

## Supplementary Material

### Synthesis, characterization, antimicrobial activities and electrochemical behavior of new phenolic azo dyes from two thienocoumarin amines

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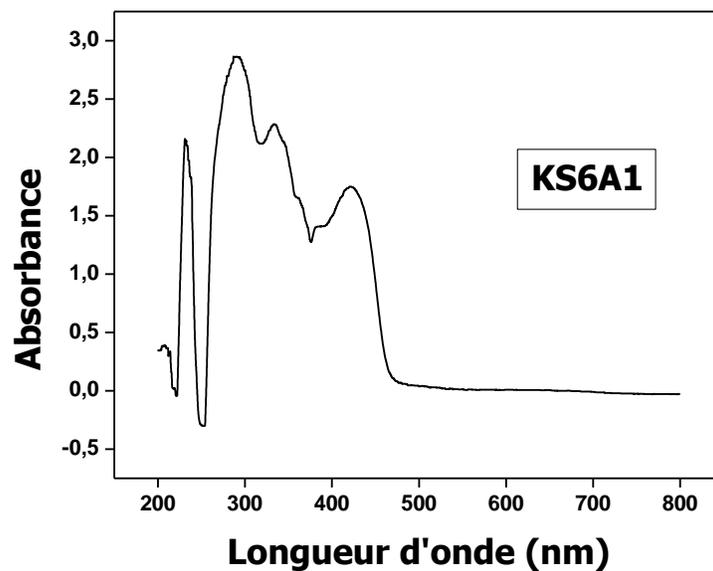
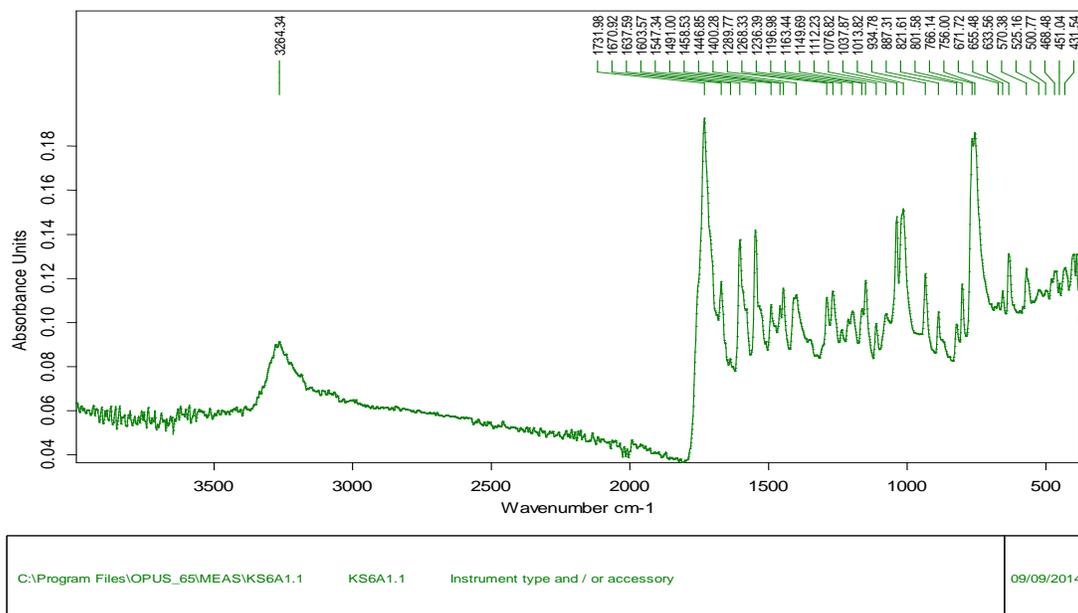
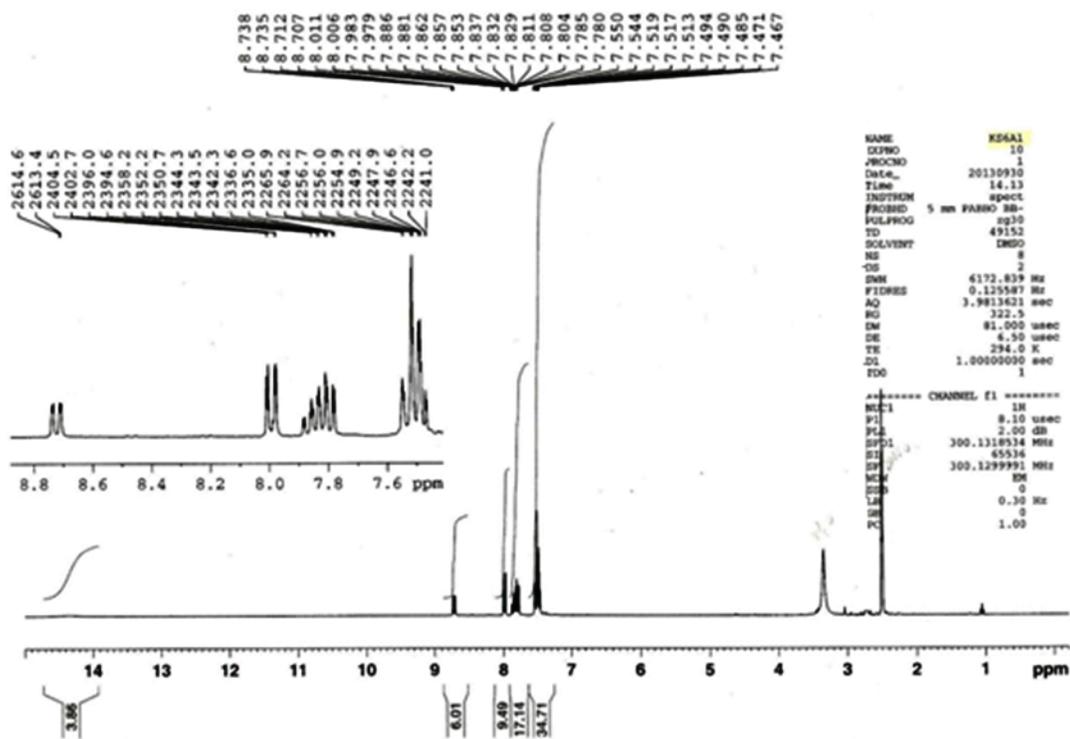


Figure 1. UV spectrum of compound 5a in ethanol as solvent.



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Figure 2. IR spectrum of compound 5a.

Figure 3. <sup>1</sup>H-NMR (DMSO-d<sub>6</sub>, 300 MHz) spectrum of compound 5a.



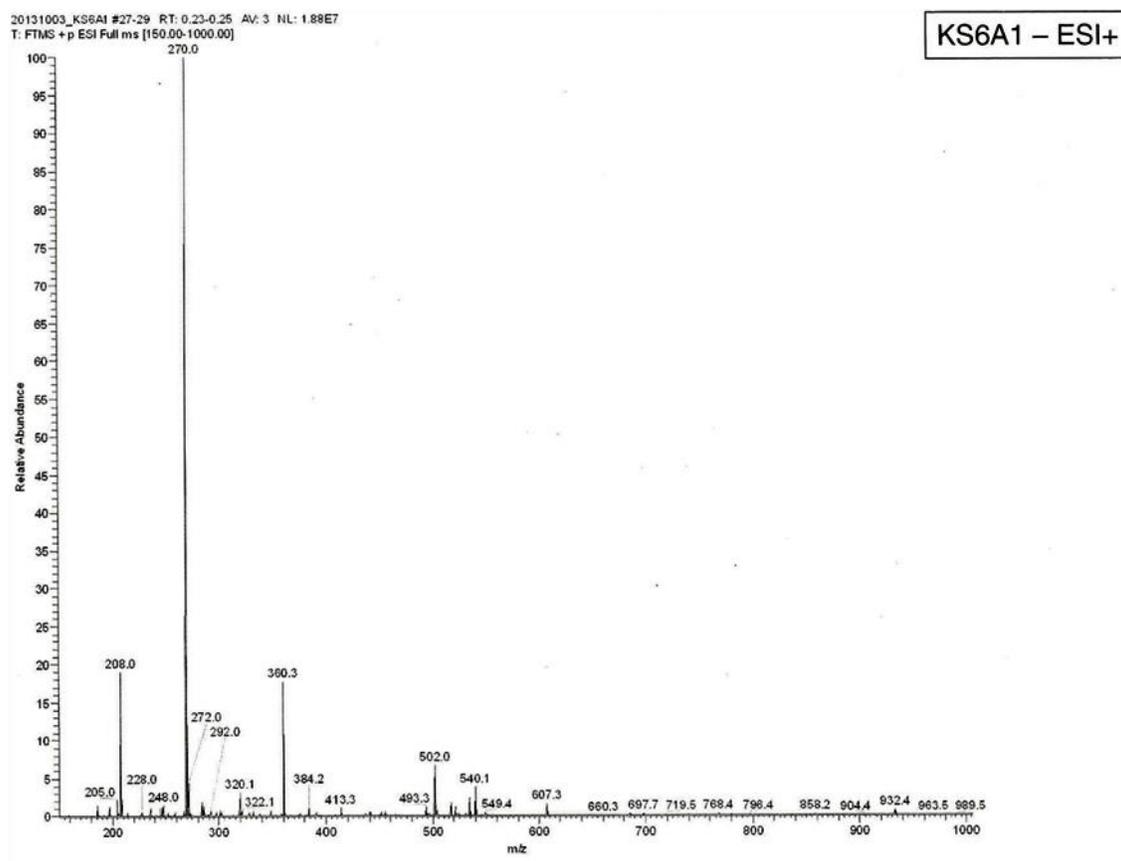


Figure 6. HRMS ESI-Positive mode of compound 5a.

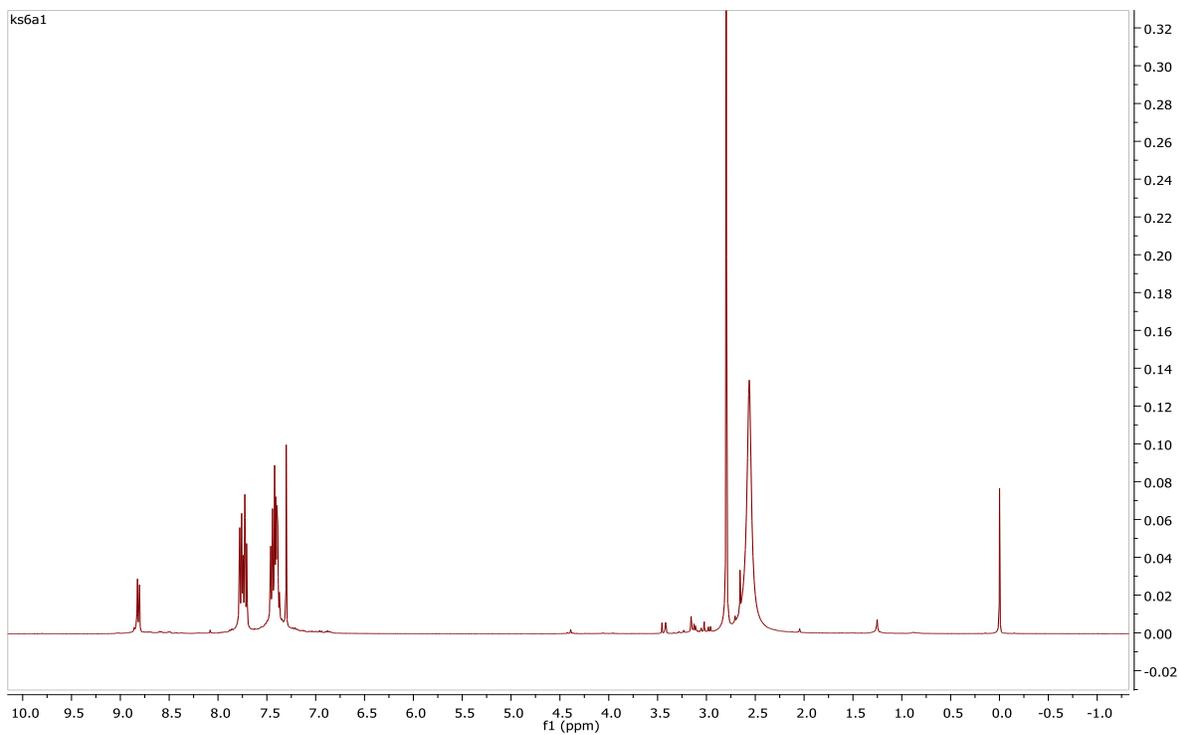


Figure 7.  $^1\text{H-NMR}$  ( $\text{DMSO-d}_6/\text{CDCl}_3$ , 400 MHz), spectrum of 5a.

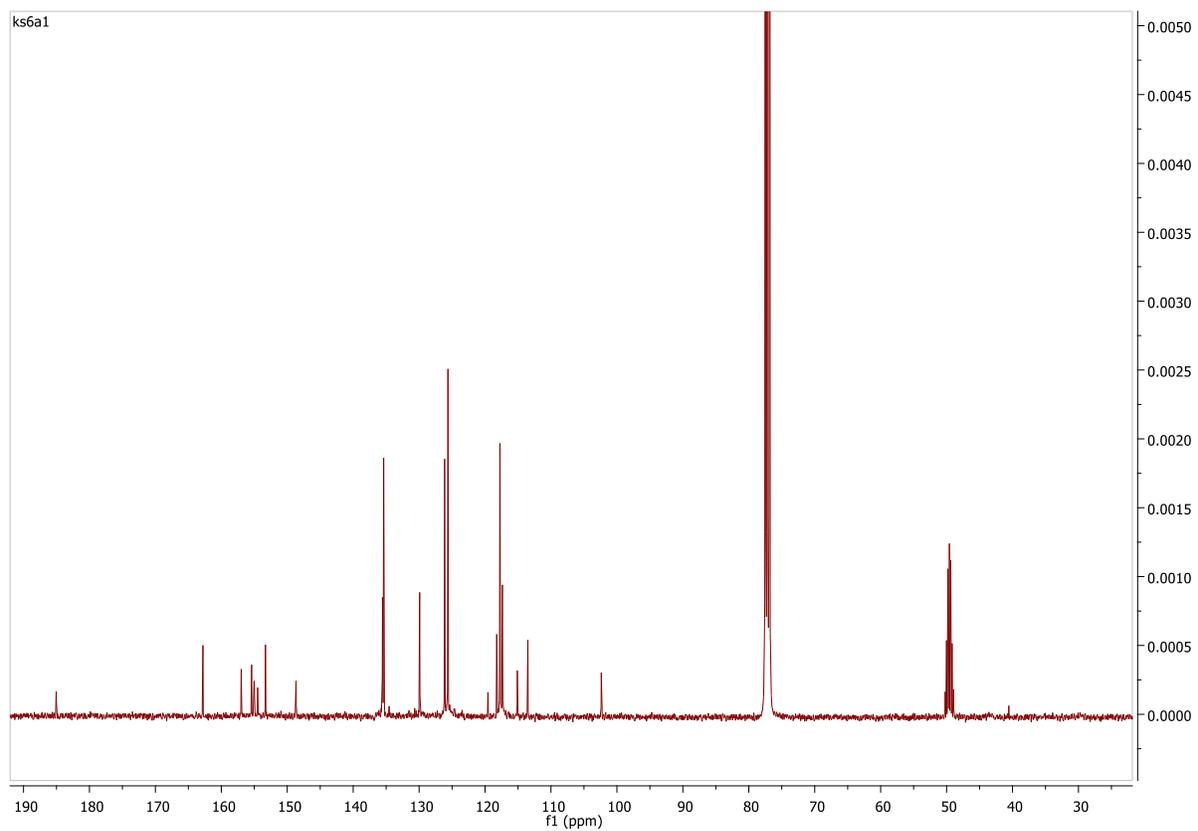
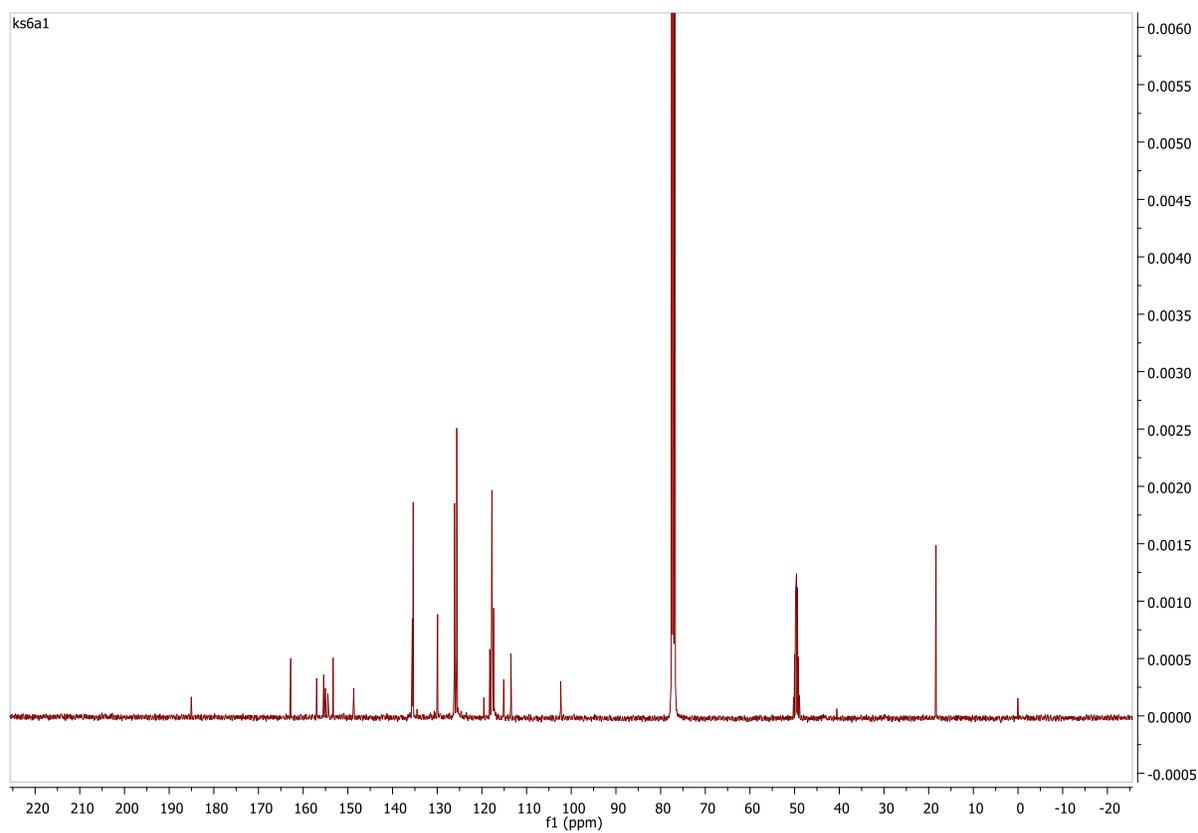


Figure 8.  $^{13}\text{C}(^1\text{H})$  NMR ( $\text{DMSO-d}_6/\text{CDCl}_3$ , 100 MHz) Spectra of 5a.

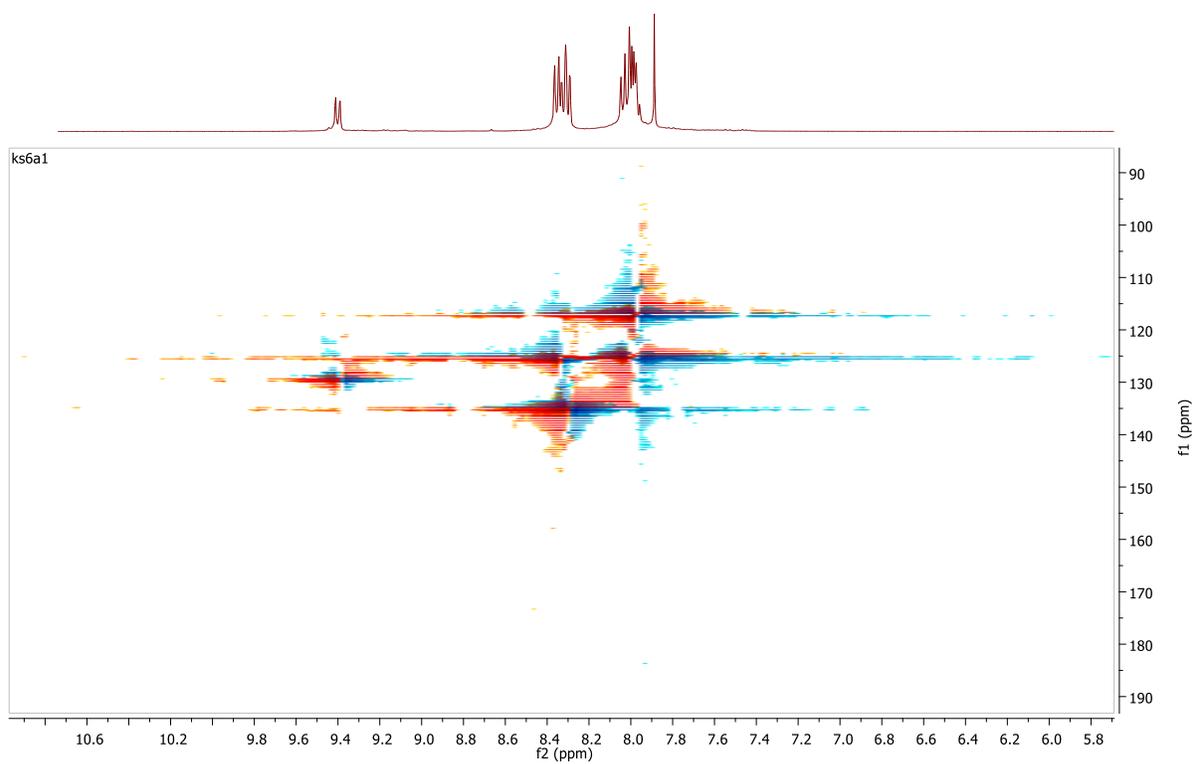


Figure 9.HSQC (DMSO-d<sub>6</sub>/CDCl<sub>3</sub>, 100 MHz) spectrum of 5a.

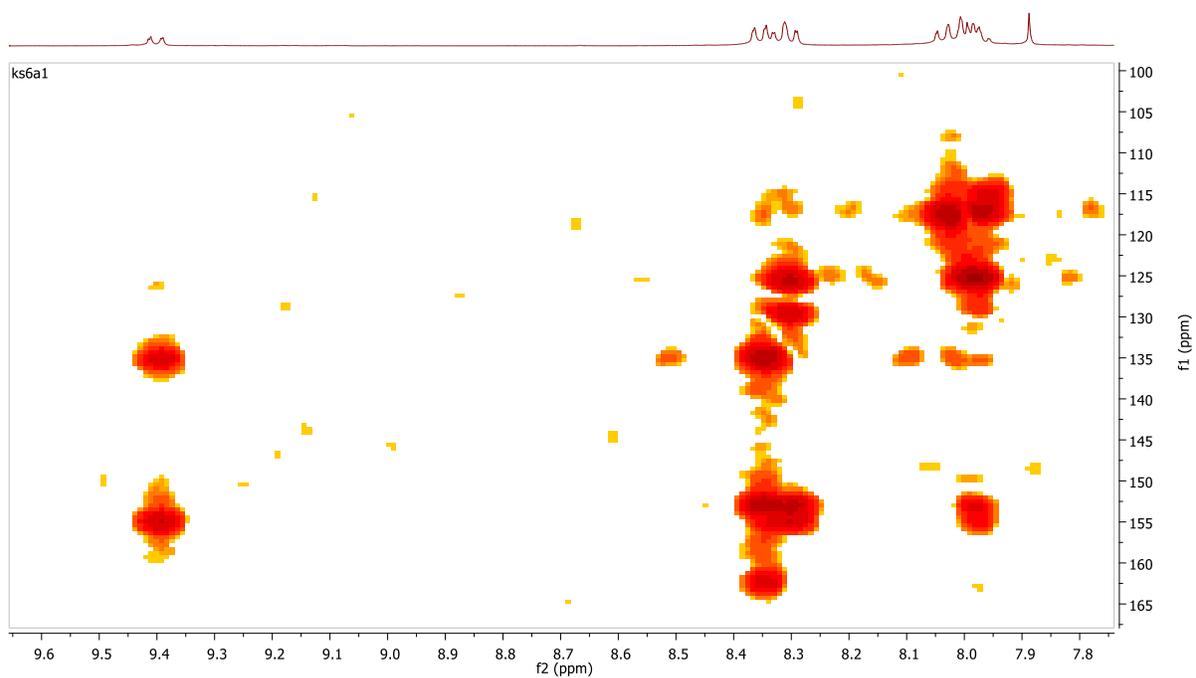


Figure 10.HMBC (DMSO-d<sub>6</sub>/CDCl<sub>3</sub>, 100 MHz) spectrum of 5a.

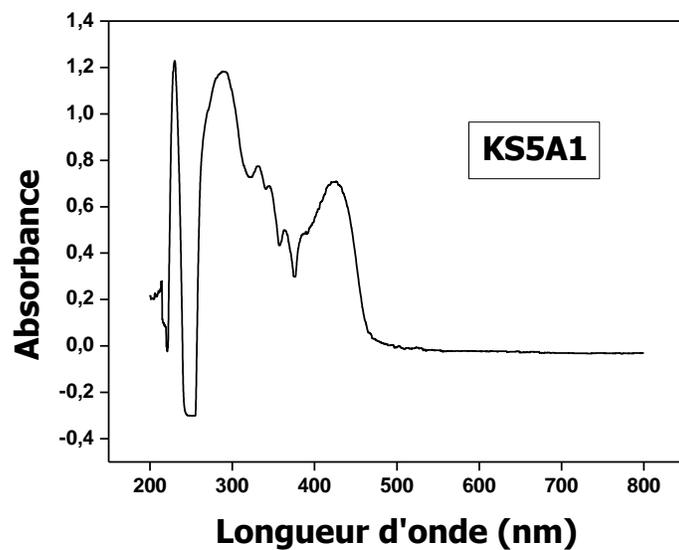


Figure 11. UV spectrum of compound 5b in ethanol as solvent.

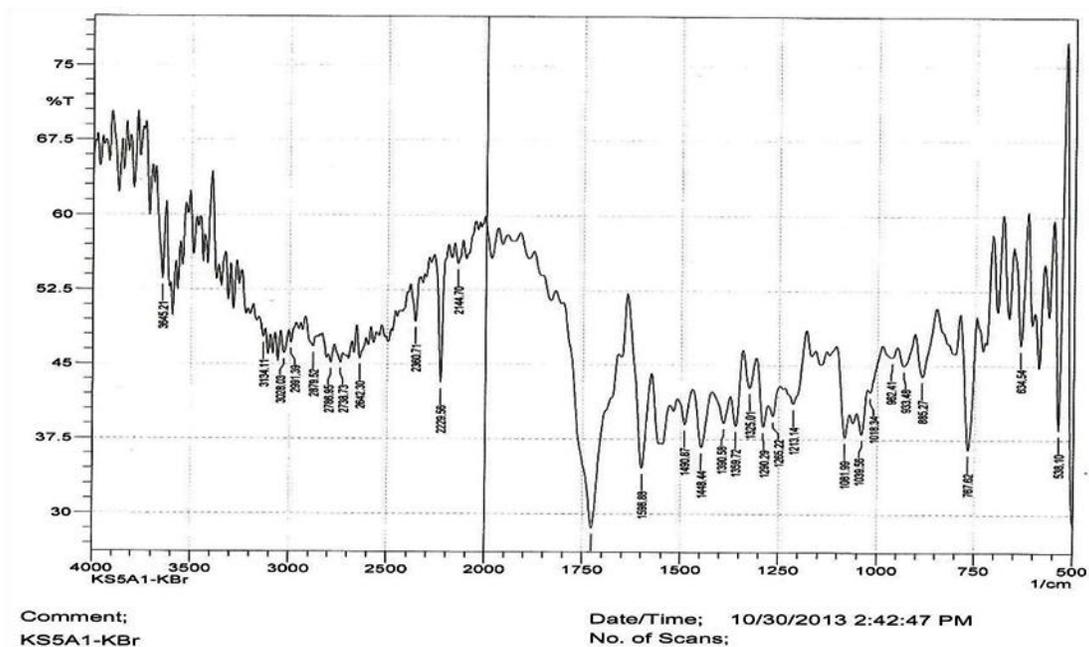


Figure 12. IR spectrum of compound 5b.

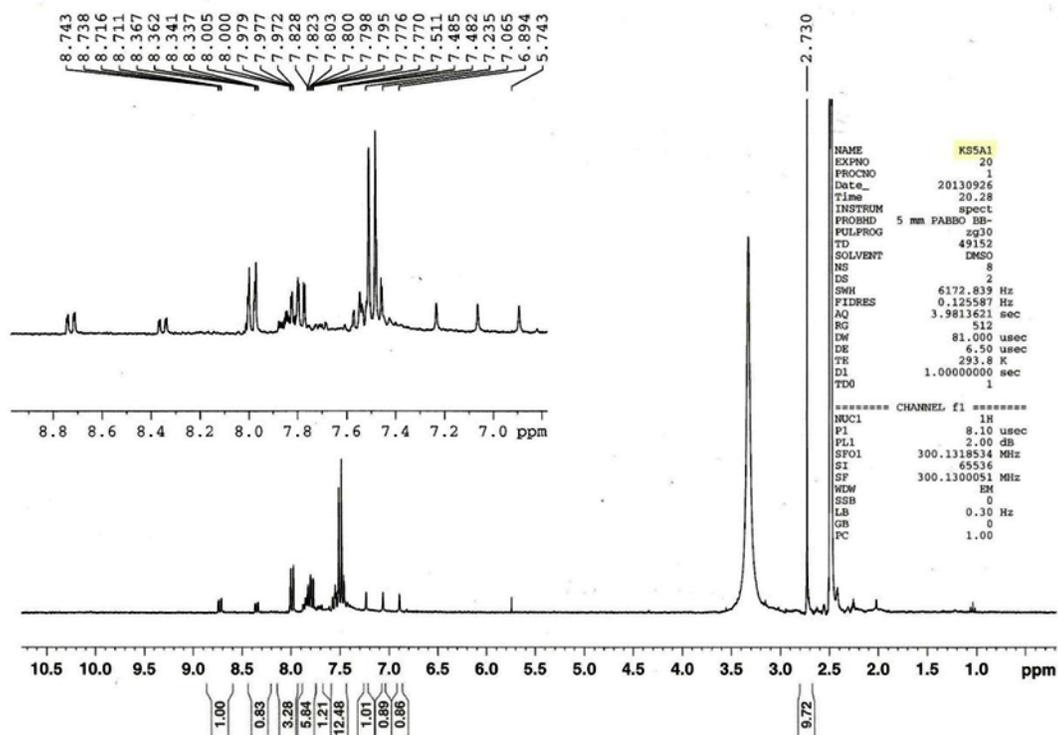


Figure 13.  $^1\text{H-NMR}$  (DMSO- $d_6$ , 300 MHz) spectrum of compound **5b**.

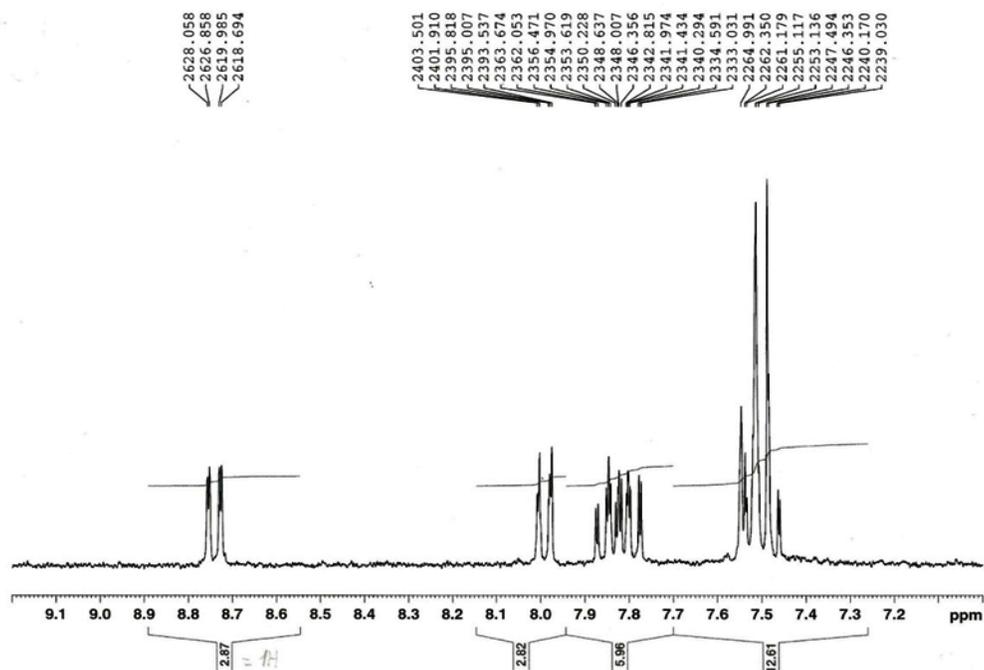


Figure 14. Enlarged  $^1\text{H-NMR}$  (DMSO- $d_6$ , 300 MHz) spectrum of compound **5b**.

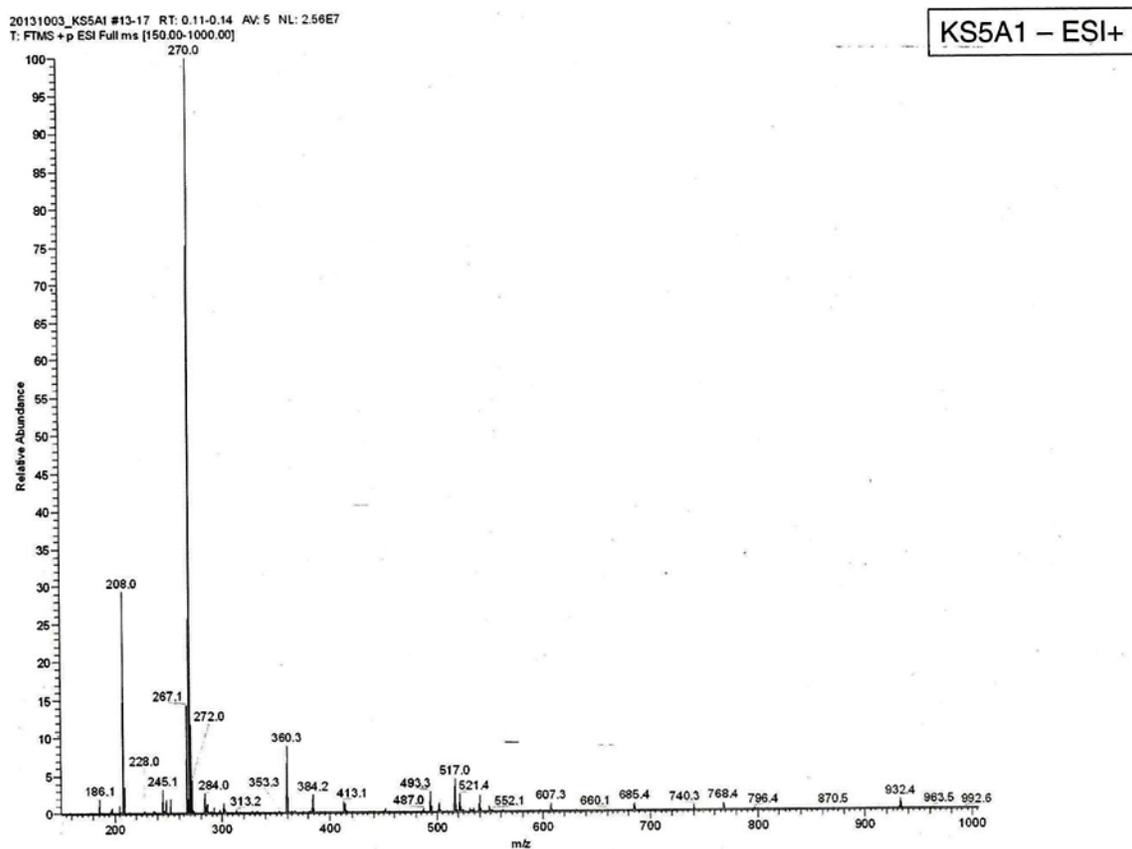


Figure 15. HRMS ESI-Positive mode of compound **5b**.

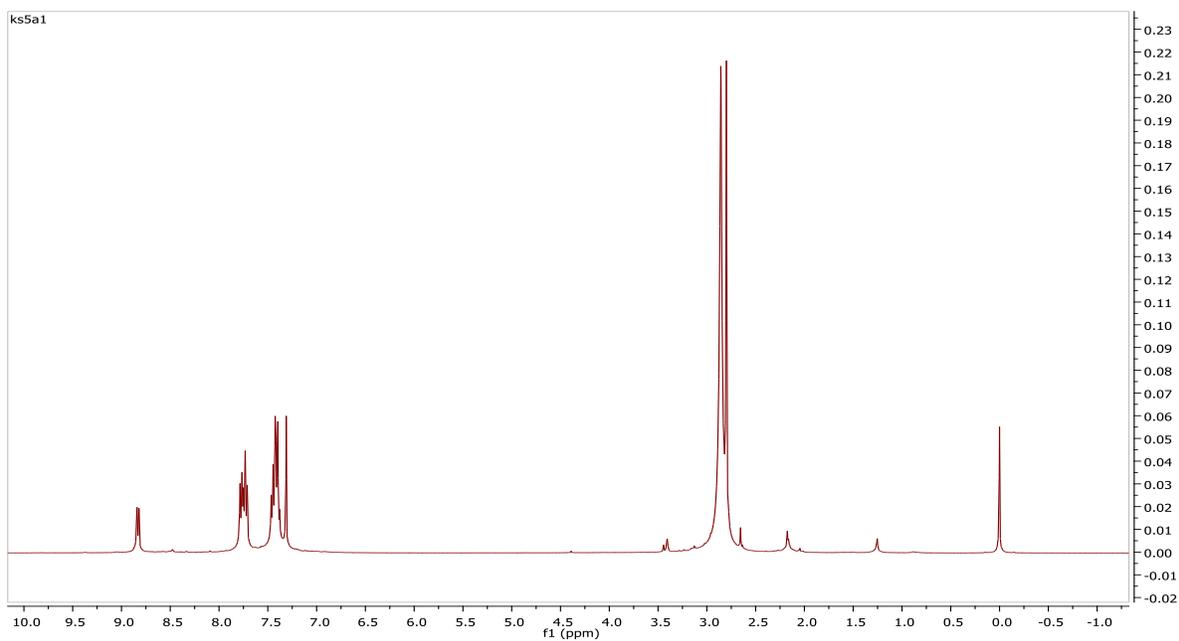


Figure 16.  $^1\text{H-NMR}$  ( $\text{DMSO-d}_6/\text{CDCl}_3$ , 400 MHz) spectrum of **5b**.

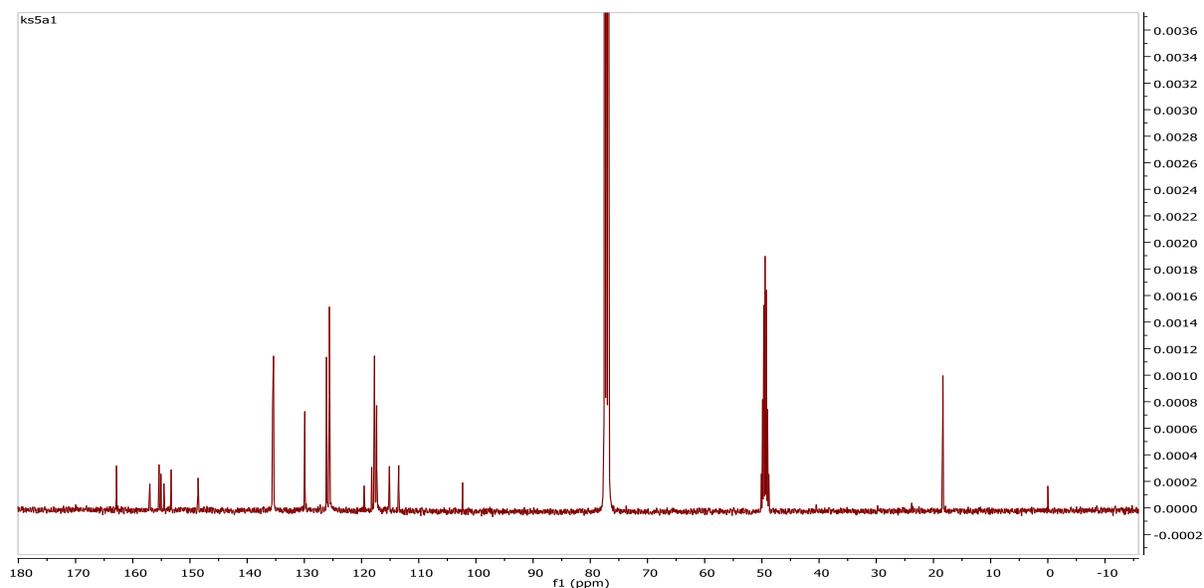


Figure 17.  $^{13}\text{C}$ ( $^1\text{H}$ ) NMR (DMSO- $d_6$ /CDCl $_3$ , 100 MHz) Spectra of 5b.

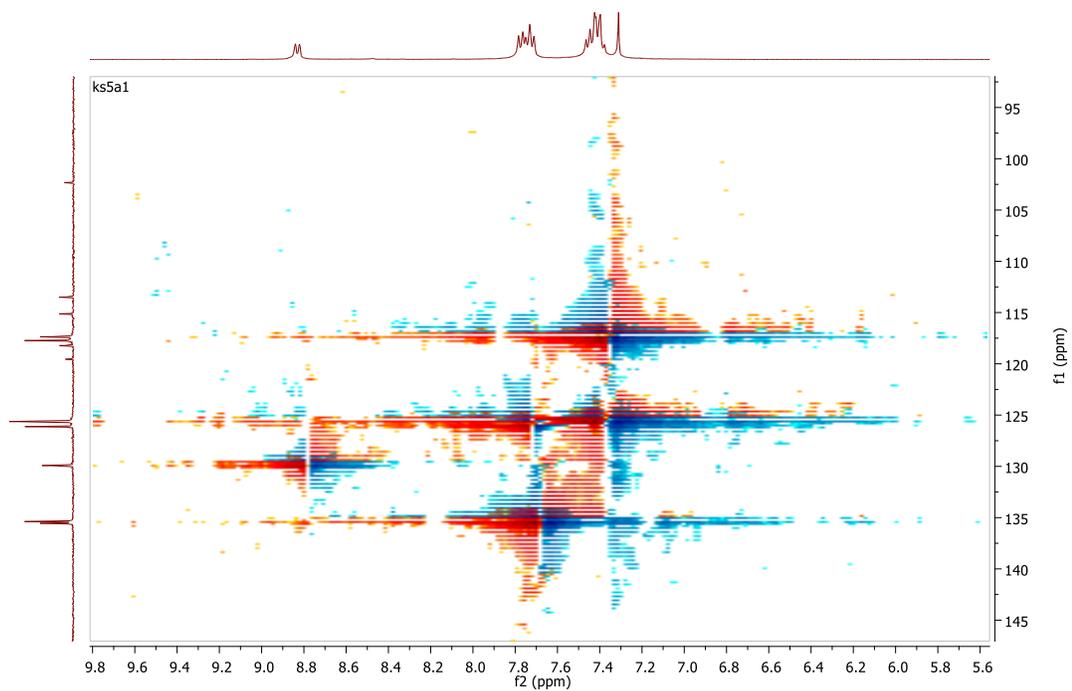


Figure 18. HSQC (DMSO- $d_6$ /CDCl $_3$ , 100 MHz) spectrum of 5b.

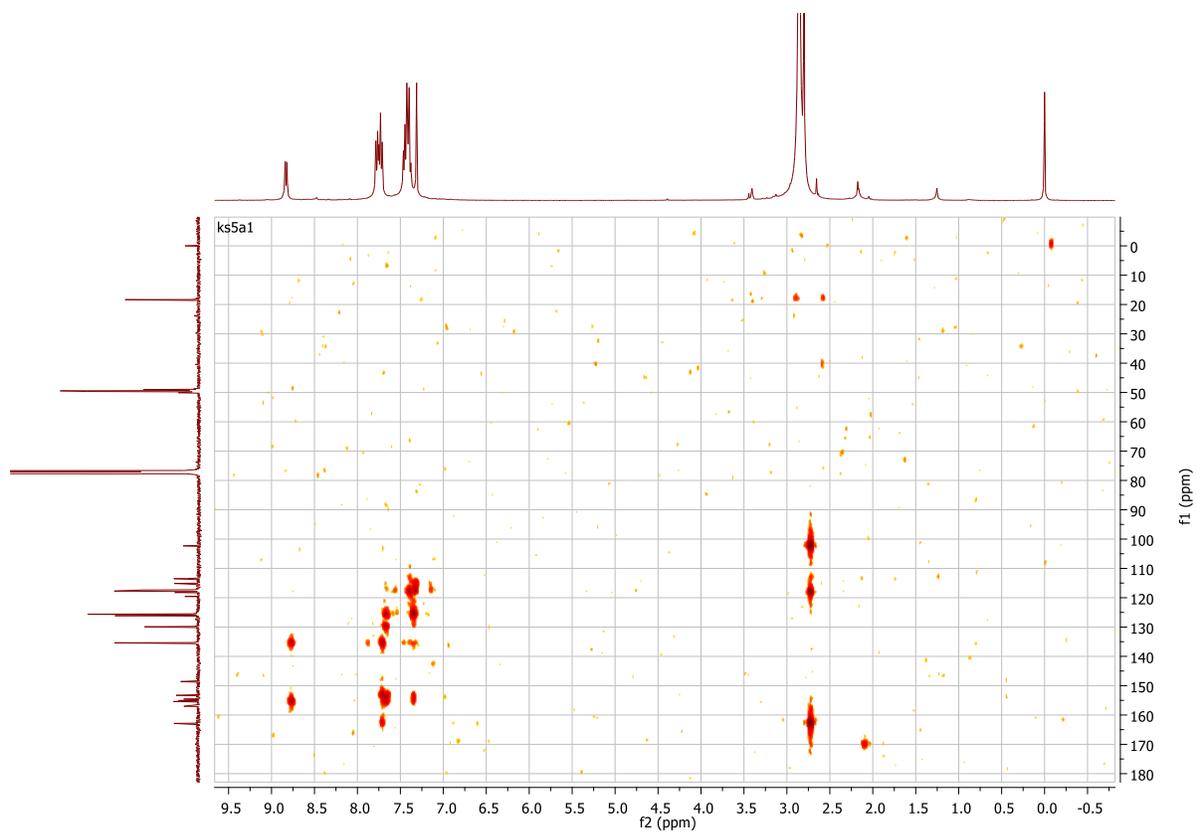


Figure 19. HMBC (DMSO-d<sub>6</sub>/CDCl<sub>3</sub>, 100 MHz) spectrum of 5b.

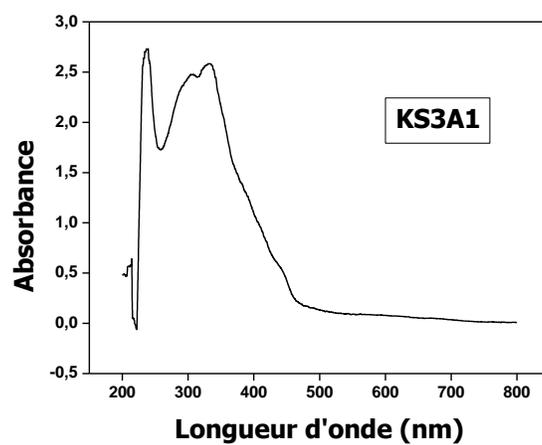
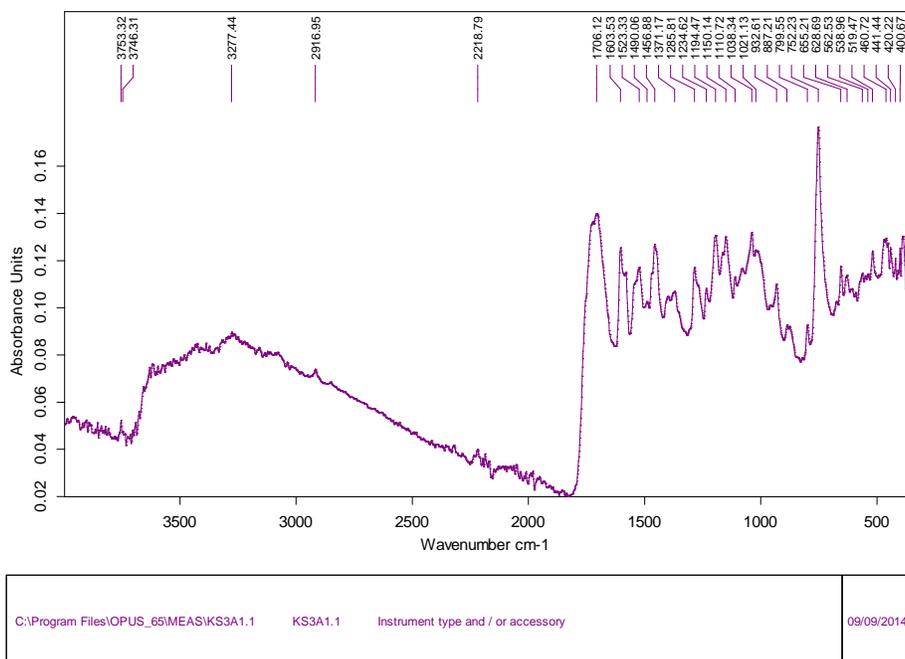
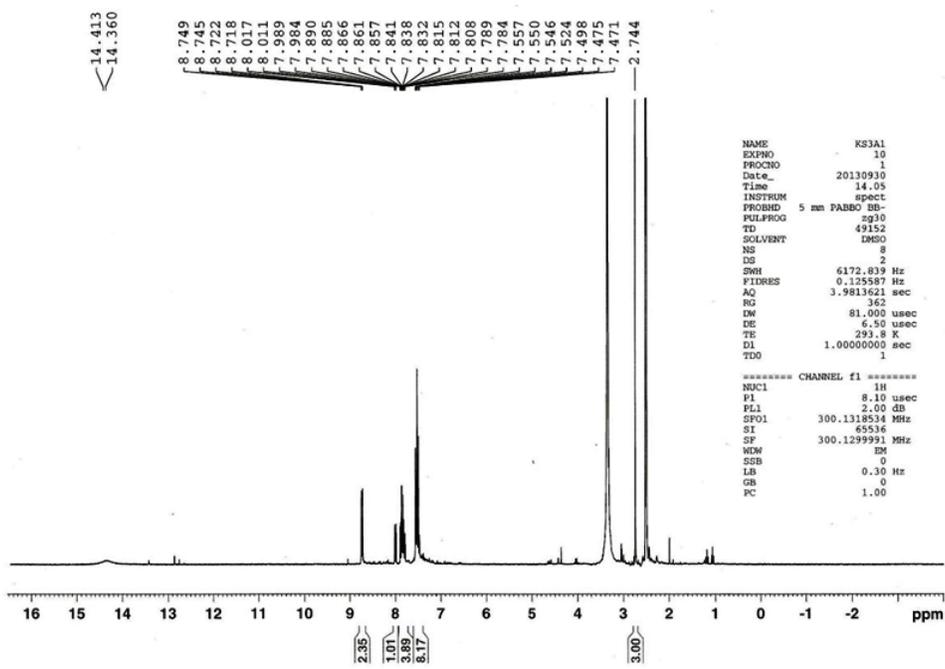


Figure 20. UV spectrum of compound 5c in ethanol as solvent.



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Figure 21. IR spectrum of compound 5c.

Figure 22. <sup>1</sup>H-NMR (DMSO-d<sub>6</sub>, 500 MHz) spectrum of compound 5c.

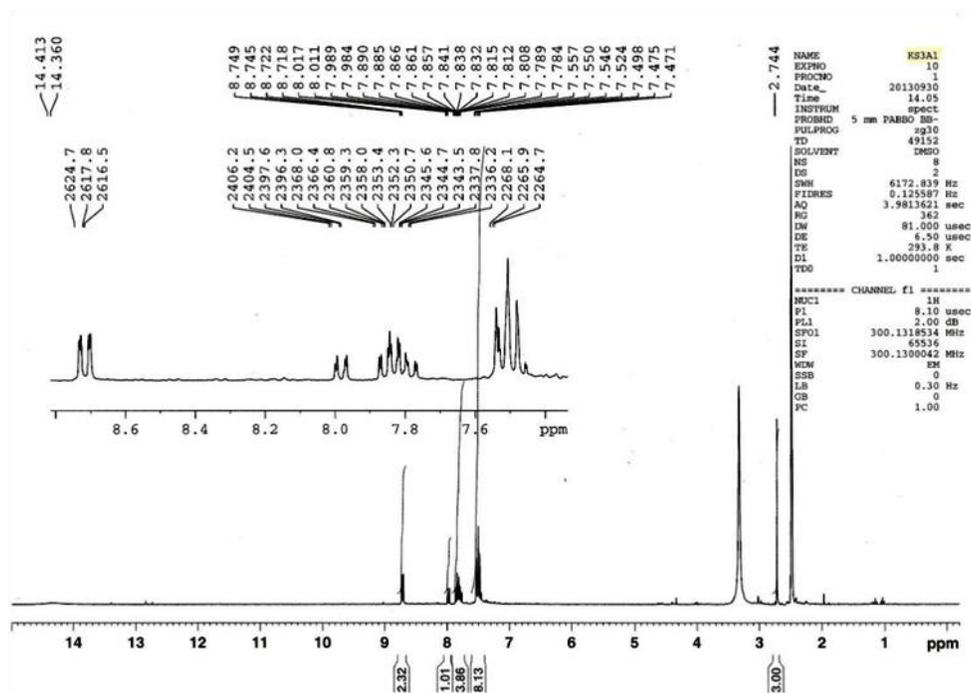


Figure 23. Enlarged  $^1\text{H}$ -NMR (DMSO- $d_6$ , 500 MHz) spectrum of compound 5c.

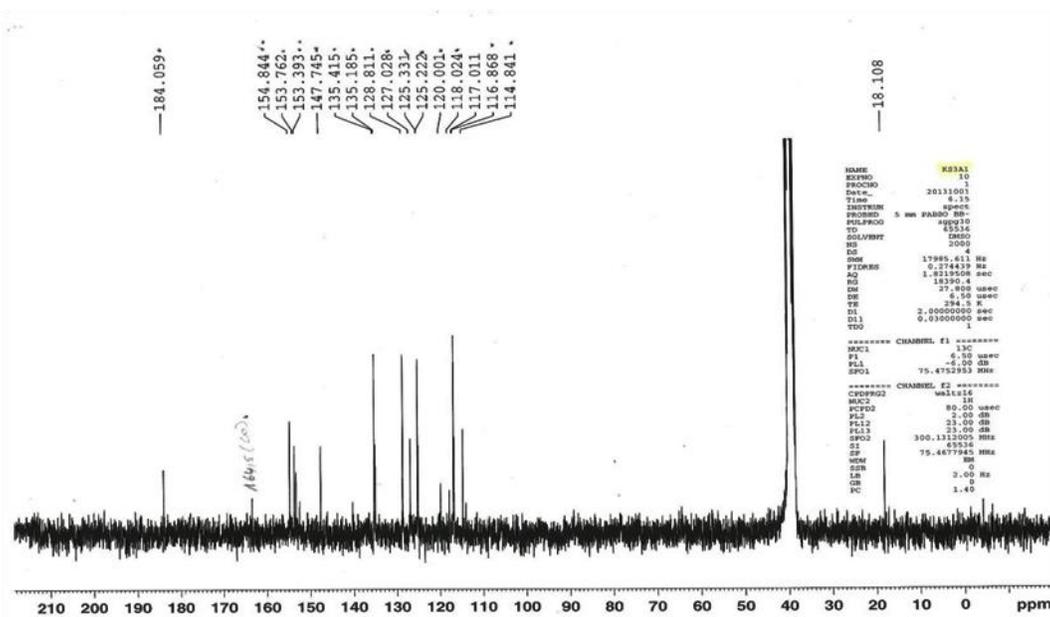


Figure 24.  $^{13}\text{C}(^1\text{H})$ -NMR (DMSO- $d_6$ , 75 MHz) of compound 5c.

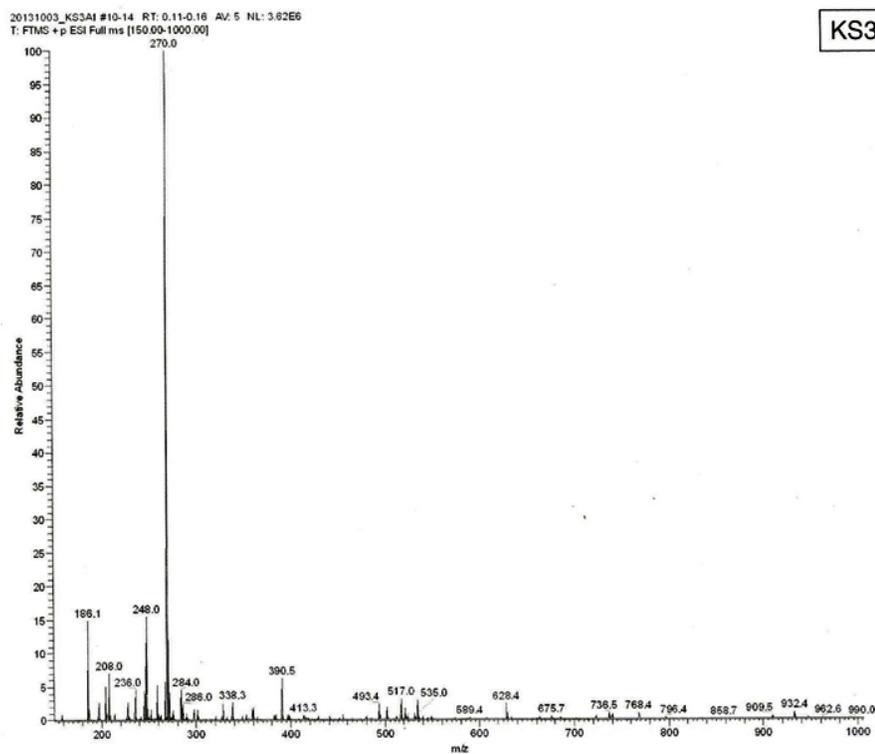


Figure 25. HRMS ESI-Positive mode of compound 5c.

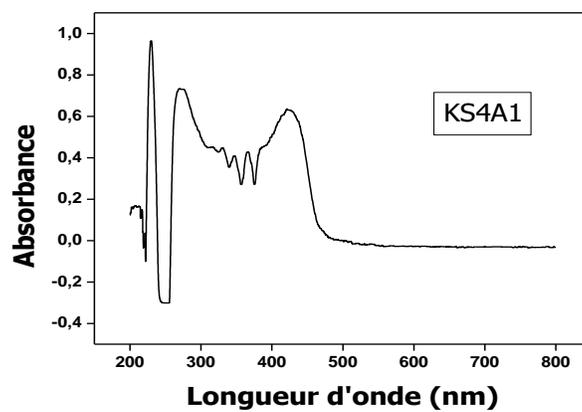


Figure 26. UV spectrum of compound 6 in ethanol as solvent.

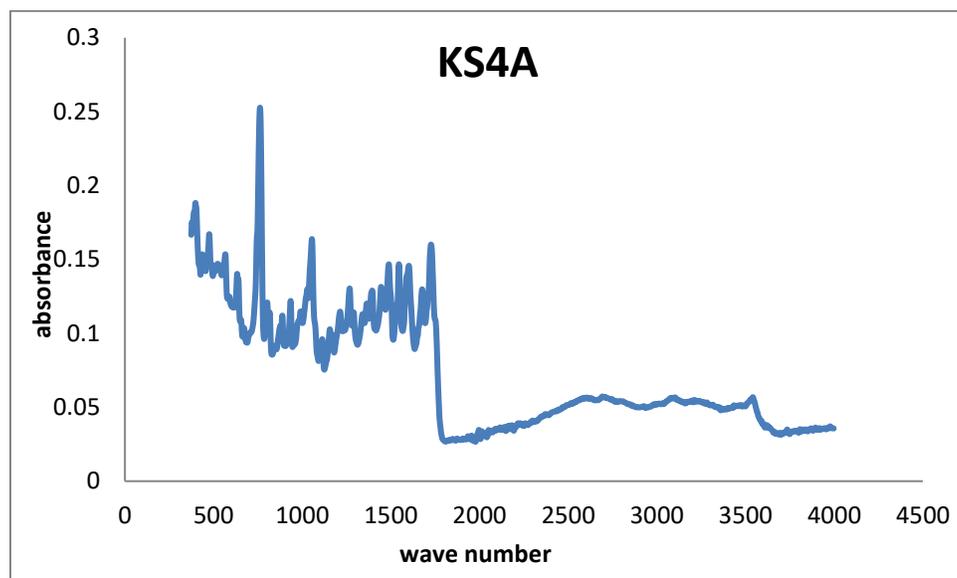


Figure 27. IR spectrum of compound 6.

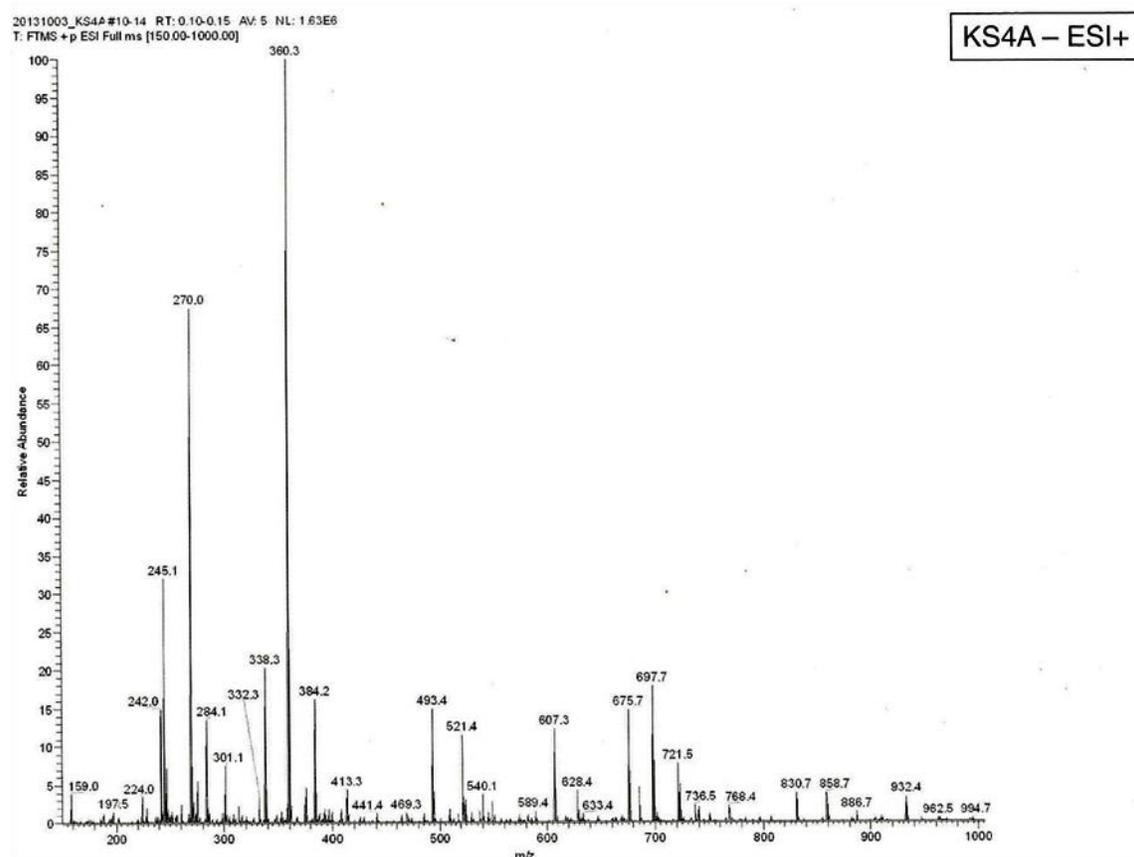


Figure 28. HRMS ESI-Positive mode of compound 6.

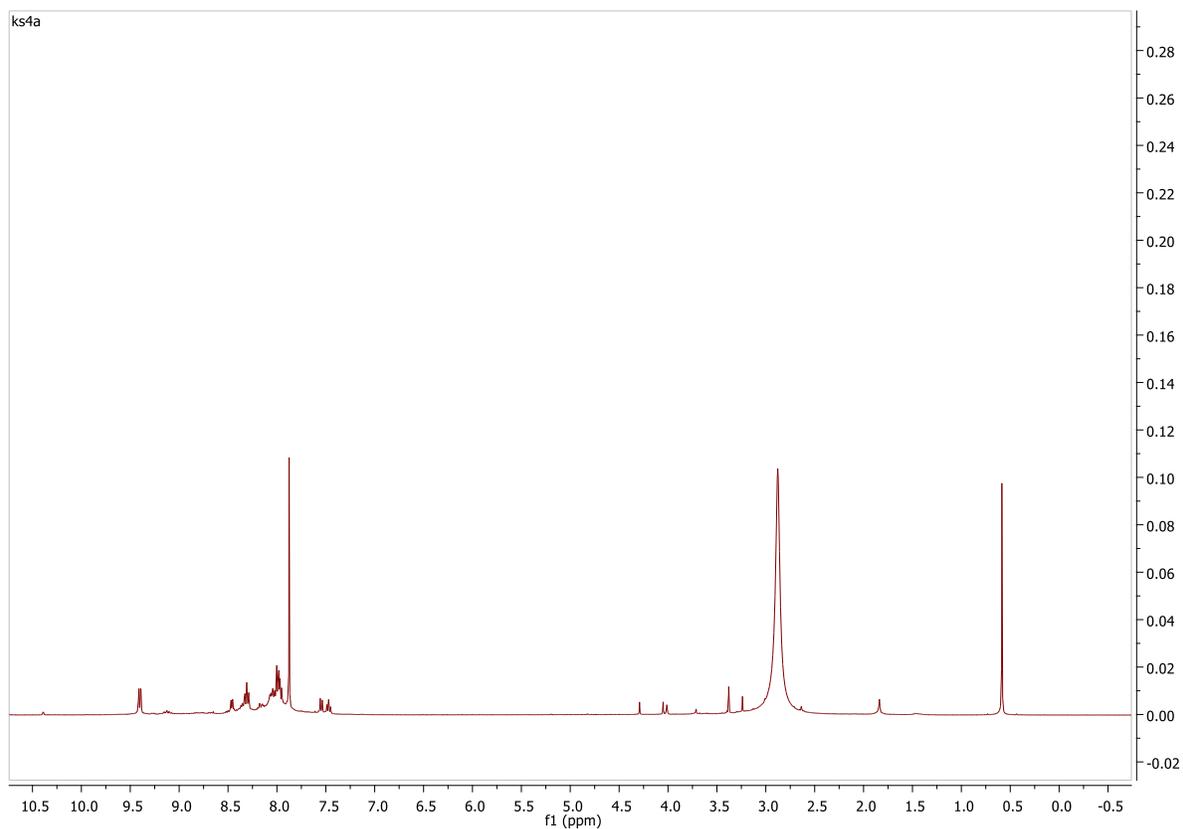


Figure 29.  $^1\text{H-NMR}$  (DMSO- $d_6$ /CDCl $_3$ , 400 MHz) spectrum of **6**.

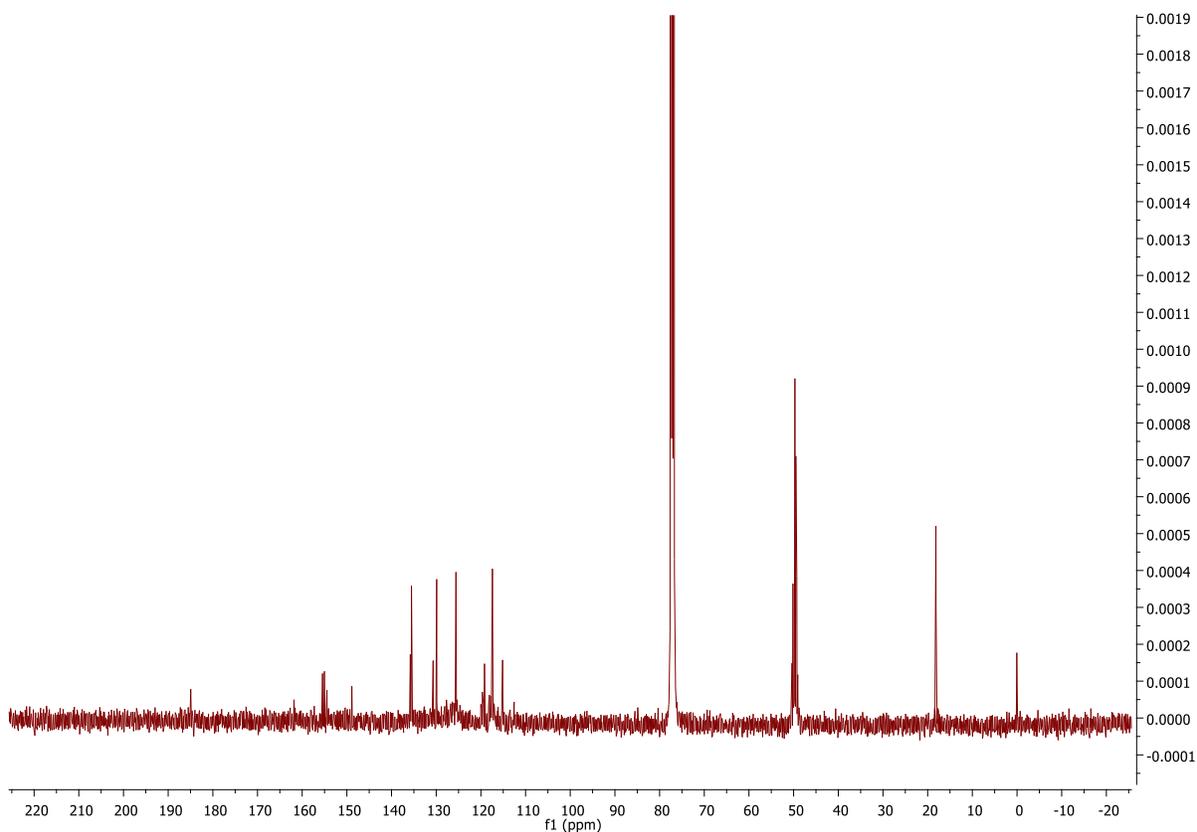


Figure 30.  $^{13}\text{C}(^1\text{H})$  NMR (DMSO- $d_6$ /CDCl $_3$ , 100 MHz) Spectrum of **6**.

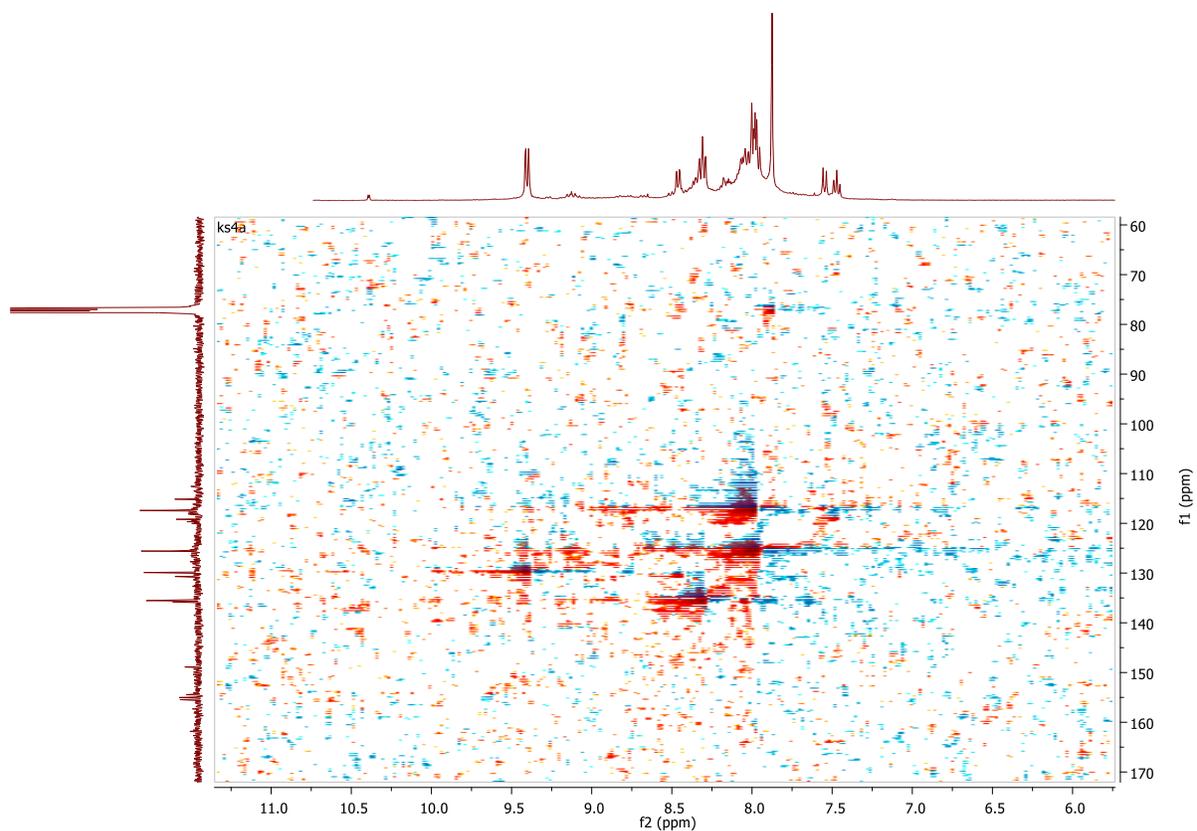


Figure 31. HSQC (DMSO-d<sub>6</sub>/CDCl<sub>3</sub>, 100 MHz) spectrum of 6.

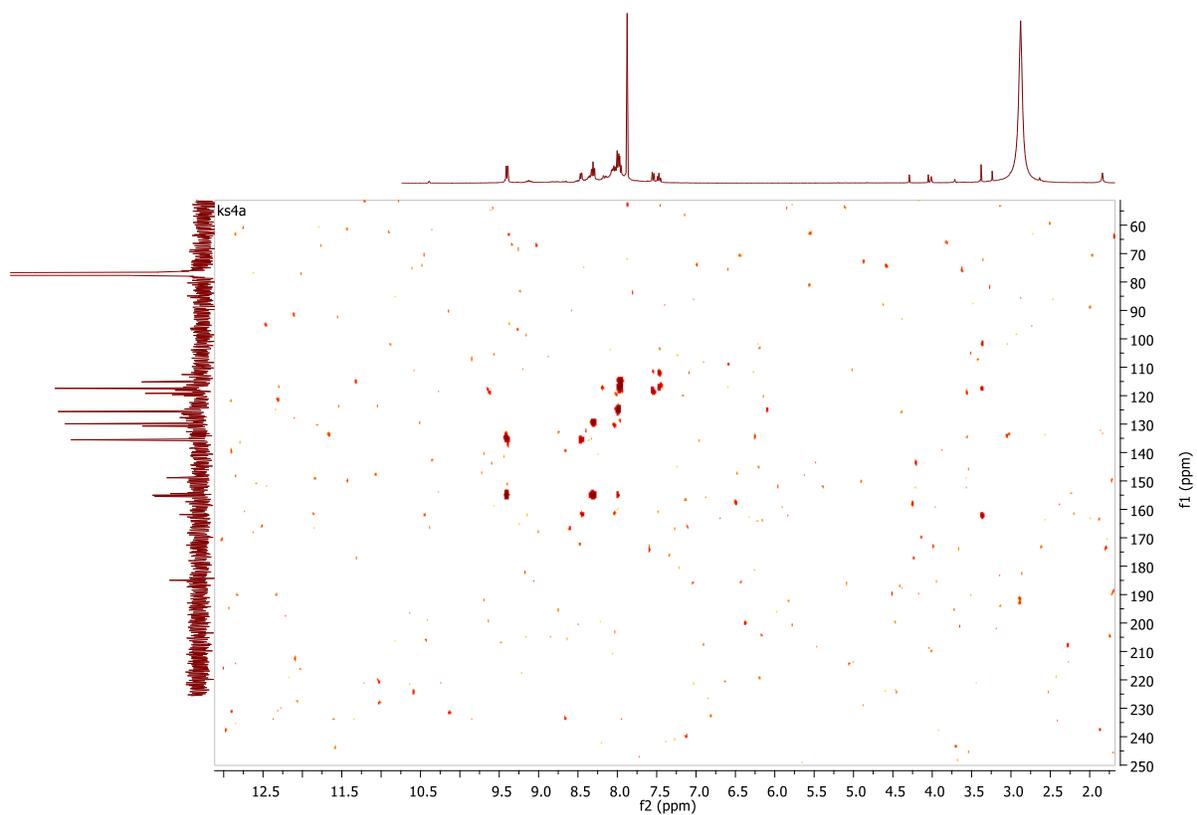
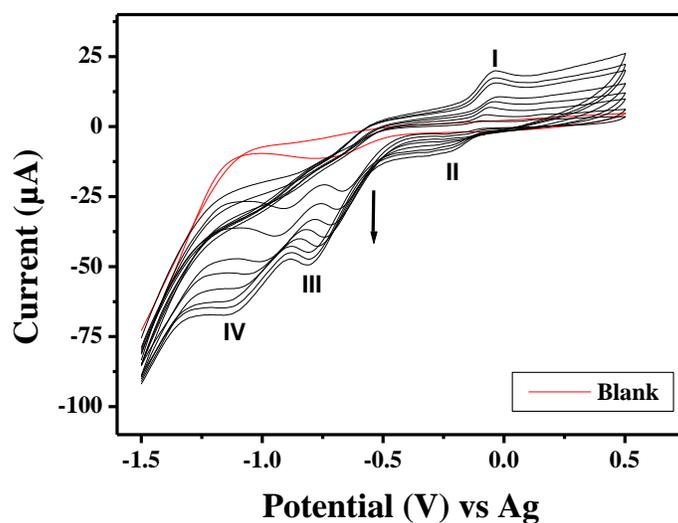
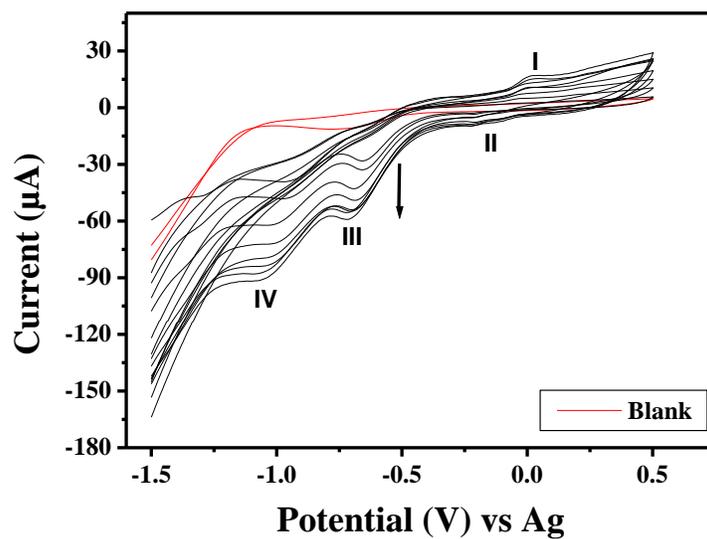


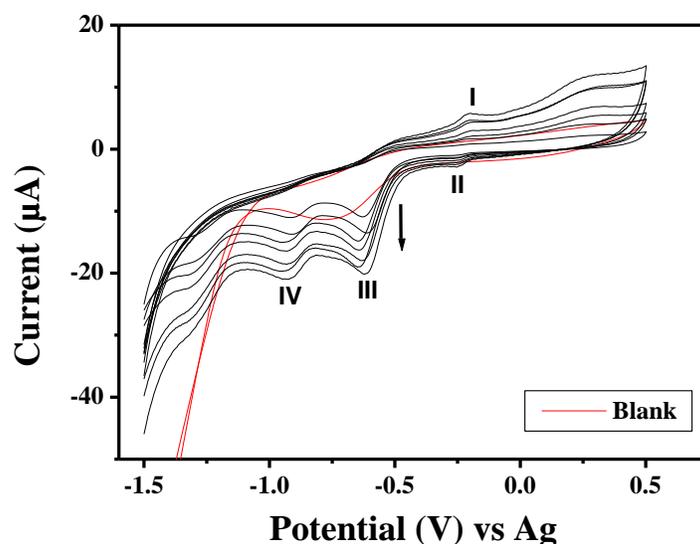
Figure 32. HMBC (DMSO-d<sub>6</sub>/CDCl<sub>3</sub>, 100 MHz) spectrum of 6.



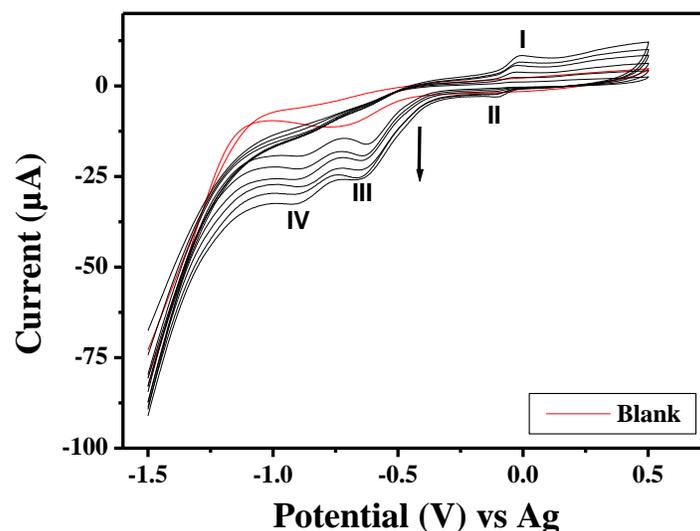
**Figure 33.** Cyclic voltammograms of 943 μM **5a** in 0.05 M H<sub>2</sub>SO<sub>4</sub> at various scan rates: 30, 60, 90, 120, 150, 240, 270 and 300 mV/s.



**Figure 34.** Cyclic voltammograms of 1120 μM **5b** in 0.05 M H<sub>2</sub>SO<sub>4</sub> at various scan rates: 30, 60, 90, 120, 150, 180, 270 and 300 mV/s.

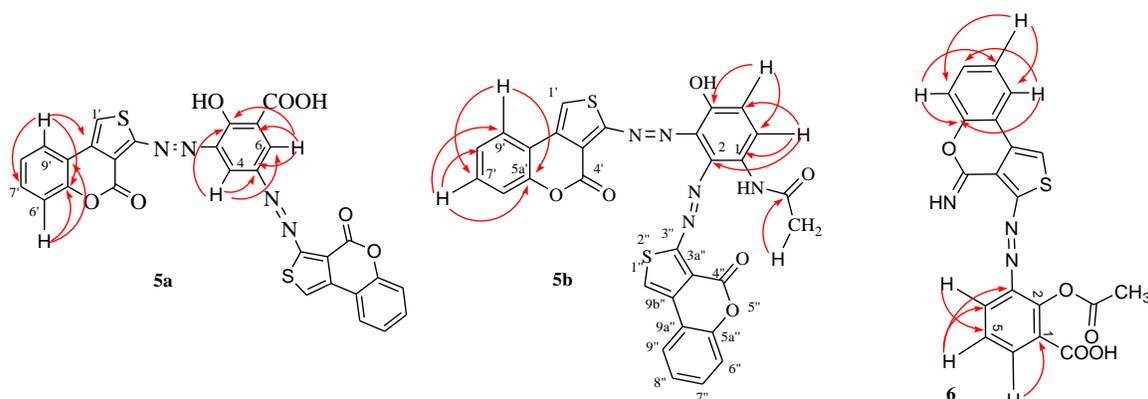


**Figure 35.** Cyclic voltammograms of 268  $\mu\text{M}$  **5c** in 0.05 M  $\text{H}_2\text{SO}_4$  at various scan rates: 30, 60, 90, 120, 150, 180 and 210 mV/s.



**Figure 36.** Cyclic voltammograms of 289  $\mu\text{M}$  **6** in 0.05 M  $\text{H}_2\text{SO}_4$  at various scan rates: 30, 60, 90, 120, 150, and 180 mV/s.

**Table 1.** Important HMBC interactions and  $^1\text{H}$  and  $^{13}\text{C}$  chemical shifts  $\delta$  in compounds **5a**, **5b** and **6** in  $\text{CDCl}_3/\text{DMSO}-d_6$  as solvent.



5a			5b			6		
N°C	$\delta_c$	HMBC (H $\rightarrow$ C)	N°C	$\delta_c$	HMBC(H $\rightarrow$ C)	N°C	$\delta_c$	HMBC(H $\rightarrow$ C)
1'/1''	125.6	H-9' (8.80)	1'/1''	125.6	/	1'	119.7	
3'/3''	156.9	/	3'/3''	155.4	/	3'	154.4	
3a'/3a''	148.7	/	3a'/3a''	148.6	/	3a'	148.9	/
4'/4''	162.8	H-1' (7.70); H-6' (7.35)	4'/4''	162.9	H-1' (7.74)	4'	157.3	H-6' (7.49)
5a'/5a''	155.4	H-9' (8.80); H-7' (7.69); H-6' (7.35)	5a'/5a''	155.1	H-9' (8.82); H-7' (7.71); H-6' (7.39)	5a'	155.5	H-9' (8.82);
6'/6''	117.7	H-7' (7.69); H-8' (7.39)	6'/6''	117.7	H-7' (7.71); H-8' (7.45)	6'	117.4	H-8' (7.39)
7'/7''	135.4	H-9' (8.80); H-8' (7.39)	7'/7''	135.4	H-9' (8.82); H-8' (7.45);	7'	135.6	H-9' (8.82)
8'/8''	126.1	7.69 (H-7'); H-8' (7.39)	8'/8''	126.1	H-7' (7.71); H-6' (7.39)	8'	125.4	H-6' (7.49); H-8' (7.39)
9'/9''	129.9	H-1' (7.70); H-7' (7.69); H-8' (7.39)	9'/9''	129.9	H-7' (7.71)	9'	129.9	H-7' (7.73)
9a'/9a''	118.2	7.39 (H-8'); H-6' (7.35)	9a'/9a''	118.2	H-8' (7.45); H-6' (7.39)	9a'	115.8	H-8' (7.39);
9b'/9b''	153.6	H-9' (8.80); 7.70 (H-1')	9b'/9b''	153.3	H-9' (8.82); H-1' (7.74);	9b'	155.1	H-1' (7.40)
1	113.5	H-6 (7.37)	1	154.5	H-6 (7.37)	1	135.8	H-6 (7.88)
2	154.4	H-4 (7.72); H-6 (7.37)	2	113.5	H-6 (7.37)	2	154.2	
3	102.4	/	3	102.3	/	3	112.4	H-5 (6.96); H-4 (6.89)
4	117.4	H-6 (7.37)	4	157.5	H-5 (7.73)	4	119.2	H-5 (6.96);
5	119.5	H-6 (7.37); H-4 (7.72)	5	117.4	H-6 (7.37)	5	117.3	H-4 (6.89);
6	135.5	7.72 (H-4)	6	135.6	H-5 (7.73)	6	130.7	
COOH	185.1	/	C=O		H(CH <sub>3</sub> )(2.80)	COOH	184.1	
			CH <sub>3</sub>	18.4	/	C=O	161.8	H-6(7.88)
						CH <sub>3</sub>	18.2	