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## **APPENDICES**

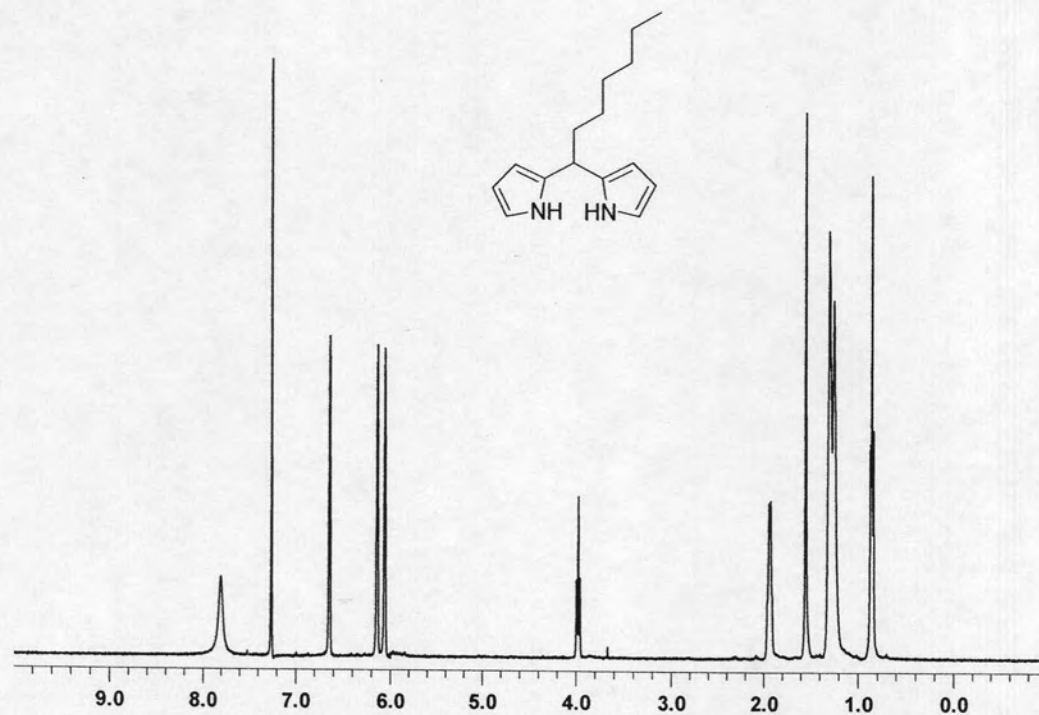


Figure A-1 The <sup>1</sup>H NMR spectrum of 5-hexyldipyrromethane (1)

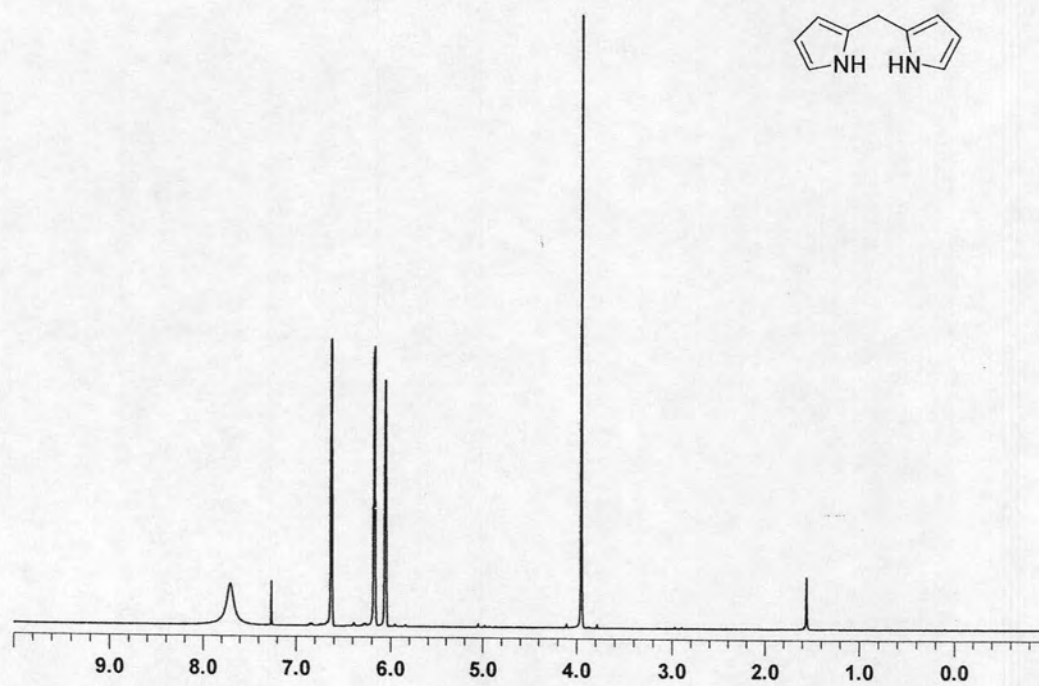


Figure A-2 The <sup>1</sup>H NMR spectrum of dipyrromethane (2)

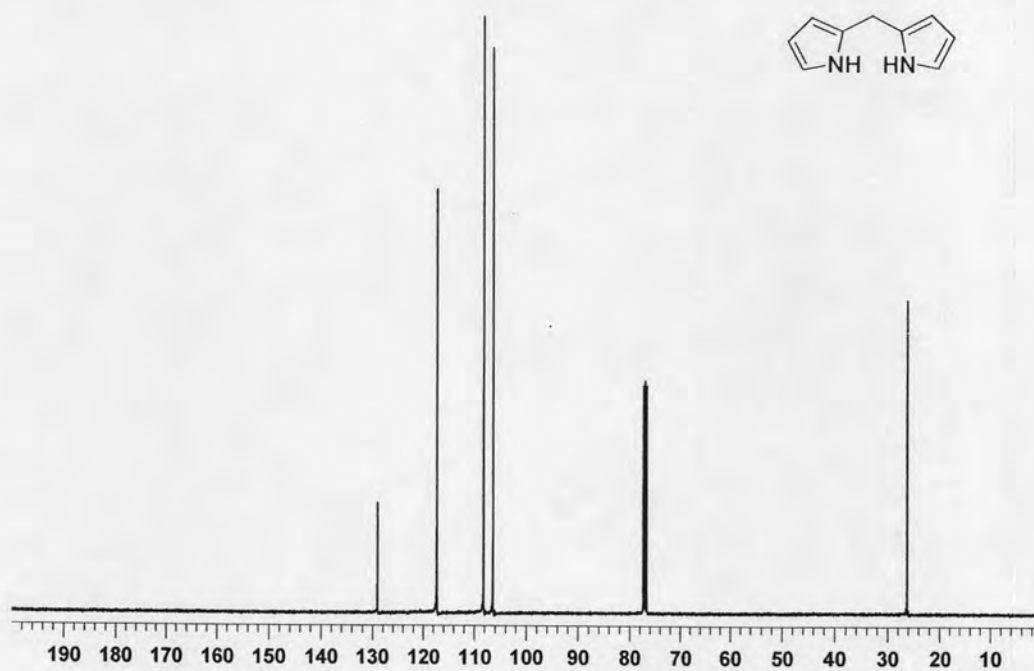


Figure A-3 The  $^{13}\text{C}$  NMR spectrum of dipyrromethane (2)

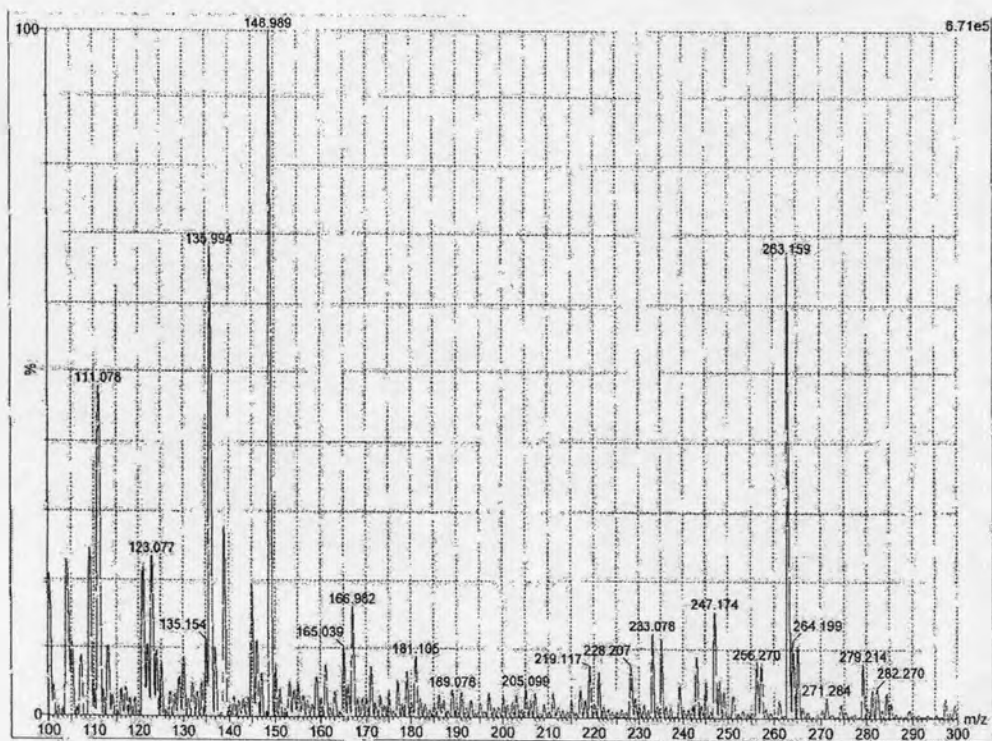


Figure A-4 The ESI mass spectrum of dipyrromethane (2)

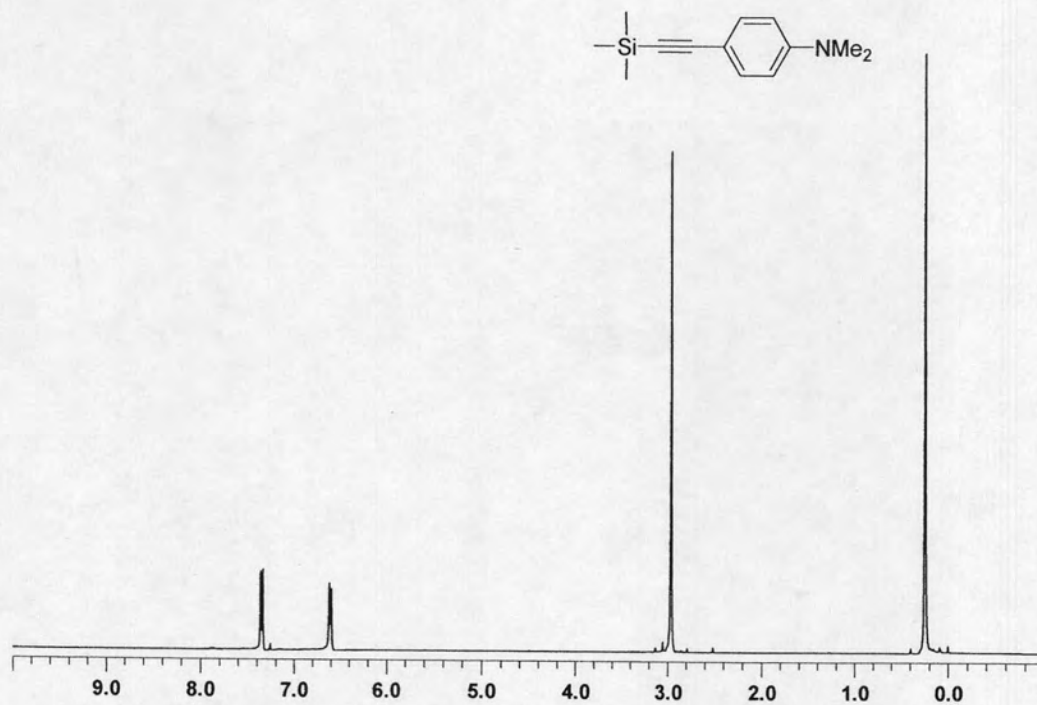


Figure A-5 The <sup>1</sup>H NMR spectrum of DMAP-TMSE (3)

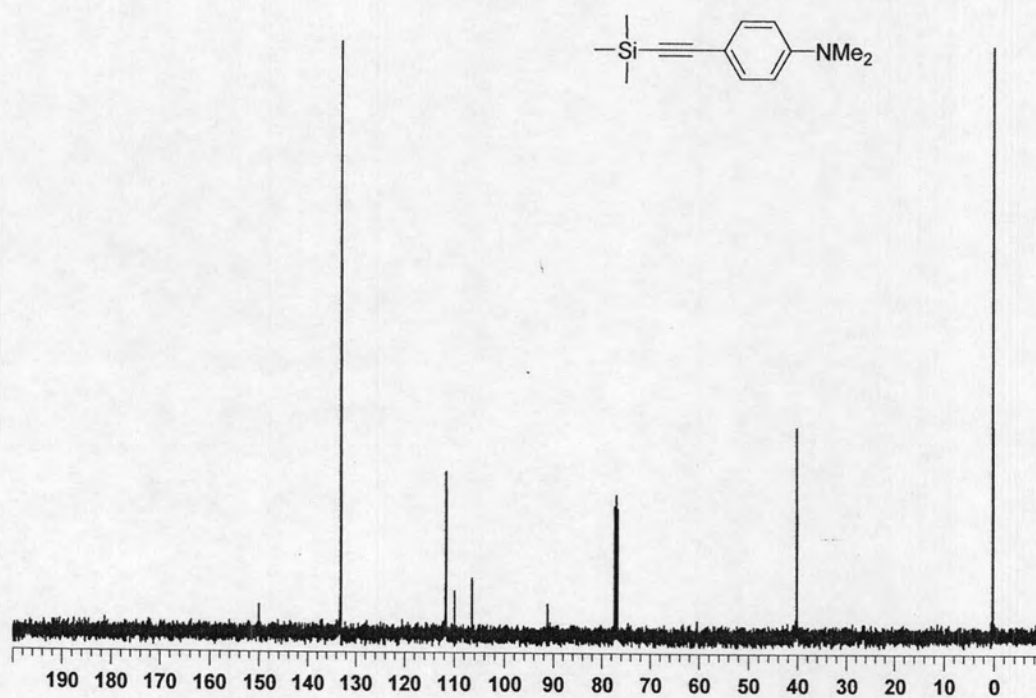


Figure A-6 The <sup>13</sup>C NMR spectrum of DMAP-TMSE (3)

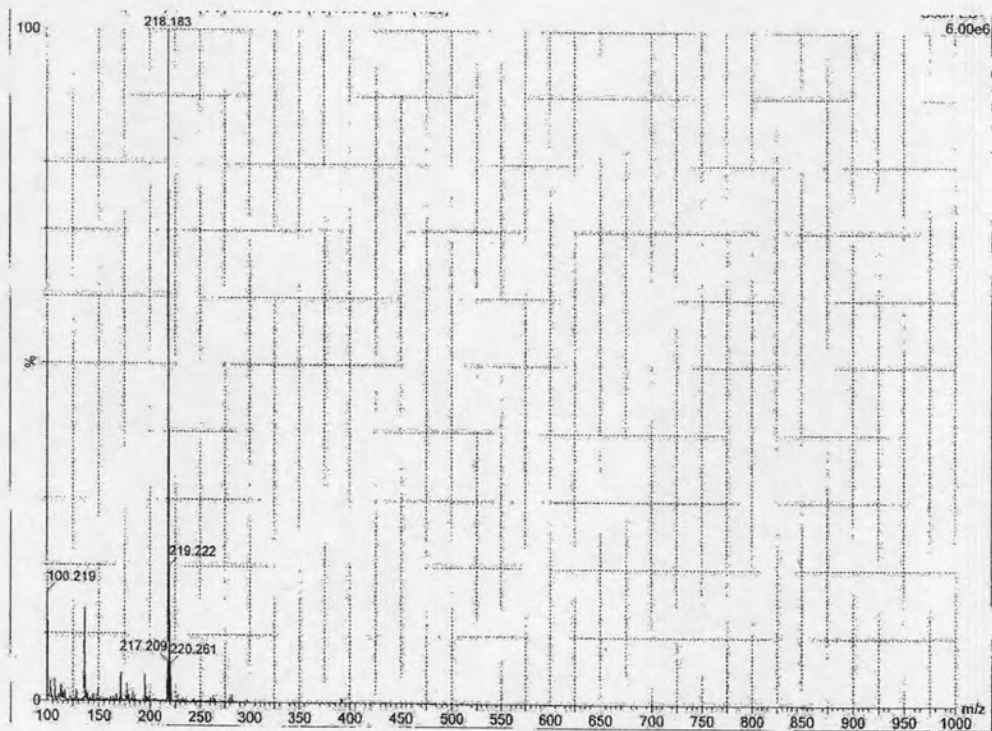


Figure A-7 The ESI mass spectrum of DMAP-TMSE (3)

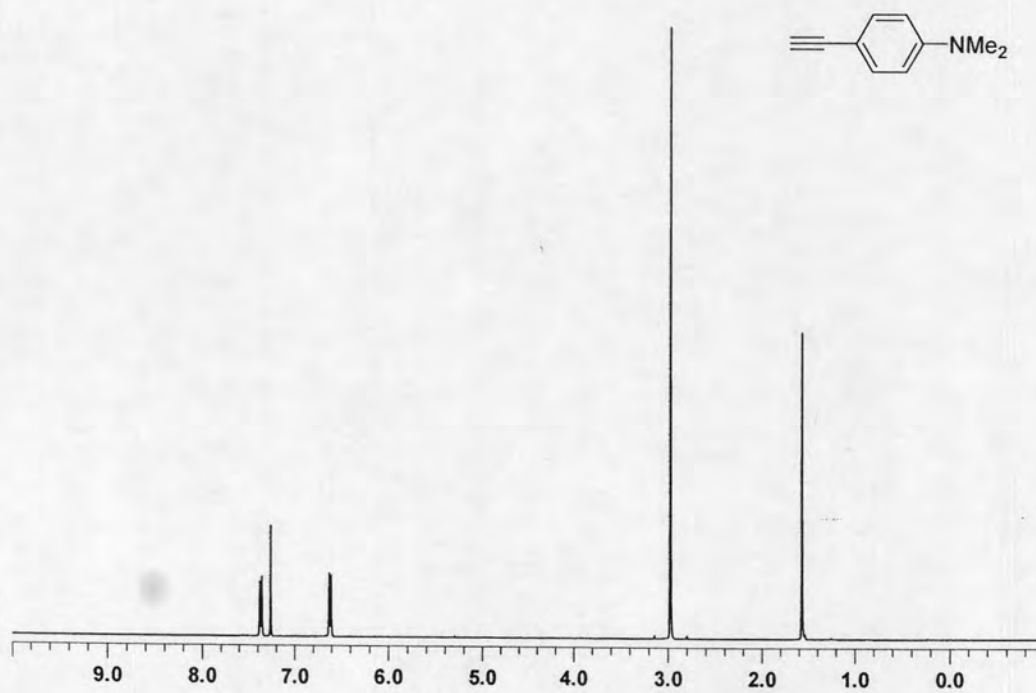


Figure A-8 The  $^1\text{H}$  NMR spectrum of DMAPE (4)

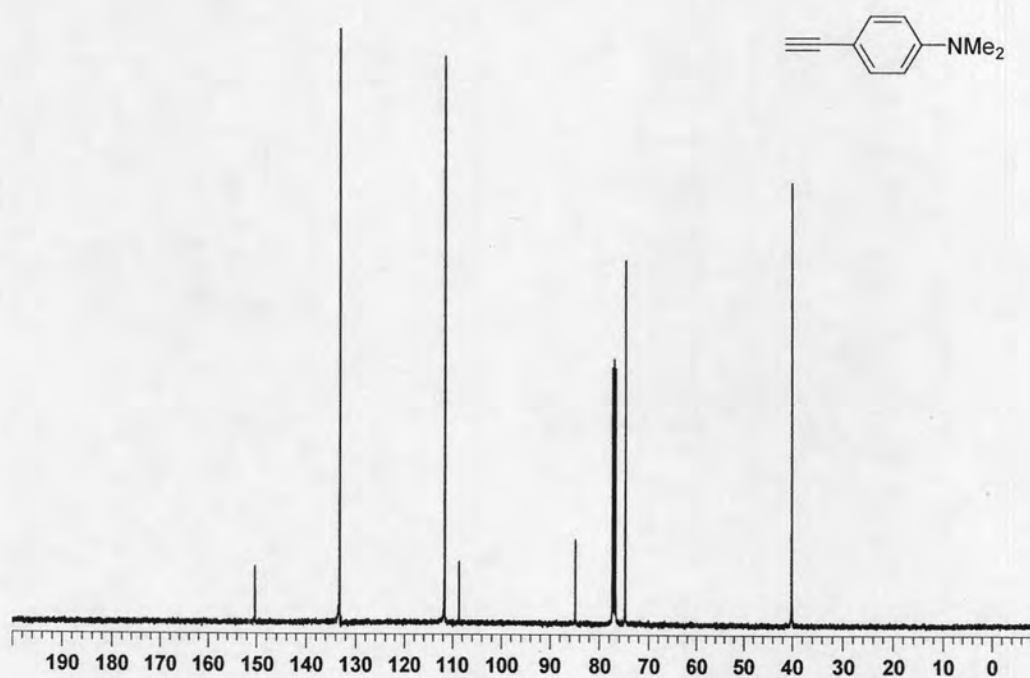


Figure A-9 The  $^{13}\text{C}$  NMR spectrum of DMAPE (4)

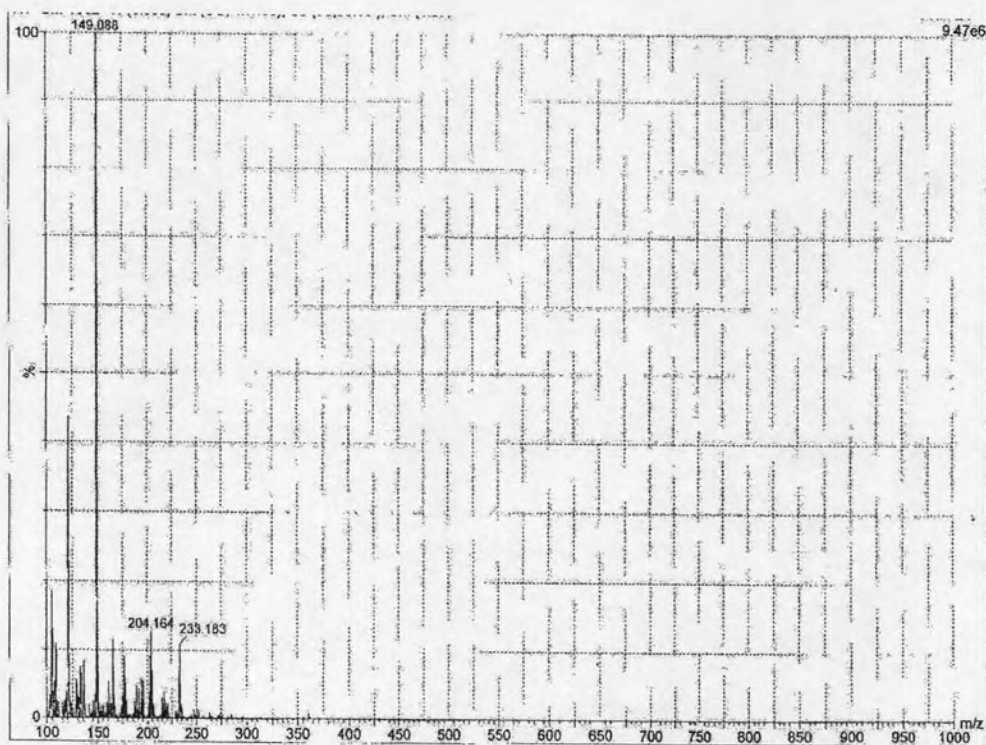


Figure A-10 The ESI mass spectrum of DMAPE (4)

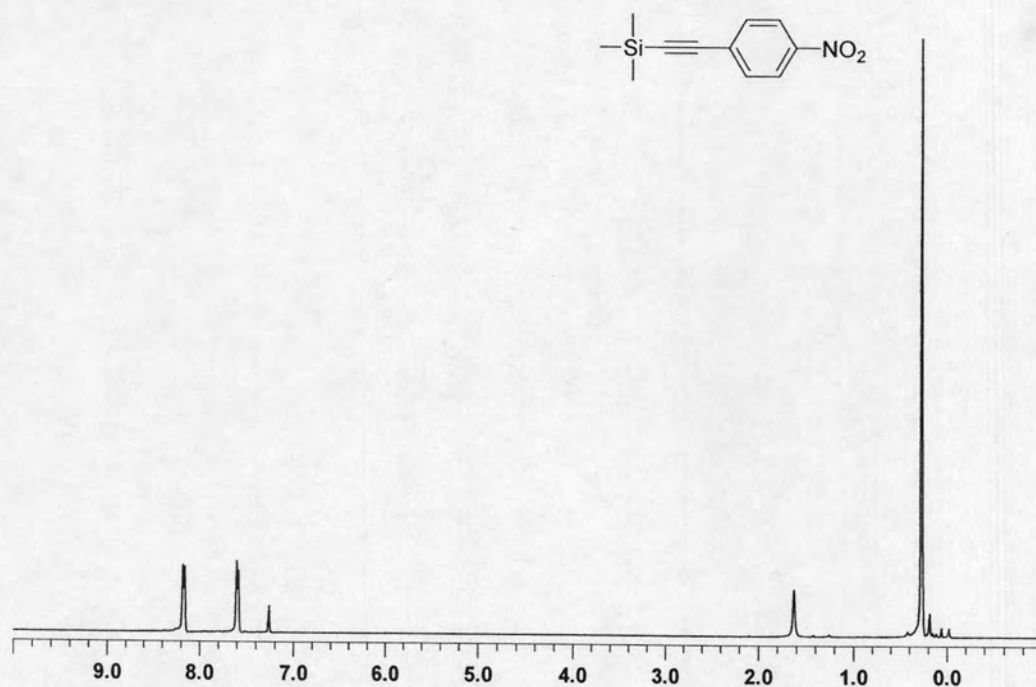


Figure A-11 The <sup>1</sup>H NMR spectrum of NP-TMSE (5)

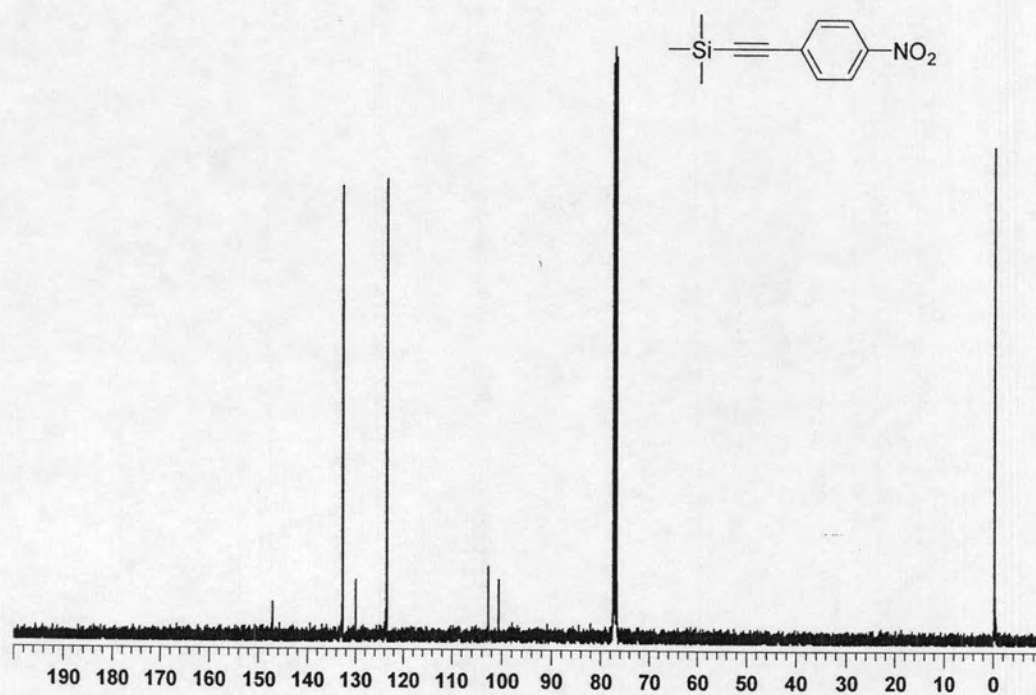


Figure A-12 The <sup>13</sup>C NMR spectrum of NP-TMSE (5)

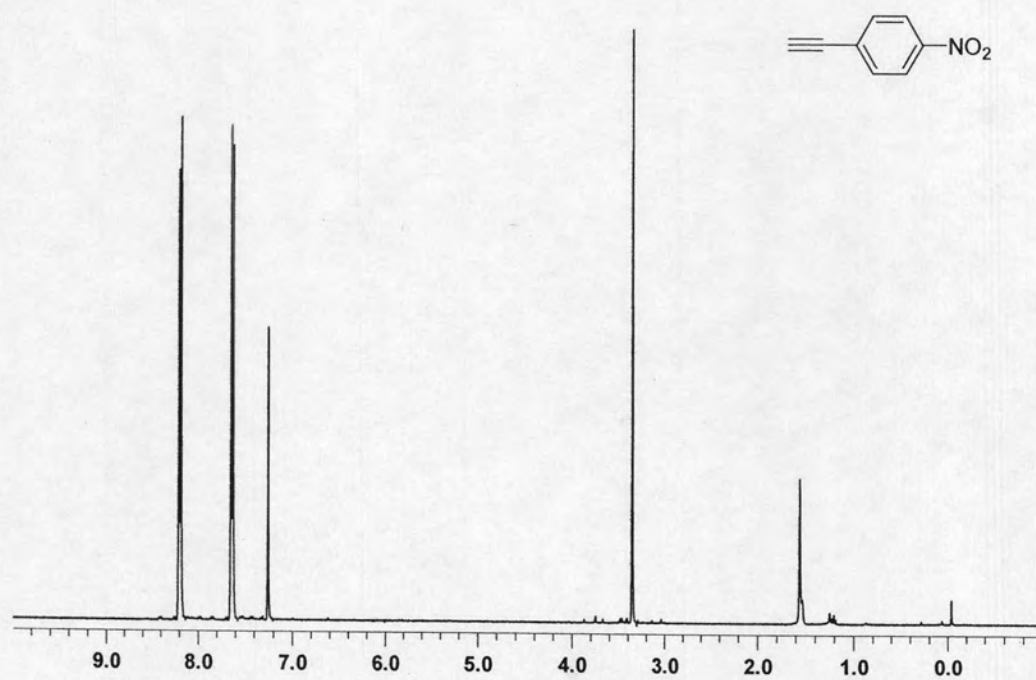


Figure A-13 The  $^1\text{H}$  NMR spectrum of NPE (6)

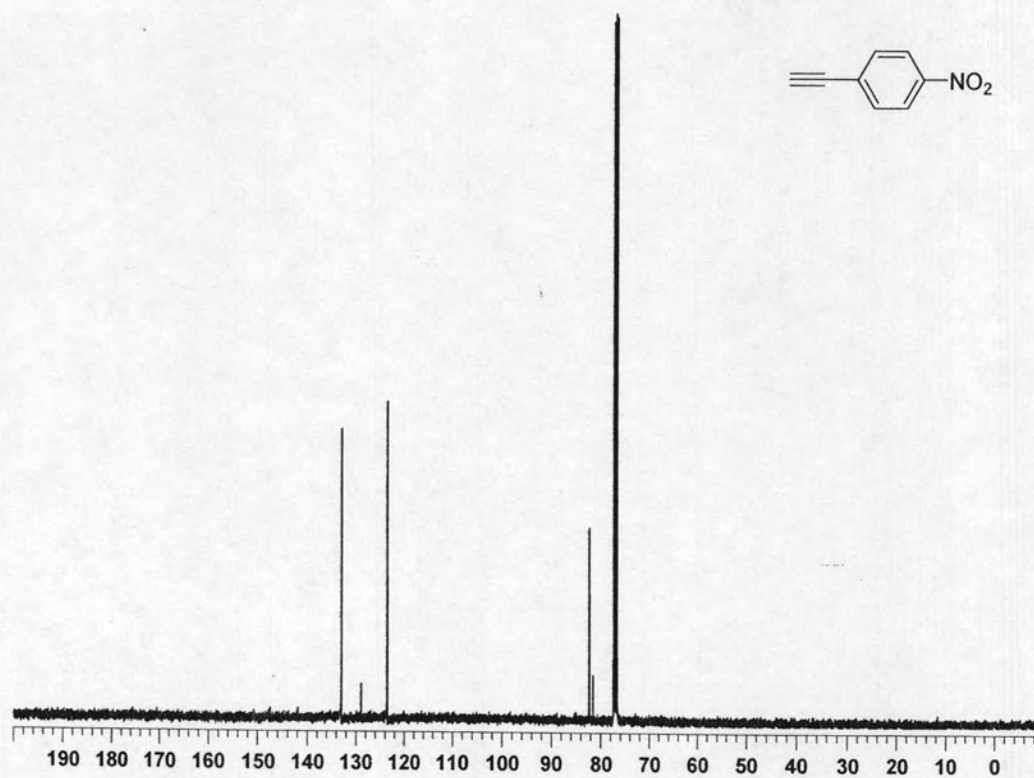


Figure A-14 The  $^{13}\text{C}$  NMR spectrum of NPE (6)



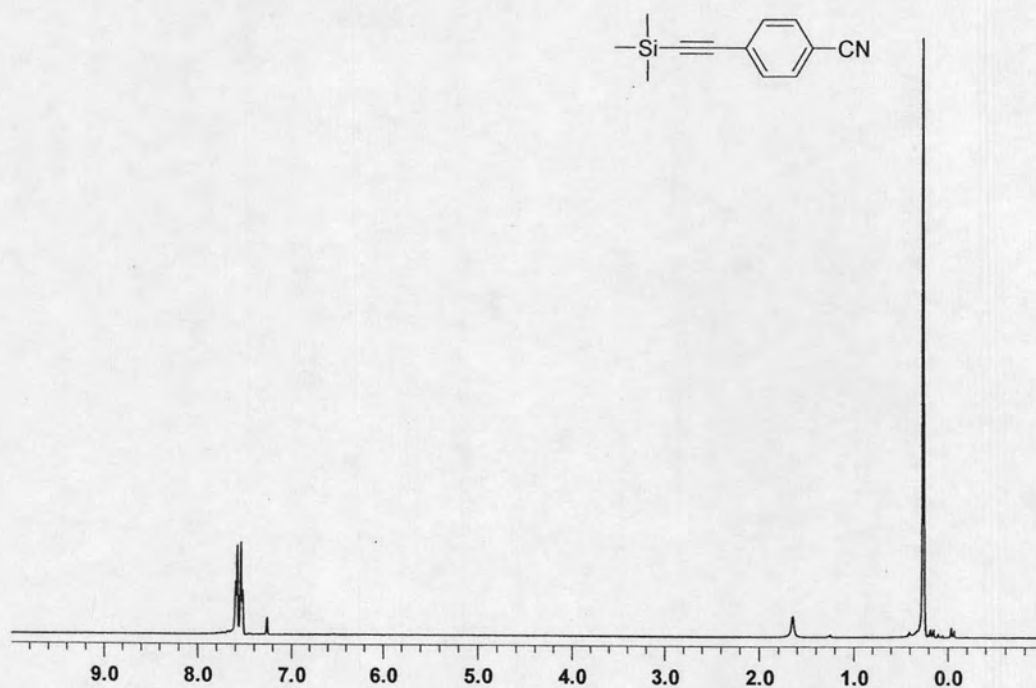


Figure A-15 The <sup>1</sup>H NMR spectrum of CP-TMSE (7)

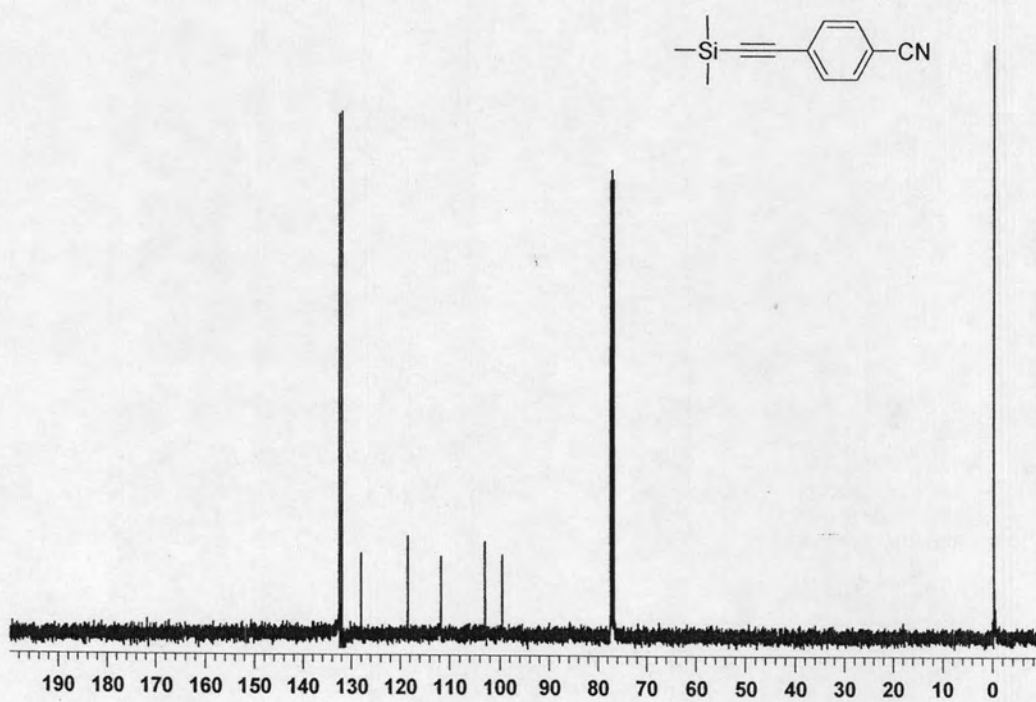


Figure A-16 The <sup>13</sup>C NMR spectrum of CP-TMSE (7)

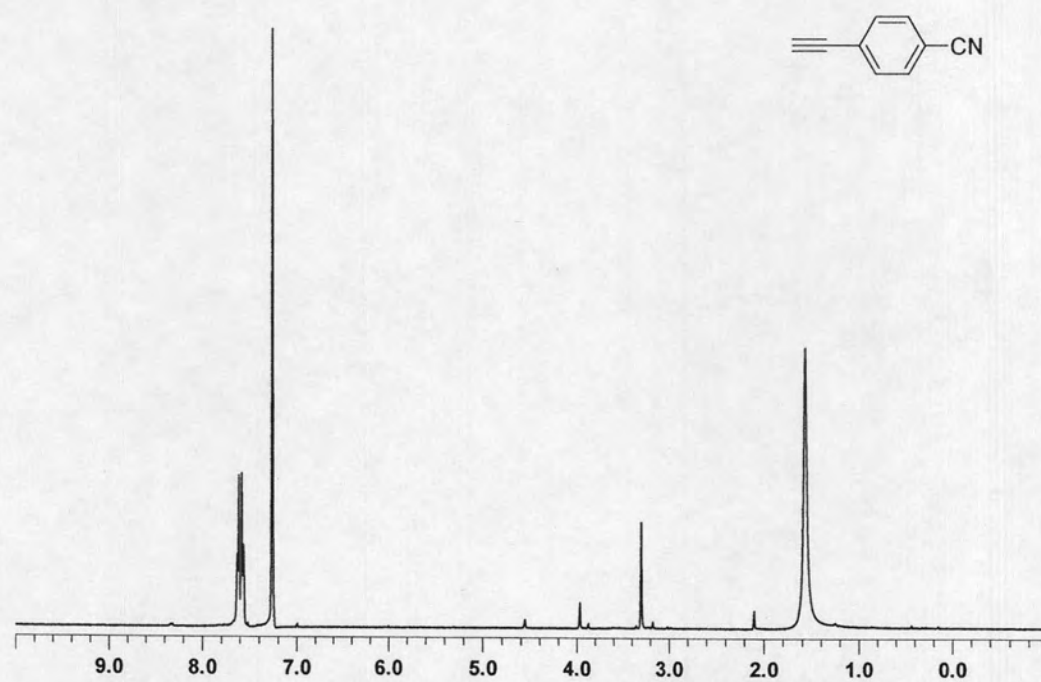


Figure A-17 The  $^1\text{H}$  NMR spectrum of CPE (8)

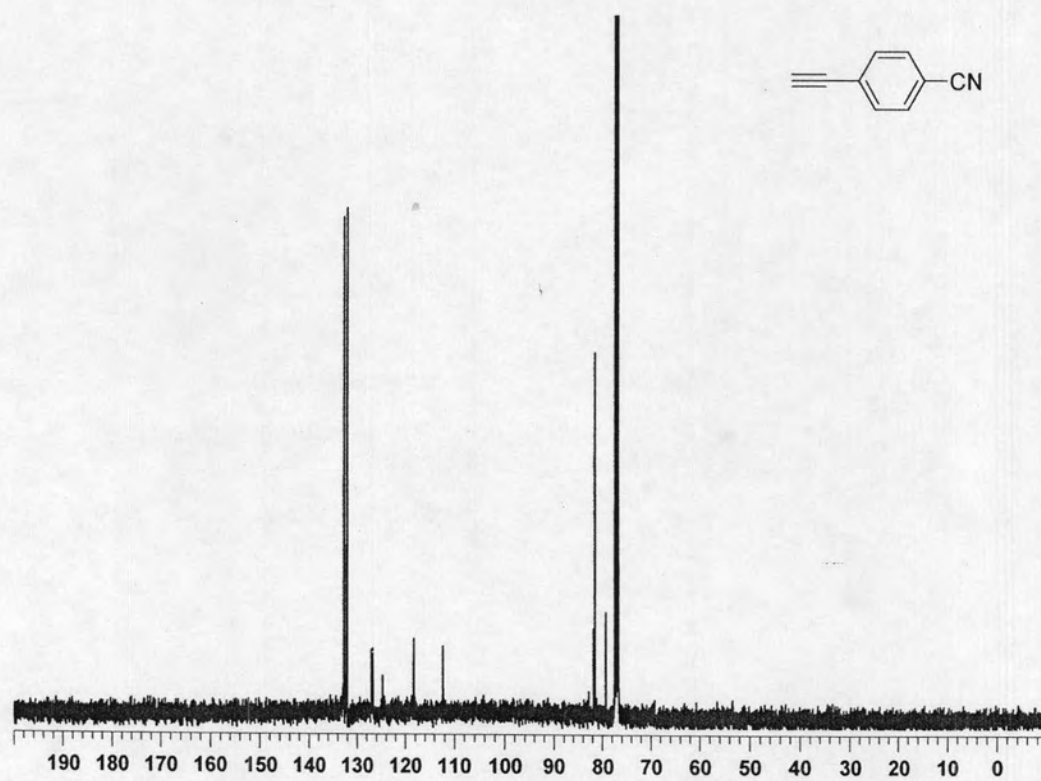


Figure A-18 The  $^{13}\text{C}$  NMR spectrum of CPE (8)

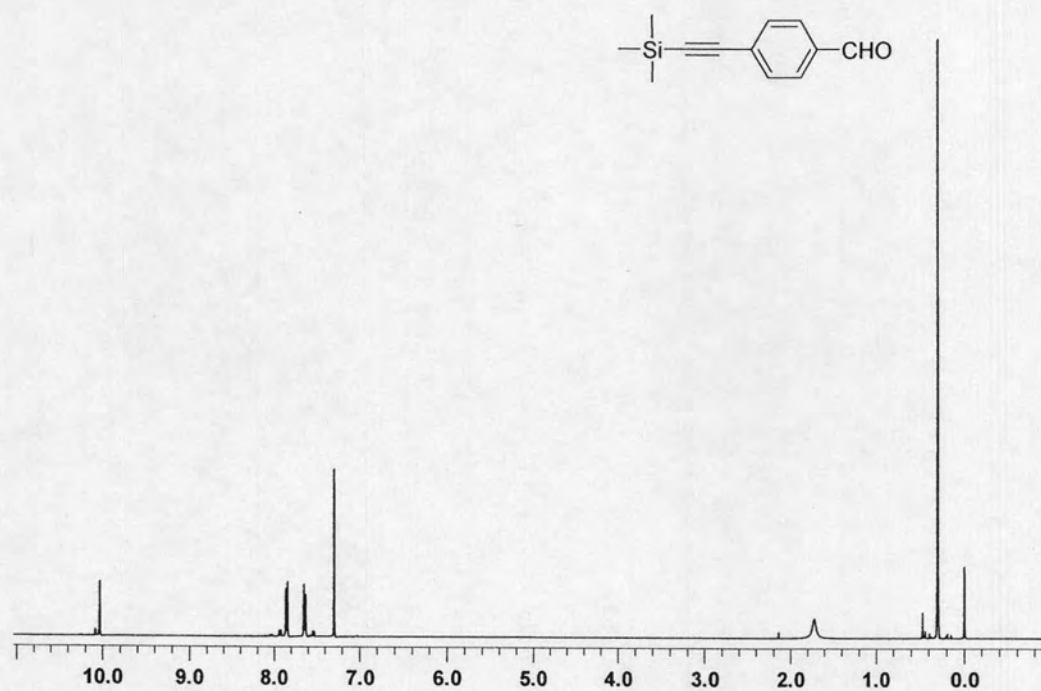


Figure A-19 The <sup>1</sup>H NMR spectrum of FP-TMSE (9)

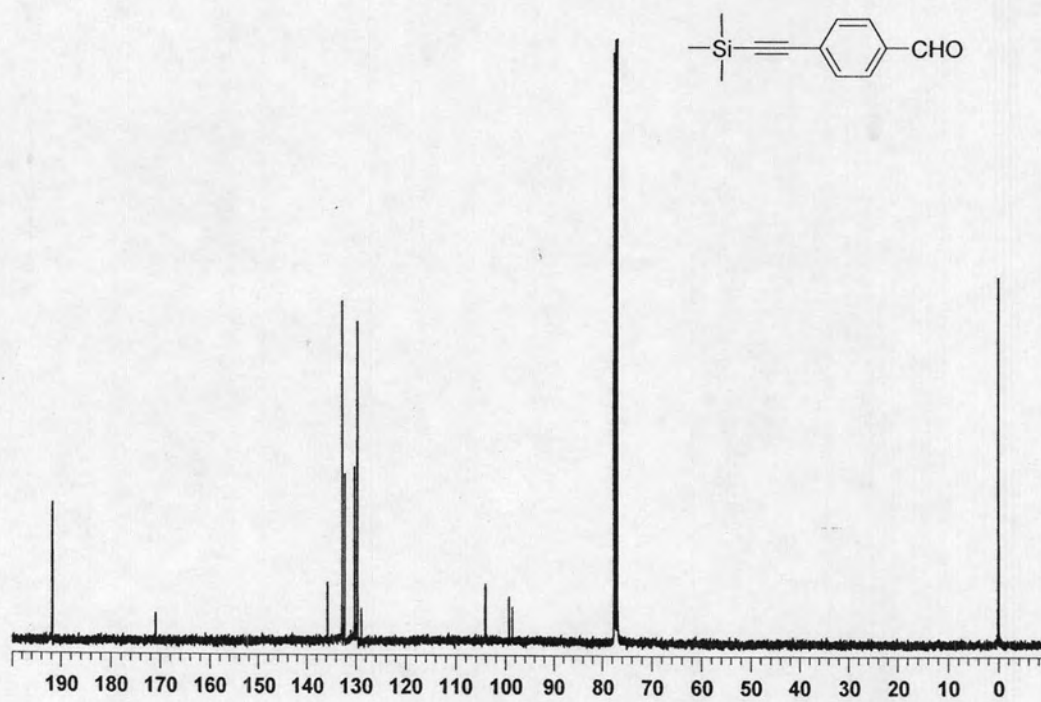


Figure A-20 The <sup>13</sup>C NMR spectrum of FP-TMSE (9)

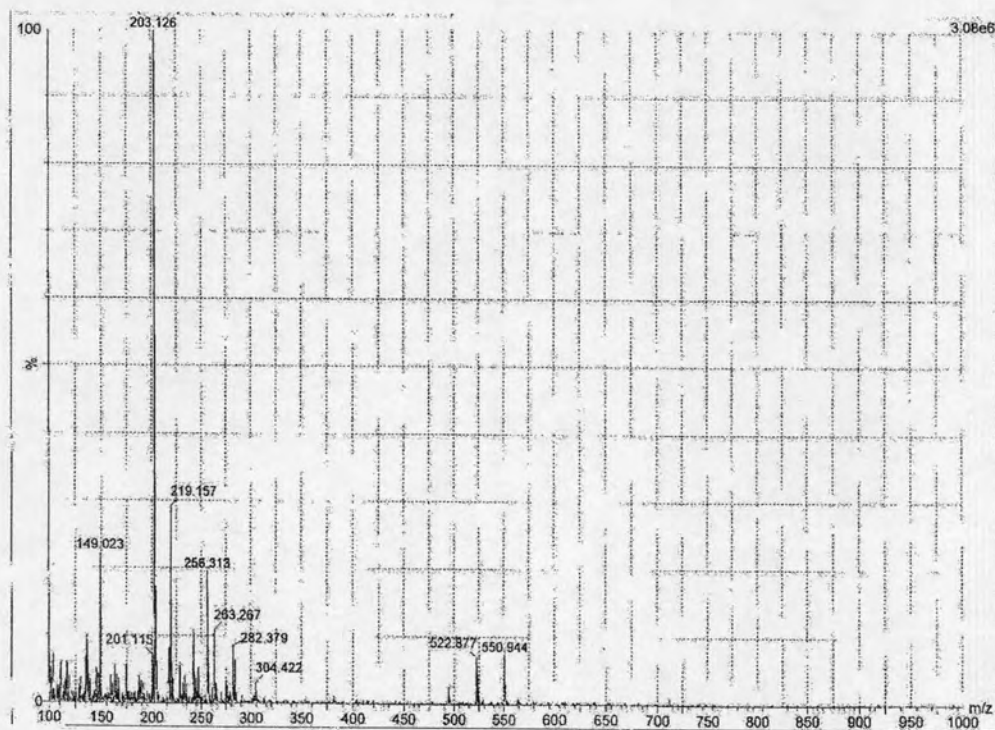


Figure A-21 The ESI mass spectrum of FP-TMSE (9)

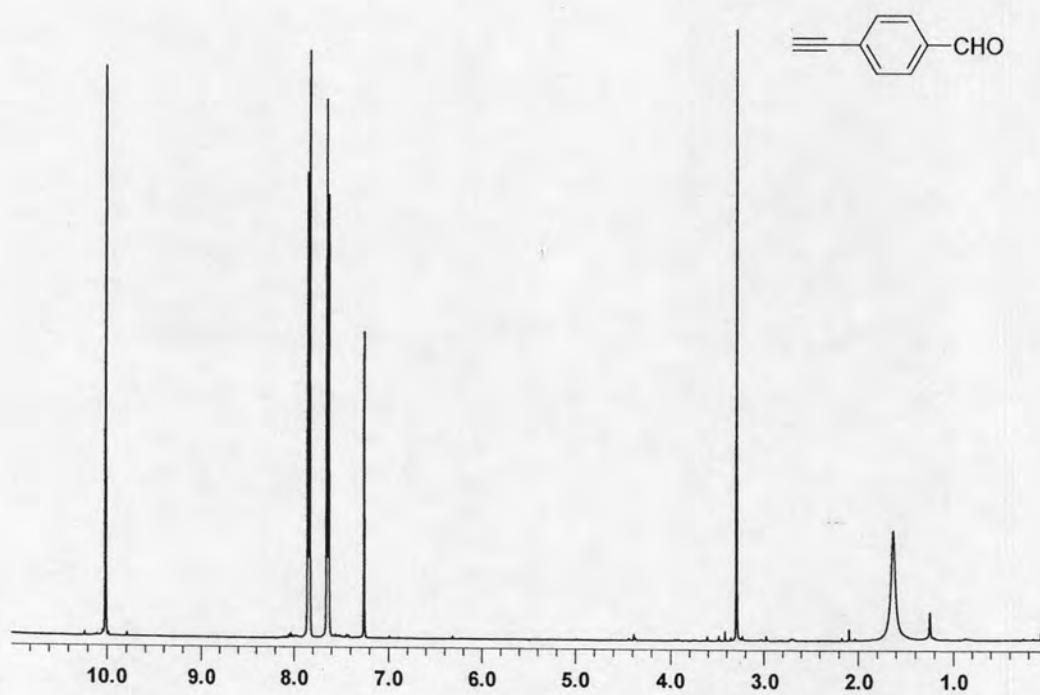


Figure A-22 The <sup>1</sup>H NMR spectrum of FPE (10)

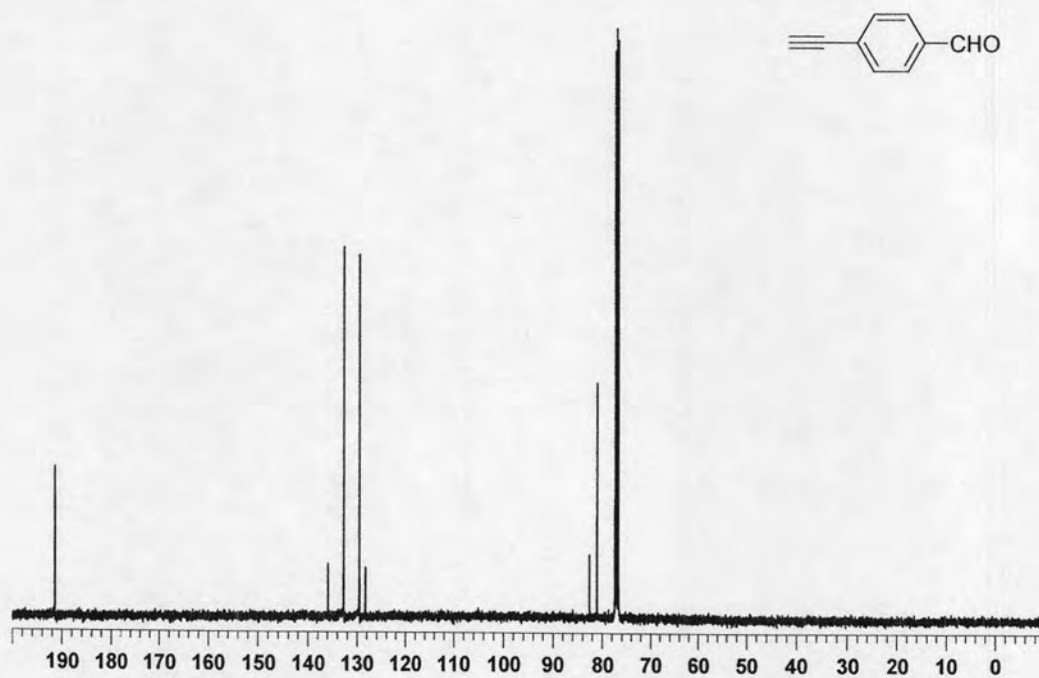


Figure A-23 The  $^{13}\text{C}$  NMR spectrum of FPE (10)

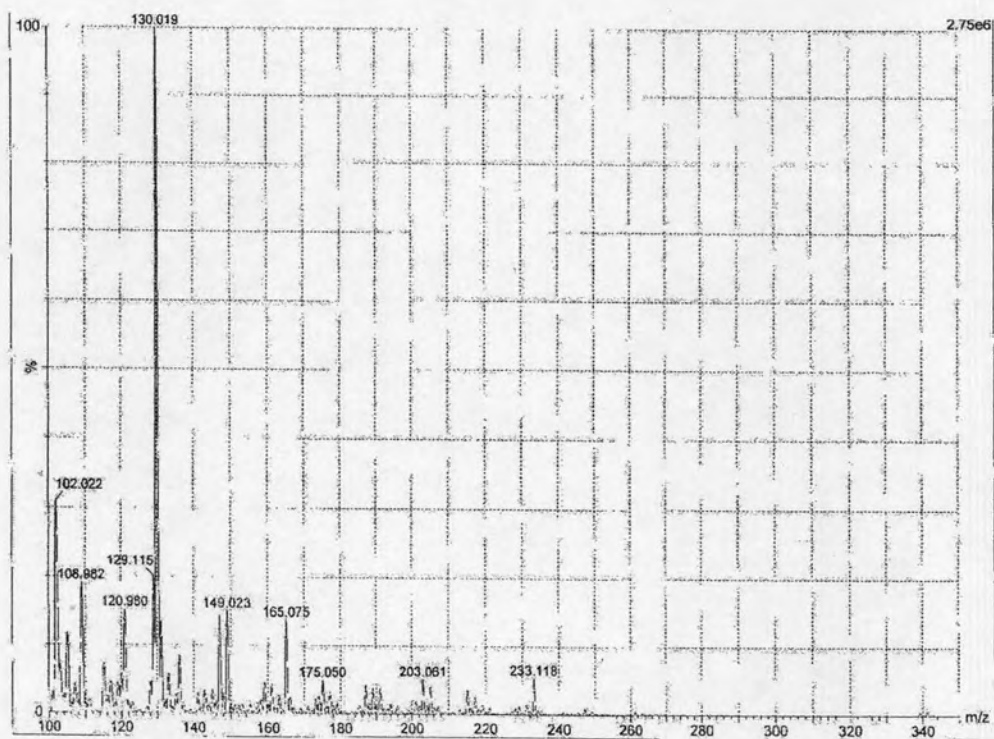


Figure A-24 The ESI mass spectrum of FPE (10)

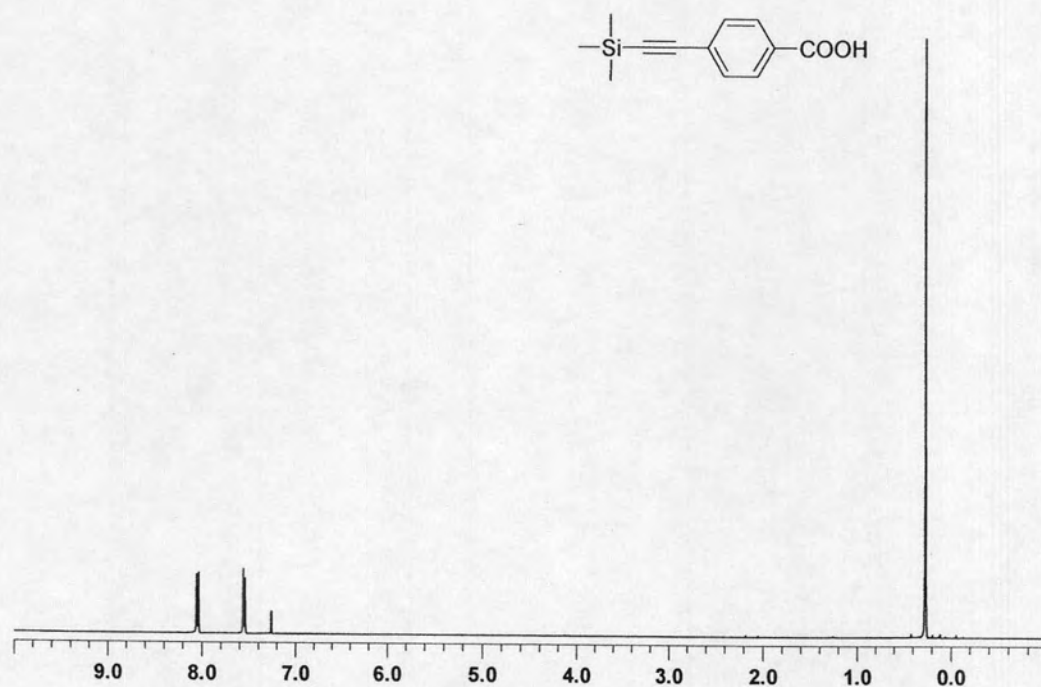


Figure A-25 The <sup>1</sup>H NMR spectrum of CarP-TMSE (11)

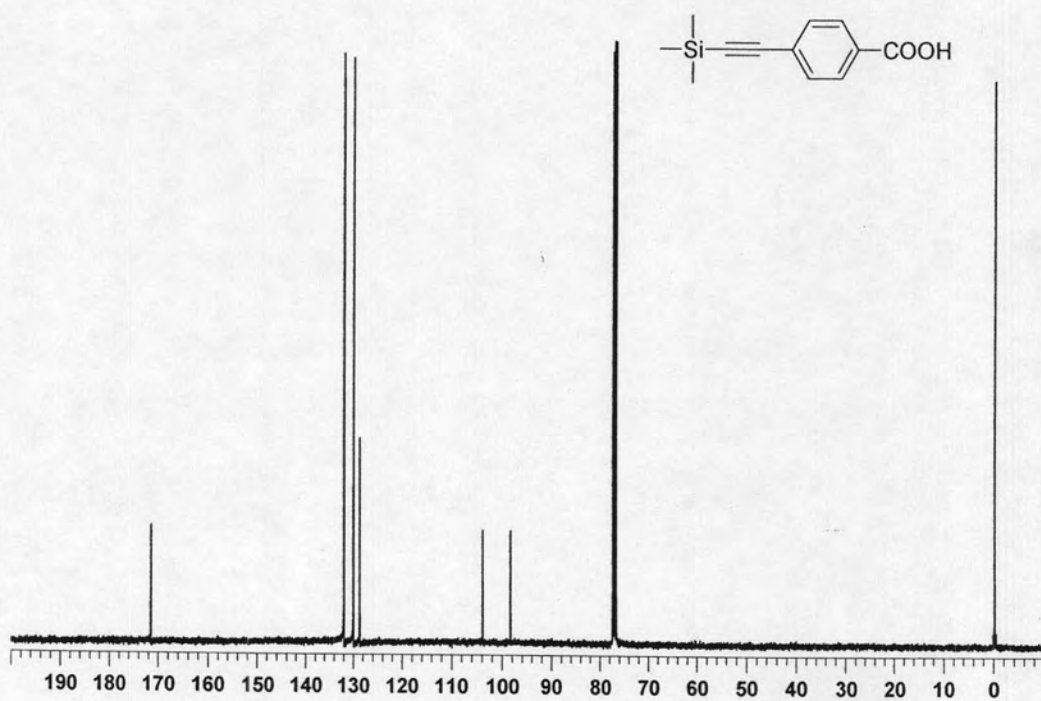


Figure A-26 The <sup>13</sup>C NMR spectrum of CarP-TMSE (11)

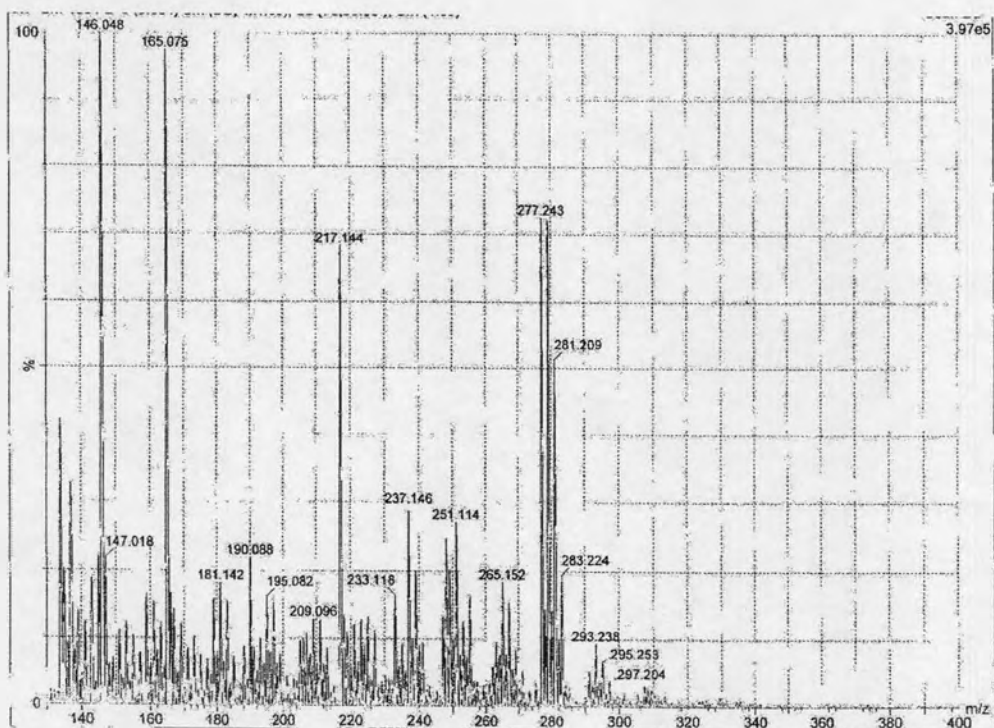


Figure A-27 The ESI mass spectrum of CarP-TMSE (11)

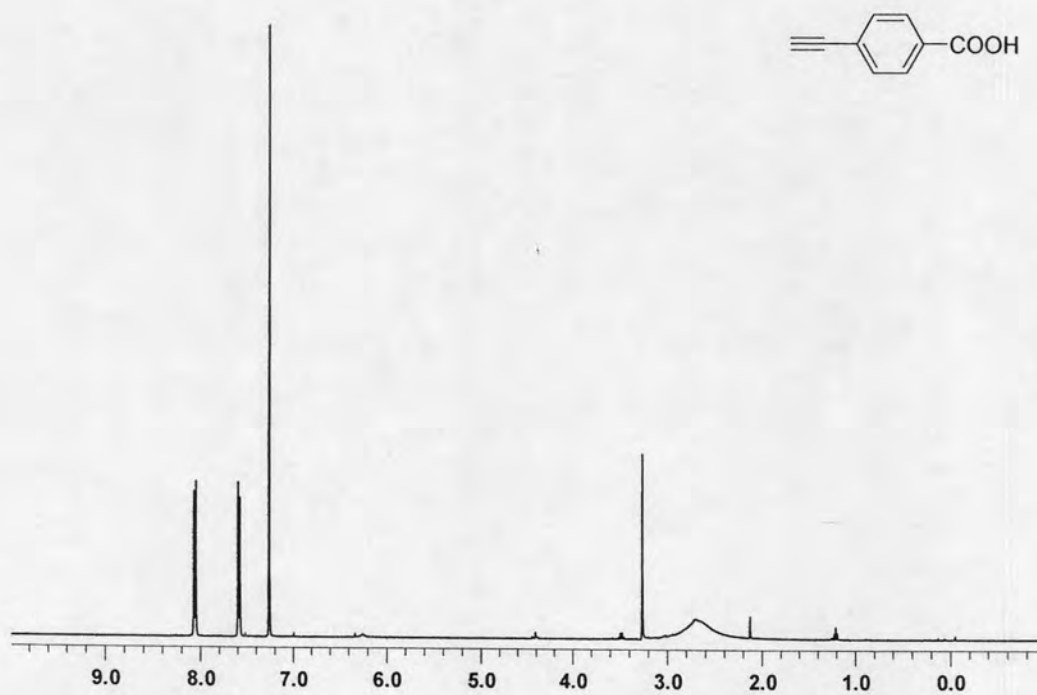


Figure A-28 The <sup>1</sup>H NMR spectrum of CarPE (12)

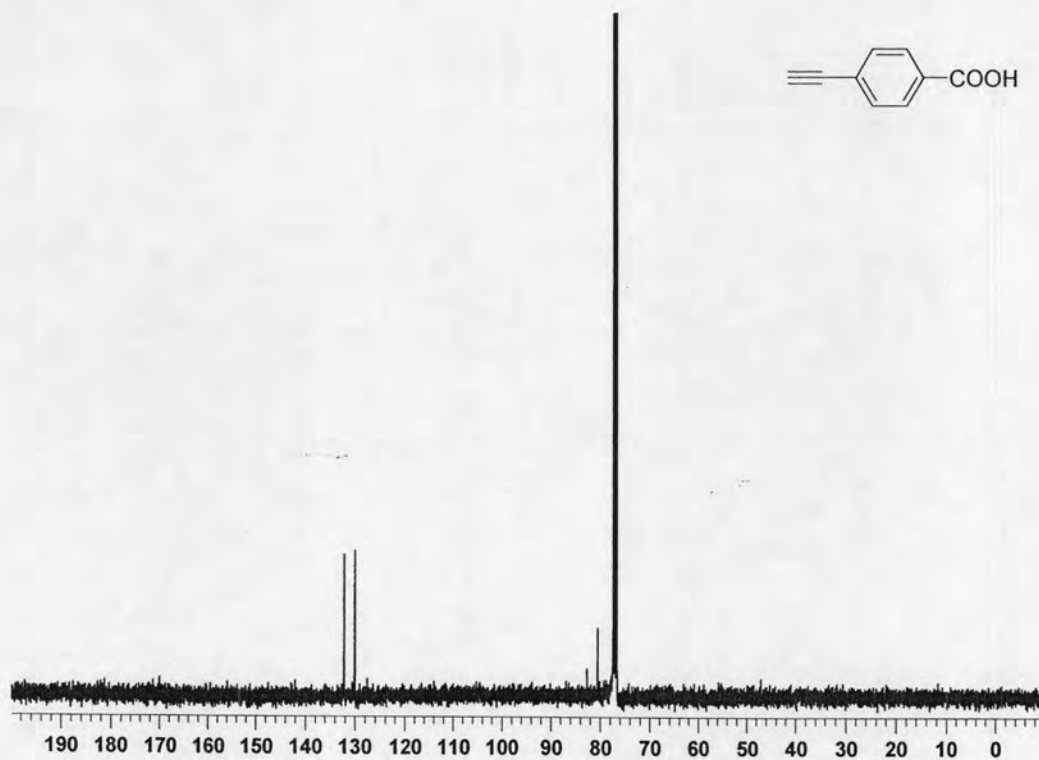


Figure A-29 The  $^{13}\text{C}$  NMR spectrum of CarPE (12)

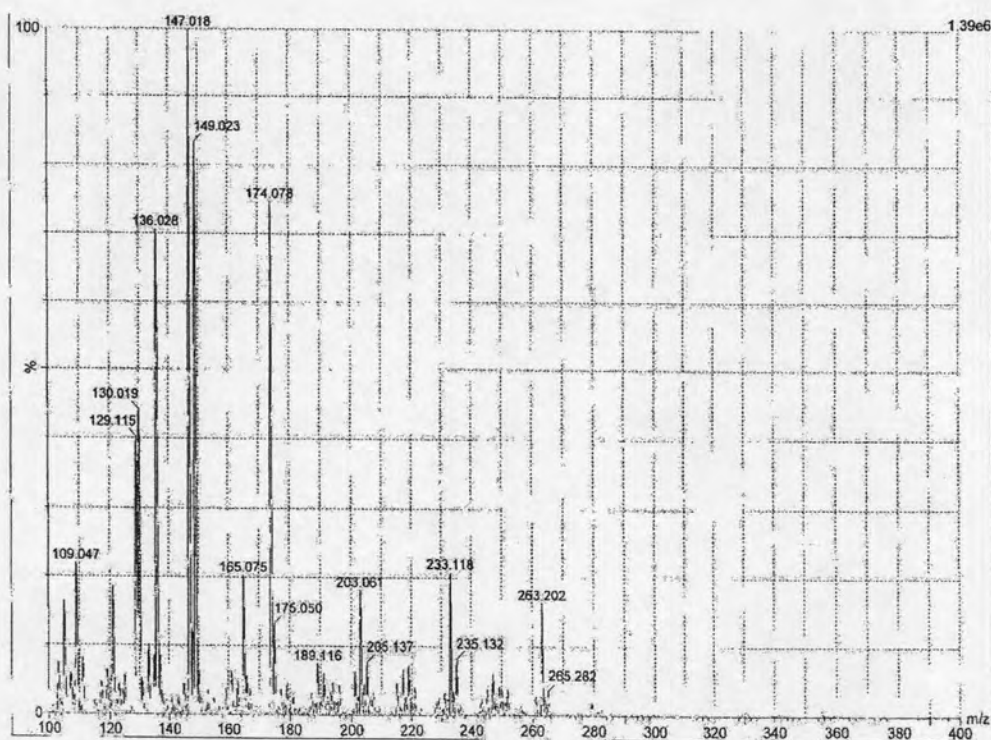
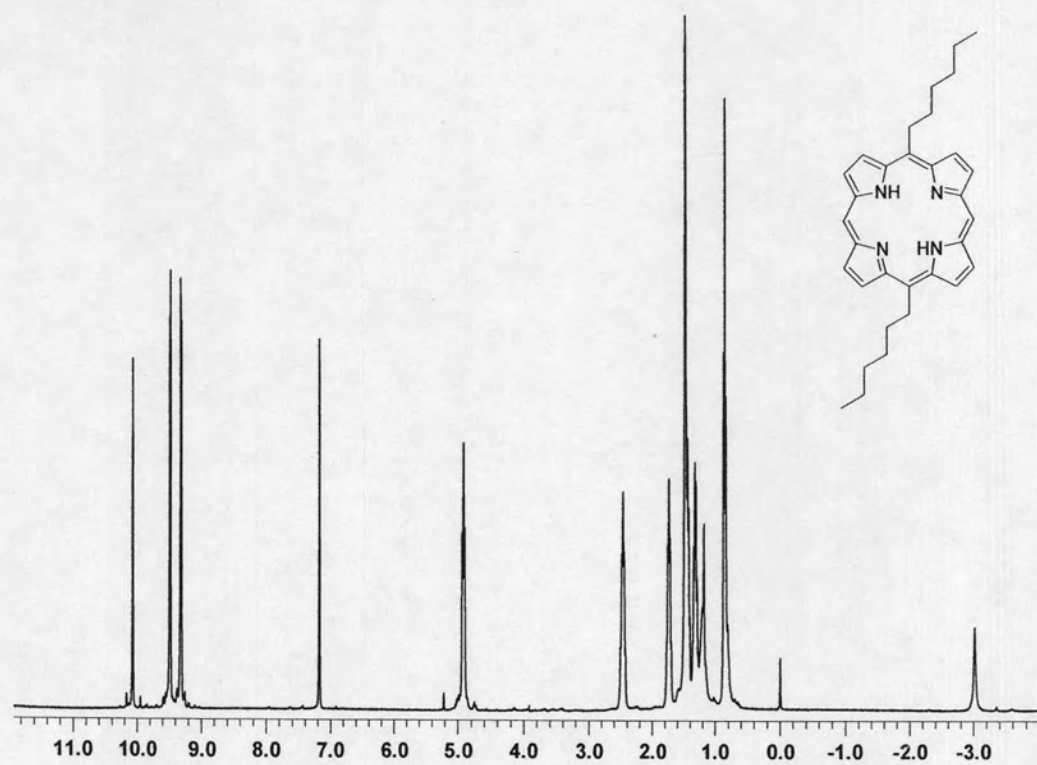
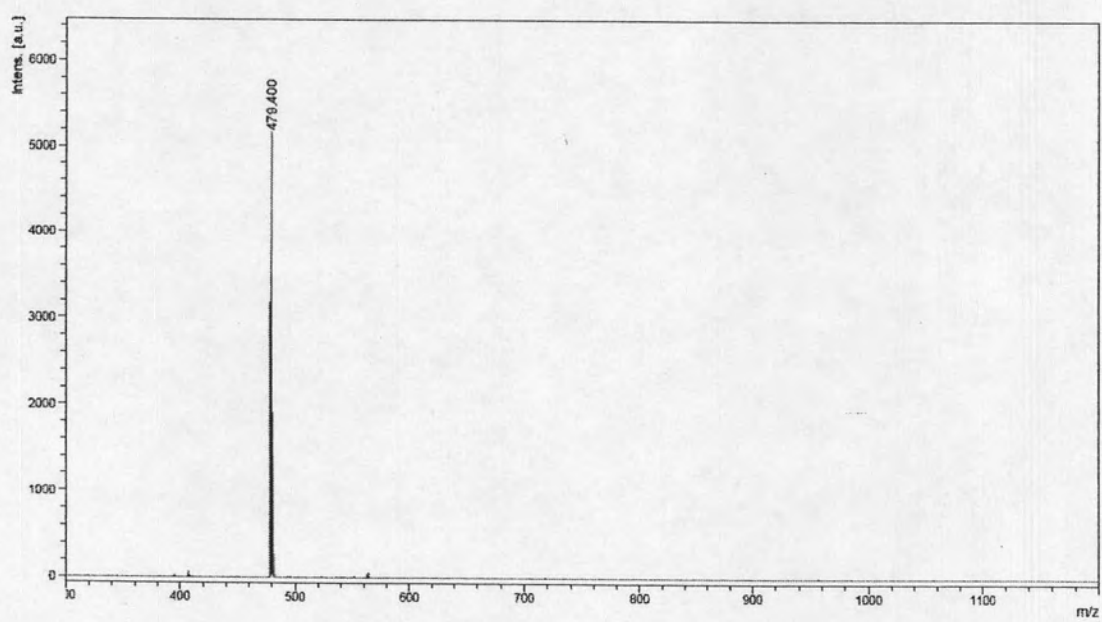


Figure A-30 The ESI mass spectrum of CarPE (12)

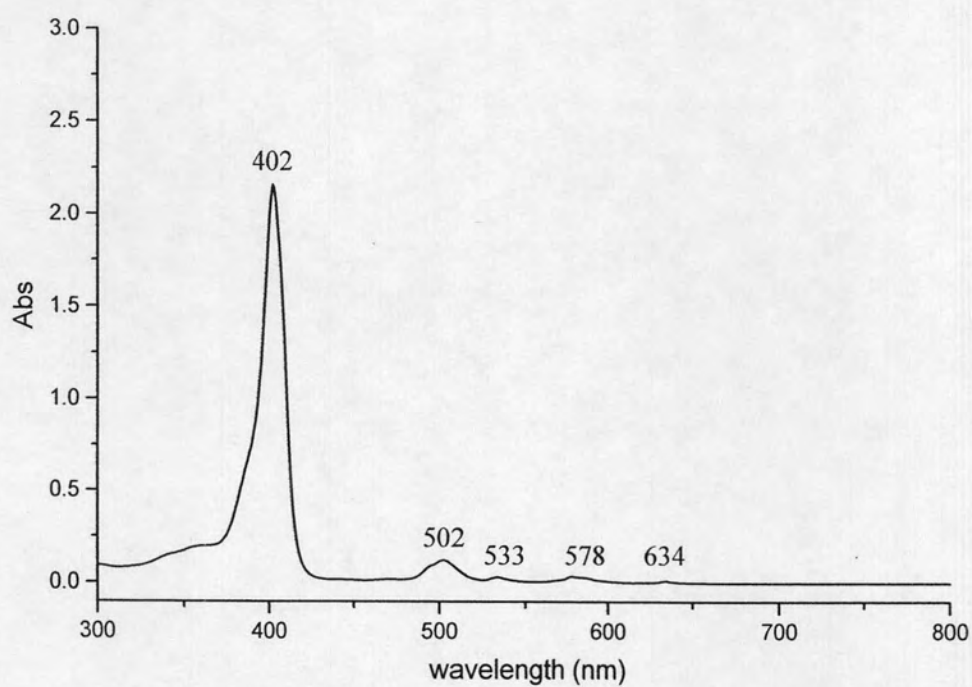




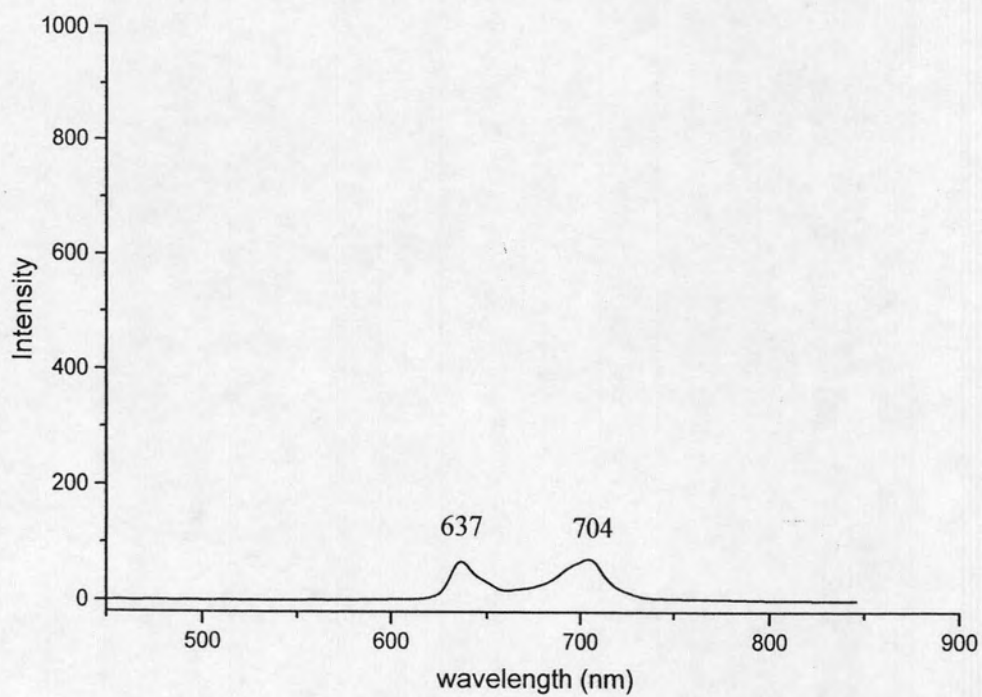
**Figure A-31** The  $^1\text{H}$  NMR spectrum of DHP (13)



**Figure A-32** The MALDI-TOF mass spectrum of DHP (13)



**Figure A-33** The UV-visible spectrum of DHP (13)



**Figure A-34** The fluorescence spectrum of DHP (13)

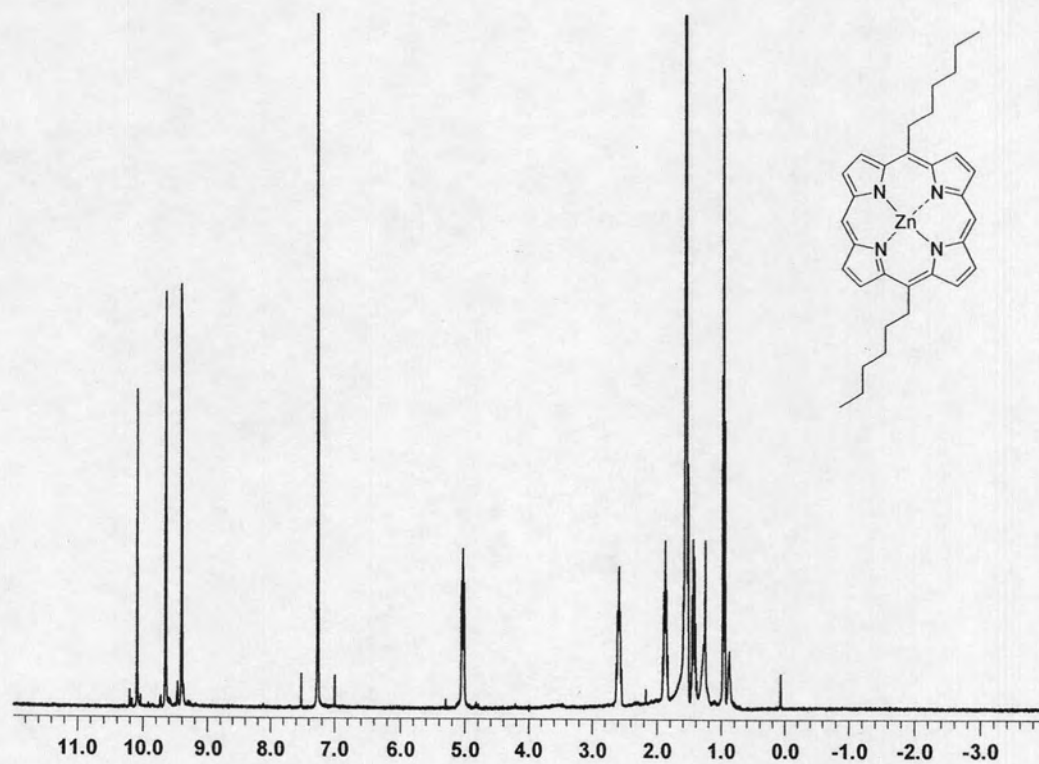


Figure A-35 The  $^1\text{H}$  NMR spectrum of Zn-DHP (14)

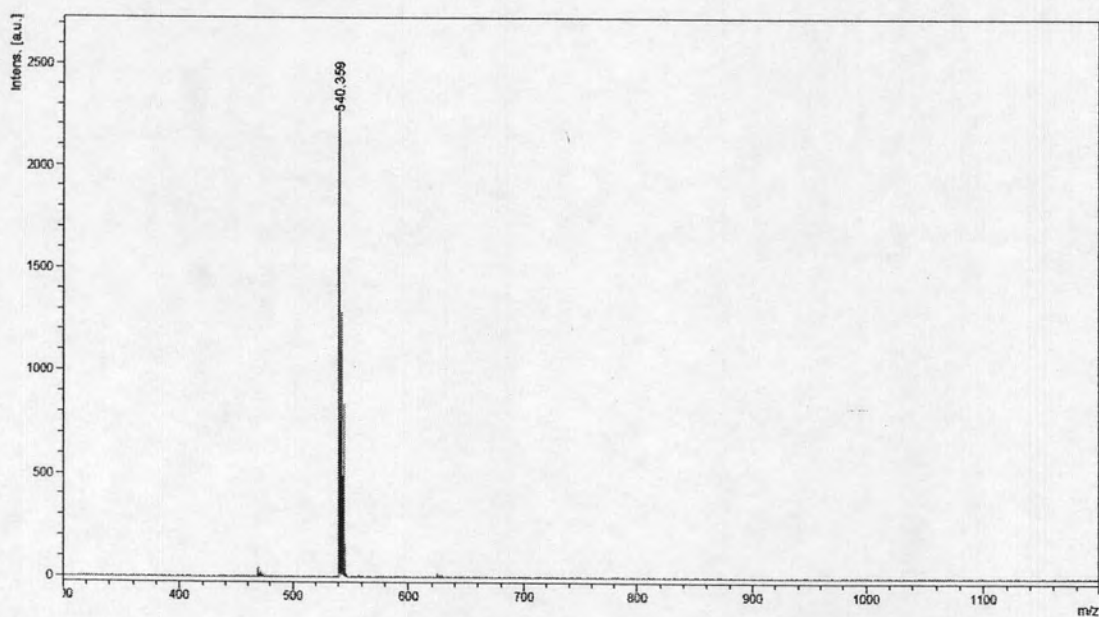
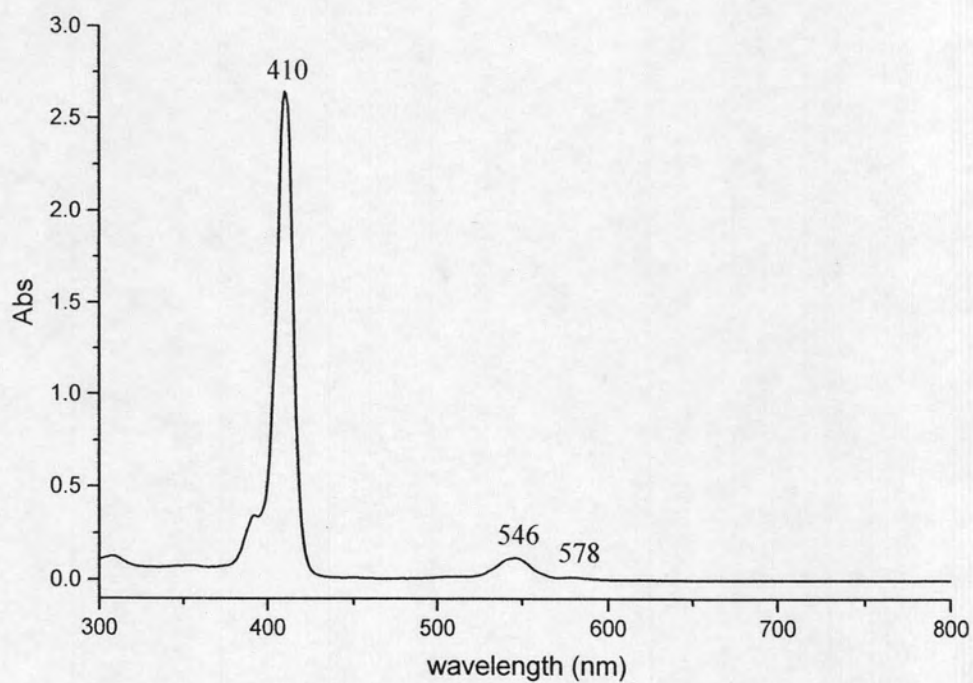
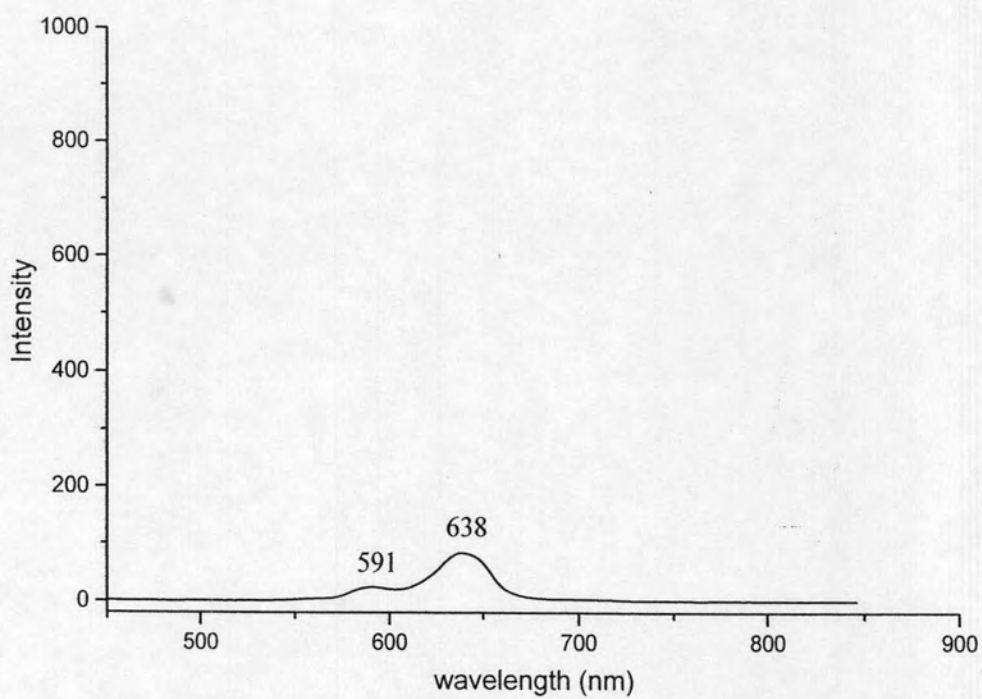


Figure A-36 The MALDI-TOF mass spectrum of Zn-DHP (14)



**Figure A-37** The UV-visible spectrum of Zn-DHP (14)



**Figure A-38** The fluorescence spectrum of Zn-DHP (14)

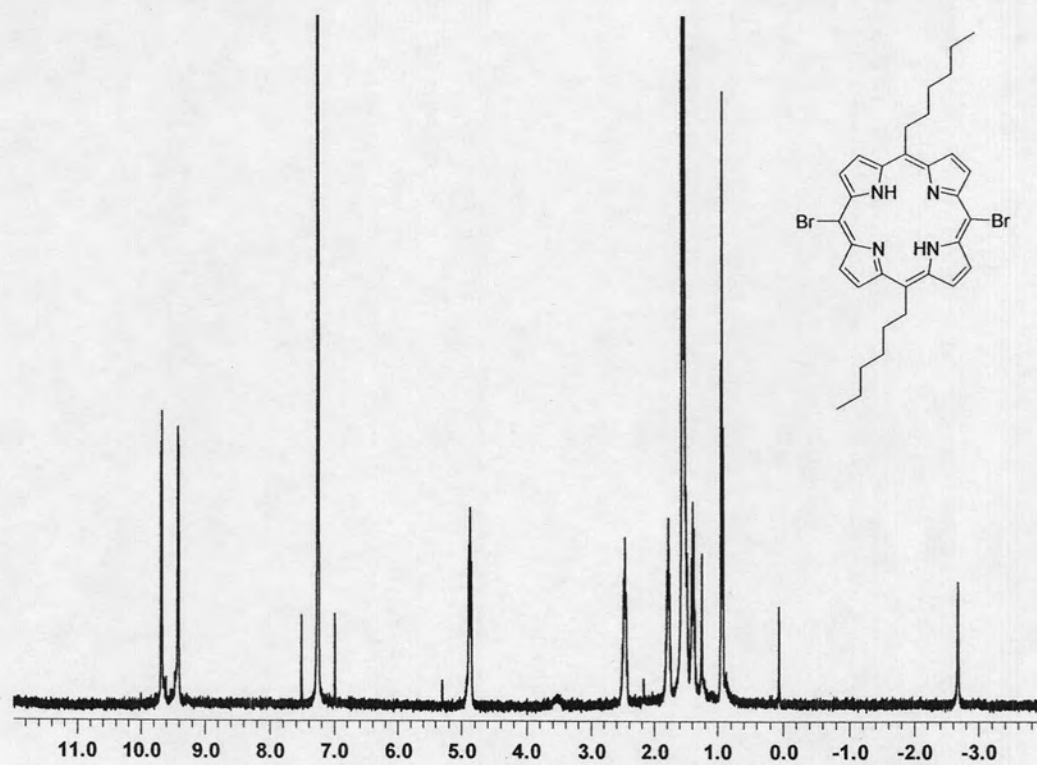


Figure A-39 The  $^1\text{H}$  NMR spectrum of Br<sub>2</sub>DHP (15)

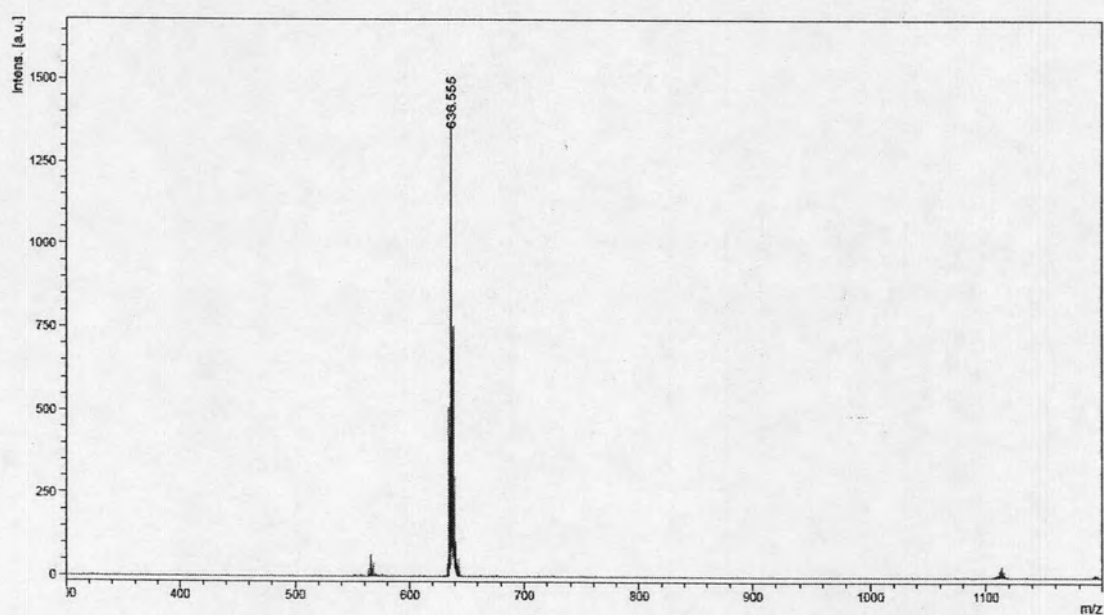
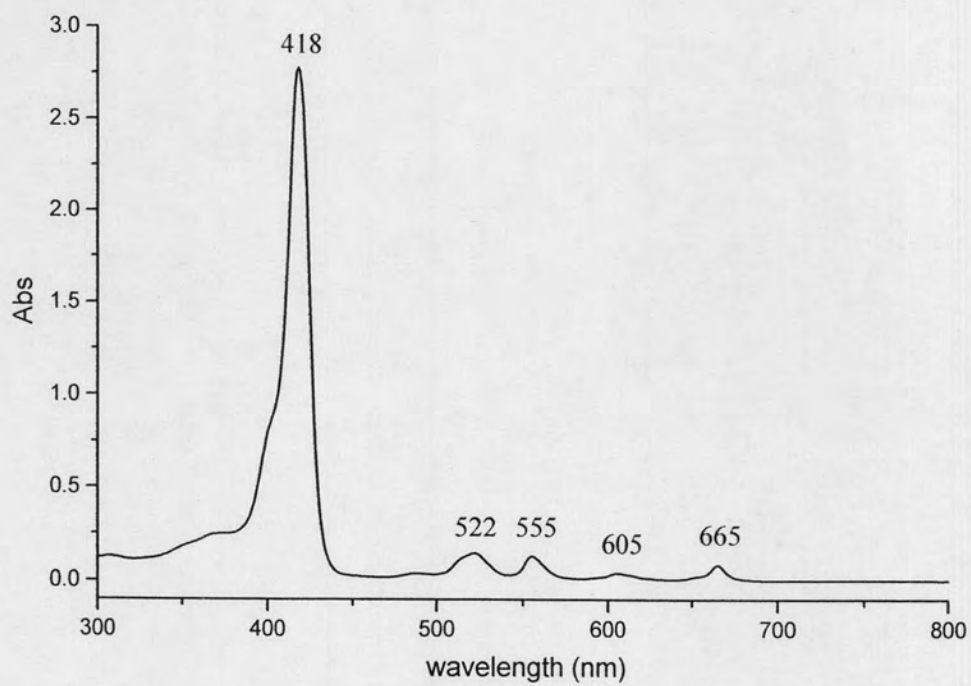
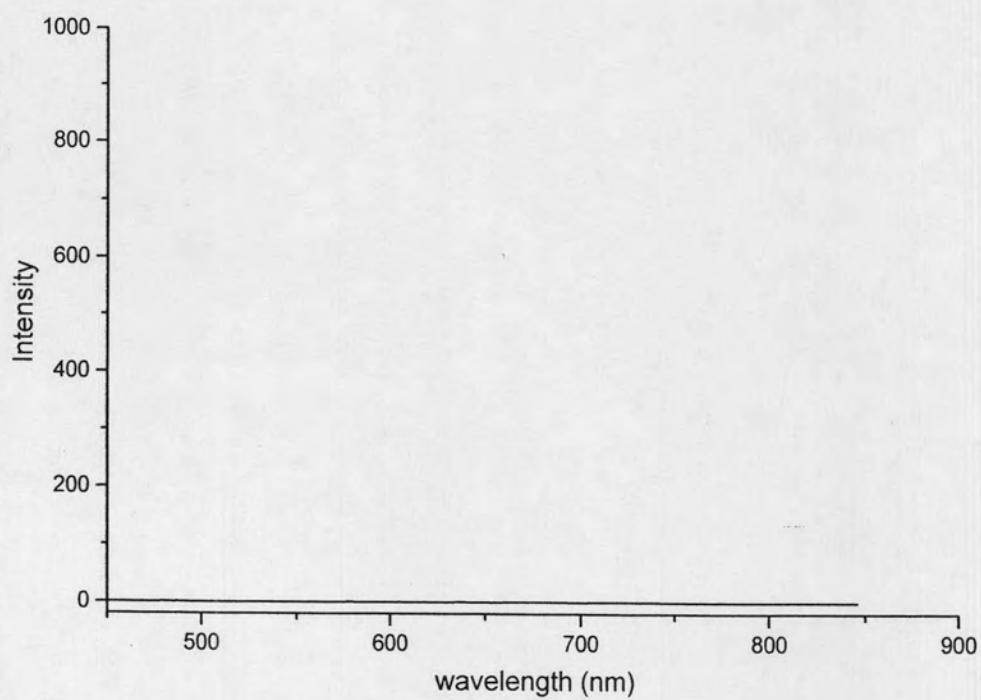


Figure A-40 The MALDI-TOF mass spectrum of Br<sub>2</sub>DHP (15)



**Figure A-41** The UV-visible spectrum of Br<sub>2</sub>DHP (15)



**Figure A-42** The fluorescence spectrum of Br<sub>2</sub>DHP (15)

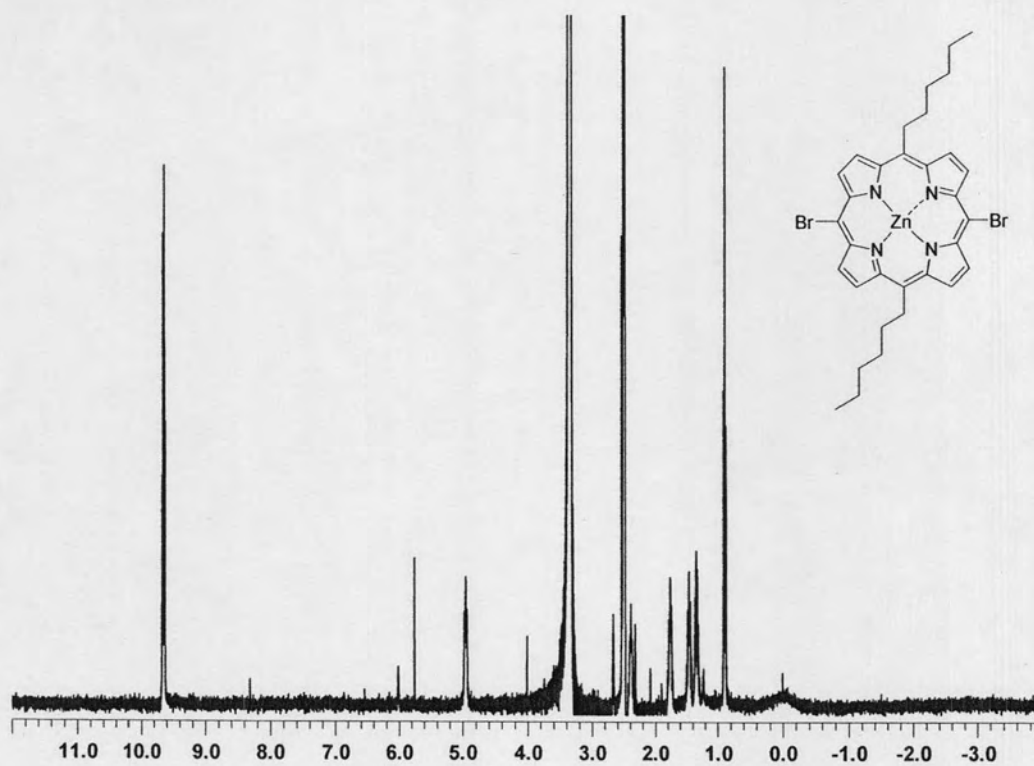


Figure A-43 The  $^1\text{H}$  NMR spectrum of Zn-Br<sub>2</sub>DHP (16)

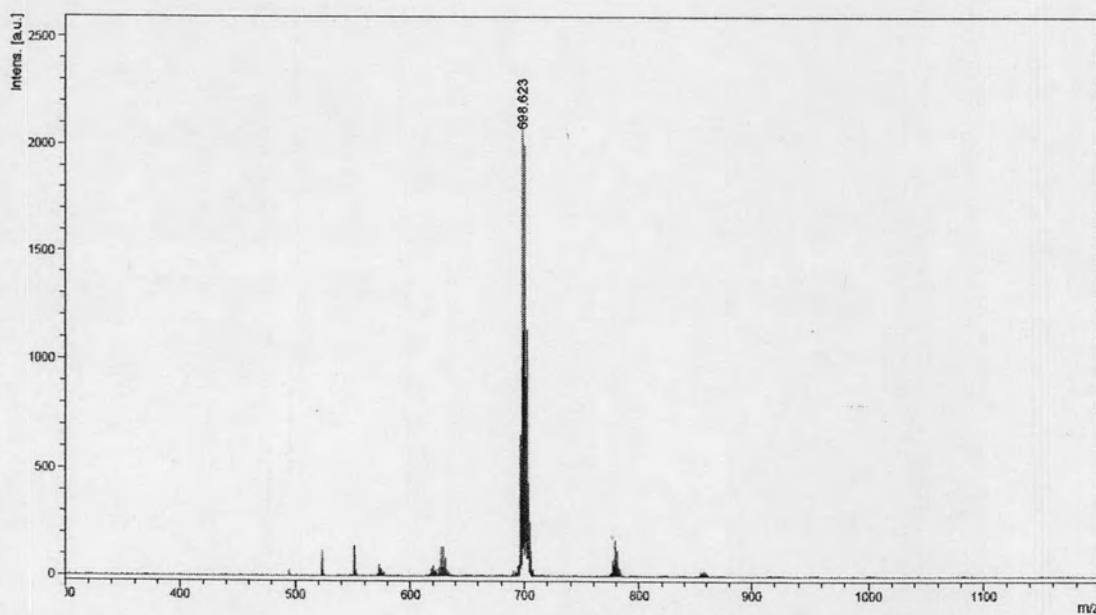
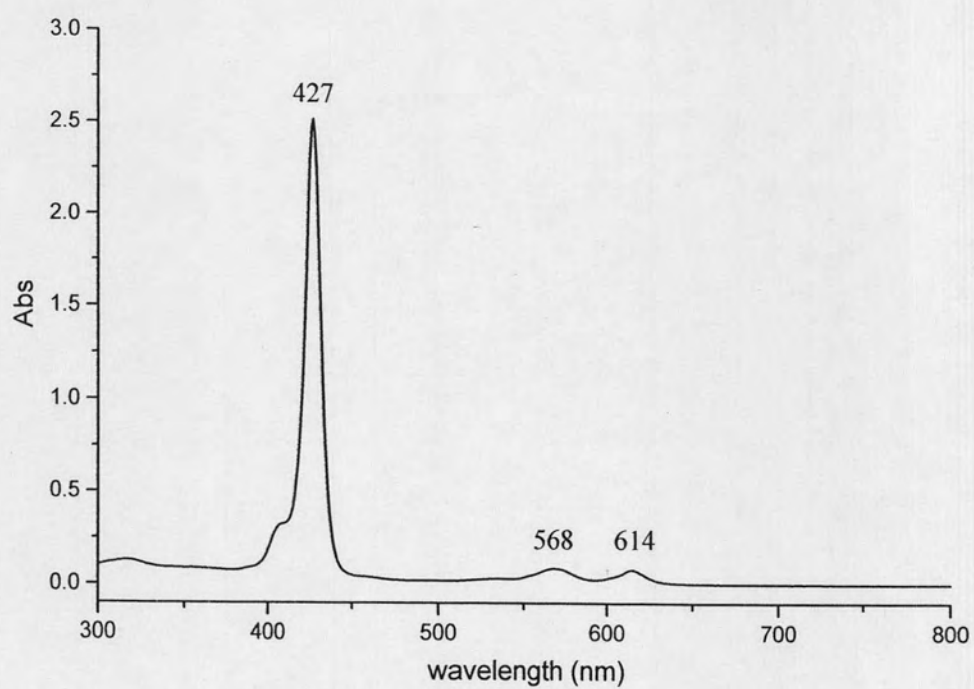
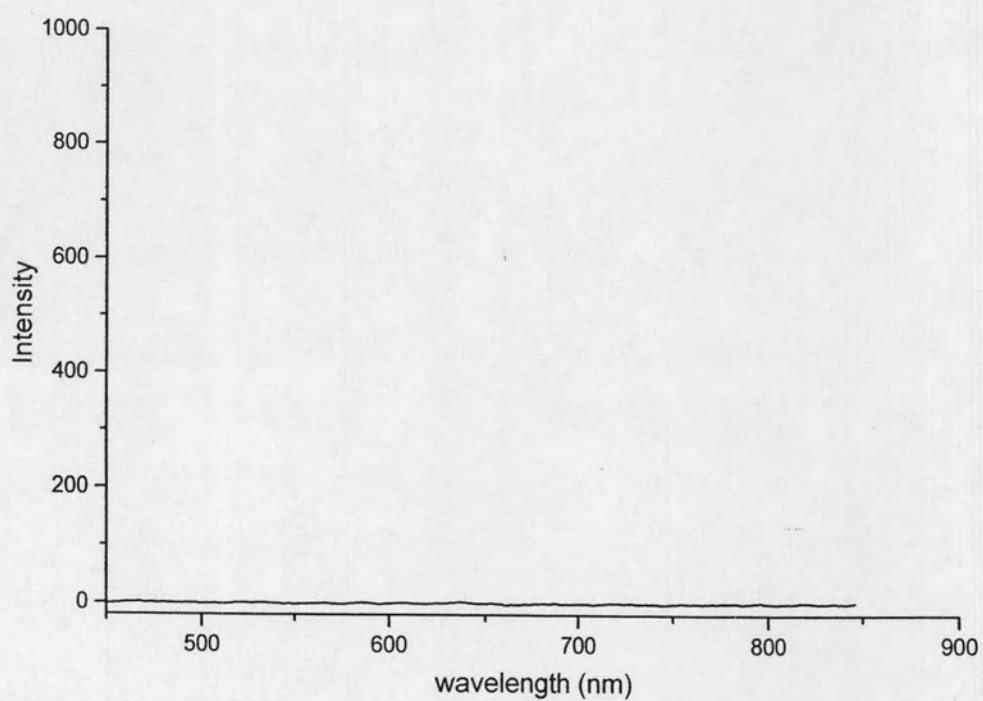


Figure A-44 The MALDI-TOF mass spectrum of Zn-Br<sub>2</sub>DHP (16)



**Figure A-45** The UV-visible spectrum of Zn-Br<sub>2</sub>DHP (16)



**Figure A-46** The fluorescence spectrum of Zn-Br<sub>2</sub>DHP (16)



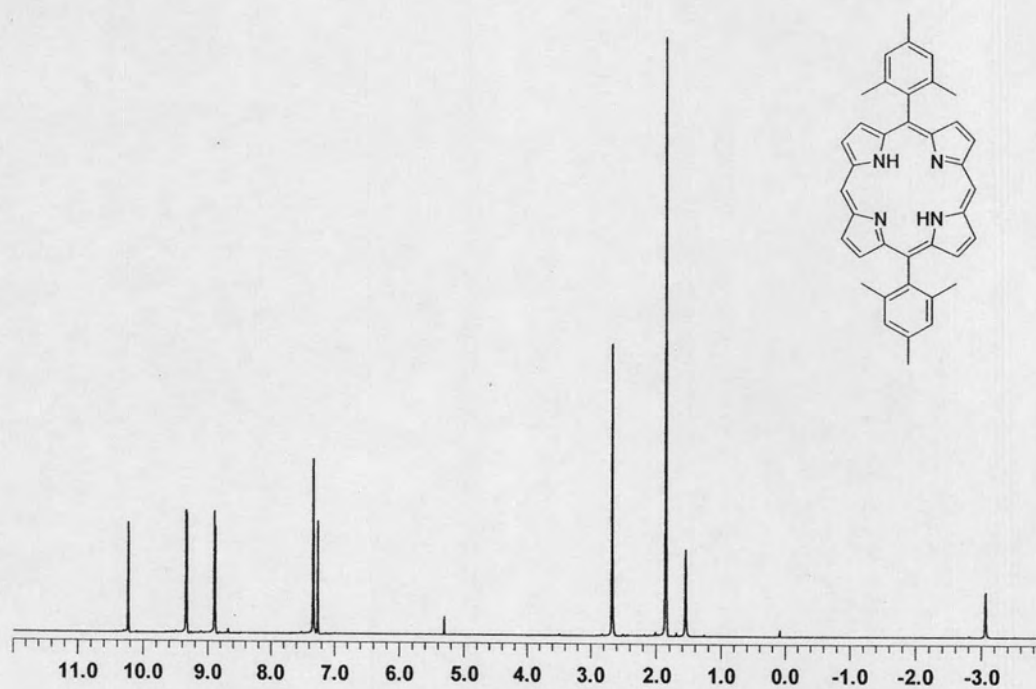


Figure A-47 The  $^1\text{H}$  NMR spectrum of DMP (17)

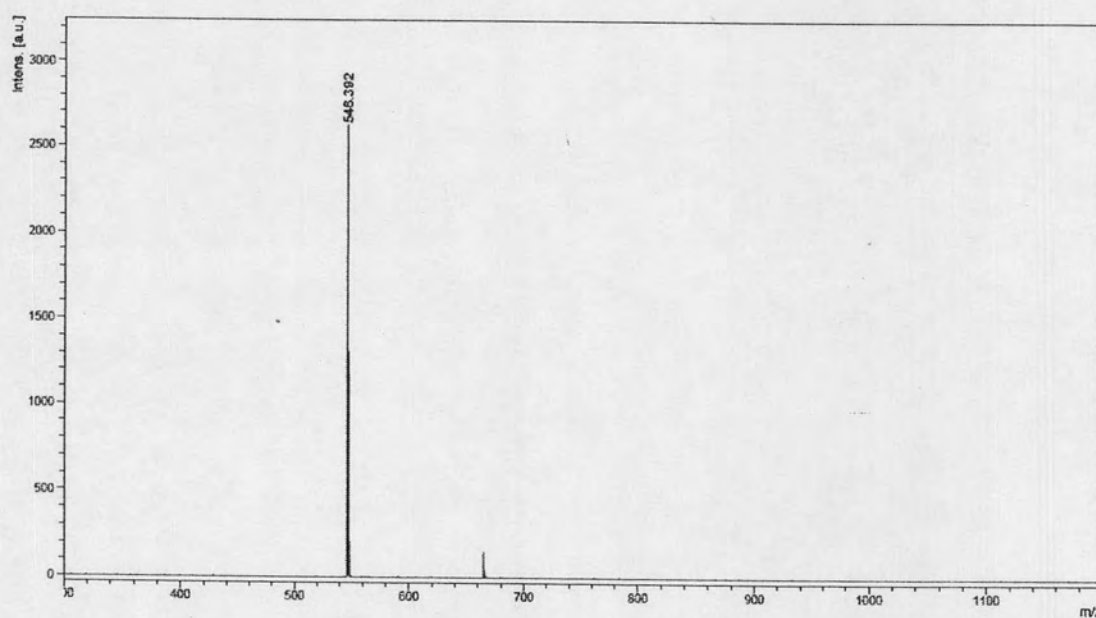
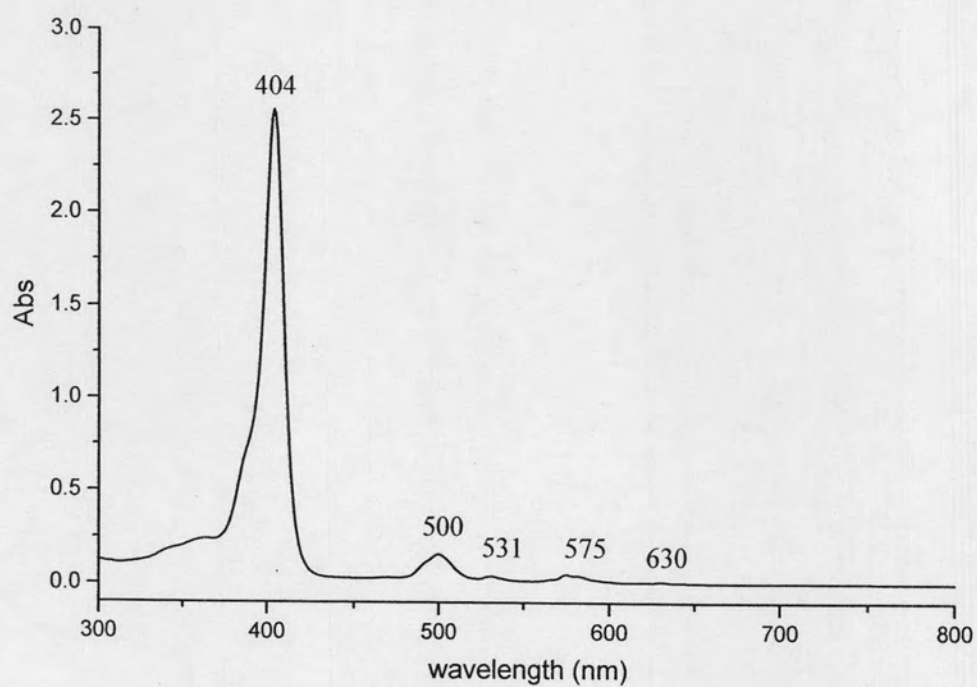
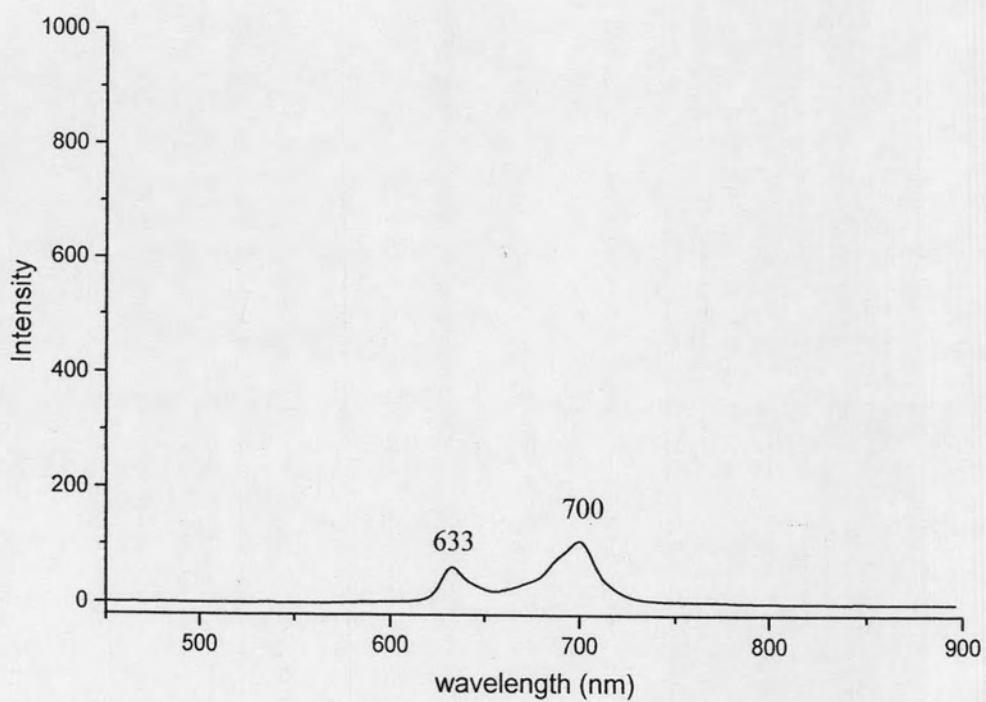


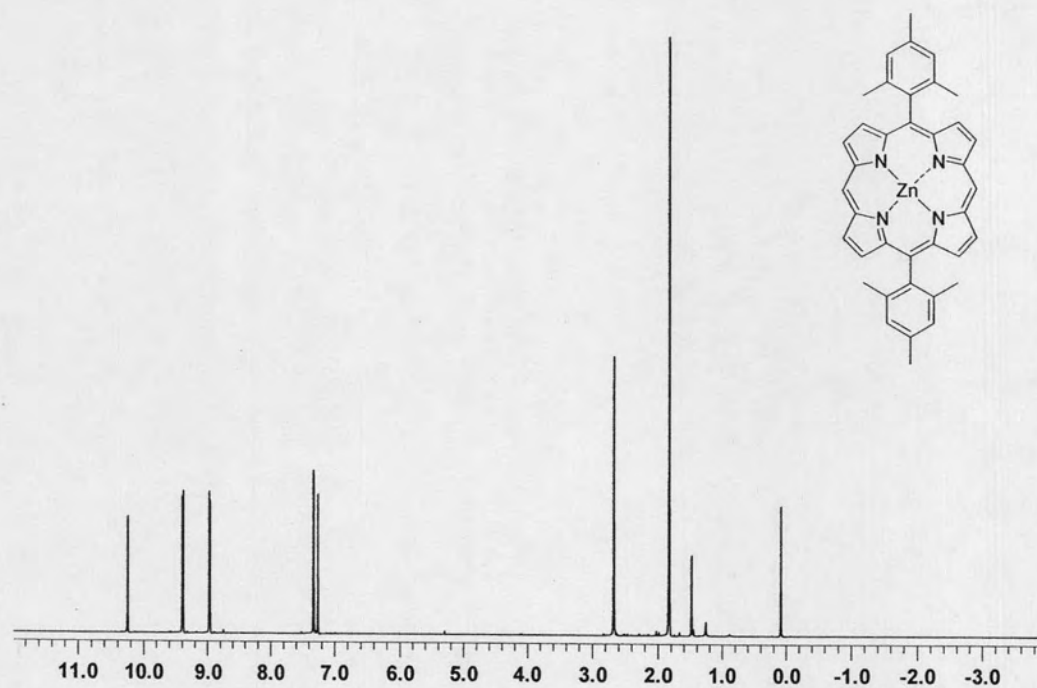
Figure A-48 The MALDI-TOF mass spectrum of DMP (17)



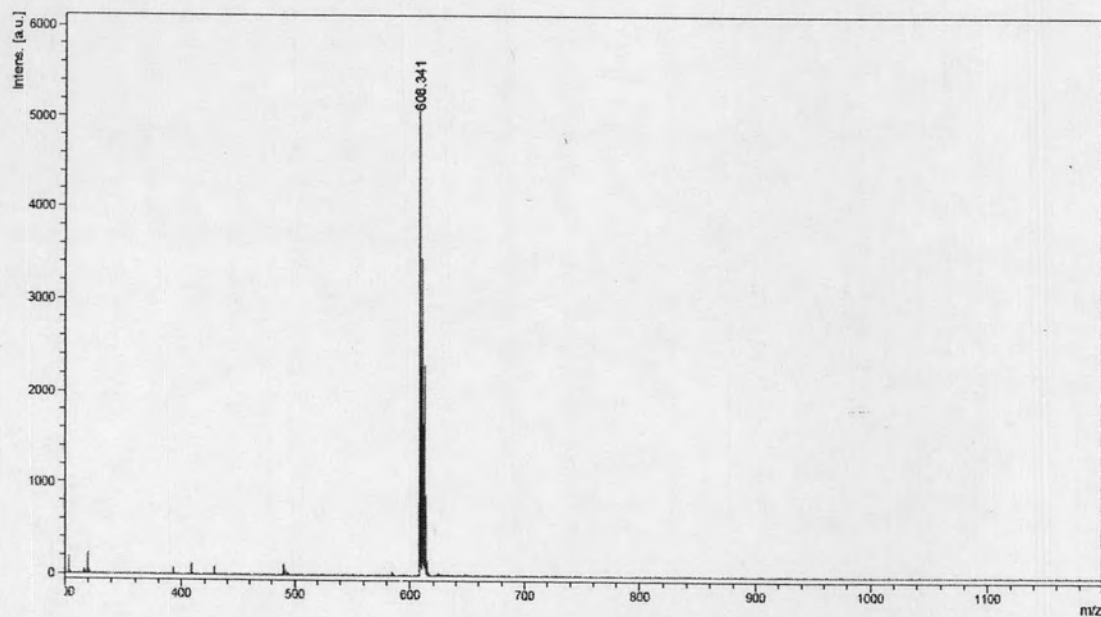
**Figure A-49** The UV-visible spectrum of DMP (17)



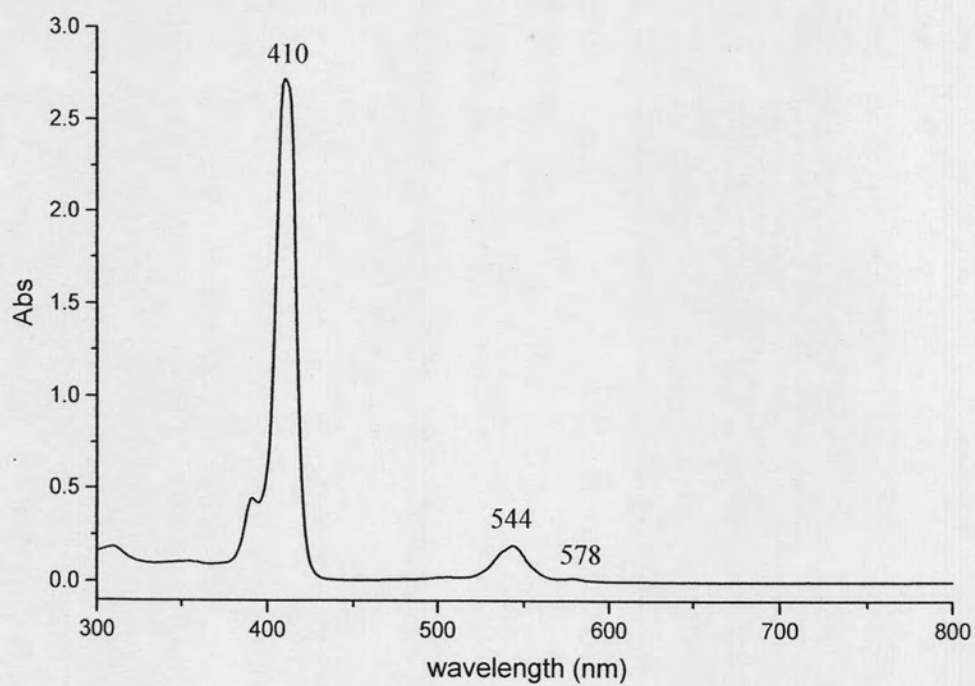
**Figure A-50** The fluorescence spectrum of DMP (17)



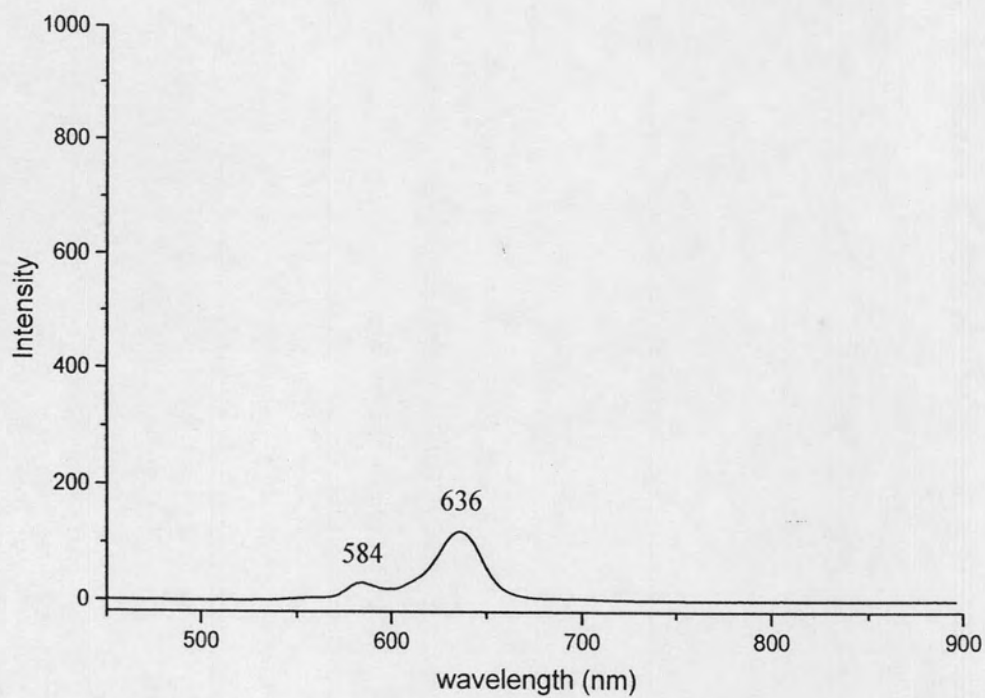
**Figure A-51** The  $^1\text{H}$  NMR spectrum of Zn-DMP (18)



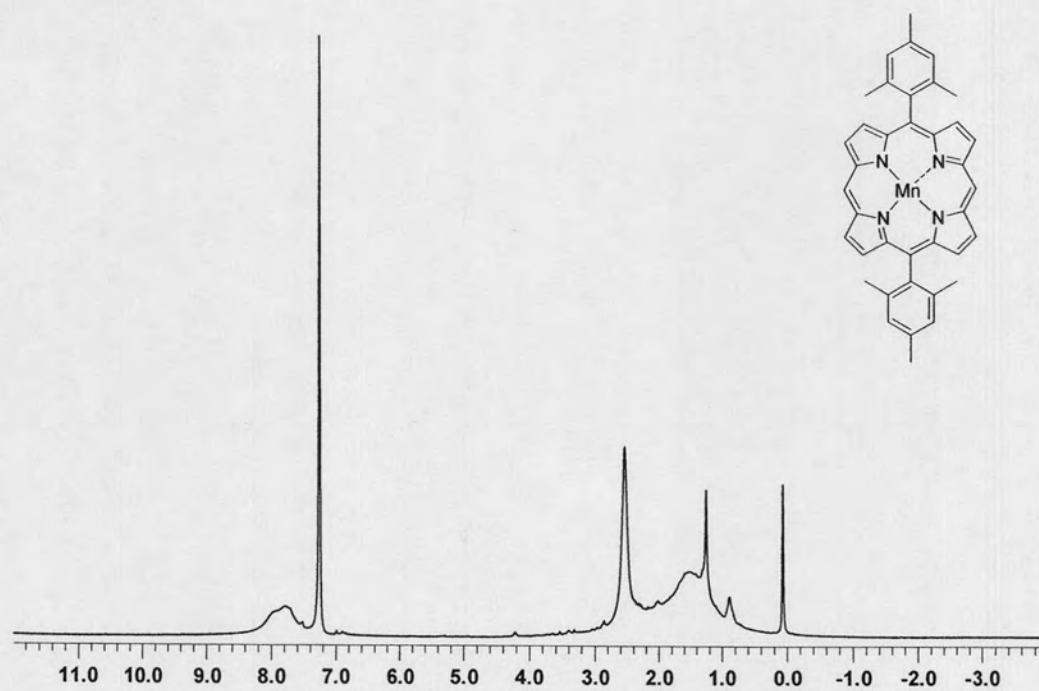
**Figure A-52** The MALDI-TOF mass spectrum of Zn-DMP (18)



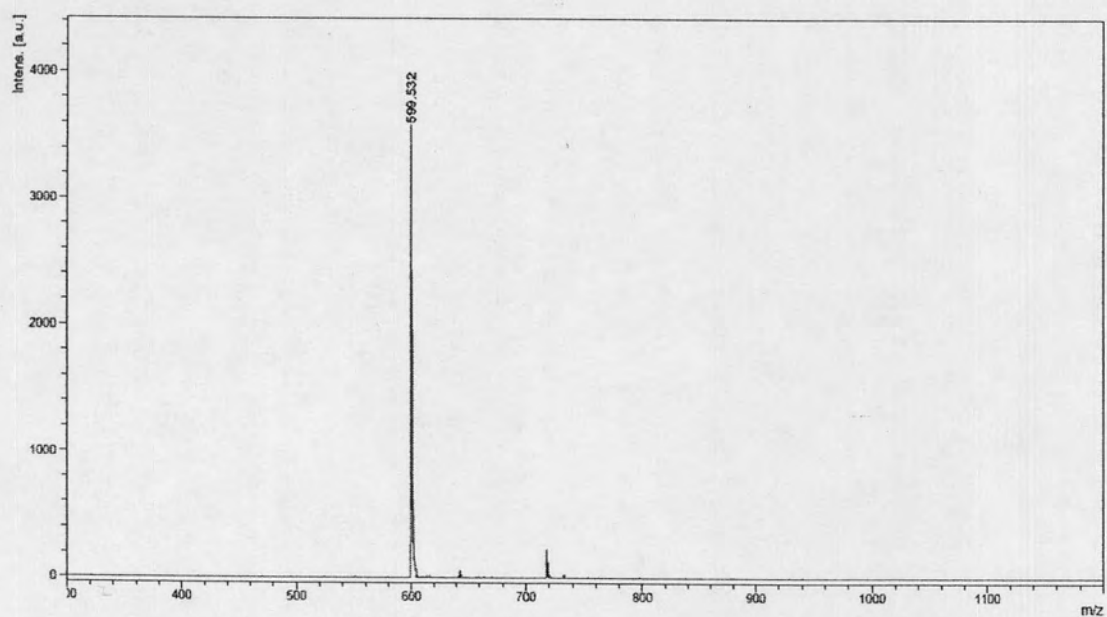
**Figure A-53** The UV-visible spectrum of Zn-DMP (18)



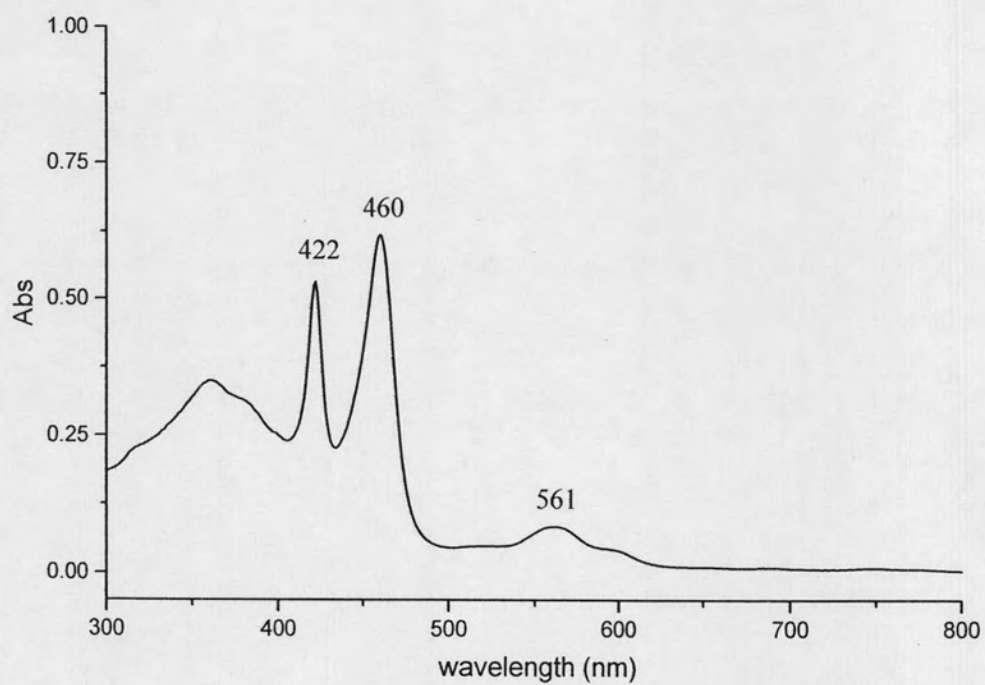
**Figure A-54** The fluorescence spectrum of Zn-DMP (18)



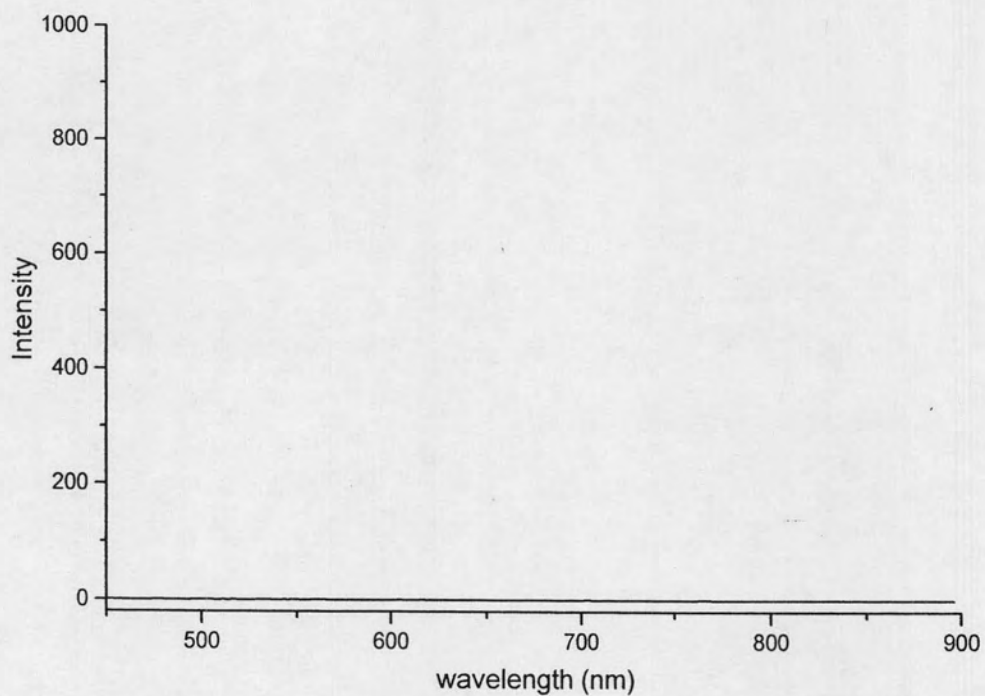
**Figure A-55** The  $^1\text{H}$  NMR spectrum of Mn-DMP (19)



**Figure A-56** The MALDI-TOF mass spectrum of Mn-DMP (19)



**Figure A-57** The UV-visible spectrum of Mn-DMP (19)



**Figure A-58** The fluorescence spectrum of Mn-DMP (19)

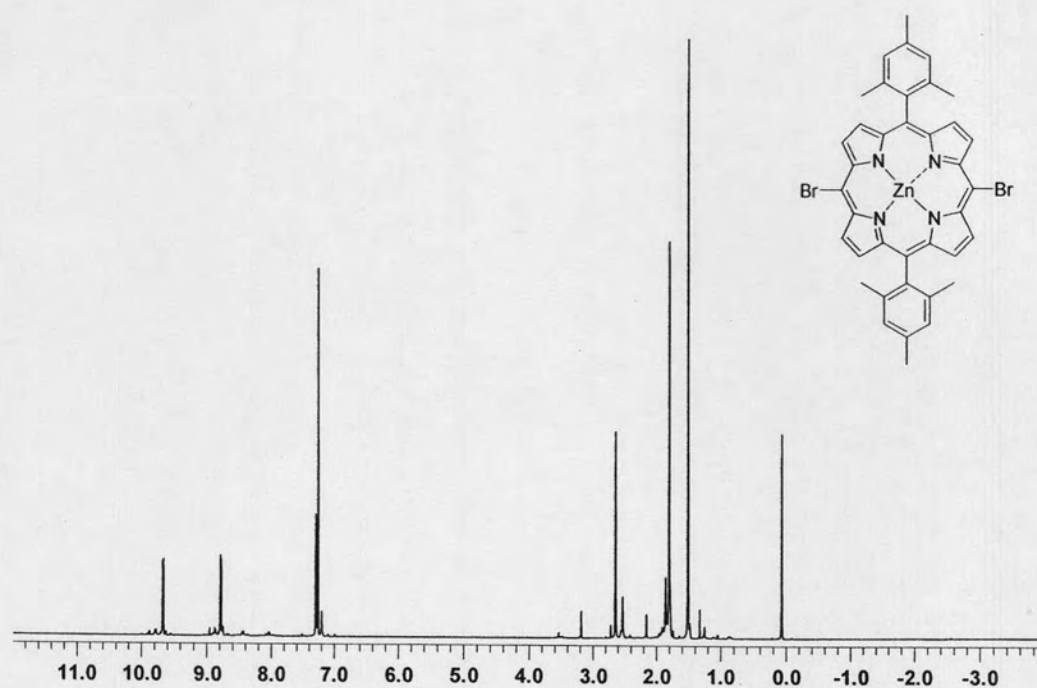


Figure A-59 The  $^1\text{H}$  NMR spectrum of Zn-Br<sub>2</sub>DMP (20)

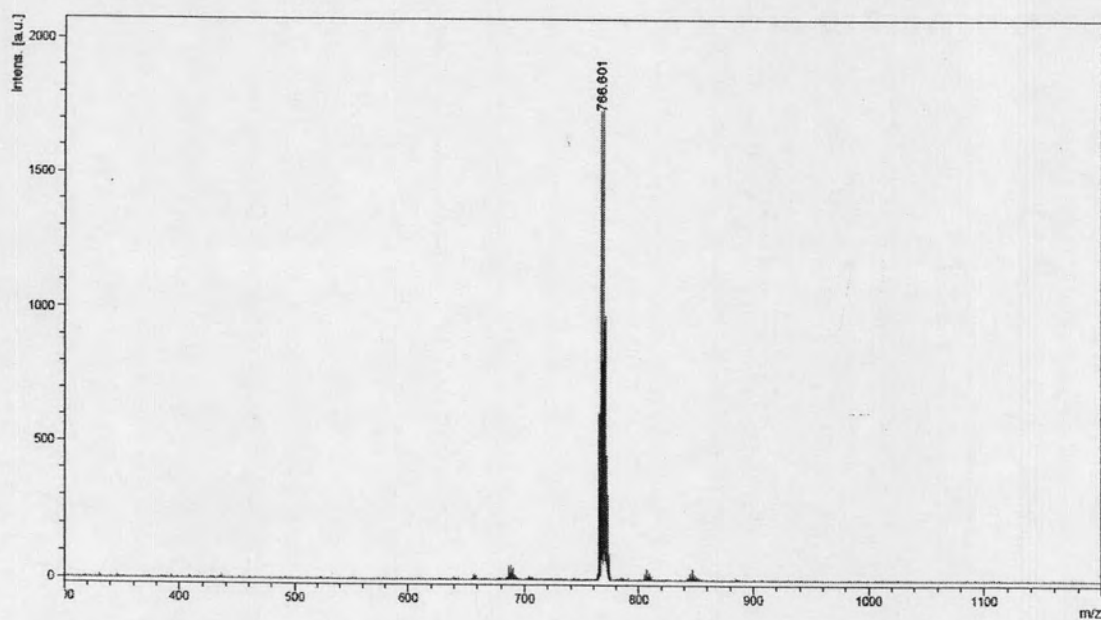
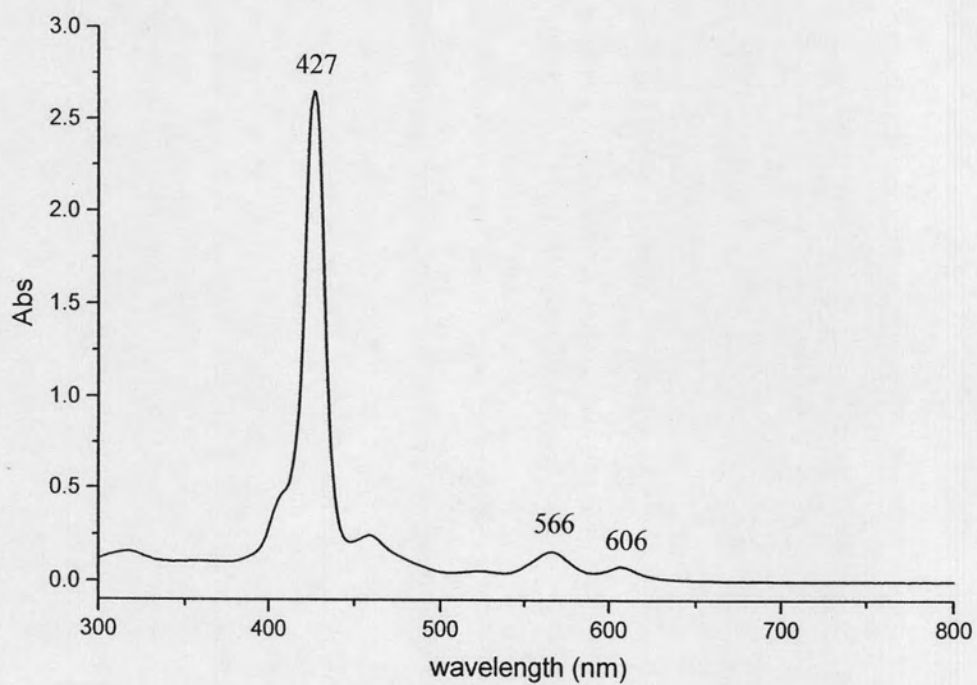
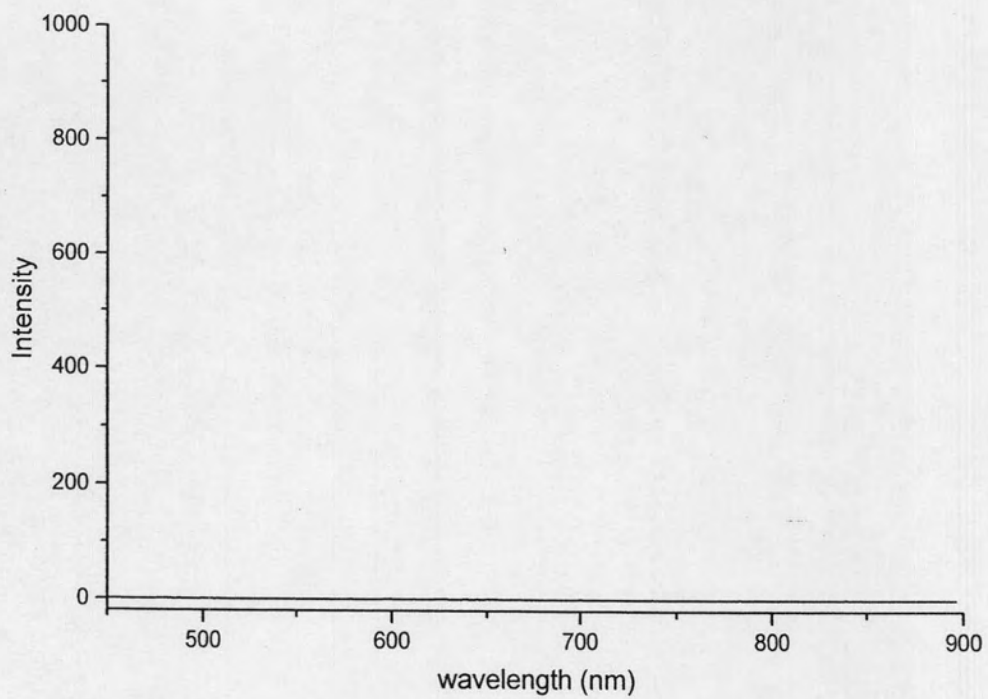


Figure A-60 The MALDI-TOF mass spectrum of Zn-Br<sub>2</sub>DMP (20)

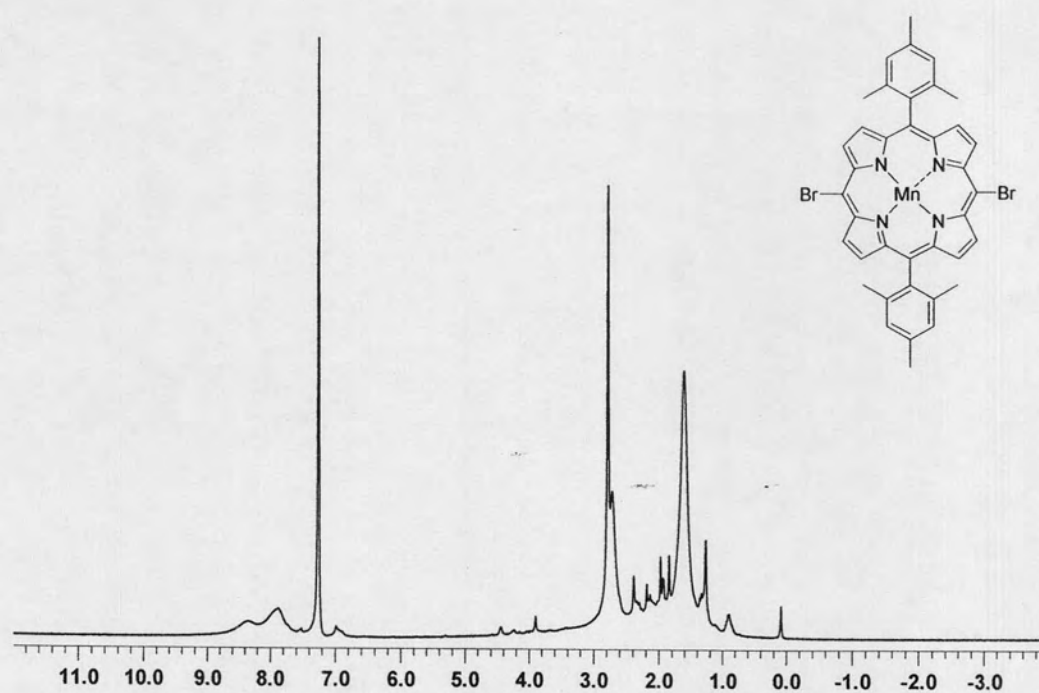


**Figure A-61** The UV-visible spectrum of Zn-Br<sub>2</sub>DMP (20)

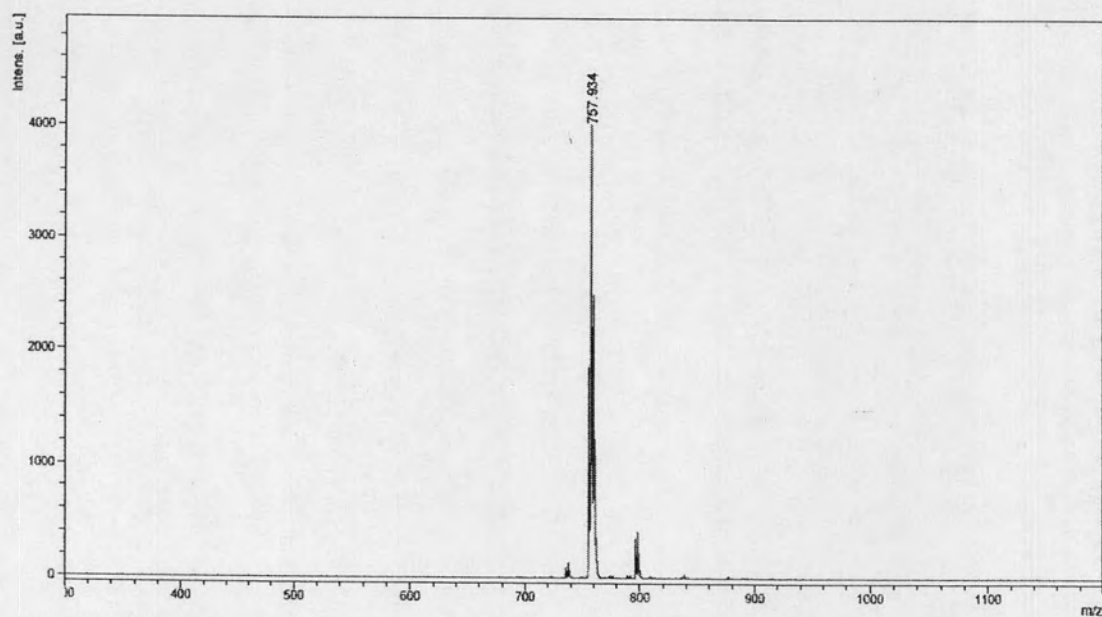


**Figure A-62** The fluorescence spectrum of Zn-Br<sub>2</sub>DMP (20)

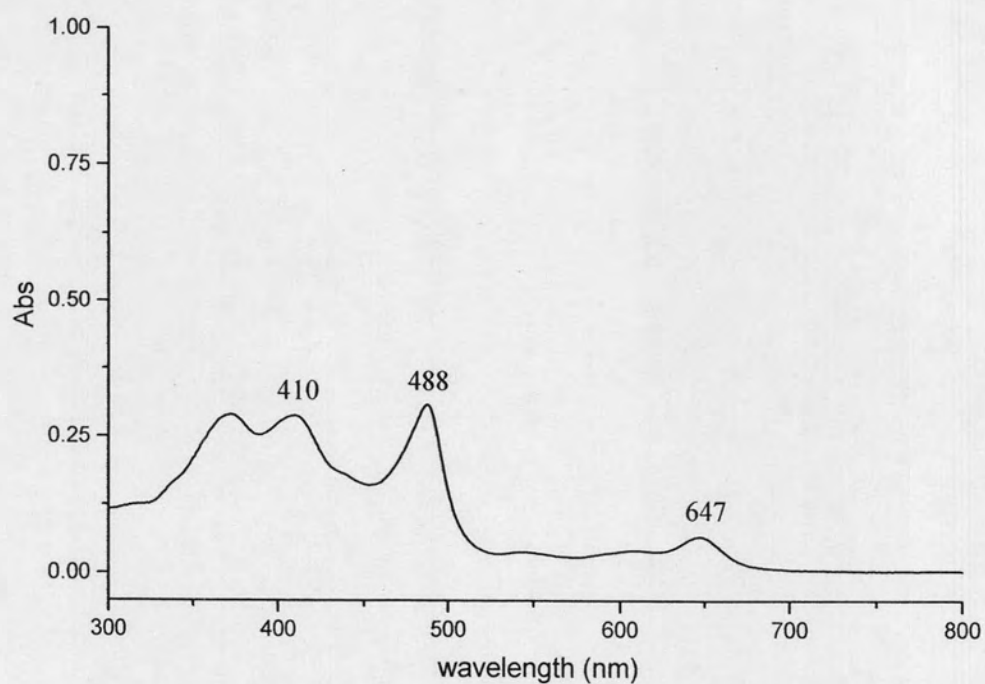




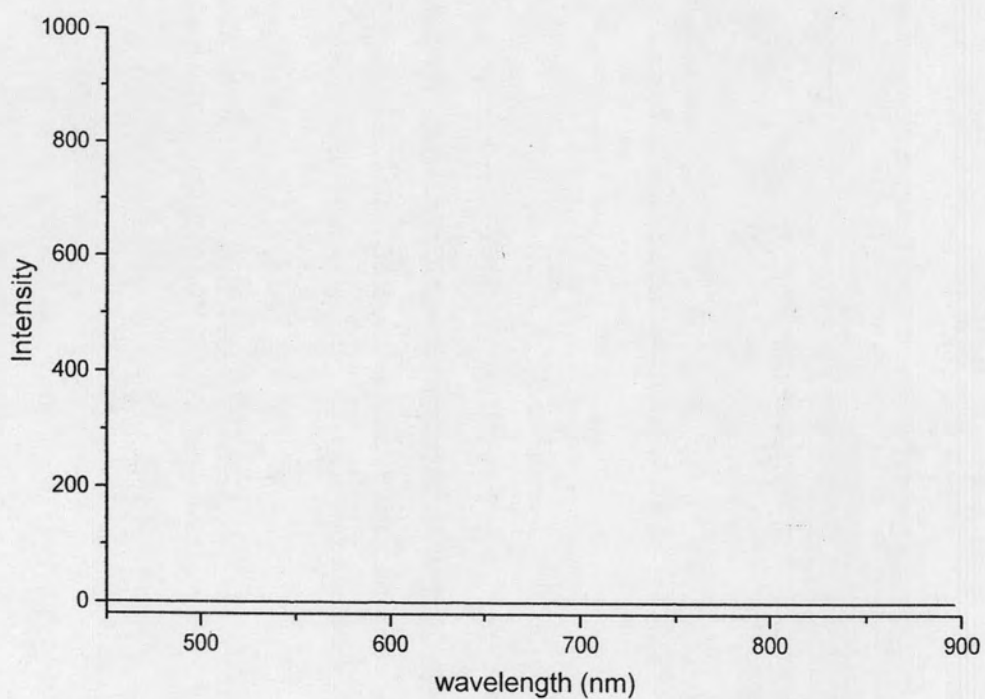
**Figure A-63** The  $^1\text{H}$  NMR spectrum of Mn-Br<sub>2</sub>DMP (21)



**Figure A-64** The MALDI-TOF mass spectrum of Mn-Br<sub>2</sub>DMP (21)



**Figure A-65** The UV-visible spectrum of Mn-Br<sub>2</sub>DMP (21)



**Figure A-66** The fluorescence spectrum of Mn-Br<sub>2</sub>DMP (21)

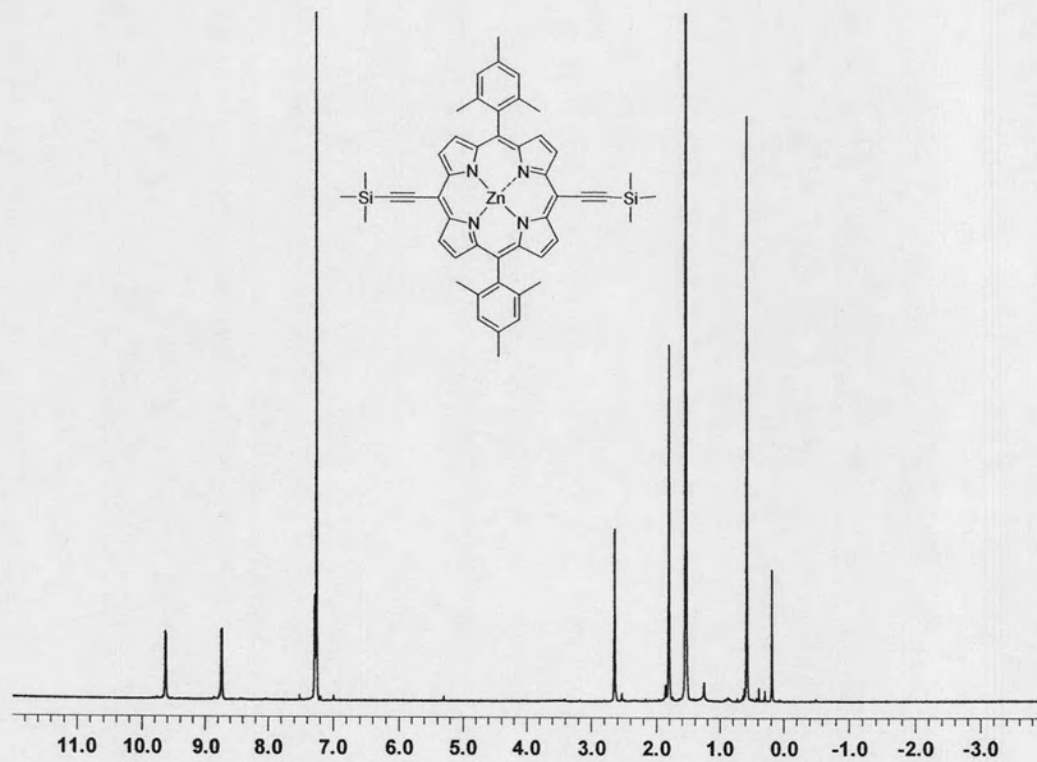


Figure A-67 The <sup>1</sup>H NMR spectrum of Zn-(TMSE)<sub>2</sub>DMP (22)

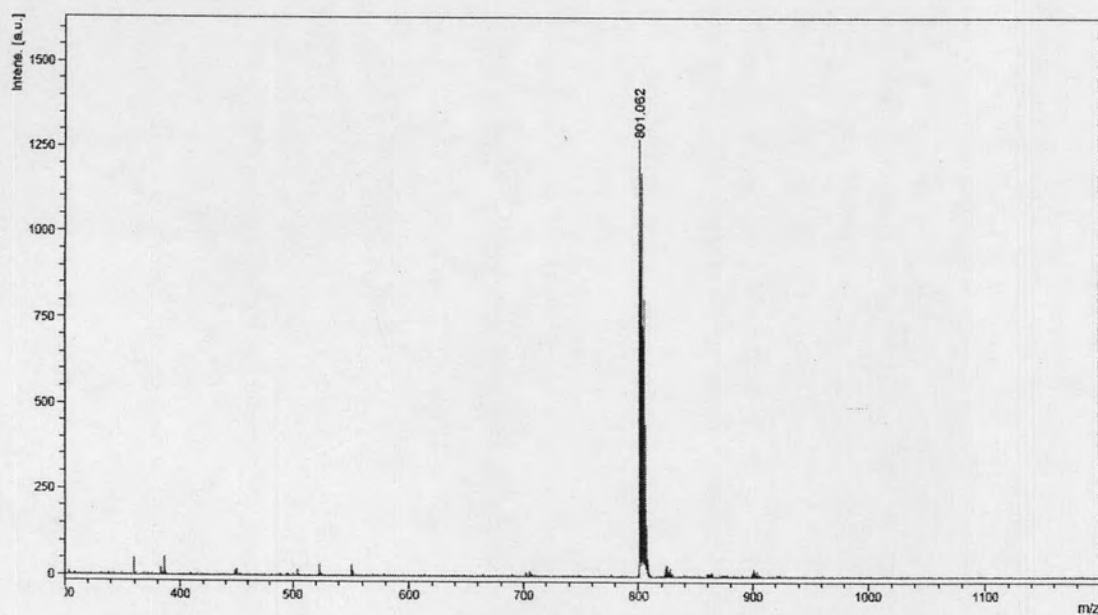
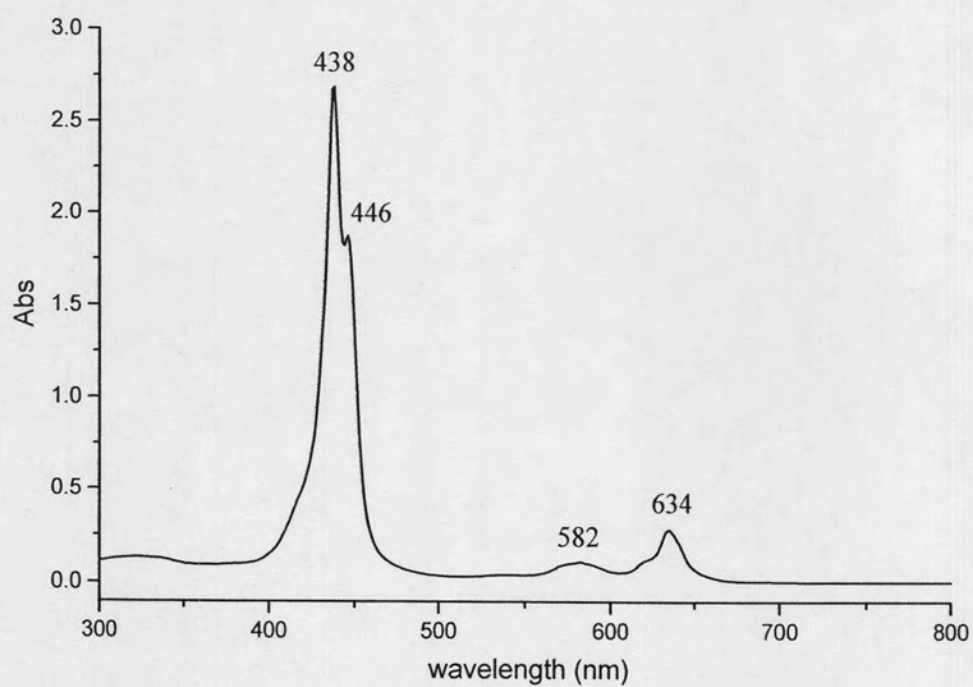
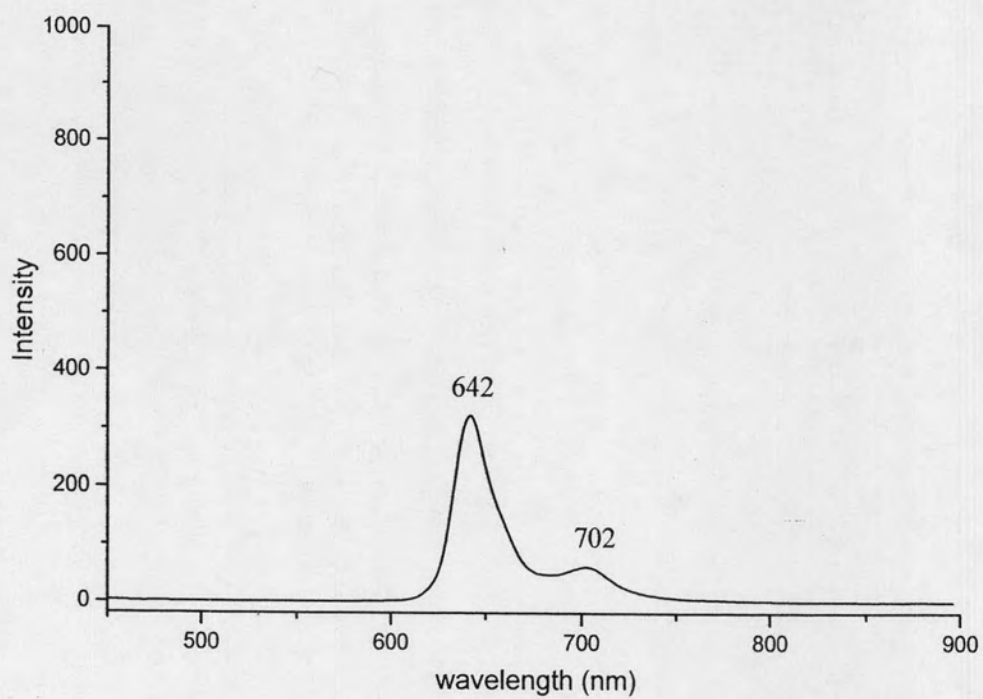


Figure A-68 The MALDI-TOF mass spectrum of Zn-(TMSE)<sub>2</sub>DMP (22)



**Figure A-69** The UV-visible spectrum of Zn-(TMSE)<sub>2</sub>DMP (22)



**Figure A-70** The fluorescence spectrum of Zn-(TMSE)<sub>2</sub>DMP (22)

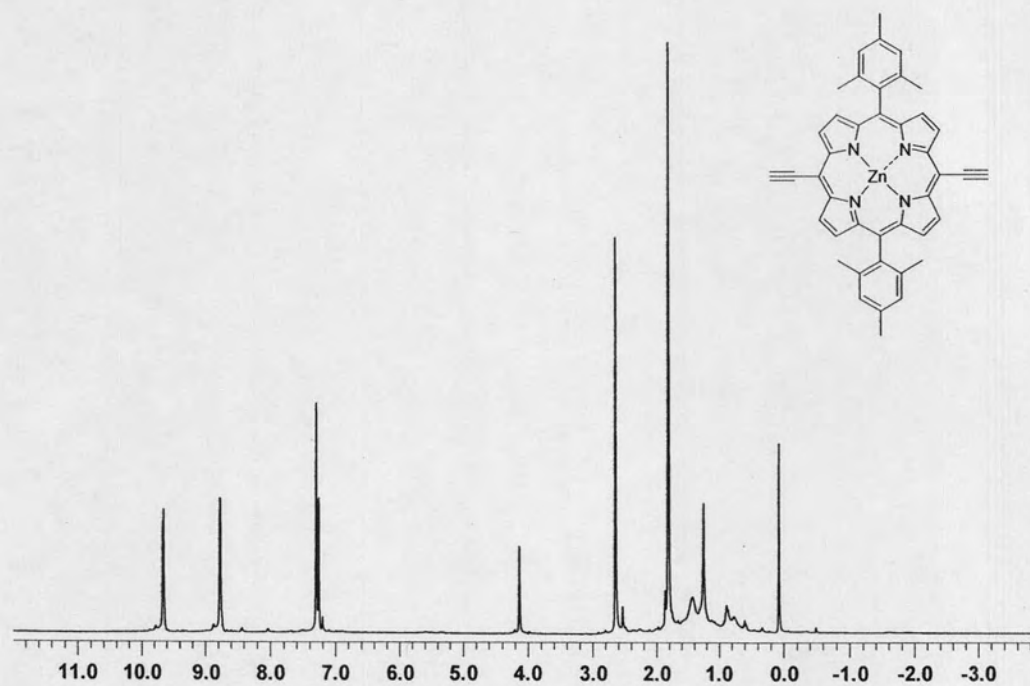


Figure A-71 The  $^1\text{H}$  NMR spectrum of Zn-E<sub>2</sub>DMP (23)

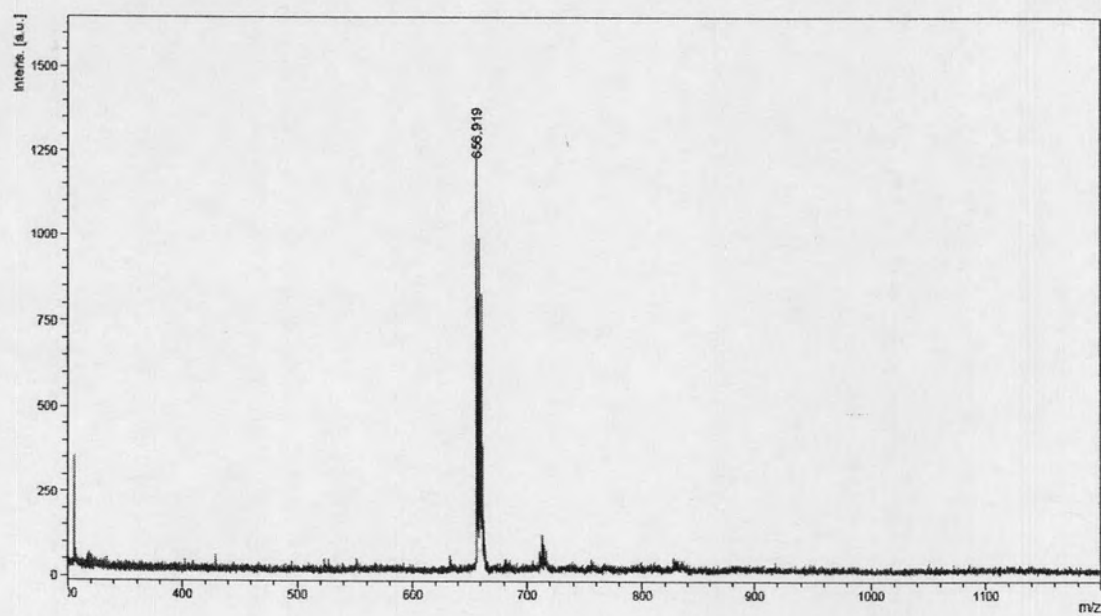
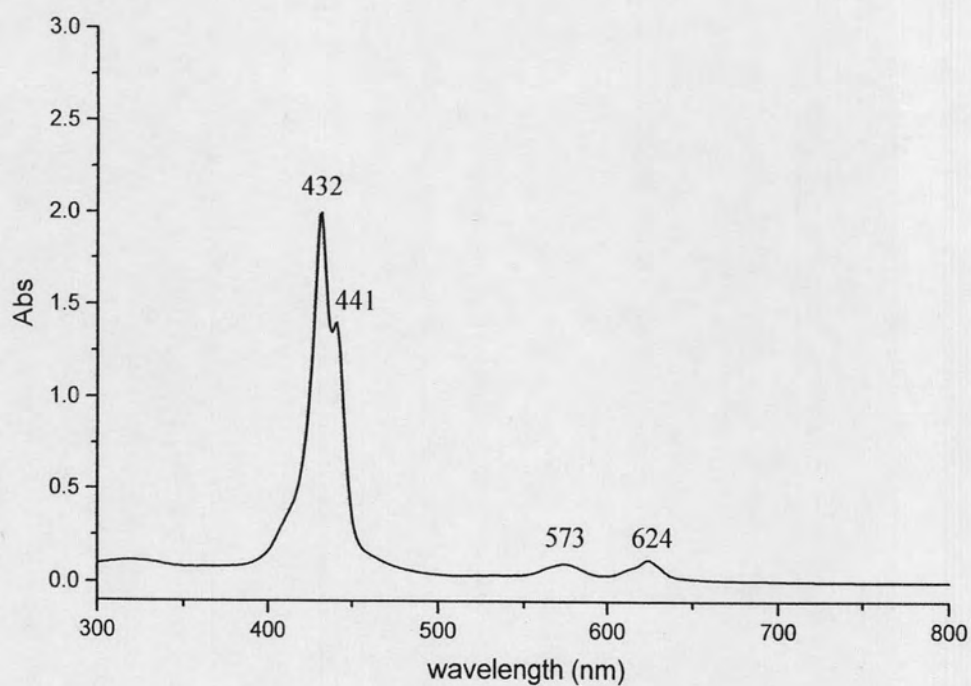
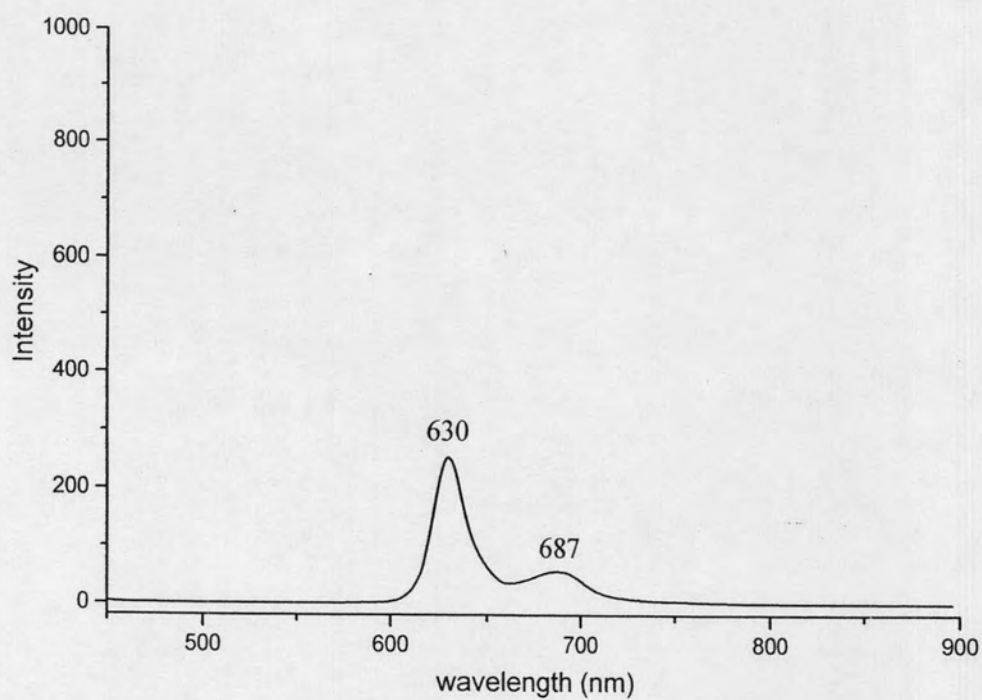


Figure A-72 The MALDI-TOF mass spectrum of Zn-E<sub>2</sub>DMP (23)



**Figure A-73** The UV-visible spectrum of Zn-E<sub>2</sub>DMP (23)



**Figure A-74** The fluorescence spectrum of Zn-E<sub>2</sub>DMP (23)

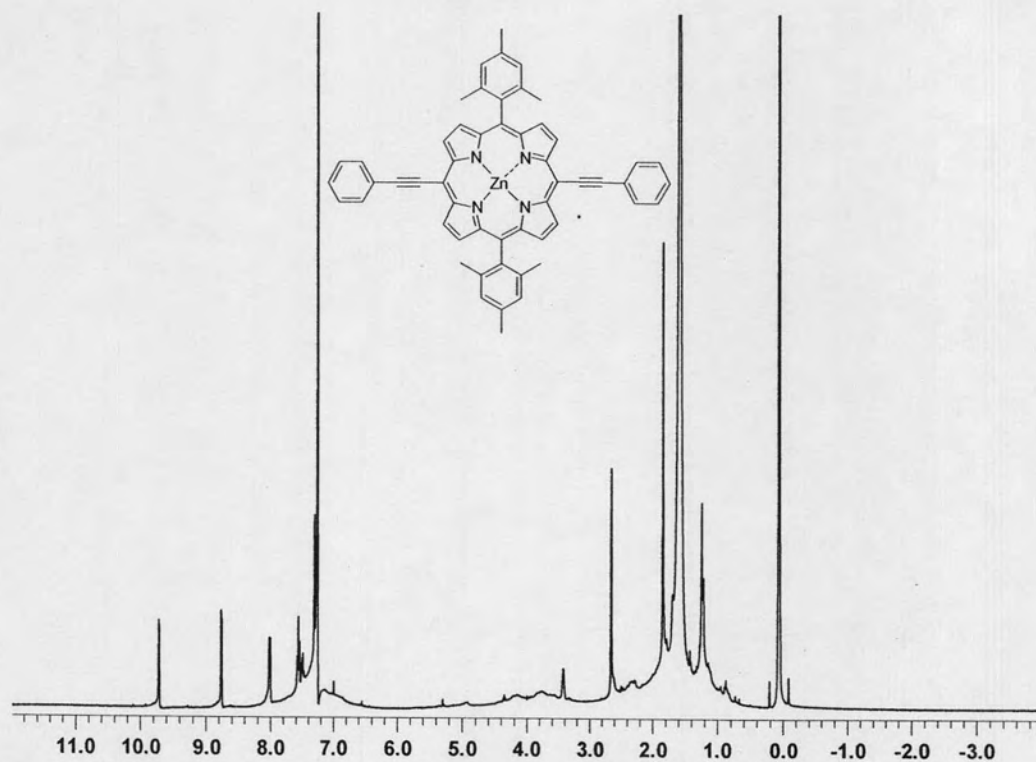


Figure A-75 The  $^1\text{H}$  NMR spectrum of Zn-(PE)<sub>2</sub>DMP (24)

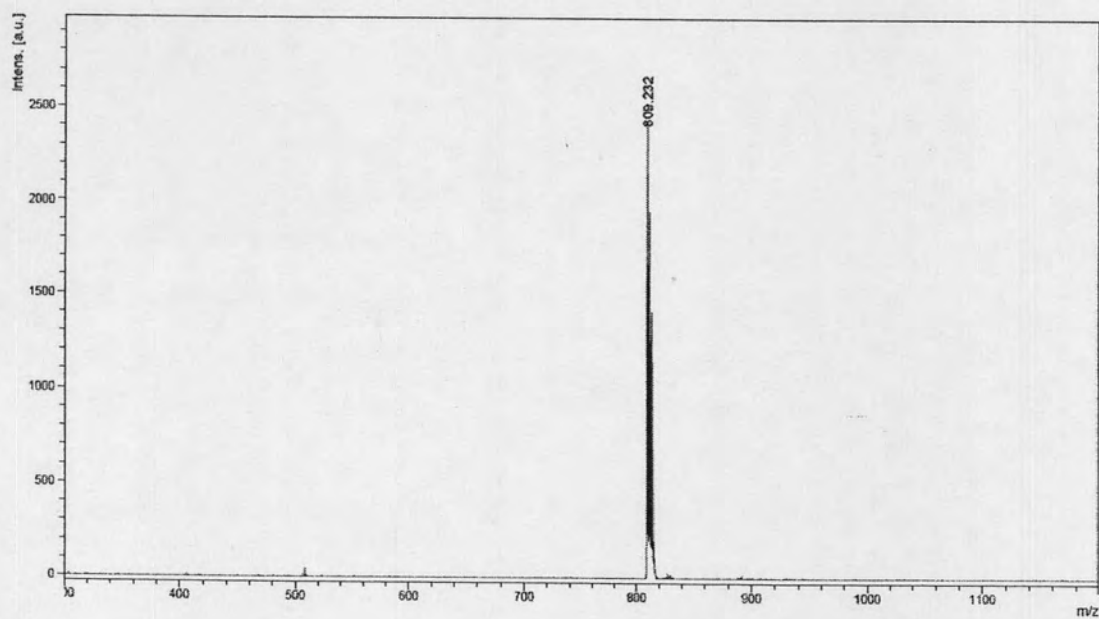
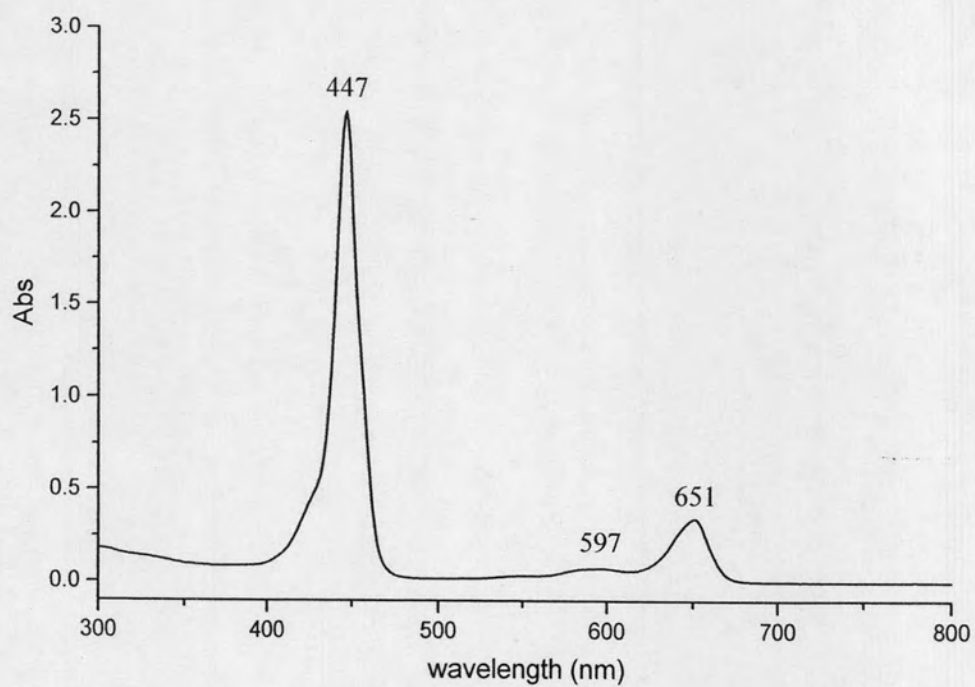
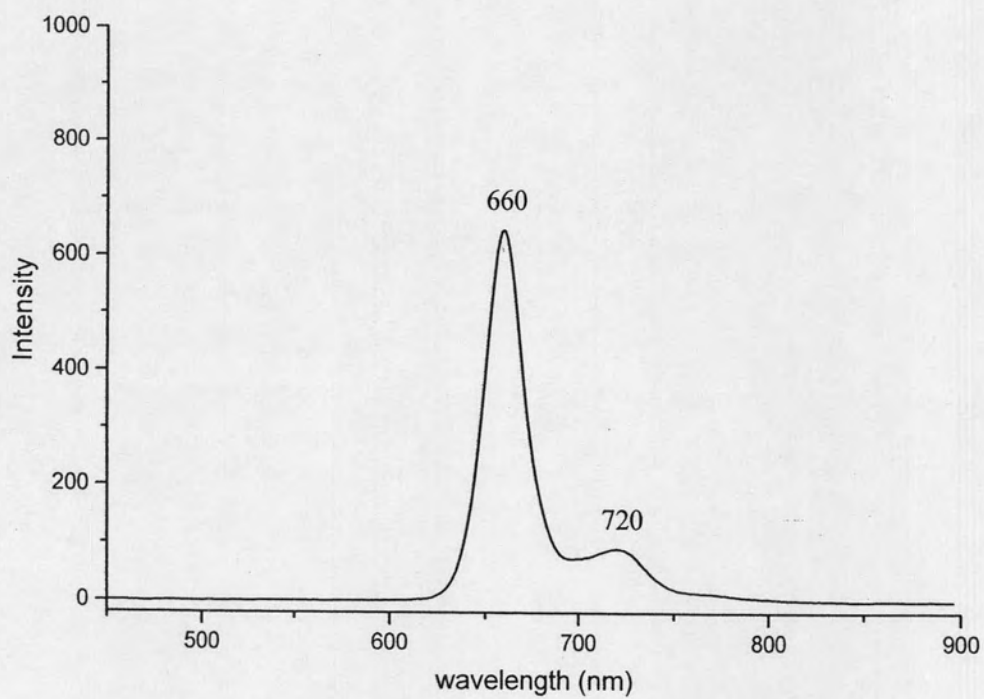


Figure A-76 The MALDI-TOF mass spectrum of Zn-(PE)<sub>2</sub>DMP (24)



**Figure A-77** The UV-visible spectrum of Zn-(PE)<sub>2</sub>DMP (24)



**Figure A-78** The fluorescence spectrum of Zn-(PE)<sub>2</sub>DMP (24)



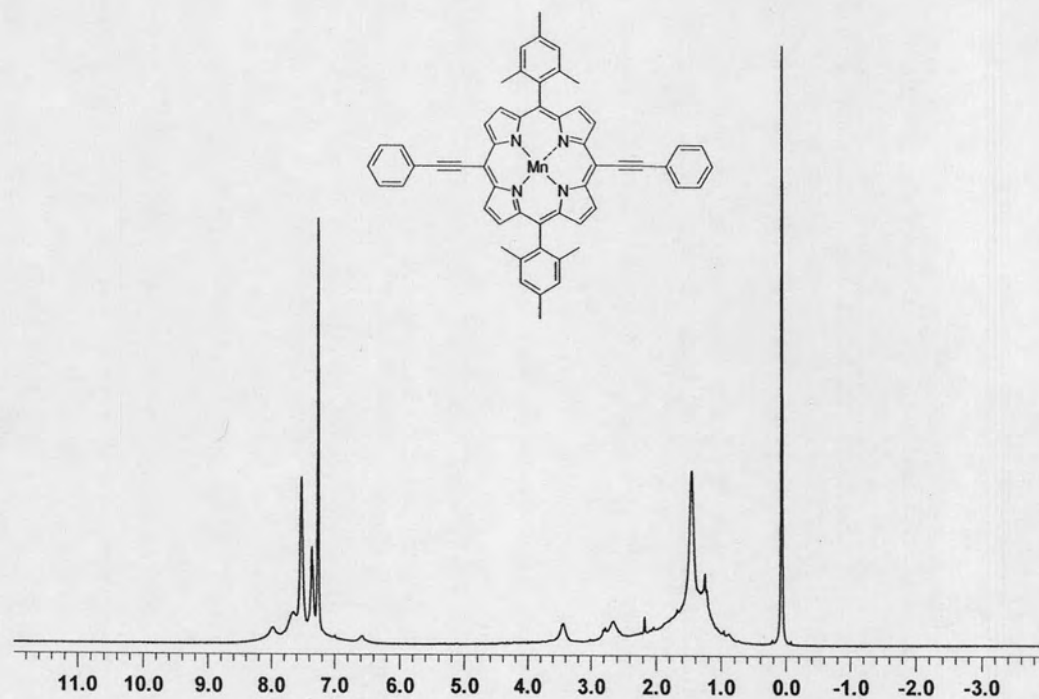


Figure A-79 The <sup>1</sup>H NMR spectrum of Mn-(PE)<sub>2</sub>DMP (25)

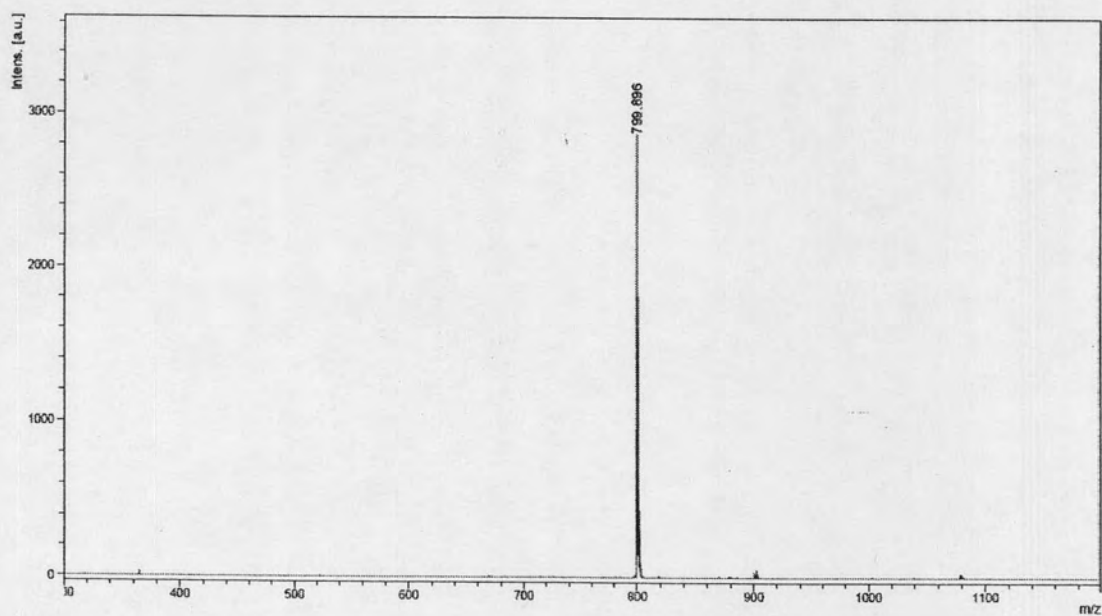
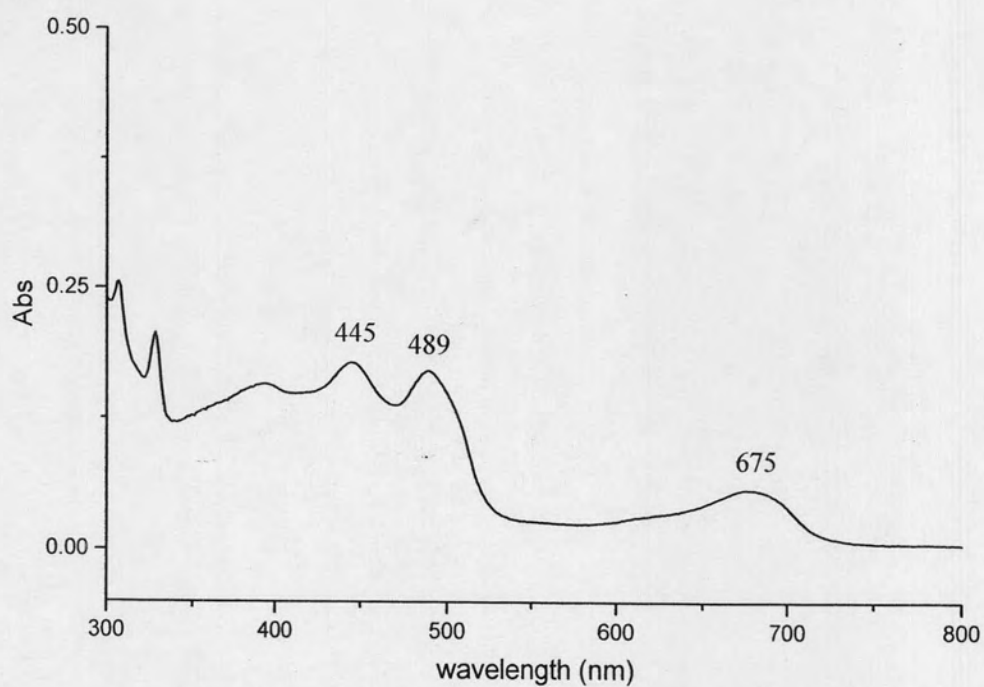
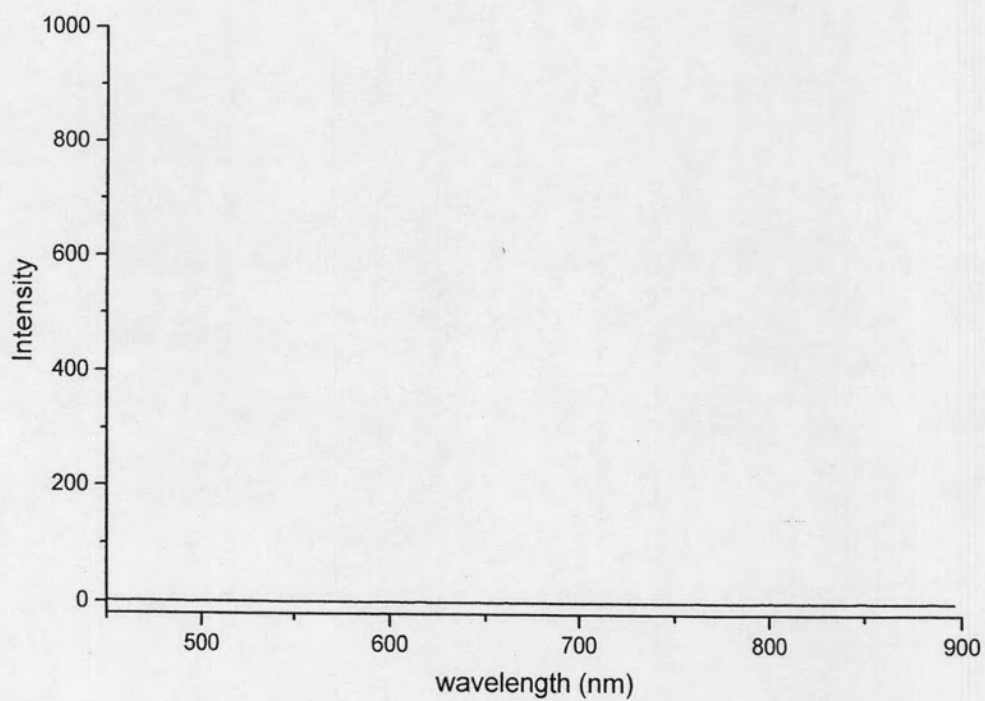


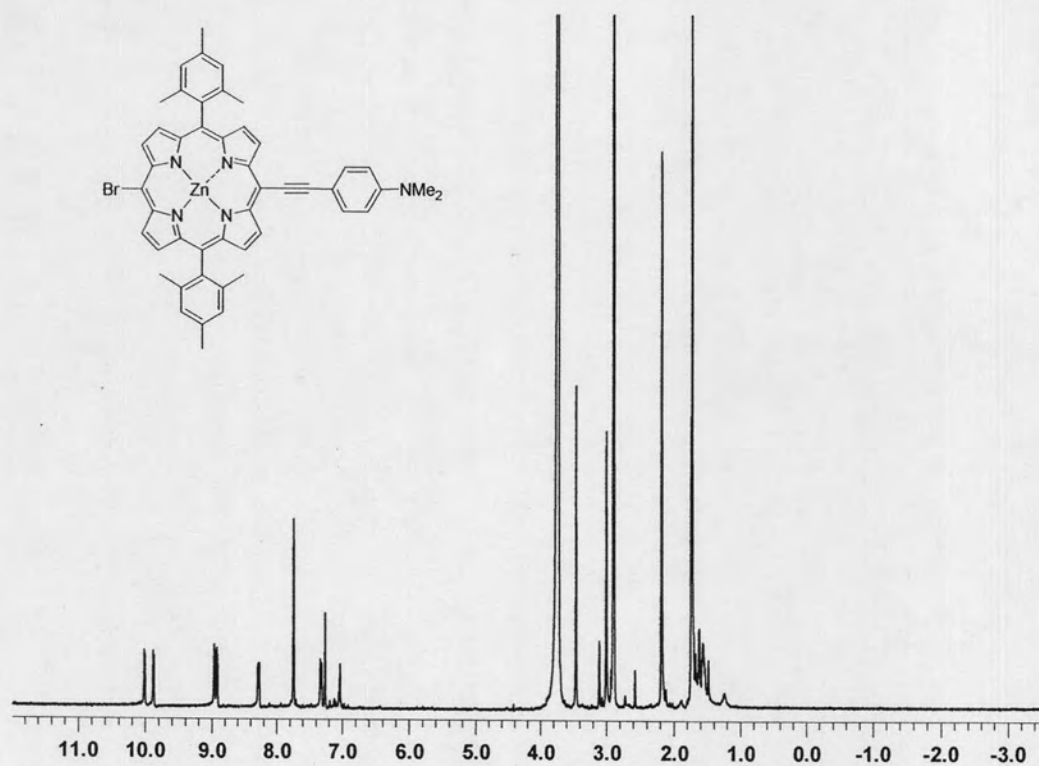
Figure A-80 The MALDI-TOF mass spectrum of Mn-(PE)<sub>2</sub>DMP (25)



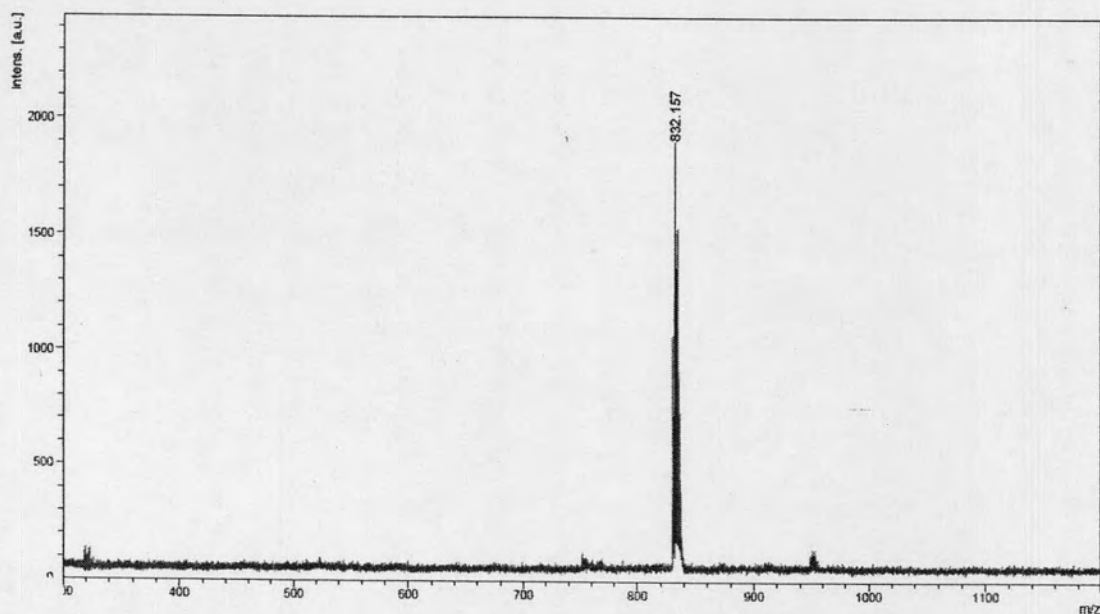
**Figure A-81** The UV-visible spectrum of Mn-(PE)<sub>2</sub>DMP (25)



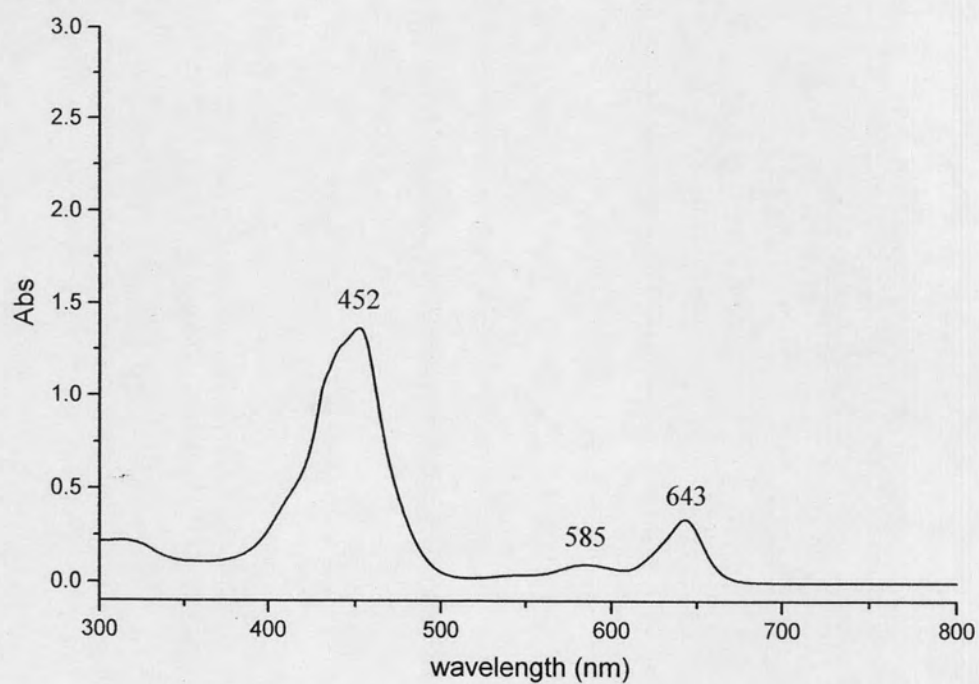
**Figure A-82** The fluorescence spectrum of Mn-(PE)<sub>2</sub>DMP (25)



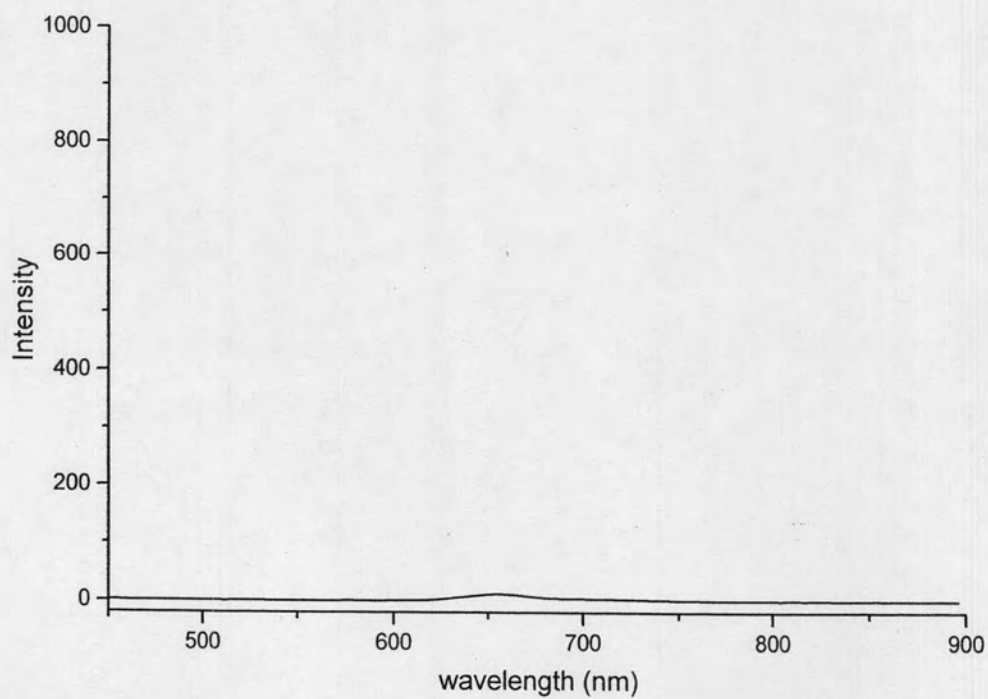
**Figure A-83** The  $^1\text{H}$  NMR spectrum of Zn-(DMAPE)(Br)DMP (26)



**Figure A-84** The MALDI-TOF mass spectrum of Zn-(DMAPE)(Br)DMP (26)



**Figure A-85** The UV-visible spectrum of Zn-(DMAPE)(Br)DMP (26)



**Figure A-86** The fluorescence spectrum of Zn-(DMAPE)(Br)DMP (26)

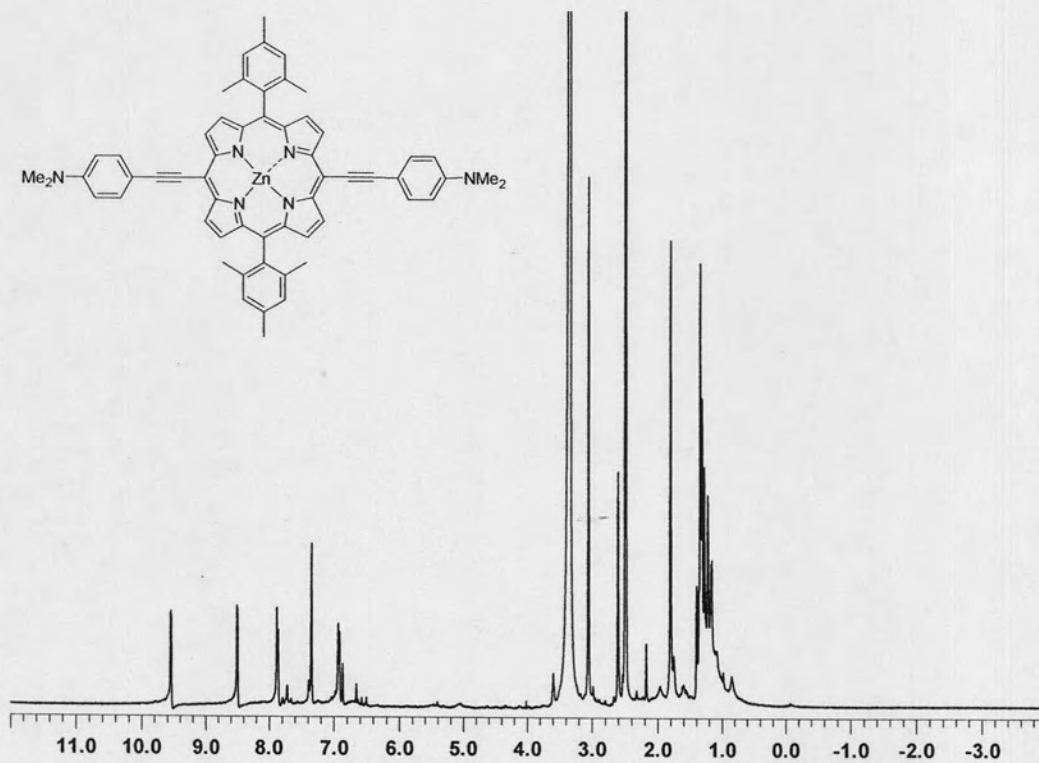


Figure A-87 The <sup>1</sup>H NMR spectrum of Zn-(DMAPE)<sub>2</sub>DMP (27)

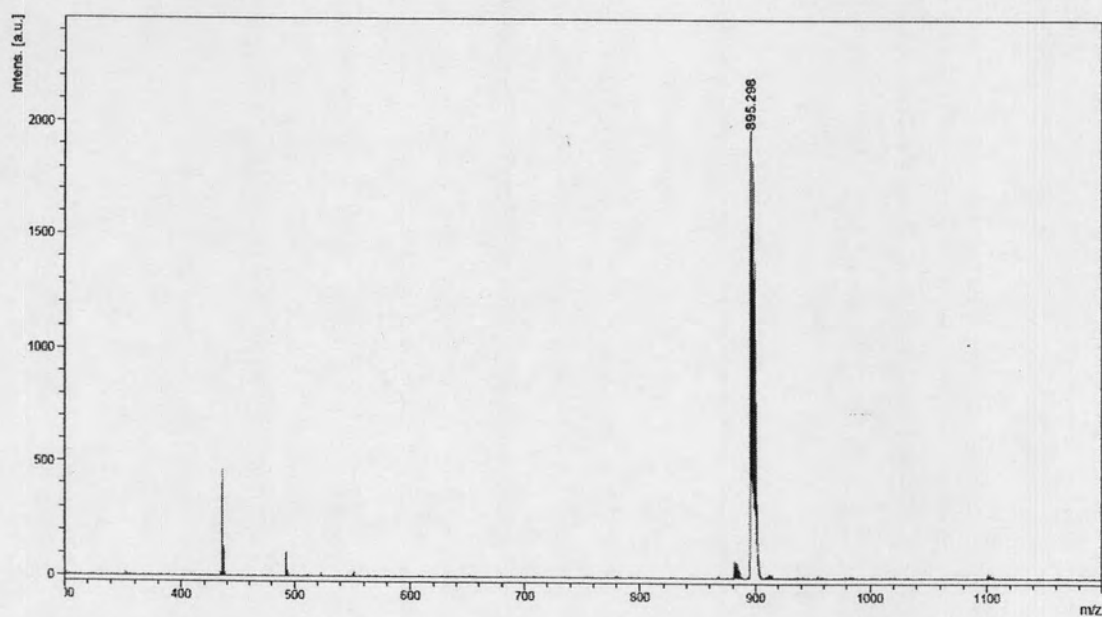
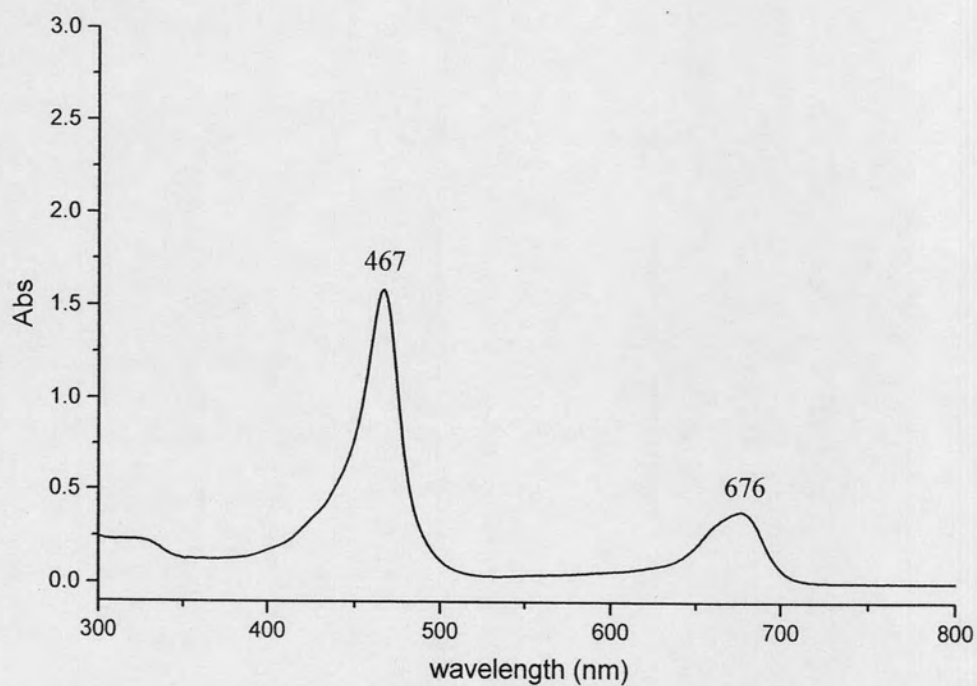
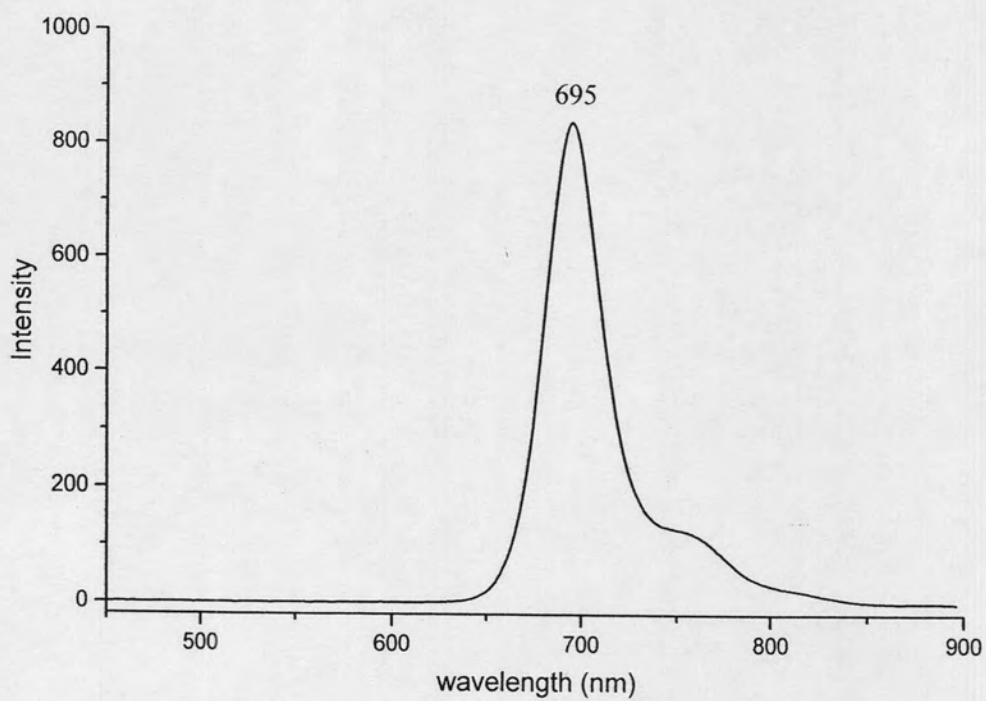


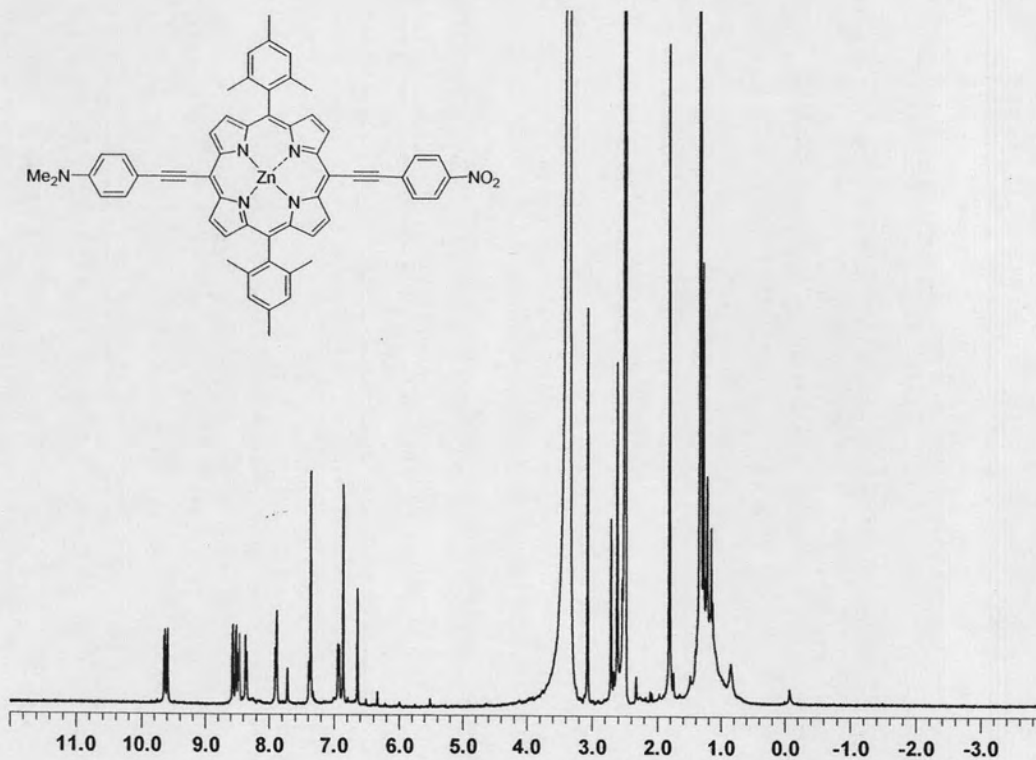
Figure A-88 The MALDI-TOF mass spectrum of Zn-(DMAPE)<sub>2</sub>DMP (27)



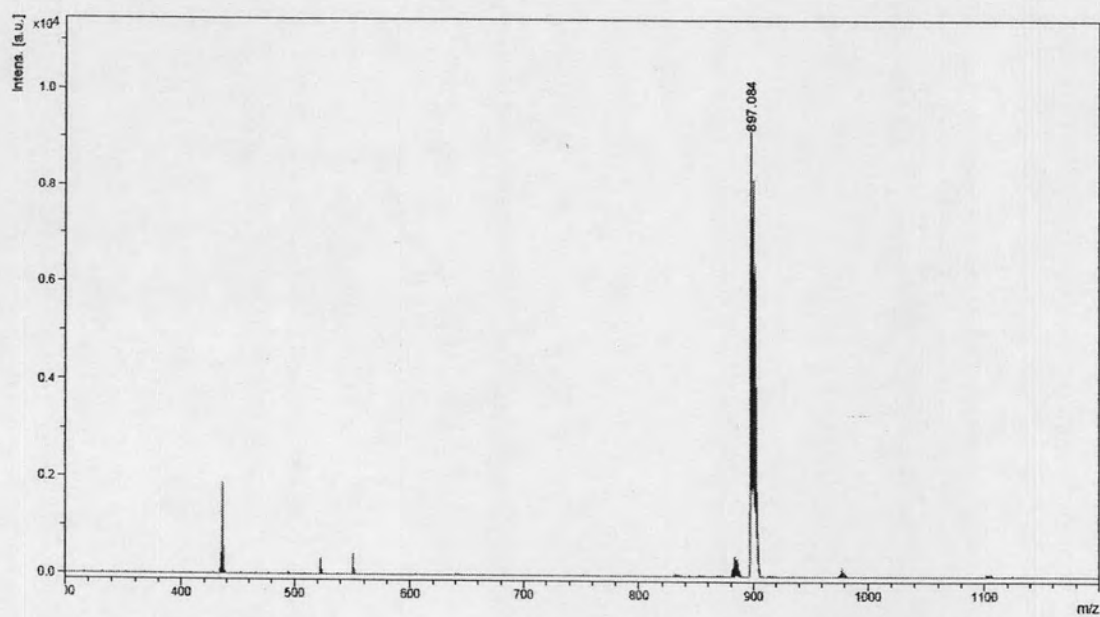
**Figure A-89** The UV-visible spectrum of Zn-(DMAPE)<sub>2</sub>DMP (27)



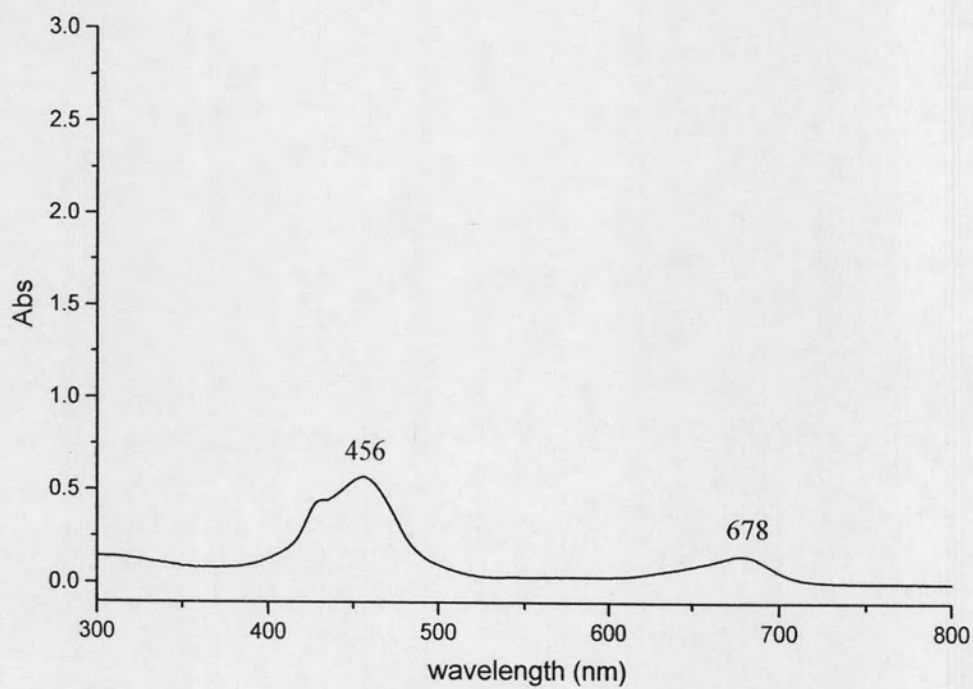
**Figure A-90** The fluorescence spectrum of Zn-(DMAPE)<sub>2</sub>DMP (27)



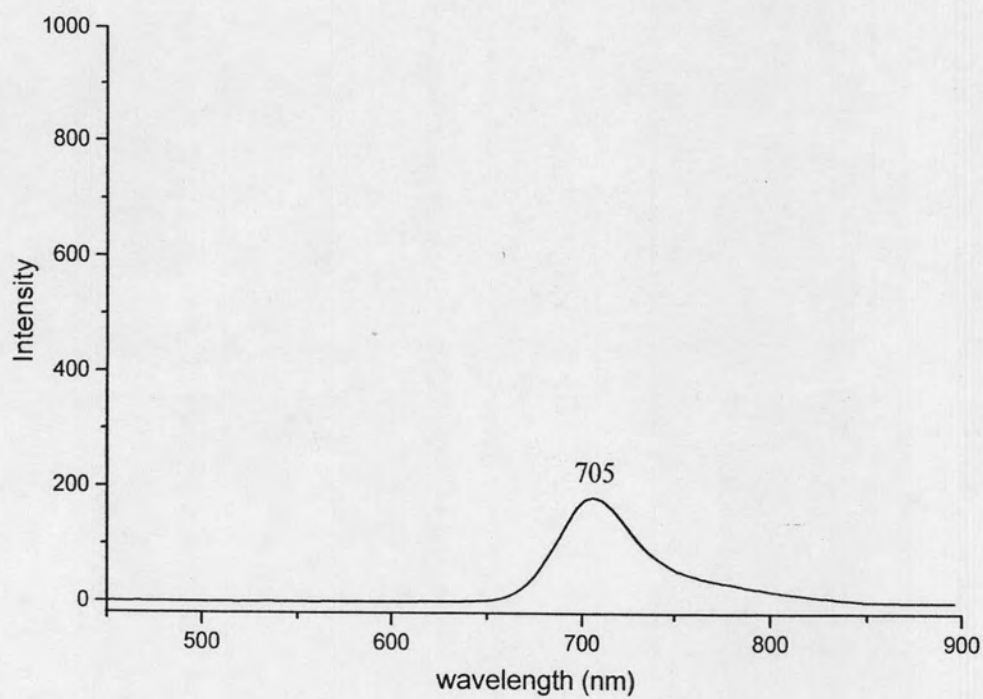
**Figure A-91** The  $^1\text{H}$  NMR spectrum of Zn-(DMAPE)(NPE)DMP (28)



**Figure A-92** The MALDI-TOF mass spectrum of Zn-(DMAPE)(NPE)DMP (28)



**Figure A-93** The UV-visible spectrum of Zn-(DMAPE)(NPE)DMP (**28**)



**Figure A-94** The fluorescence spectrum of Zn-(DMAPE)(NPE)DMP (**28**)



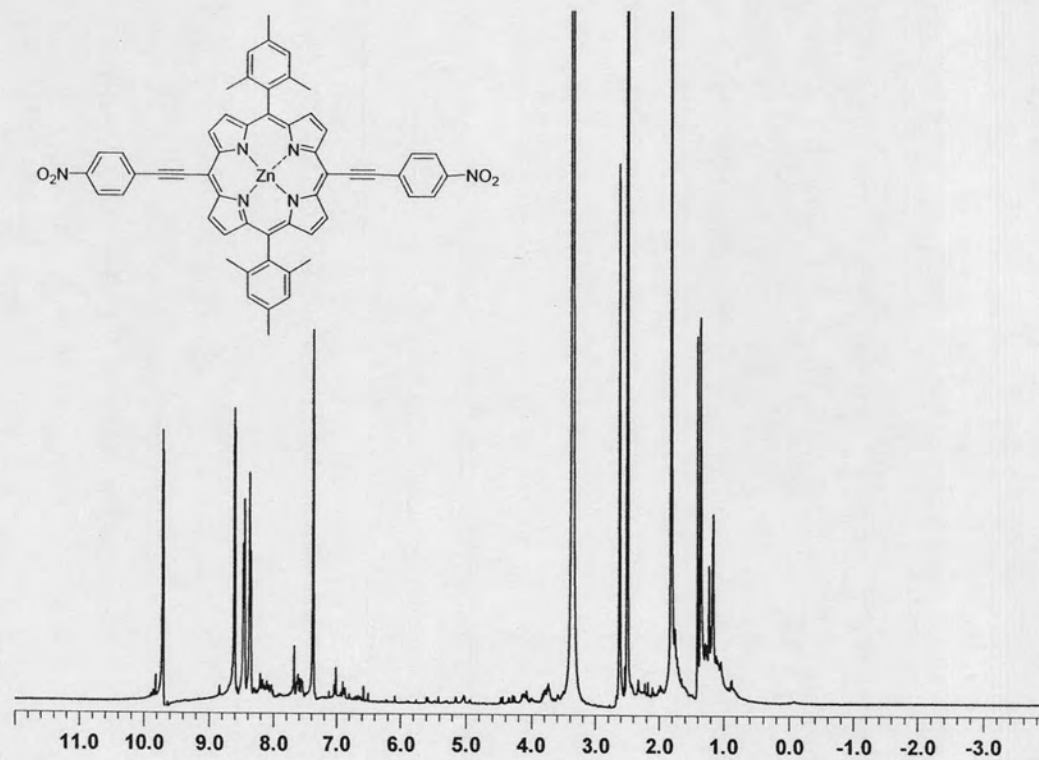


Figure A-95 The <sup>1</sup>H NMR spectrum of Zn-(NPE)<sub>2</sub>DMP (29)

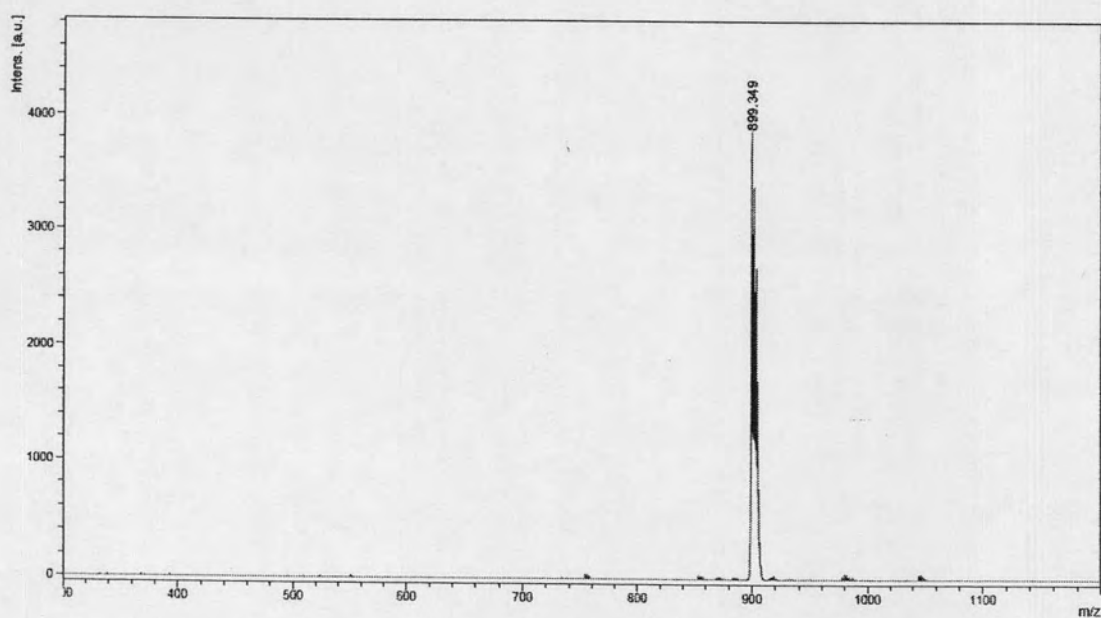
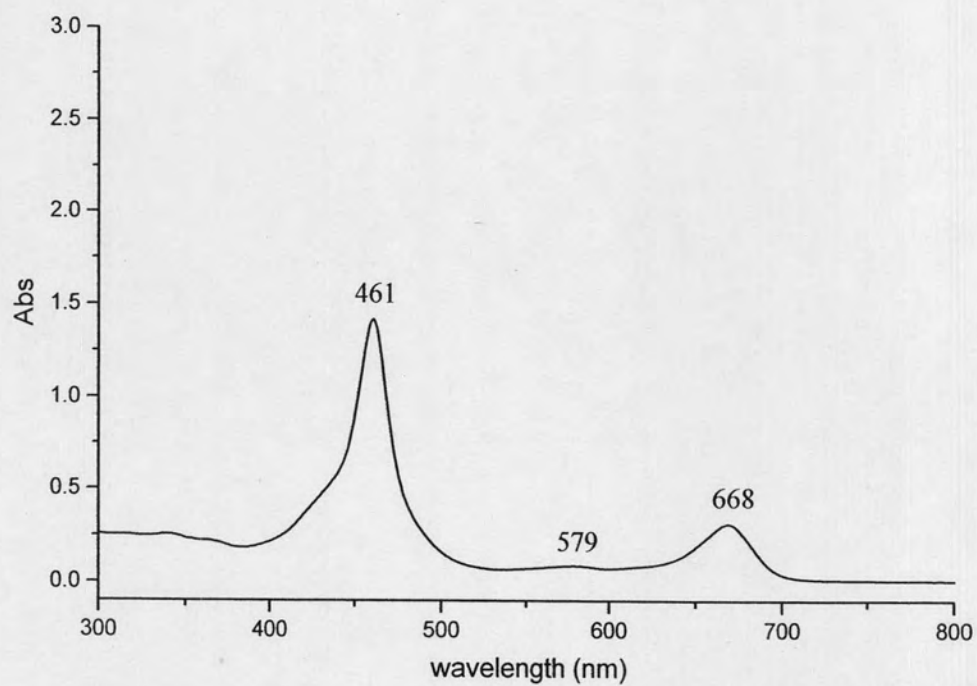
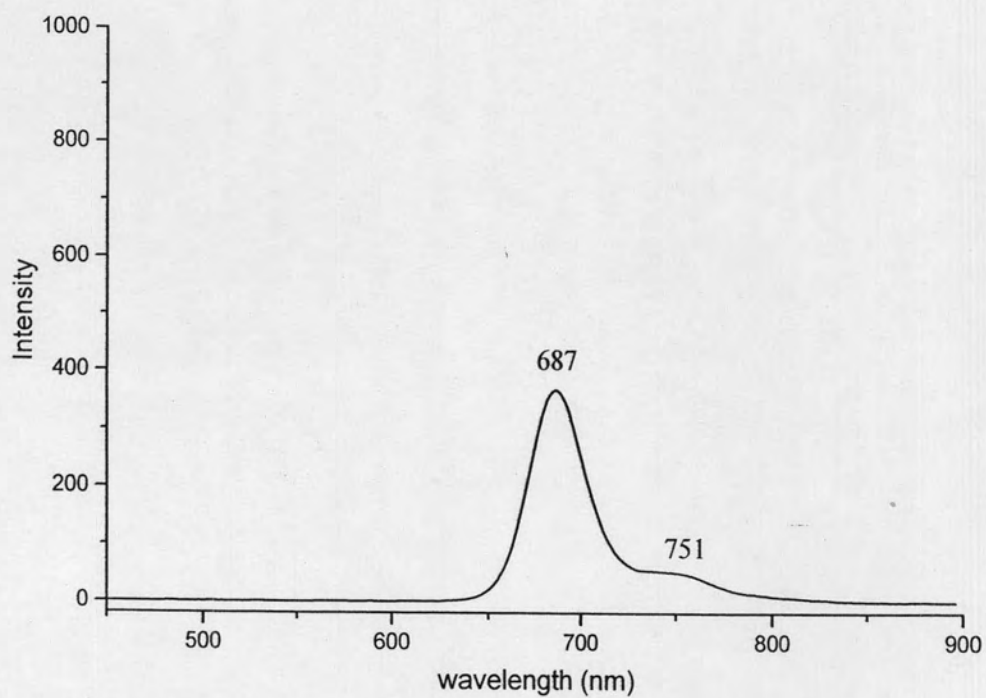


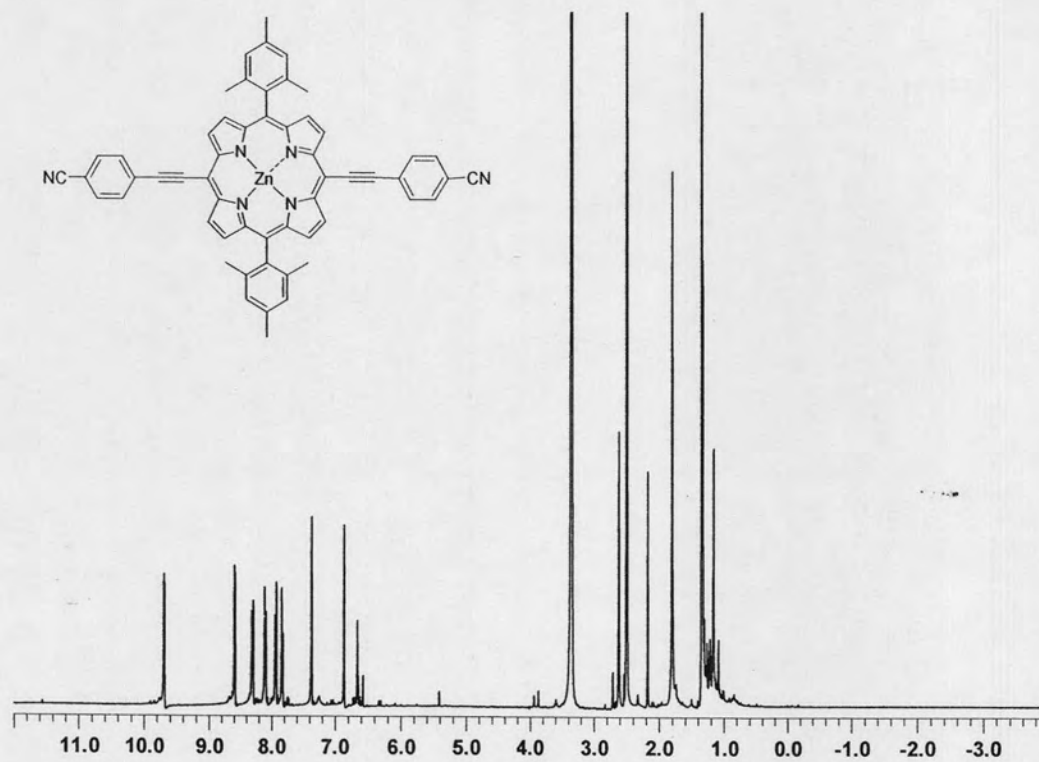
Figure A-96 The MALDI-TOF mass spectrum of Zn-(NPE)<sub>2</sub>DMP (29)



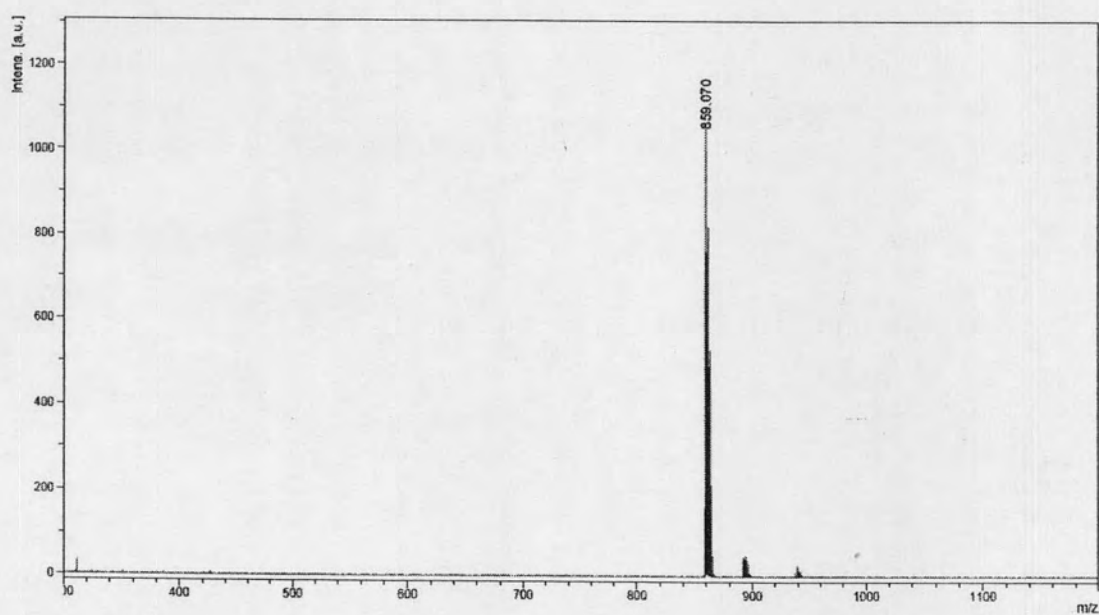
**Figure A-97** The UV-visible spectrum of Zn-(NPE)<sub>2</sub>DMP (29)



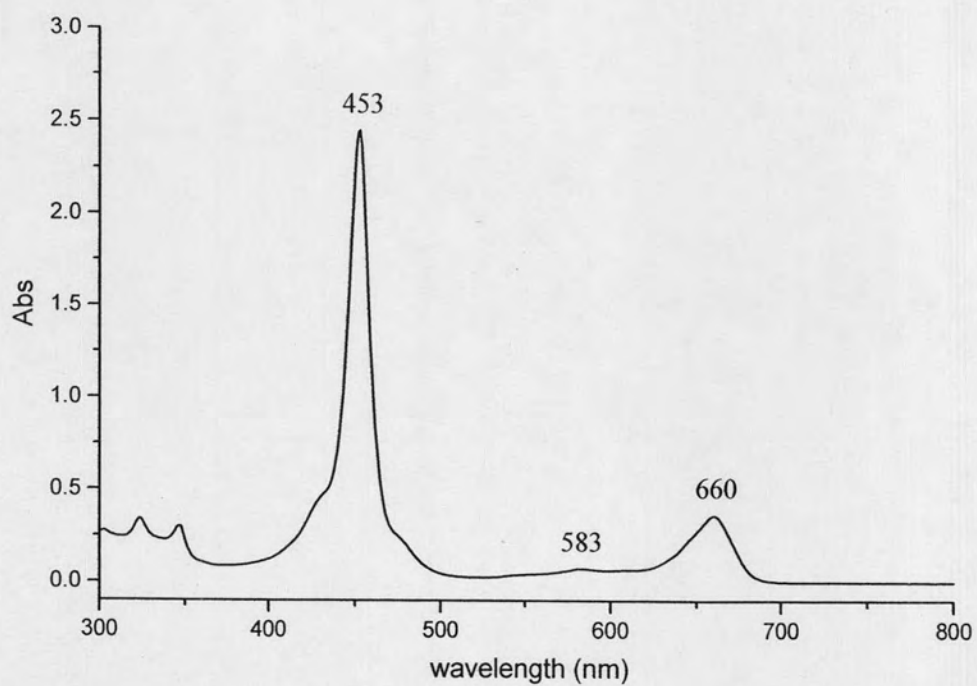
**Figure A-98** The fluorescence spectrum of Zn-(NPE)<sub>2</sub>DMP (29)



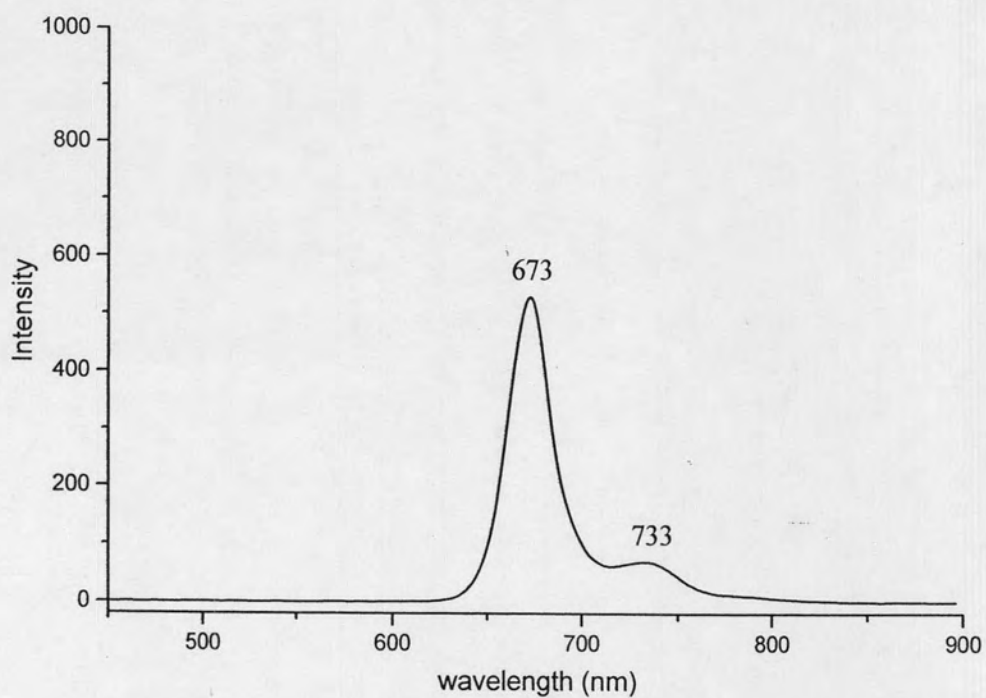
**Figure A-99** The <sup>1</sup>H NMR spectrum of Zn-(CPE)<sub>2</sub>DMP (30)



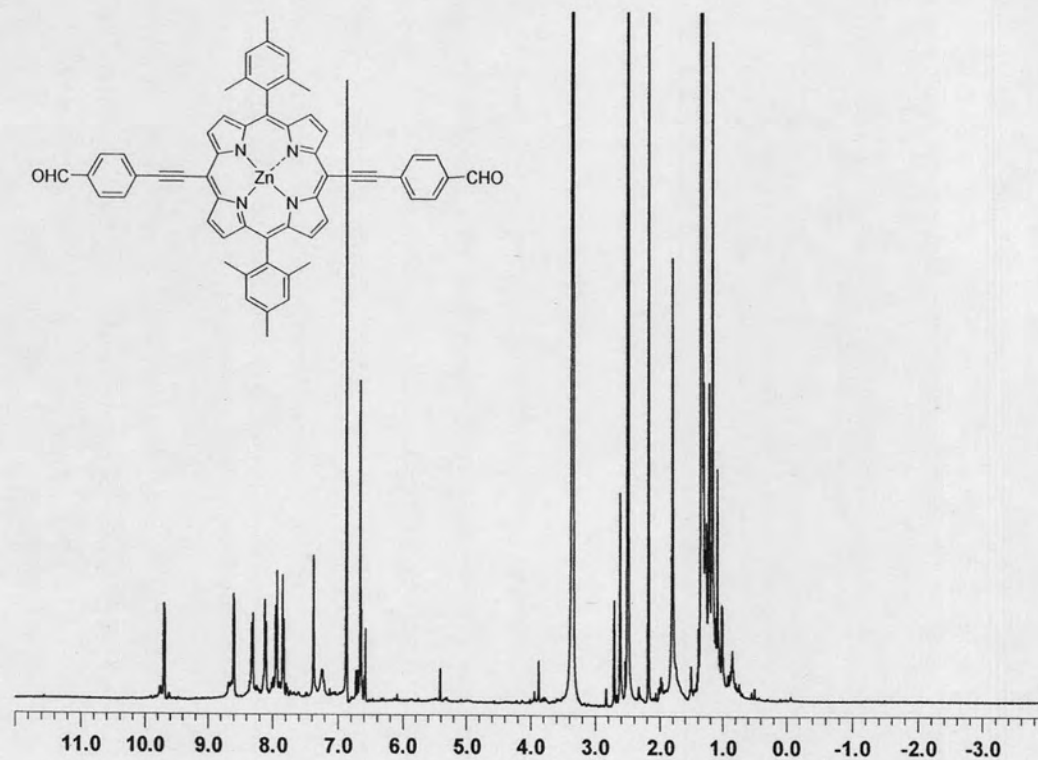
**Figure A-100** The MALDI-TOF mass spectrum of Zn-(CPE)<sub>2</sub>DMP (30)



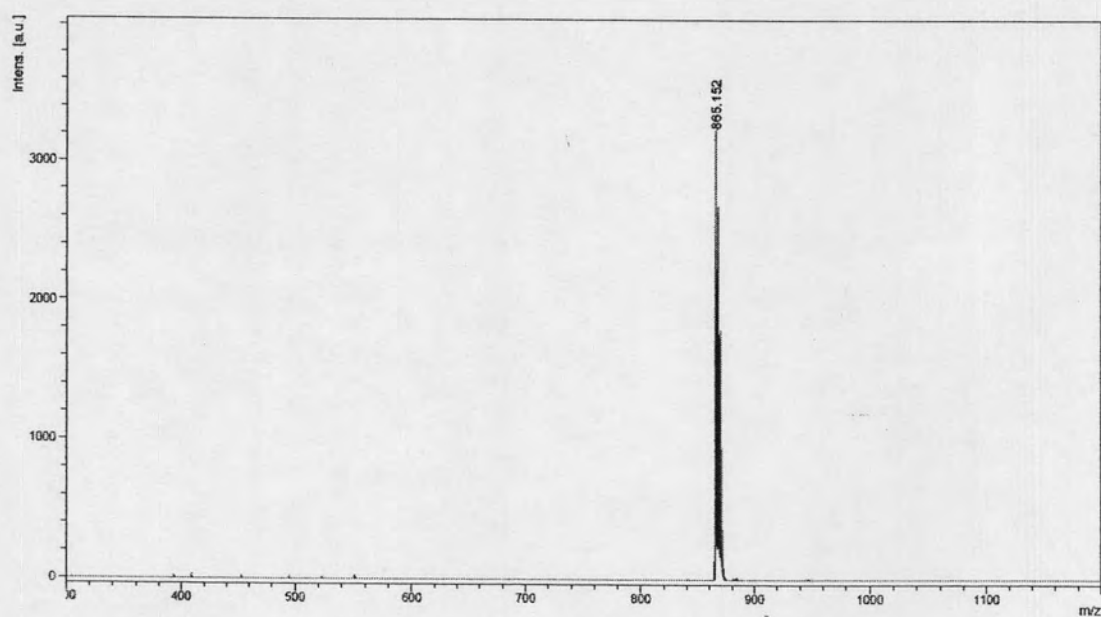
**Figure A-101** The UV-visible spectrum of Zn-(CPE)<sub>2</sub>DMP (30)



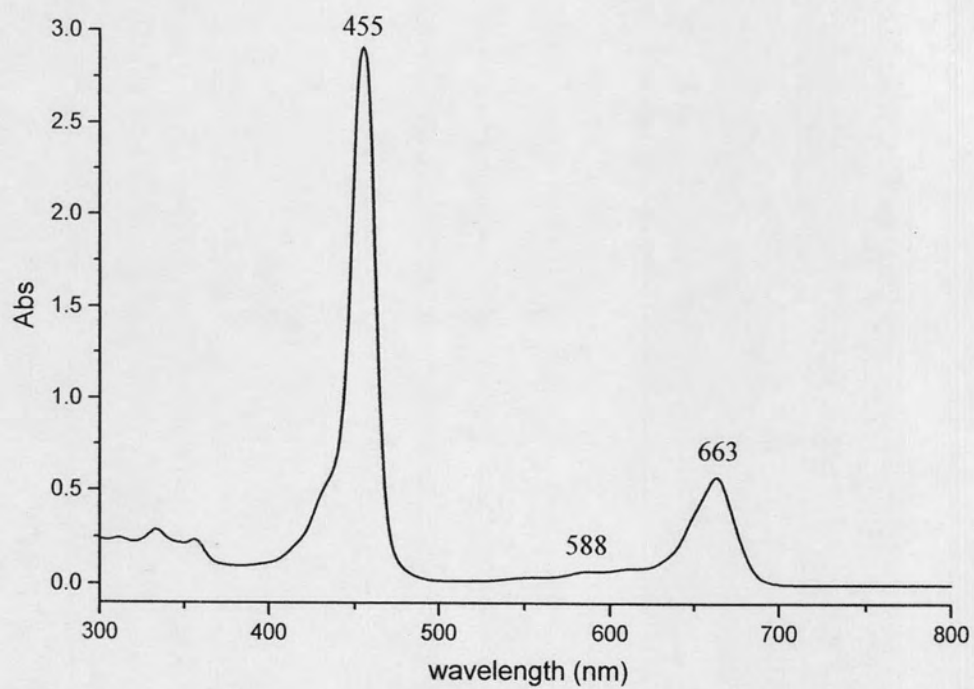
**Figure A-102** The fluorescence spectrum of Zn-(CPE)<sub>2</sub>DMP (30)



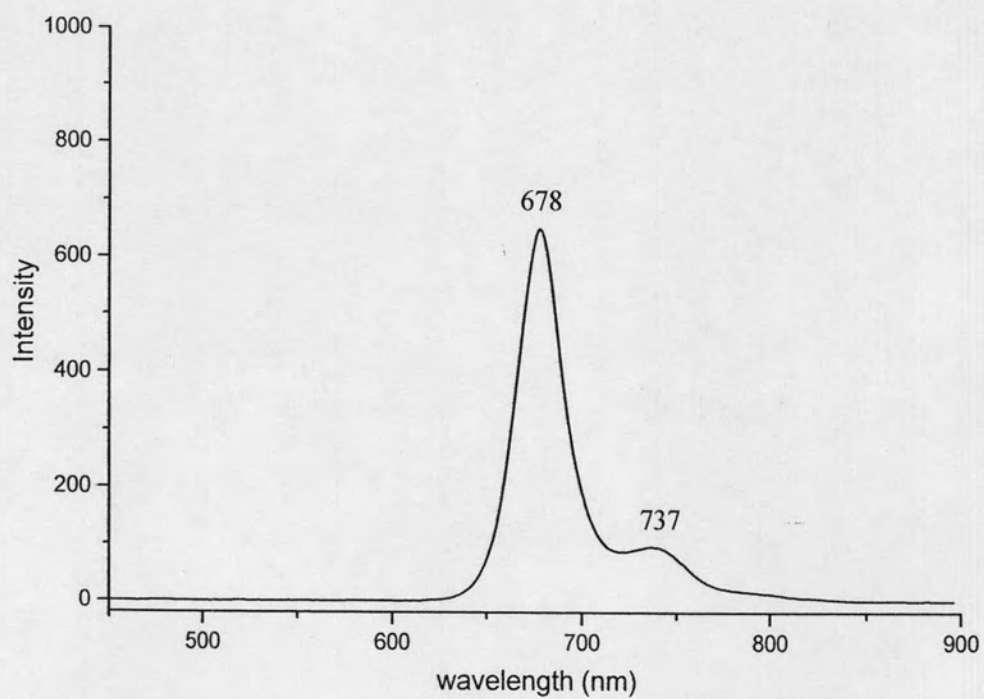
**Figure A-103** The <sup>1</sup>H NMR spectrum of Zn-(FPE)<sub>2</sub>DMP (31)



**Figure A-104** The MALDI-TOF mass spectrum of Zn-(FPE)<sub>2</sub>DMP (31)



**Figure A-105** The UV-visible spectrum of Zn-(FPE)<sub>2</sub>DMP (31)



**Figure A-106** The fluorescence spectrum of Zn-(FPE)<sub>2</sub>DMP (31)

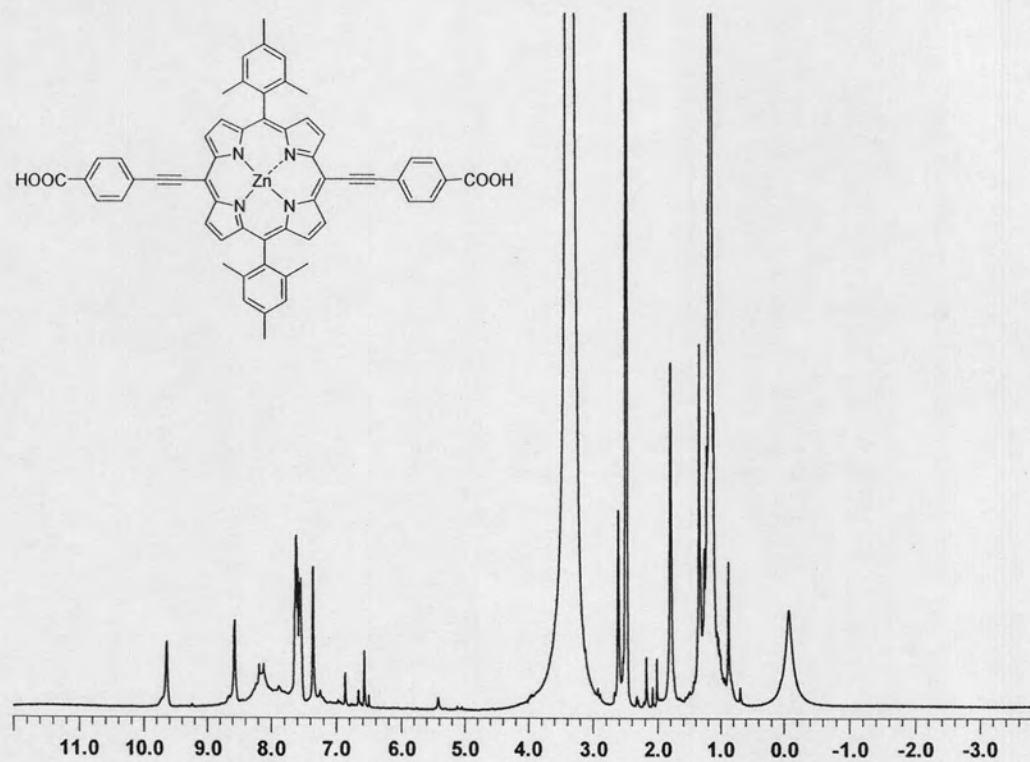


Figure A-107 The <sup>1</sup>H NMR spectrum of Zn-(CarPE)<sub>2</sub>DMP (32)

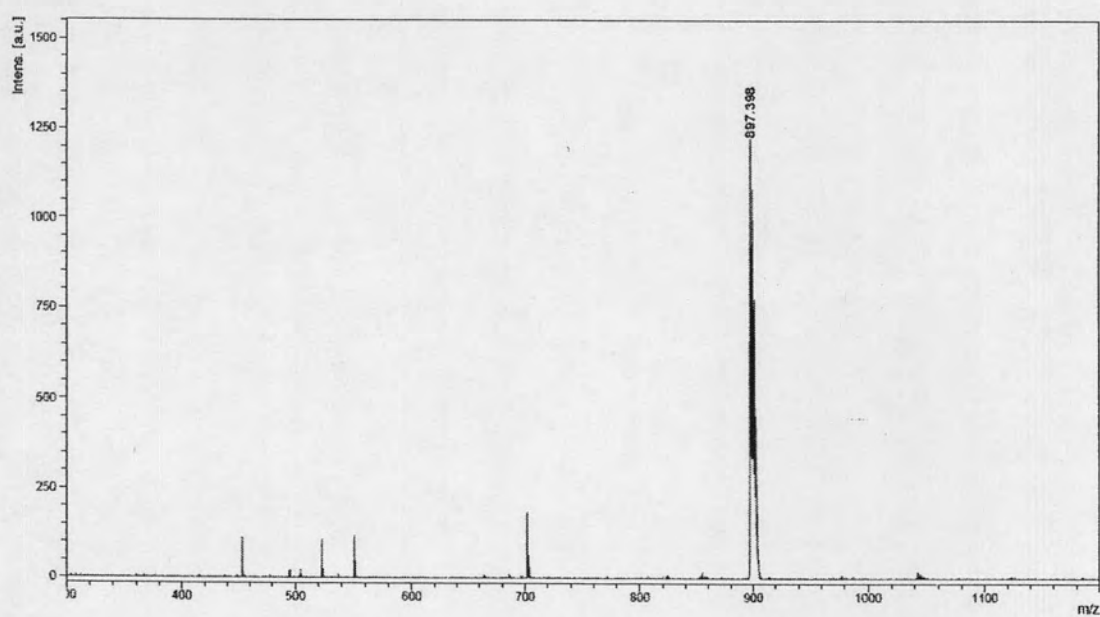
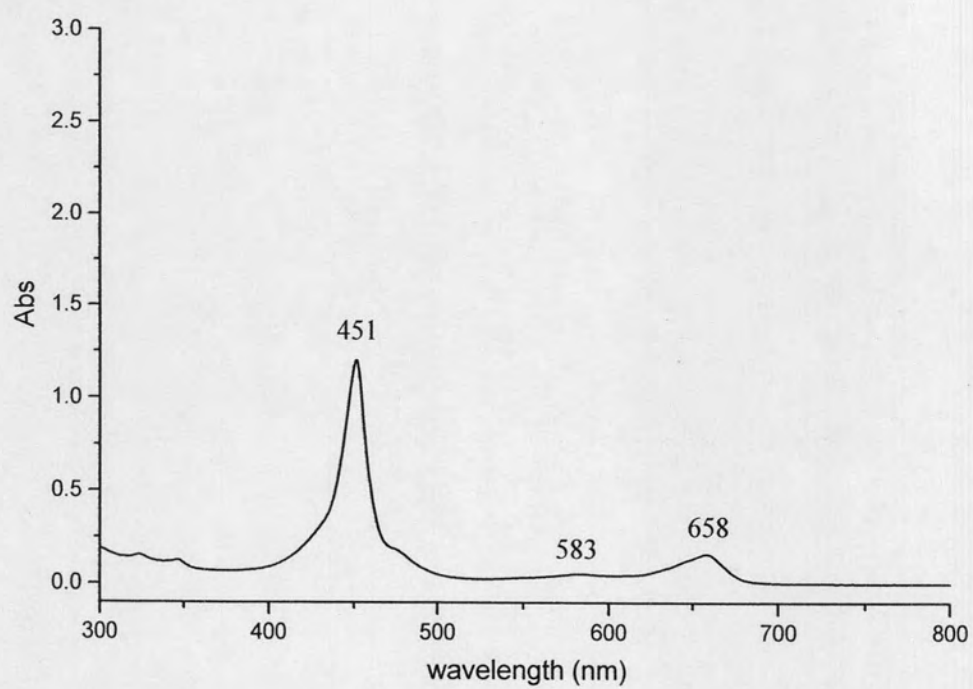
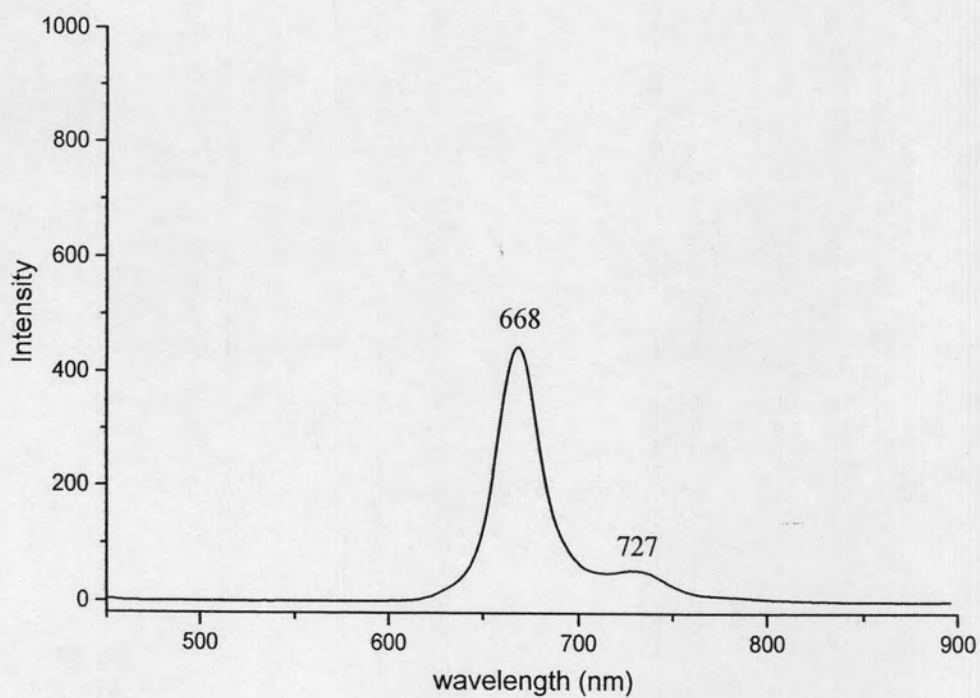


Figure A-108 The MALDI-TOF mass spectrum of Zn-(CarPE)<sub>2</sub>DMP (32)



**Figure A-109** The UV-visible spectrum of Zn-(CarPE)<sub>2</sub>DMP (32)



**Figure A-110** The fluorescence spectrum of Zn-(CarPE)<sub>2</sub>DMP (32)



## VITAE

Mr. Wuttichai Reainthippayasakul was born on June 14<sup>th</sup>, 1984 in Bangkok, Thailand. He received a Bachelor Degree of Science, majoring in Chemistry from Faculty of Science, Chulalongkorn University in 2005. Since 2006, he has been a graduate student studying Organic Chemistry as his major course at Department of Chemistry, Faculty of Science, Chulalongkorn University. During his studies towards the Master's degree, he was awarded by Chulalongkorn University Graduate Scholarship to Commemorate the 72<sup>nd</sup> Anniversary of His Majesty King Bhumibol Adulyadej during 2006-2007.

His present address is 93 Soi Krungthep-Nonthaburi 23, Krungthep-Nonthaburi Rd., Bangsue, Bangkok, Thailand 10800, Tel. (02)-5858469.