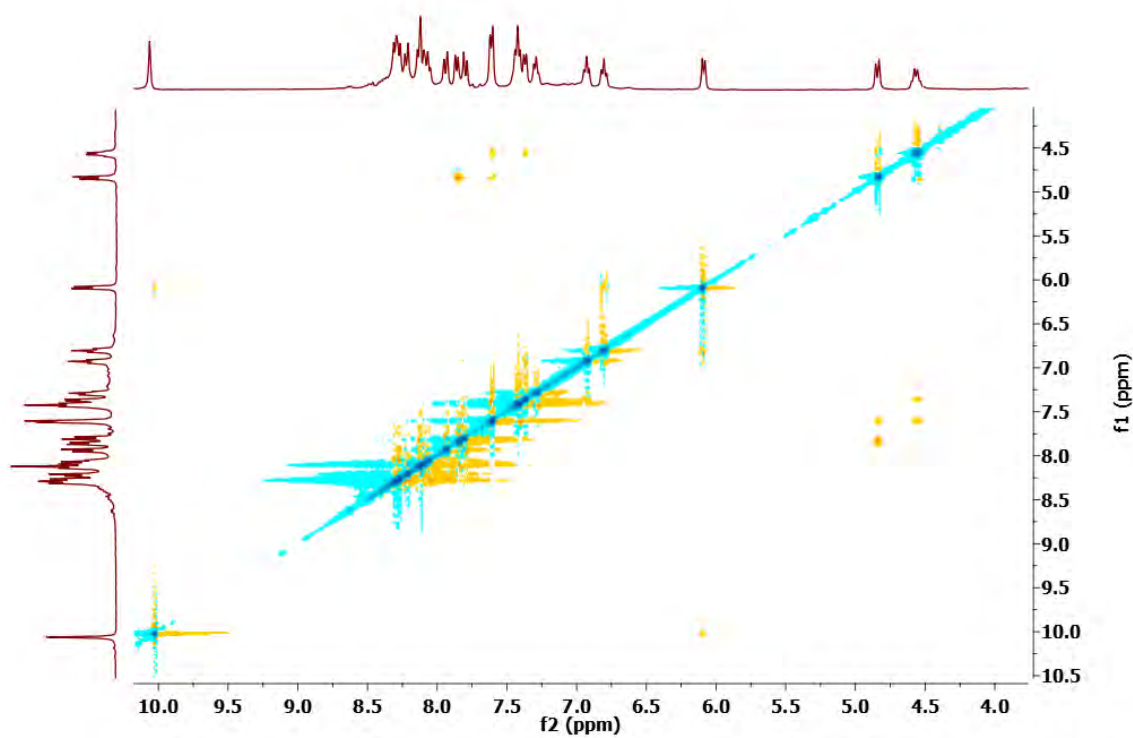
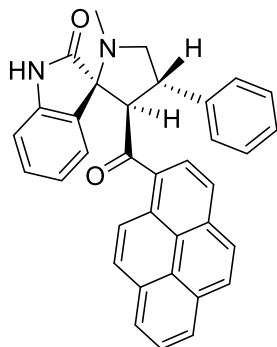
$^1\text{H}$ - $^{13}\text{C}$ -HSQC spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)



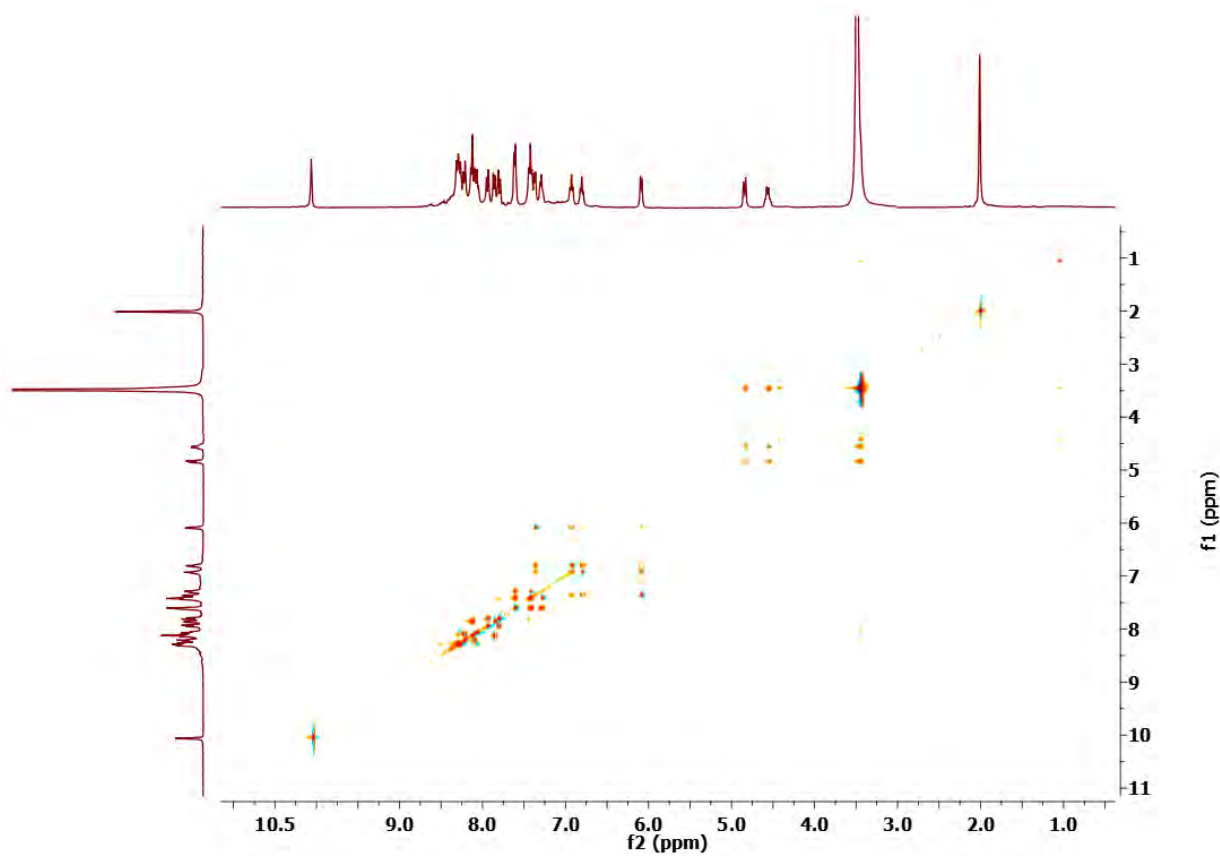
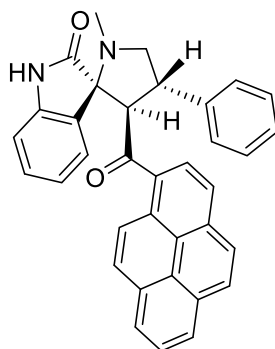
$^1\text{H}$ - $^{13}\text{C}$ -HMBC spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)



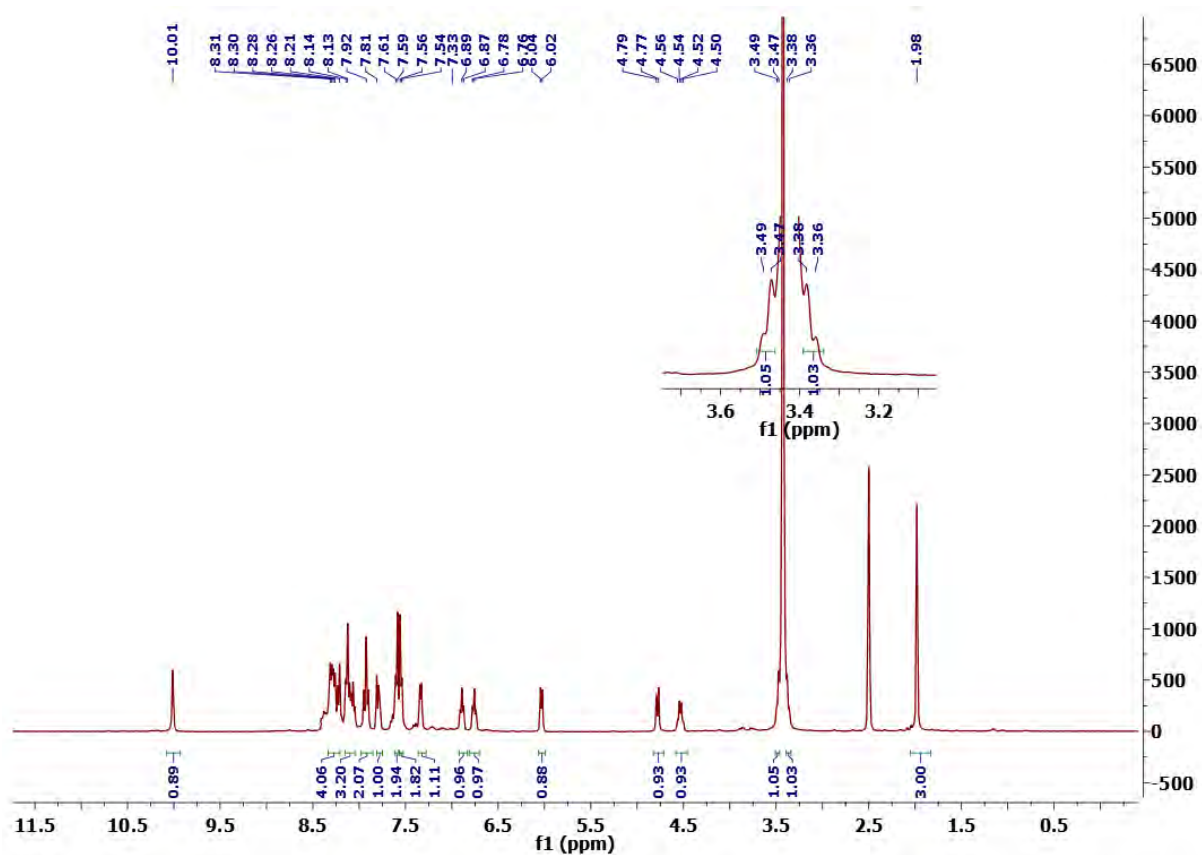
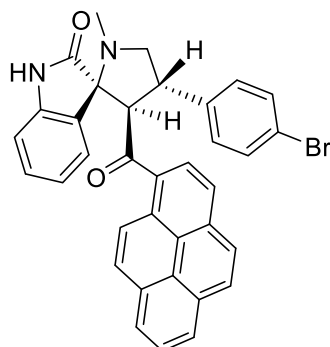
$^1\text{H}$ - $^1\text{H}$  ROESY spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)



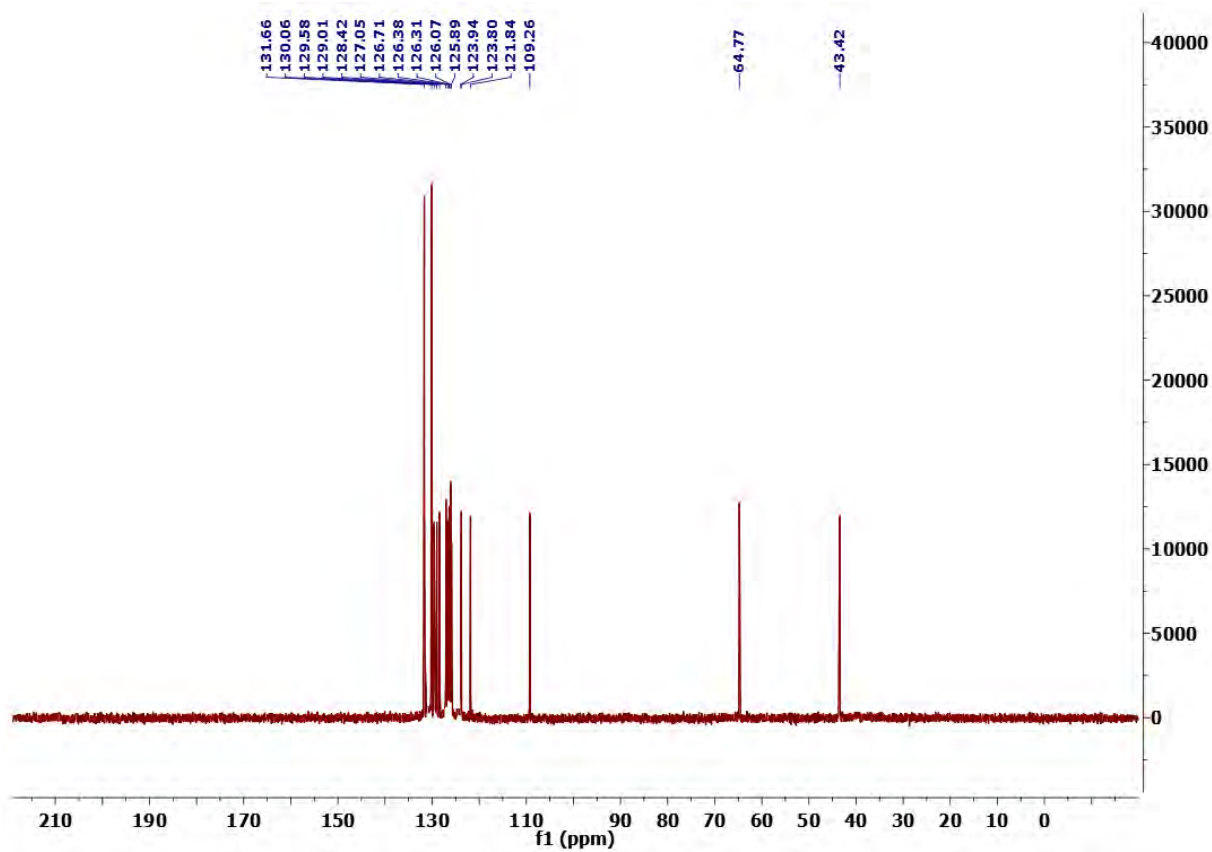
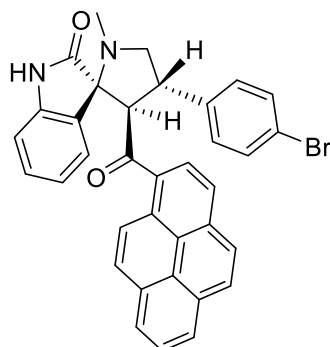
$^1\text{H}$ - $^1\text{H}$  TOCSY spectrum of (3*S*,3'*R*,4'*S*)-1'-methyl-4'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (22)



<sup>1</sup>H NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)

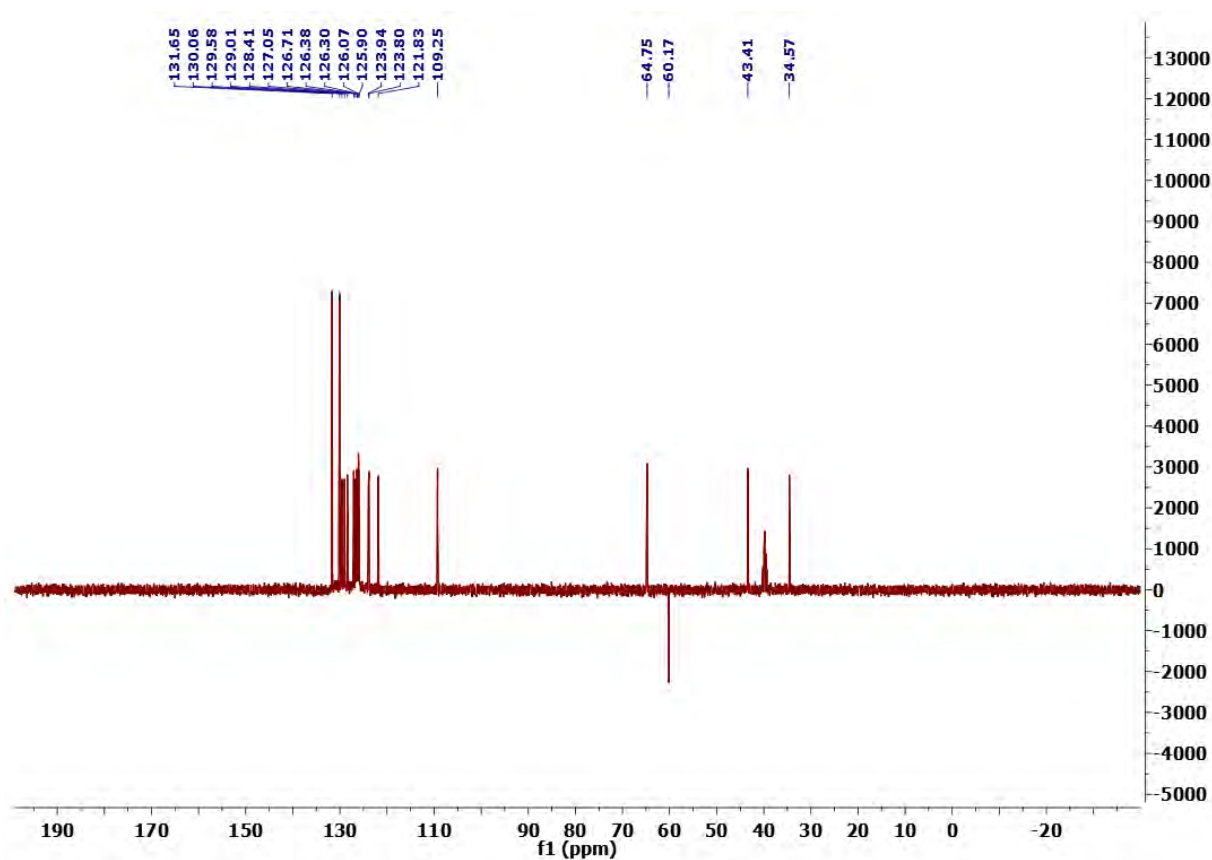
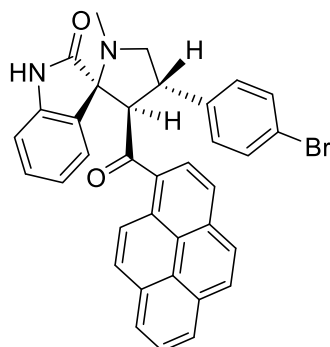


DEPT-90 NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)

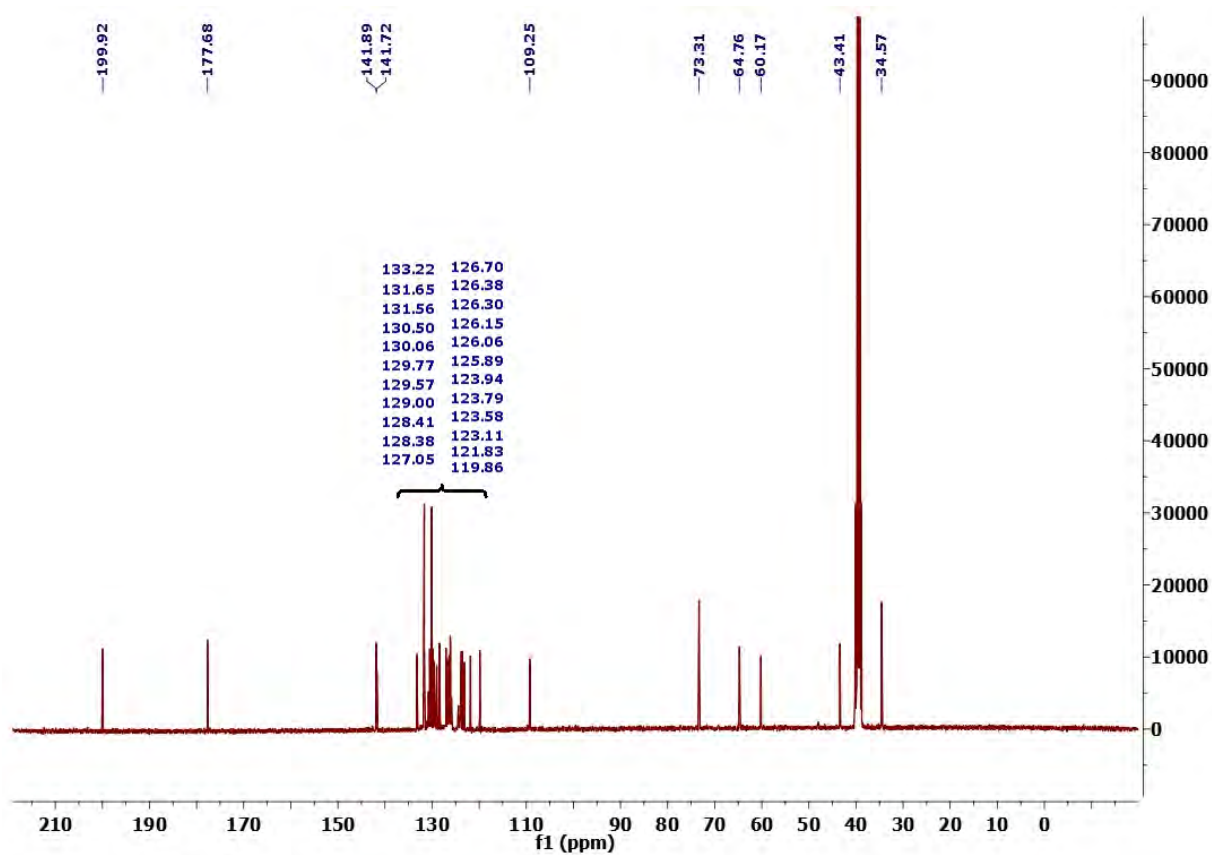
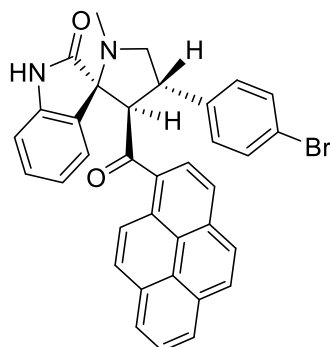




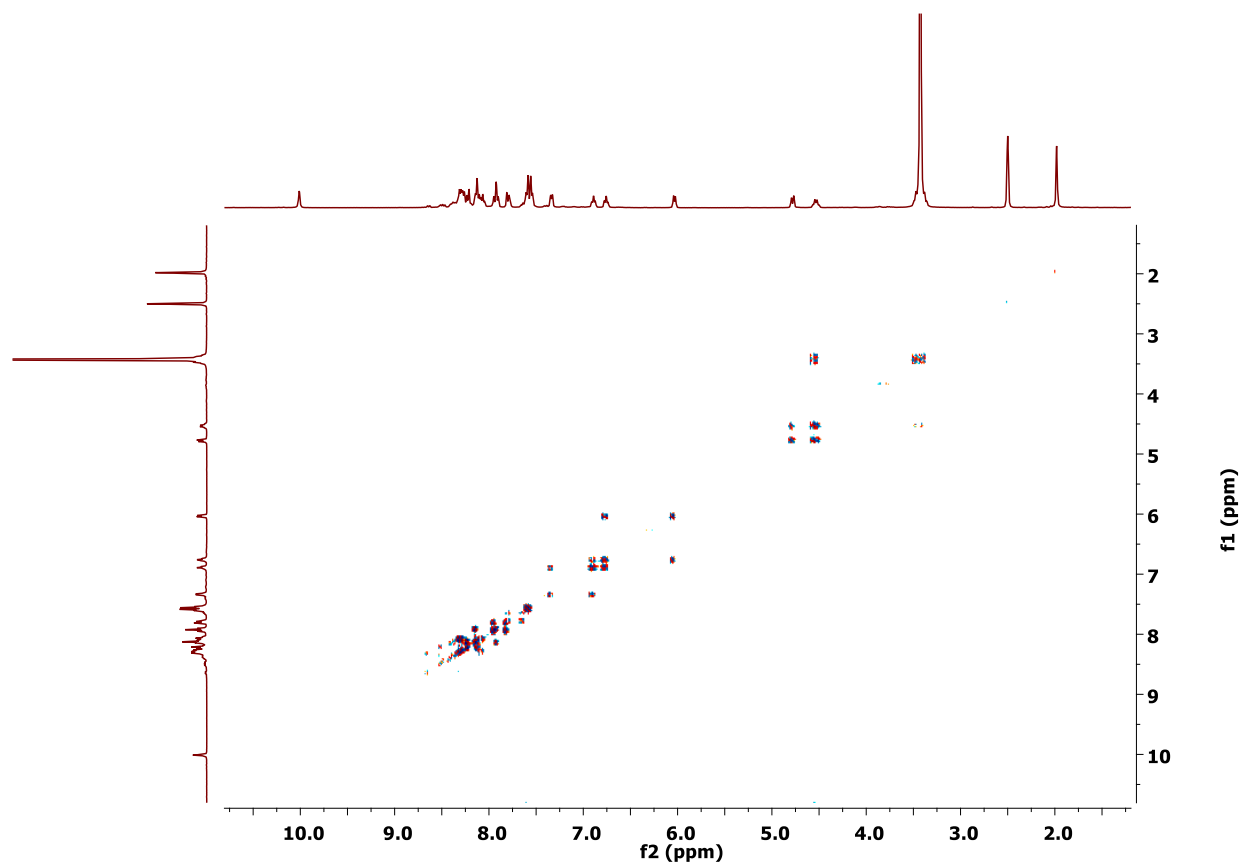
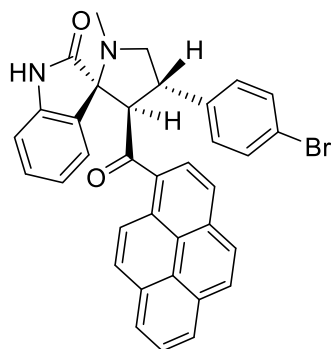
DEPT-135 NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)



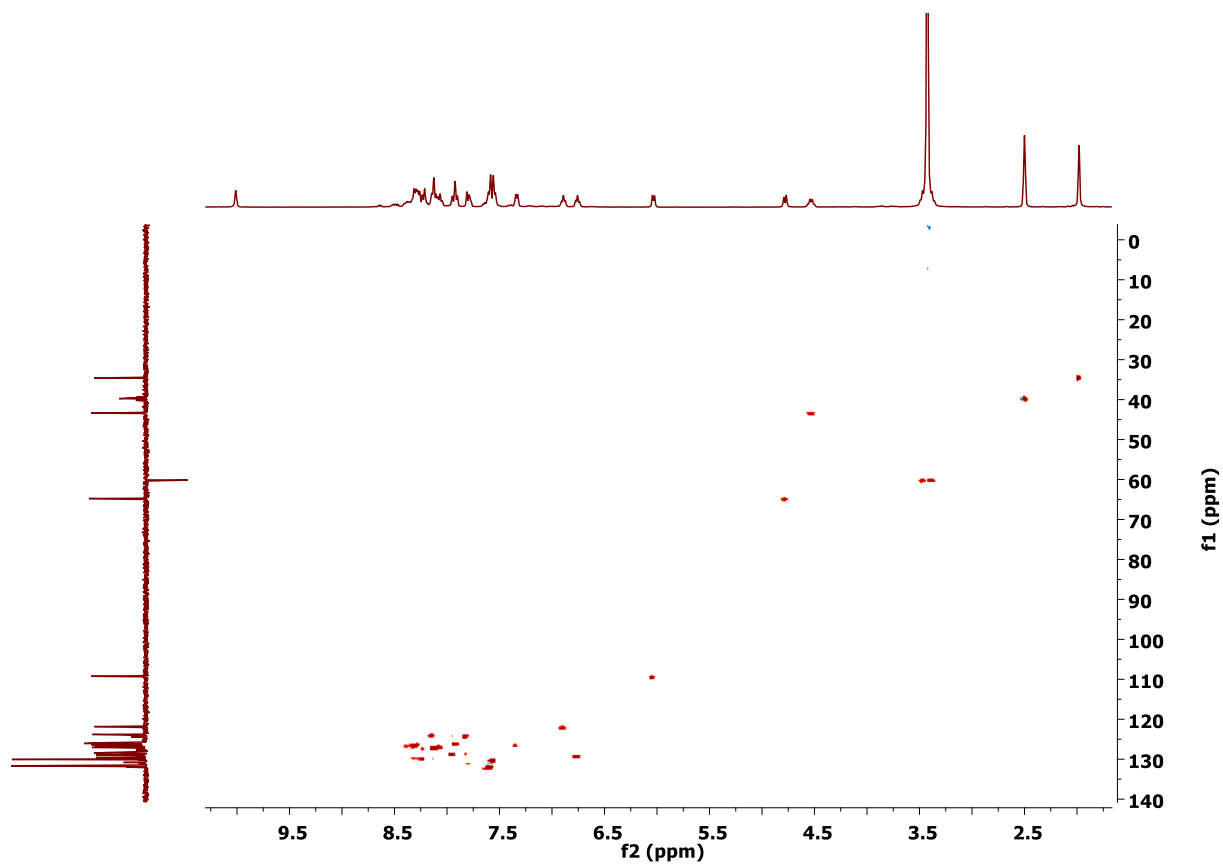
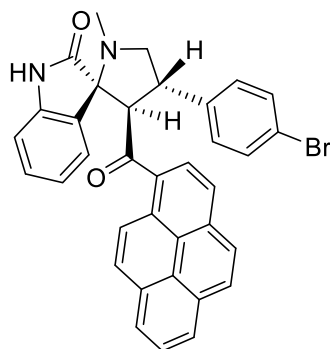
<sup>13</sup>C NMR spectrum of (3S,3'R,4'S)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)



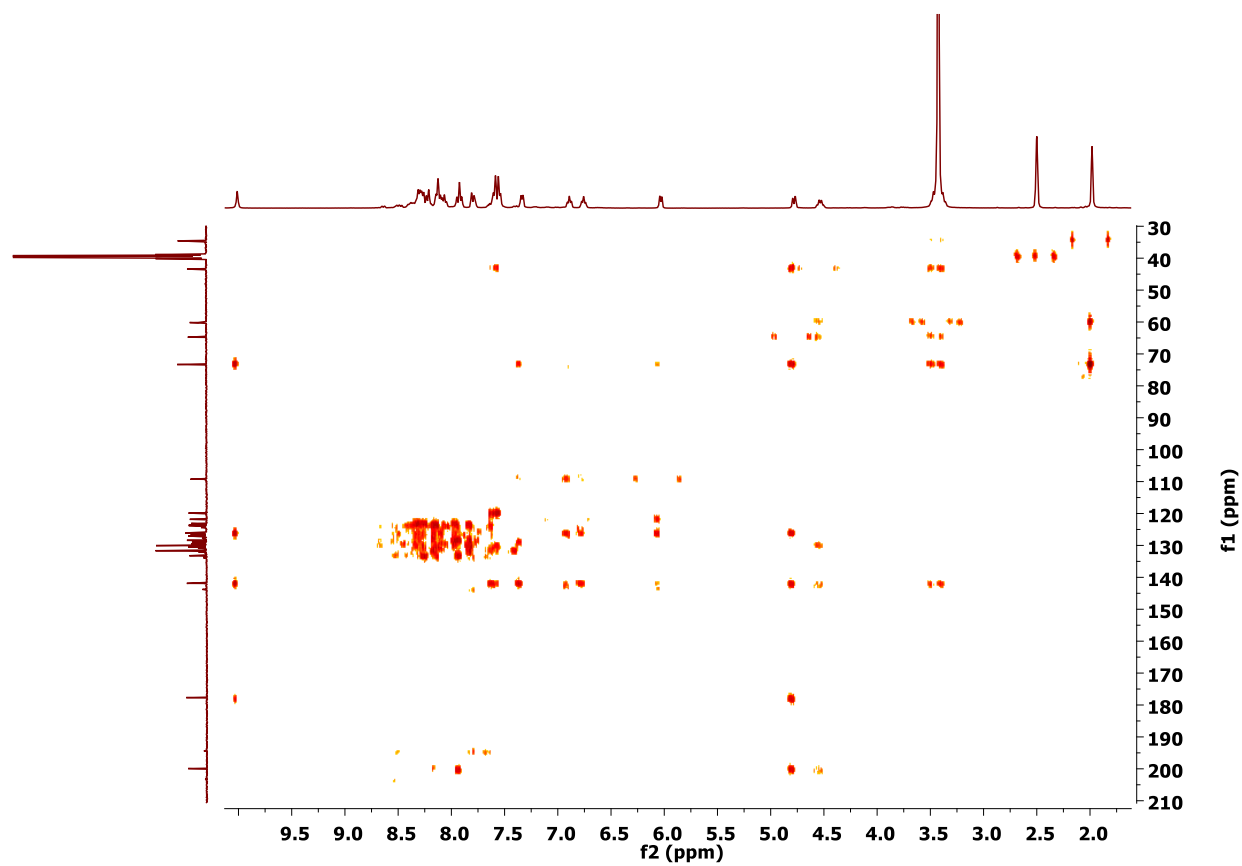
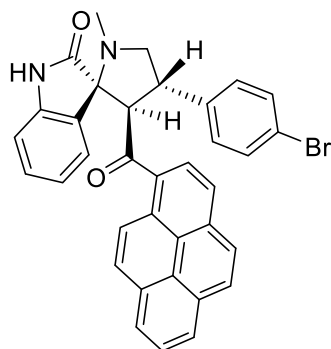
$^1\text{H}$ - $^1\text{H}$ -COSY NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)



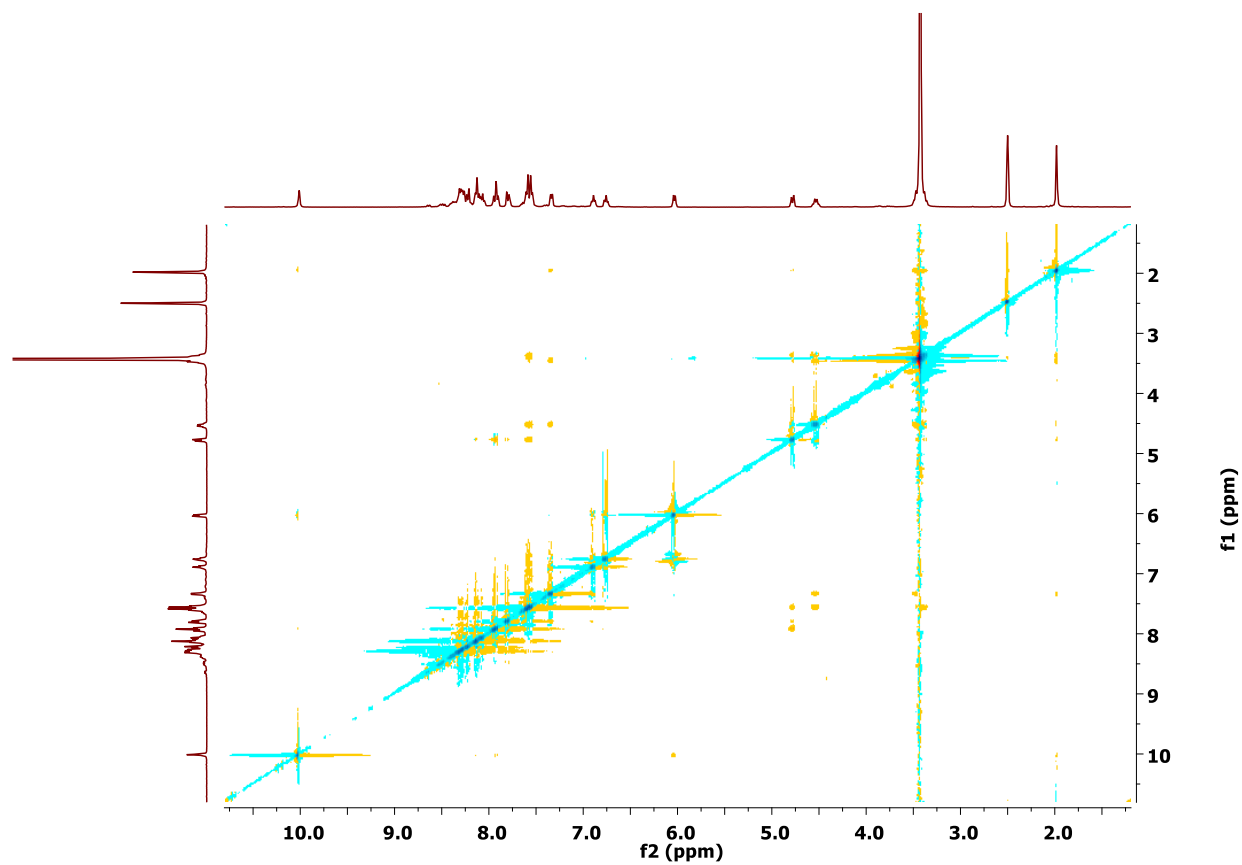
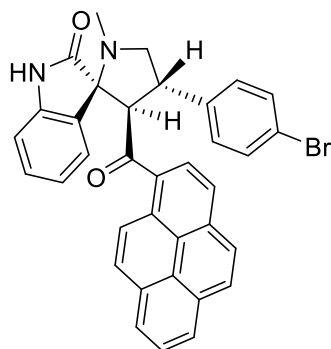
$^1\text{H}$ - $^{13}\text{C}$ -HSQC NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)



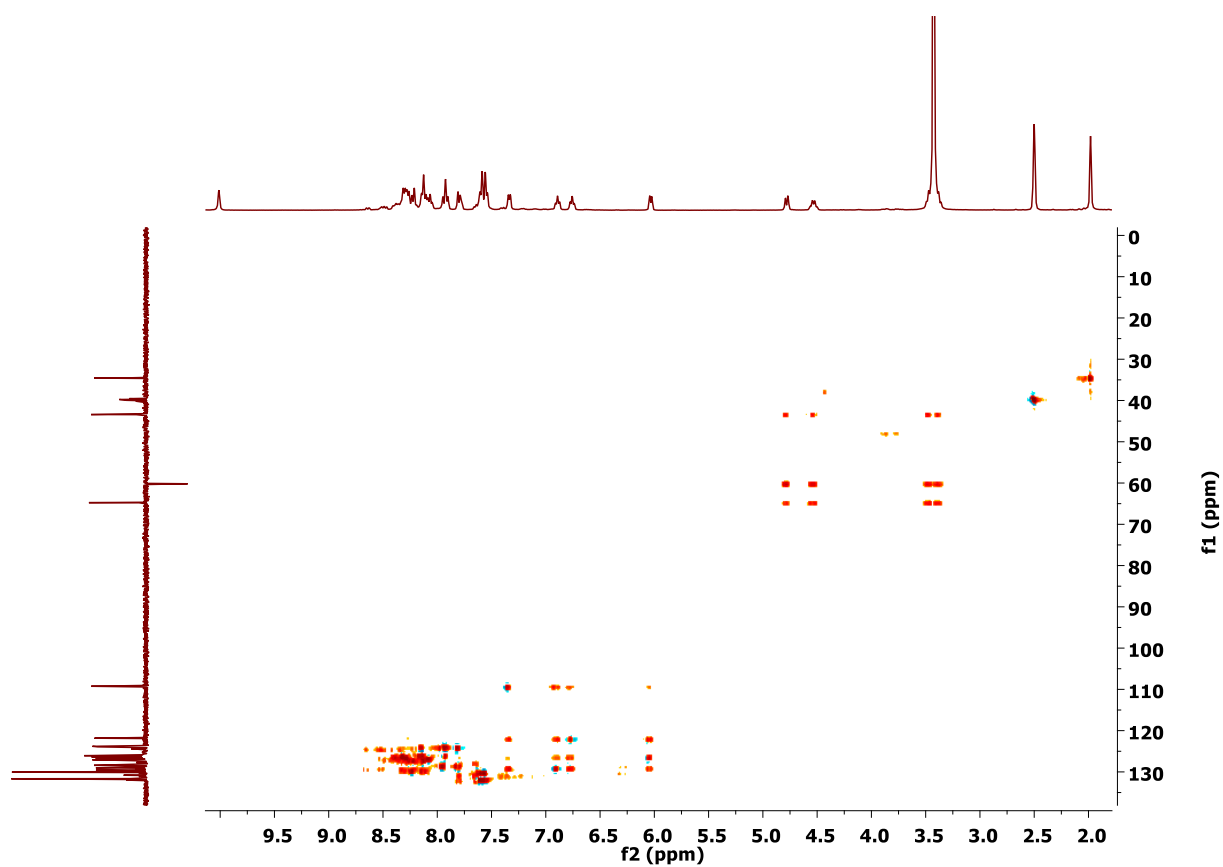
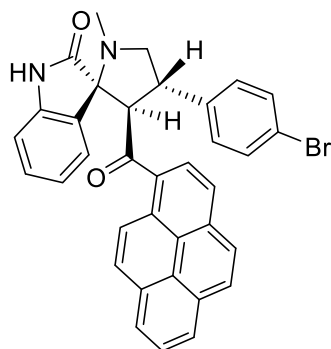
**$^1\text{H}$ - $^{13}\text{C}$ -HMBC NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)**



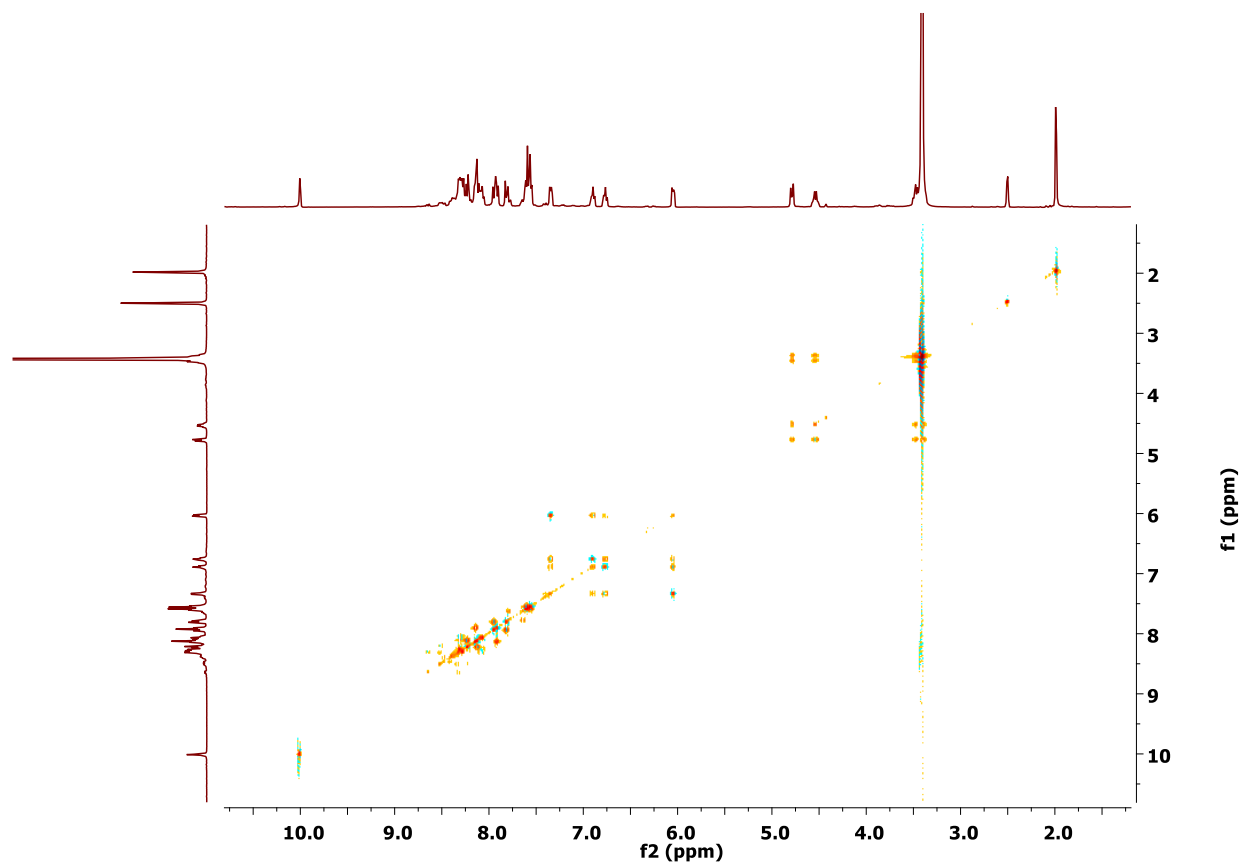
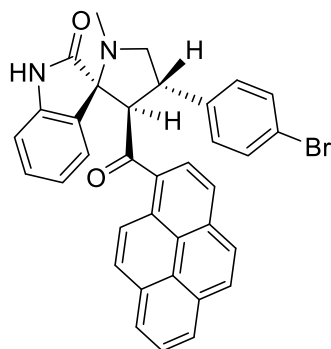
$^1\text{H}$ - $^1\text{H}$  ROESY NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)



HSQC-TOCSY NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)

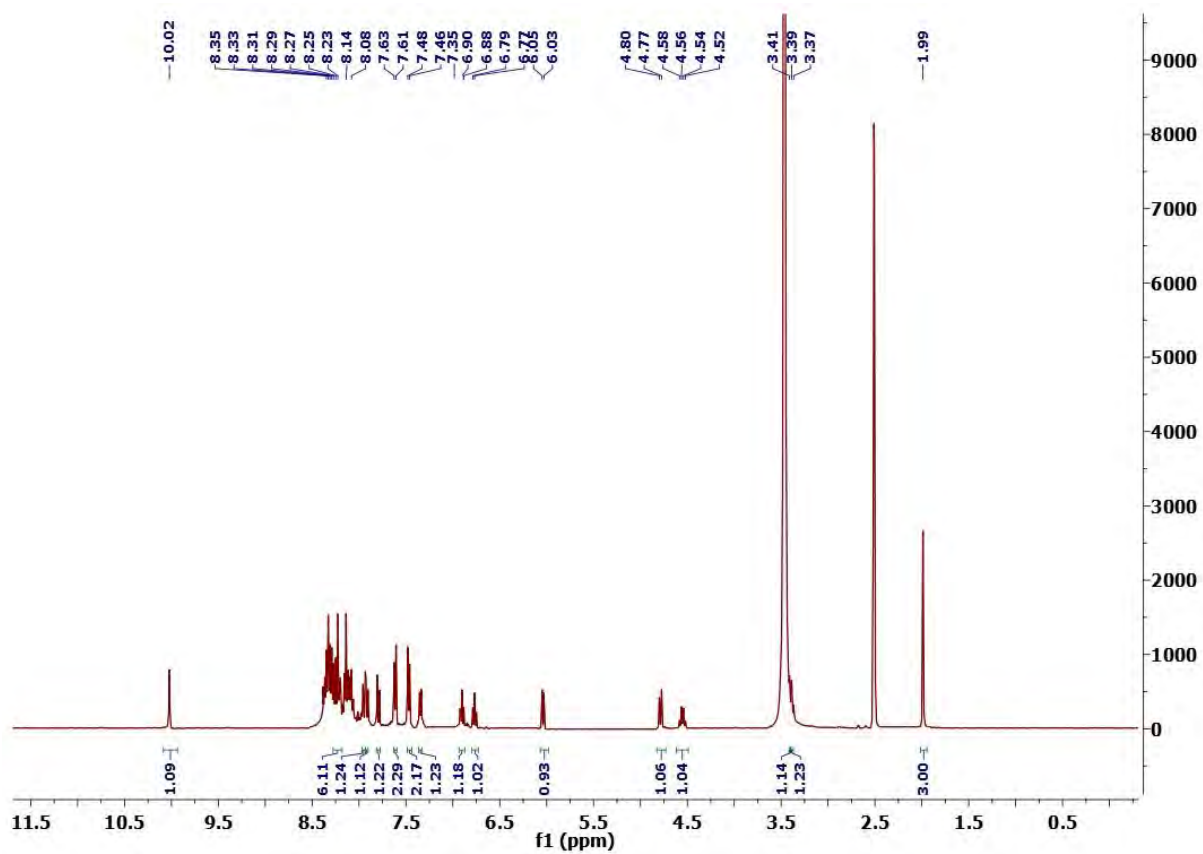
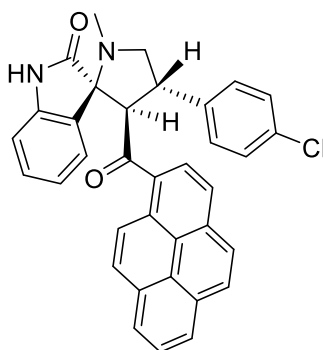


TOCSY NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-bromophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (24)

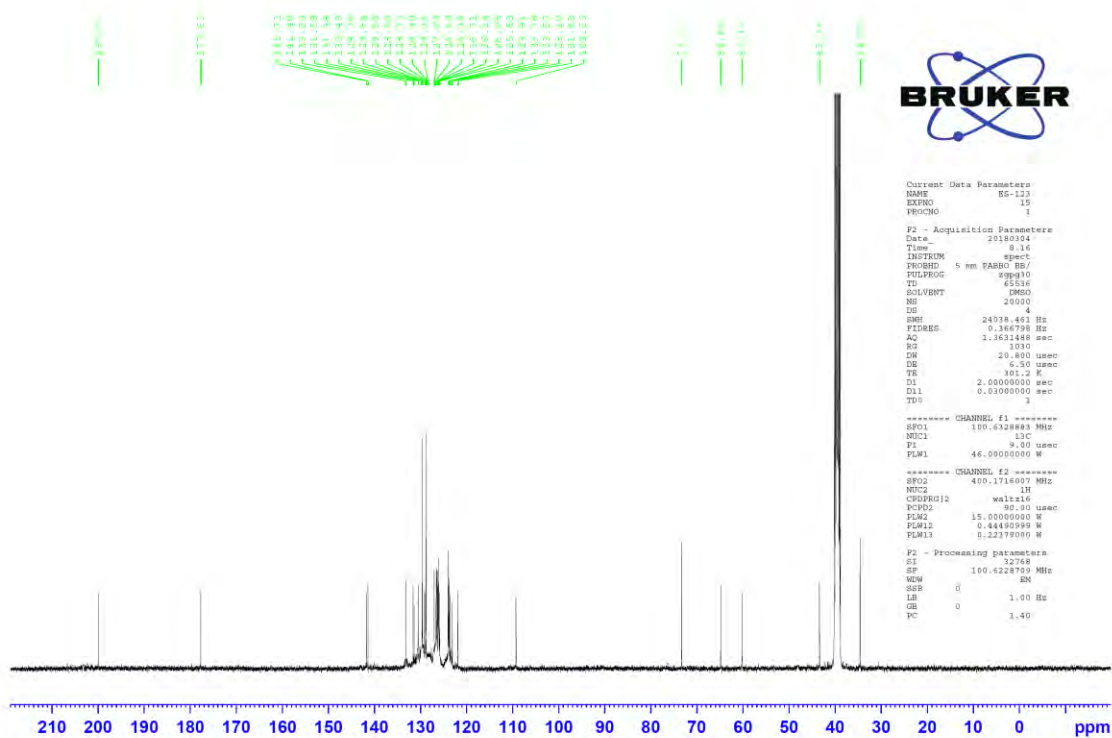
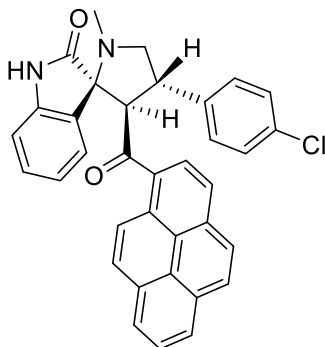




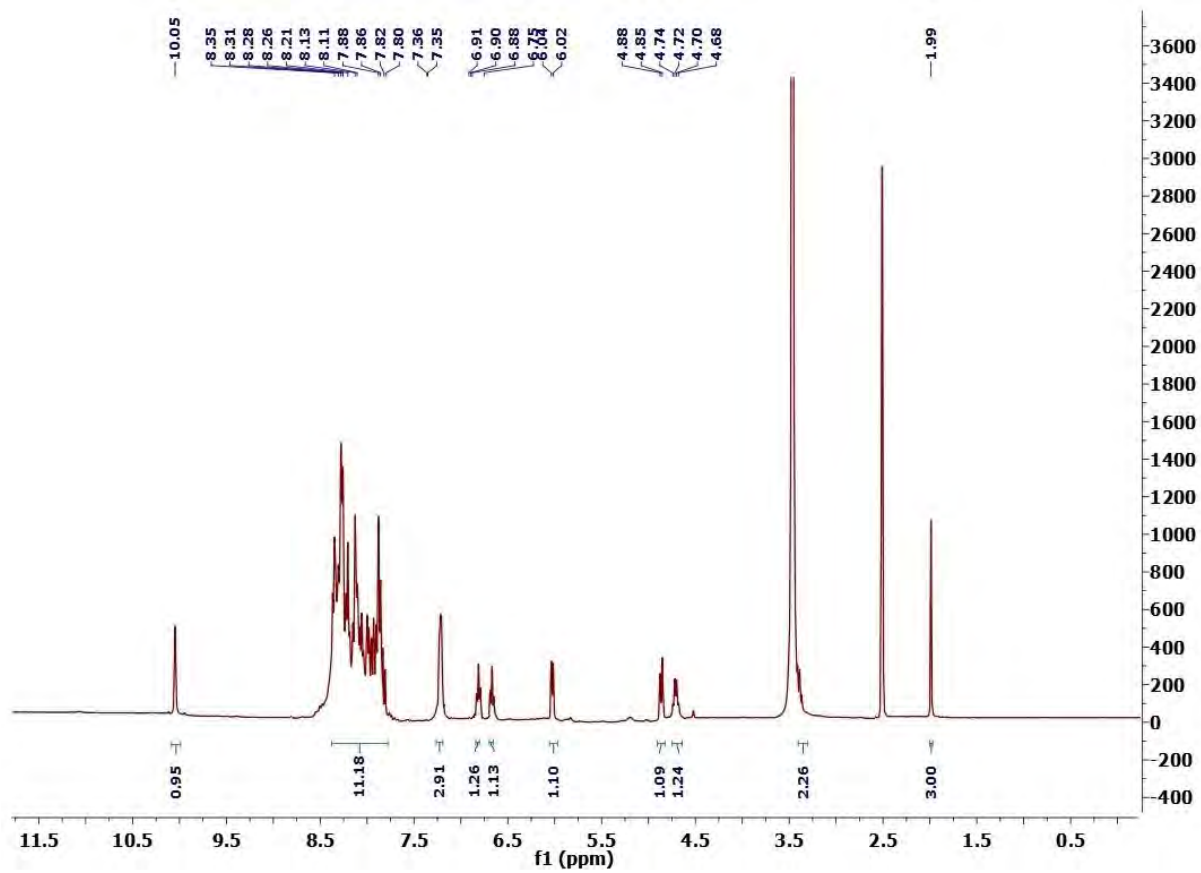
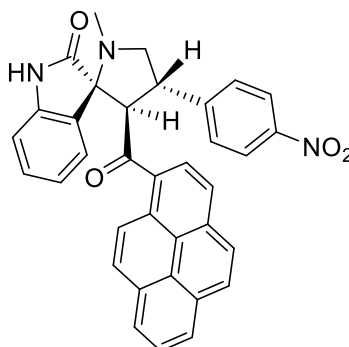
$^1\text{H}$  NMR spectrum of (3S,3'R,4'S)-4'-(4-chlorophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (23)



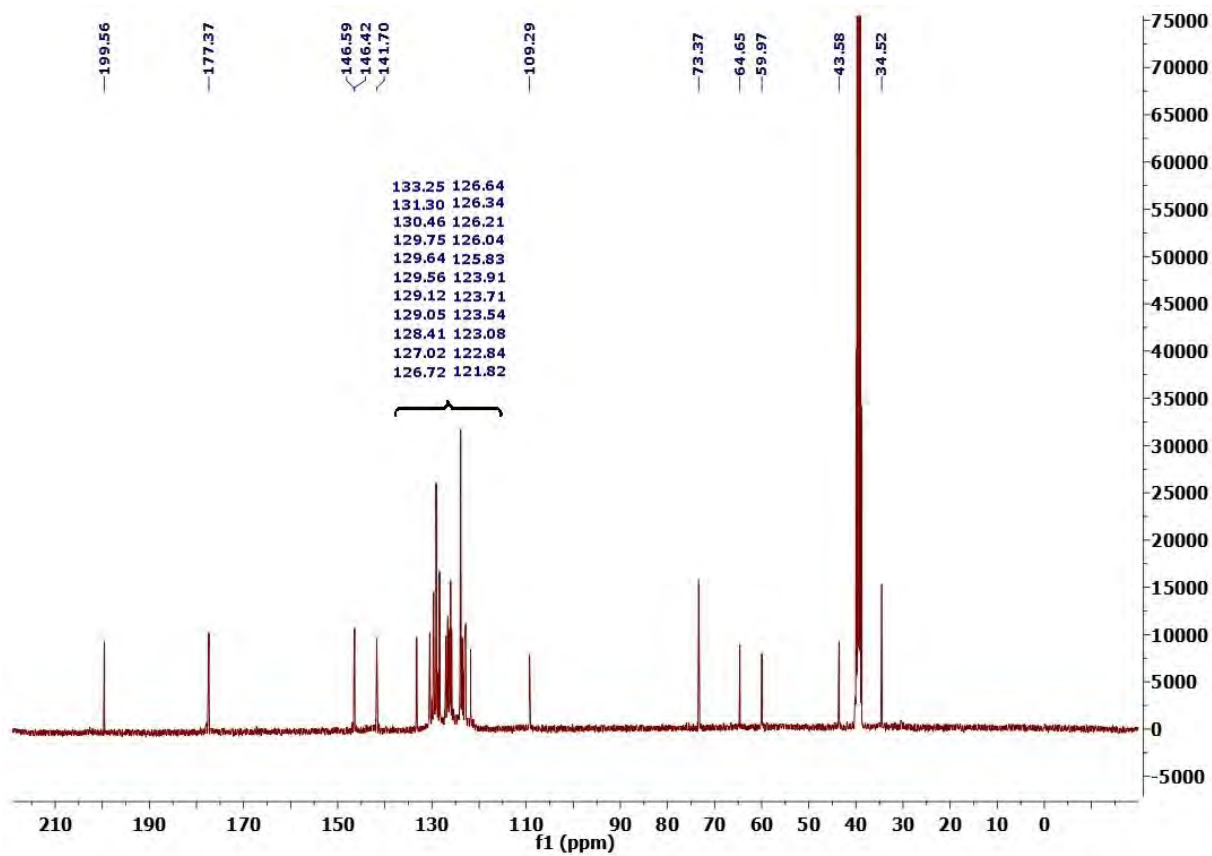
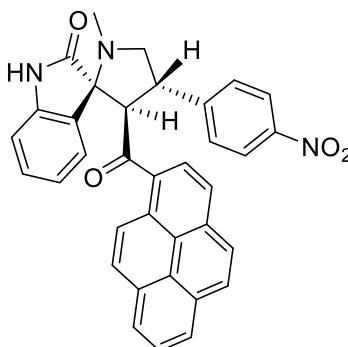
<sup>13</sup>C NMR spectrum of (3S,3'R,4'S)-4'-(4-chlorophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (23)



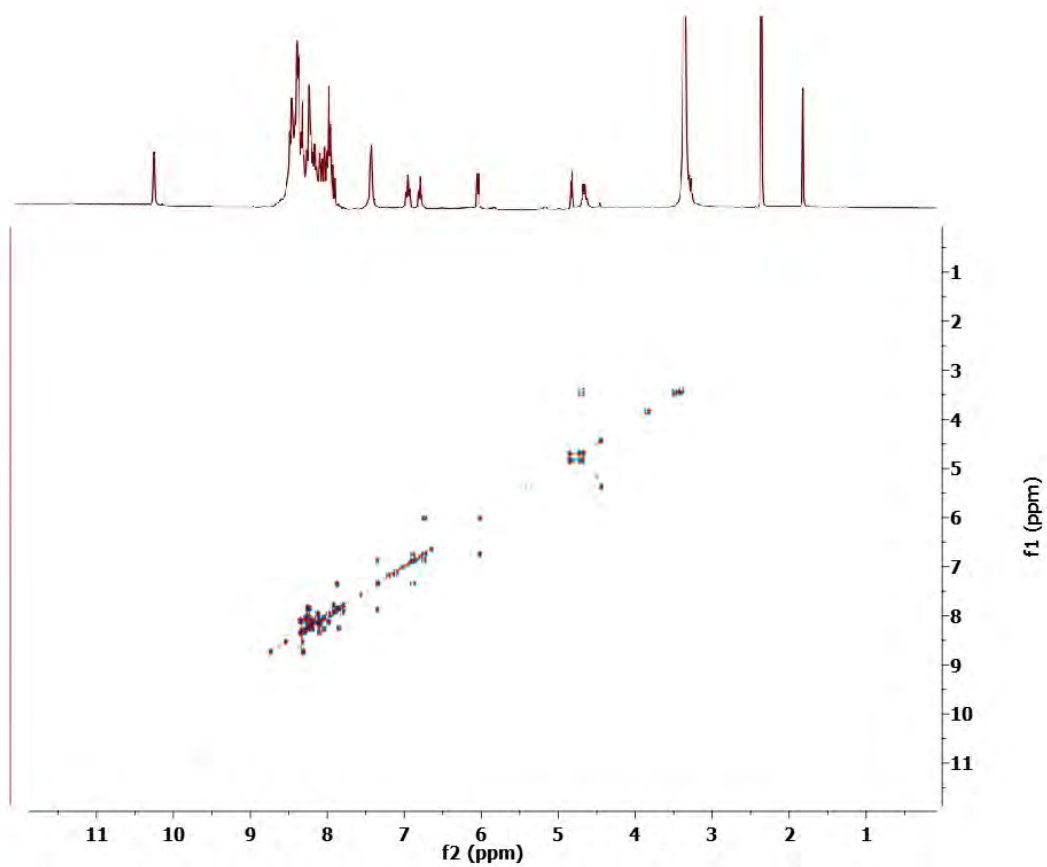
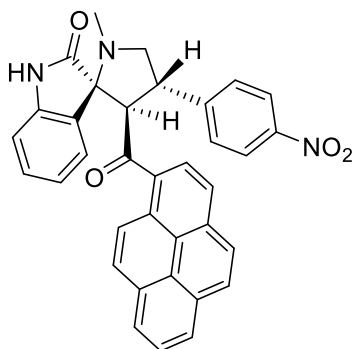
<sup>1</sup>H NMR spectrum of (3S,3'R,4'S)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)



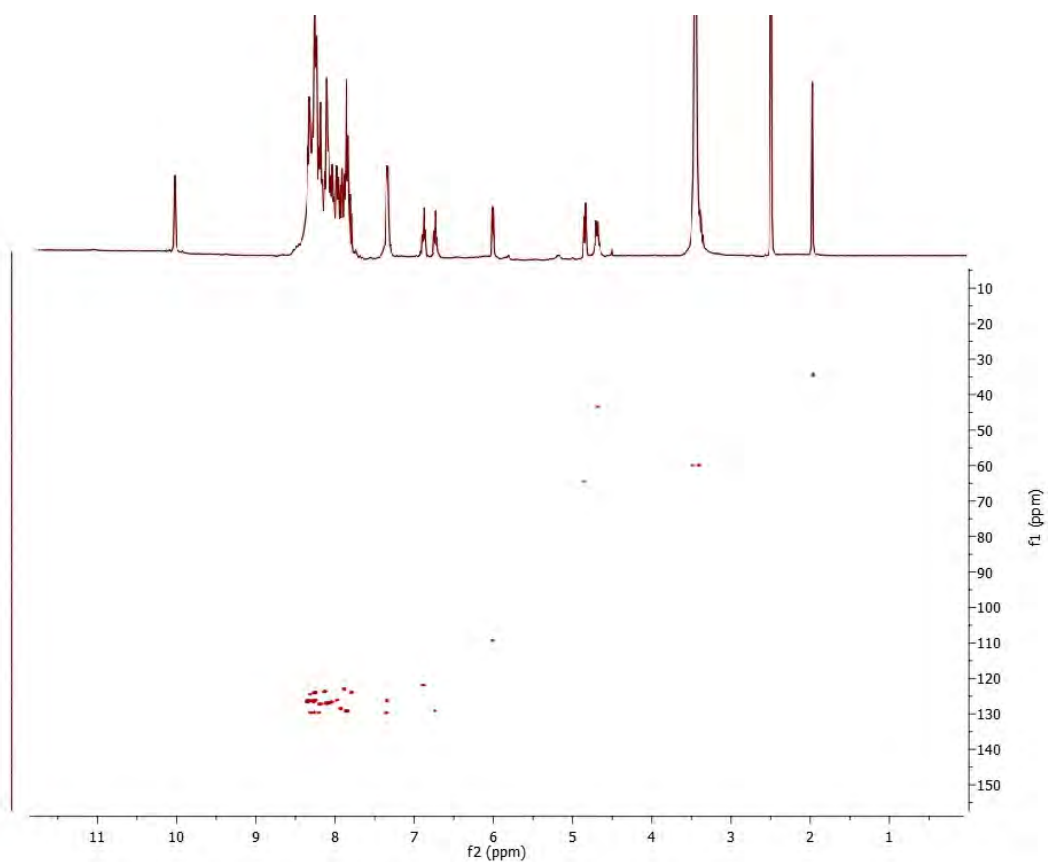
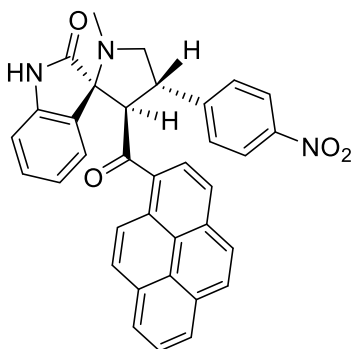
<sup>13</sup>C NMR spectrum of (3*S*,3'*R*,4'*S*)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)



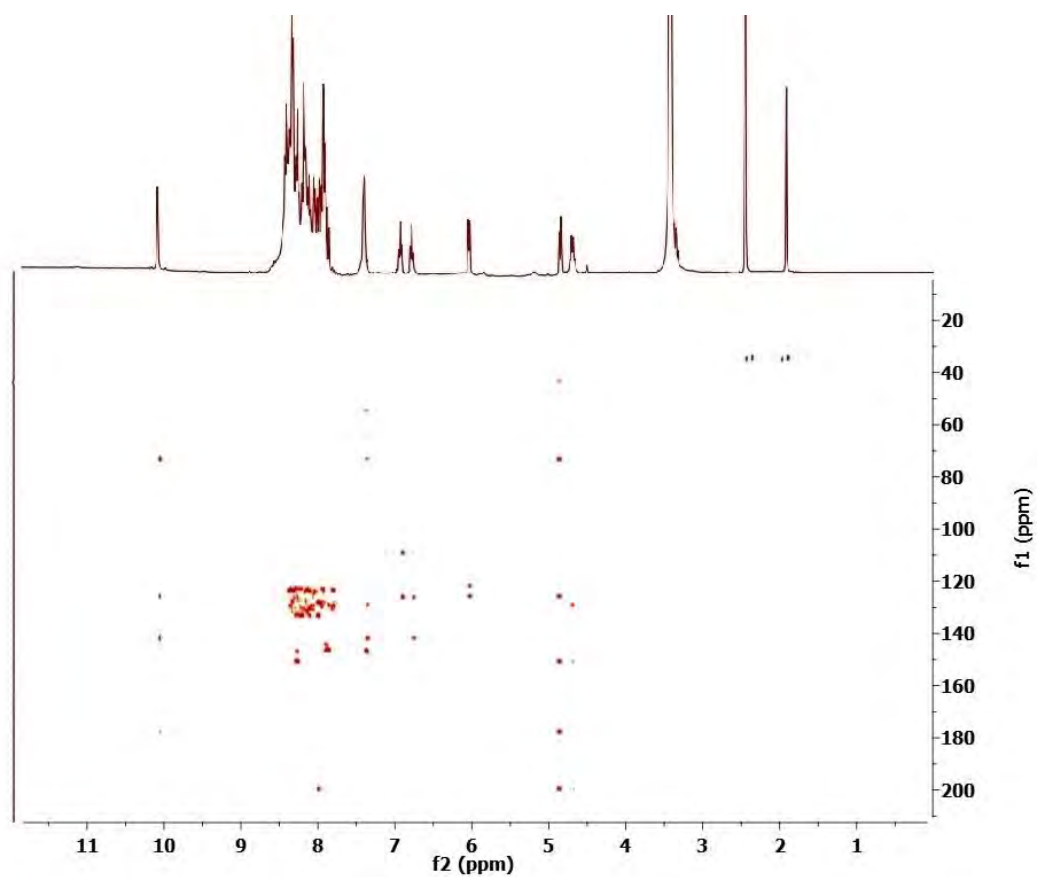
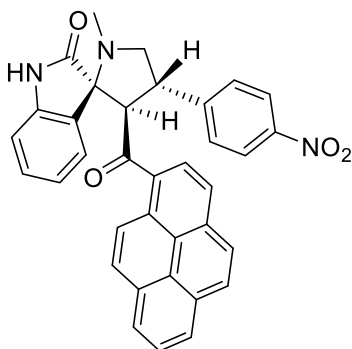
$^1\text{H}$ - $^1\text{H}$ -COSY NMR spectrum of (3*S*,3'*R*,4'*S*)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)



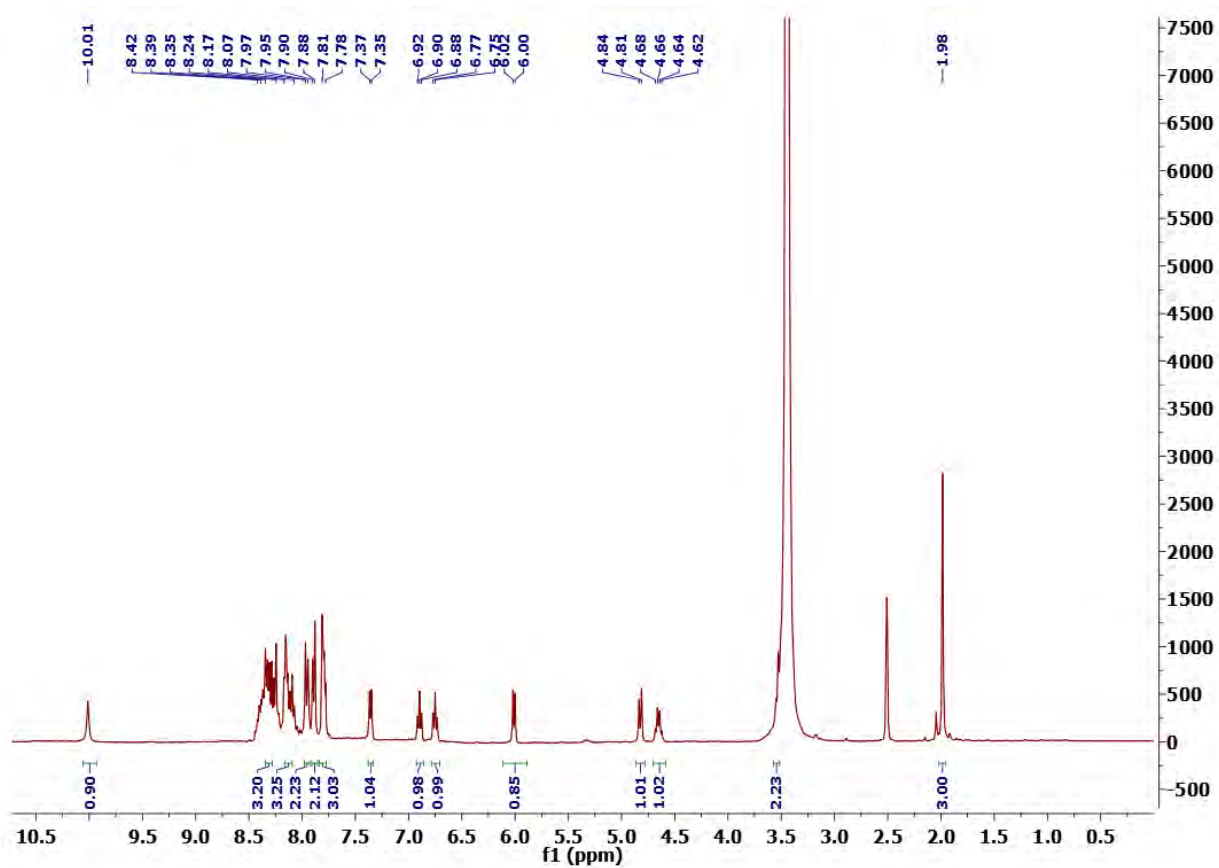
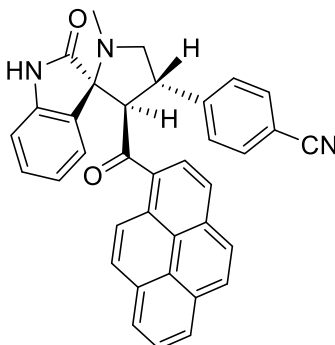
**$^1\text{H}$ - $^{13}\text{C}$ -HSQC NMR NMR spectrum of (3*S*,3'*R*,4'*S*)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)**



$^1\text{H}$ - $^{13}\text{C}$ -HMBC NMR spectrum of (3*S*,3'*R*,4'*S*)- 1'-methyl-4'-(4-nitrophenyl)-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (26)

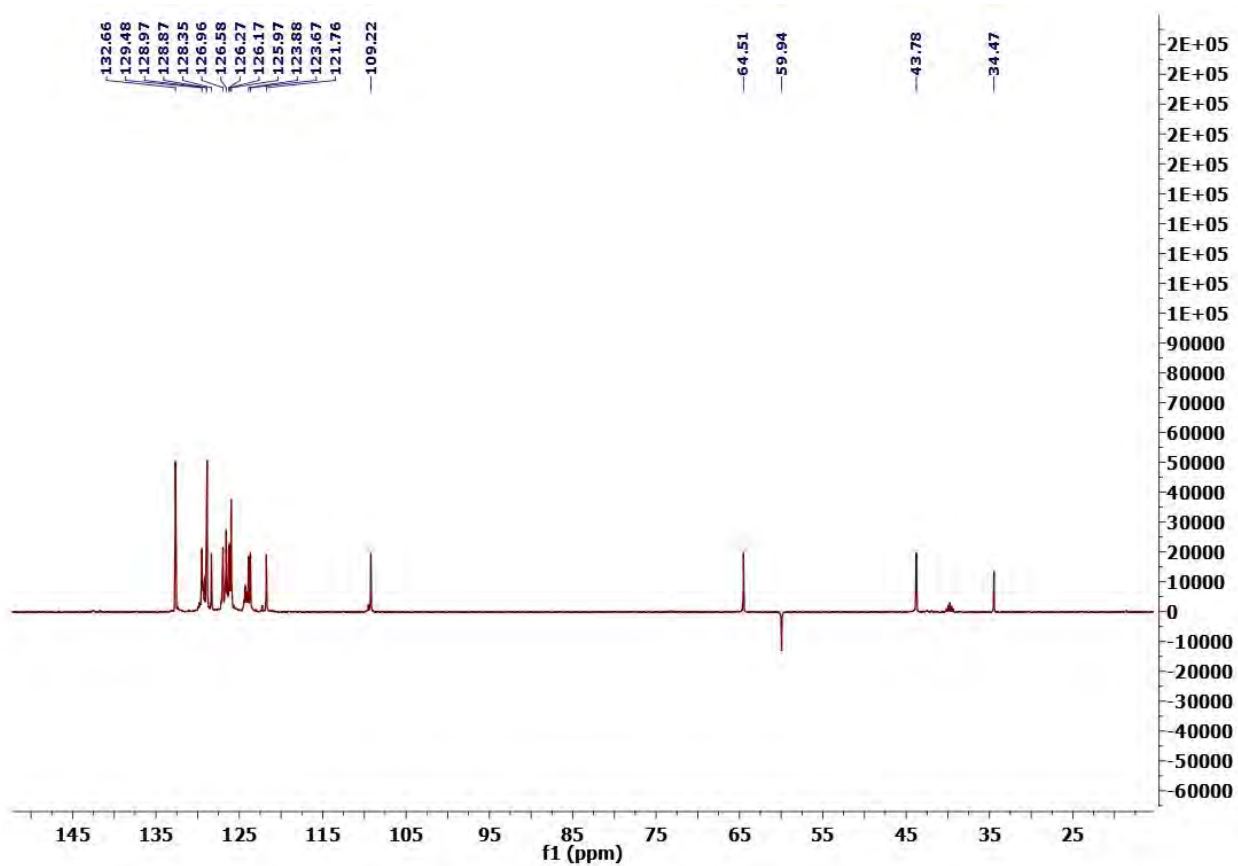
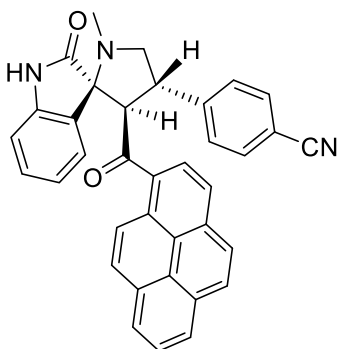


<sup>1</sup>H NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)

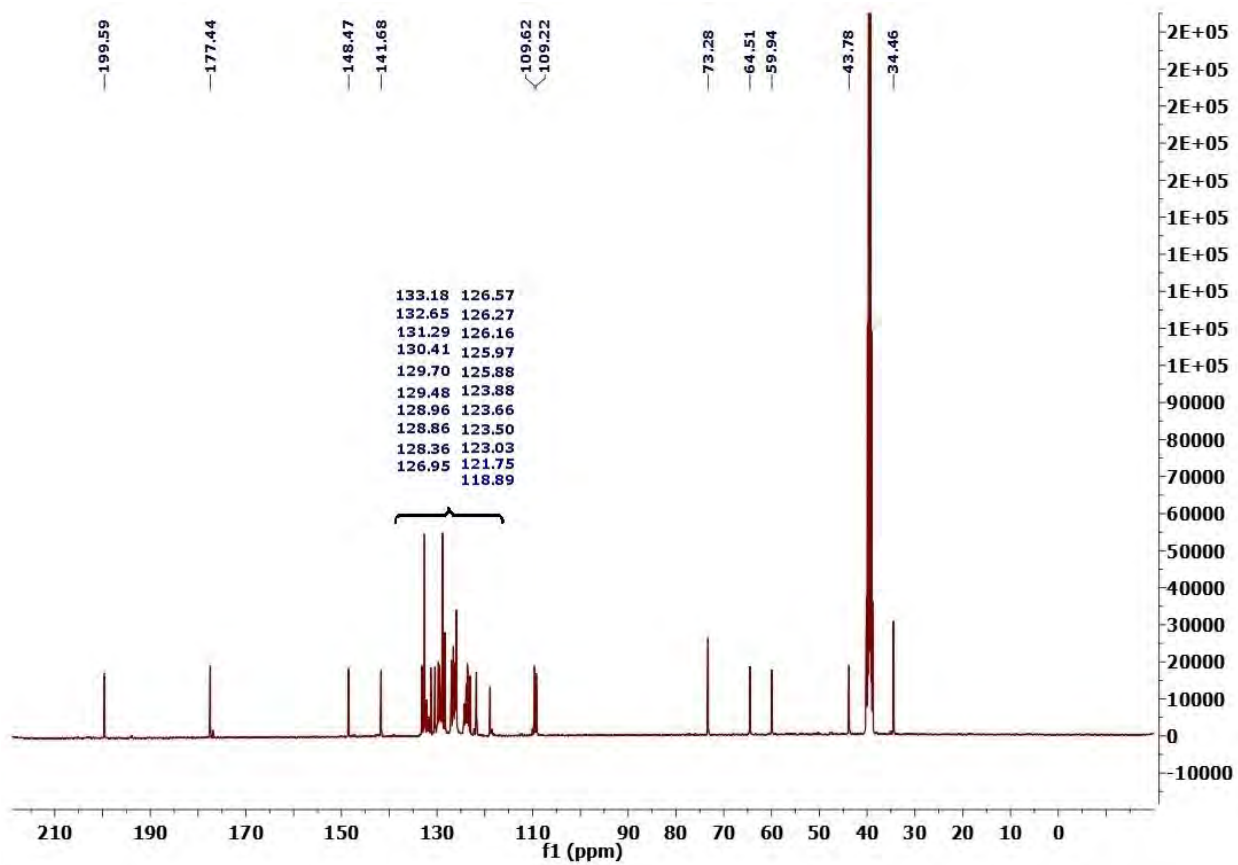
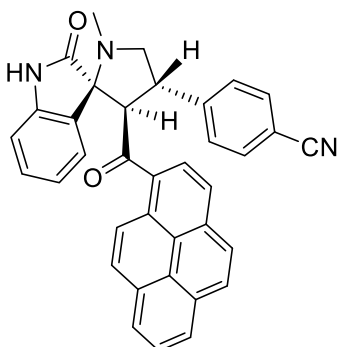




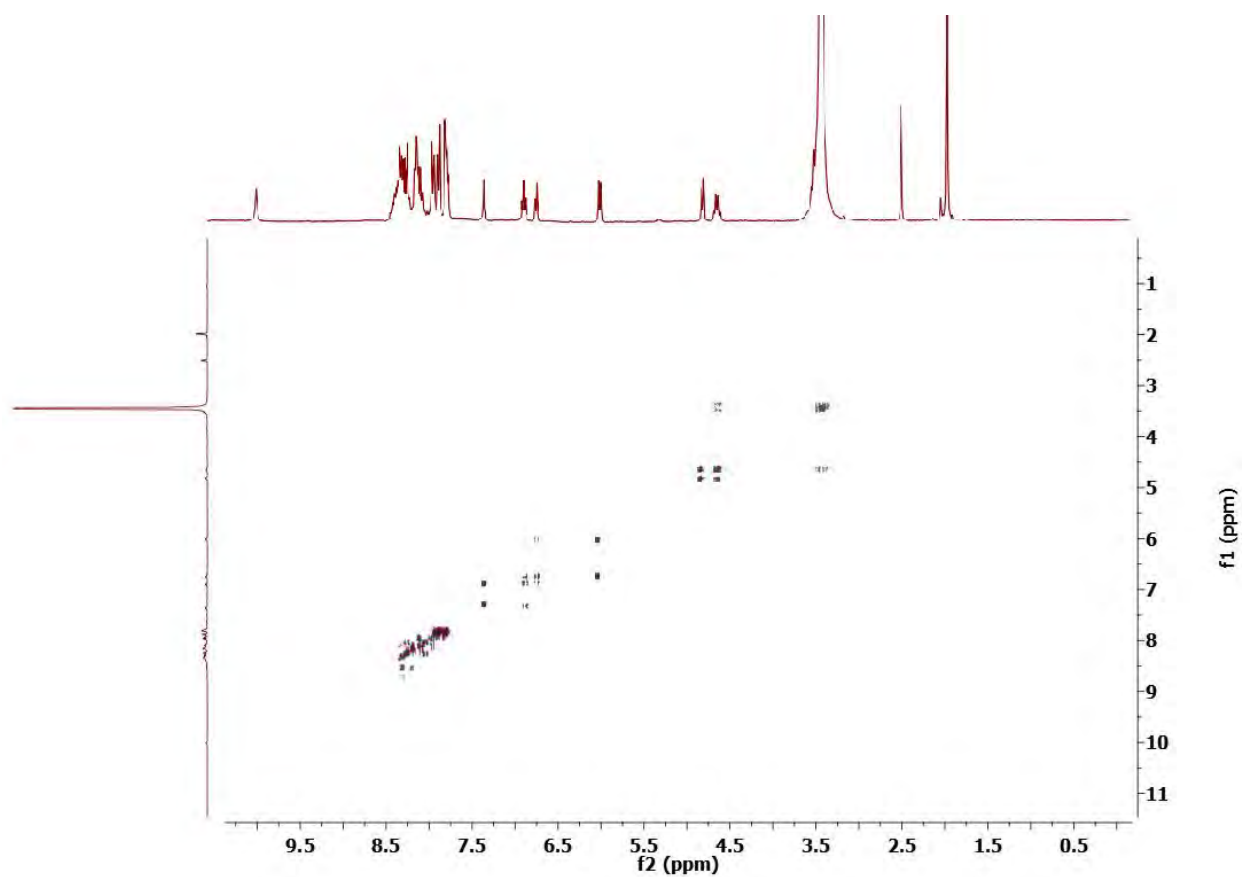
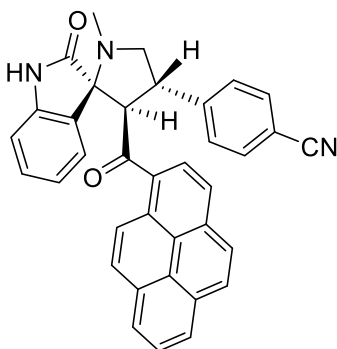
DEPT-135 NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)



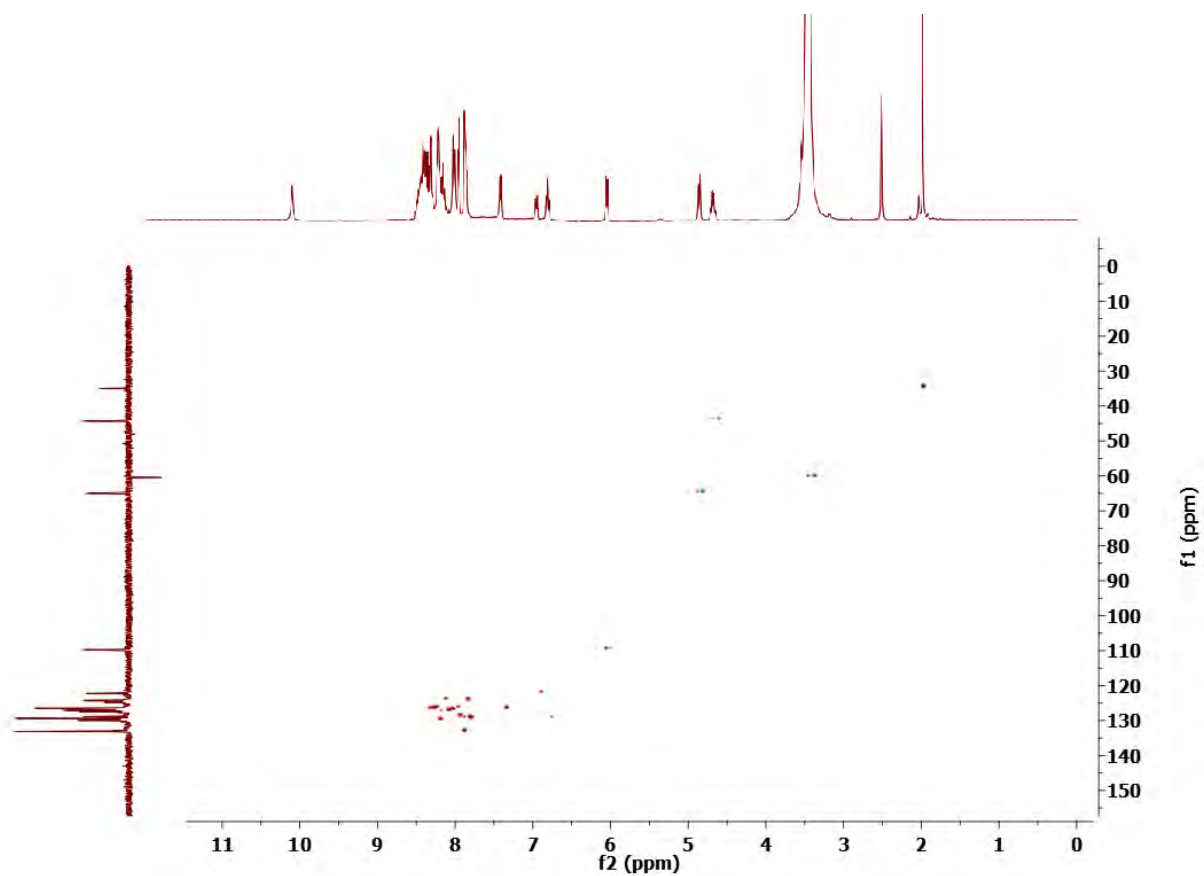
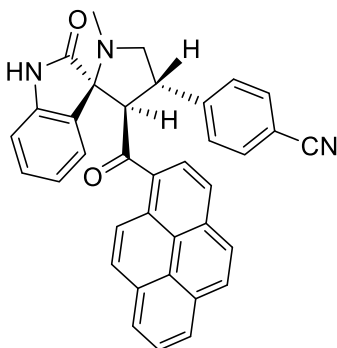
<sup>13</sup>C NMR spectrum of (3S,3'R,4'S)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)



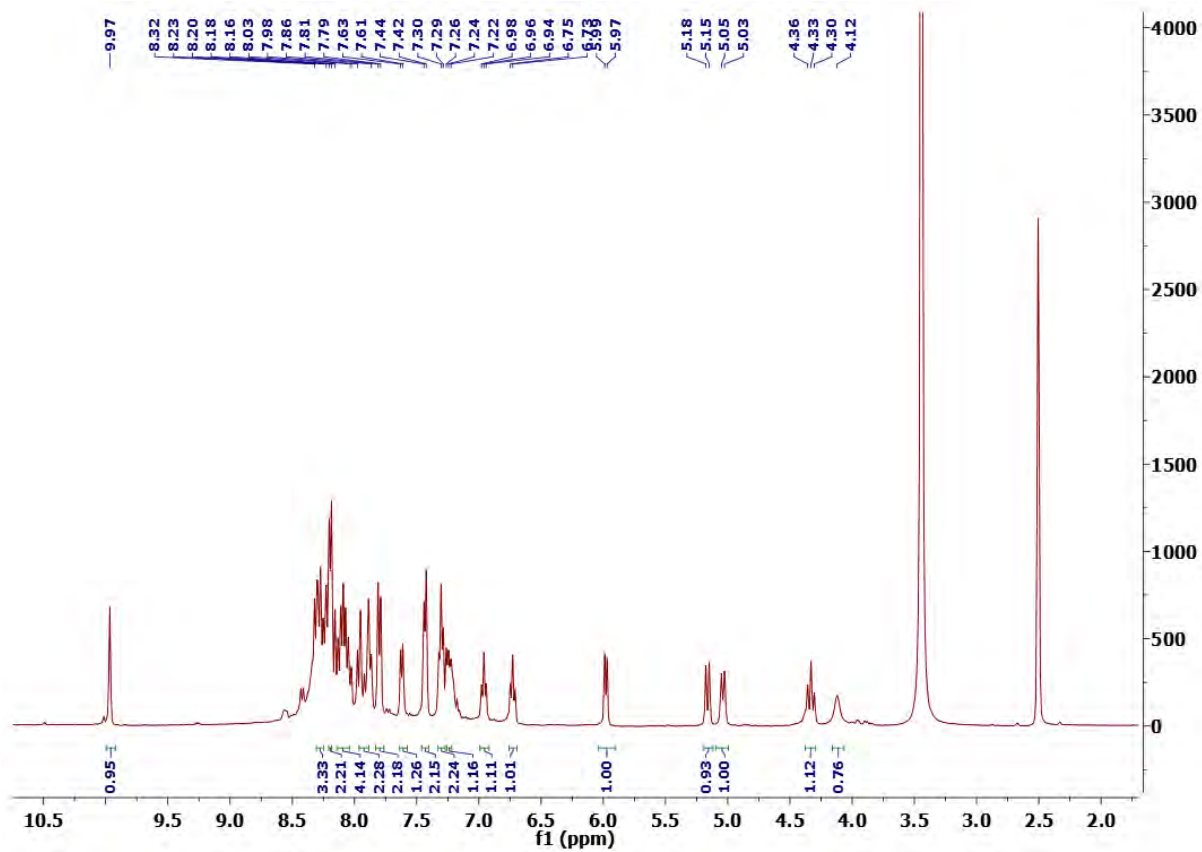
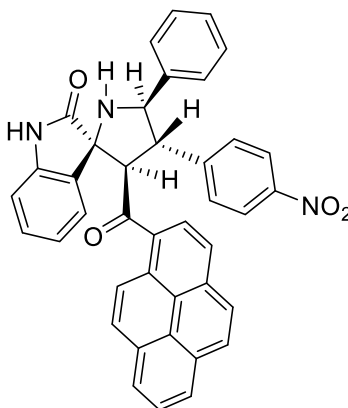
$^1\text{H}$ - $^1\text{H}$ -COSY NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)



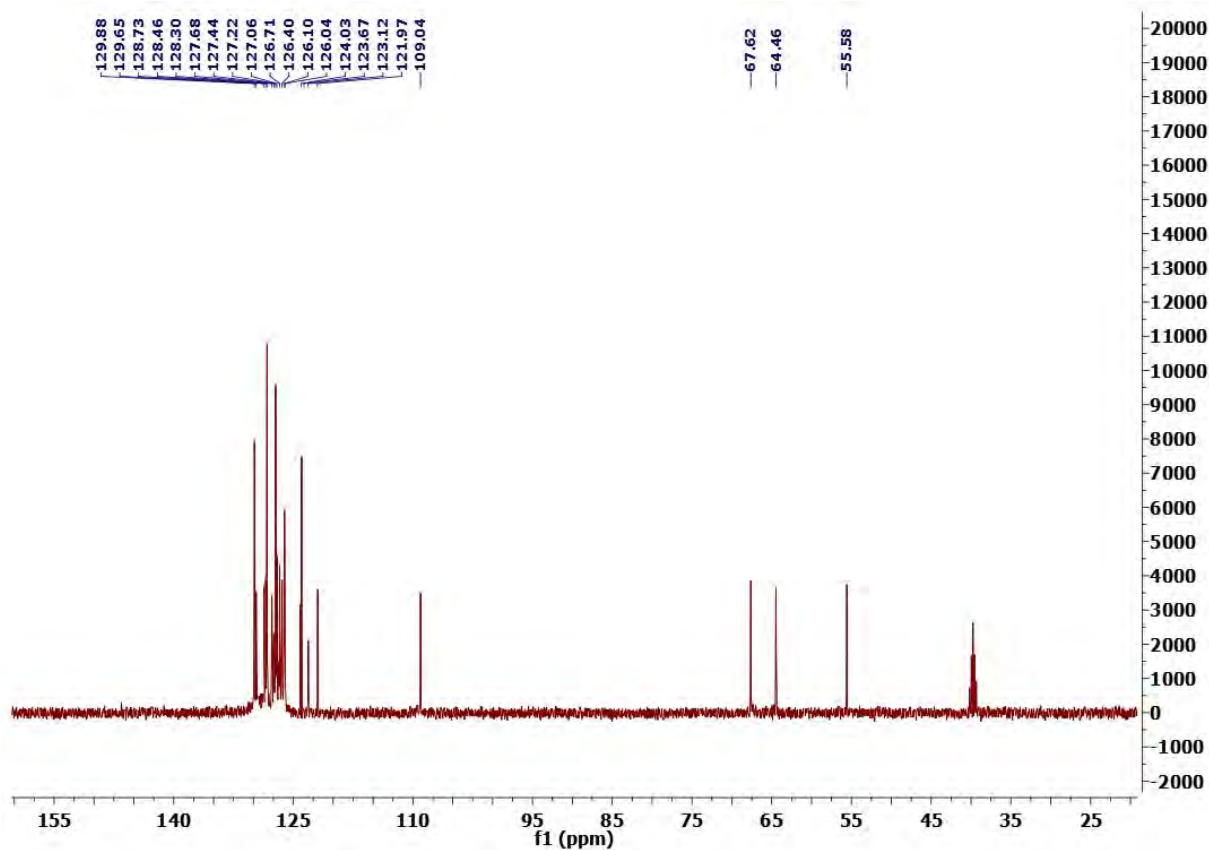
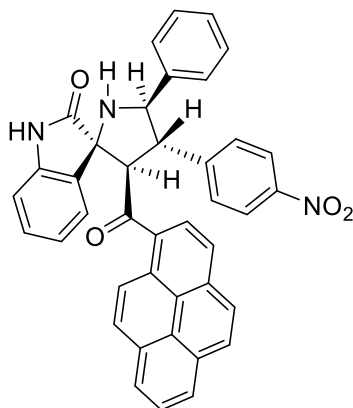
**$^1\text{H}$ - $^{13}\text{C}$ -HSQC NMR spectrum of (3*S*,3'*R*,4'*S*)-4'-(4-cyanophenyl)-1'-methyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (27)**



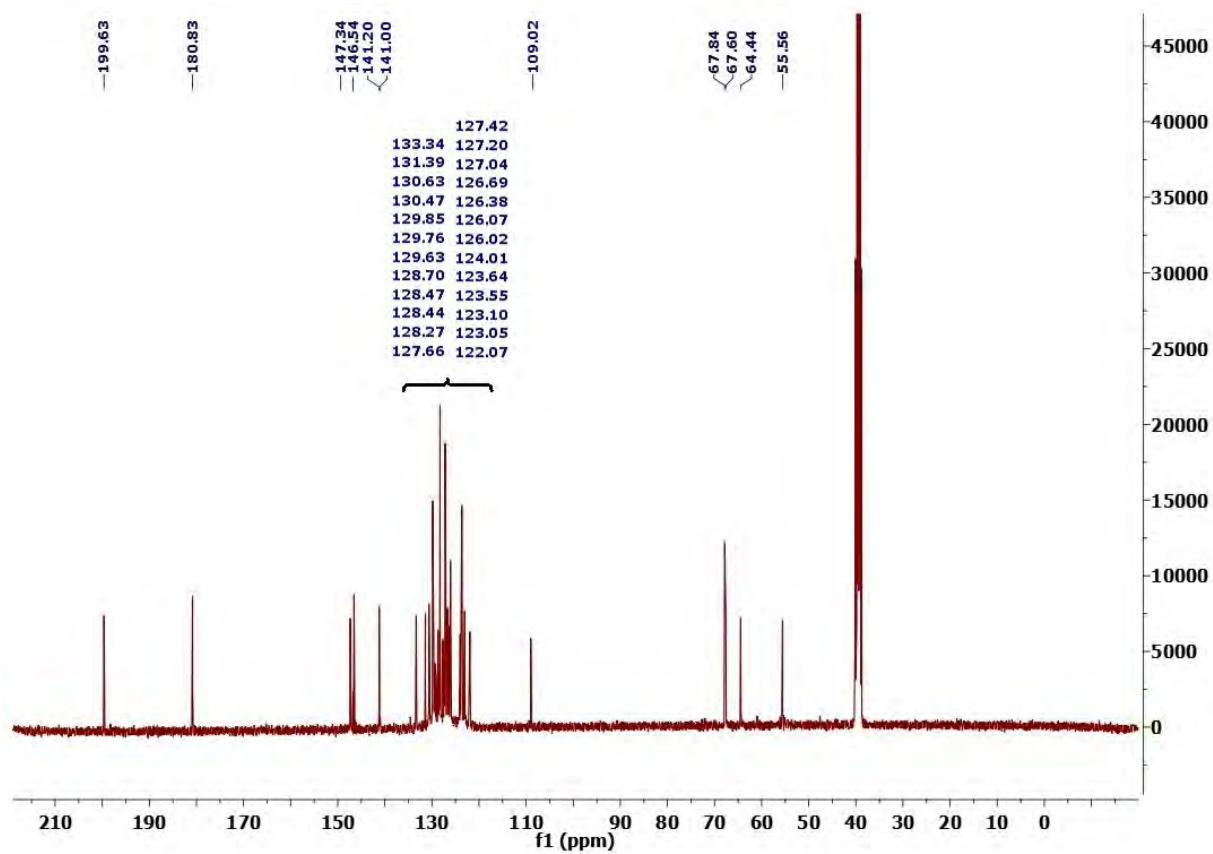
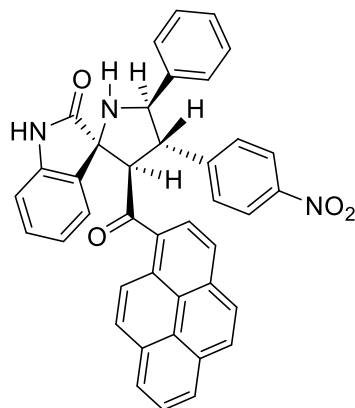
<sup>1</sup>NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C<sub>40</sub>H<sub>27</sub>N<sub>3</sub>O<sub>4</sub>)



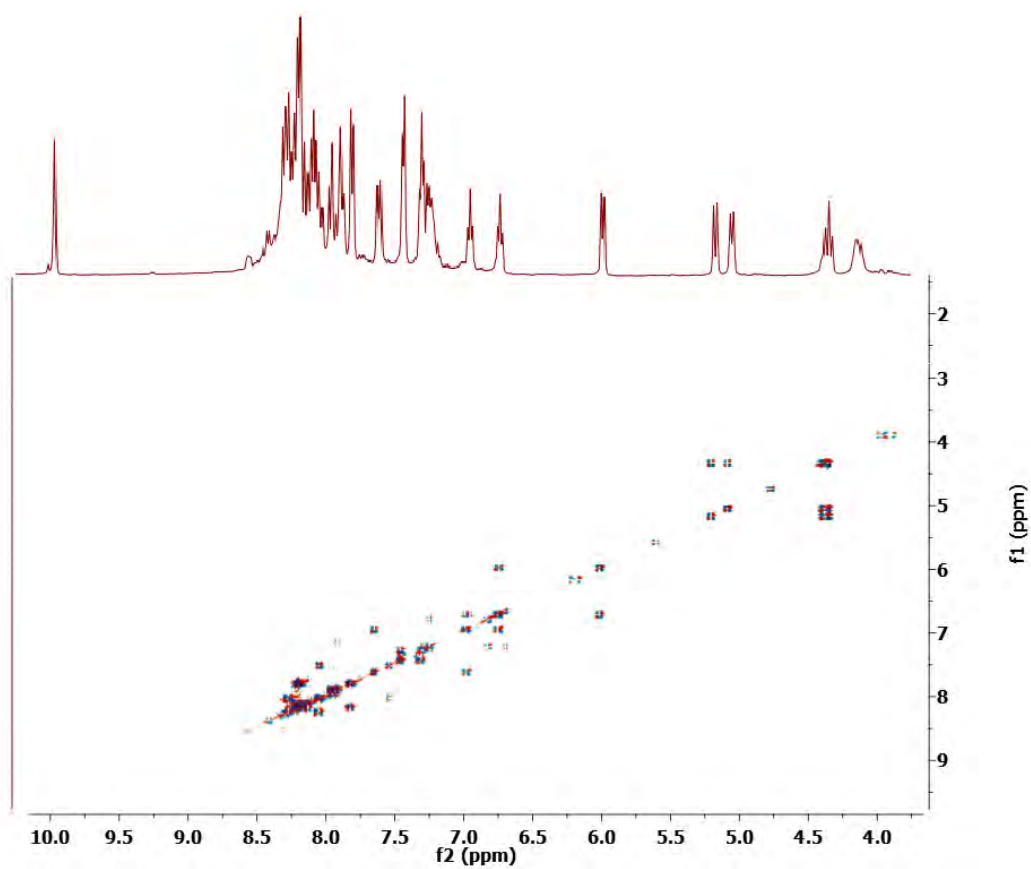
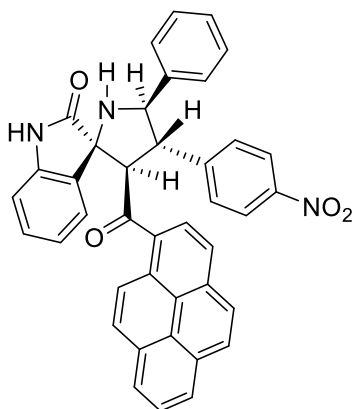
DEPT-90 NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32, C<sub>40</sub>H<sub>27</sub>N<sub>3</sub>O<sub>4</sub>)



$^{13}\text{C}$  NMR spectrum of (3*S*,3'*R*,4*S*,5'*R*)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32,  $\text{C}_{40}\text{H}_{27}\text{N}_3\text{O}_4$ )

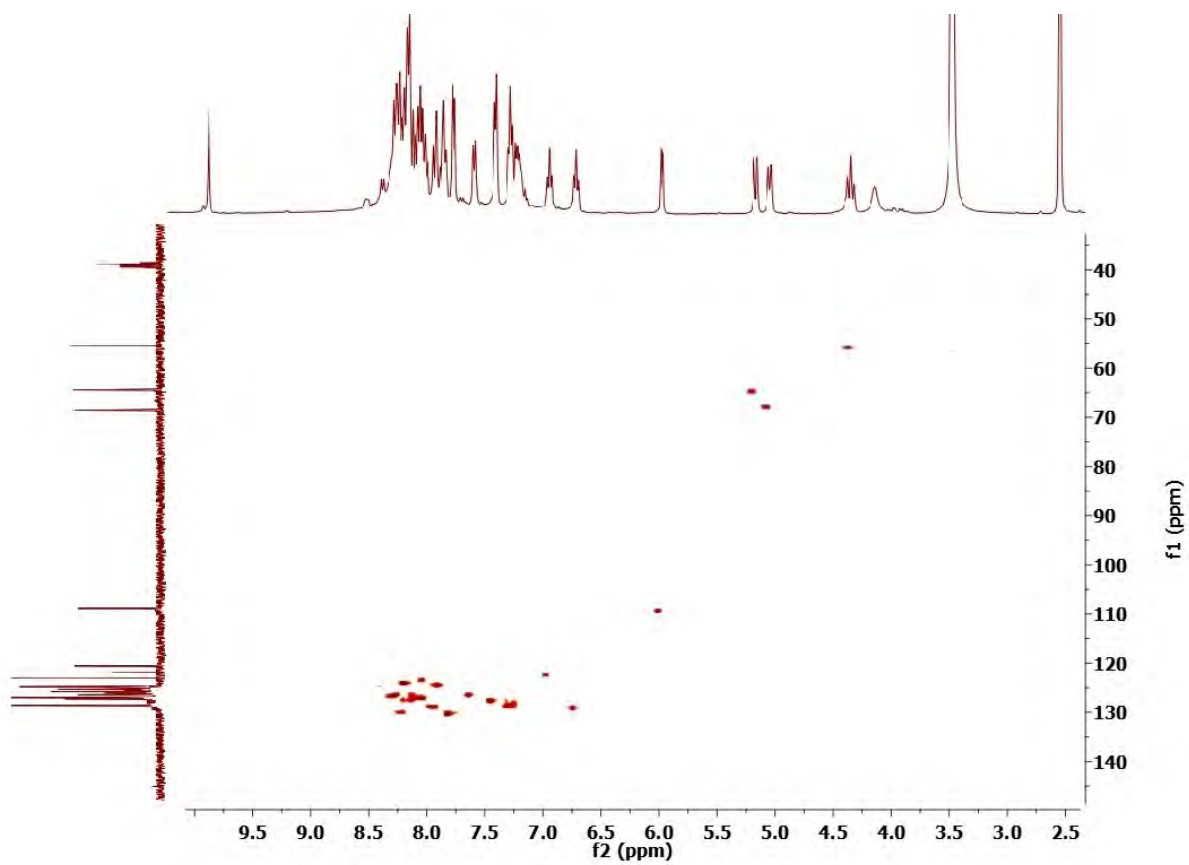
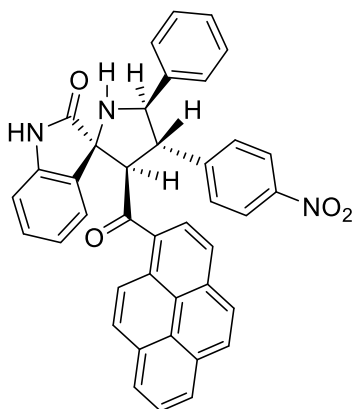


$^1\text{H}$ - $^1\text{H}$ -COSY NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32,  $\text{C}_{40}\text{H}_{27}\text{N}_3\text{O}_4$ )

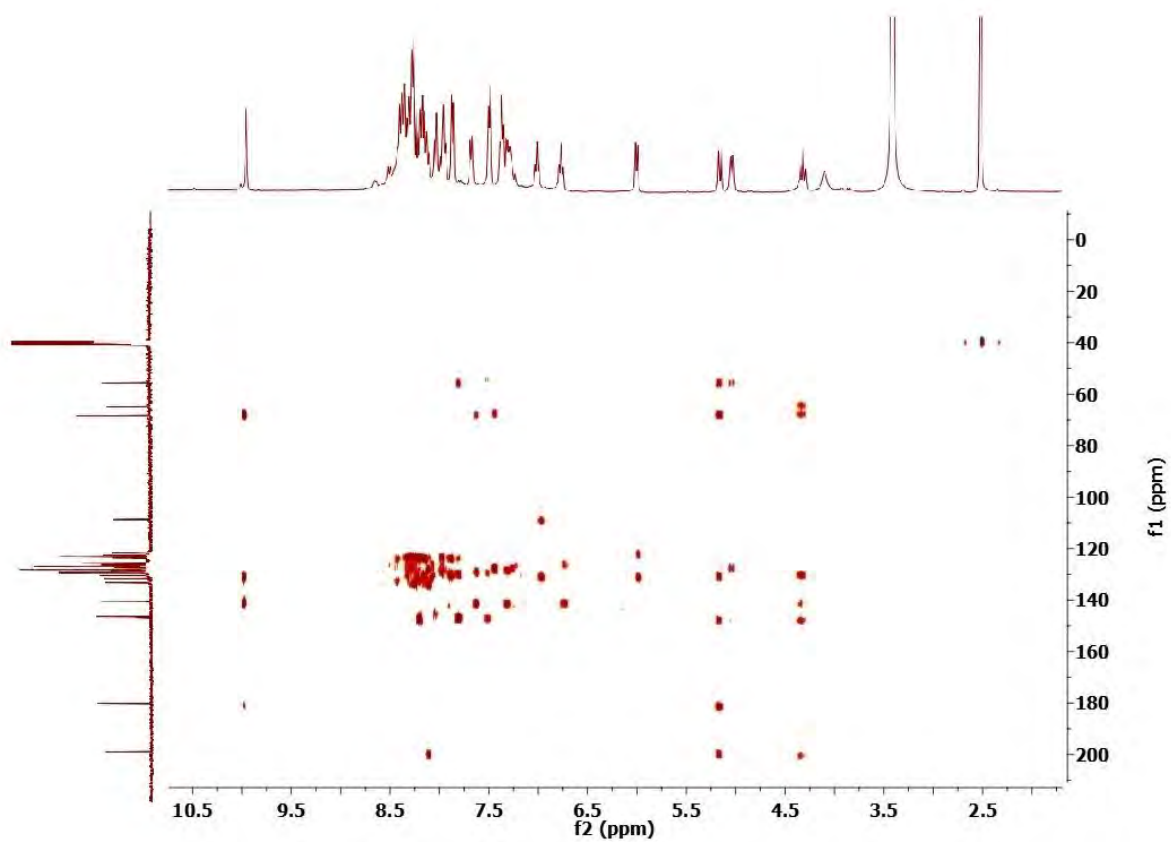
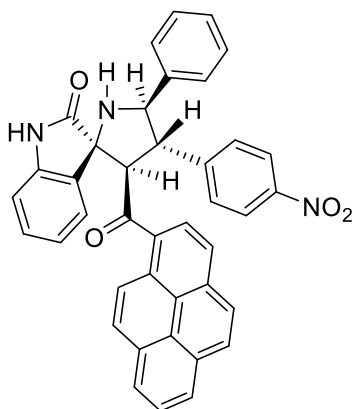




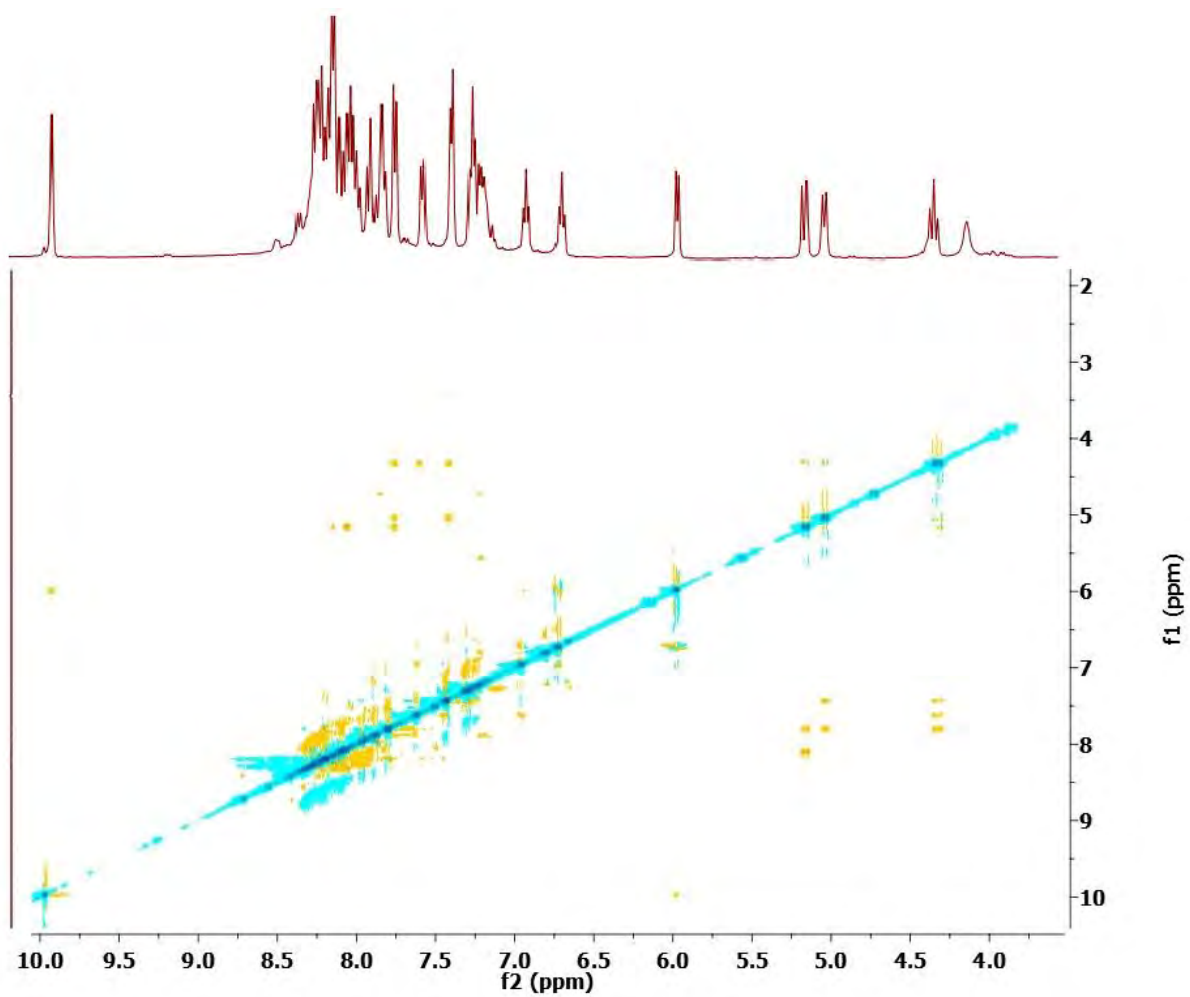
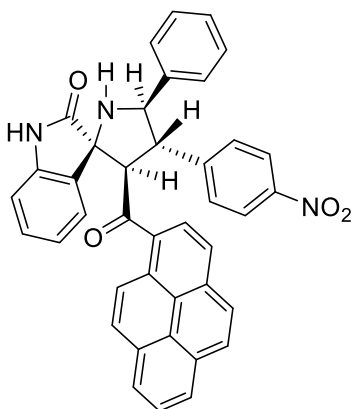
$^1\text{H}$ - $^{13}\text{C}$ -HSQC NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32,  $\text{C}_{40}\text{H}_{27}\text{N}_3\text{O}_4$ )



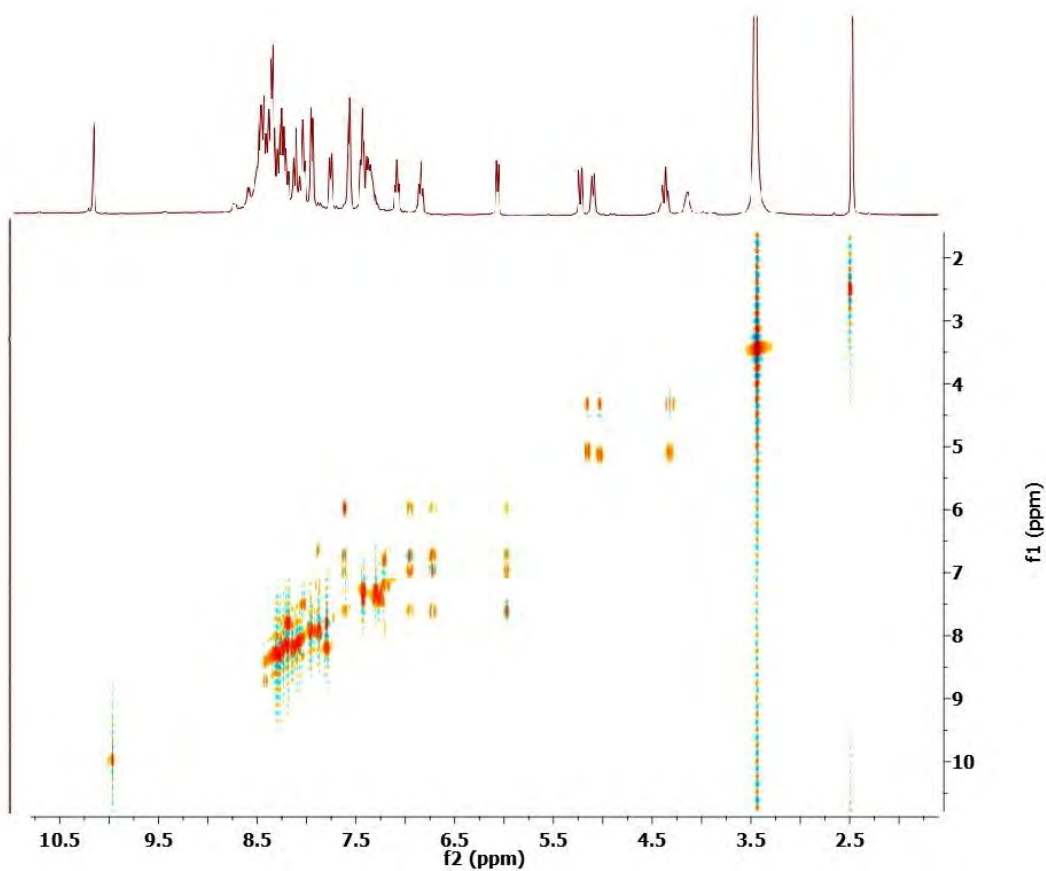
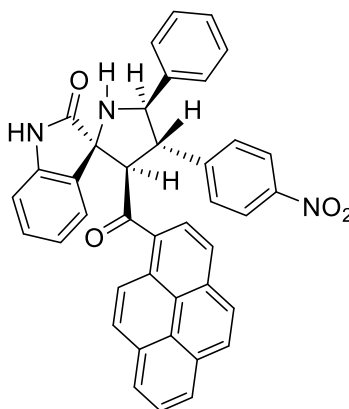
**$^1\text{H}$ - $^{13}\text{C}$ -HMBC NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32,  $\text{C}_{40}\text{H}_{27}\text{N}_3\text{O}_4$ )**



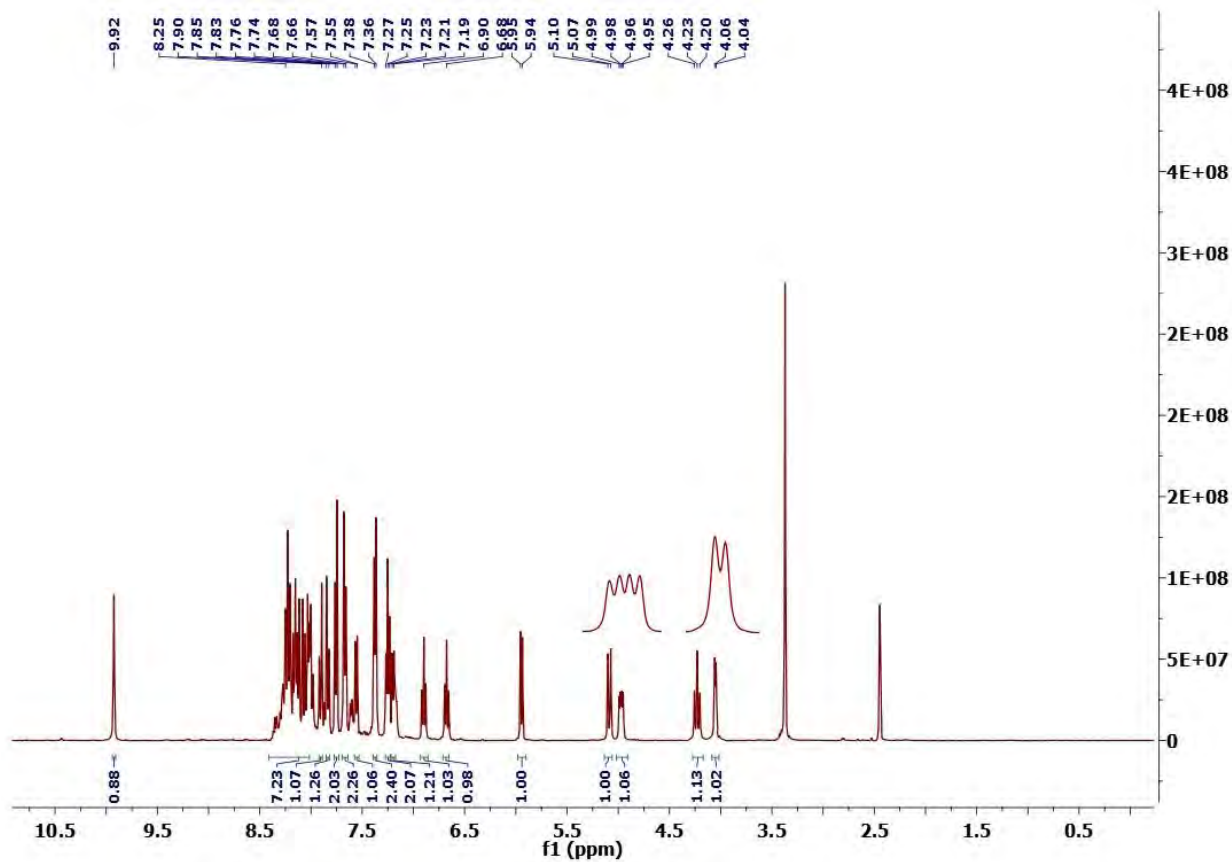
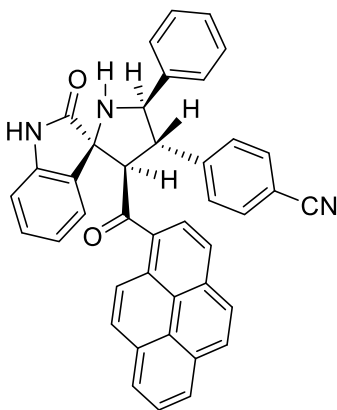
**$^1\text{H}$ - $^1\text{H}$  ROESY NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (32,  $\text{C}_{40}\text{H}_{27}\text{N}_3\text{O}_4$ )**



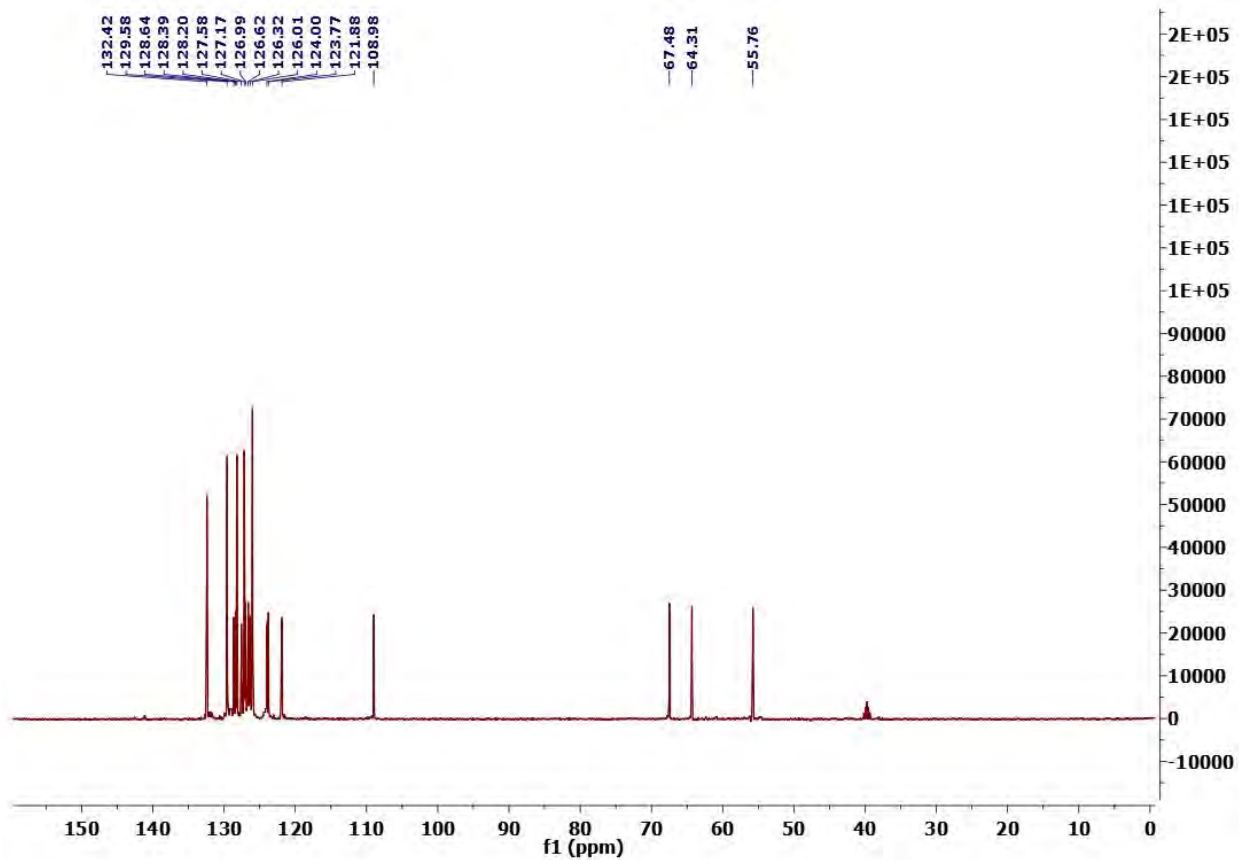
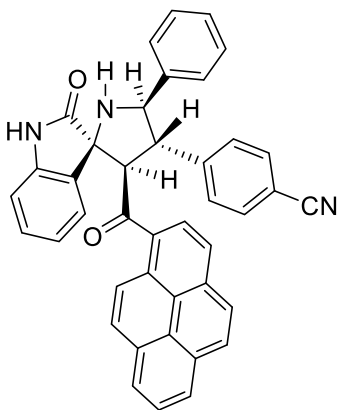
TOCSY NMR spectrum of (3*S*,3'*R*,4*S*,5'*R*)-4'-(4-nitrophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (**32**, C<sub>40</sub>H<sub>27</sub>N<sub>3</sub>O<sub>4</sub>)



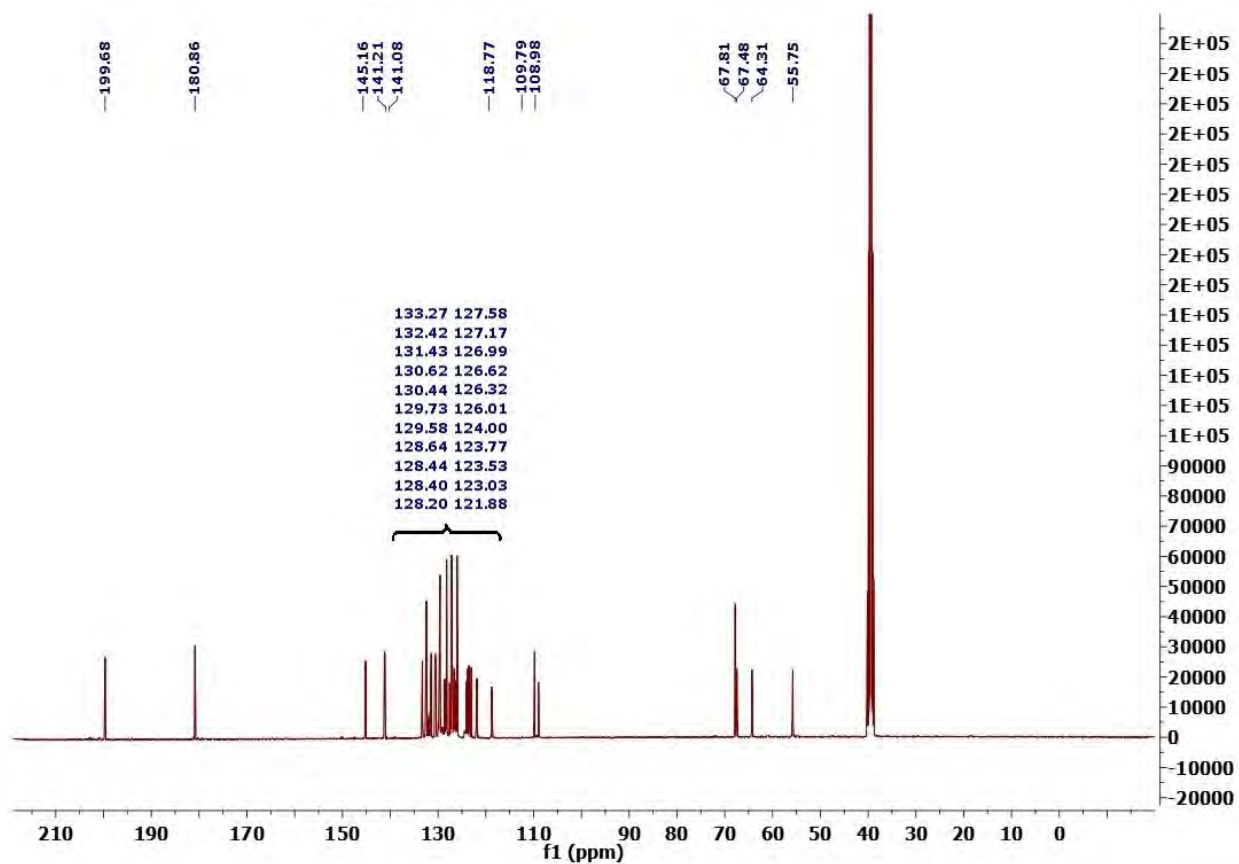
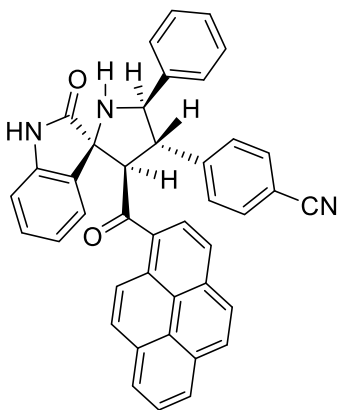
$^1\text{H}$  NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33,  $\text{C}_{41}\text{H}_{27}\text{N}_3\text{O}_2$ )



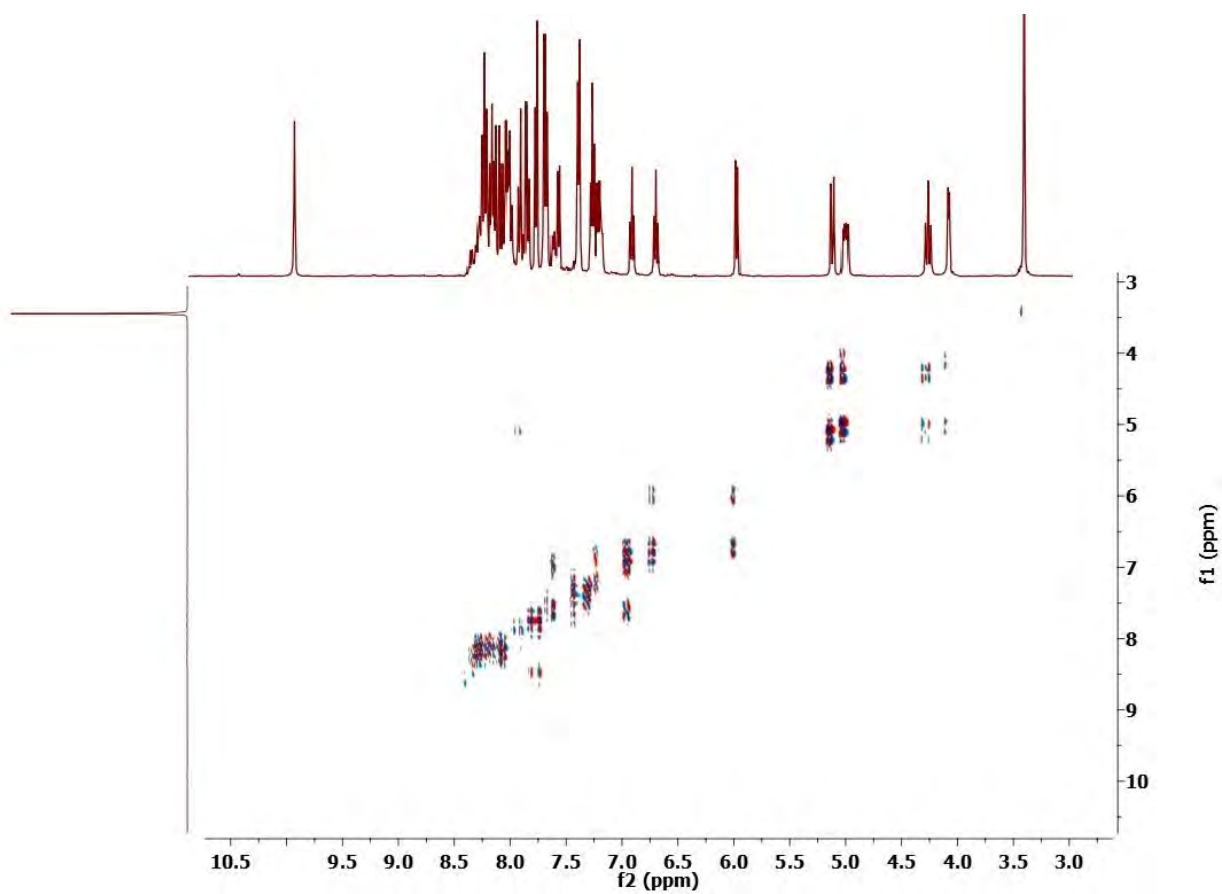
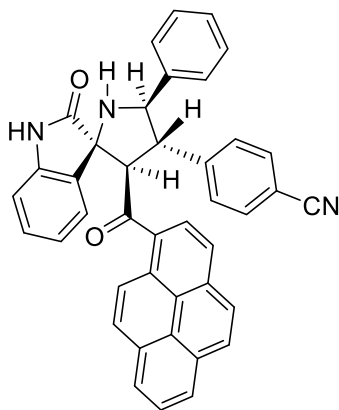
DEPT-90 NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C<sub>41</sub>H<sub>27</sub>N<sub>3</sub>O<sub>2</sub>)



<sup>13</sup>C NMR spectrum of (3S,3'R,4'S,5'R)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33, C<sub>41</sub>H<sub>27</sub>N<sub>3</sub>O<sub>2</sub>)

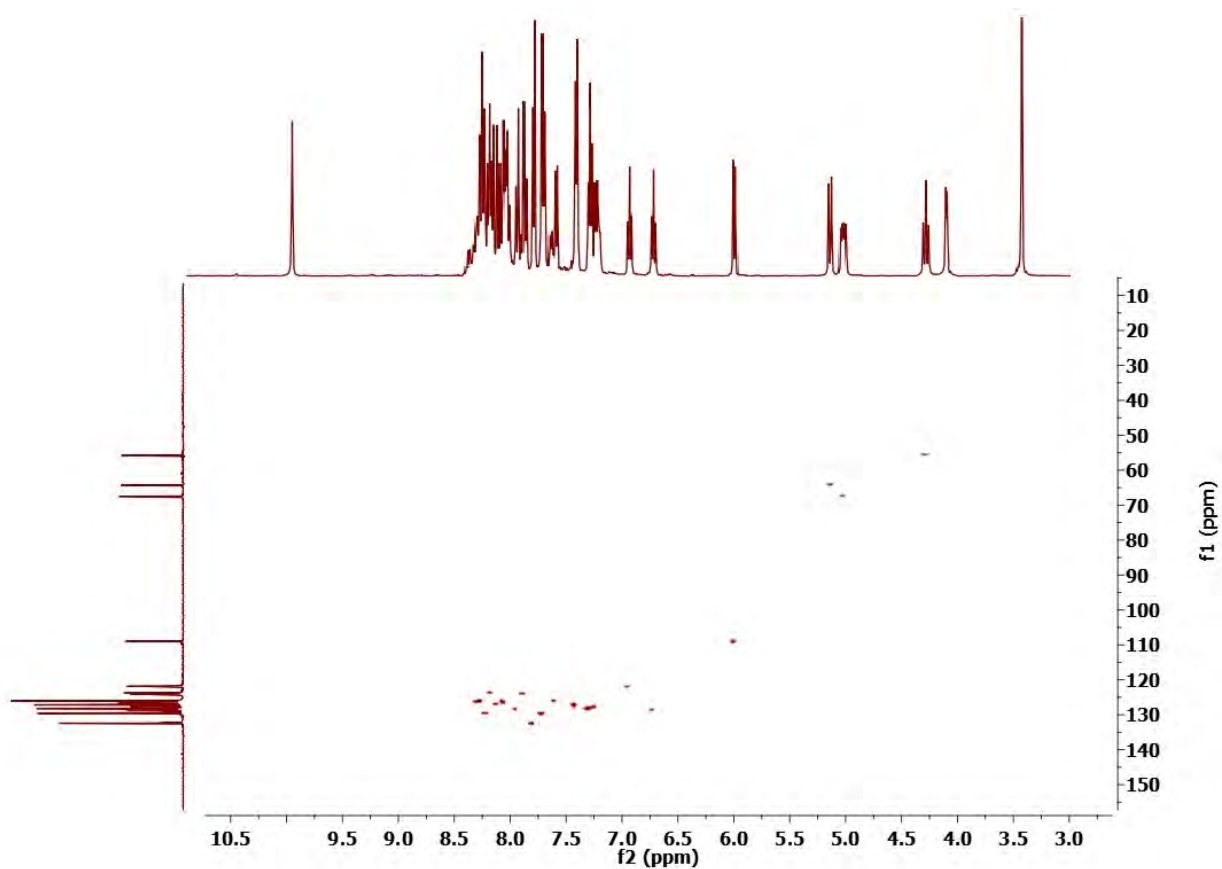
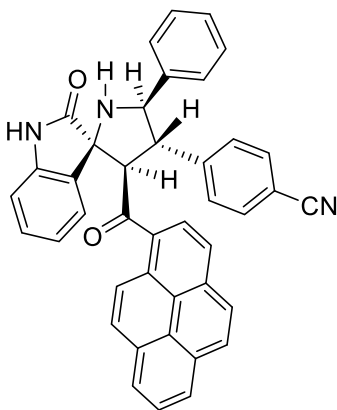


**$^1\text{H}$ - $^1\text{H}$ -COSY NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33,  $\text{C}_{41}\text{H}_{27}\text{N}_3\text{O}_2$ )**





$^1\text{H}$ - $^{13}\text{C}$ -HSQC NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33,  $\text{C}_{41}\text{H}_{27}\text{N}_3\text{O}_2$ )



$^1\text{H}$ - $^{13}\text{C}$ -HMBC NMR spectrum of (3*S*,3'*R*,4'*S*,5'*R*)-4'-(4-cyanophenyl)-5'-phenyl-3'-(pyrene-1-carbonyl)spiro[indoline-3,2'-pyrrolidin]-2-one (33,  $\text{C}_{41}\text{H}_{27}\text{N}_3\text{O}_2$ )

