Electronic Supplementary Information

Novel phthalide derivatives from the rhizomes of *Ligusticum chuanxiong* and their inhibitory effect against lipopolysaccharide-induced nitric oxide production in RAW 264.7 macrophage cells

Wei Wei, Xiu-Wen Wu, Xiu-Wei Yang*

State Key Laboratory of Natural and Biomimetic Drugs (Peking University),

Department of Natural Medicines, School of Pharmaceutical Sciences, Peking

University Health Science Center, Peking University, Beijing 100191, PR China.

*Corresponding author at: No. 38, Xueyuan Road, Haidian District, Beijing, 100191,

PR China. Tel.: 86 10 82801569; fax: +86 10 82802724. E-mail address:

xwyang@bjmu.edu.cn (X. W. Yang).

Contents

Figure S 311. UV spectrum of **4** in MeOH

Figure S 312. ^{1}H NMR spectrum of **4** in $CDCl_3$

Figure S 35. ^{13}C NMR spectrum of **4** in $CDCl_3$

Figure S 36. DEPT spectrum of **4** in $CDCl_3$

Figure S 37. ^{1}H–^{1}H COSY spectrum of **4** in $CDCl_3$

Figure S 38. HSQC spectrum of **4** in $CDCl_3$

Figure S 39. HMBC spectrum of **4** in $CDCl_3$

Figure S 40. NOESY spectrum of **4** in $CDCl_3$

Figure S 41. HRESIMS data of **5**

Figure S 413. IR spectrum of **5**

Figure S 414. UV spectrum of **5** in MeOH

Figure S 415. ^{1}H NMR spectrum of **5** in $CDCl_3$

Figure S 45. ^{13}C NMR spectrum of **5** in $CDCl_3$

Figure S 46. DEPT spectrum of **5** in $CDCl_3$

Figure S 47. ^{1}H–^{1}H COSY spectrum of **5** in $CDCl_3$

Figure S 48. HSQC spectrum of **5** in $CDCl_3$

Figure S 49. HMBC spectrum of **5** in $CDCl_3$

Figure S 50. NOESY spectrum of **5** in $CDCl_3$

Elemental Composition Report **Page 1**

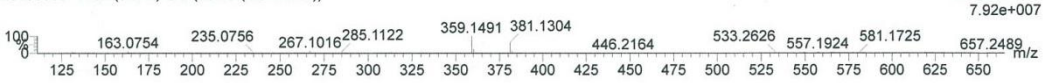
Single Mass Analysis
Tolerance = 2.0 PPM / DBE: min = -1.5, max = 50.0
Element prediction: Off
Number of isotope peaks used for i-FIT = 3

Monoisotopic Mass, Even Electron Ions
752 formula(e) evaluated with 2 results within limits (up to 50 closest results for each mass)
Elements Used:
C: 0-100 H: 0-200 N: 0-5 O: 0-30 Si: 0-1

Xevo G2 Q-TOF/YCA166#
20150508-12 12 (0.220) Cm (10:18-(1:5+27:56))

15-May-2015

Waters
TOF MS ES+
7.92e+007



Minimum:				-1.5				
Maximum:		5.0	2.0	50.0				
Mass	Calc. Mass	mDa	PPM	DBE	i-FIT	Norm	Conf(%)	Formula
359.1491	359.1495	-0.4	-1.1	9.5	1011.4	0.000	100.00	C20 H23 O6
	359.1486	0.5	1.4	0.5	1027.5	16.096	0.00	C11 H27 N2 O9 Si

Figure S 16. HRESIMS data of **1**

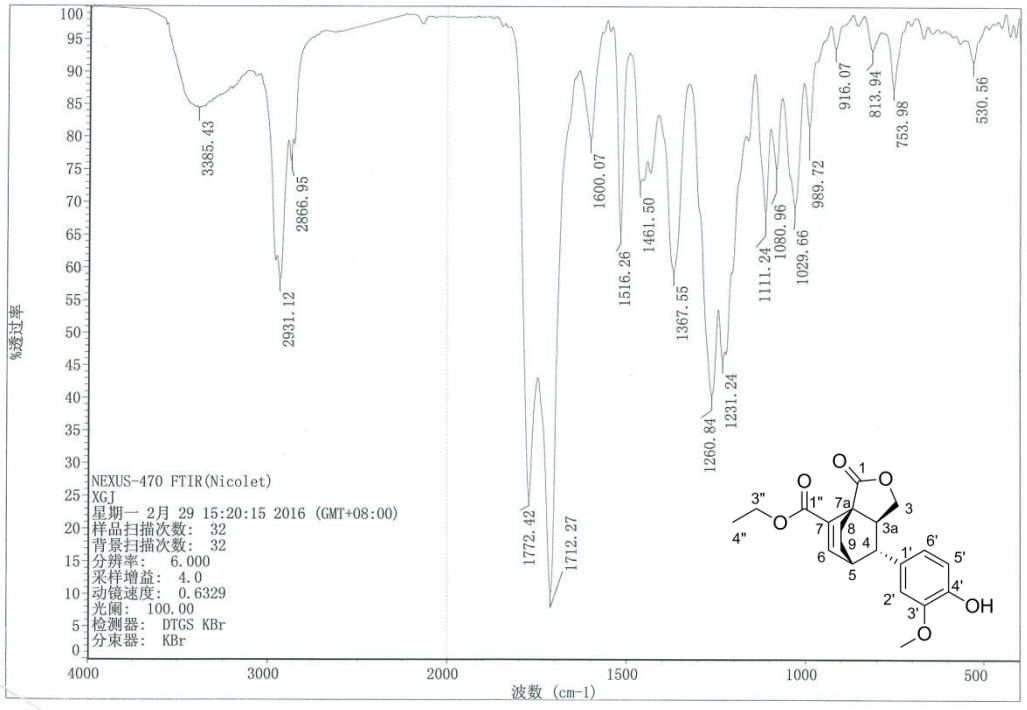


Figure S 17. IR spectrum of **1**

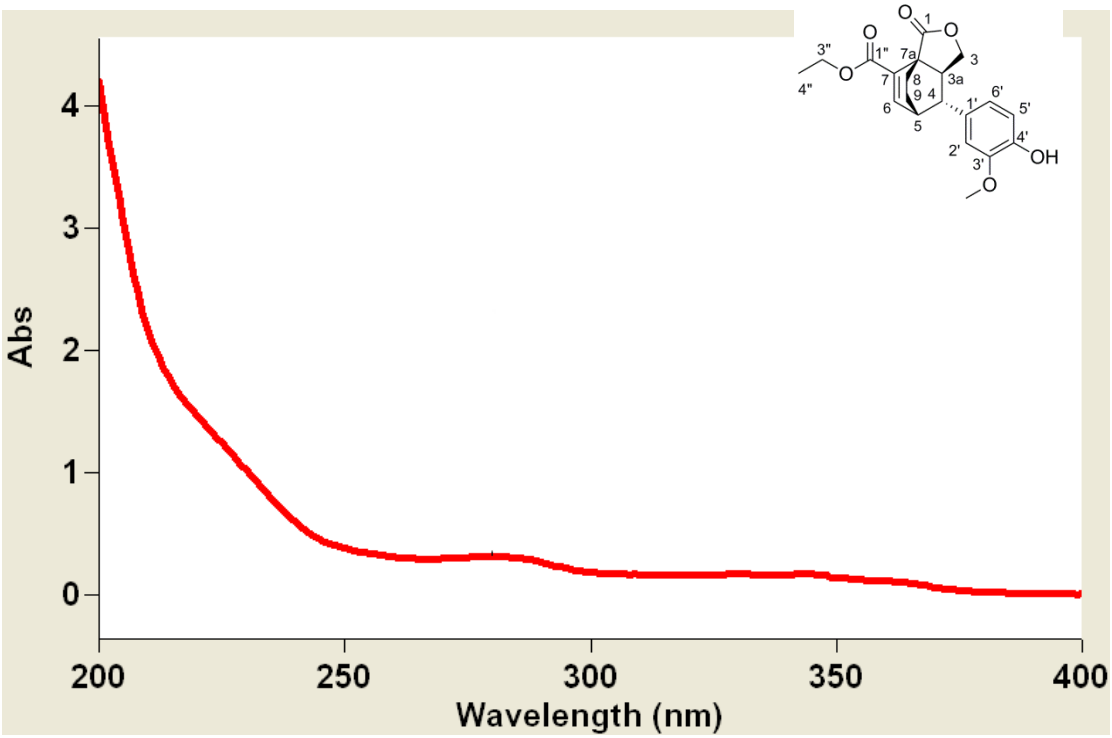


Figure S 18. UV spectrum of **1** in MeOH

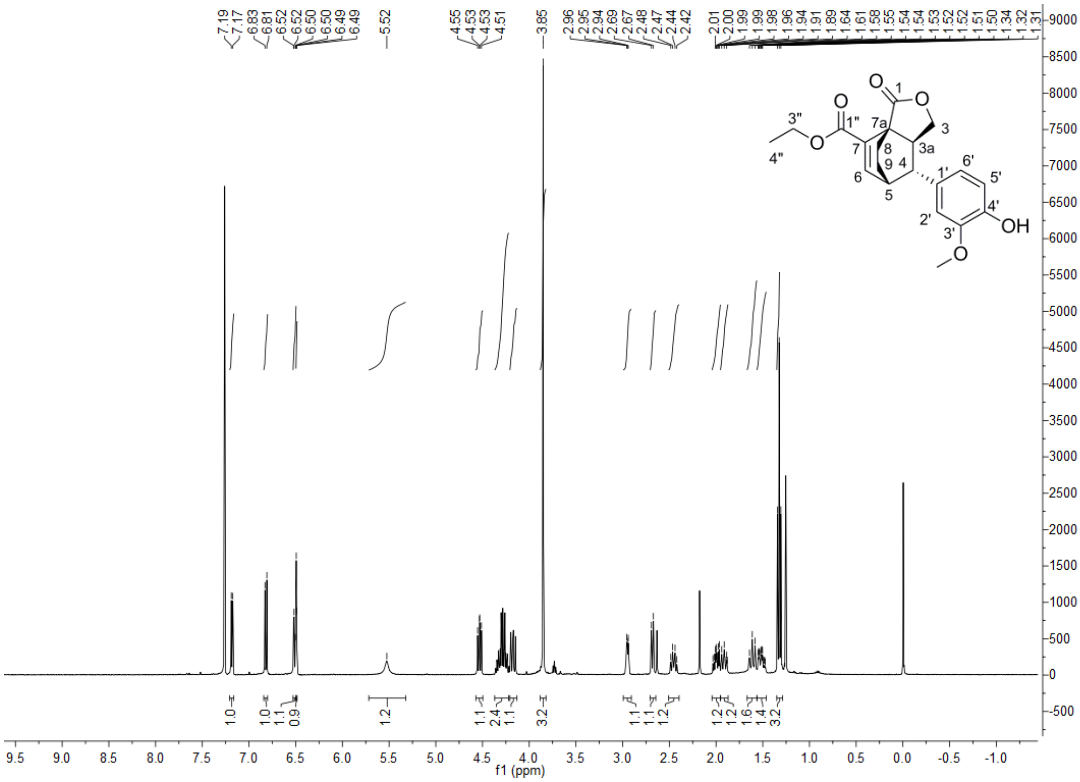


Figure S 19. ^{1}H NMR spectrum of **1** in $CDCl_3$

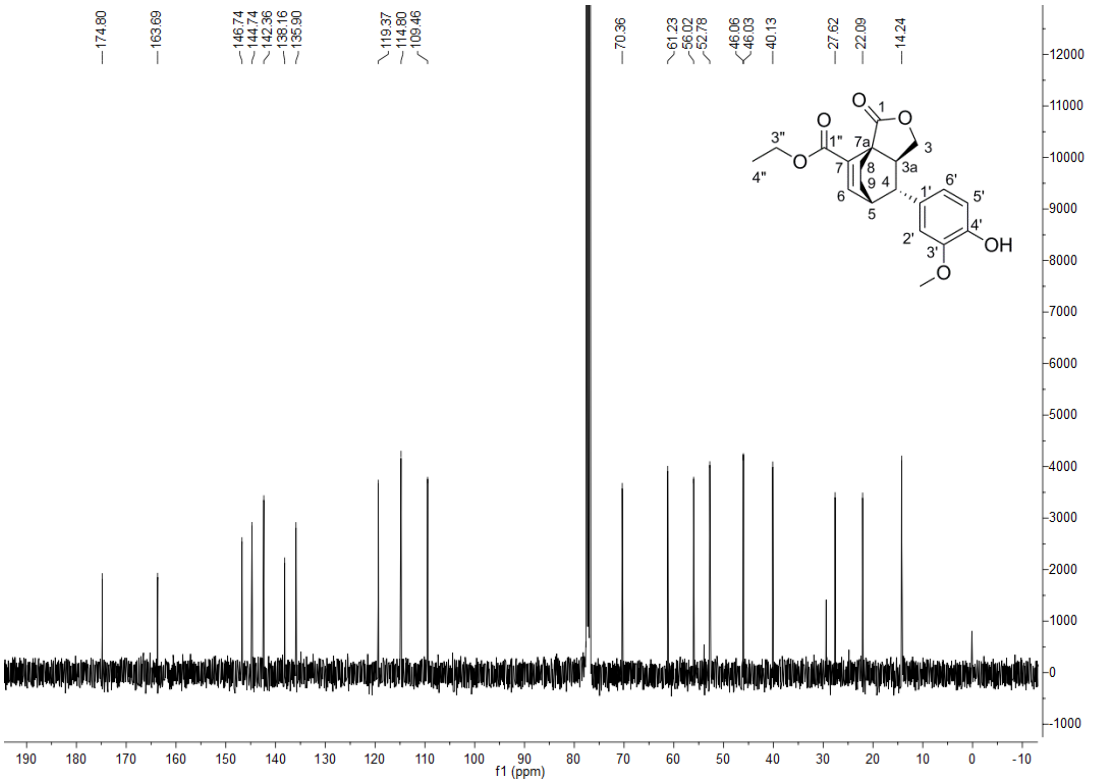


Figure S 20. ^{13}C NMR spectrum of **1** in $CDCl_3$

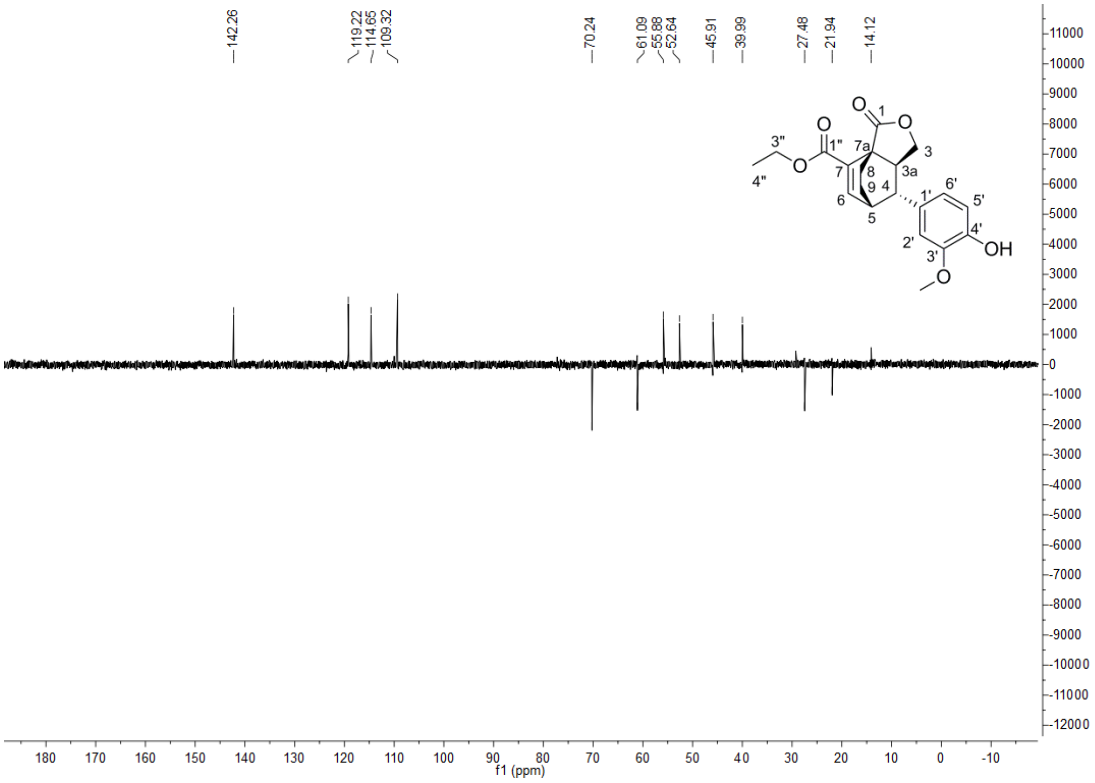


Figure S 21. DEPT 135 spectrum of **1** in $CDCl_3$

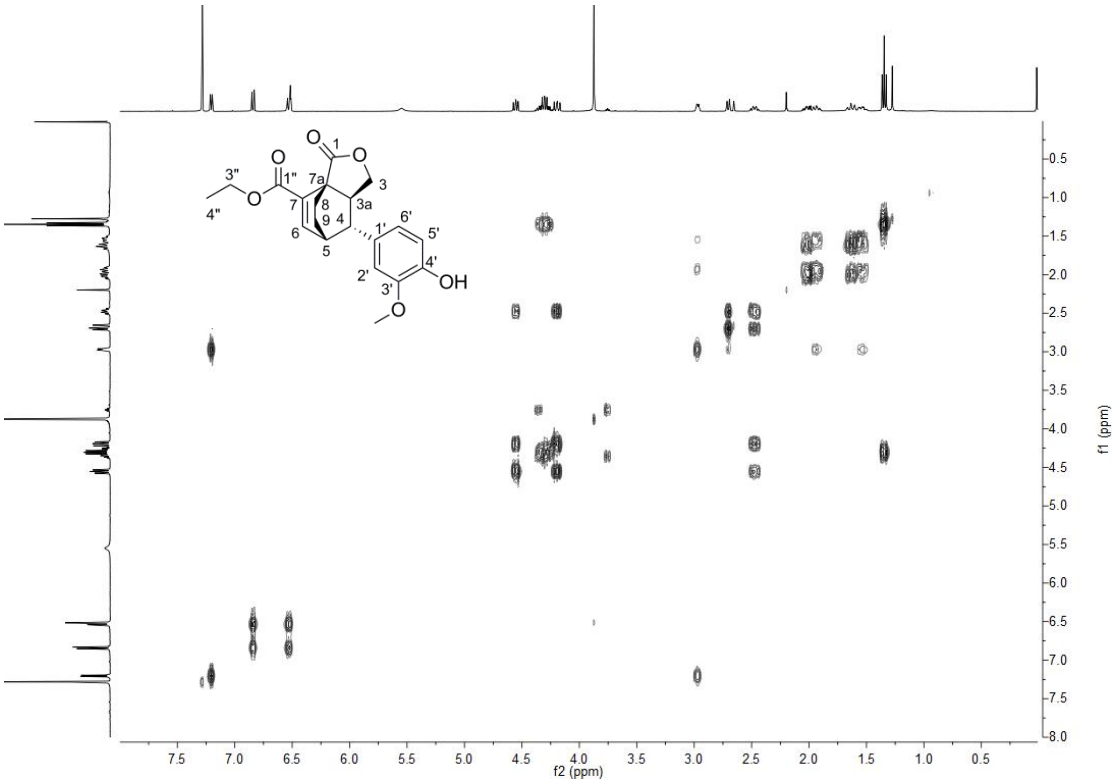


Figure S 22. $^{1}H–^{1}H$ COSY spectrum of **1** in $CDCl_3$

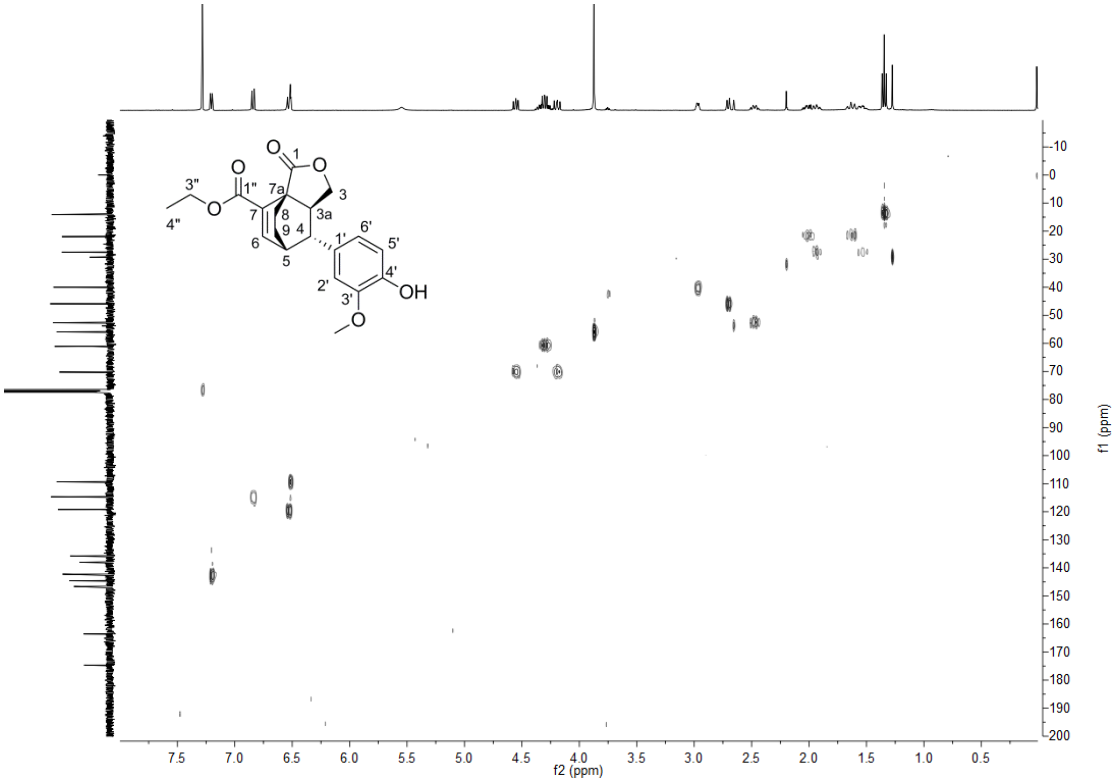


Figure S 23. HSQC spectrum of **1** in $CDCl_3$

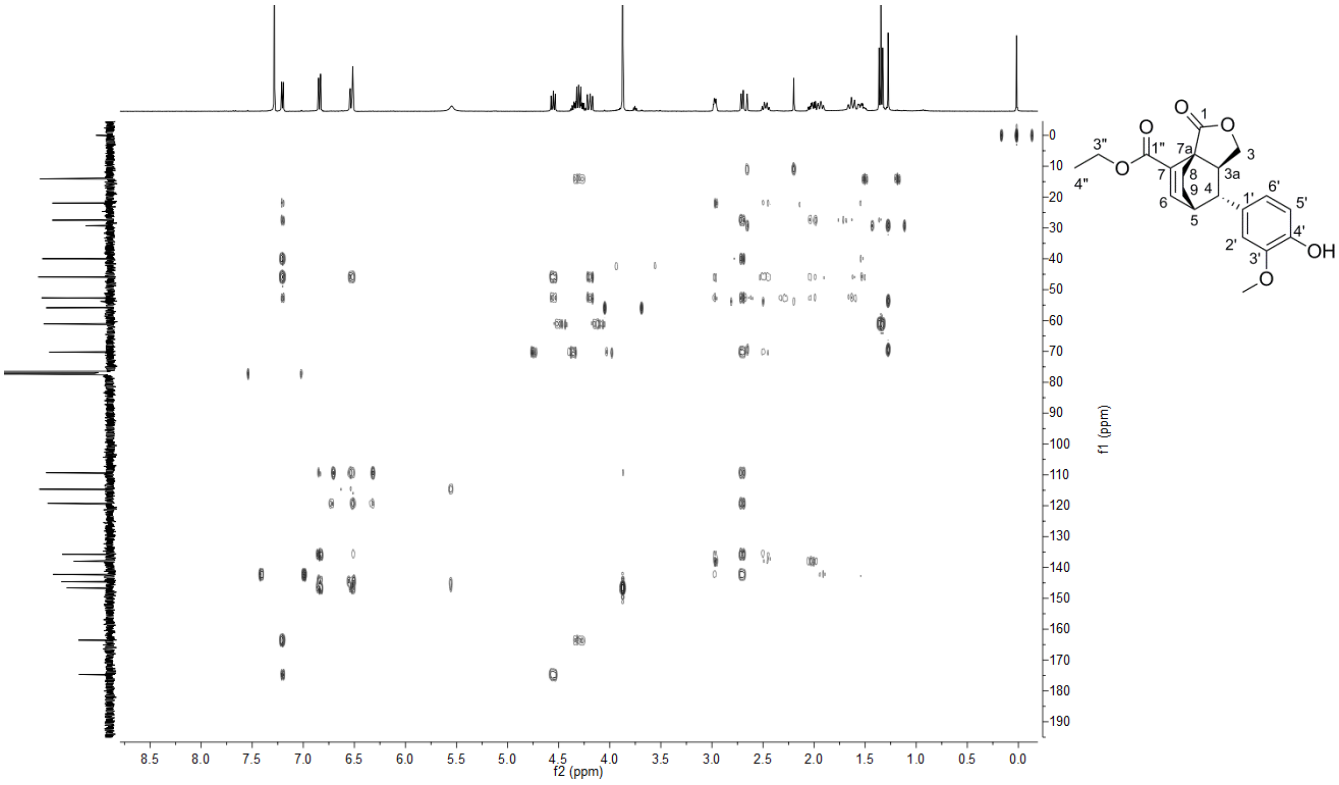


Figure S 24. HMBC sepctrum of **1** in $CDCl_3$

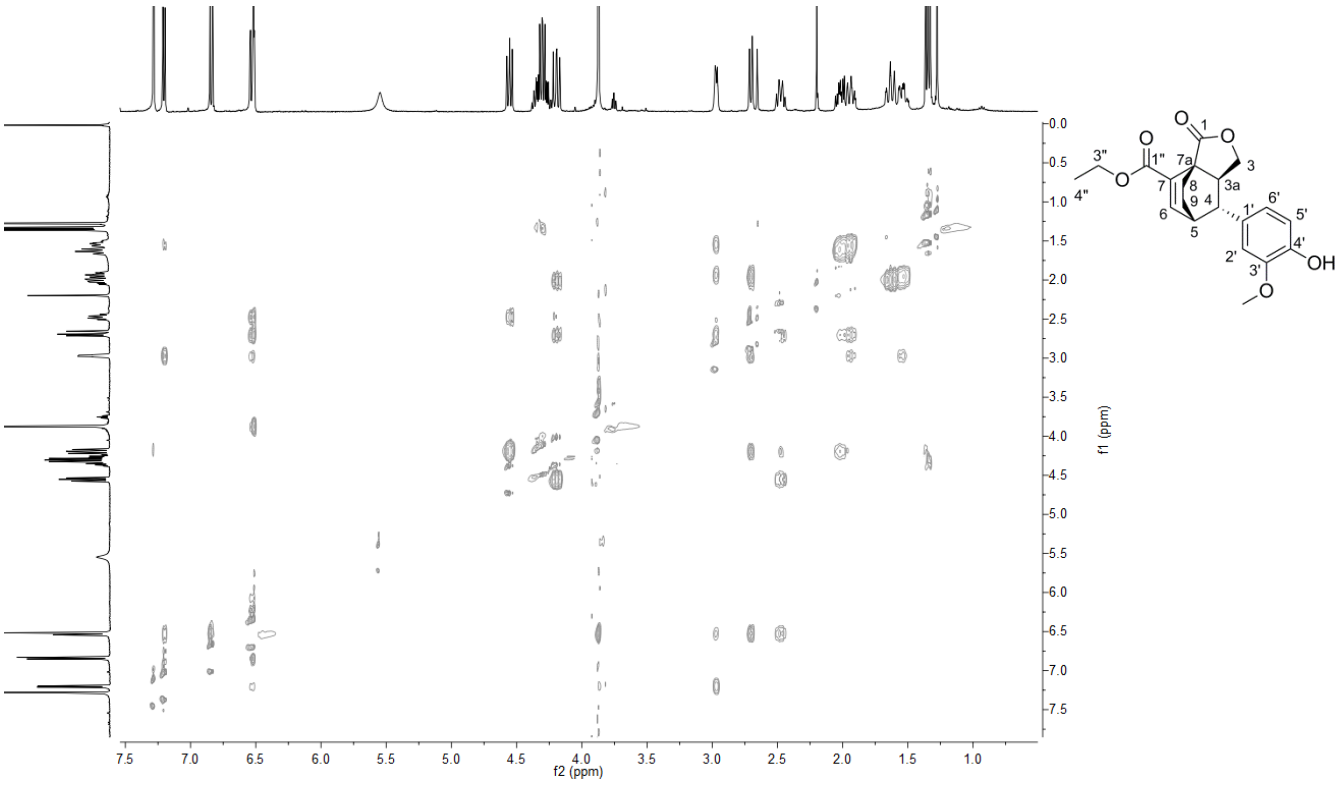


Figure S 25. NOESY spectrum of **1** in $CDCl_3$

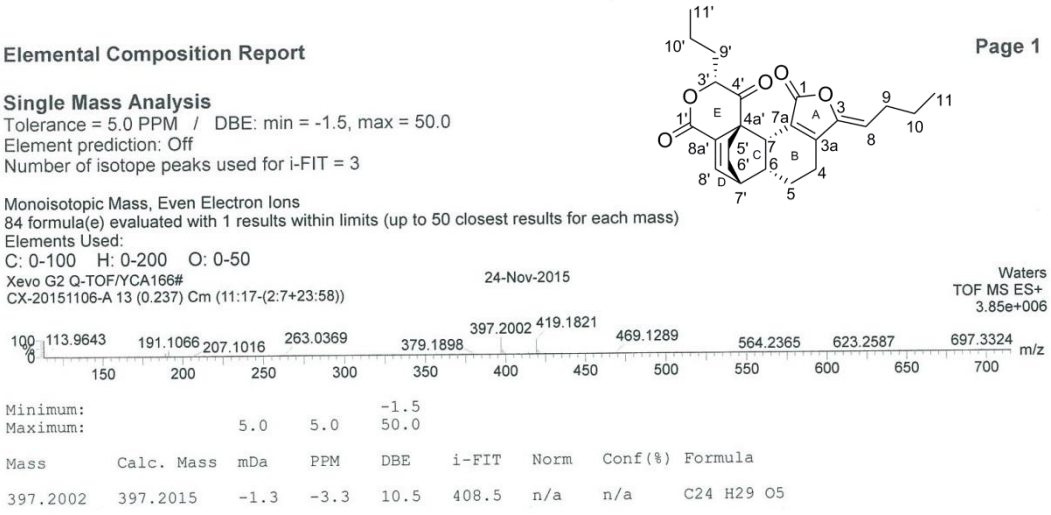


Figure S 26. HRESIMS data of **2**

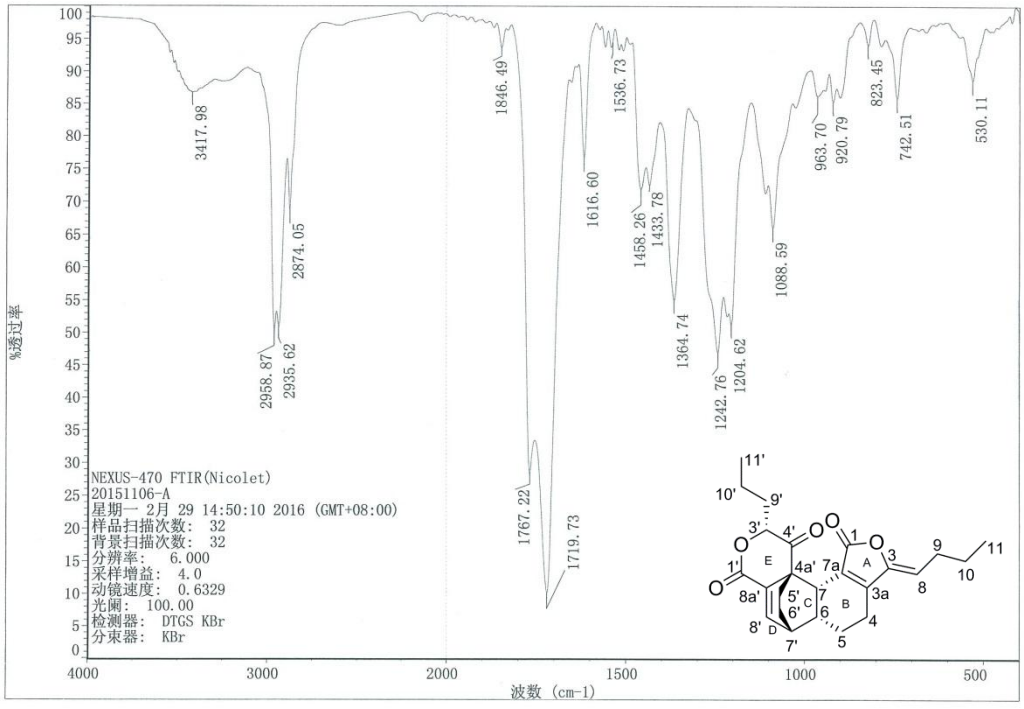


Figure S 27. IR spectrum of **2**

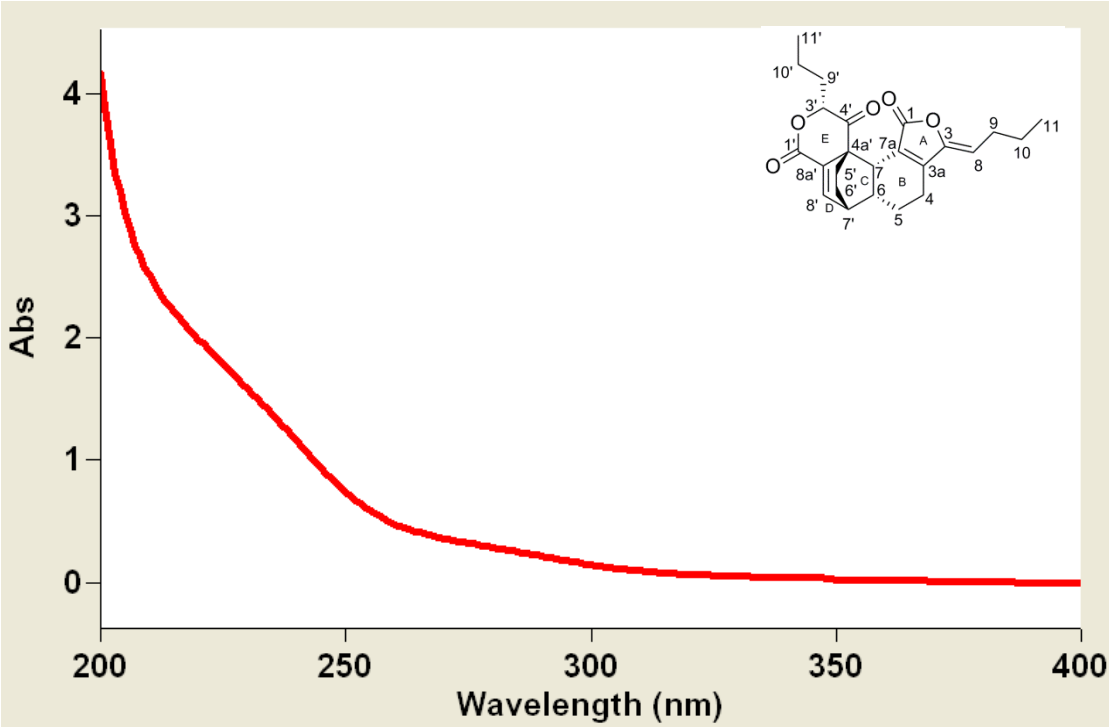


Figure S 28. UV spectrum of **2** in MeOH

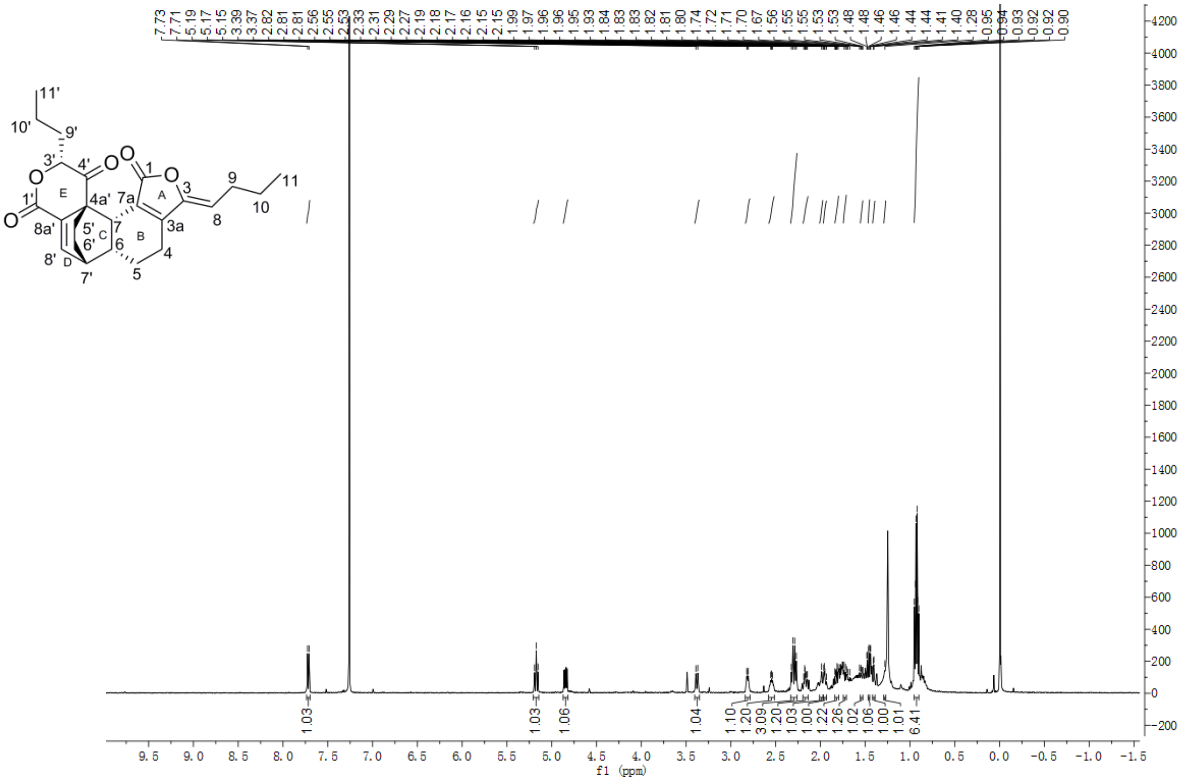


Figure S 29. ^{1}H NMR sepectrum of **2** in $CDCl_3$

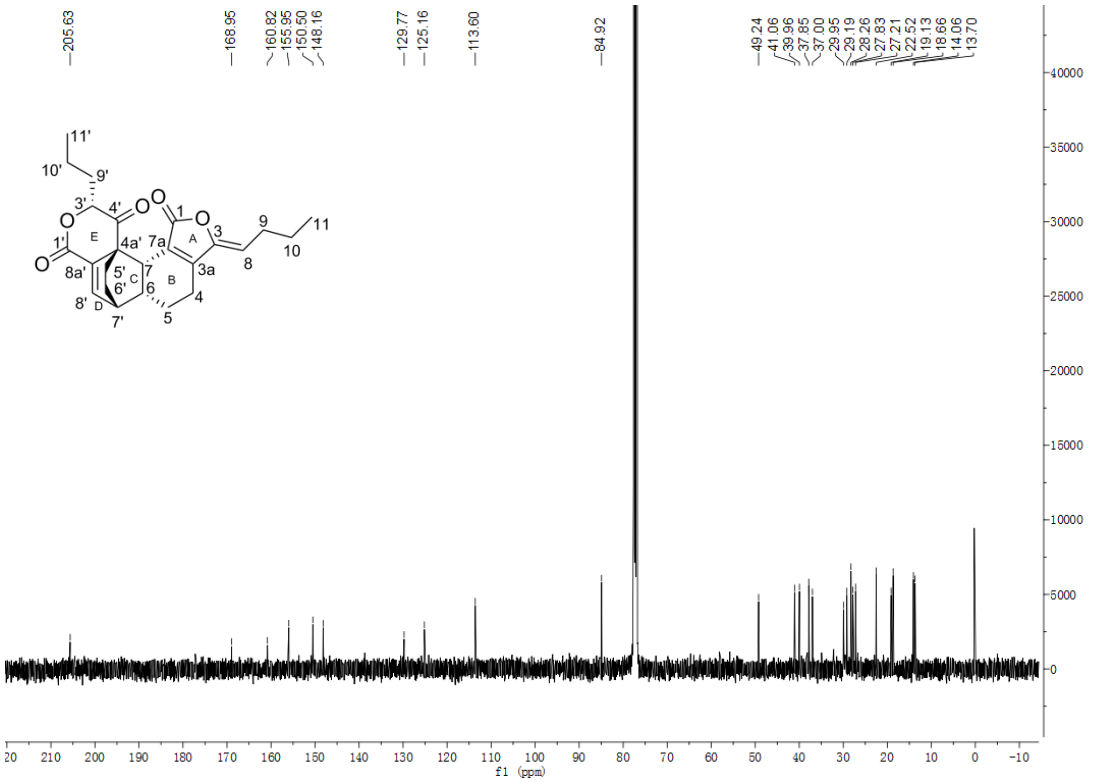


Figure S 30. ^{13}C NMR spectrum of **2** in $CDCl_3$

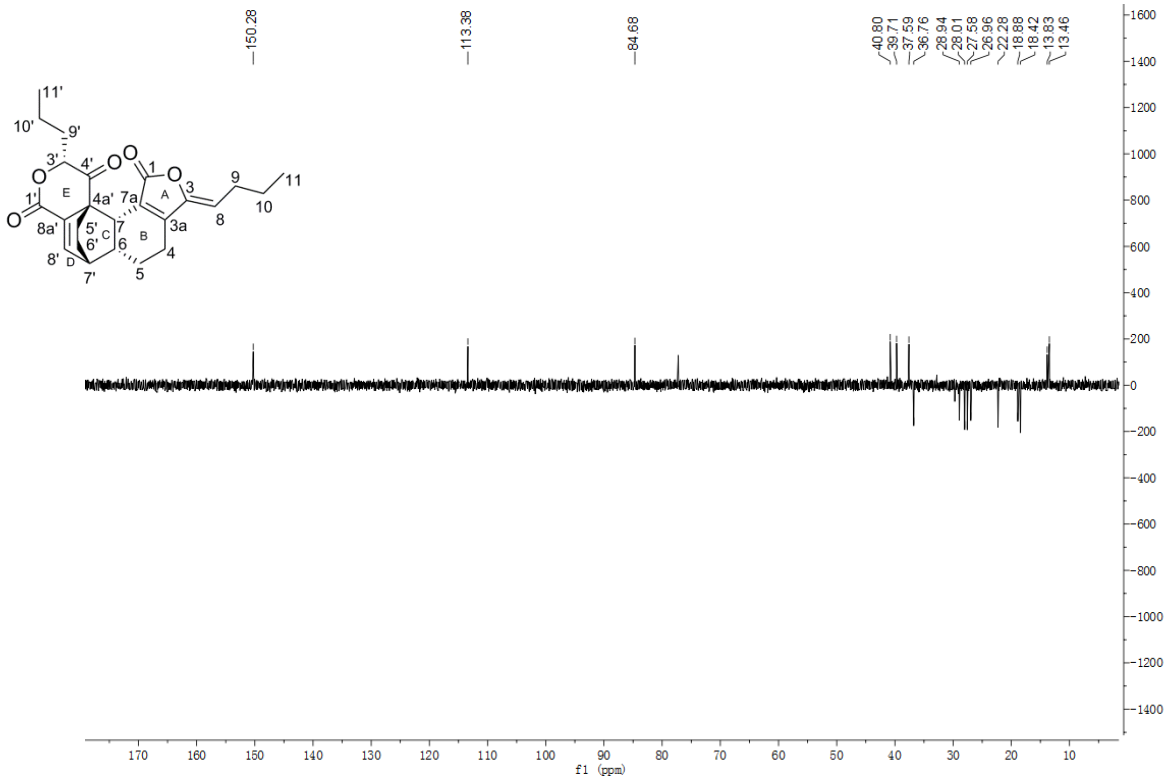


Figure S 31. DEPT spectrum of **2** in $CDCl_3$

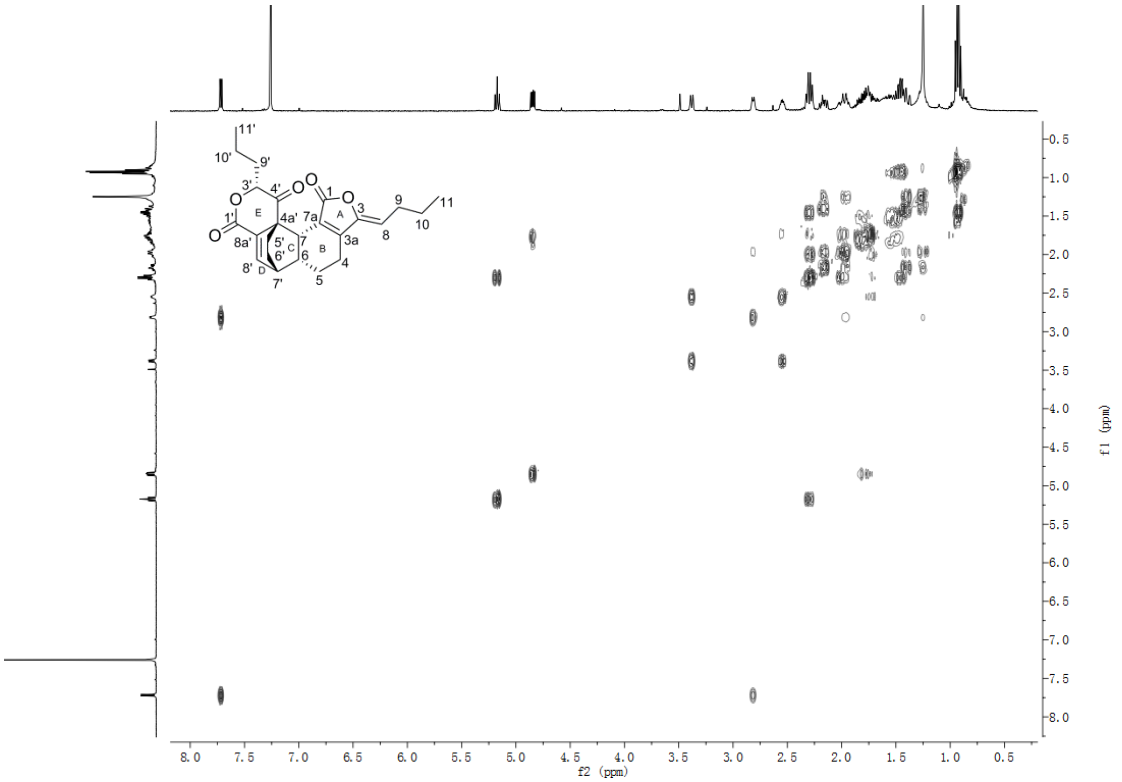


Figure S 32. $^{1}H–^{1}H$ COSY spectrum of **2** in $CDCl_3$

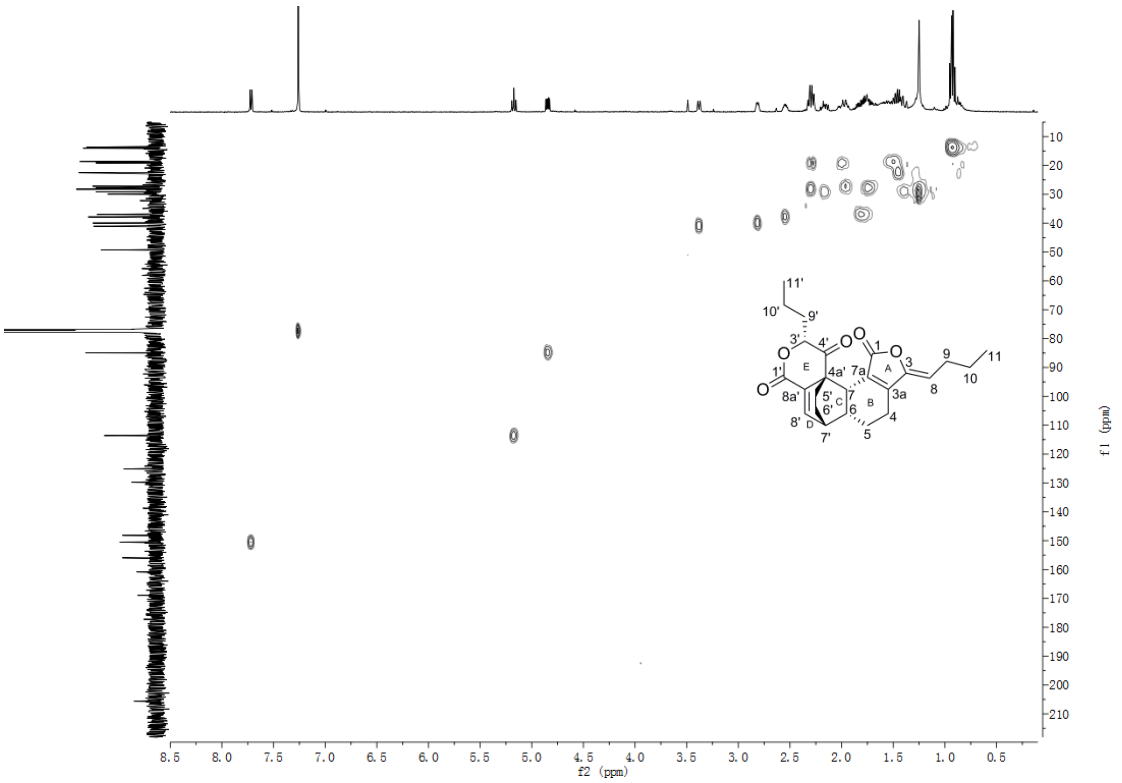


Figure S 33. HSQC spectrum of **2** in $CDCl_3$

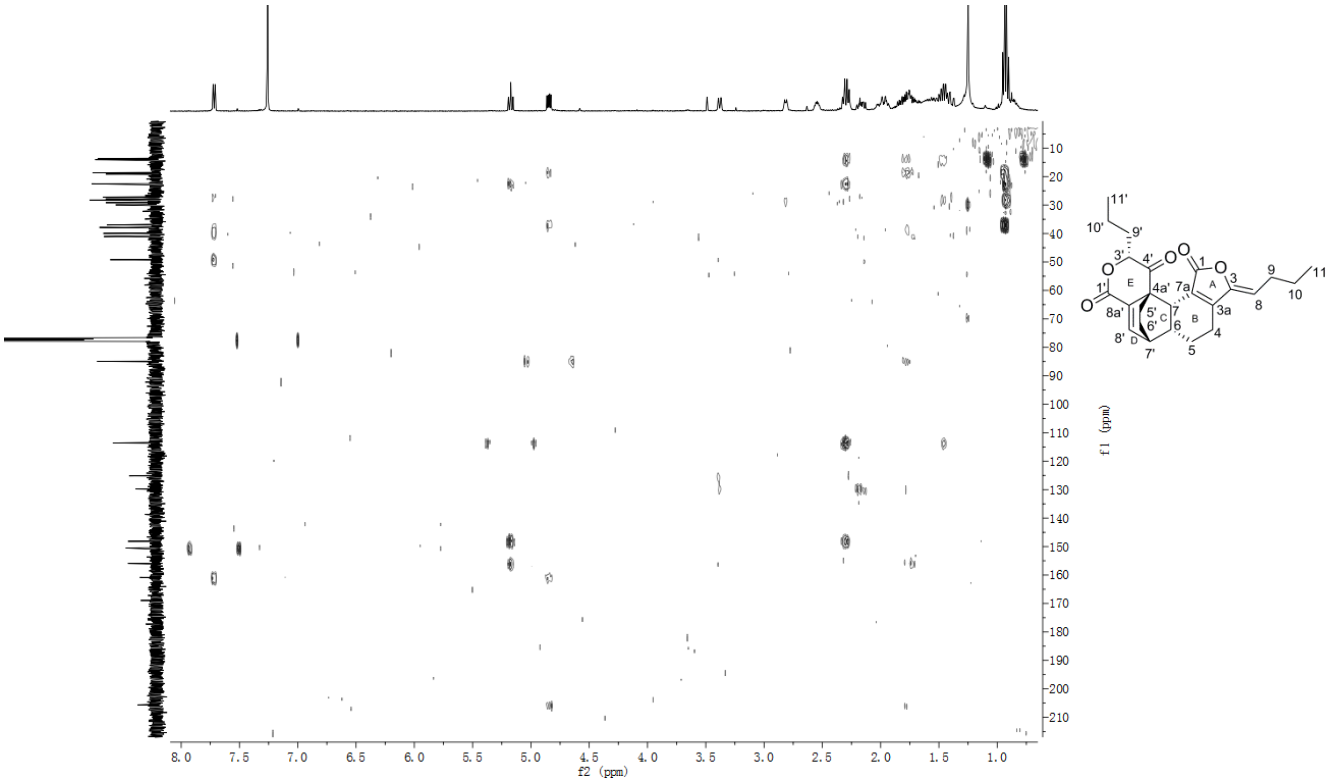


Figure S 34. HMBC spectrum of **2** in $CDCl_3$

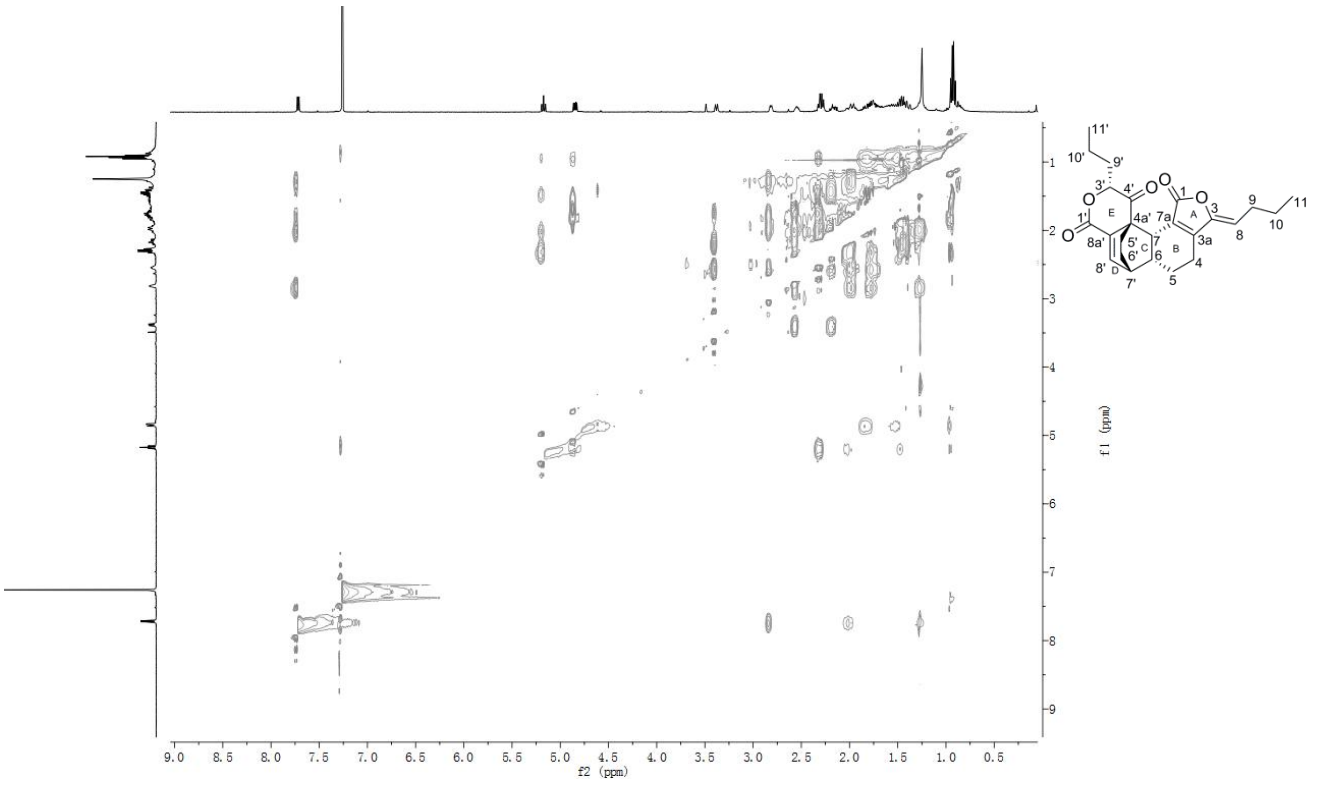


Figure S 35. NOESY spectrum of **2** in $CDCl_3$

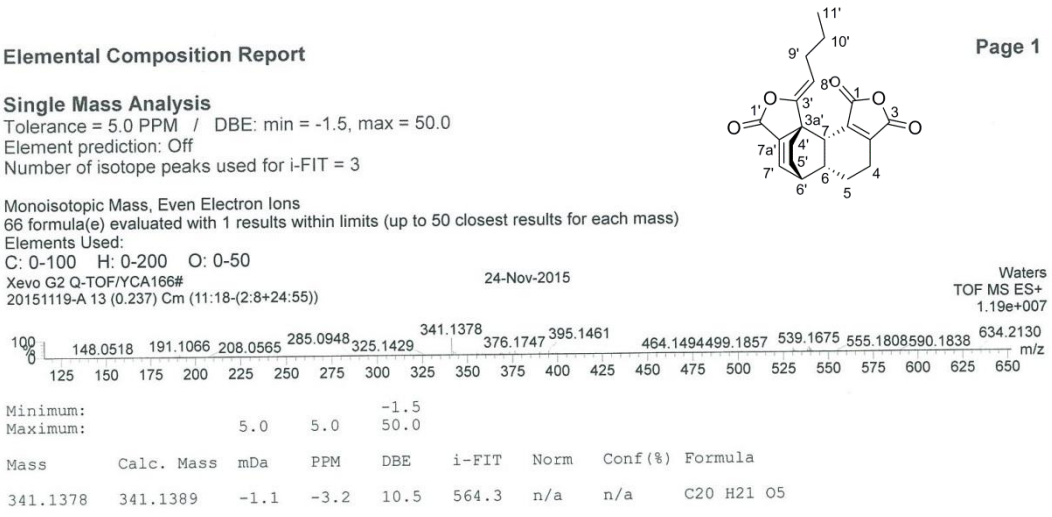


Figure S 36. HRESIMS data of **3**

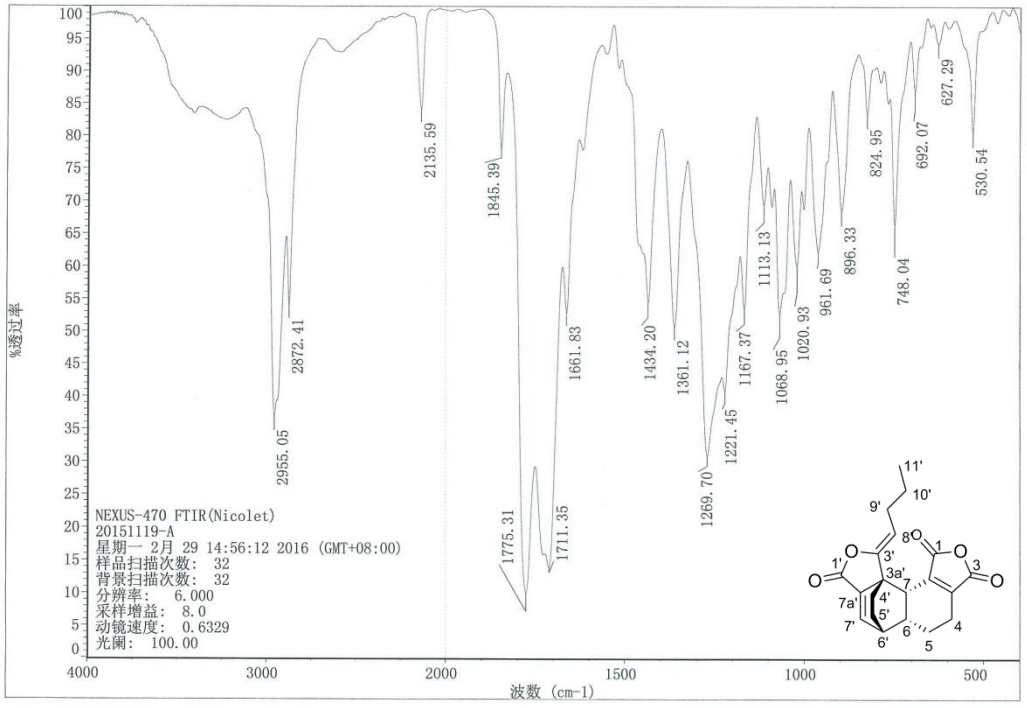


Figure S 37. IR spectrum of **3**

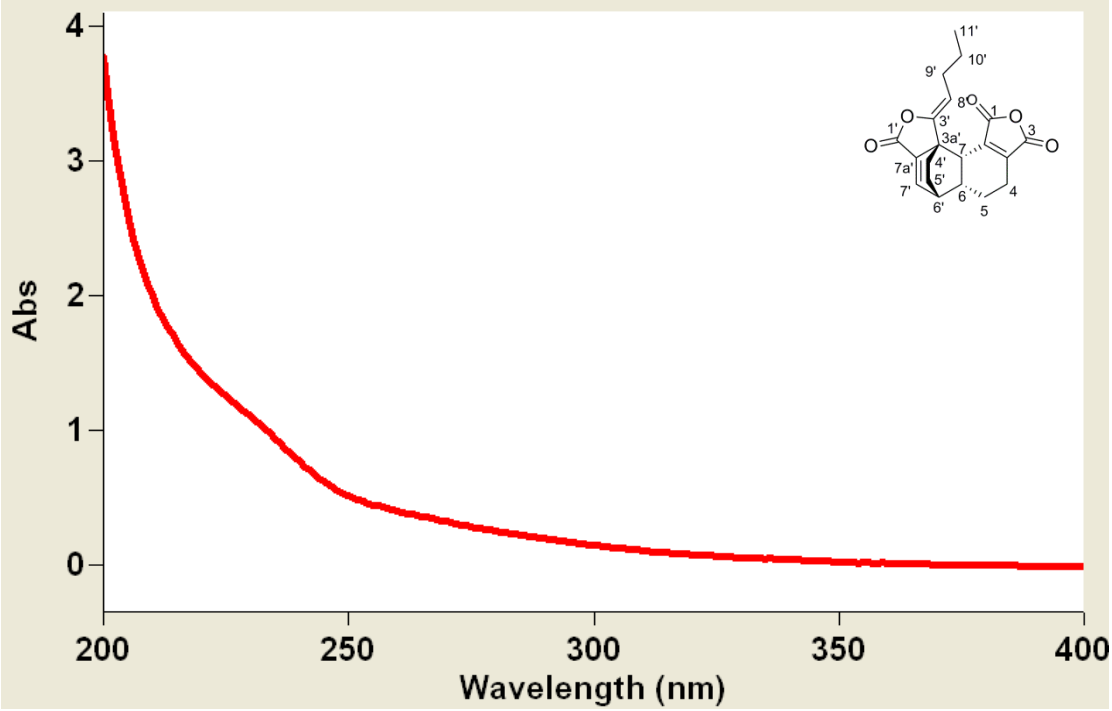


Figure S 38. UV spectrum of **3** in MeOH

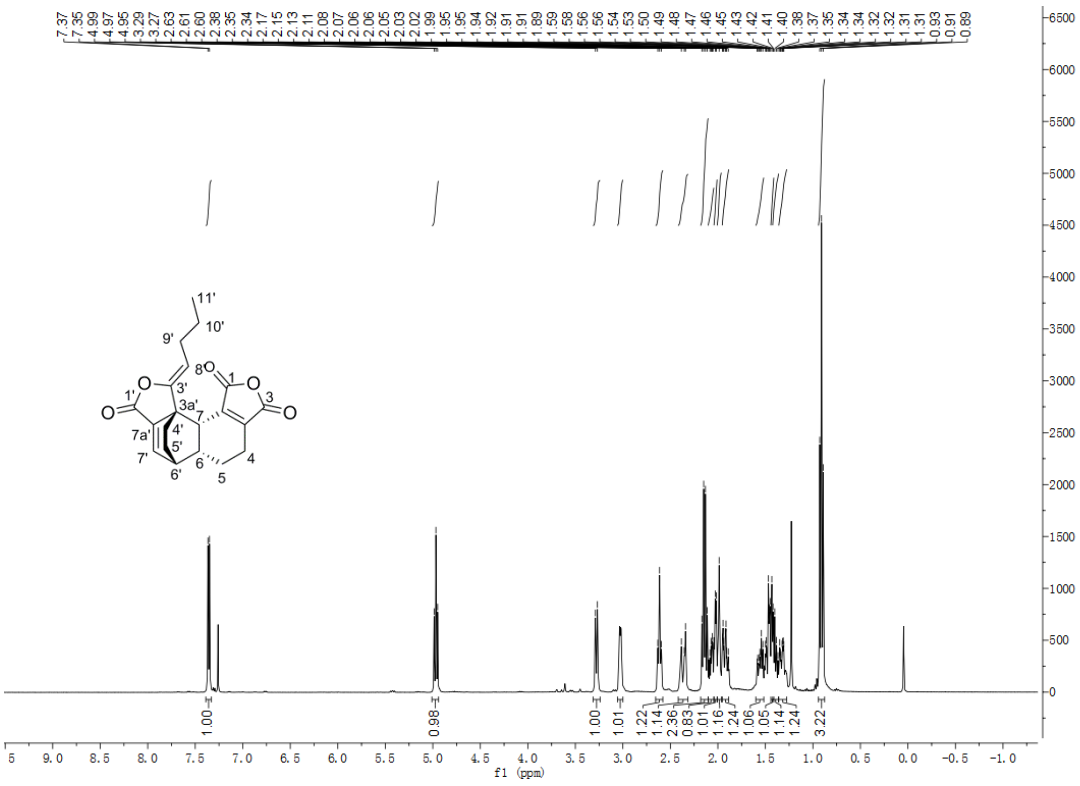


Figure S 39. ^{1}H NMR spectrum of **3** in $CDCl_3$

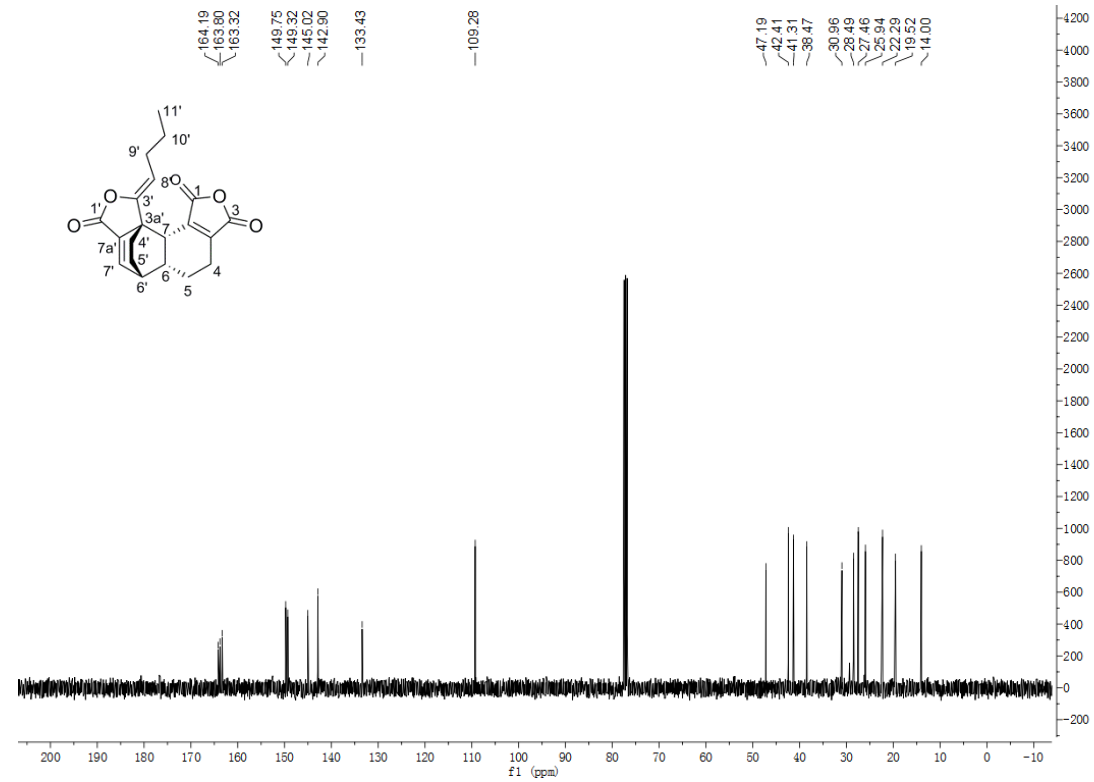


Figure S 40. ^{13}C NMR spectrum of **3** in $CDCl_3$

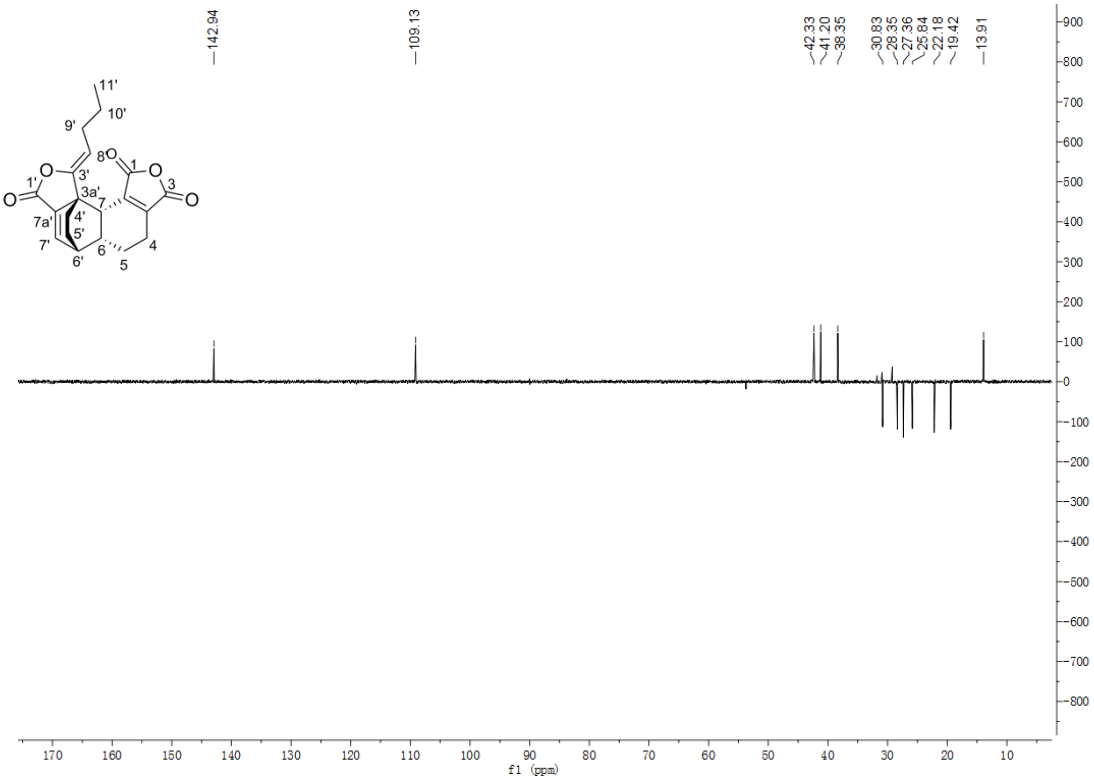


Figure S 41. DEPT spectrum of **3** in $CDCl_3$

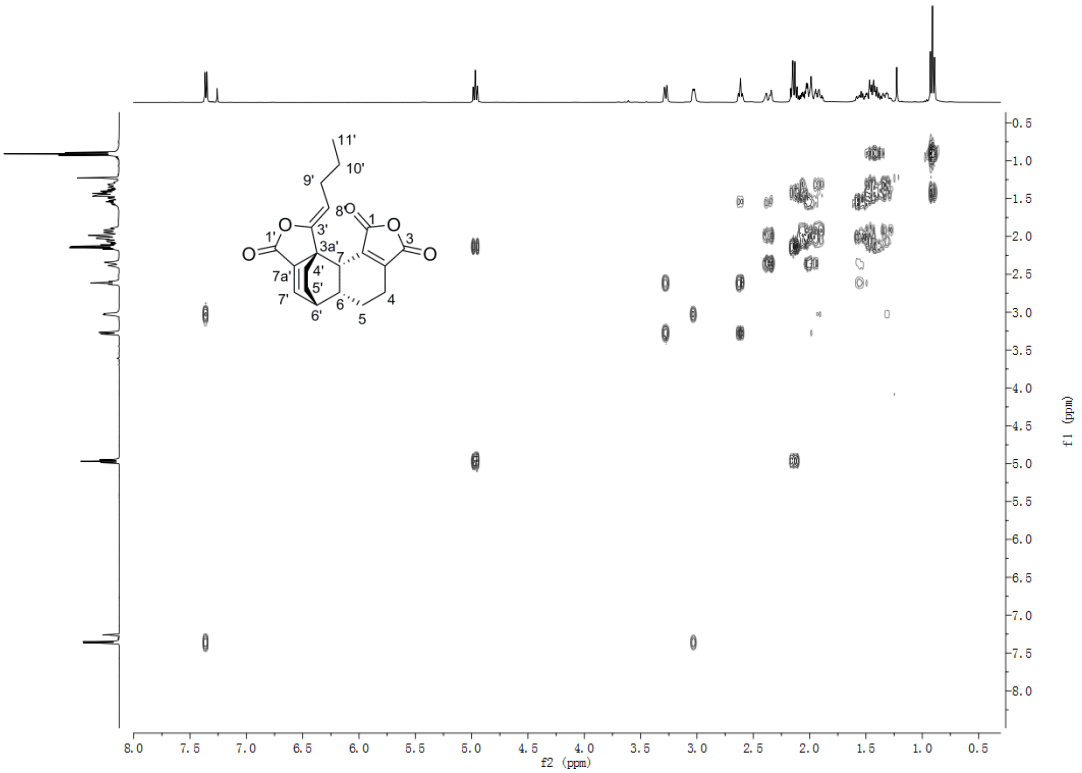


Figure S 42. $^{1}H–^{1}H$ COSY spectrum of **3** in $CDCl_3$

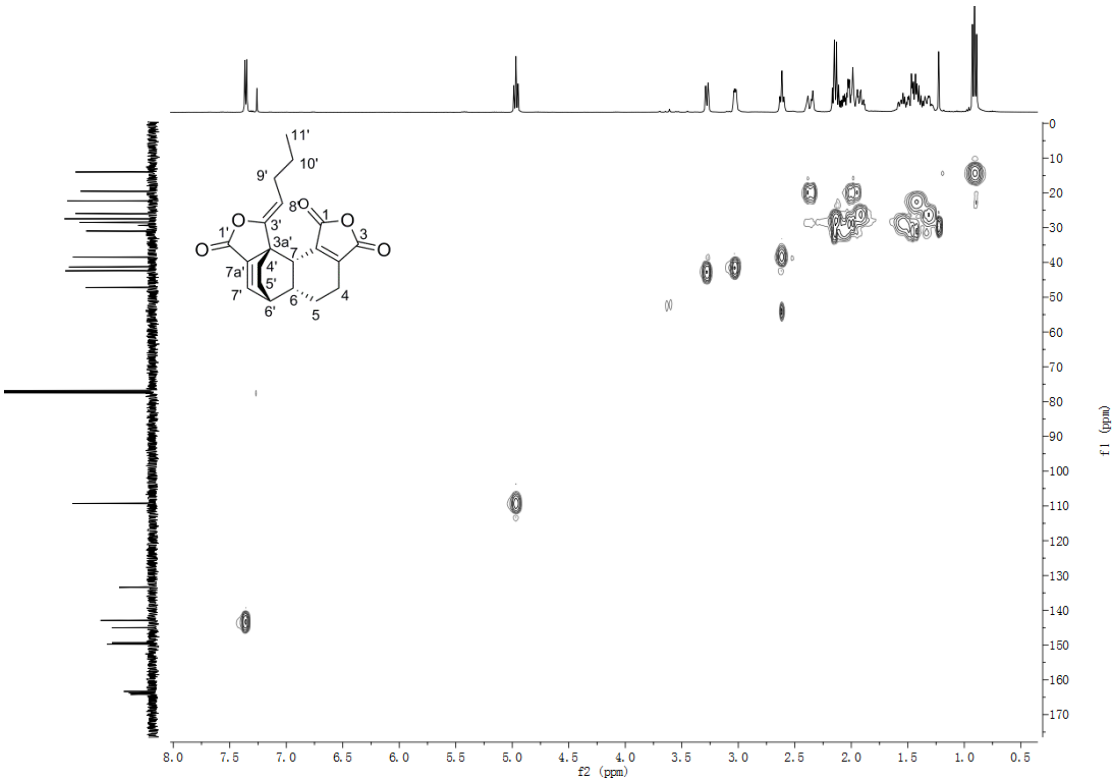


Figure S 43. HSQC spectrum of **3** in $CDCl_3$

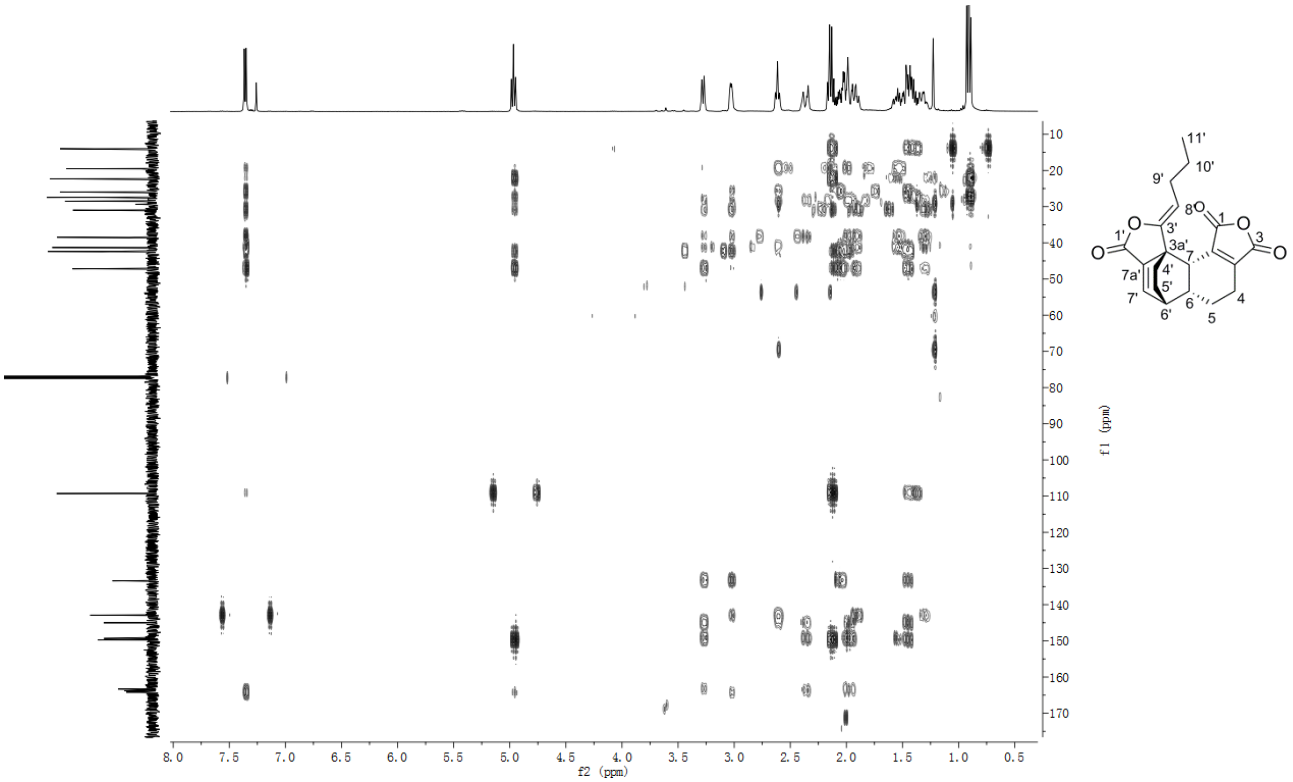


Figure S 44. HMBC spectrum of **3** in $CDCl_3$

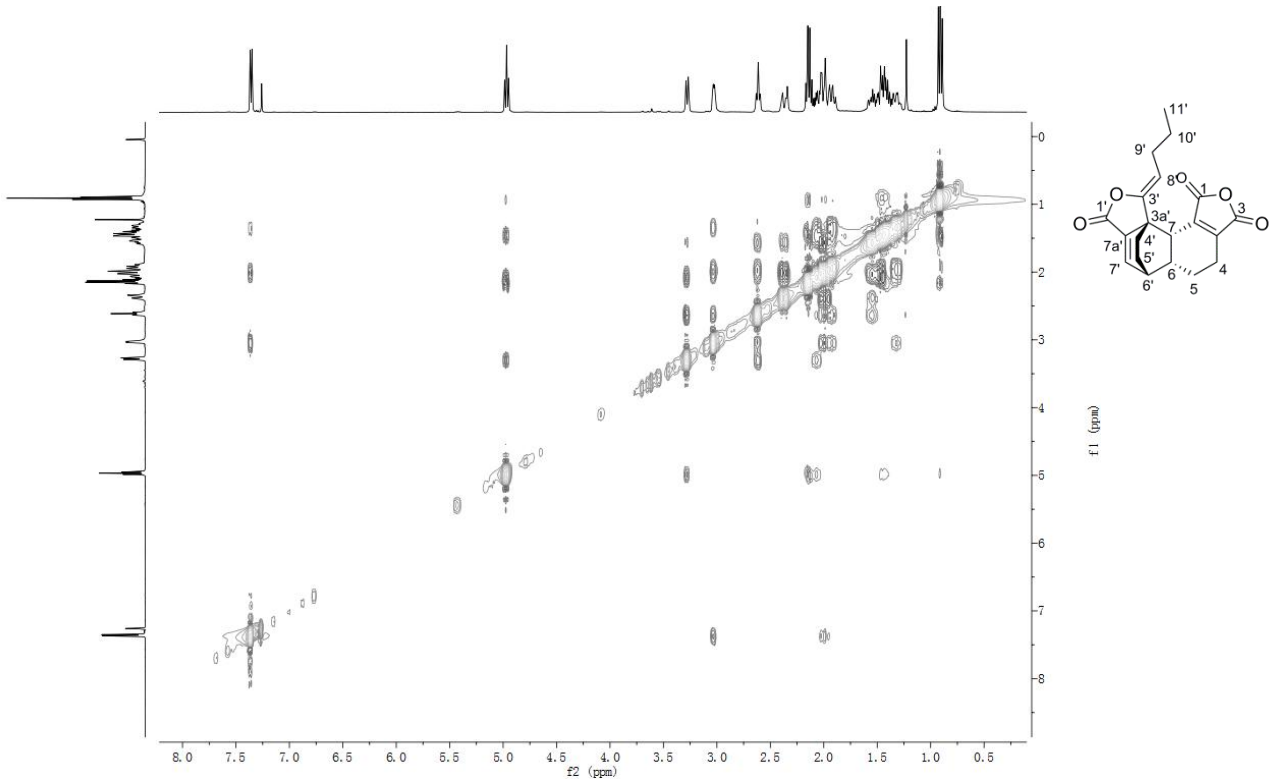


Figure S 45. NOESY spectrum of **3** in $CDCl_3$

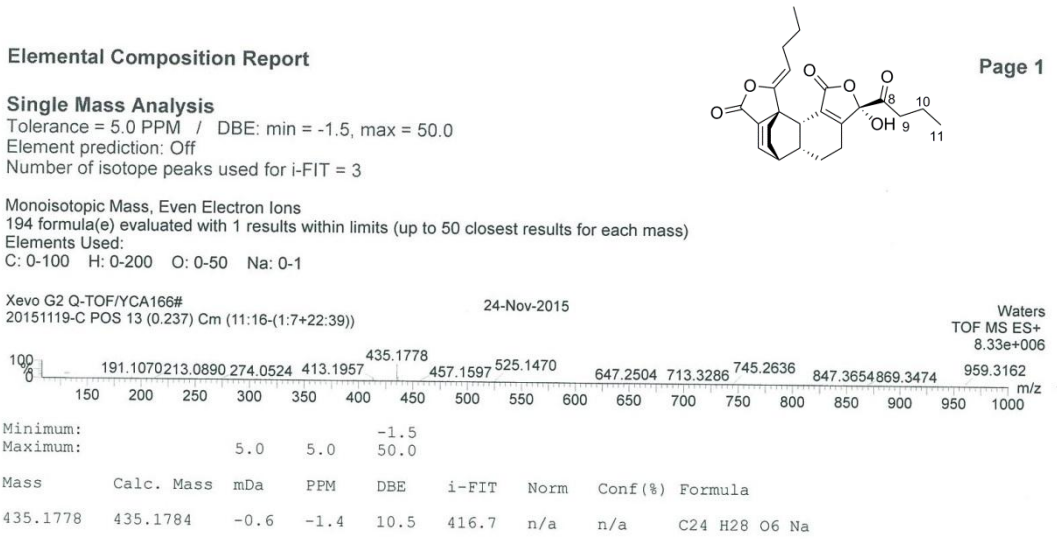


Figure S 46. HRESIMS data of **4**

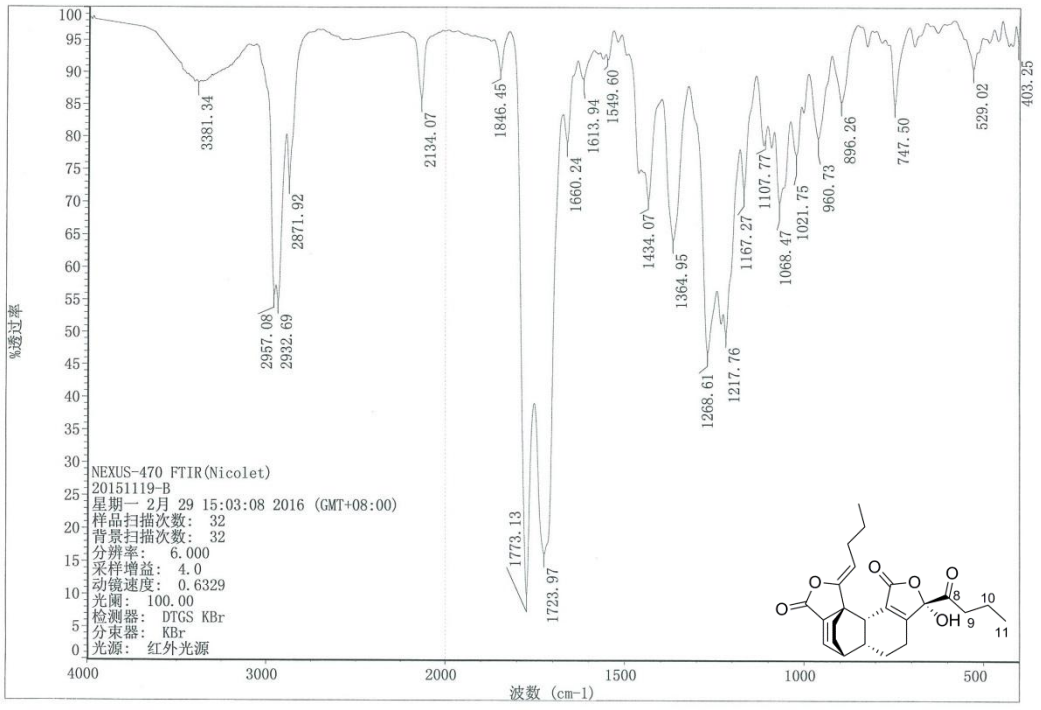


Figure S 47. IR spectrum of **4**

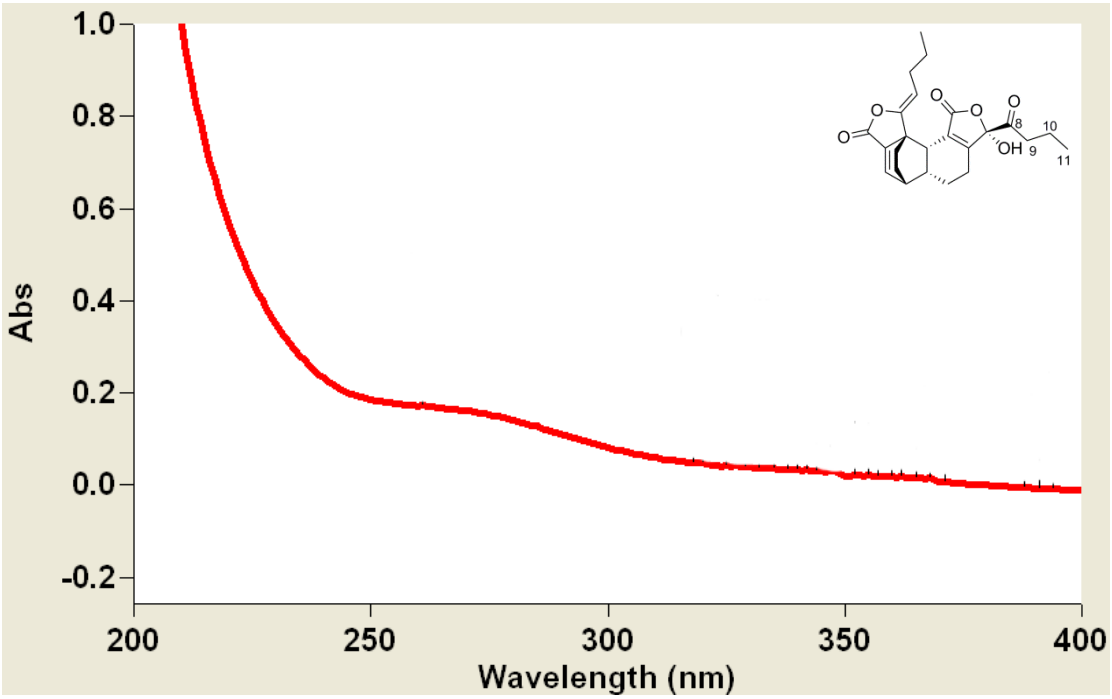


Figure S 48. UV spectrum of **4** in MeOH

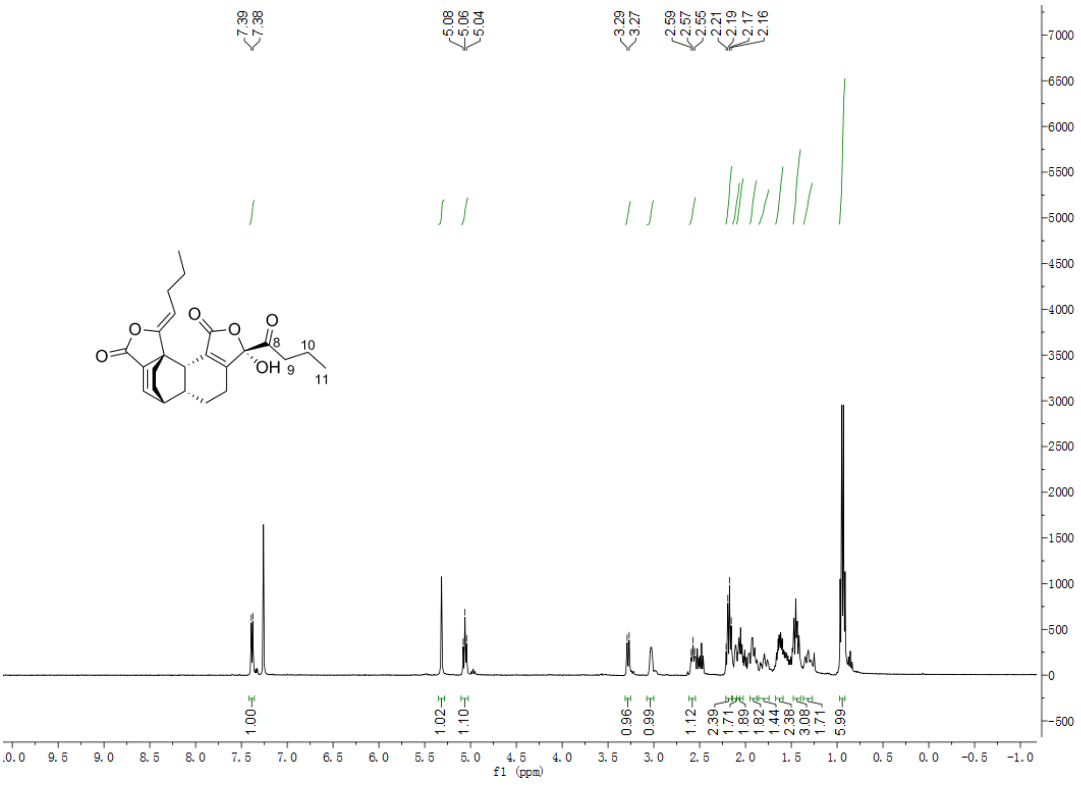


Figure S 49. ^{1}H NMR spectrum of **4** in $CDCl_3$

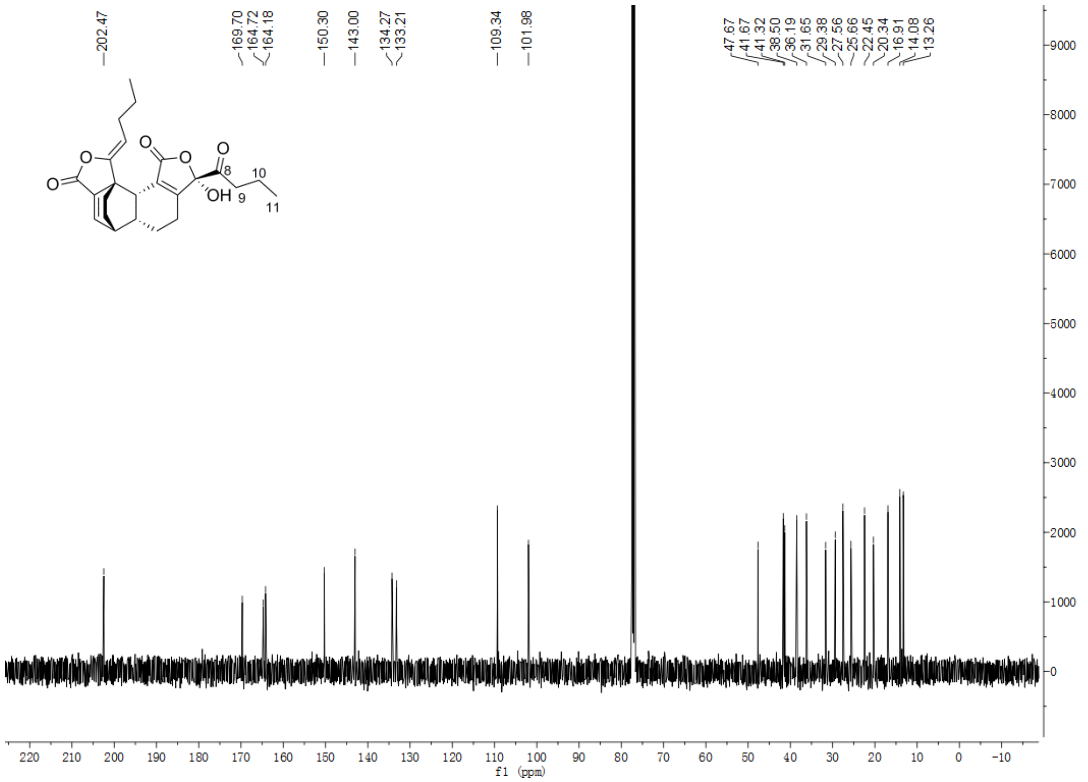


Figure S 50. ^{13}C NMR spectrum of **4** in $CDCl_3$

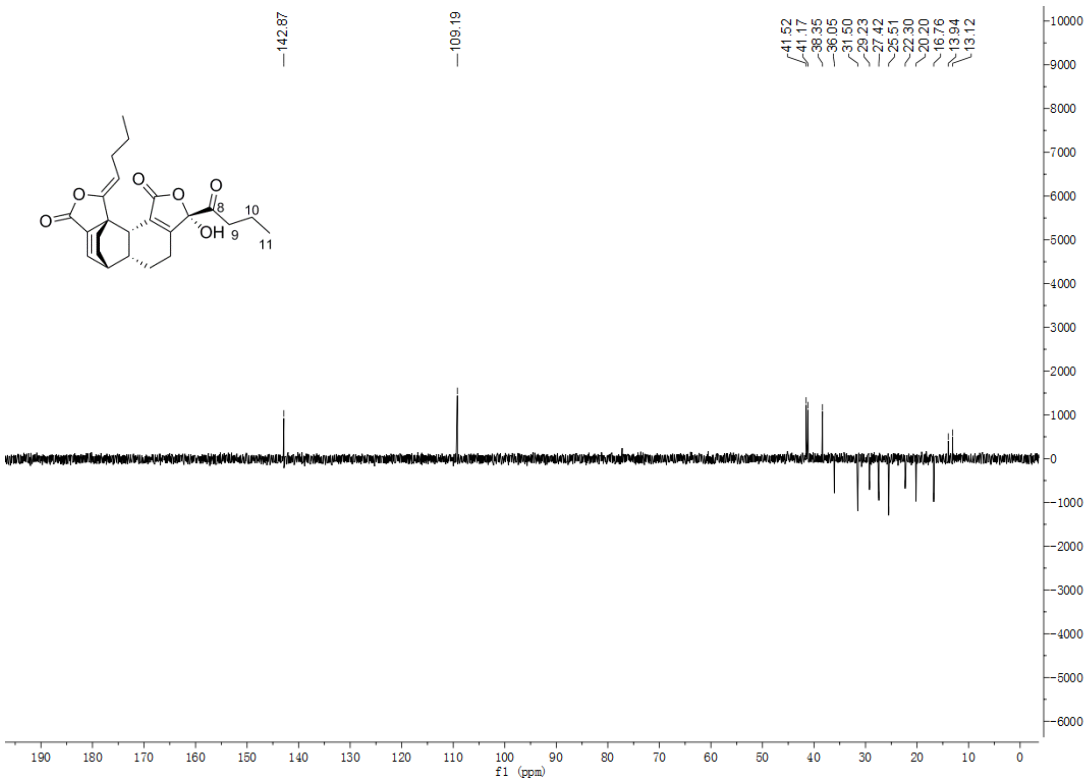


Figure S 51. DEPT spectrum of **4** in $CDCl_3$

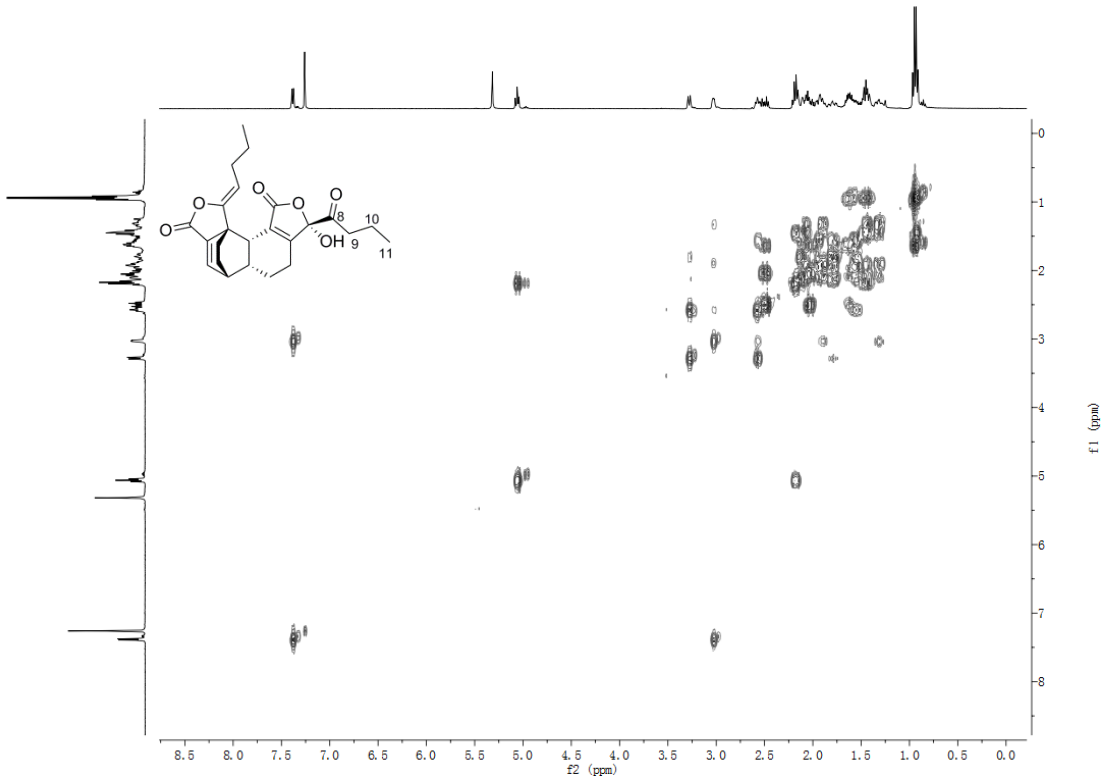


Figure S 52. $^{1}H–^{1}H$ COSY spectrum of **4** in $CDCl_3$

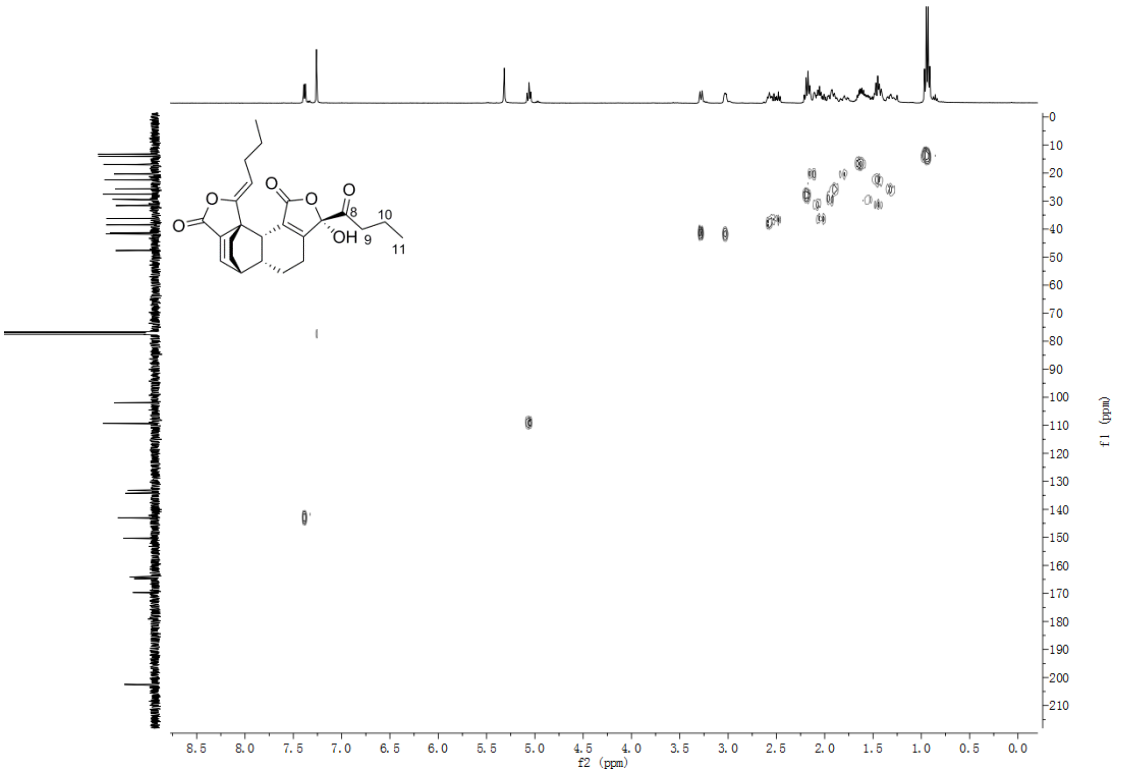


Figure S 53. HSQC spectrum of **4** in $CDCl_3$

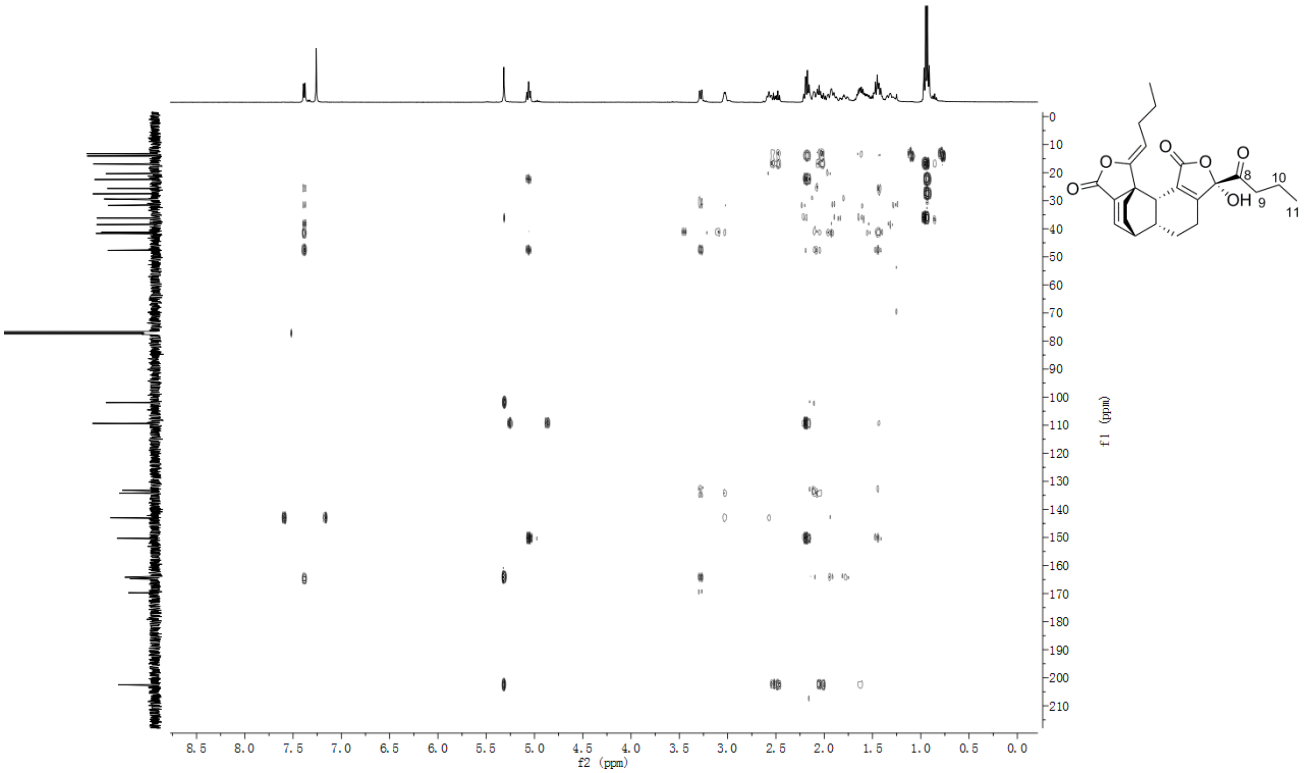


Figure S 54. HMBC spectrum of **4** in $CDCl_3$

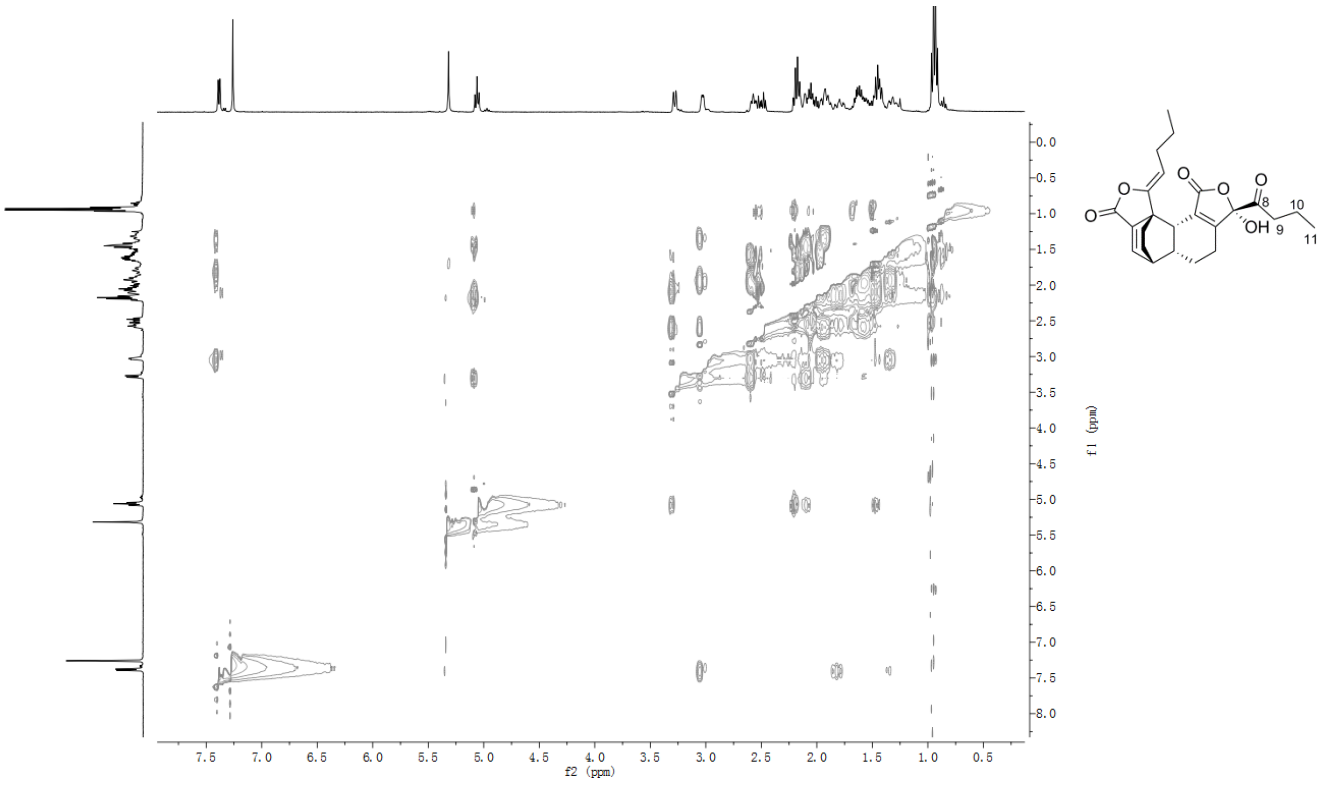
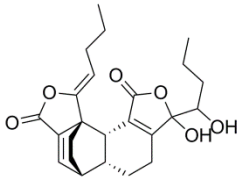


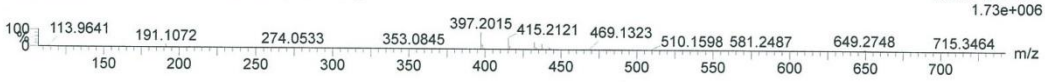
Figure S 55. NOESY spectrum of **4** in $CDCl_3$

Elemental Composition Report Page 1

Single Mass Analysis
Tolerance = 5.0 PPM / DBE: min = -1.5, max = 50.0
Element prediction: Off
Number of isotope peaks used for i-FIT = 3



Monoisotopic Mass, Even Electron Ions
178 formula(e) evaluated with 1 results within limits (up to 50 closest results for each mass)
Elements Used:
C: 0-100 H: 0-200 O: 0-50 Na: 0-1
Xevo G2 Q-TOF/YCA166#
20151123-A HRMS 12 (0.233) Cm (10:15-(2:8+21:54))
21-Dec-2015
Waters
1: TOF MS ES+
1.73e+006



Minimum:				-1.5				
Maximum:		5.0	5.0	50.0				
Mass	Calc. Mass	mDa	PPM	DBE	i-FIT	Norm	Conf(%)	Formula
415.2121	415.2121	0.0	0.0	9.5	390.1	n/a	n/a	C24 H31 O6

Figure S 56. HRESIMS data of **5**

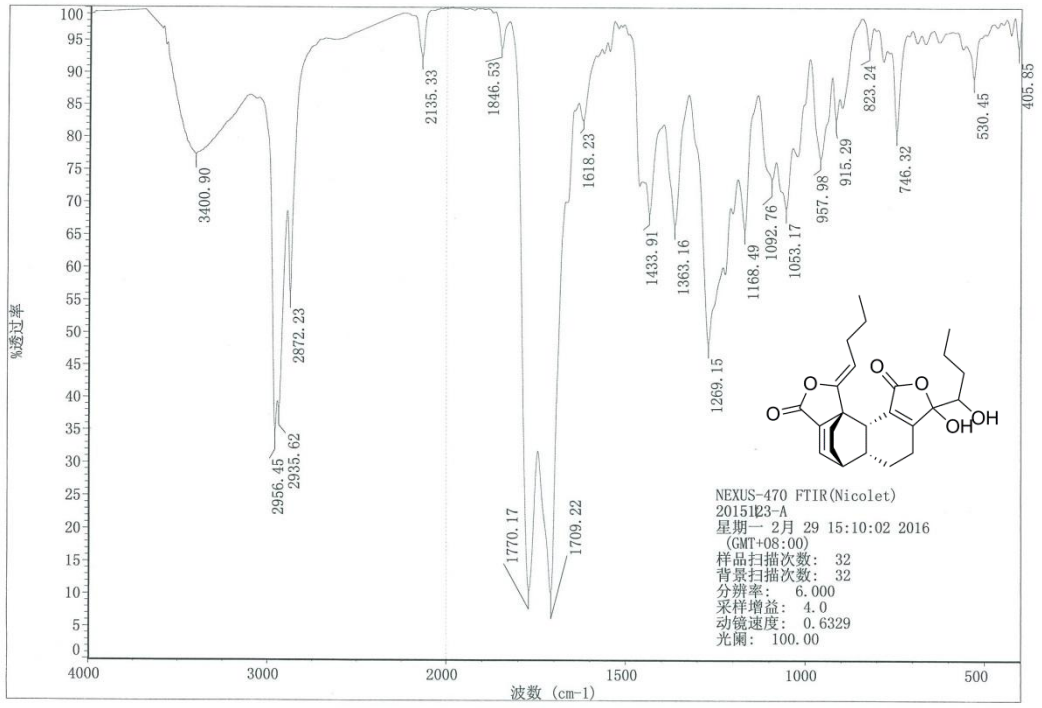


Figure S 57. IR spectrum of **5**

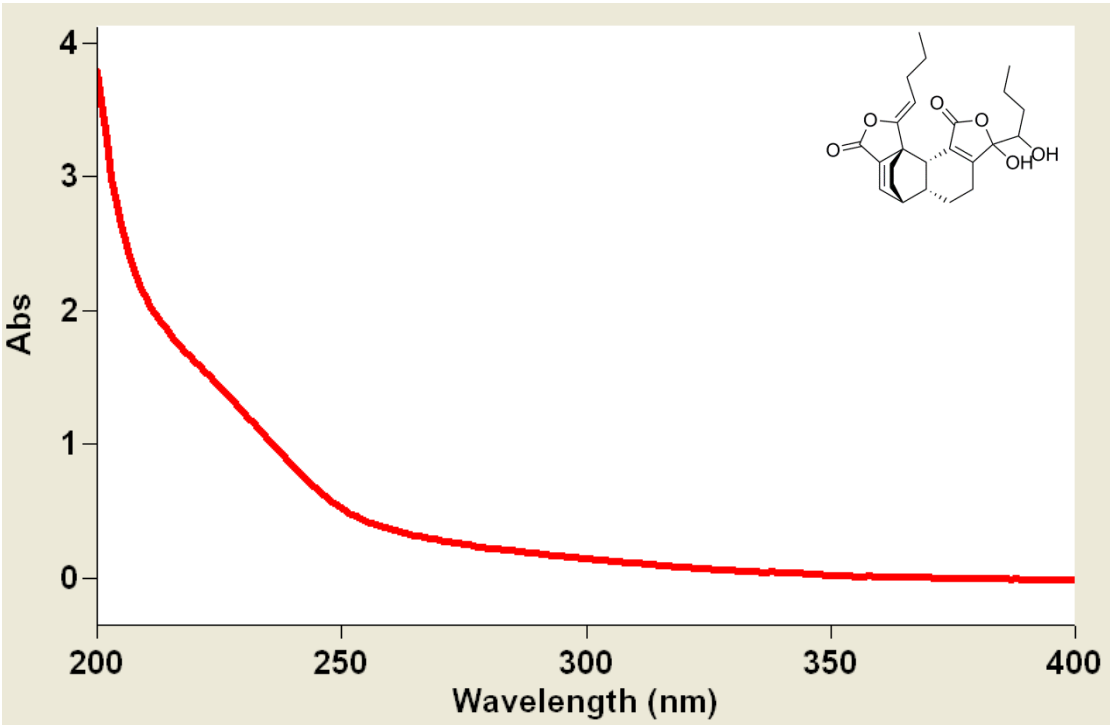


Figure S 58. UV spectrum of **5** in MeOH

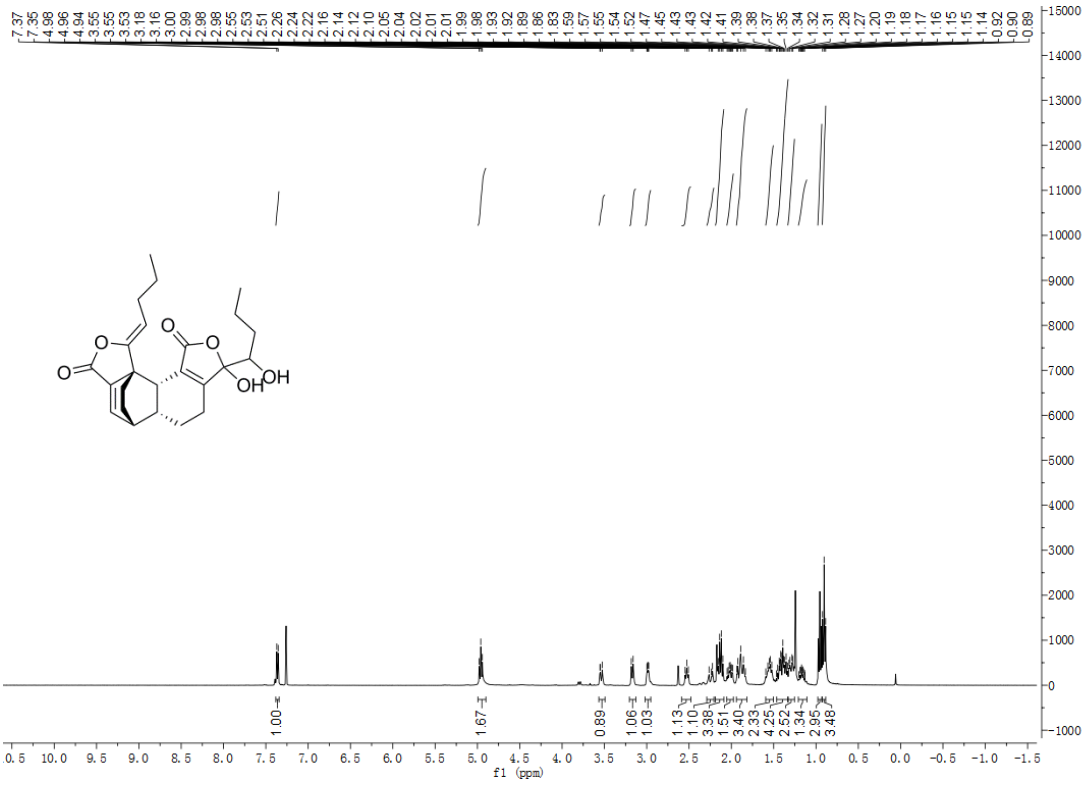


Figure S 59. ^{1}H NMR spectrum of **5** in $CDCl_3$

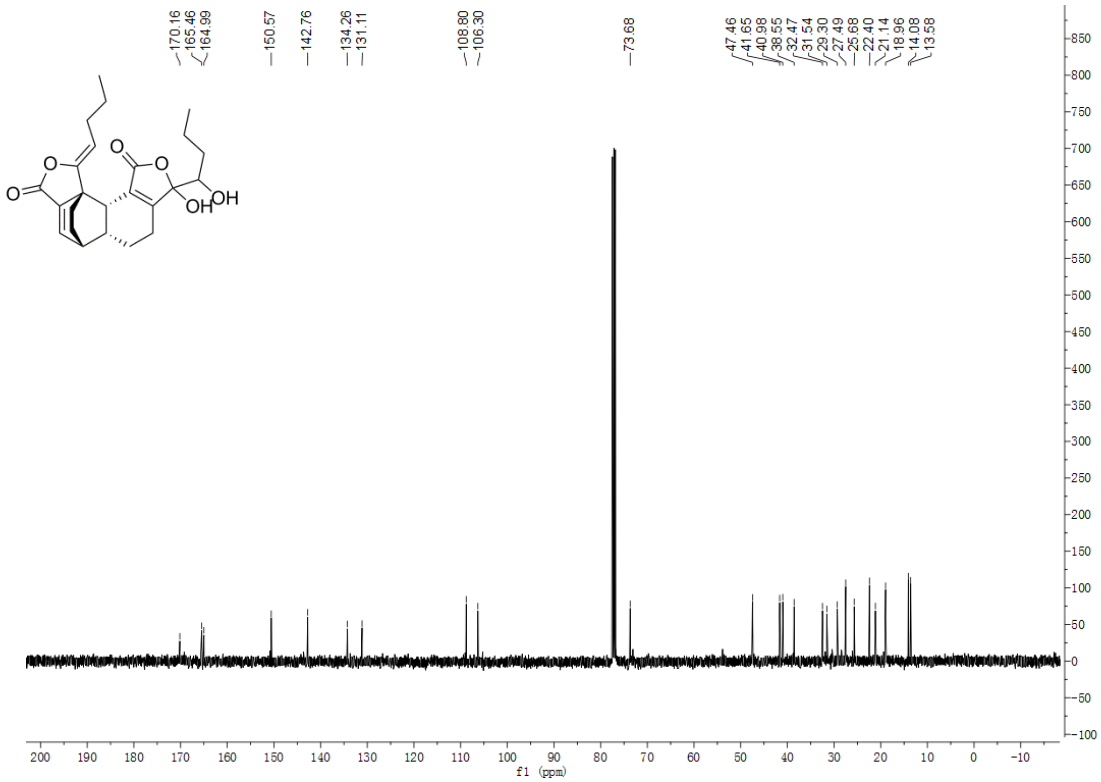


Figure S 60. ^{13}C NMR spectrum of **5** in $CDCl_3$

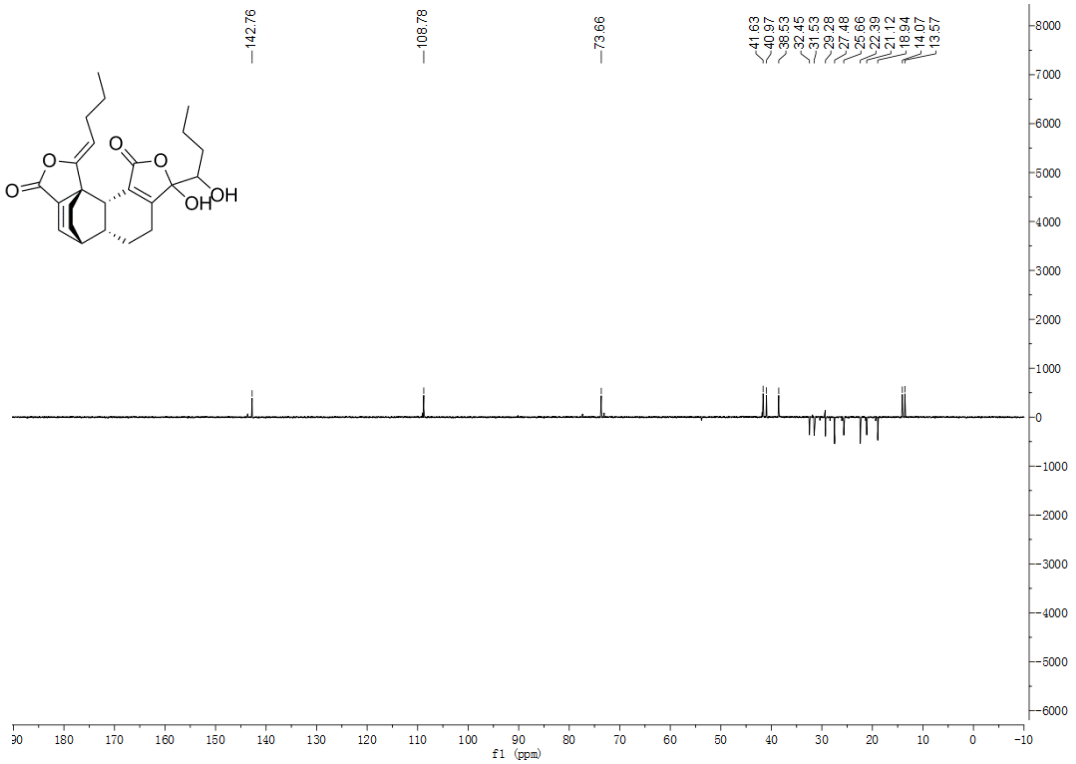


Figure S 61. DEPT spectrum of **5** in $CDCl_3$

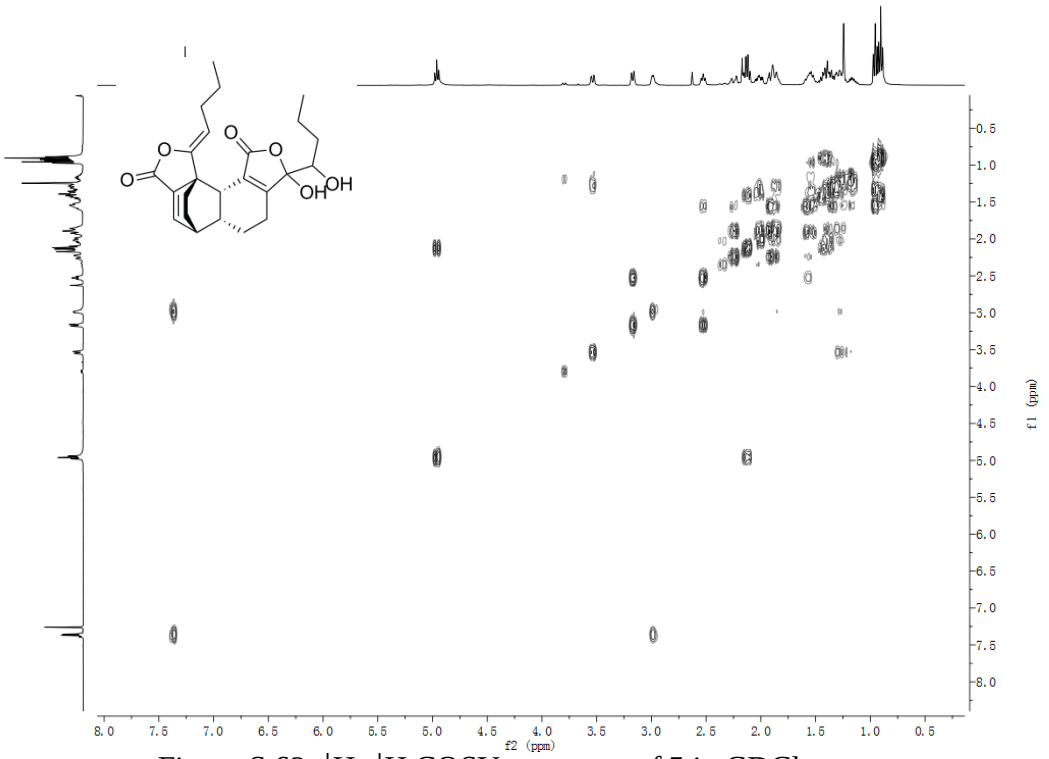


Figure S 62. $^{1}H–^{1}H$ COSY spectrum of **5** in $CDCl_3$

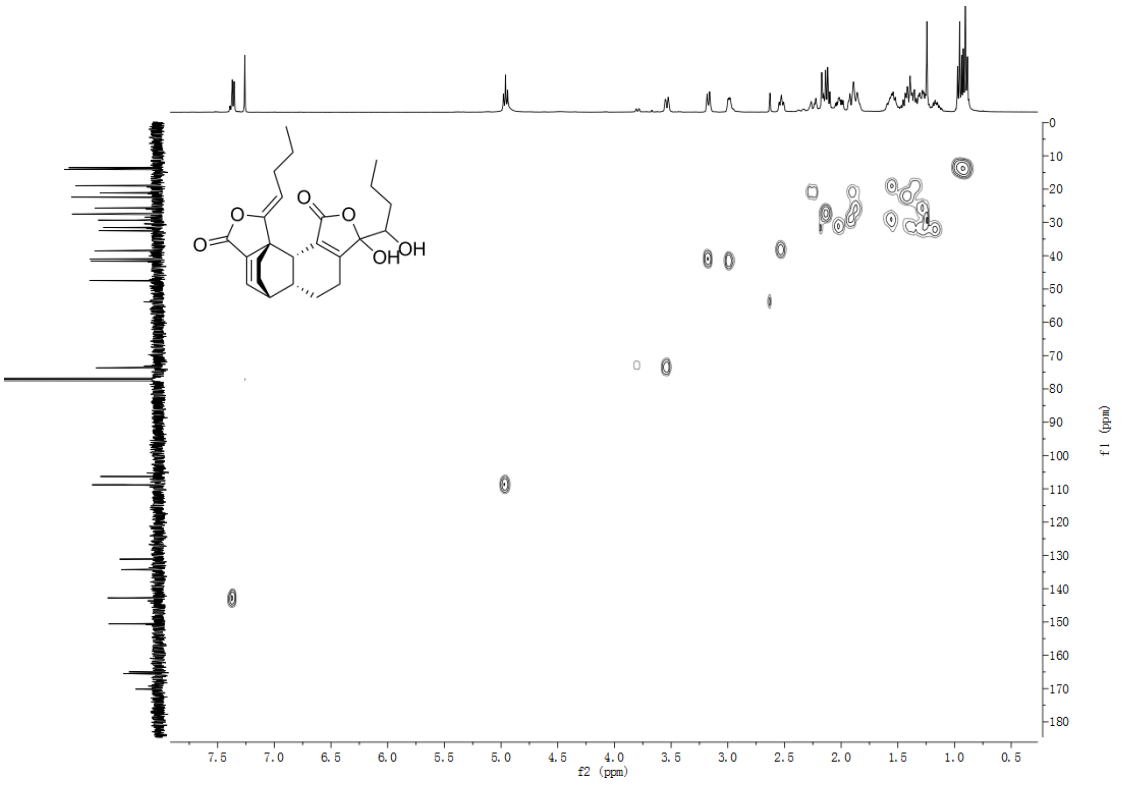


Figure S 63. HSQC spectrum of **5** in $CDCl_3$

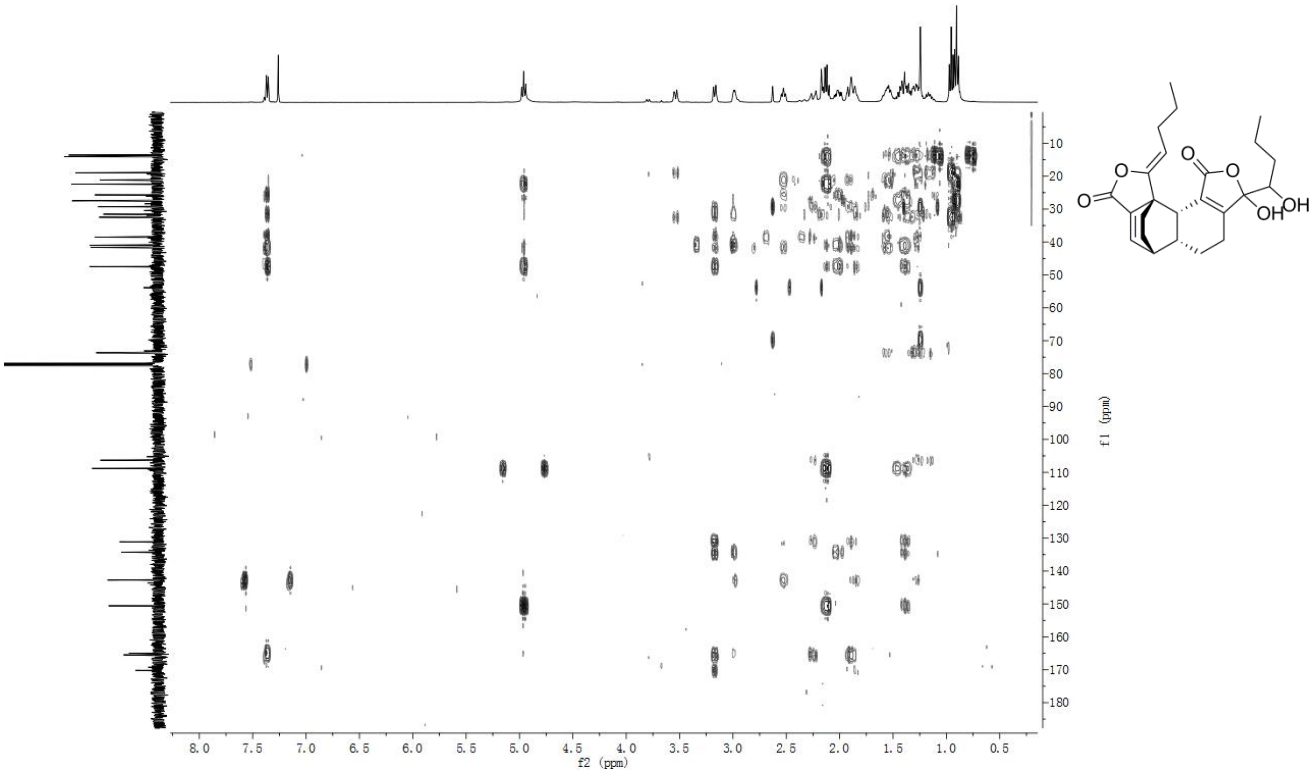


Figure S 64. HMBC spectrum of **5** in $CDCl_3$

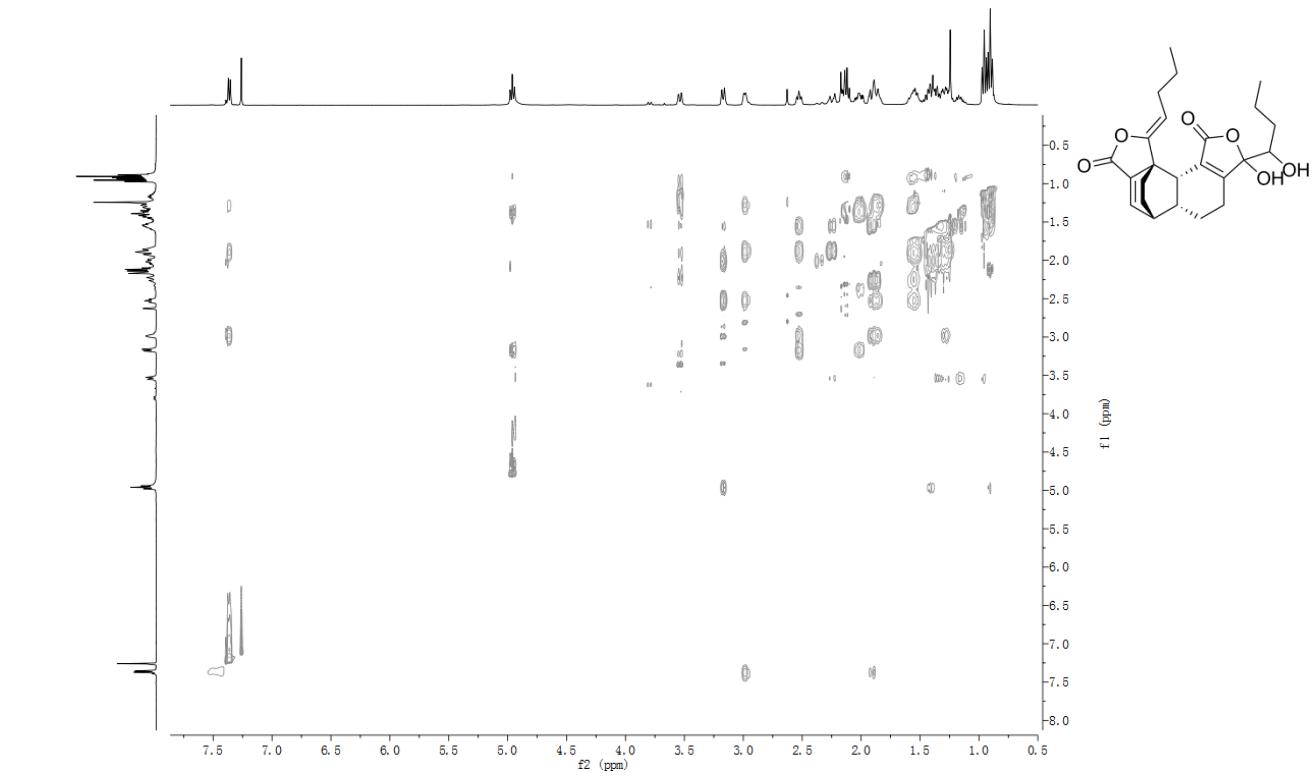


Figure S 65. NOESY spectrum of **5** in $CDCl_3$