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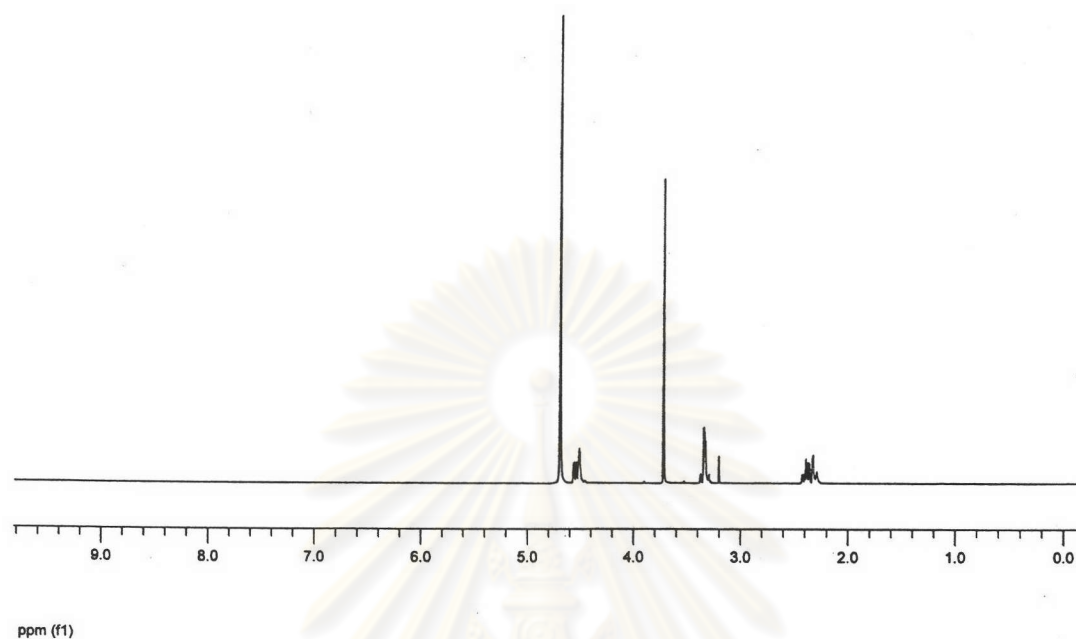


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**APPENDIX**

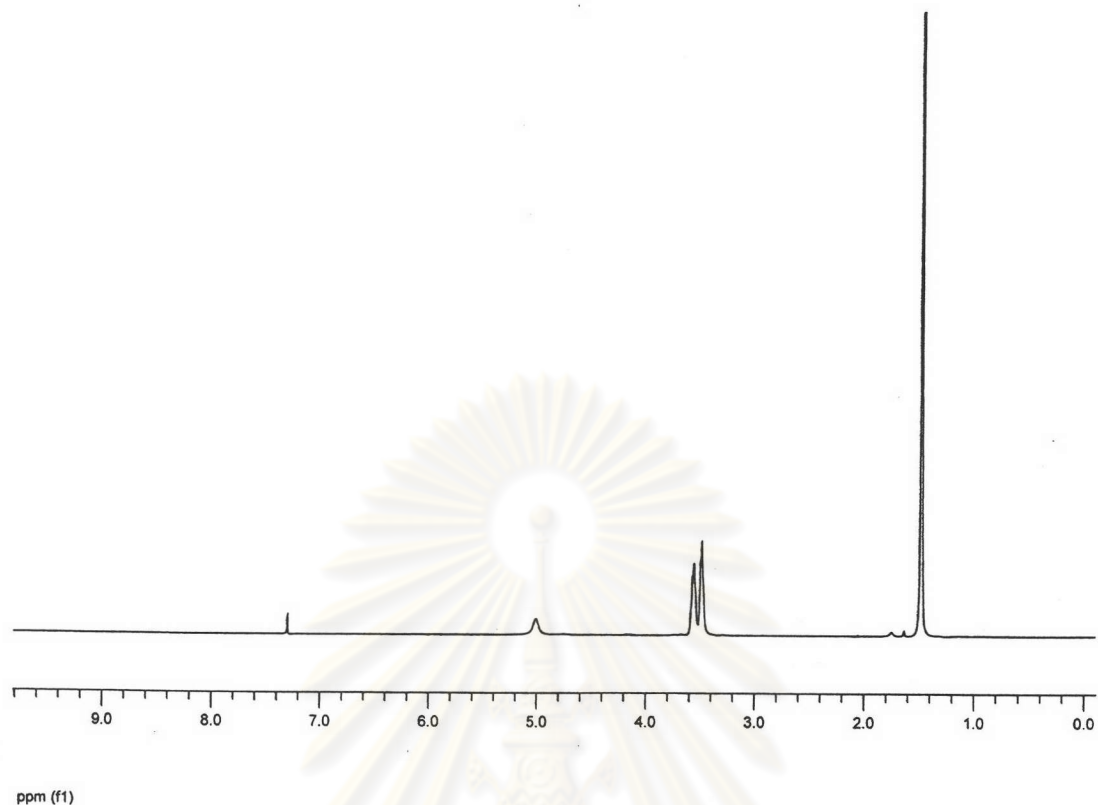
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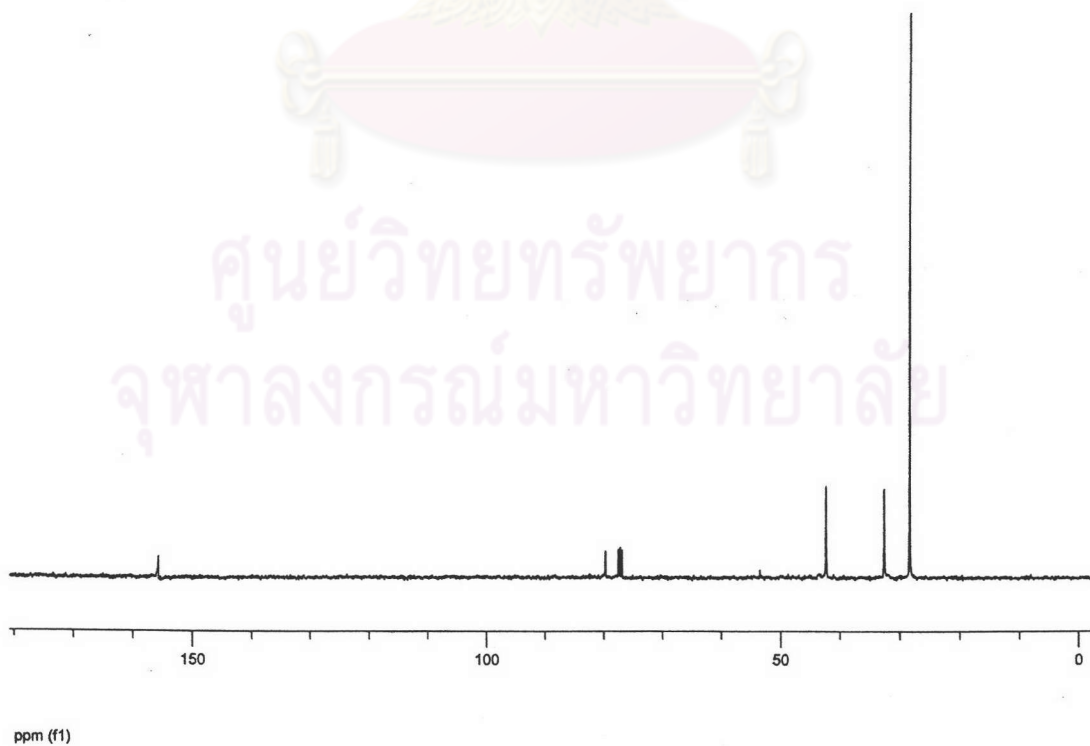
**Figure 1**  $^1\text{H}$  NMR spectrum ( $\text{D}_2\text{O}$ ) of *cis*-hydroxy-D-proline methyl ester (10)

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**Figure 2**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-*tert*-butoxycarbonyl-bromoethylamine (12)



**Figure 3**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-*tert*-butoxycarbonyl-bromoethylamine (12)

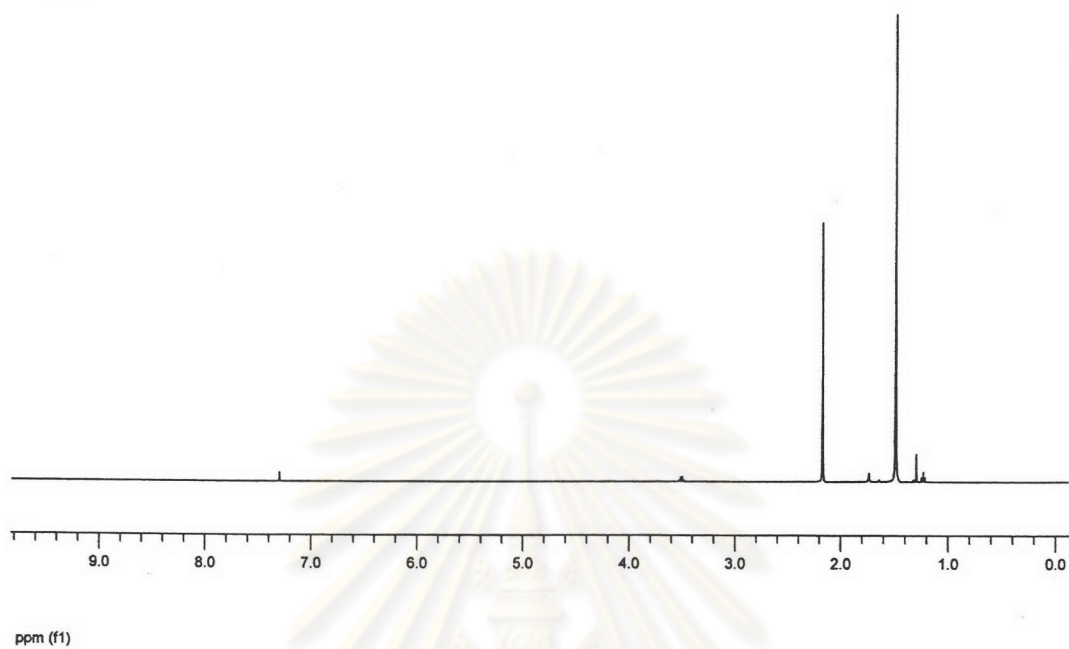


Figure 4  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-*tert*-butoxycarbonyl-aziridine (14)

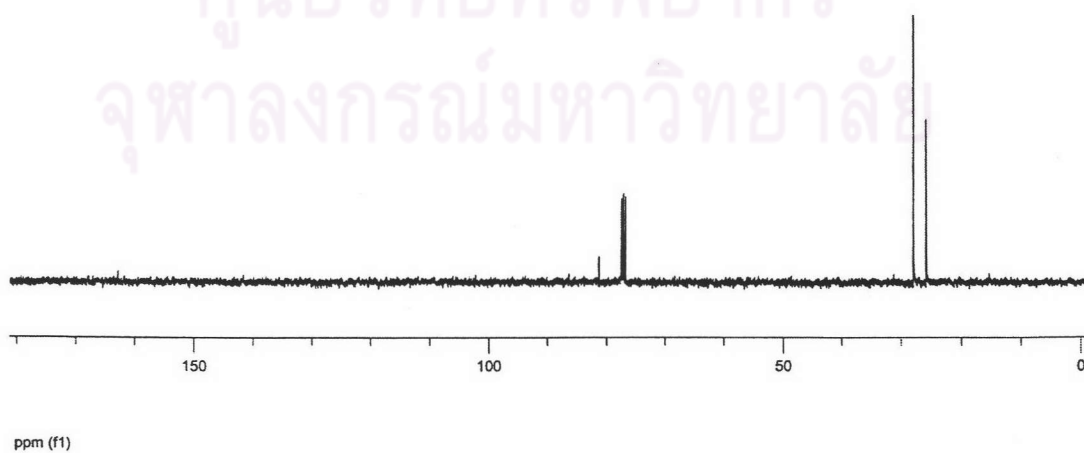
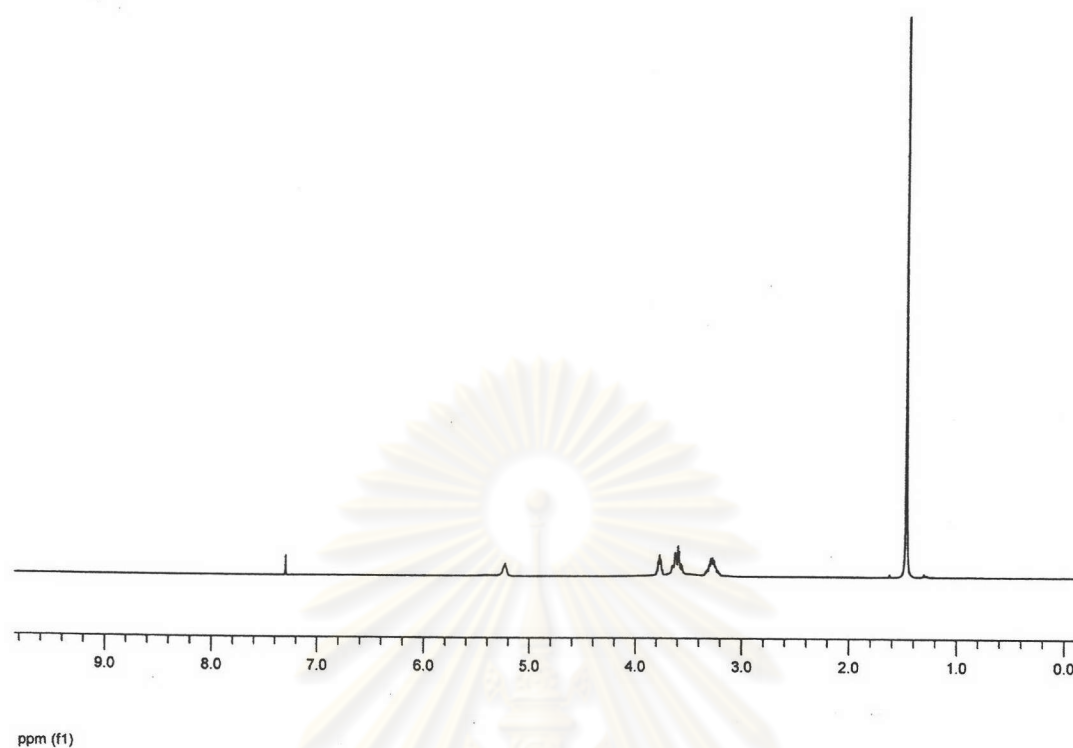
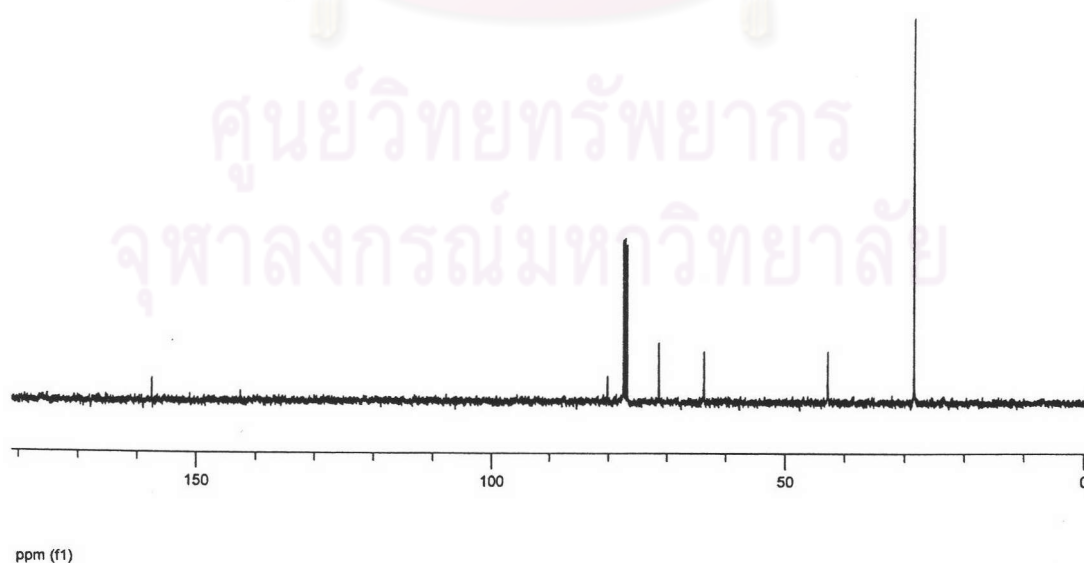


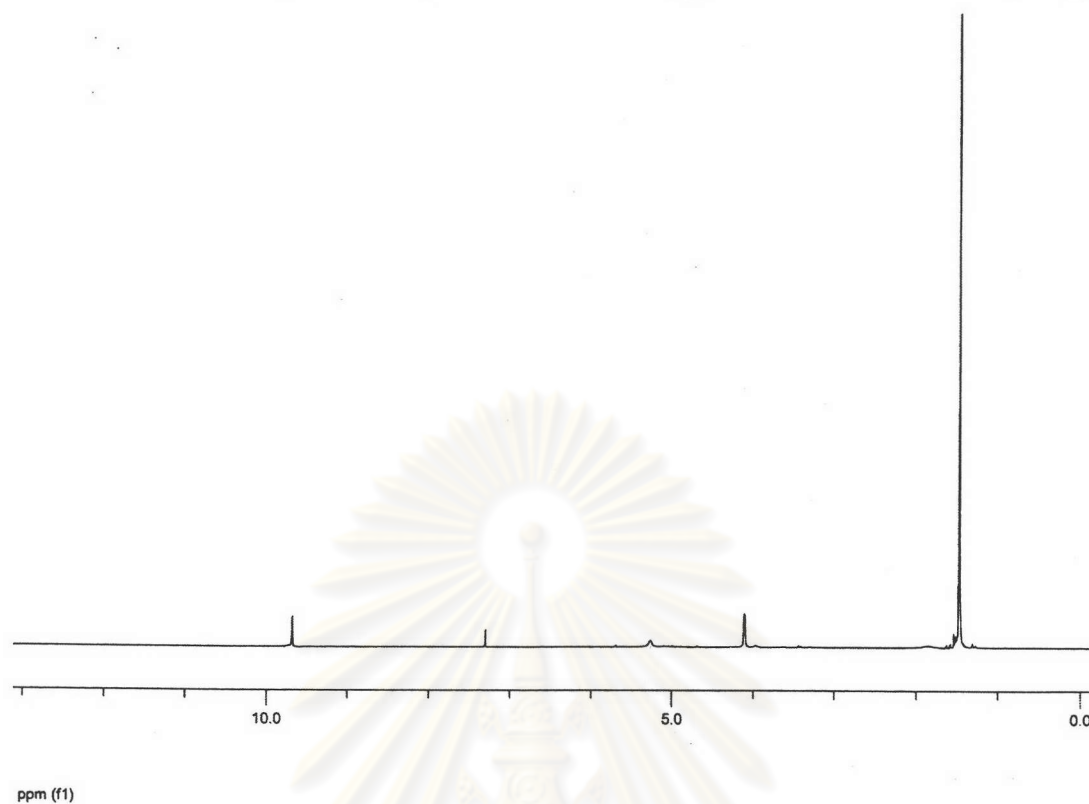
Figure 5  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-*tert*-butoxycarbonyl-aziridine (14)



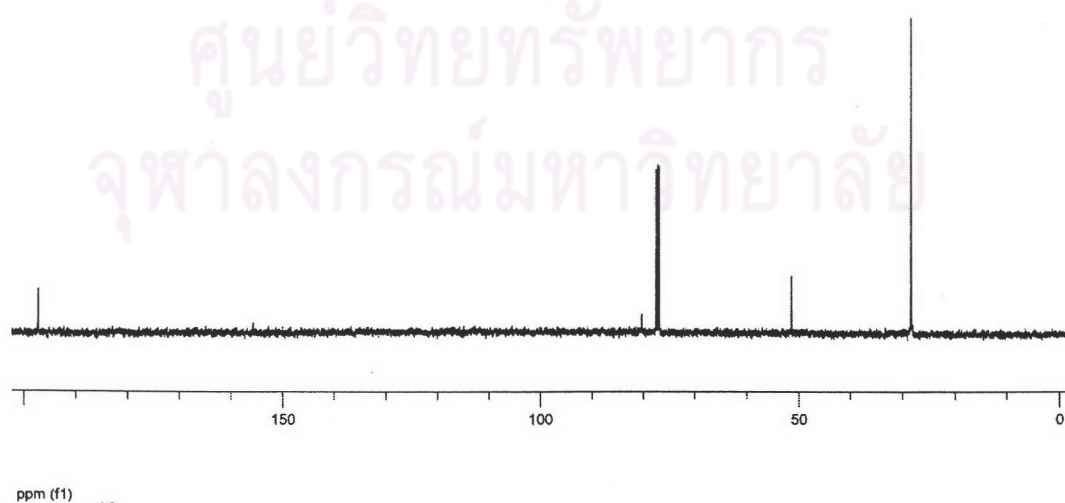
**Figure 6**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-*tert*-butoxycarbonylamino-1,2-propanediol (16)



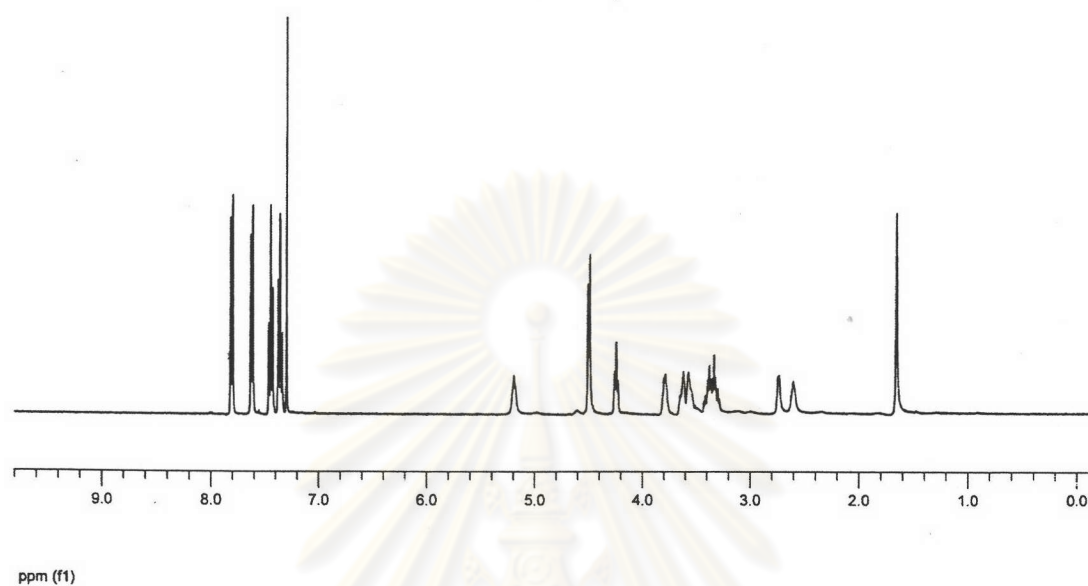
**Figure 7**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-*tert*-butoxycarbonylamino-1,2-propanediol (16)



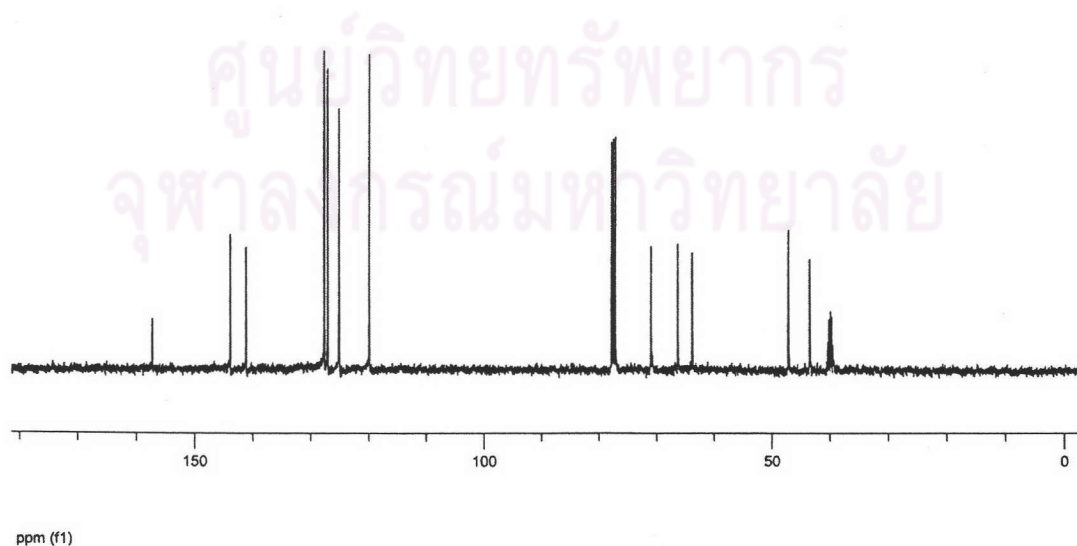
**Figure 8**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-tert-butoxycarbonylaminoacetaldehyde (17)



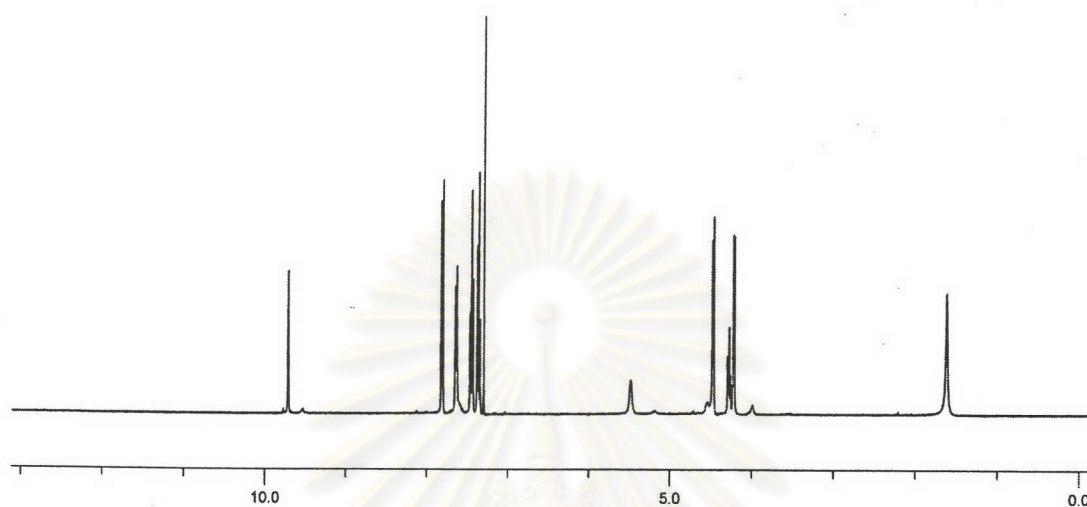
**Figure 9**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-tert-butoxycarbonylaminoacetaldehyde (17)



**Figure 10**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-fluoren-9-ylmethoxycarbonylamino-1,2-propanediol (18)

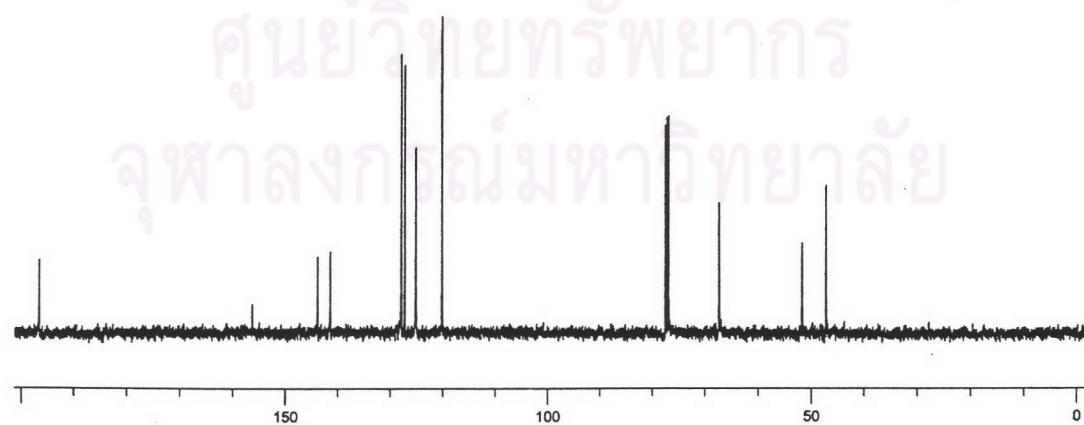


**Figure 11**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$  and DMSO) of *N*-fluoren-9-ylmethoxy carbonylamino-1,2-propanediol (18)



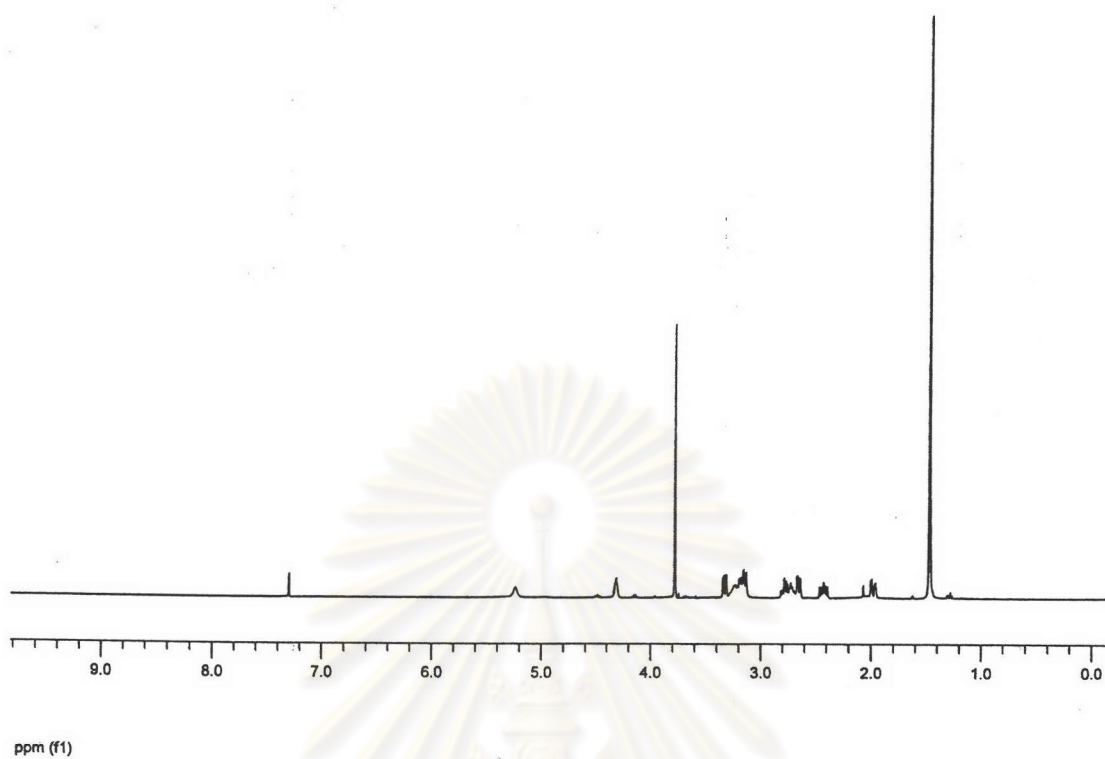
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**Figure 12**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-fluoren-9-ylmethoxycarbonylamino acetaldehyde (**19**)

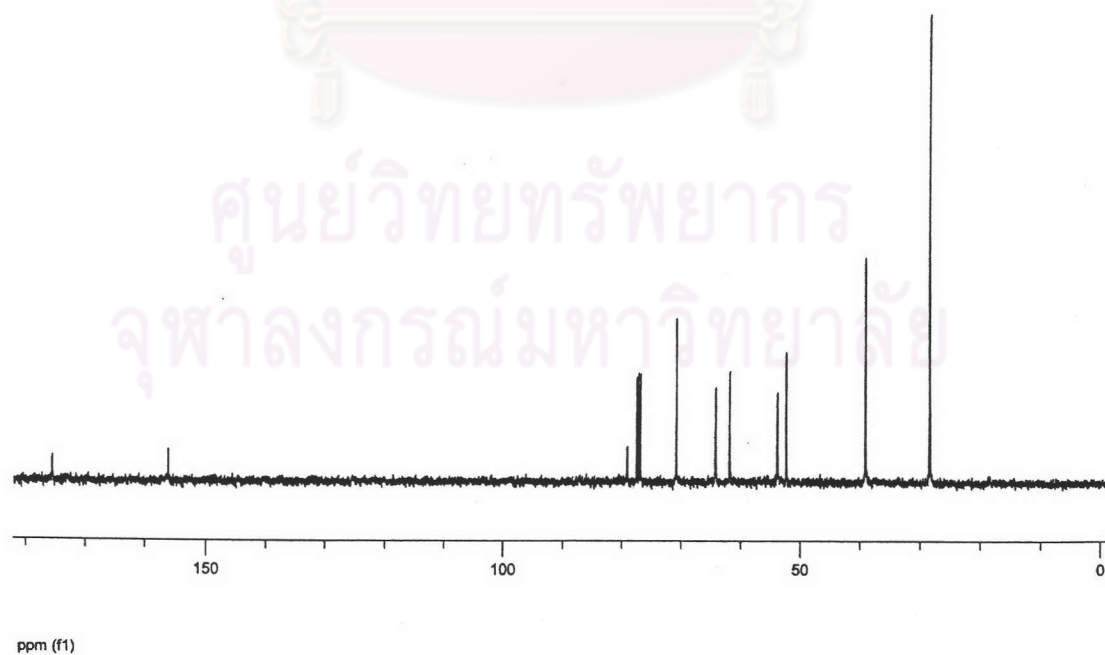


ppm (f1)

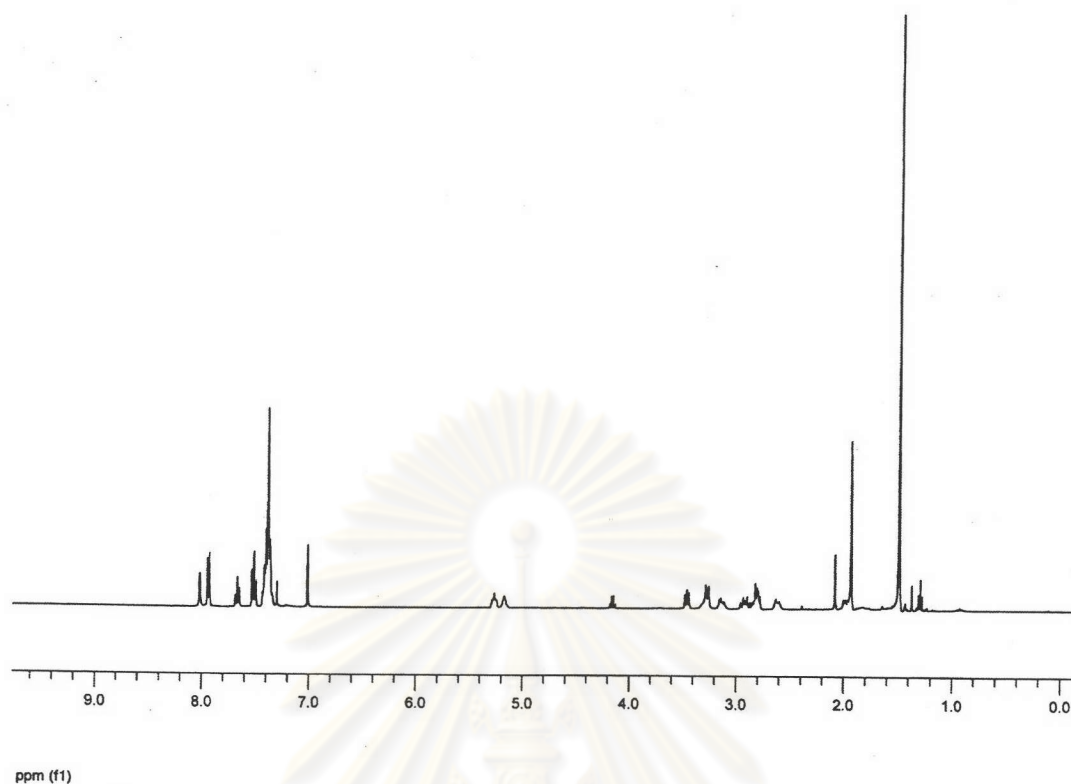
**Figure 13**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-fluoren-9-ylmethoxycarbonylamino acetaldehyde (**19**)



**Figure 14**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-*tert*-butoxycarbonylamino)ethyl-*cis*-4-hydroxy-D-proline methyl ester (20)



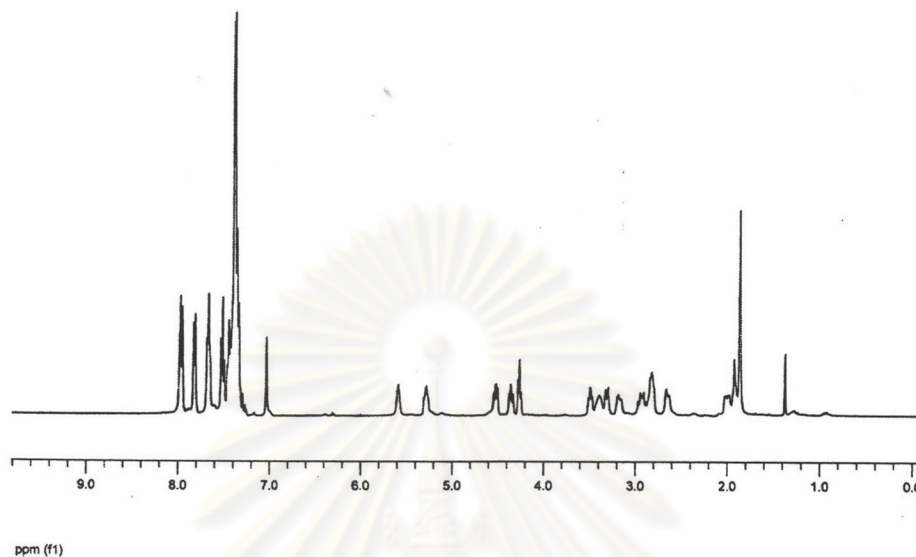
**Figure 15**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-*tert*-butoxycarbonylamino)ethyl-*cis*-4-hydroxy-D-proline methyl ester (20)



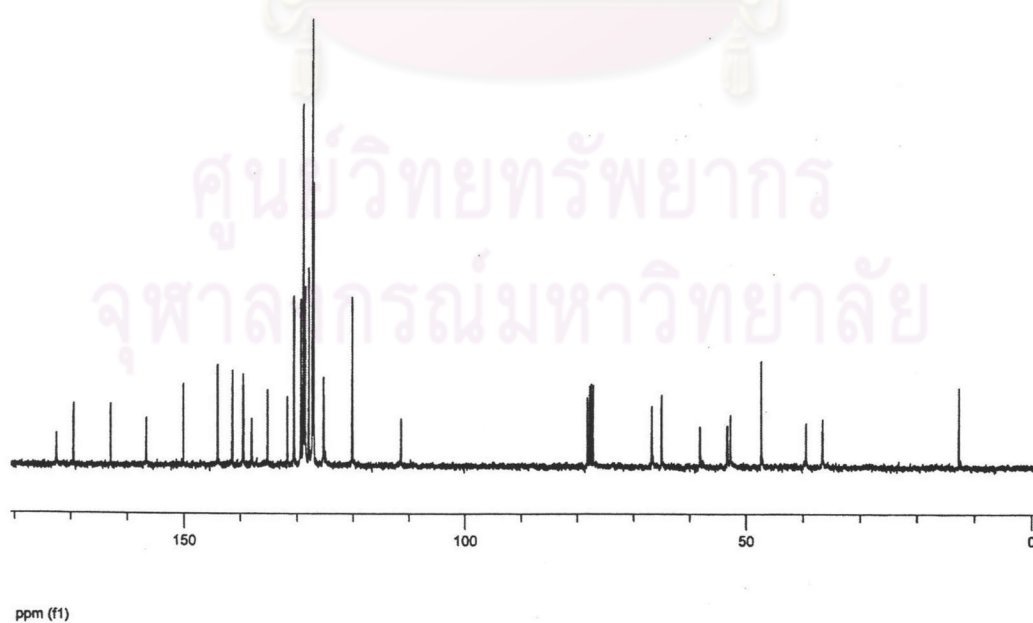
**Figure 16**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-*tert*-butoxycarbonylamino)ethyl-*cis*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-*L*-proline diphenylmethyl ester (**22**)

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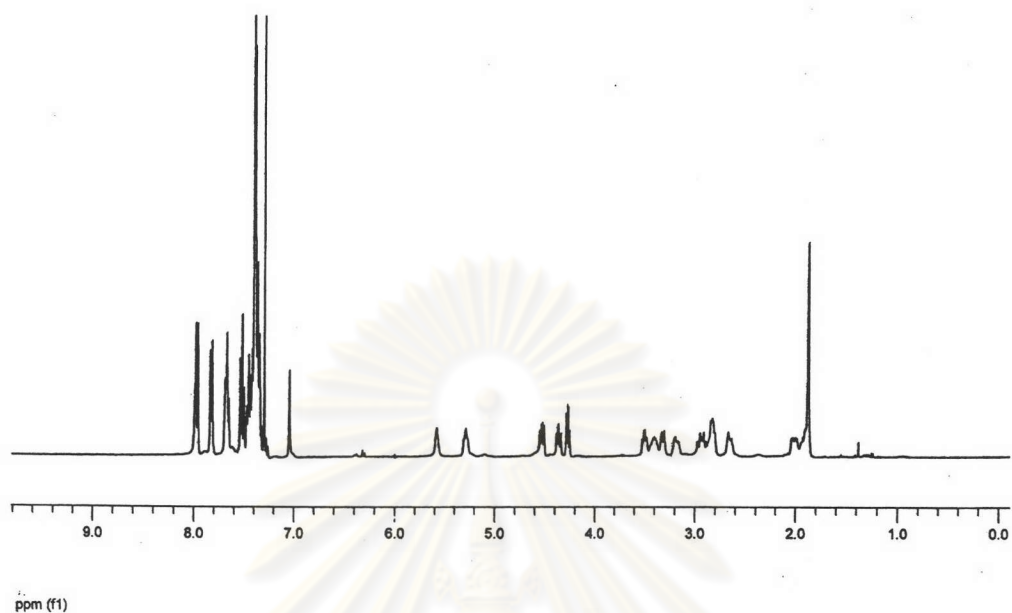




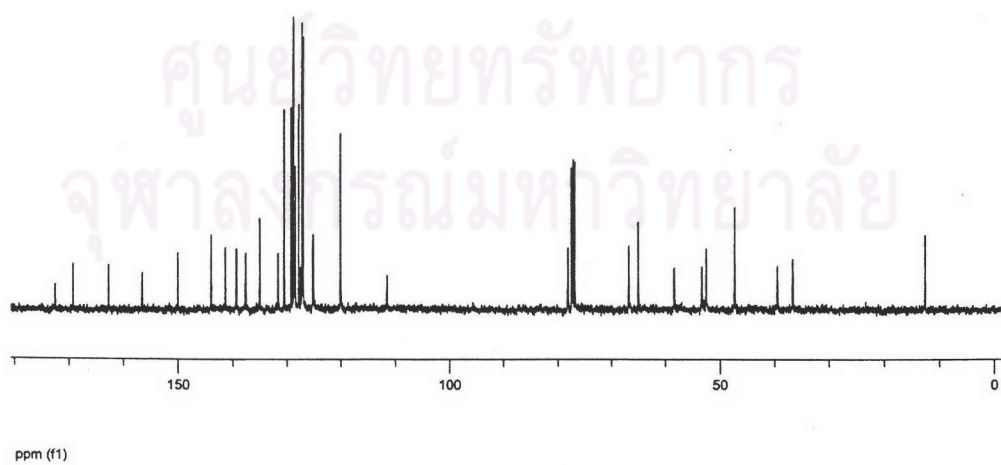
**Figure 17**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^3$ -benzoylthymine-1-yl)-*D*-proline diphenylmethyl ester (**23**)



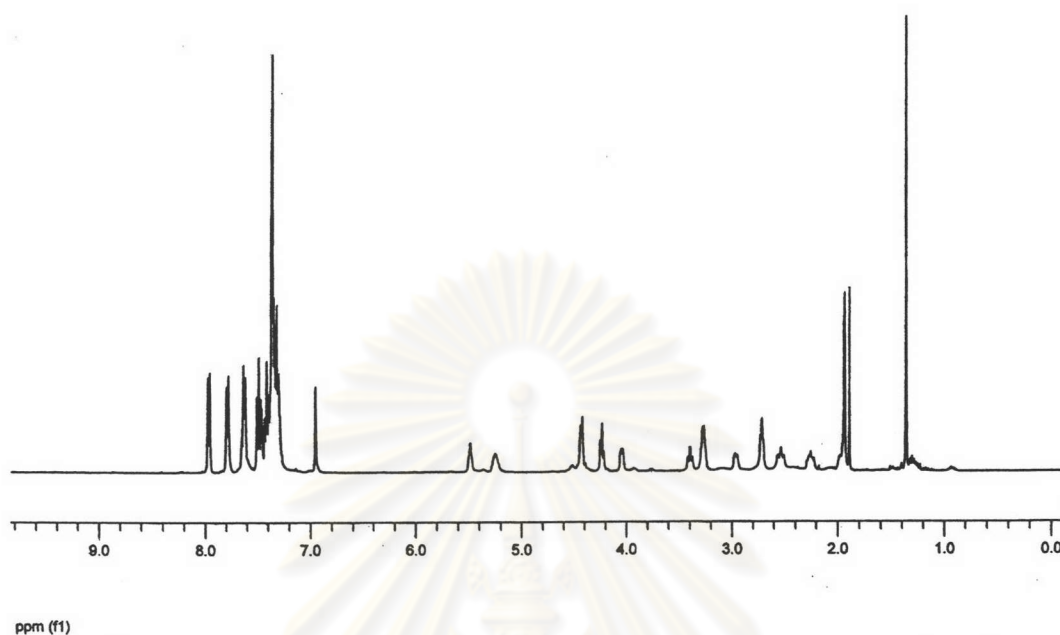
**Figure 18**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^3$ -benzoylthymine-1-yl)-*D*-proline diphenylmethyl ester (**23**)



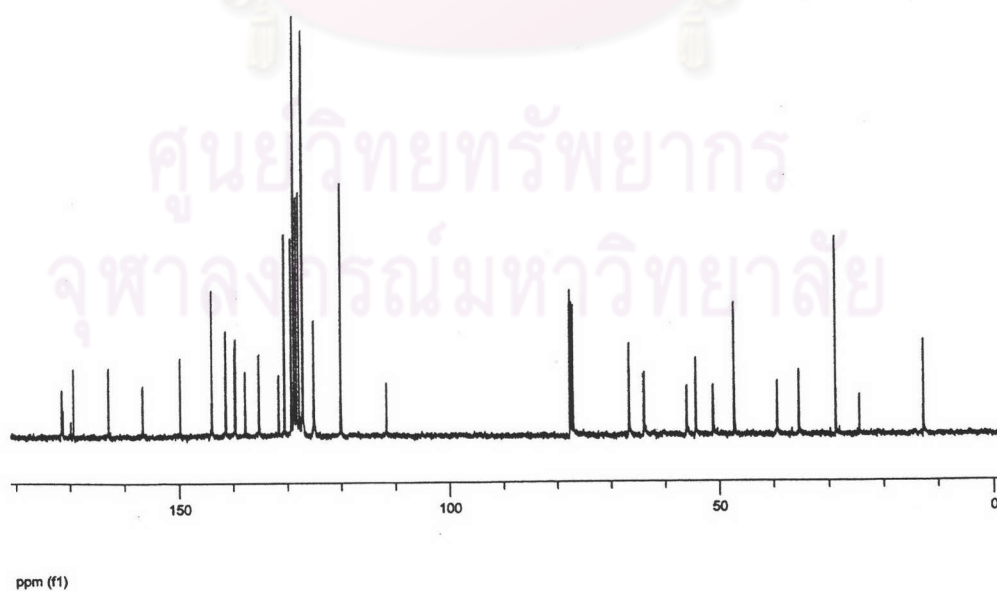
**Figure 19**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-L-proline diphenylmethyl ester (**24**)



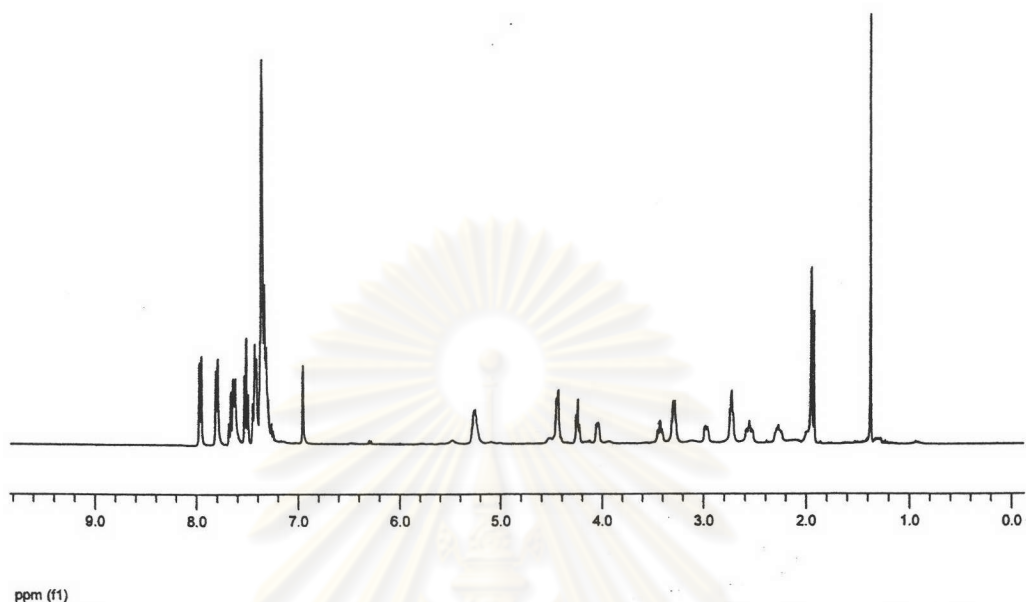
**Figure 20**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-L-proline diphenylmethyl ester (**24**)



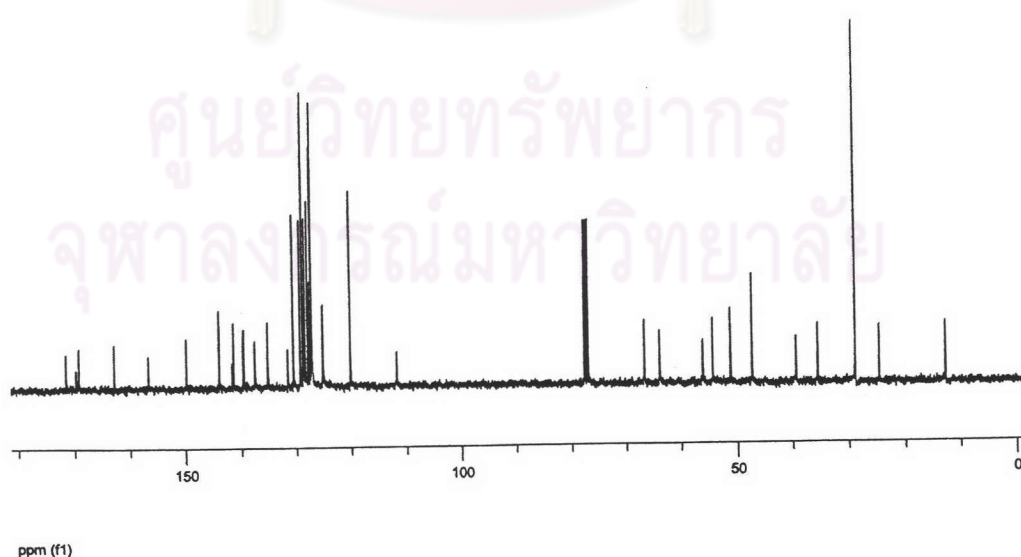
**Figure 21**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-*D*-proline diphenylmethyl ester (**25**)



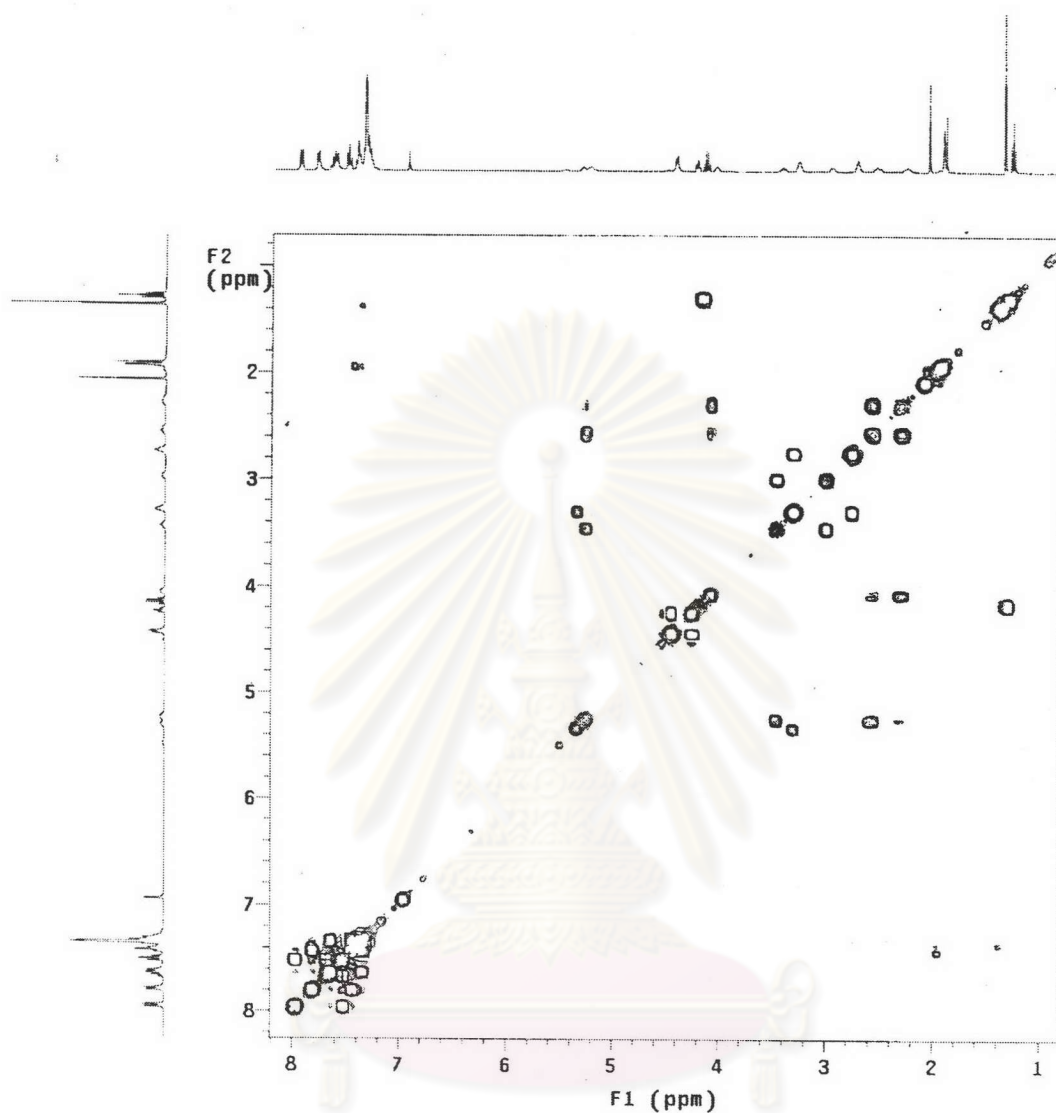
**Figure 22**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-*D*-proline diphenylmethyl ester (**25**)



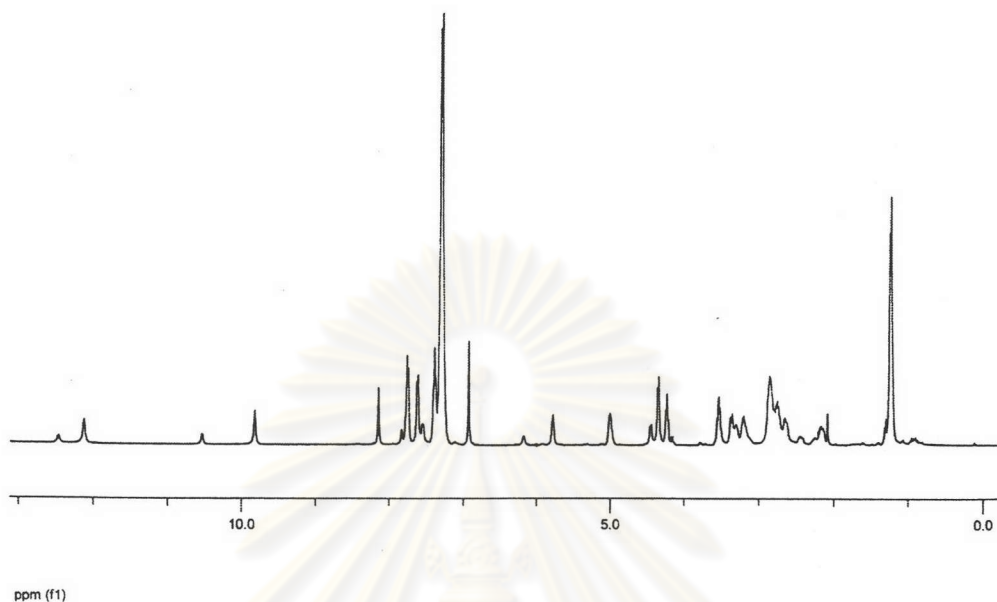
**Figure 23**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-L-proline diphenylmethyl ester (**26**)



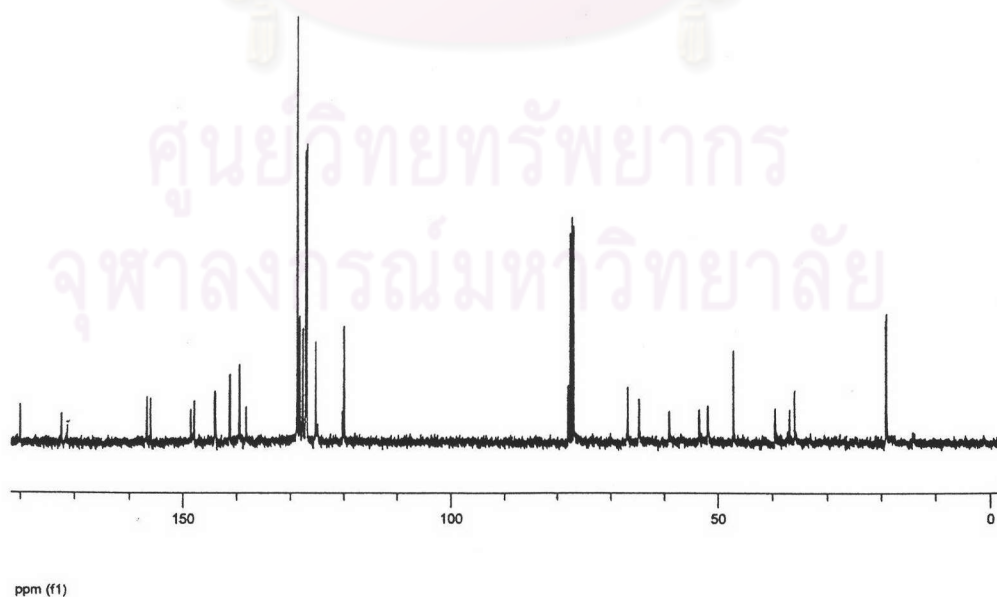
**Figure 24**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-L-proline diphenylmethyl ester (**26**)



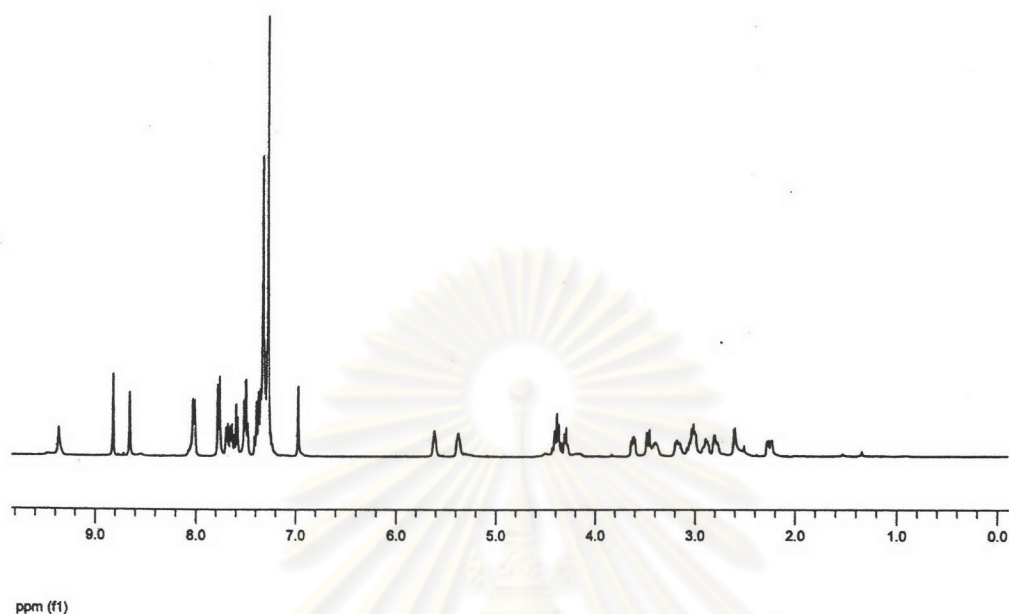
**Figure 25**  $^1\text{H}$ - $^1\text{H}$  COSY NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxy carbonylamino)ethyl-*trans*-4-(*N*<sup>3</sup>-benzoylthymine-1-yl)-*L*-proline diphenylmethyl ester (**26**)



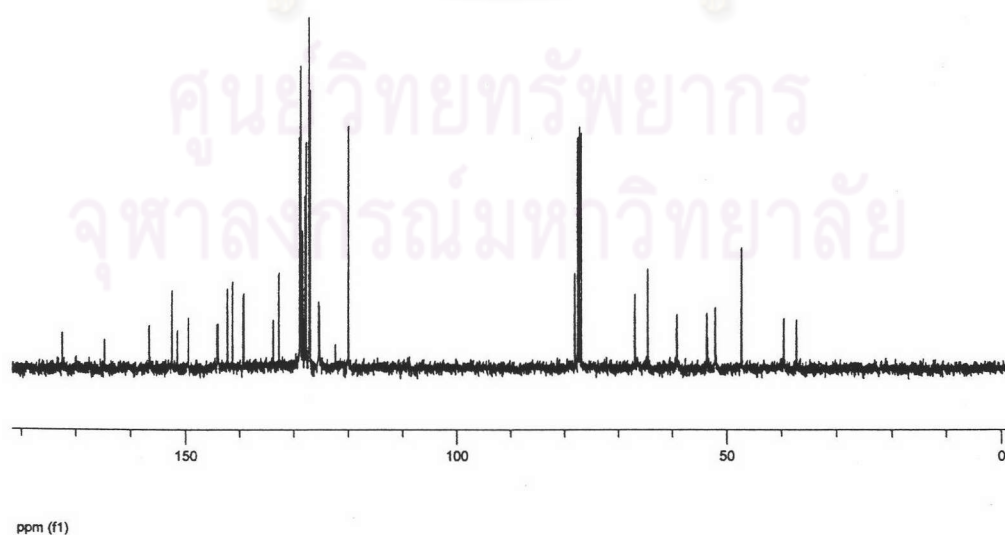
**Figure 26**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^2$ -isobutyrylguanin-9-yl)-*D*-proline diphenylmethyl ester (**27**)



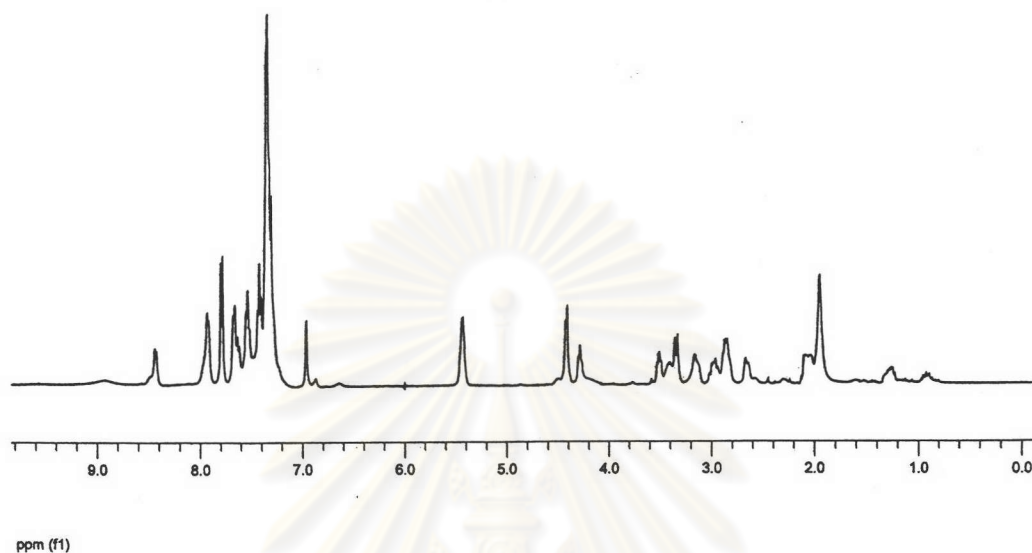
**Figure 27**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^2$ -isobutyrylguanin-9-yl)-*D*-proline diphenylmethyl ester (**27**)



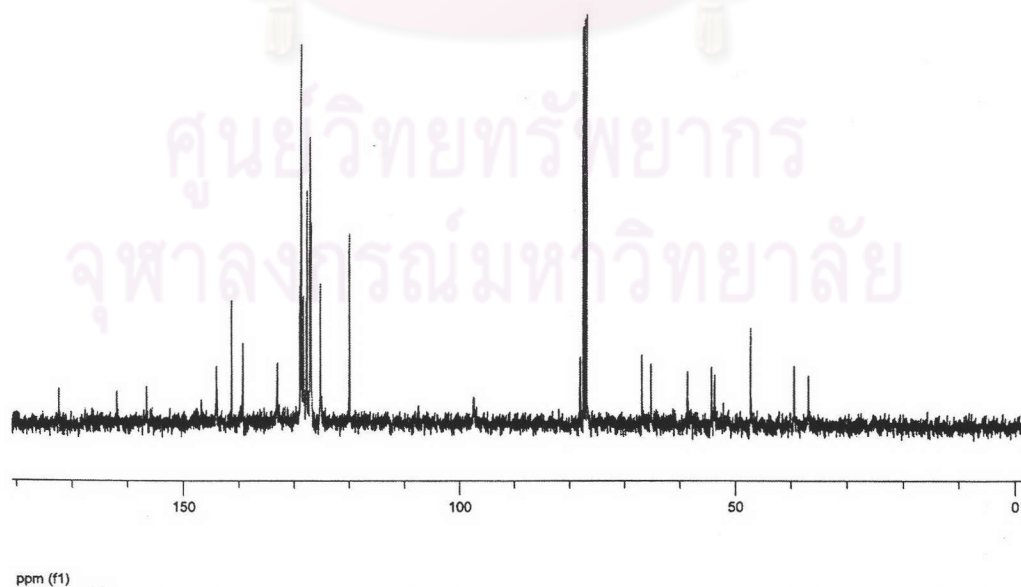
**Figure 28**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoyladenin-9-yl)-*D*-proline diphenylmethyl ester (**28**)



**Figure 29**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoyladenin-9-yl)-*D*-proline diphenylmethyl ester (**28**)

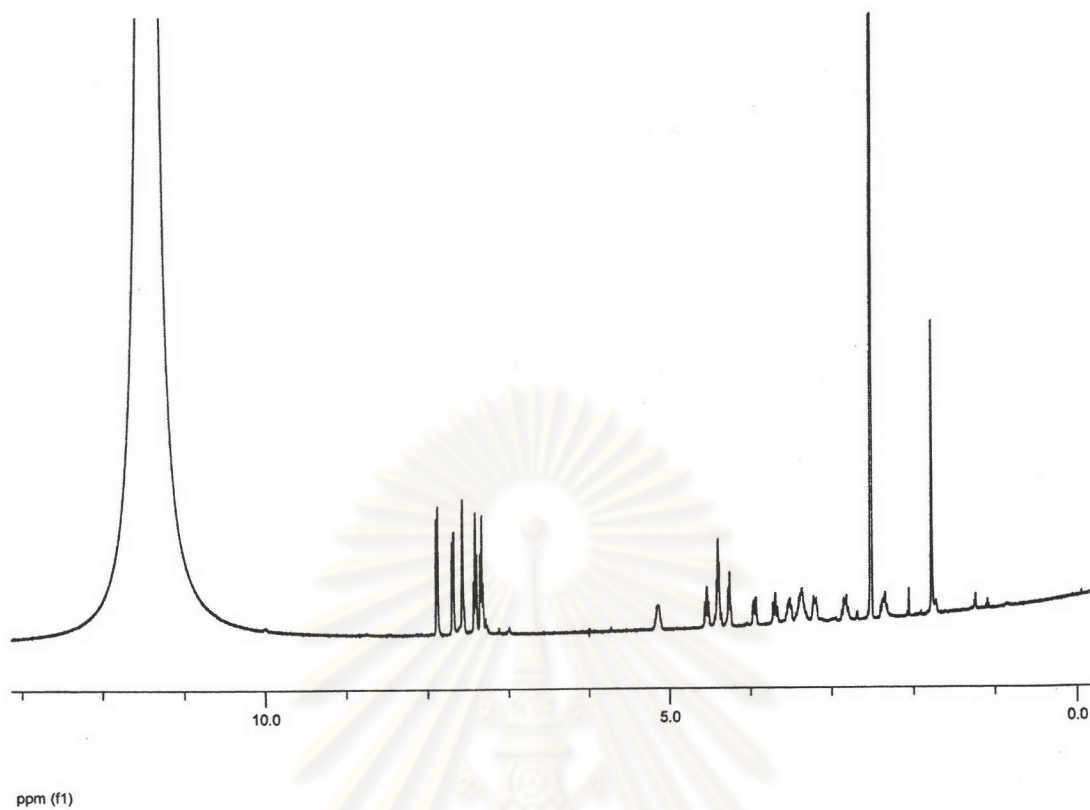


**Figure 30**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoylcytosin-1-yl)-*D*-proline diphenylmethyl ester (**29**)

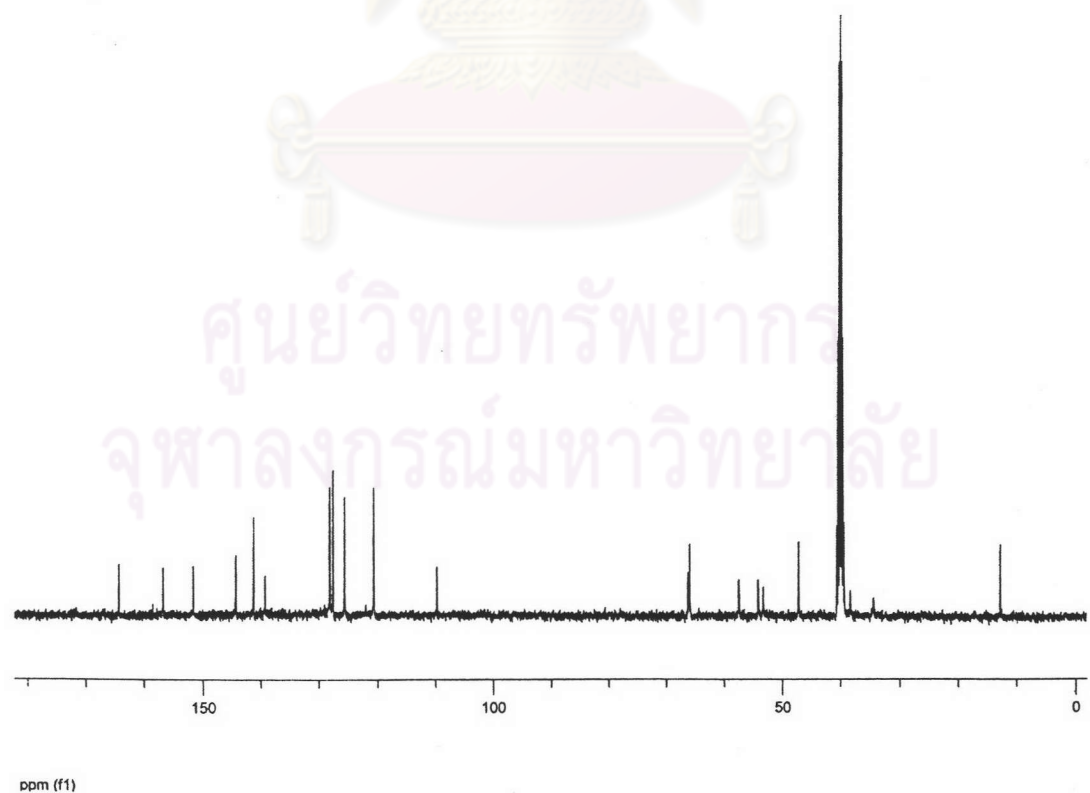


**Figure 31**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoylcytosin-1-yl)-*D*-proline diphenylmethyl ester (**29**)

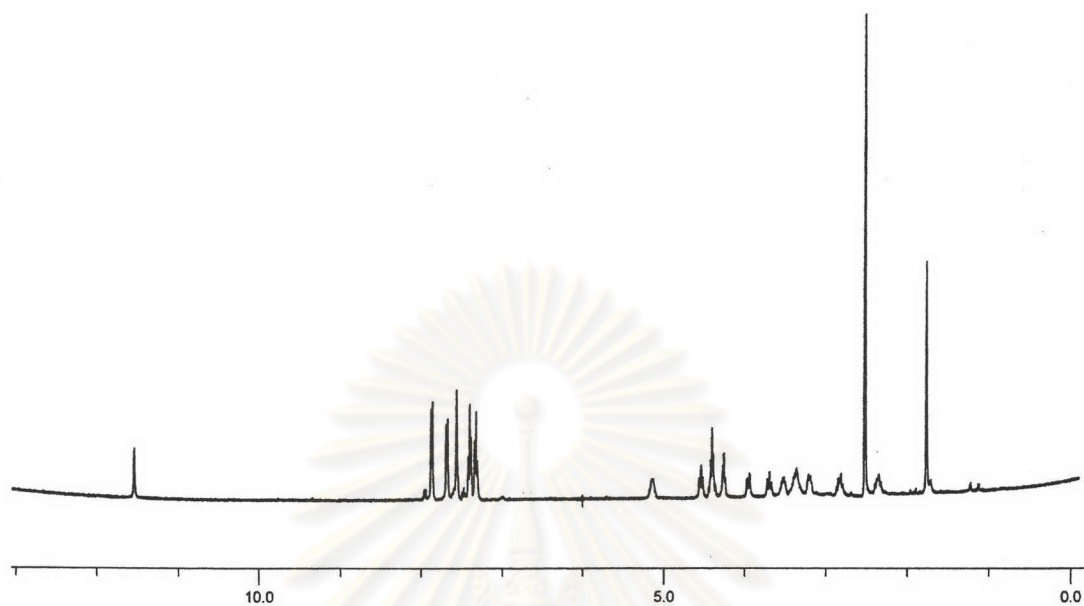




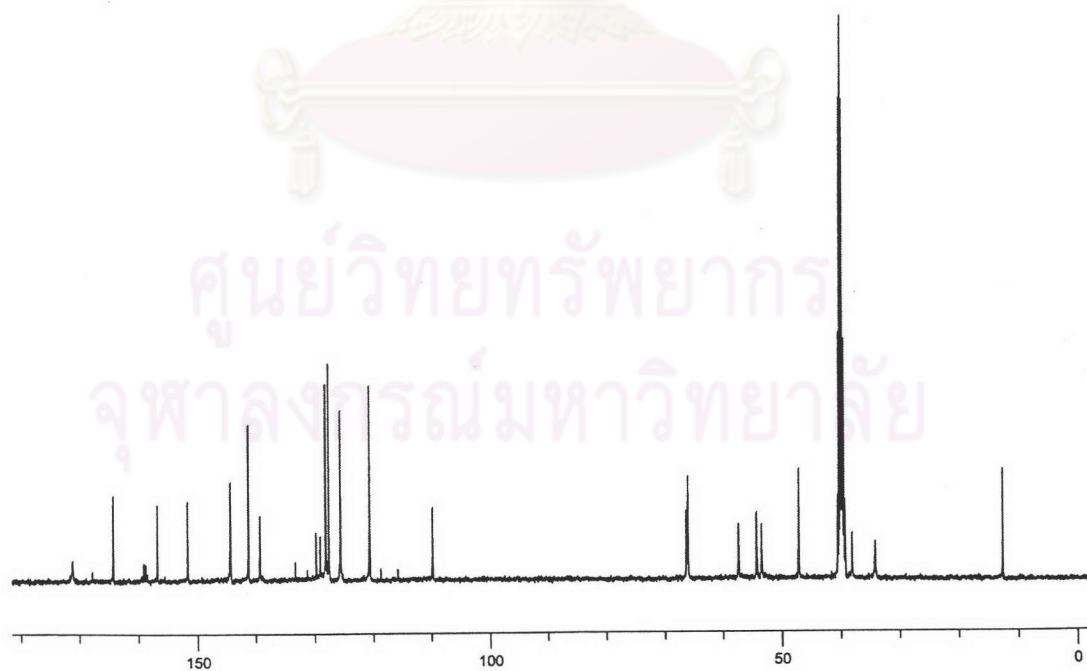
**Figure 32**  $^1\text{H}$  NMR spectrum (DMSO- $d_6$  + 1 drop TFA) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*cis*-4-(thymine-1-yl)-D-proline (**30**)



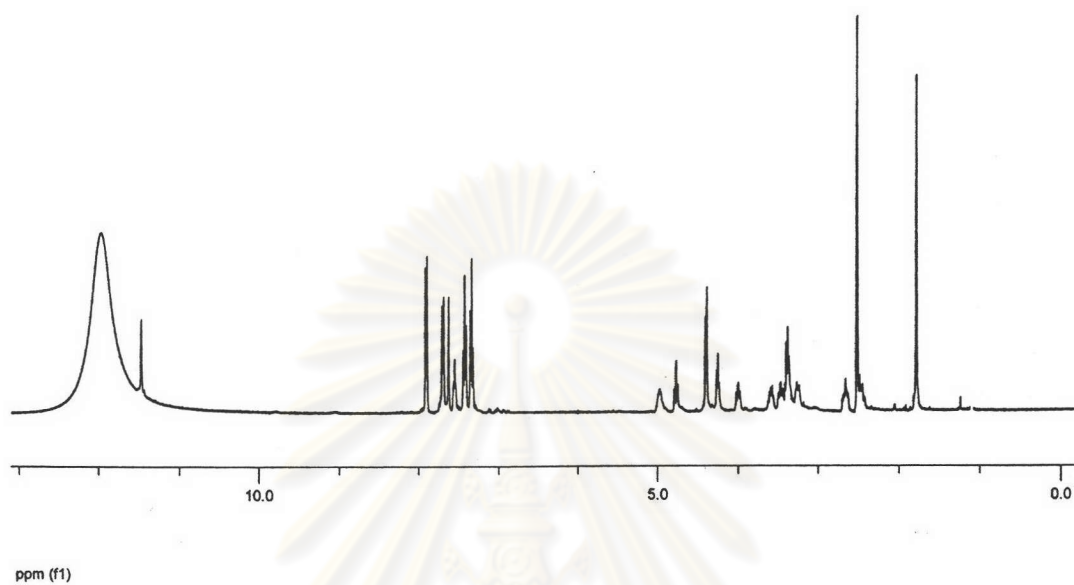
**Figure 33**  $^{13}\text{C}$  NMR spectrum (DMSO- $d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*cis*-4-(thymine-1-yl)-D-proline (**30**)



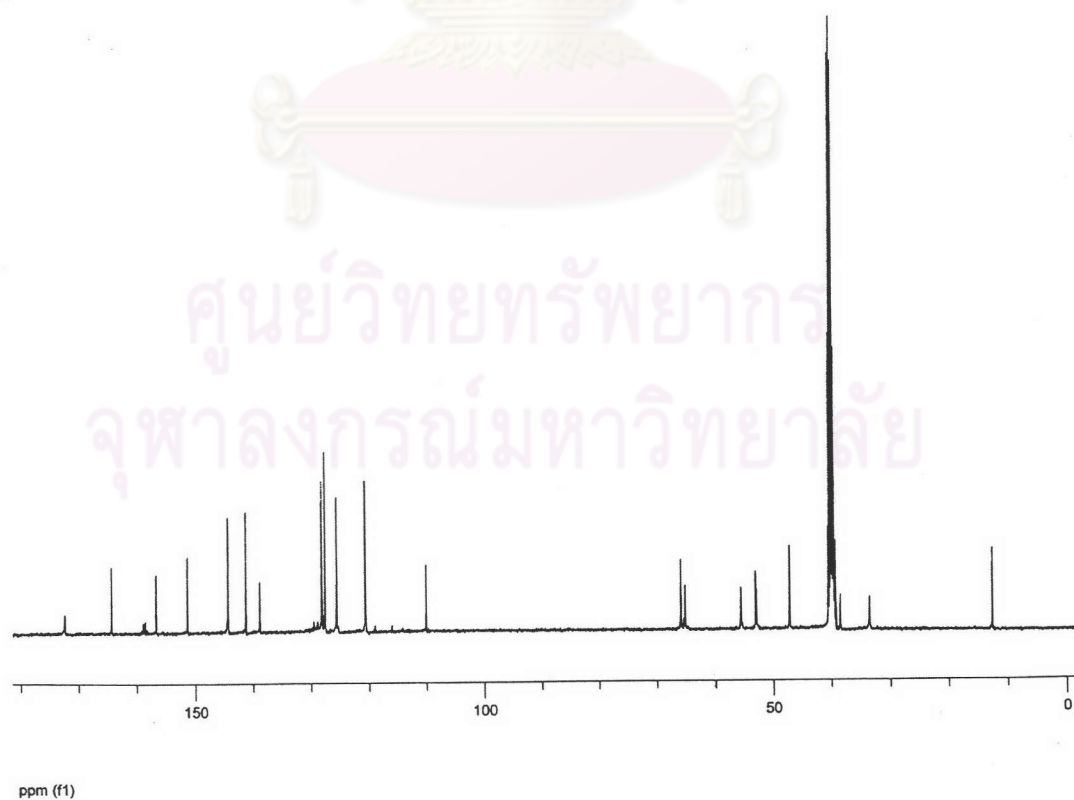
ppm (f1),  
**Figure 34**  $^1\text{H}$  NMR spectrum (DMSO- $d_6$  + 1 drop TFA) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*cis*-4-(thymine-1-yl)-L-proline (**31**)



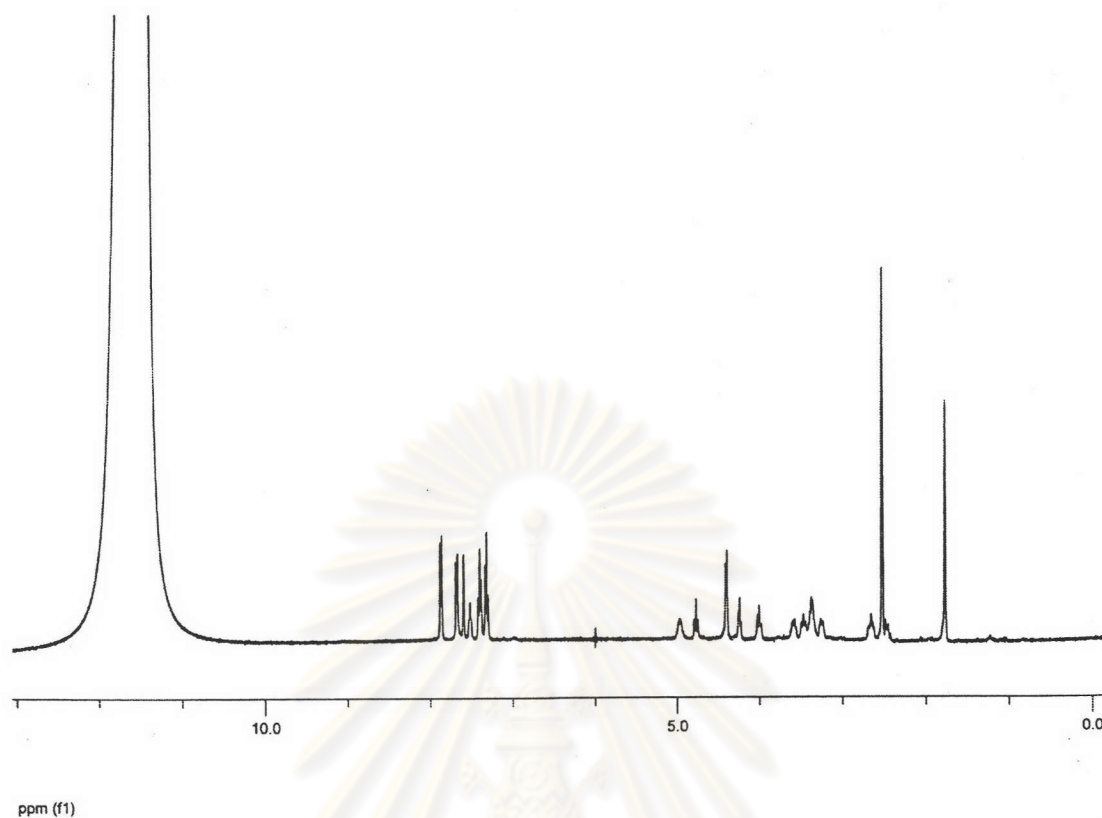
ppm (f1)  
**Figure 35**  $^{13}\text{C}$  NMR spectrum (DMSO- $d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*cis*-4-(thymine-1-yl)-L-proline (**31**)



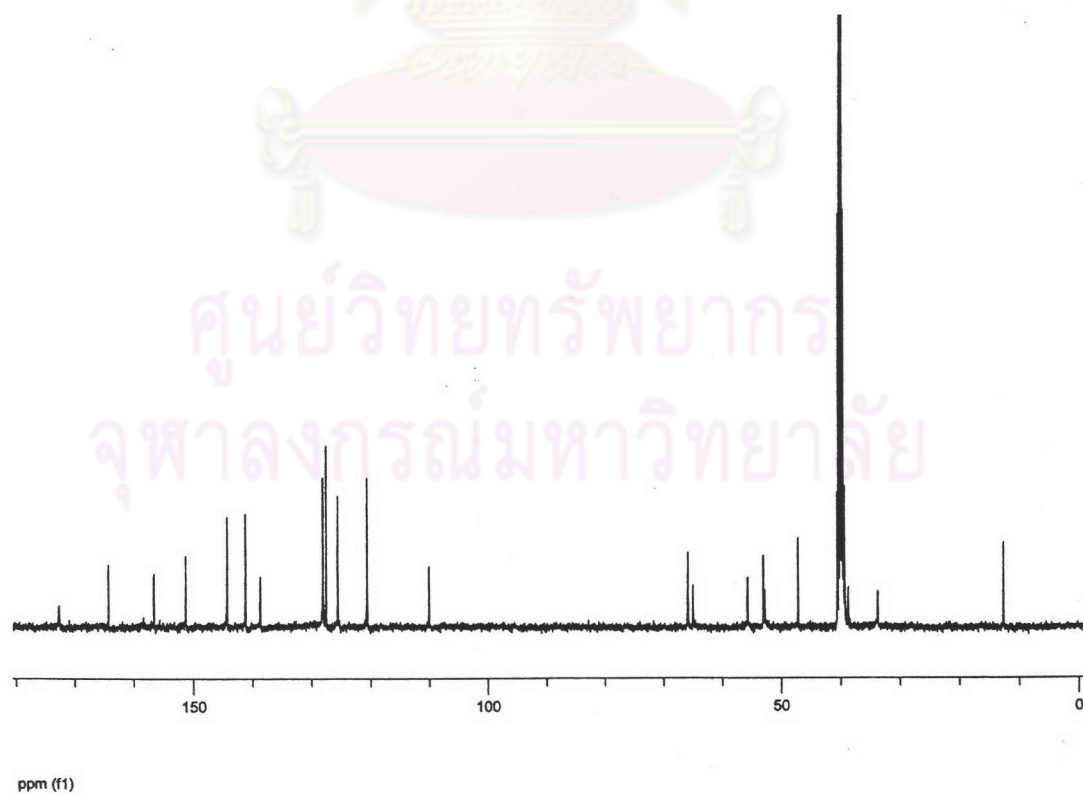
**Figure 36**  $^1\text{H}$  NMR spectrum (DMSO- $d_6$  + 1 drop TFA) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*trans*-4-(thymine-1-yl)-D-proline (**32**)



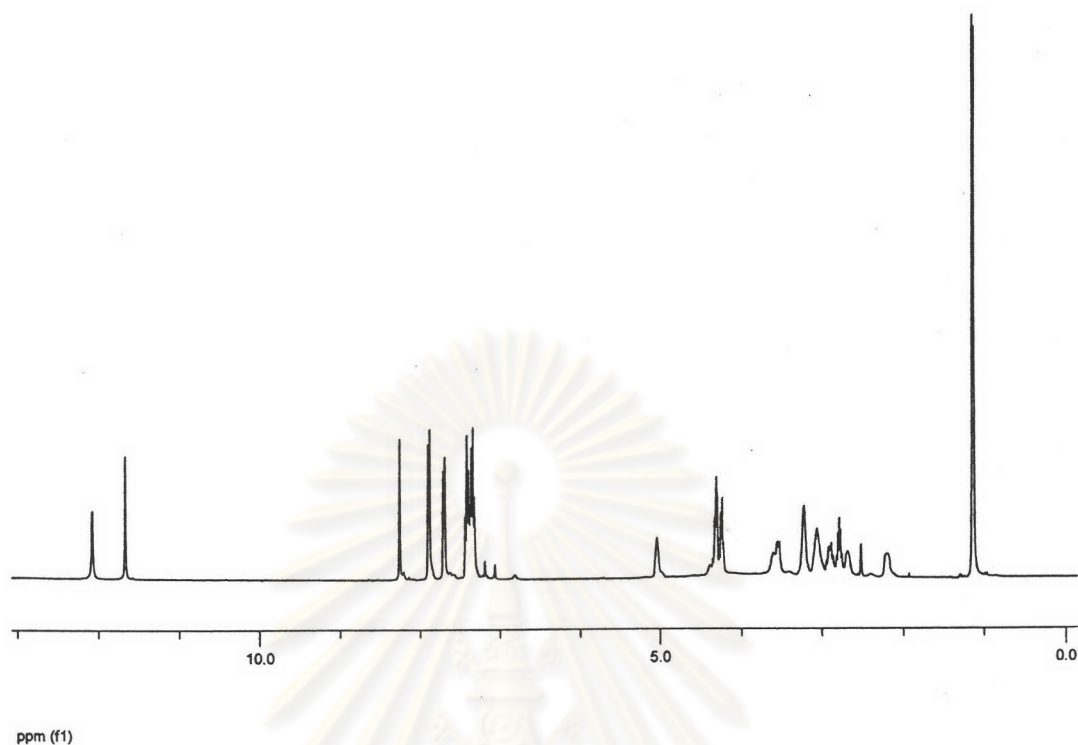
**Figure 37**  $^{13}\text{C}$  NMR spectrum (DMSO- $d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*trans*-4-(thymine-1-yl)-D-proline (**32**)



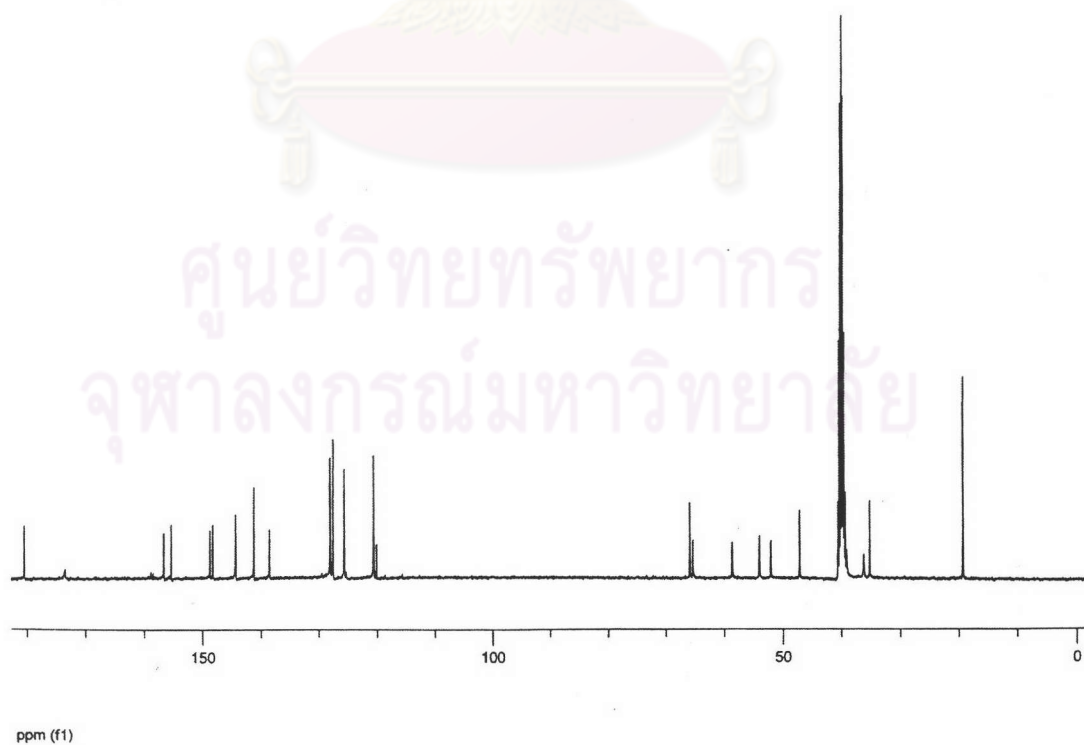
**Figure 38**  $^1\text{H}$  NMR spectrum ( $\text{DMSO-}d_6$  + 1 drop TFA) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*trans*-4-(thymine-1-yl)-L-proline (**33**)



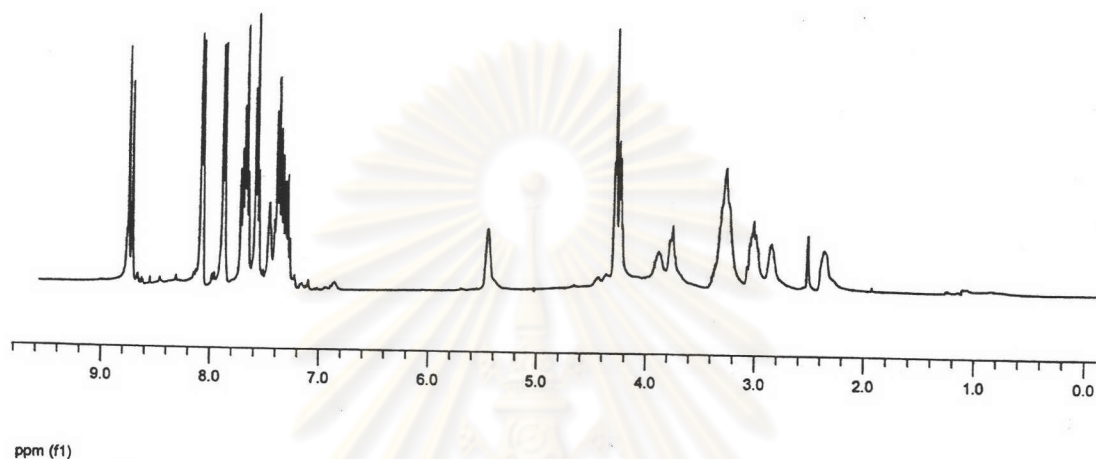
**Figure 39**  $^{13}\text{C}$  NMR spectrum ( $\text{DMSO-}d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonylamino)ethyl-*trans*-4-(thymine-1-yl)-L-proline (**33**)



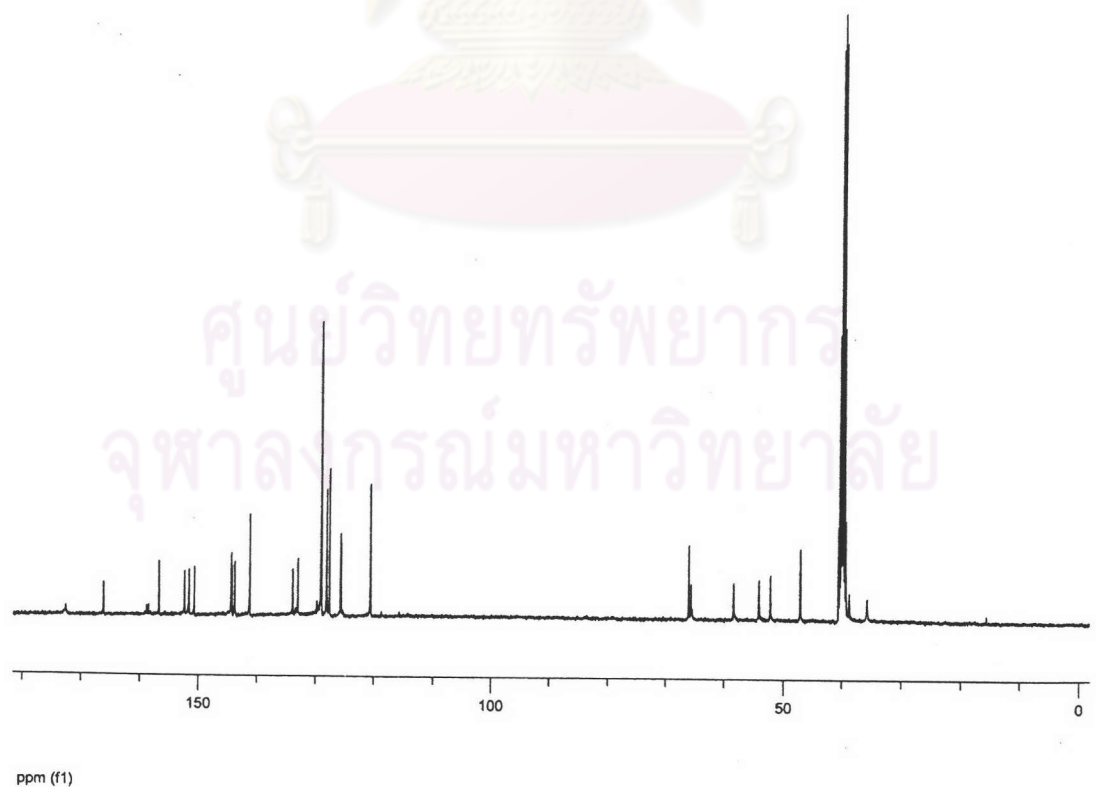
**Figure 40**  $^1\text{H}$  NMR spectrum (DMSO- $d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^2$ -isobutyrylguanin-9-yl)-D-proline (**34**)



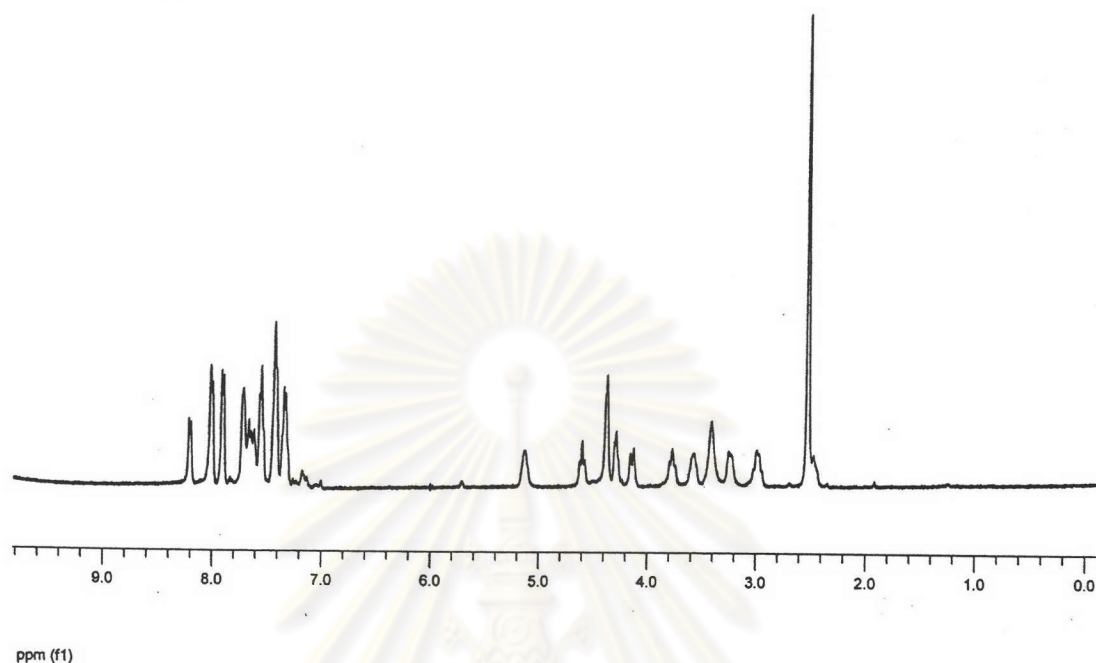
**Figure 41**  $^{13}\text{C}$  NMR spectrum (DMSO- $d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^2$ -isobutyrylguanin-9-yl)-D-proline (**34**)



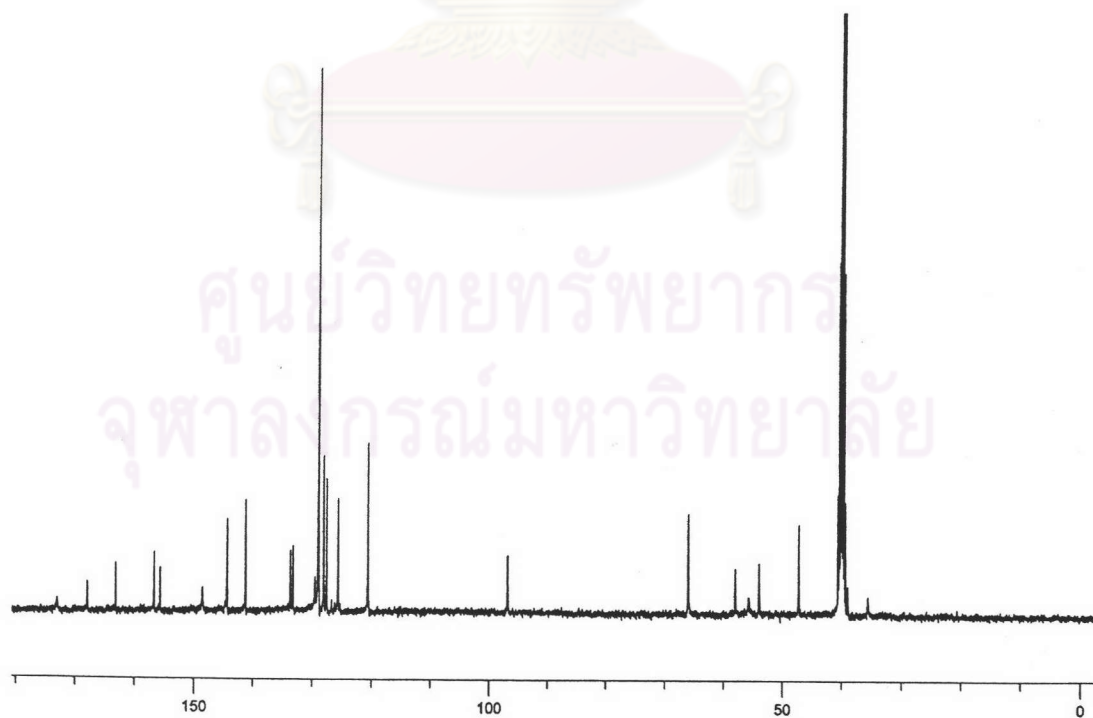
**Figure 42**  $^1\text{H}$  NMR spectrum ( $\text{DMSO-}d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoyladenine-9-yl)-*D*-proline (**35**)



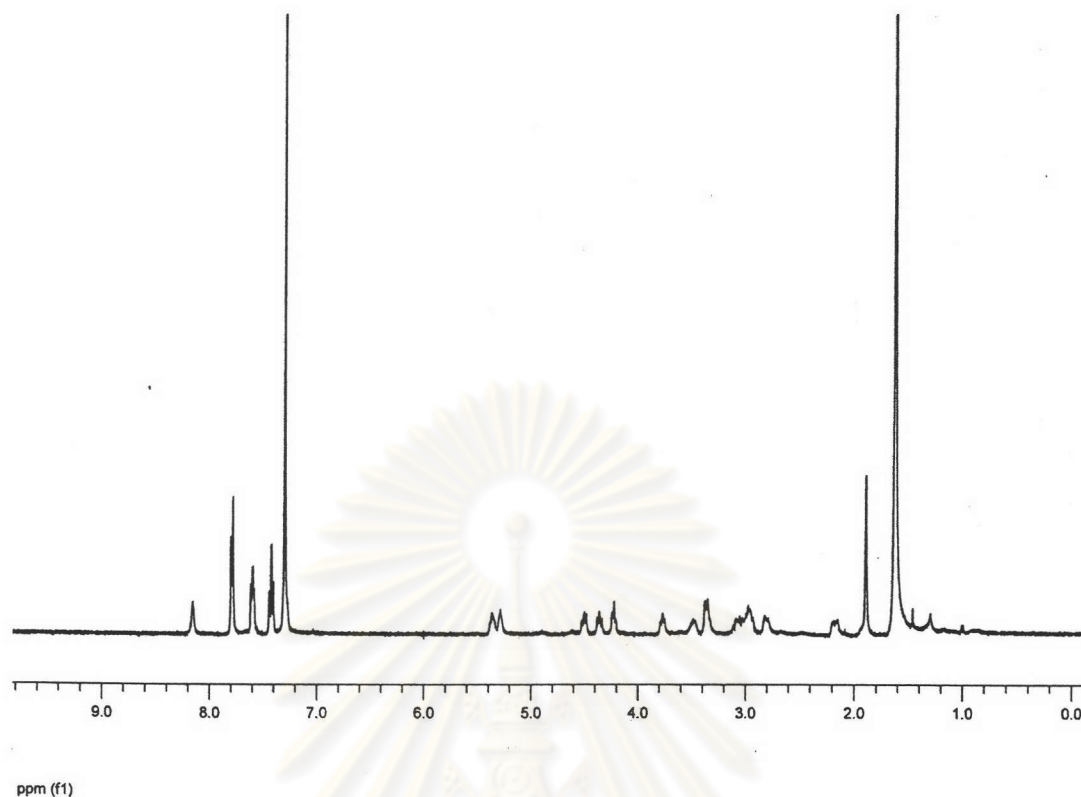
**Figure 43**  $^{13}\text{C}$  NMR spectrum ( $\text{DMSO-}d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoyladenine-9-yl)-*D*-proline (**35**)



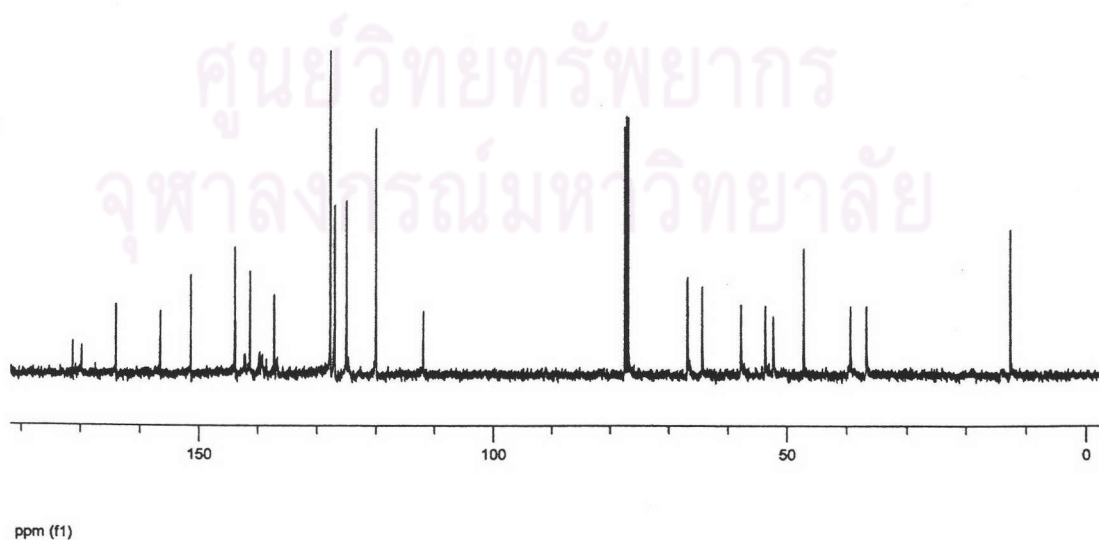
**Figure 44**  $^1\text{H}$  NMR spectrum ( $\text{DMSO-}d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^4$ -benzoylcytosin-1-yl)-*D*-proline (**36**)



**Figure 45**  $^{13}\text{C}$  NMR spectrum ( $\text{DMSO-}d_6$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-( $N^4$ -benzoylcytosin-1-yl)-*D*-proline (**36**)

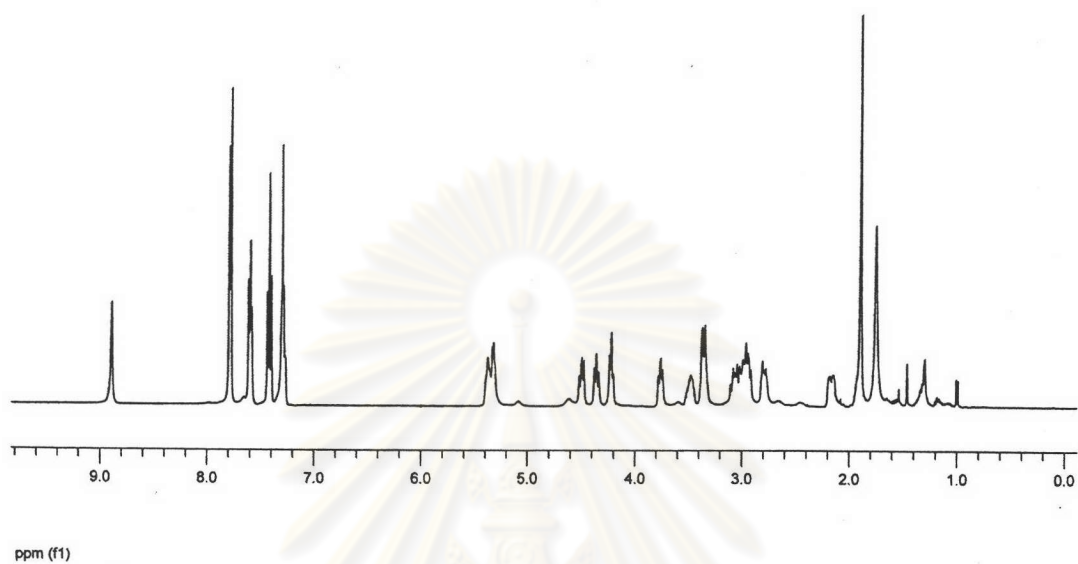


**Figure 46**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(thymine-1-yl)-*D*-proline pentafluorophenyl ester (**37**)

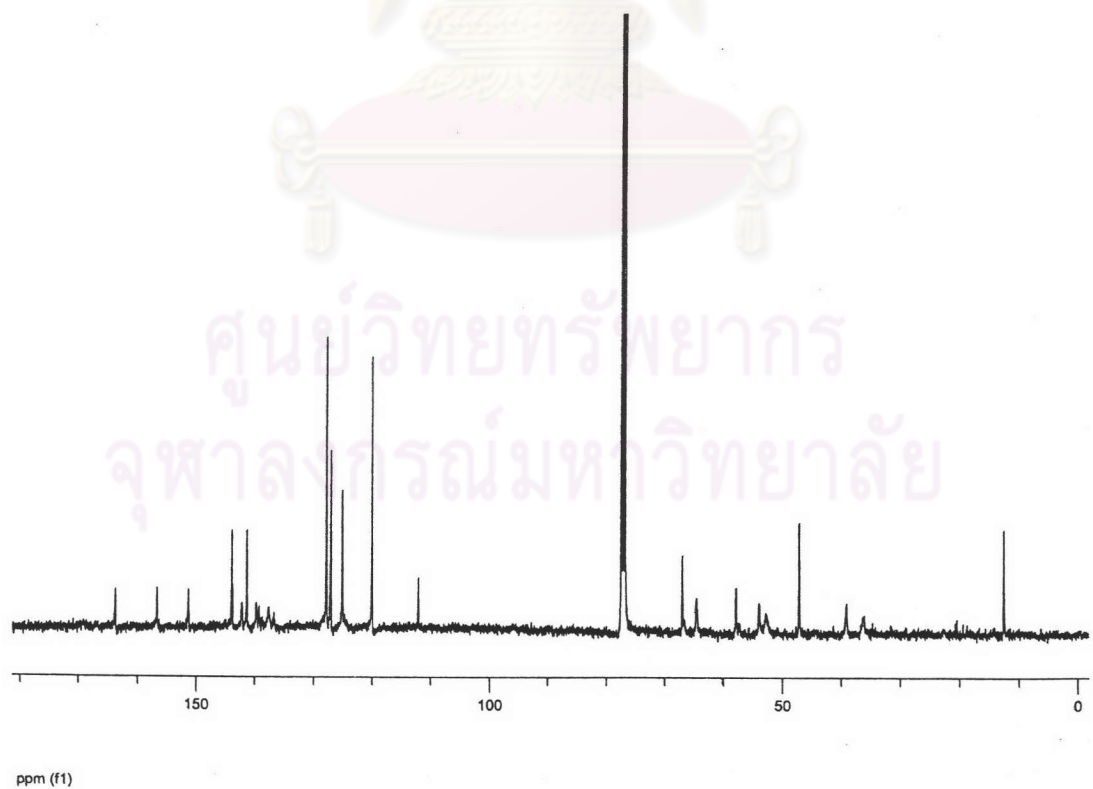


**Figure 47**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(thymine-1-yl)-*D*-proline pentafluorophenyl ester (**37**)

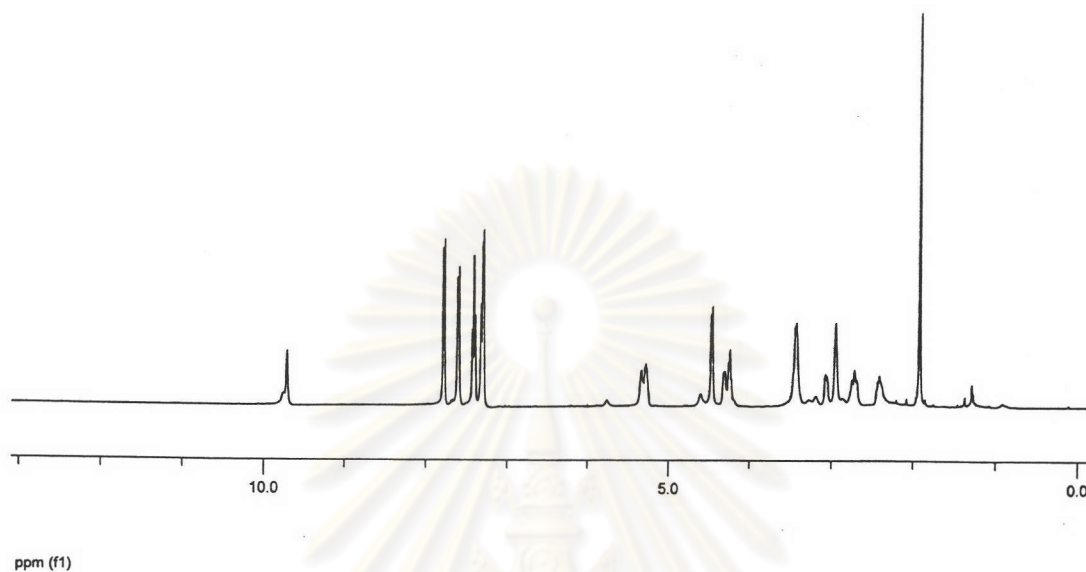




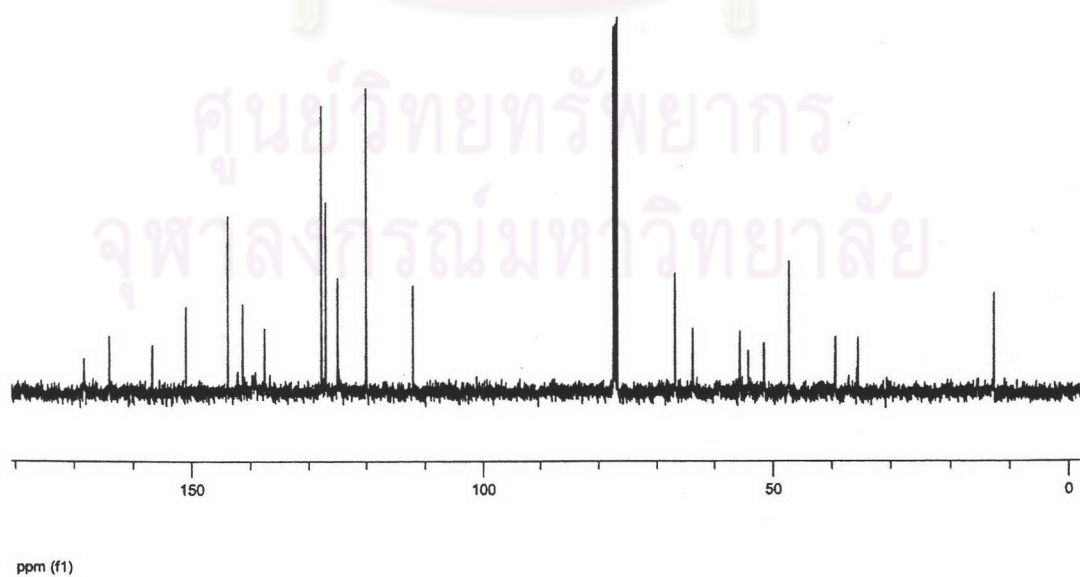
**Figure 48**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(thymine-1-yl)-L-proline pentafluorophenyl ester (**38**)



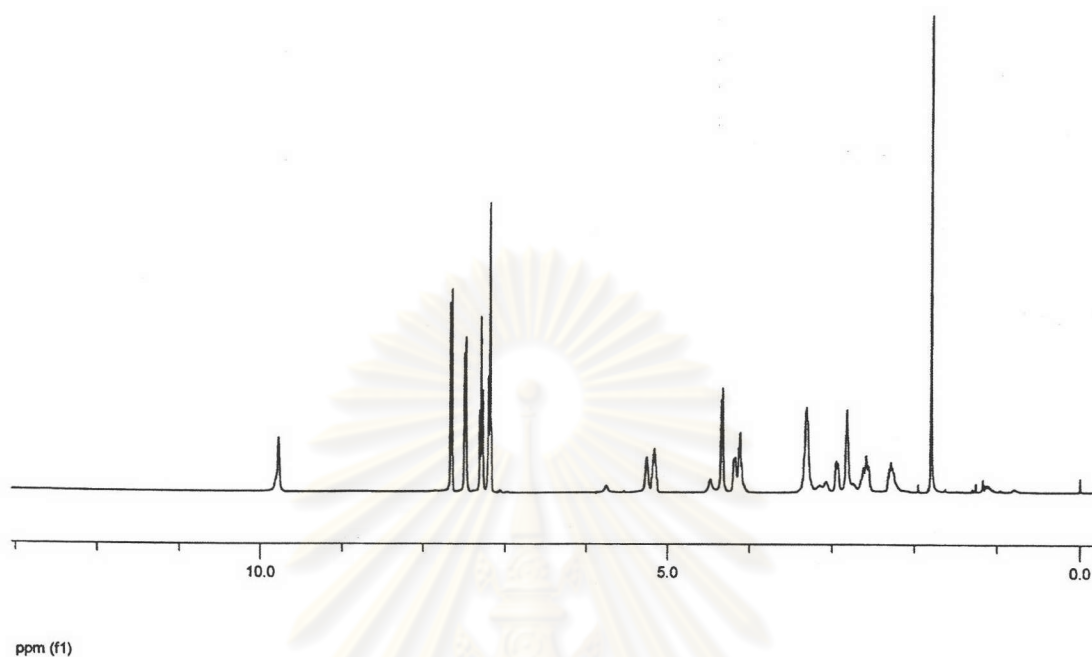
**Figure 49**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(thymine-1-yl)-L-proline pentafluorophenyl ester (**38**)



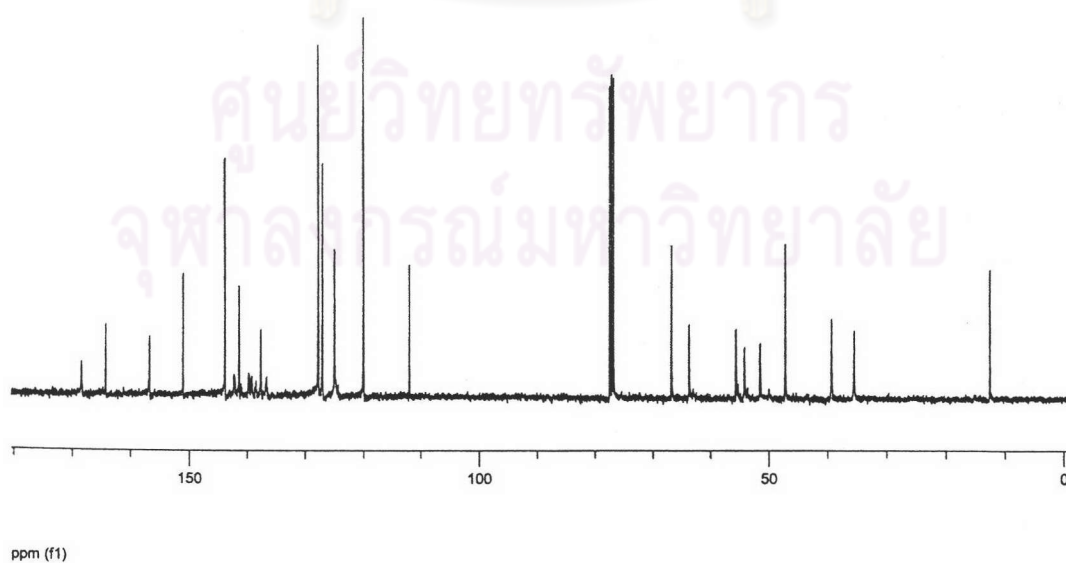
**Figure 50**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-D-proline pentafluorophenyl ester (**39**)



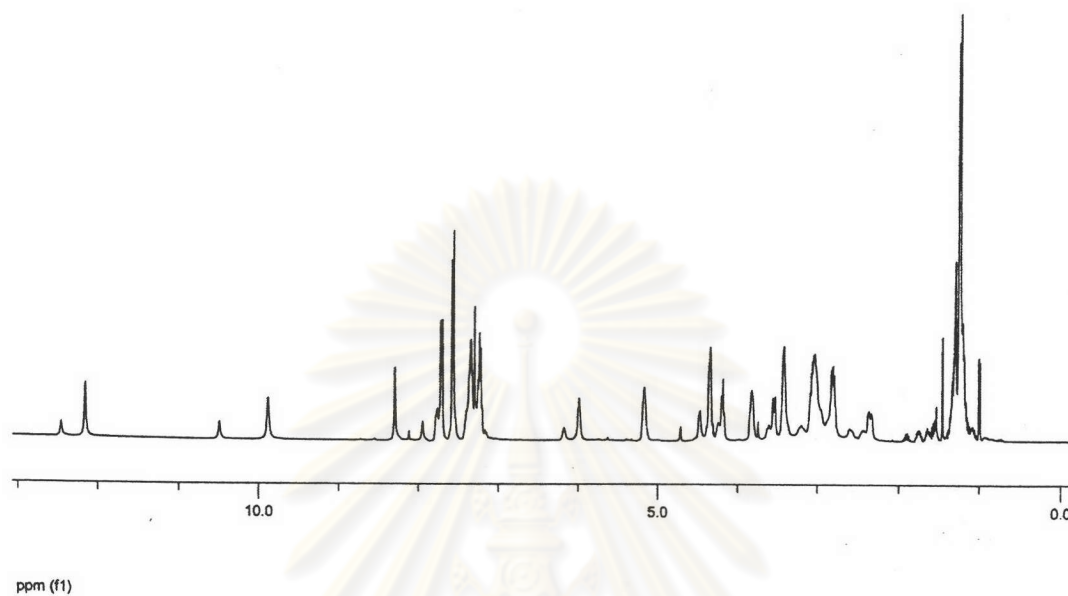
**Figure 51**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-D-proline pentafluorophenyl ester (**39**)



**Figure 52**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-L-proline pentafluorophenyl ester (**40**)

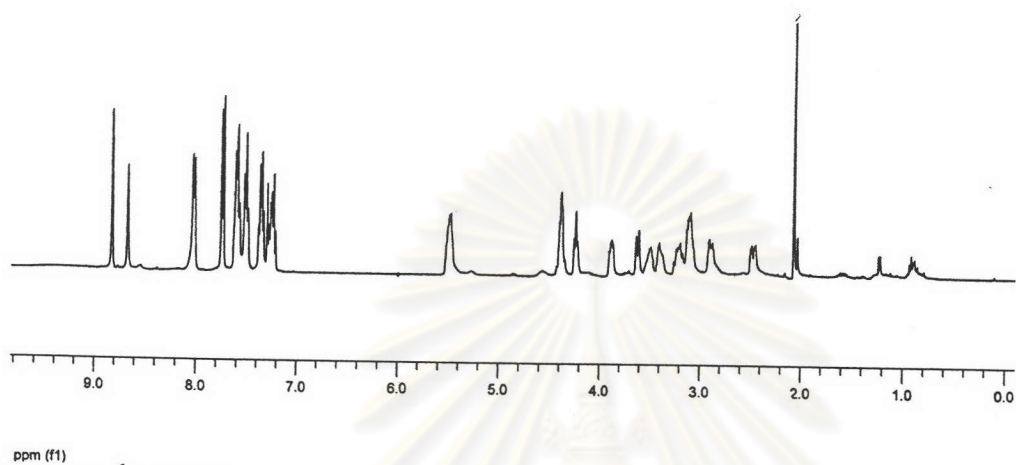


**Figure 53**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-L-proline pentafluorophenyl ester (**40**)

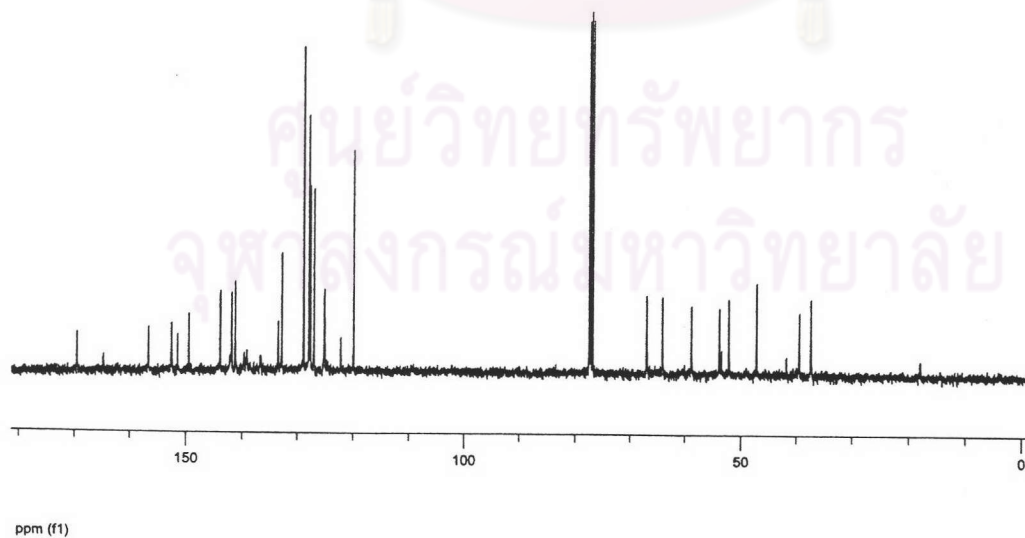


**Figure 54**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>2</sup>-isobutyrylguanin-9-yl)-*D*-proline pentafluorophenyl ester (**41**)

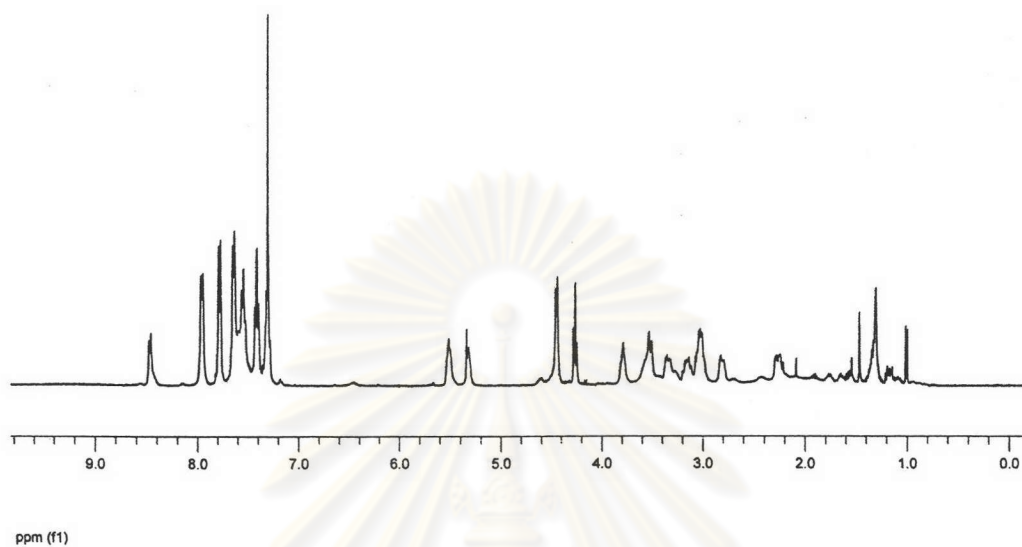
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จุฬาลงกรณ์มหาวิทยาลัย



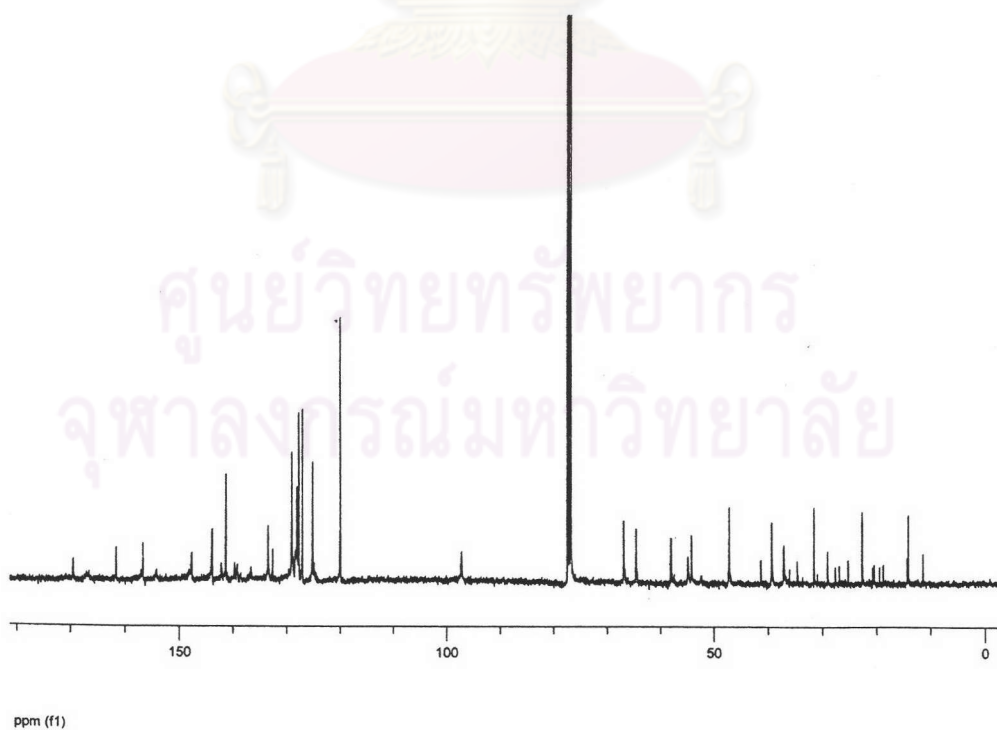
**Figure 55**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>7</sup>-benzoyladenine-9-yl)-*D*-proline pentafluorophenyl ester (**42**)



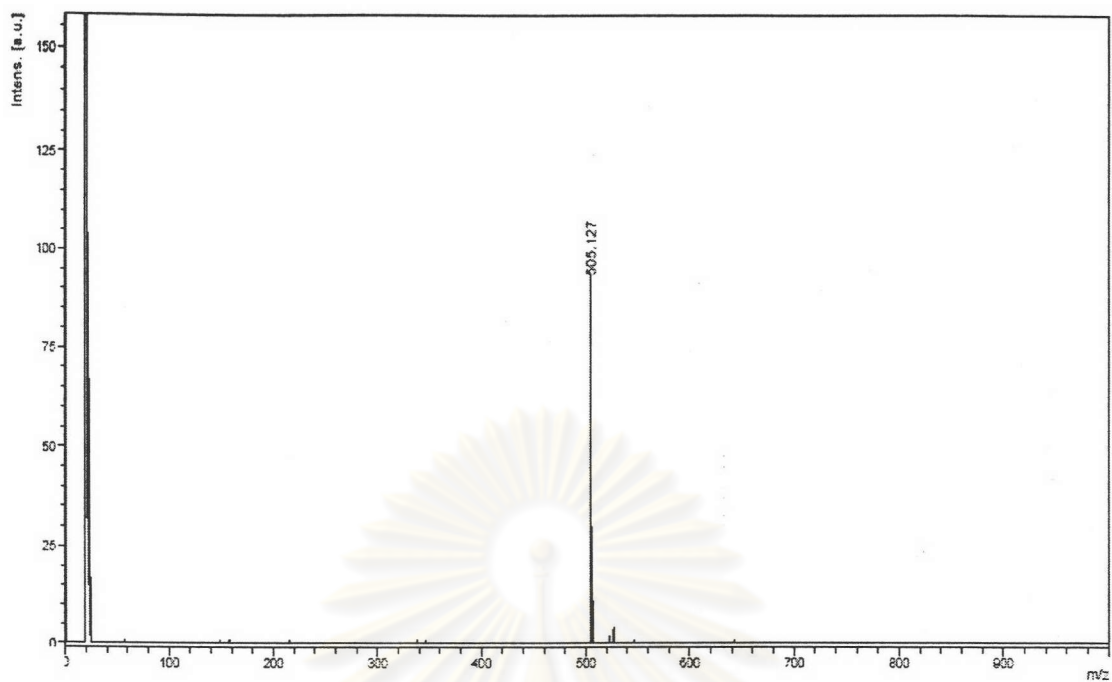
**Figure 56**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>7</sup>-benzoyladenine-9-yl)-*D*-proline pentafluorophenyl ester (**42**)



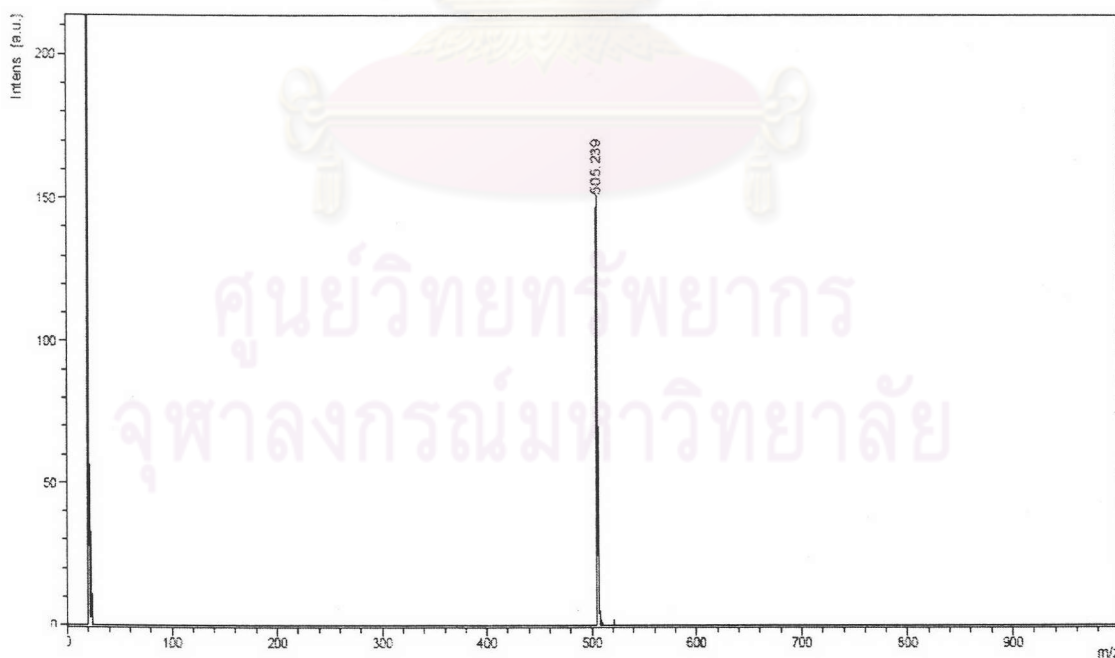
**Figure 57**  $^1\text{H}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoylcytosin-1-yl)-*D*-proline pentafluorophenyl ester (**43**)



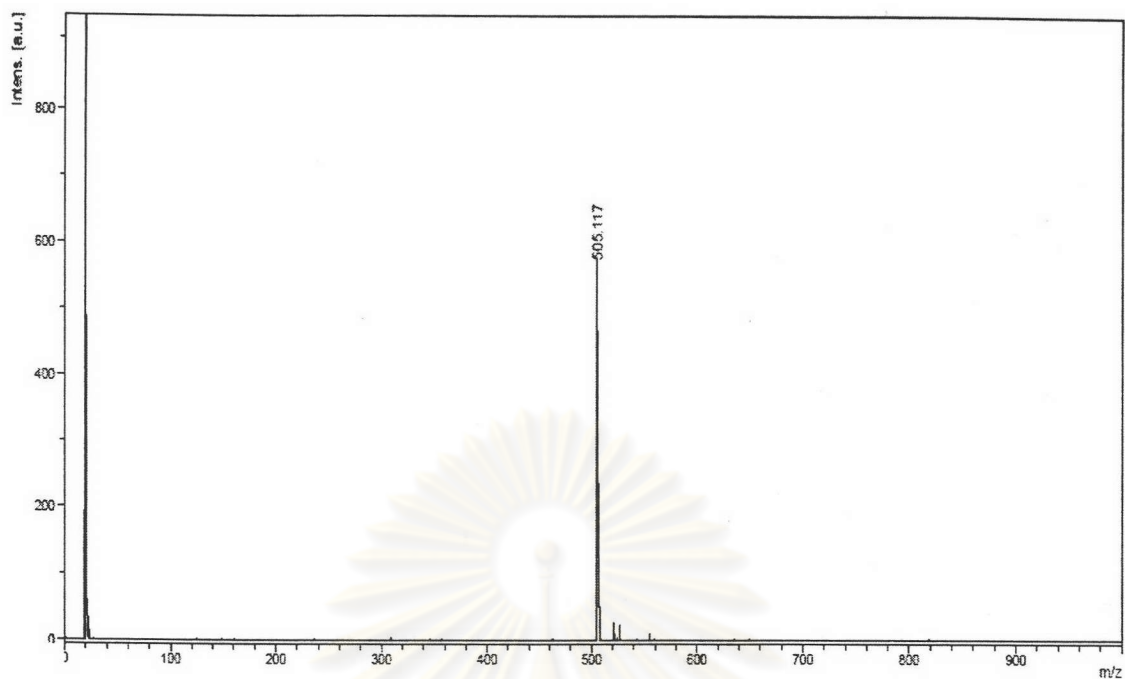
**Figure 58**  $^{13}\text{C}$  NMR spectrum ( $\text{CDCl}_3$ ) of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoylcytosin-1-yl)-*D*-proline pentafluorophenyl ester (**43**)



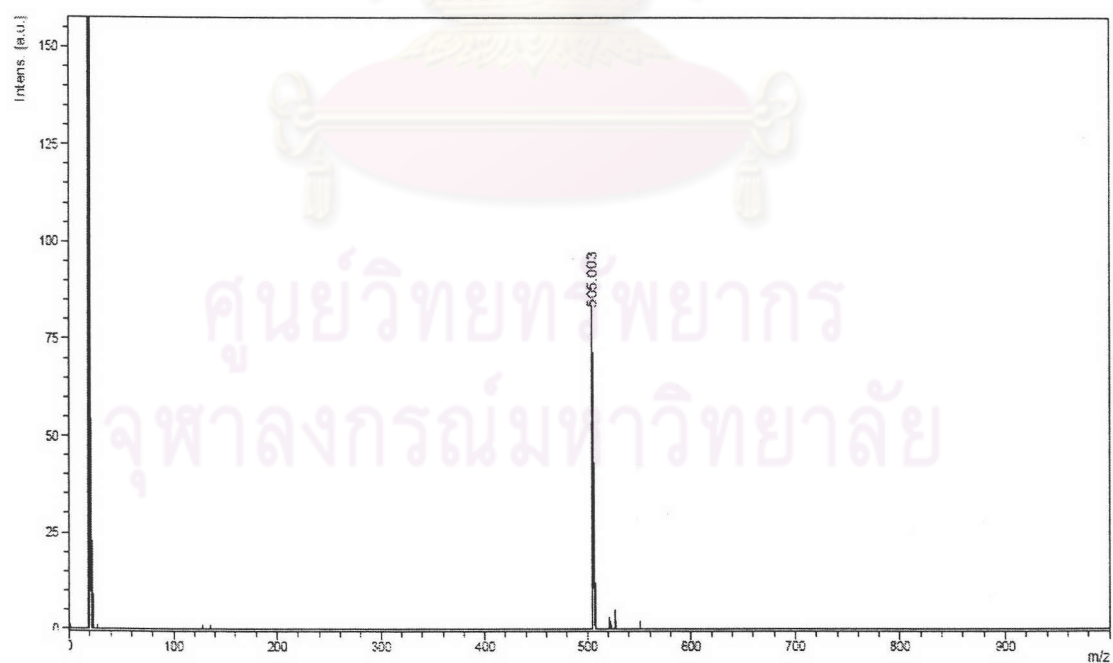
**Figure 59** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(thymine-1-yl)-D-proline (**30**)



**Figure 60** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(thymine-1-yl)-L-proline (**31**)

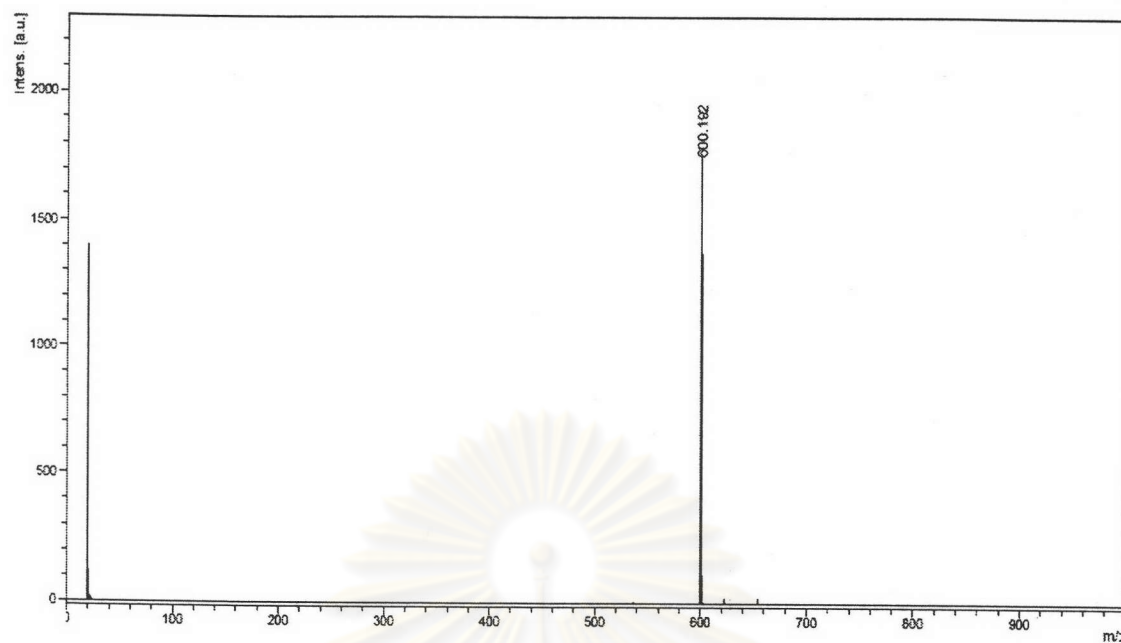


**Figure 61** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-D-proline (**32**)

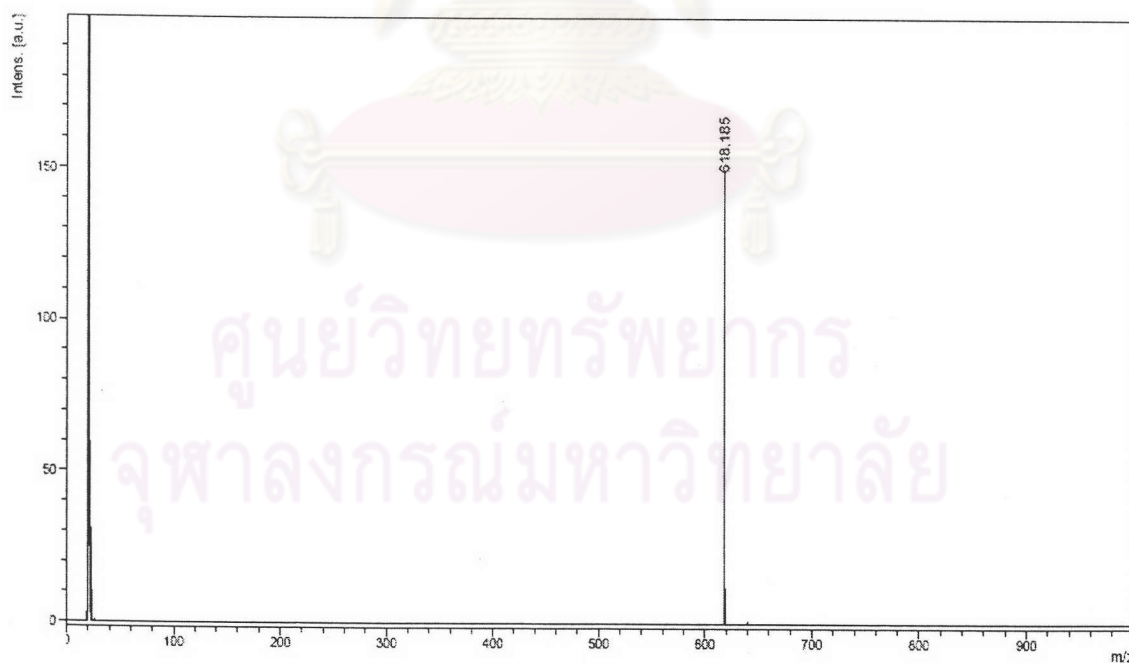


**Figure 62** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-L-proline (**33**)

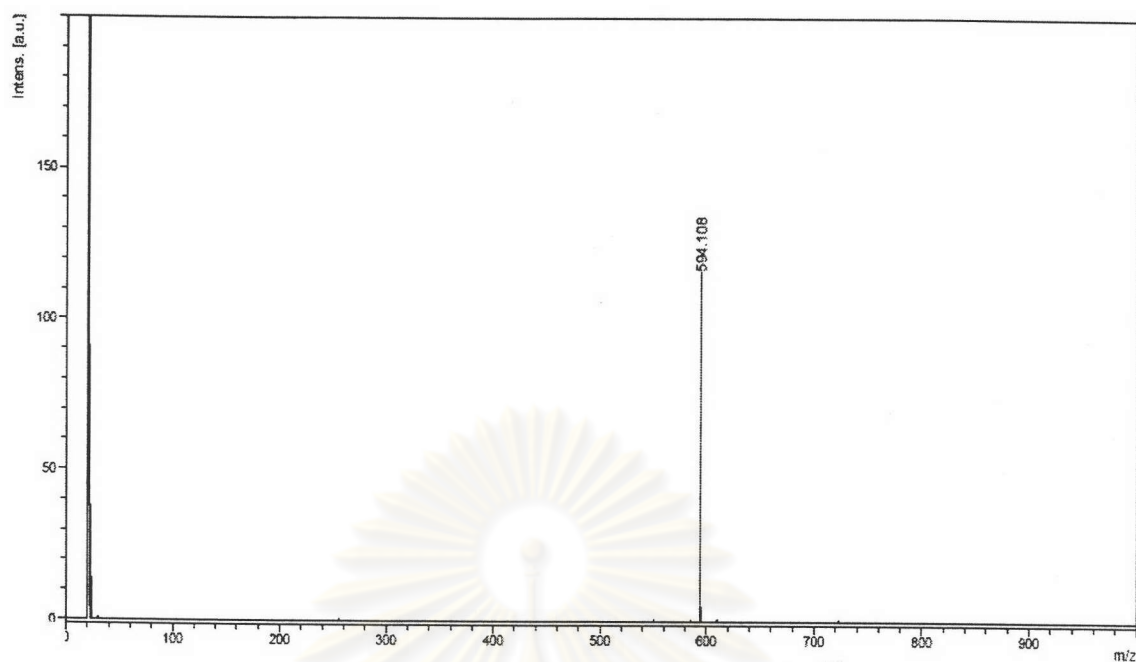




**Figure 63** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>2</sup>-isobutrylguanin-9-yl)-D-proline (**34**)

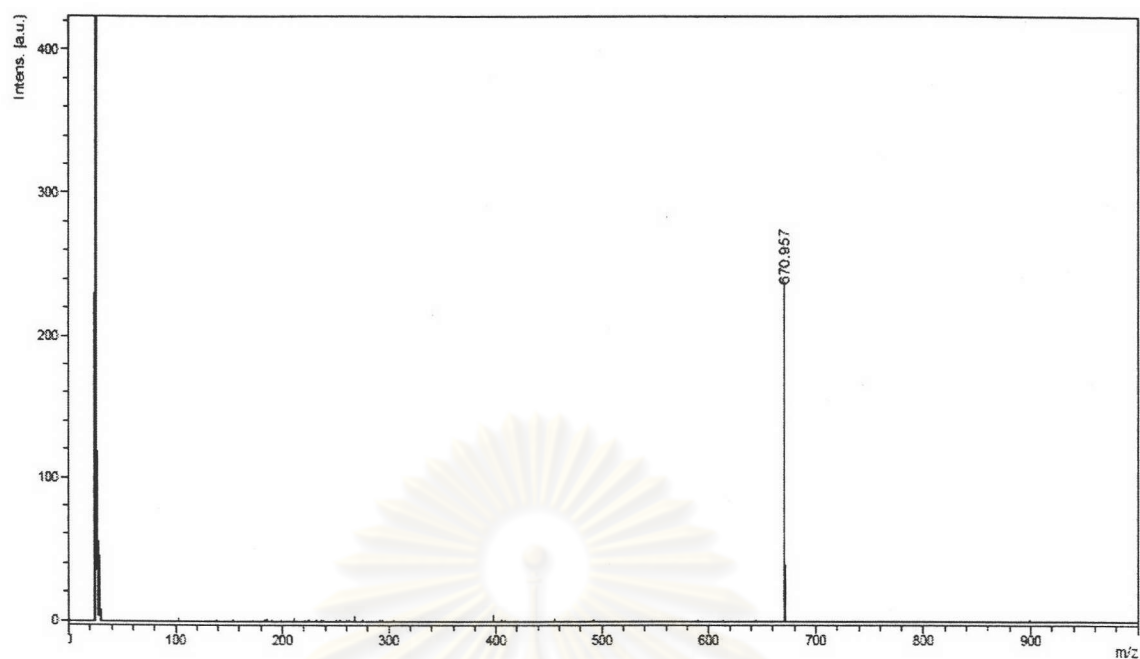


**Figure 64** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoyladenin-9-yl)-D-proline (**35**)

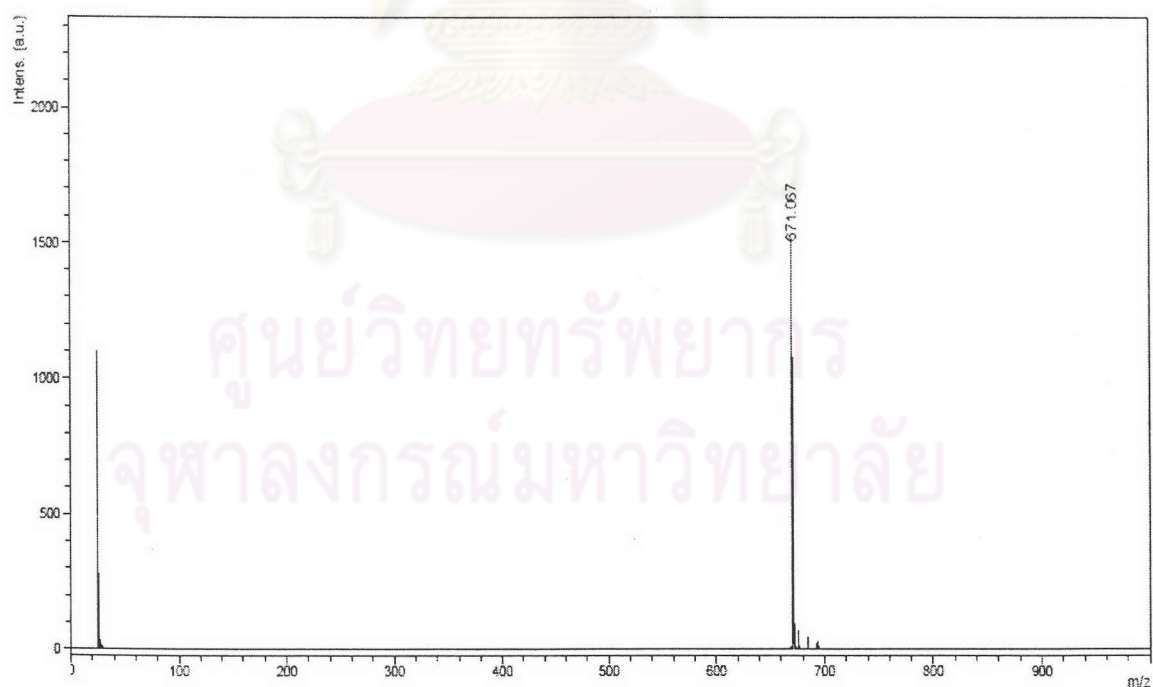


**Figure 65** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoylcytosin-1-yl)-*D*-proline (**36**)

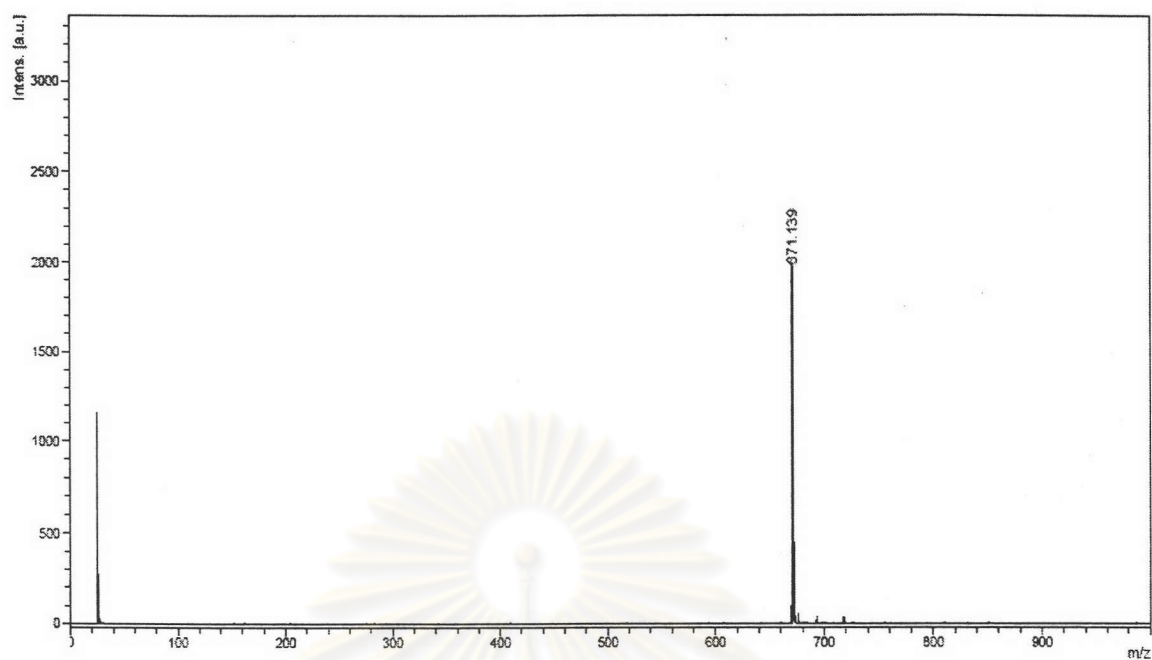
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จุฬาลงกรณ์มหาวิทยาลัย



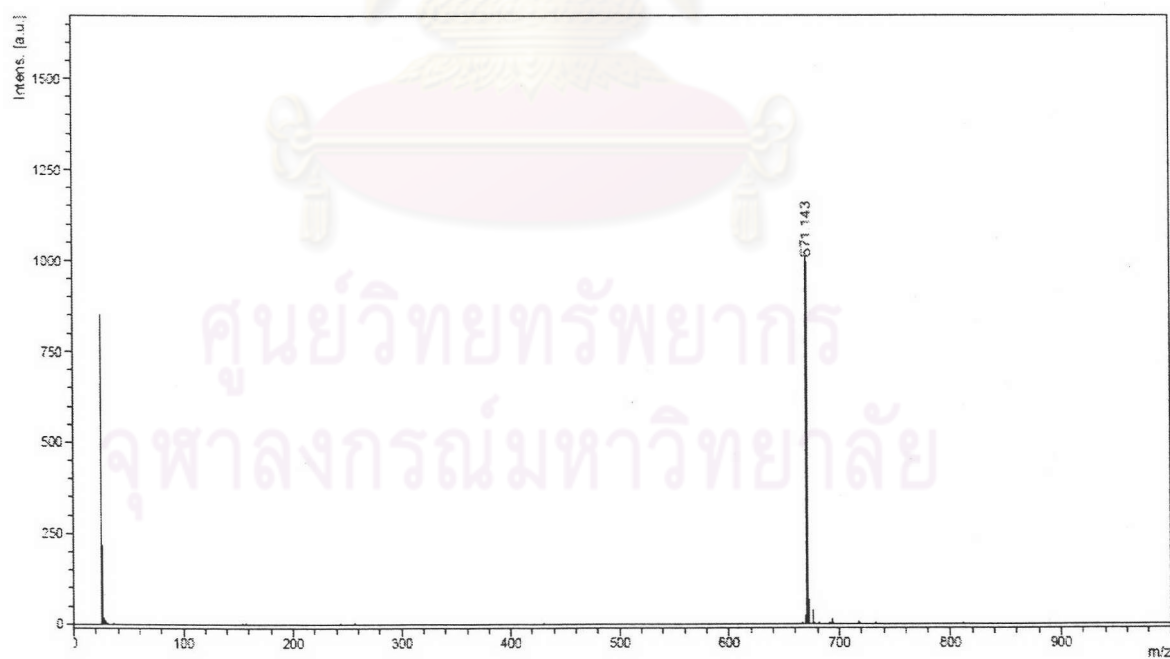
**Figure 66** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-cis-4-(thymine-1-yl)-D-proline pentafluorophenyl ester (**37**)



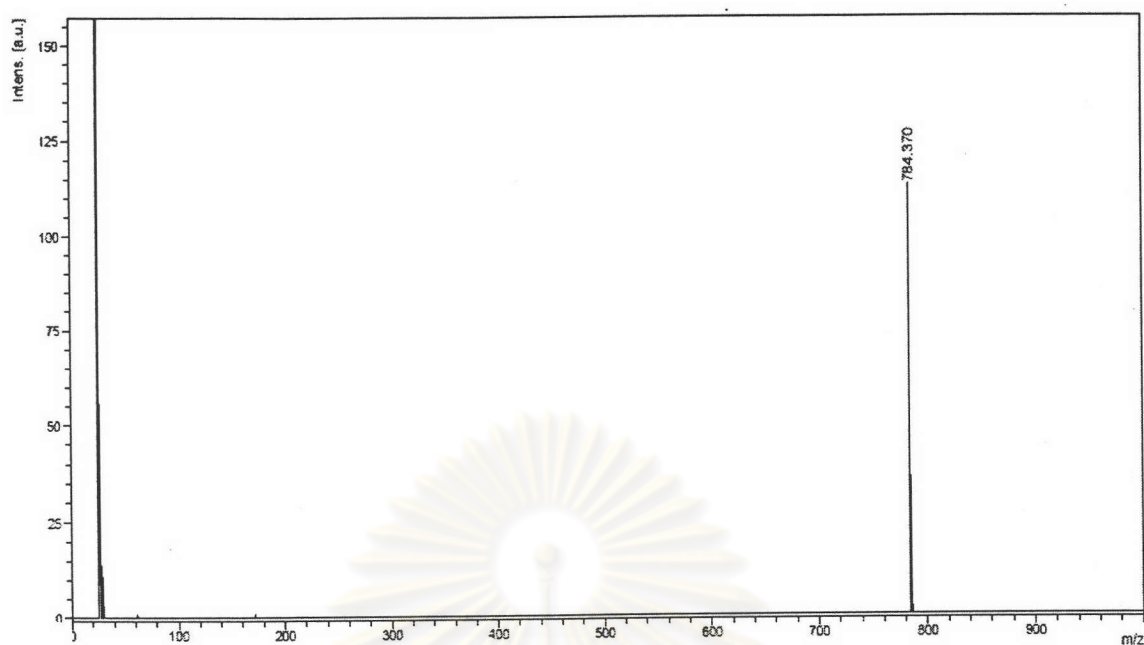
**Figure 67** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-cis-4-(thymine-1-yl)-L-proline pentafluorophenyl ester (**38**)



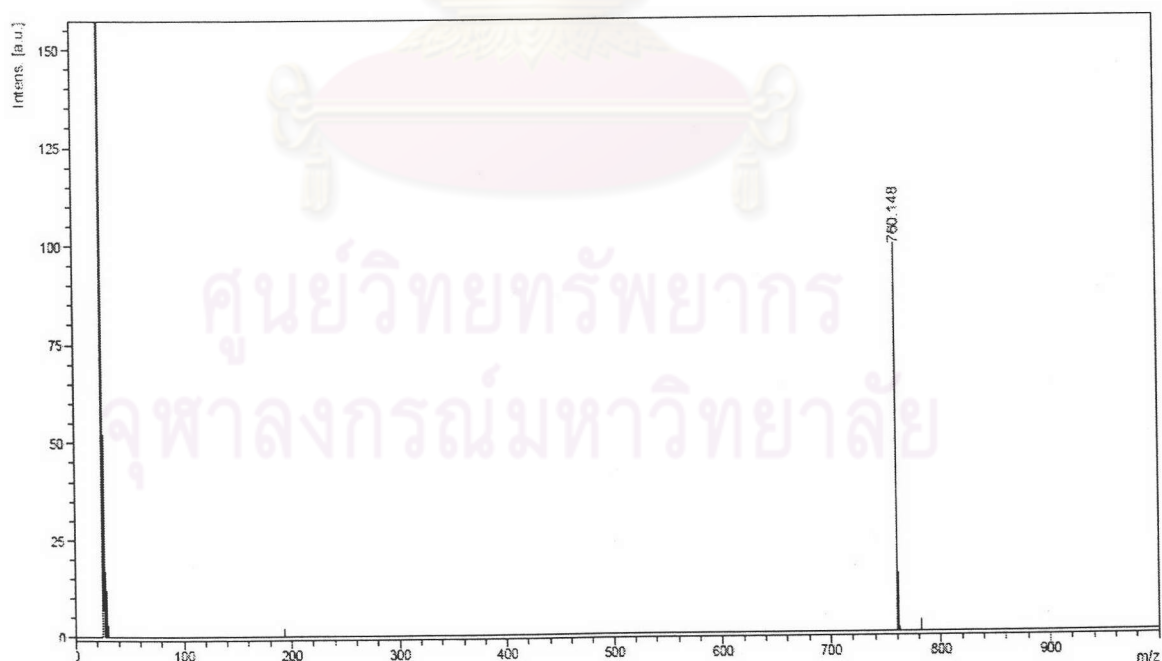
**Figure 68** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-D-proline pentafluorophenyl ester (**39**)



**Figure 69** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*trans*-4-(thymine-1-yl)-L-proline pentafluorophenyl ester (**40**)



**Figure 70** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoyladenin-9-yl)-*D*-proline pentafluorophenyl ester (**42**)



**Figure 71** MALDI-TOF mass spectrum of *N*-2-(*N*-fluoren-9-ylmethoxycarbonyl amino)ethyl-*cis*-4-(*N*<sup>4</sup>-benzoylcytosin-1-yl)-*D*-proline pentafluorophenyl ester (**43**)

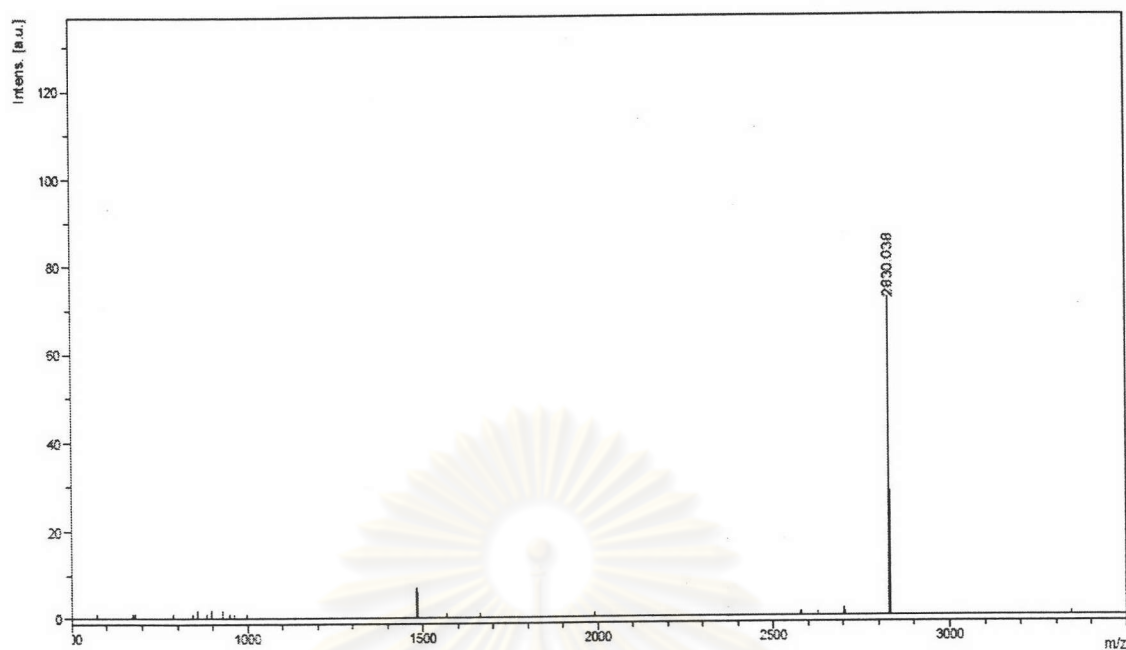


Figure 72 MALDI-TOF mass spectrum of CD-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (44)

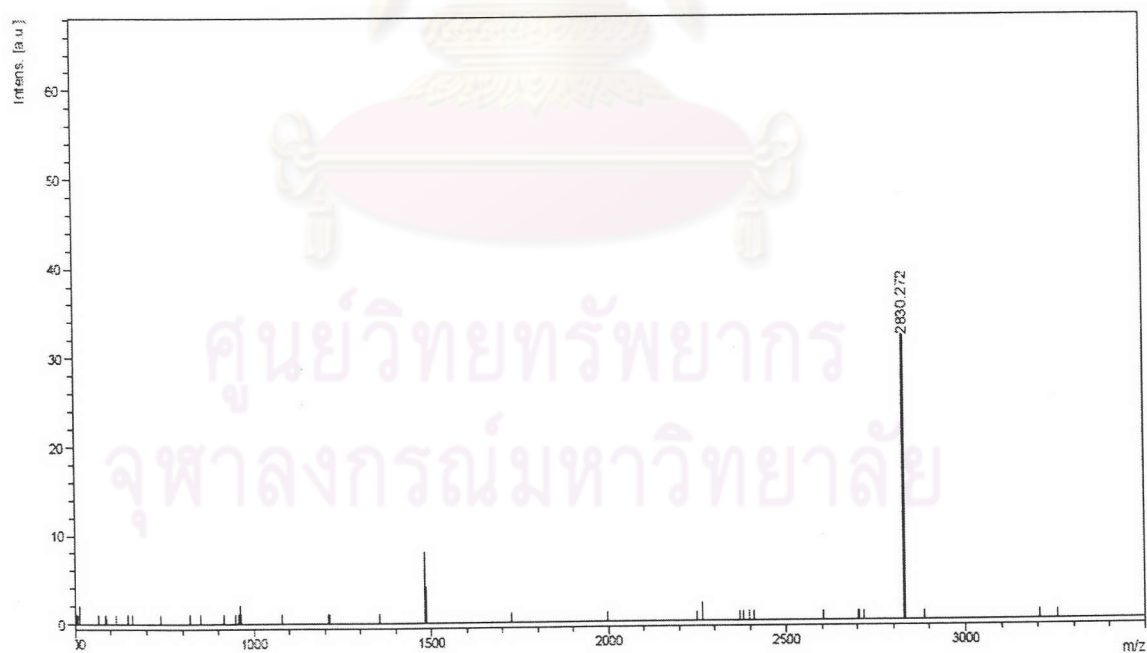


Figure 73 MALDI-TOF mass spectrum of CL-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (45)

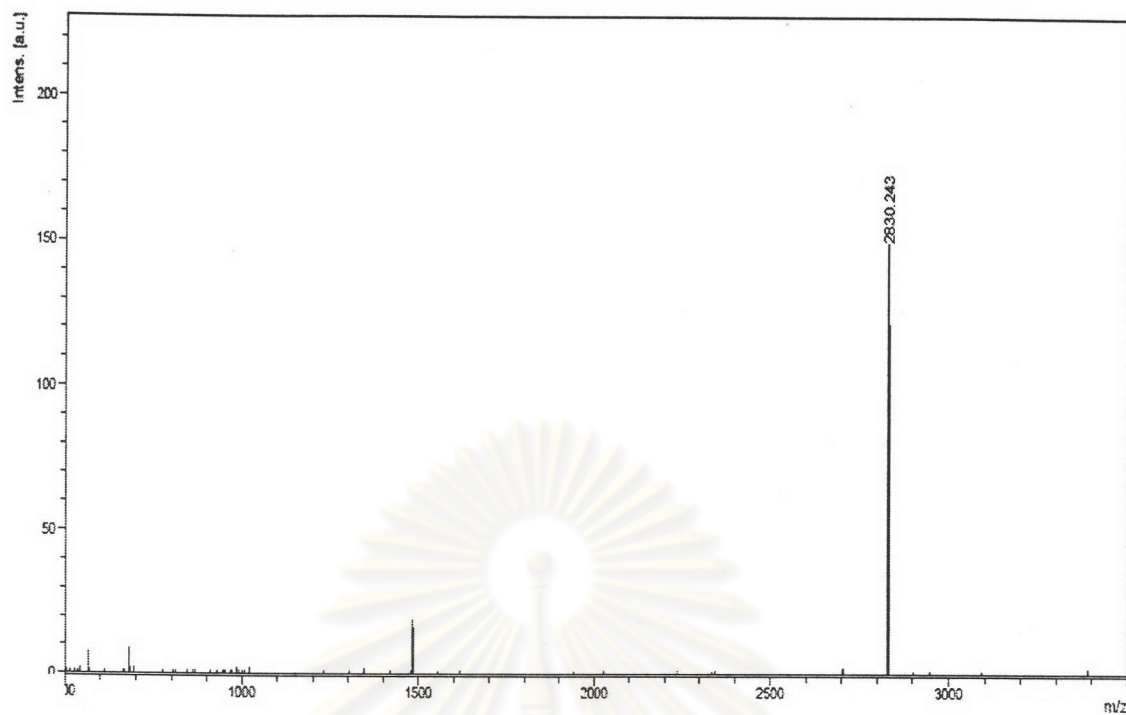


Figure 74 MALDI-TOF mass spectrum of TD-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (46)

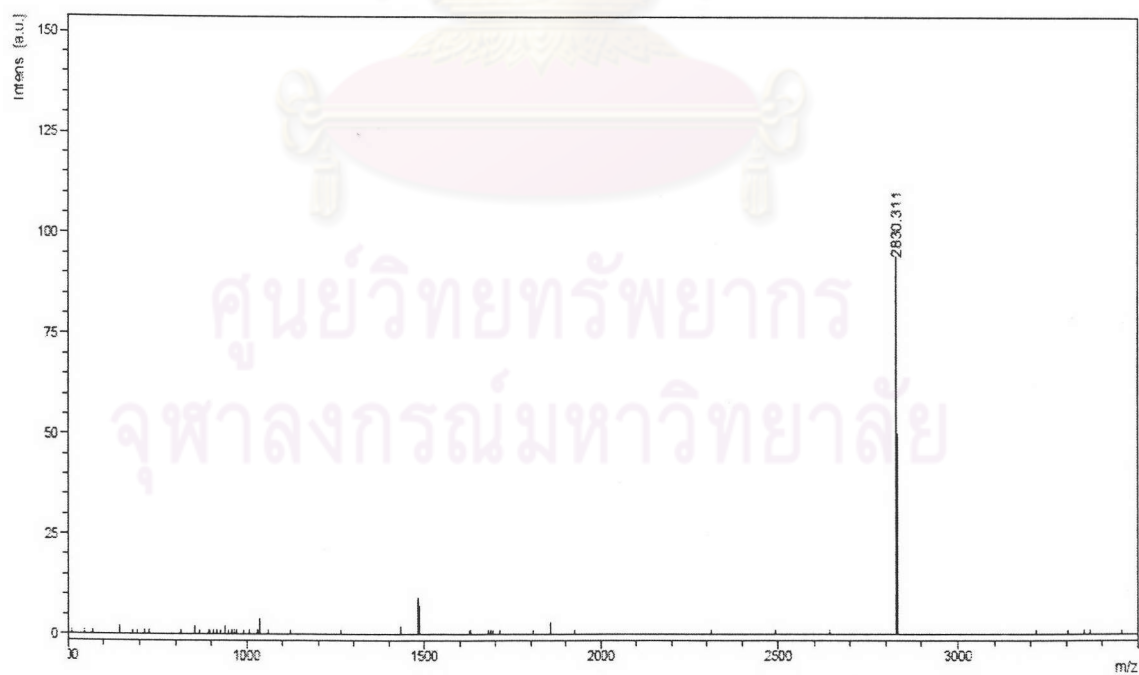
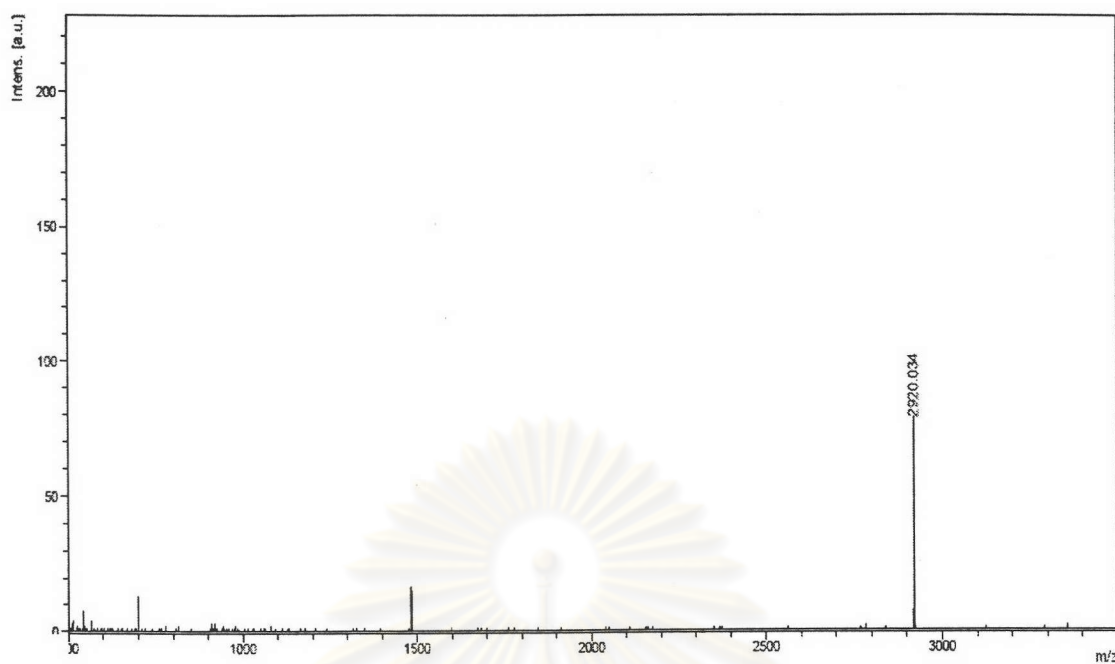
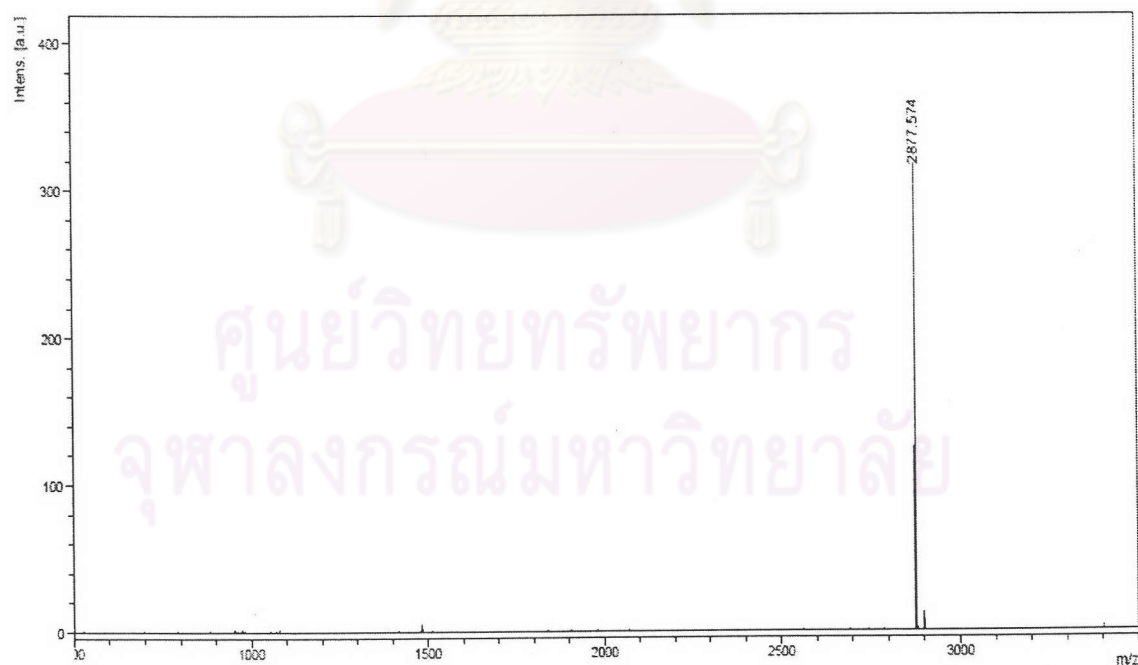


Figure 75 MALDI-TOF mass spectrum of TL-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (47)



**Figure 76** MALDI-TOF mass spectrum of CD-Ac-A<sub>10</sub>-LysNH<sub>2</sub> (**48**)



**Figure 77** MALDI-TOF mass spectrum of CD-Ac-GTAGATCACT-LysNH<sub>2</sub> (**49**)



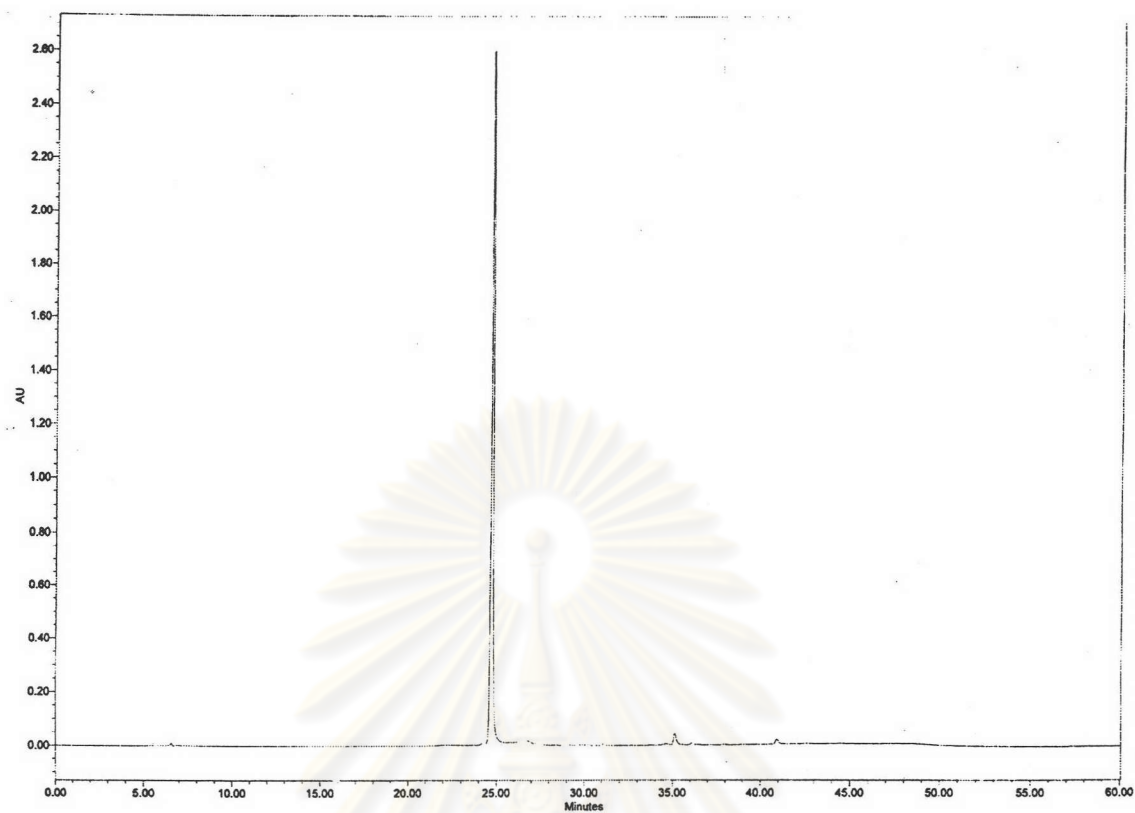


Figure 78 HPLC chromatogram of CD-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (44)

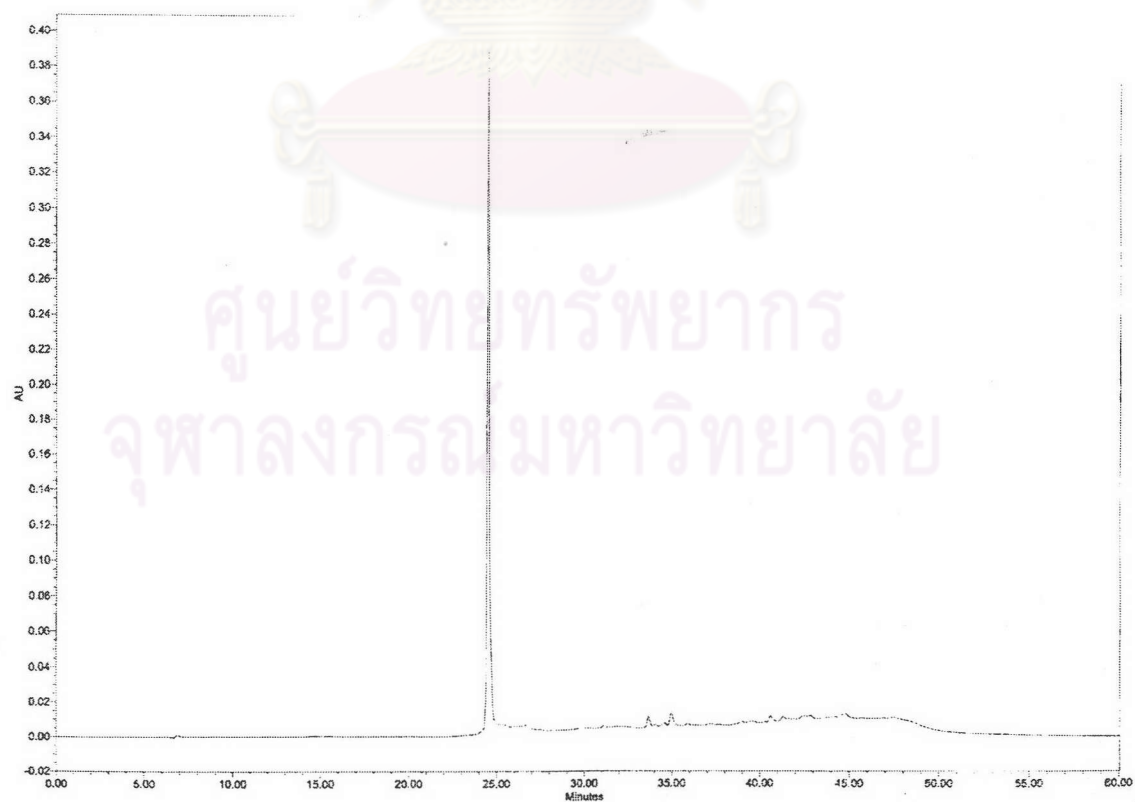


Figure 79 HPLC chromatogram of CL-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (45)

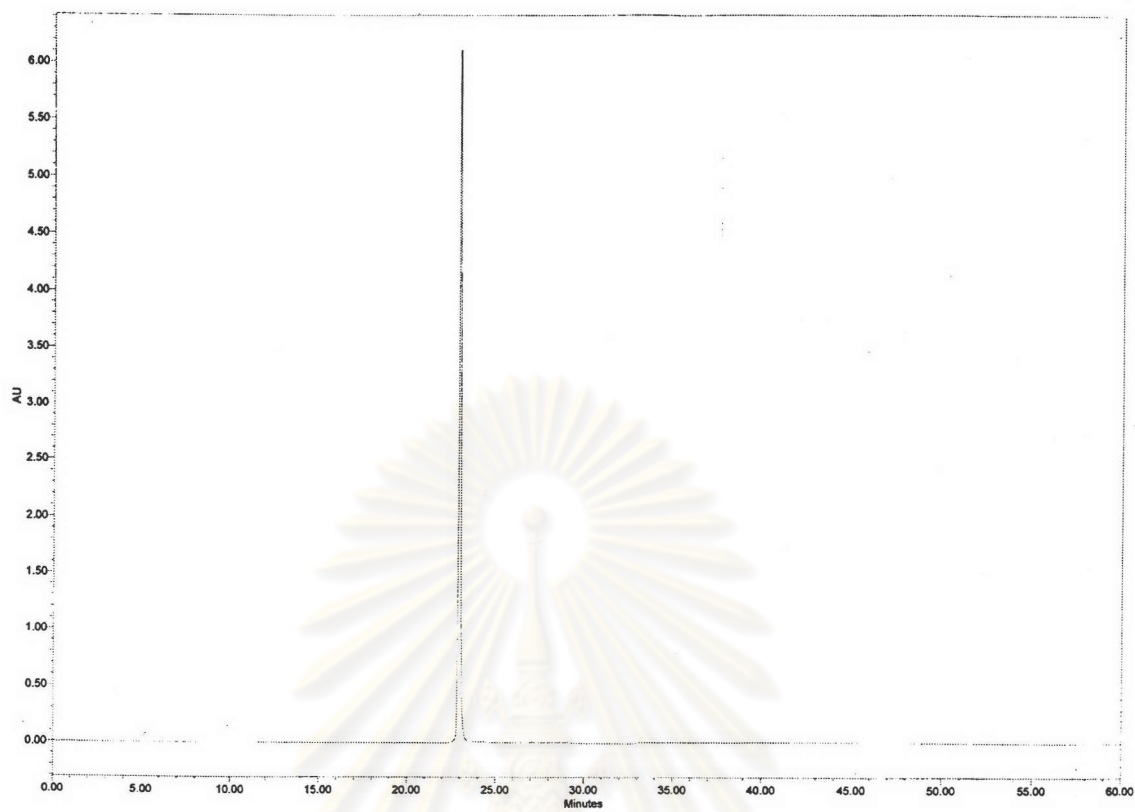


Figure 80 HPLC chromatogram of TD-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (46)

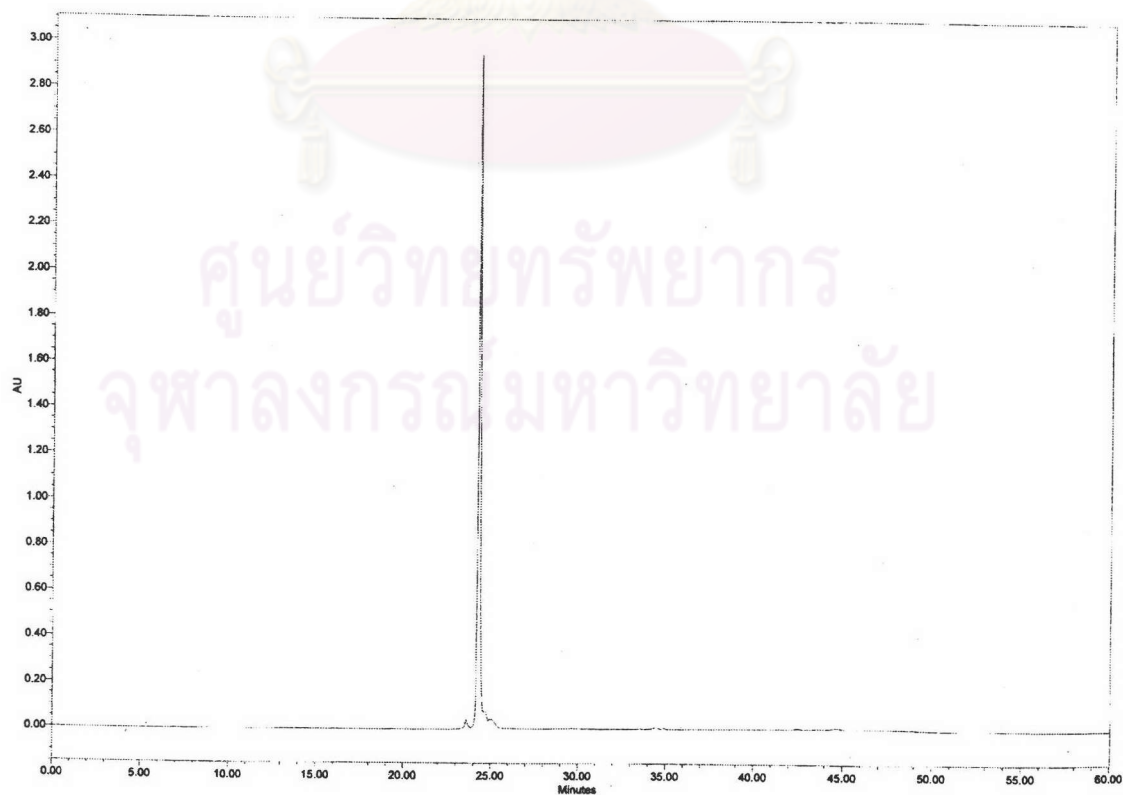


Figure 81 HPLC chromatogram of TL-Ac-T<sub>10</sub>-LysNH<sub>2</sub> (47)

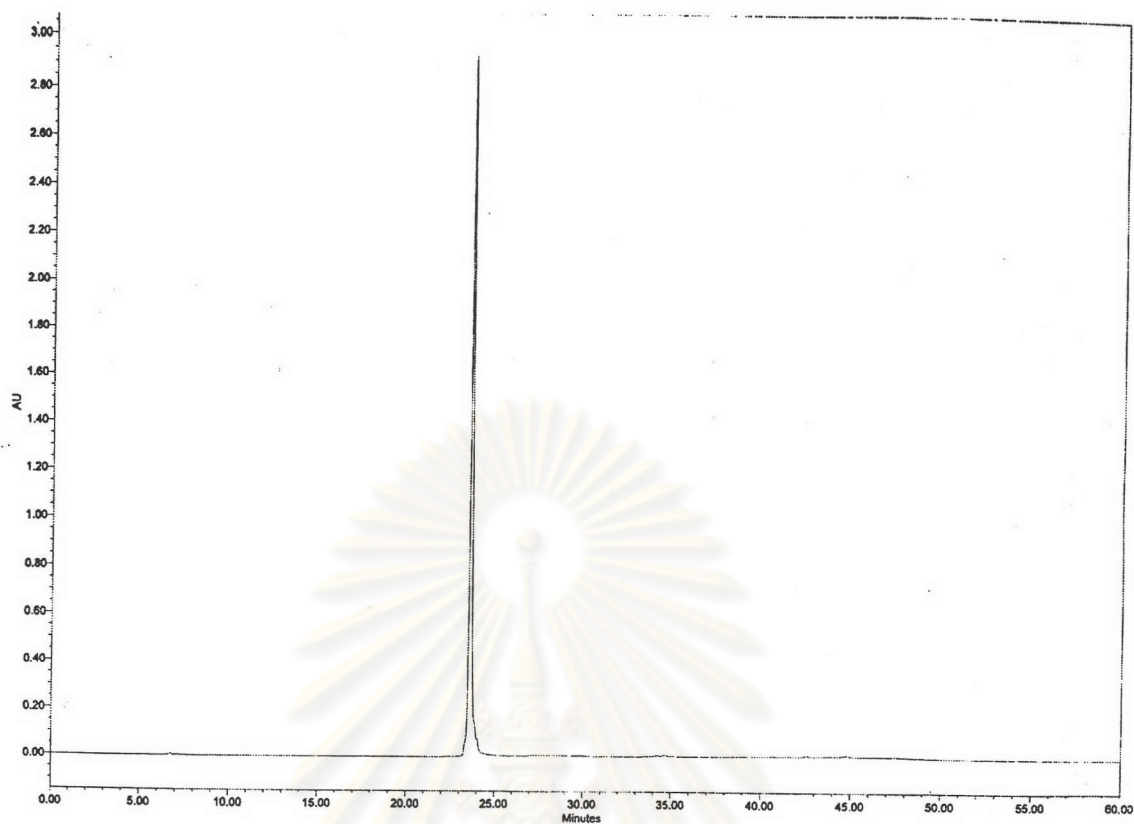


Figure 82 HPLC chromatogram of CD-Ac-A<sub>10</sub>-LysNH<sub>2</sub> (48)

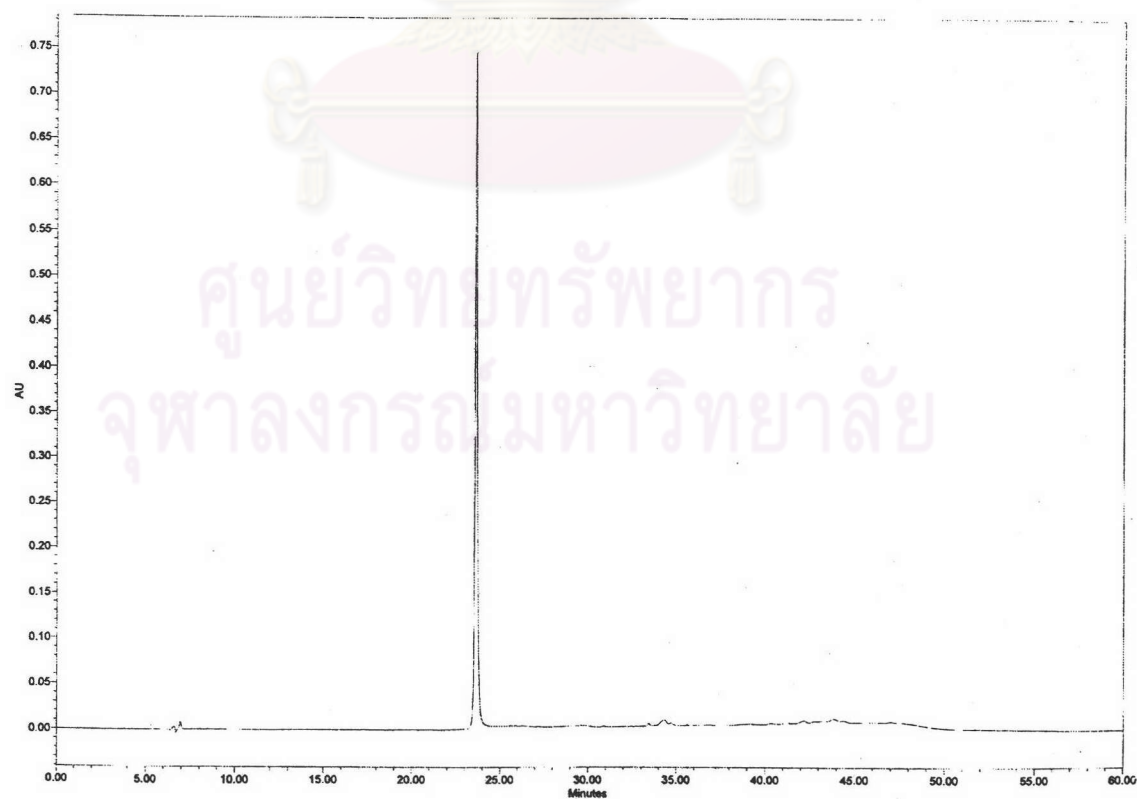


Figure 83 HPLC chromatogram of CD-Ac-GTAGATCACT-LysNH<sub>2</sub> (49)

## VITA

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