Supporting Information

A Convenient Route to *N*-[2-(Fmoc)-Aminoethyl]glycine Esters and PNA Oligomerization Using a bis-Boc Nucleobase Protecting Group Strategy

*Filip Wojciechowski and Robert H.E. Hudson**

Department of Chemistry, The University of Western Ontario, London, Ontario, Canada, N6A 5B7

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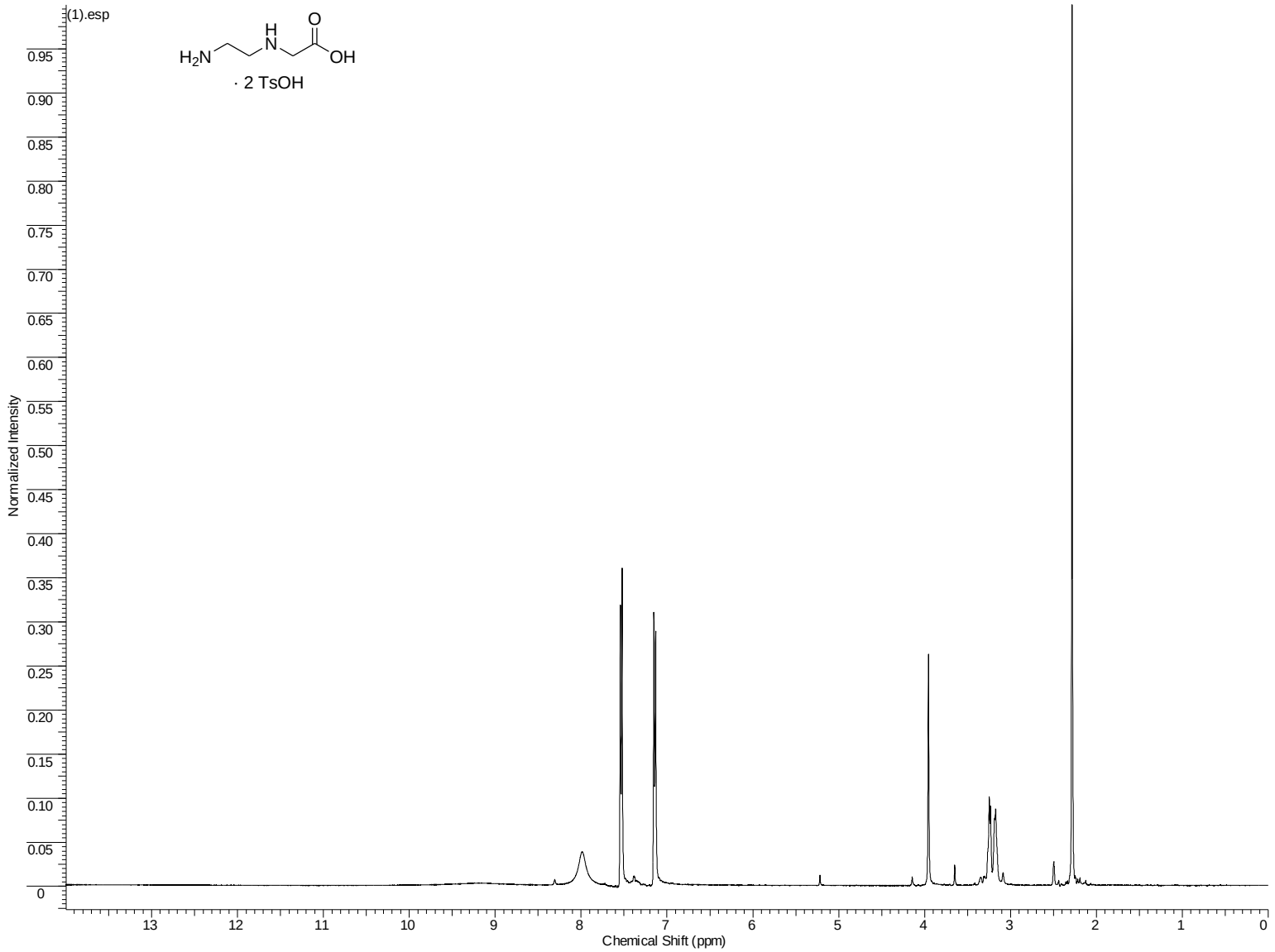
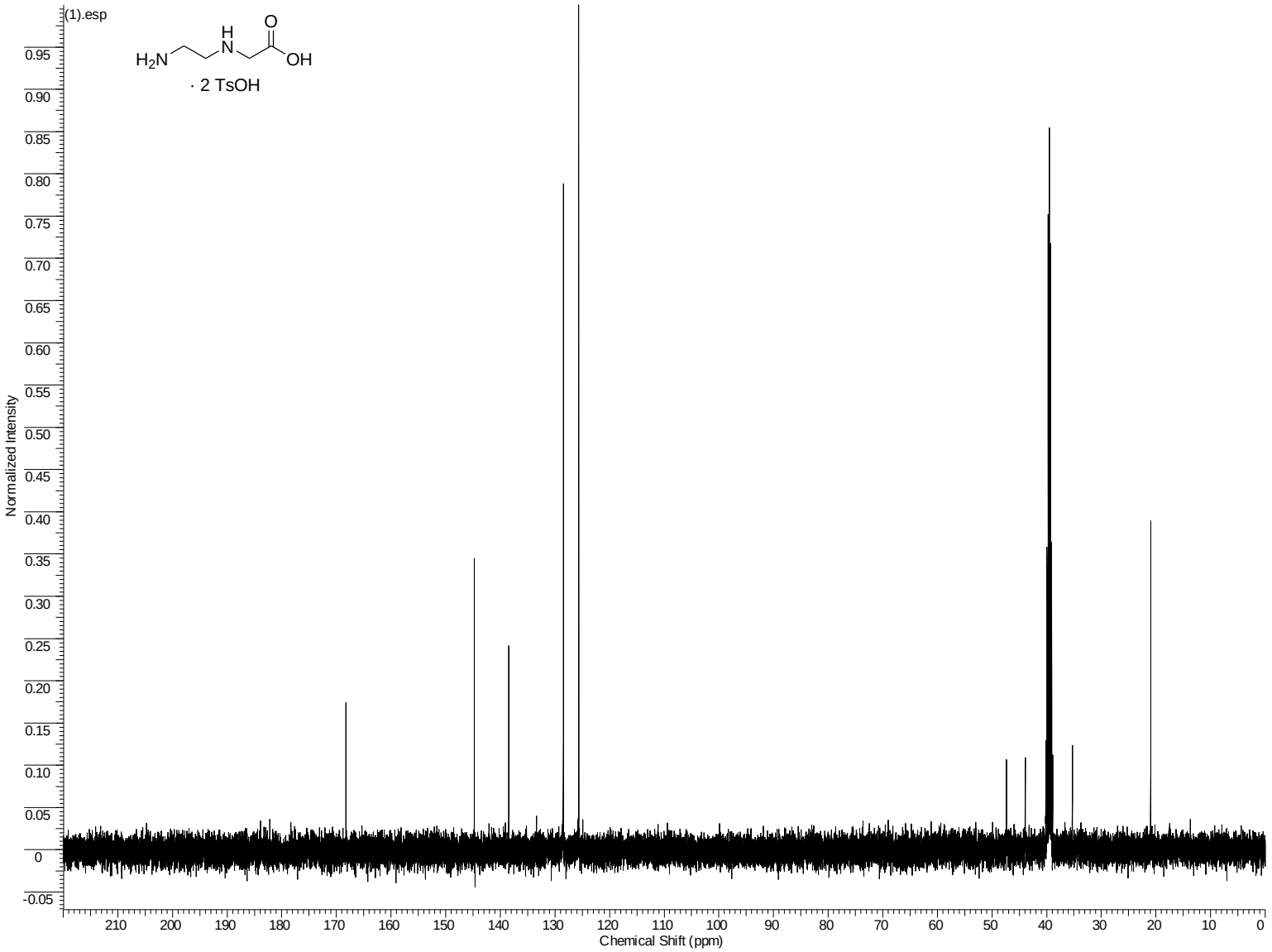
General Remarks. All chemicals were obtained from commercial sources and were of ACS reagent grade or higher and were used without further purification. Solvents for solution-phase chemistry were dried by passing through activated alumina columns. Flash column chromatography (FCC) was performed on Merck Kieselgel 60, 230-400 mesh. Thin layer chromatography (TLC) was performed on Merck Kieselgel 60 TLC plates. Chemical shifts are reported in parts per million (δ), were measured from Tetramethylsilane (0 ppm) and are referenced to the solvent $CDCl_3$ (7.26 ppm), DMSO-d_6 (2.49 ppm), D_2O (4.79 ppm) for ^1H NMR and $CDCl_3$ (77.0 ppm), DMSO-d_6 (39.5 ppm) for ^{13}C NMR. Multiplicities are described as s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet) and br s (broad singlet). Coupling constants (*J*) are reported in Hertz (Hz). Resonances due to restricted rotation around the amide bond (rotamers) are reported as major (ma.) and minor (mi.). High resolution mass spectra (HRMS) were obtained using electron impact (EI) or electrospray (ESI).

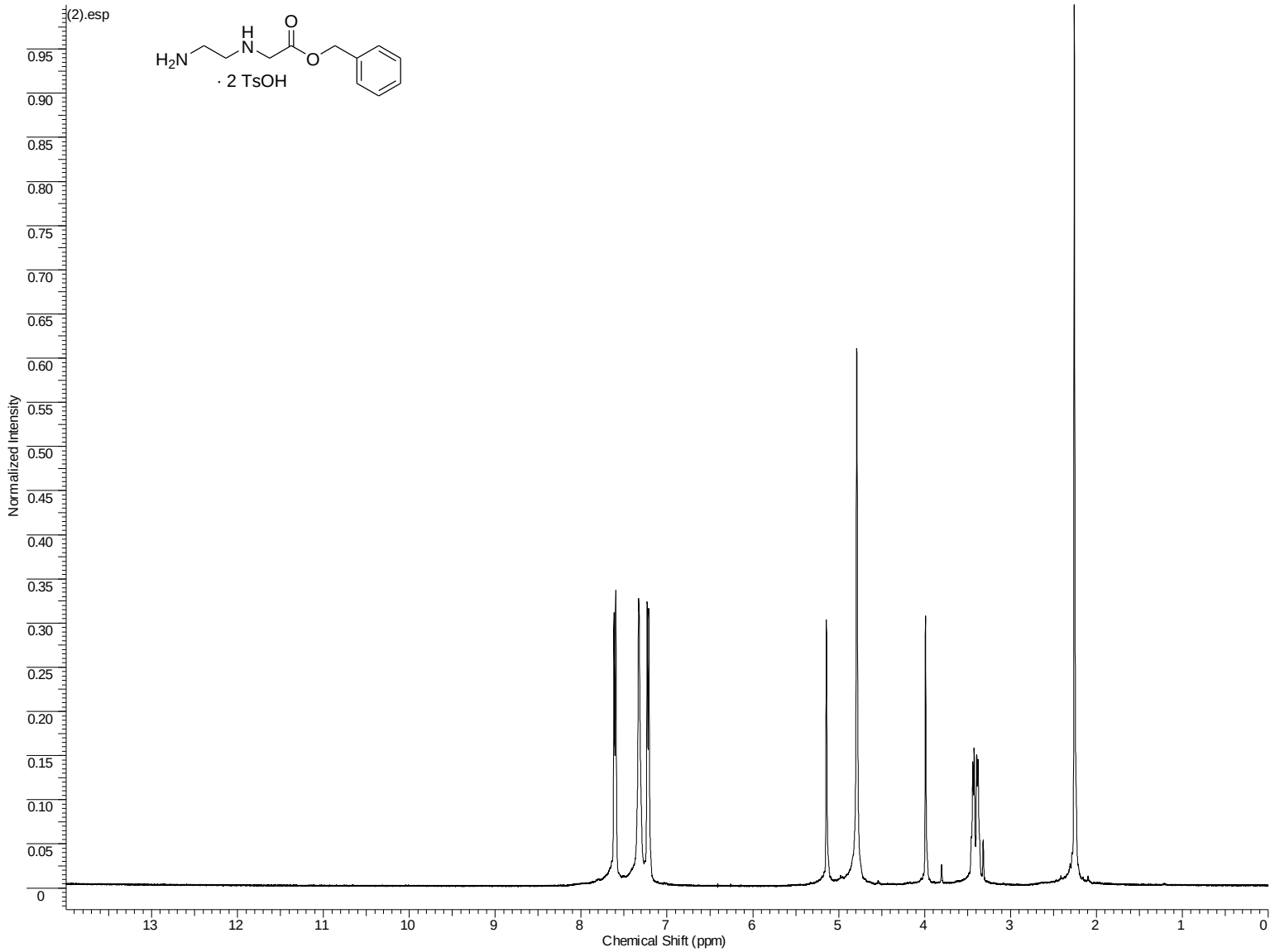
^{1}H NMR (400 MHz, DMSO-d_6) of **1**, *N*-(2-Aminoethyl)glycine · 2 TsOH



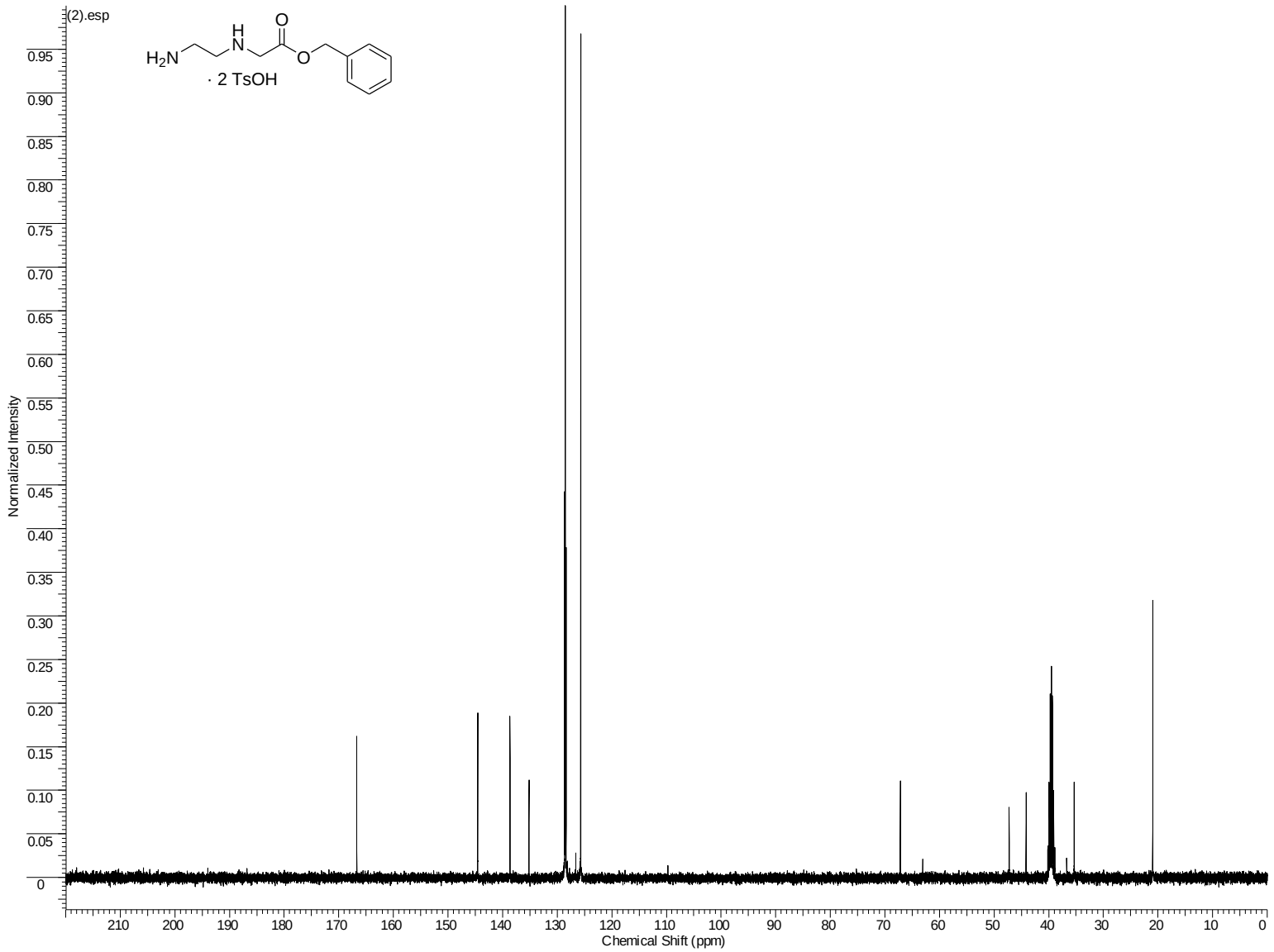
^{13}C NMR (100 MHz, DMSO-d_6) of **1**, *N*-(2-Aminoethyl)glycine · 2 TsOH



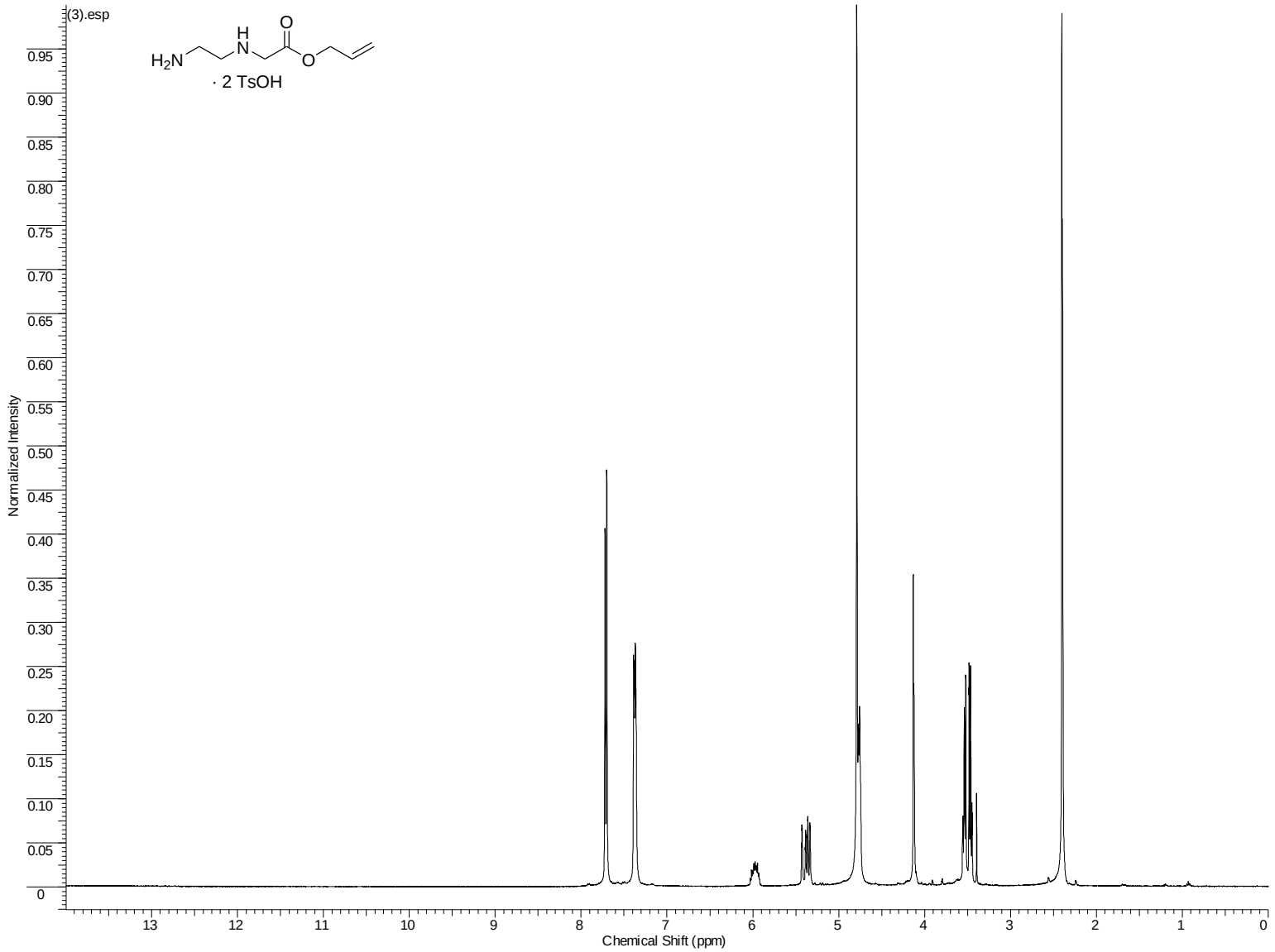
^{1}H NMR (400 MHz, D_2O) of **2**, Benzyl *N*-(2-aminoethyl)glycinate · 2 TsOH



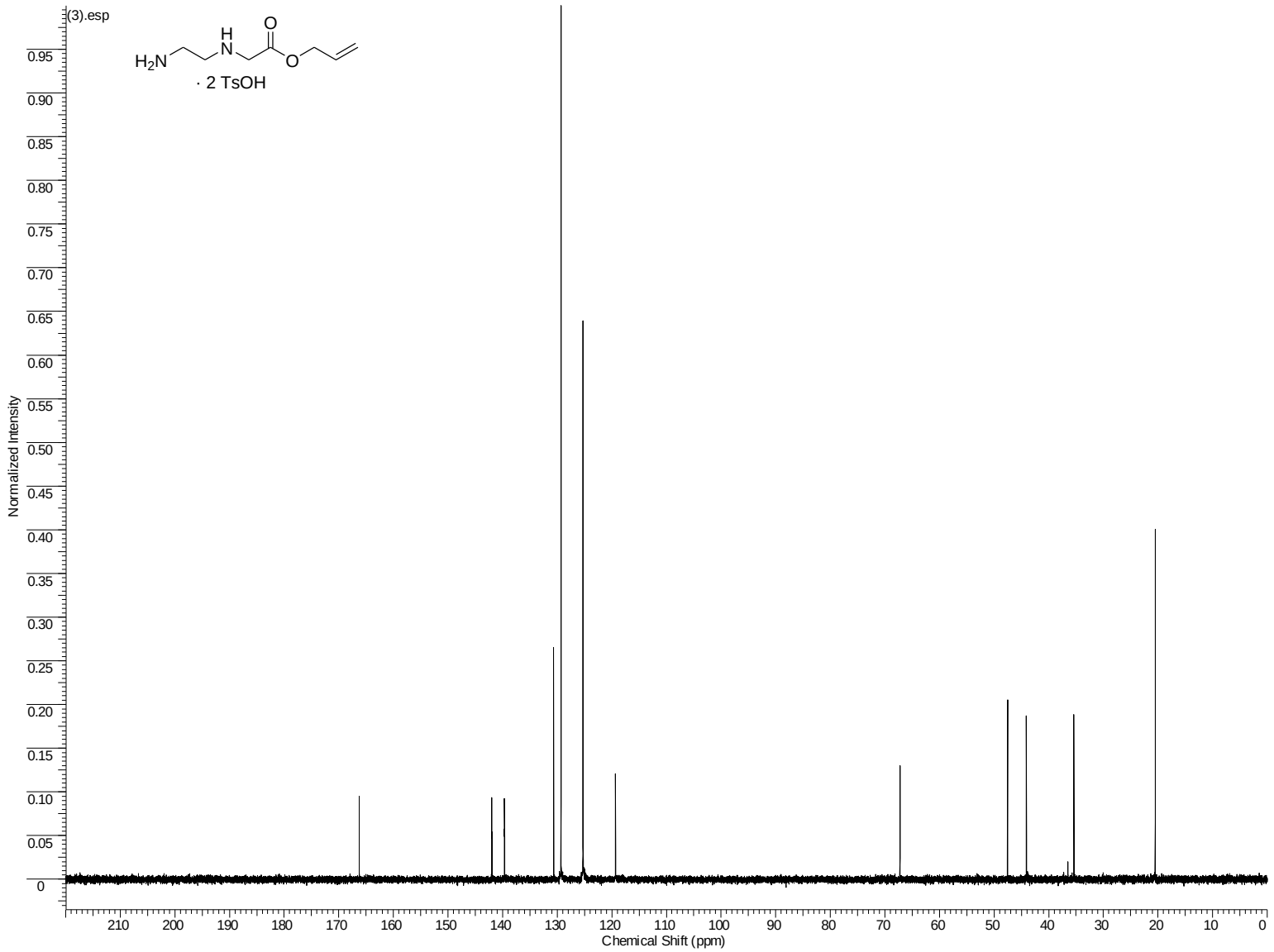
^{13}C NMR (100 MHz, DMSO-d_6) of **2**, Benzyl *N*-(2-aminoethyl)glycinate · 2 TsOH



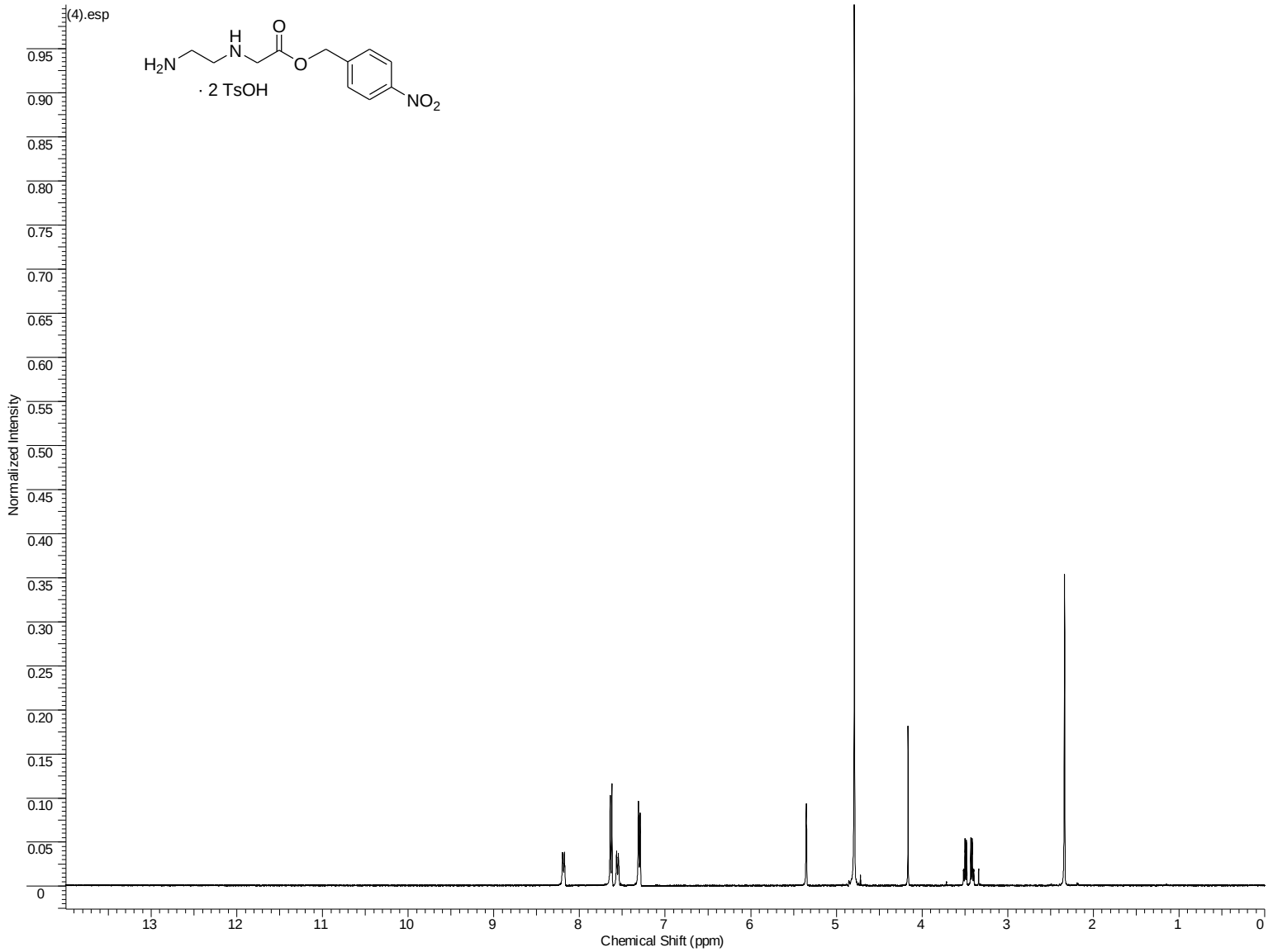
^{1}H NMR (400 MHz, D_2O) of **3**, Allyl *N*-(2-aminoethyl)glycinate · 2 TsOH



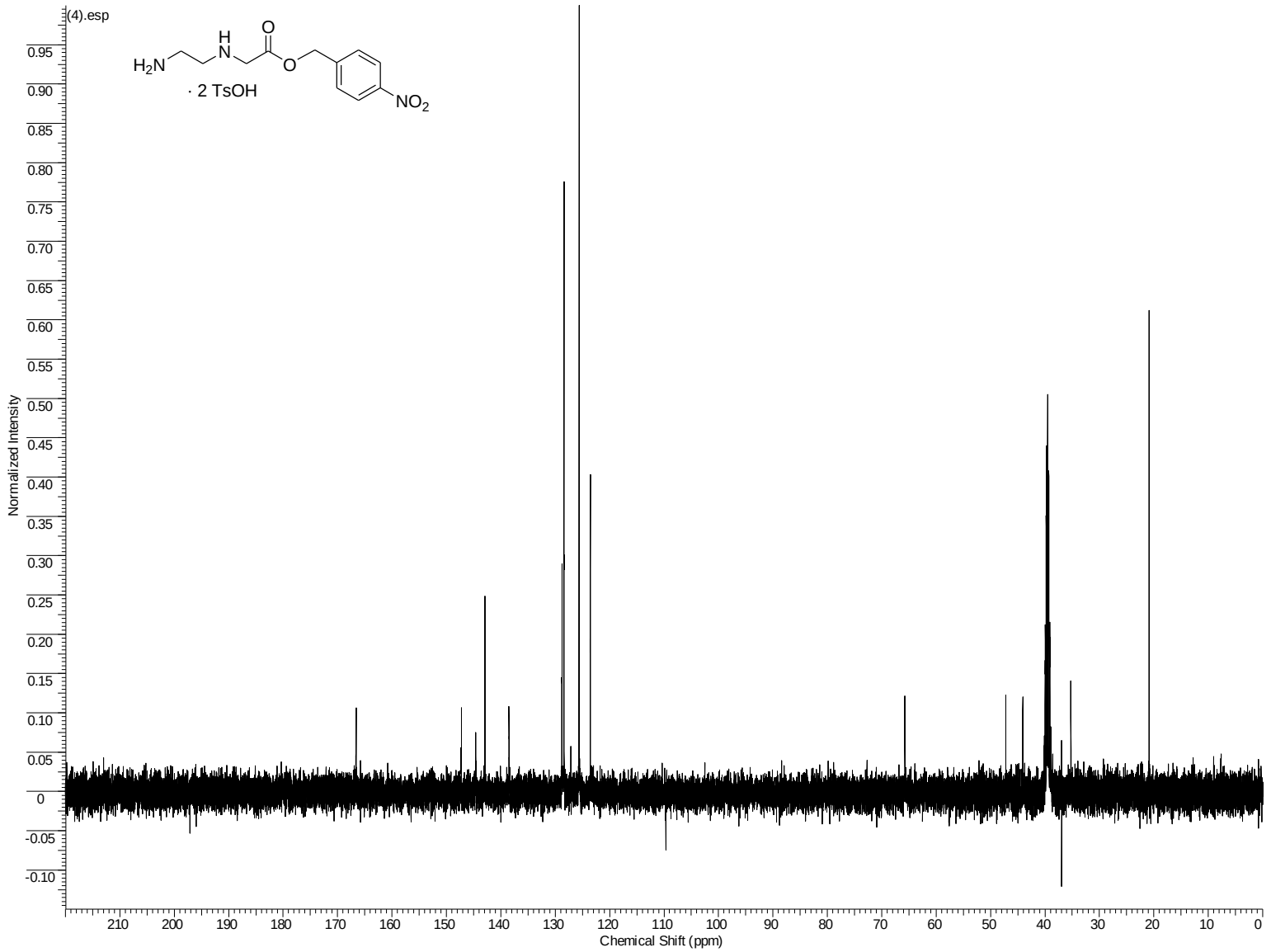
^{13}C NMR (100 MHz, D_2O) of **3**, Allyl *N*-(2-aminoethyl)glycinate · 2 TsOH



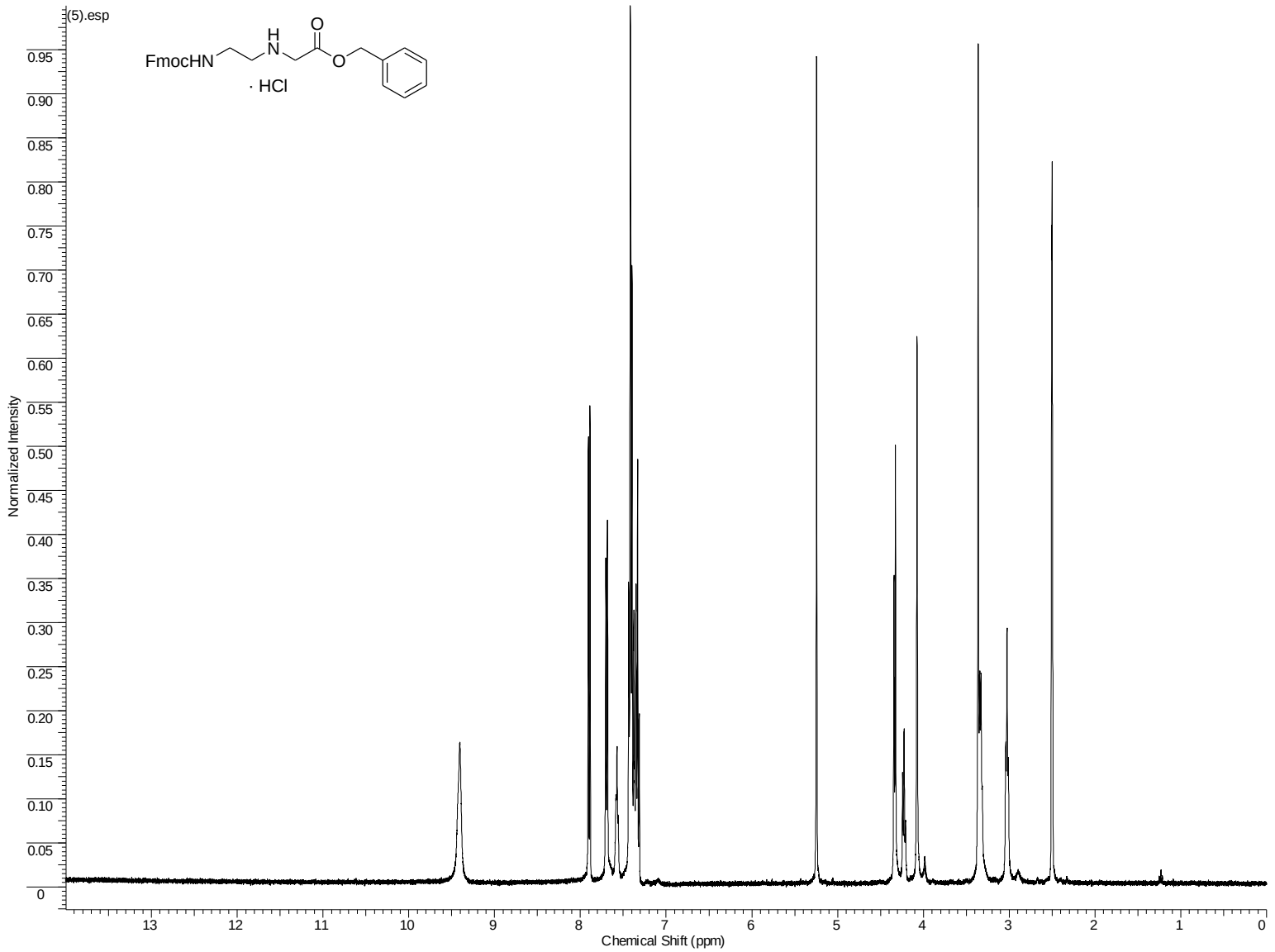
^{1}H NMR (400 MHz, D_2O) of **4**, 4-Nitrobenzyl *N*-(2-aminoethyl)glycinate · 2 TsOH



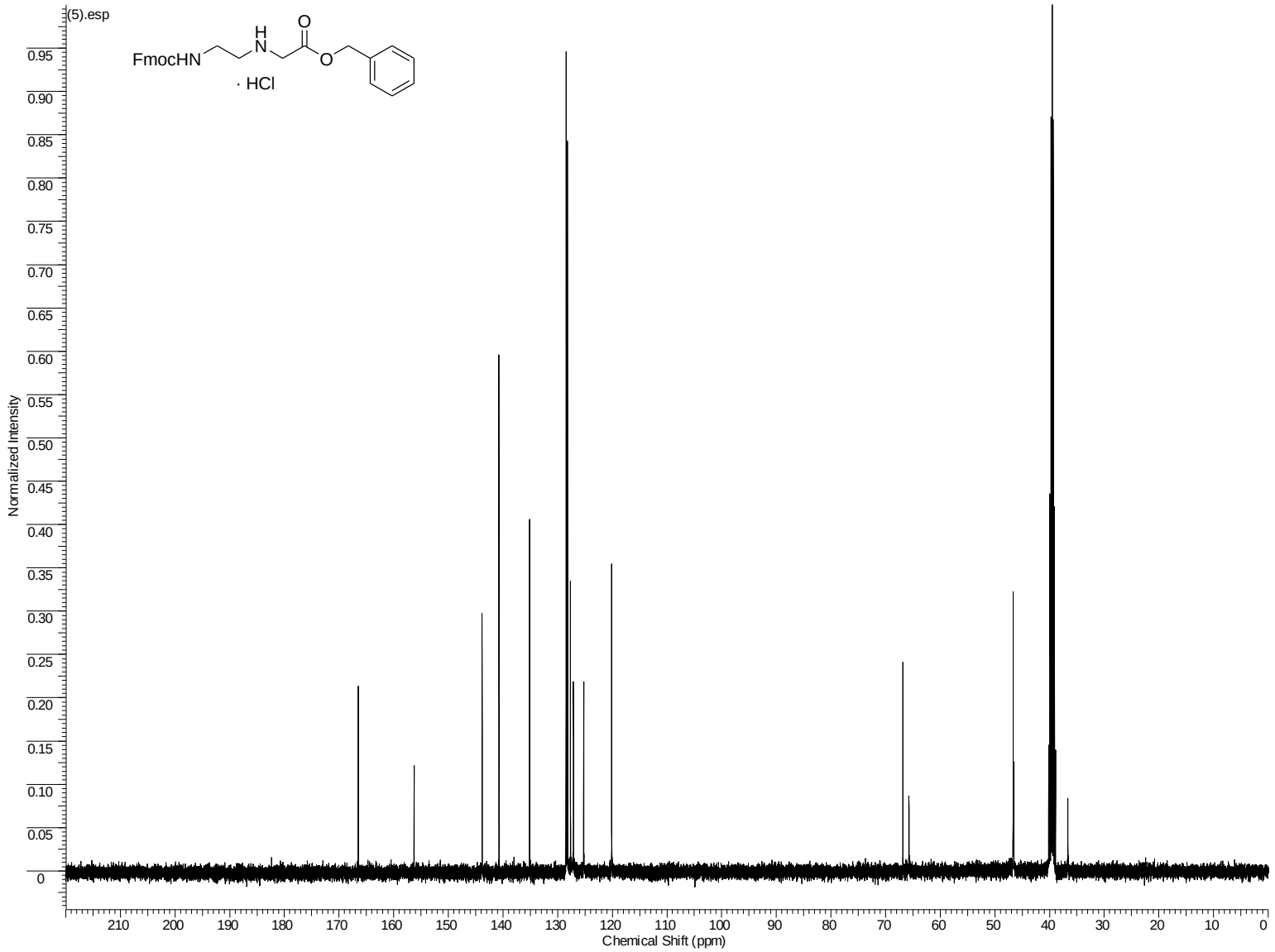
^{13}C NMR (100 MHz, DMSO-d_6) of **4**, 4-Nitrobenzyl *N*-(2-aminoethyl)glycinate · 2 TsOH



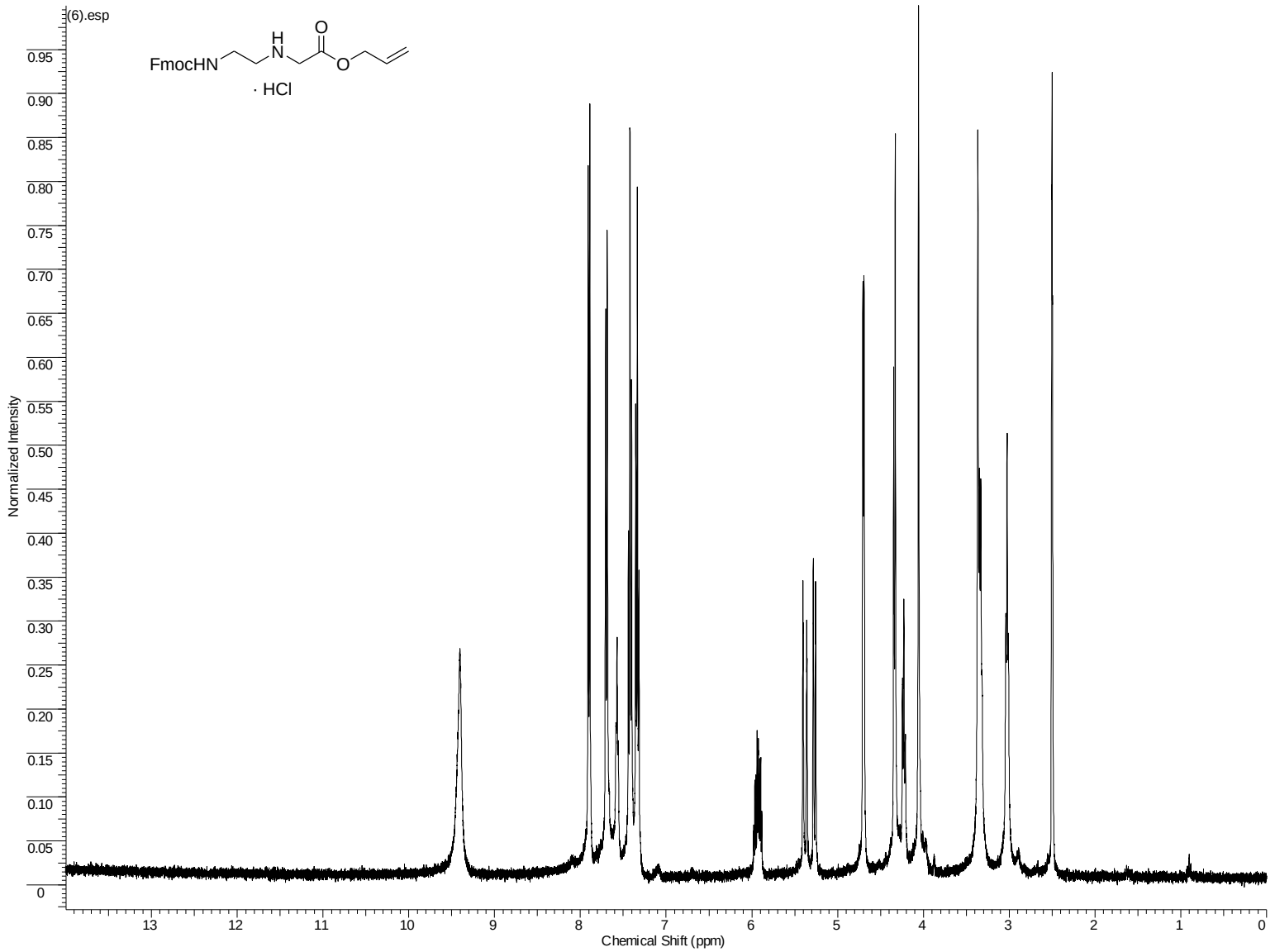
^{1}H NMR (400 MHz, DMSO-d_6) of **5**·HCl, Benzyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]glycinate hydrochloride



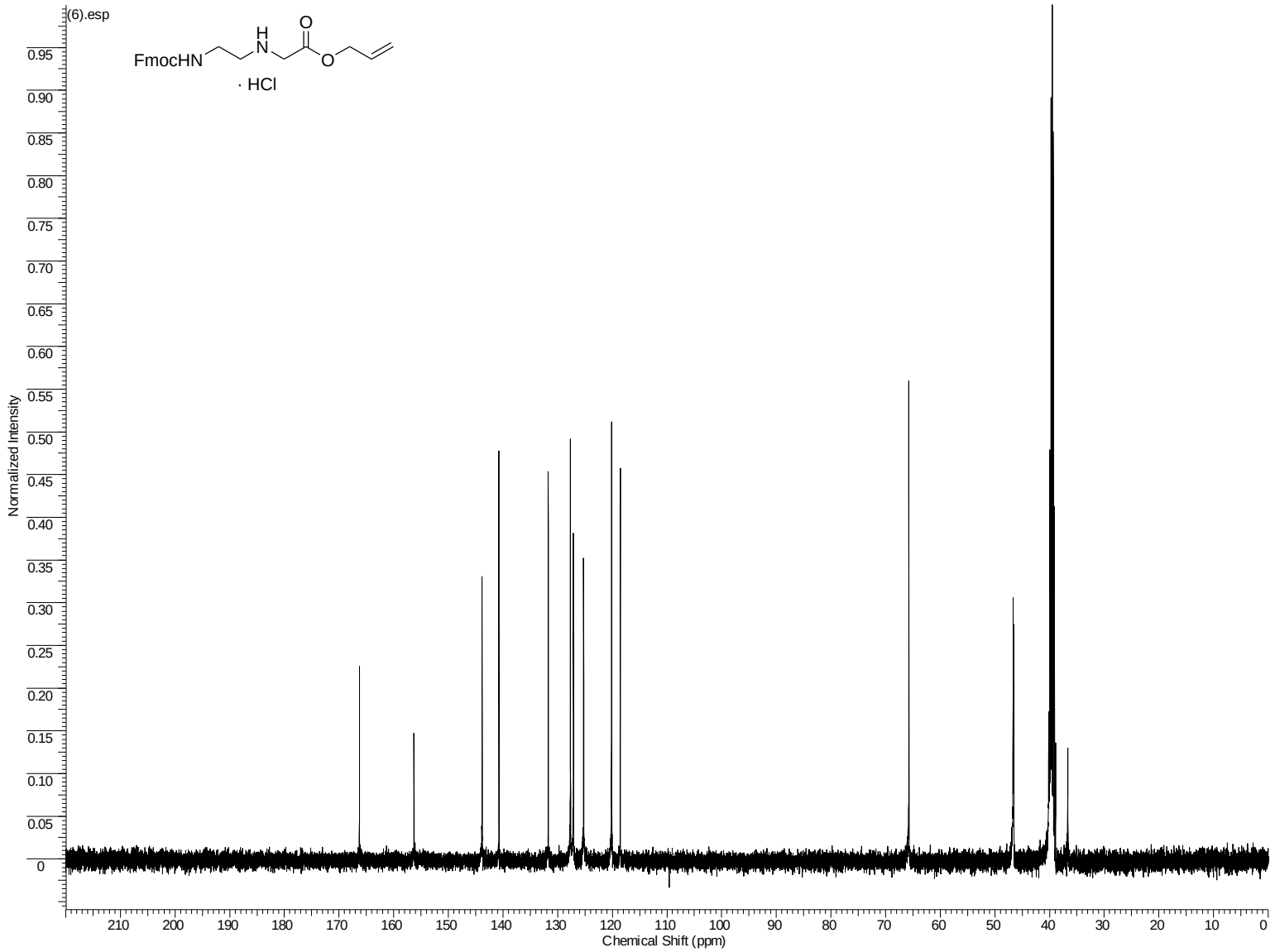
^{13}C NMR (100 MHz, DMSO-d_6) of **5**· HCl , Benzyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]glycinate hydrochloride



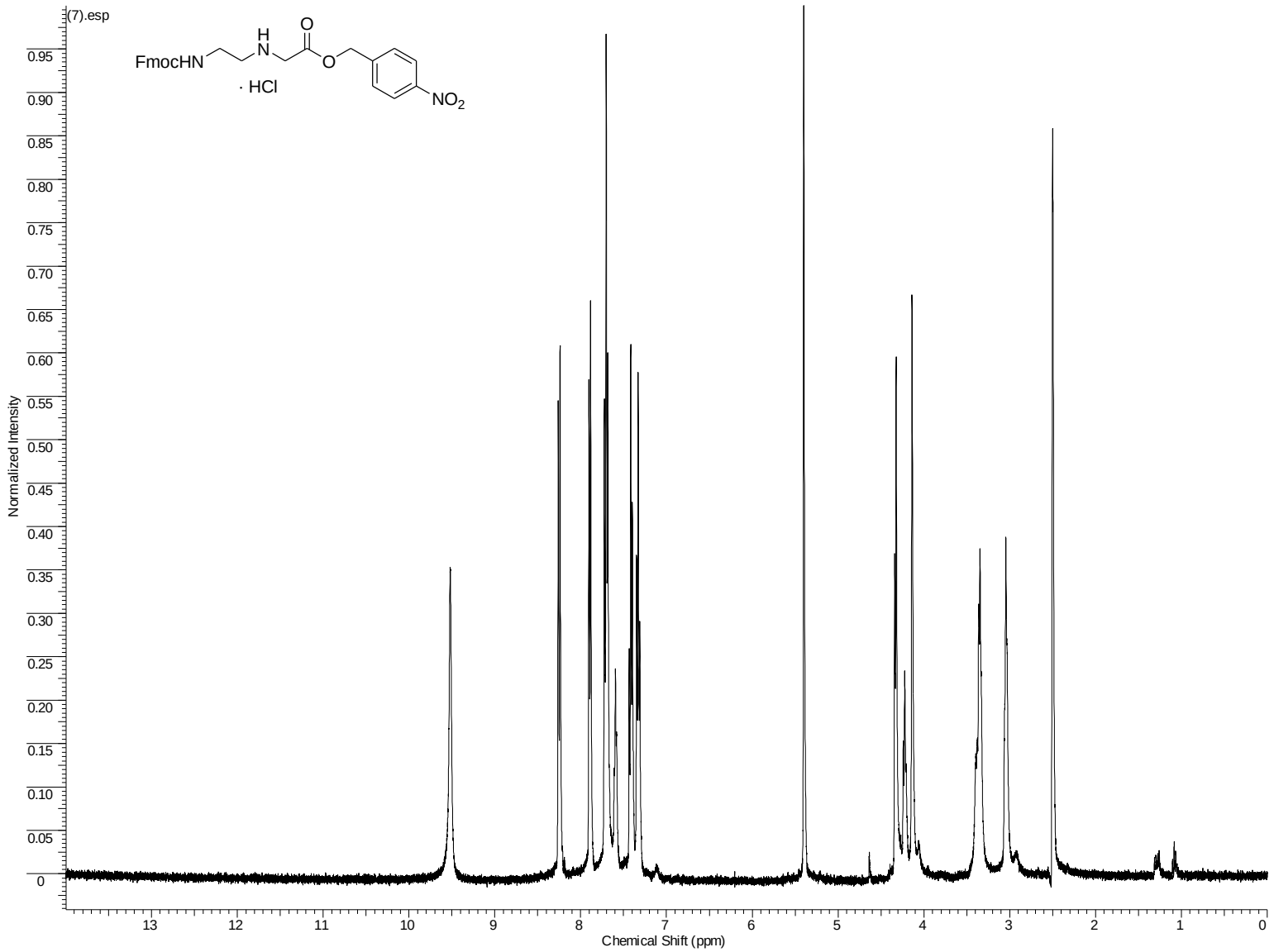
^{1}H NMR (400 MHz, DMSO-d_6) of **6**·HCl , Allyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]glycinate hydrochloride



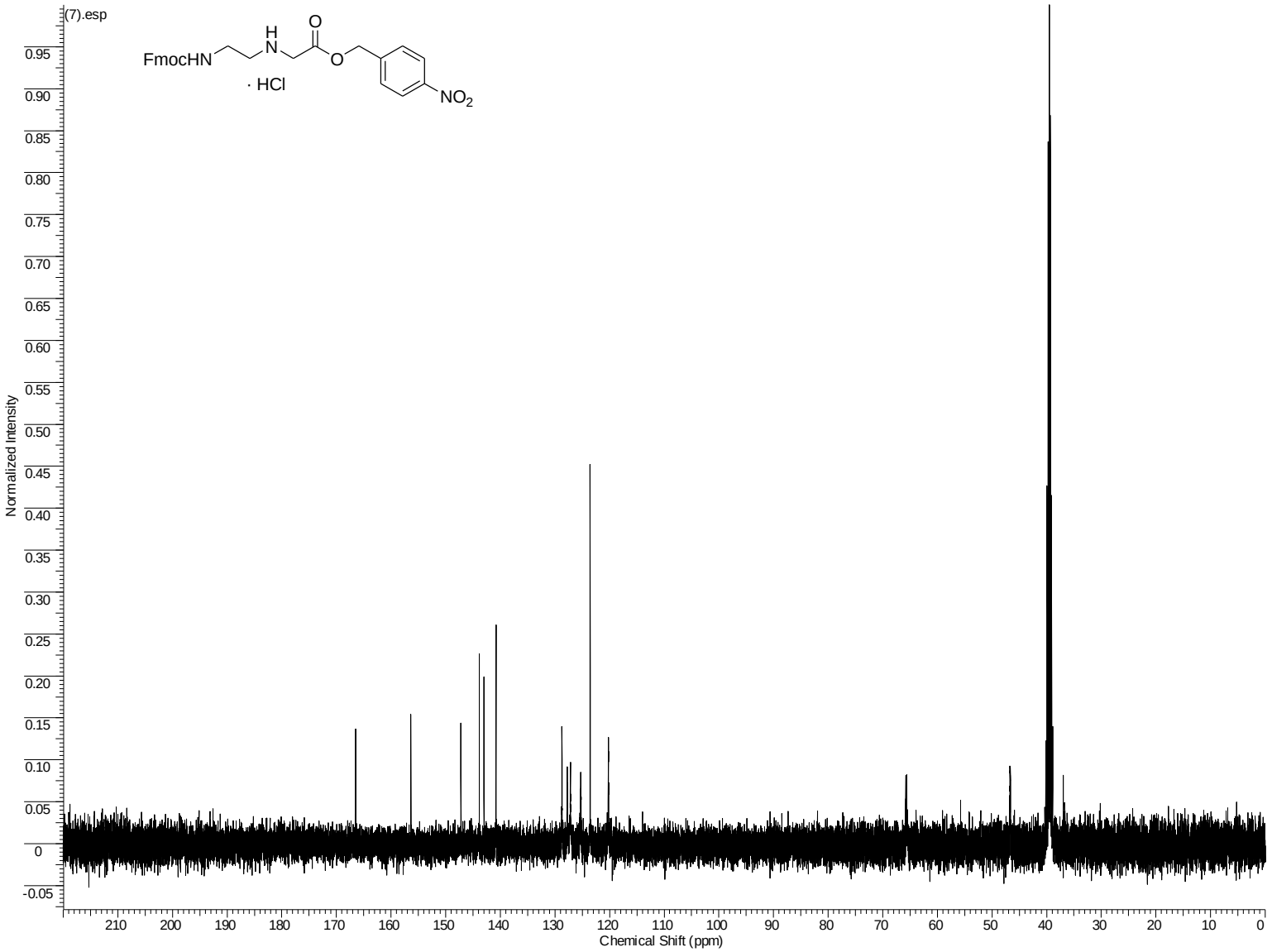
^{13}C NMR (100 MHz, DMSO-d_6) of **6**·HCl, Allyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]glycinate hydrochloride



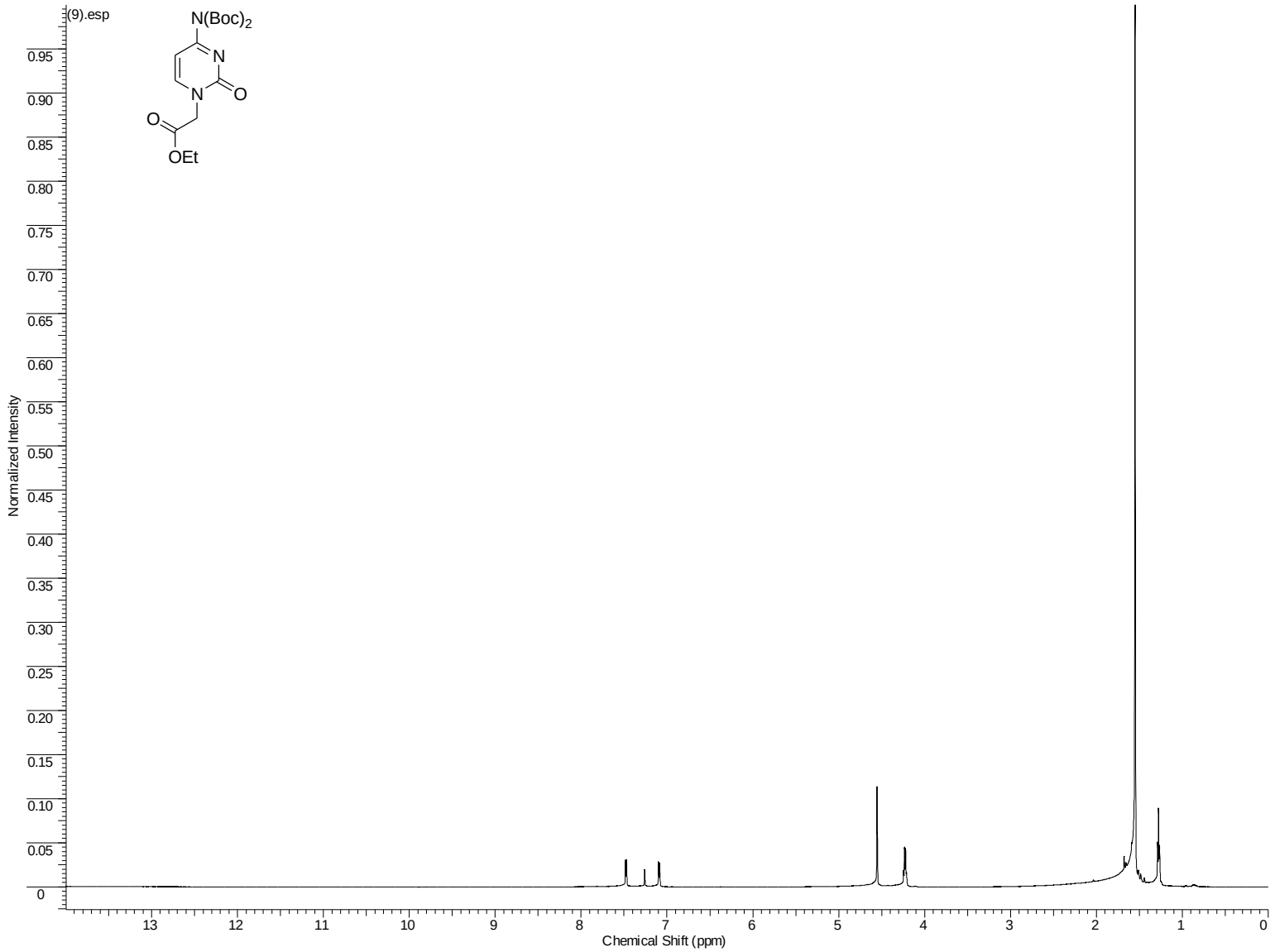
^{1}H NMR (400 MHz, DMSO-d_6) of **7**·HCl , 4-Nitrobenzyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]glycinate hydrochloride



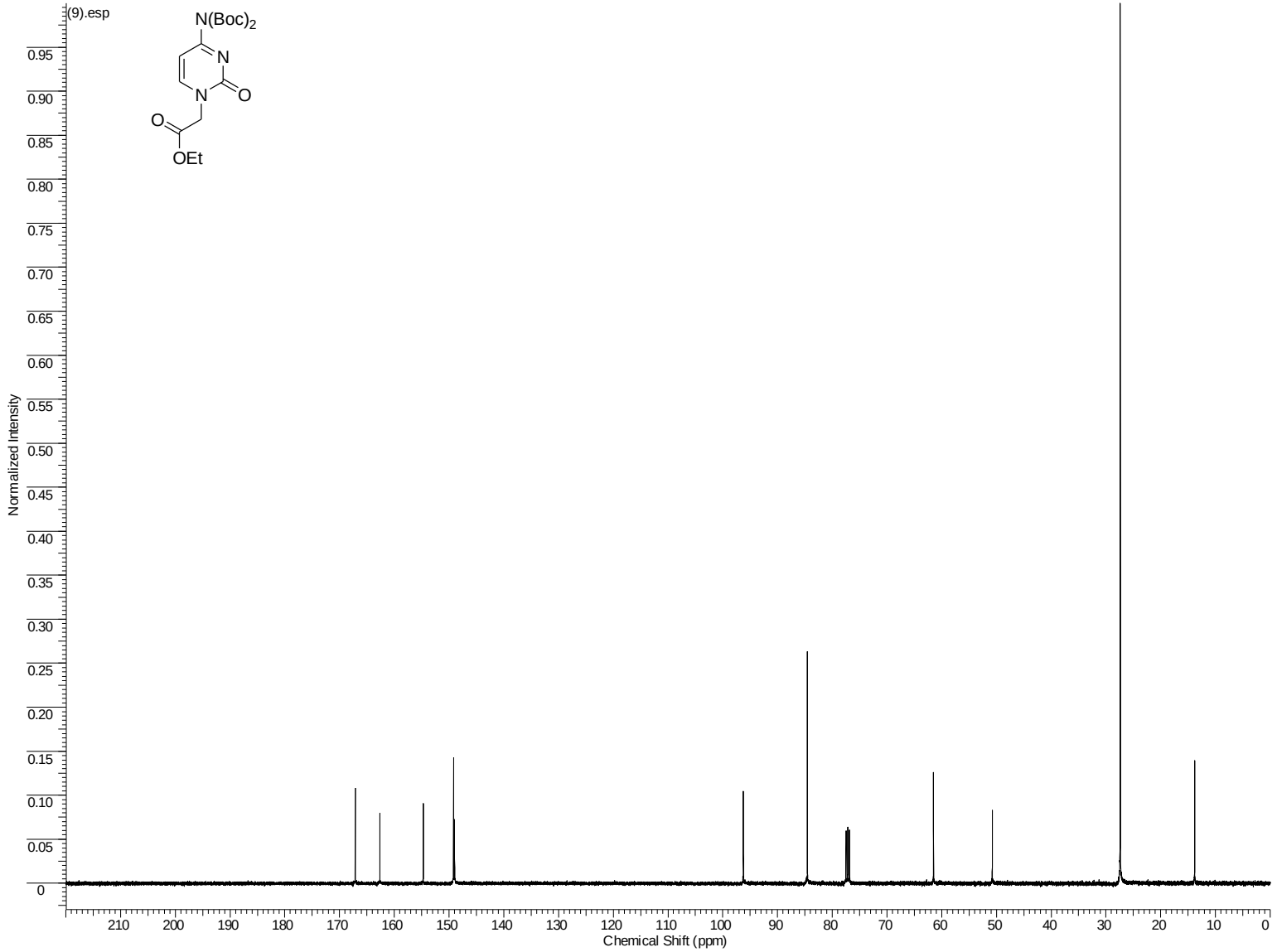
^{13}C NMR (100 MHz, DMSO-d_6) of **7**·HCl , 4-Nitrobenzyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]glycinate hydrochloride



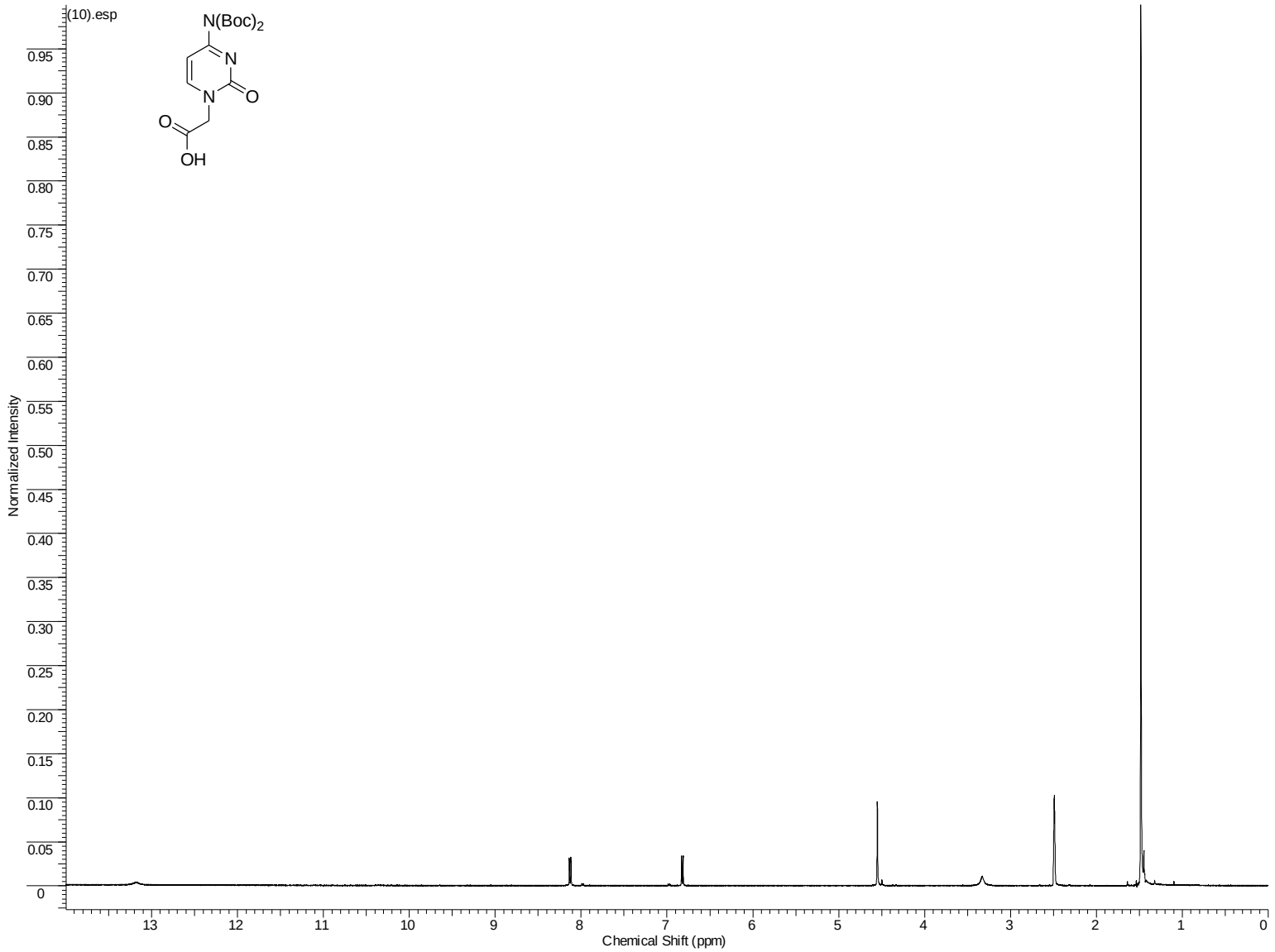
^{1}H NMR (400 MHz, $CDCl_3$) of **9**, Ethyl [N^4,N^4-bis(*tert*-butoxycarbonyl)cytosin-1-yl]acetate



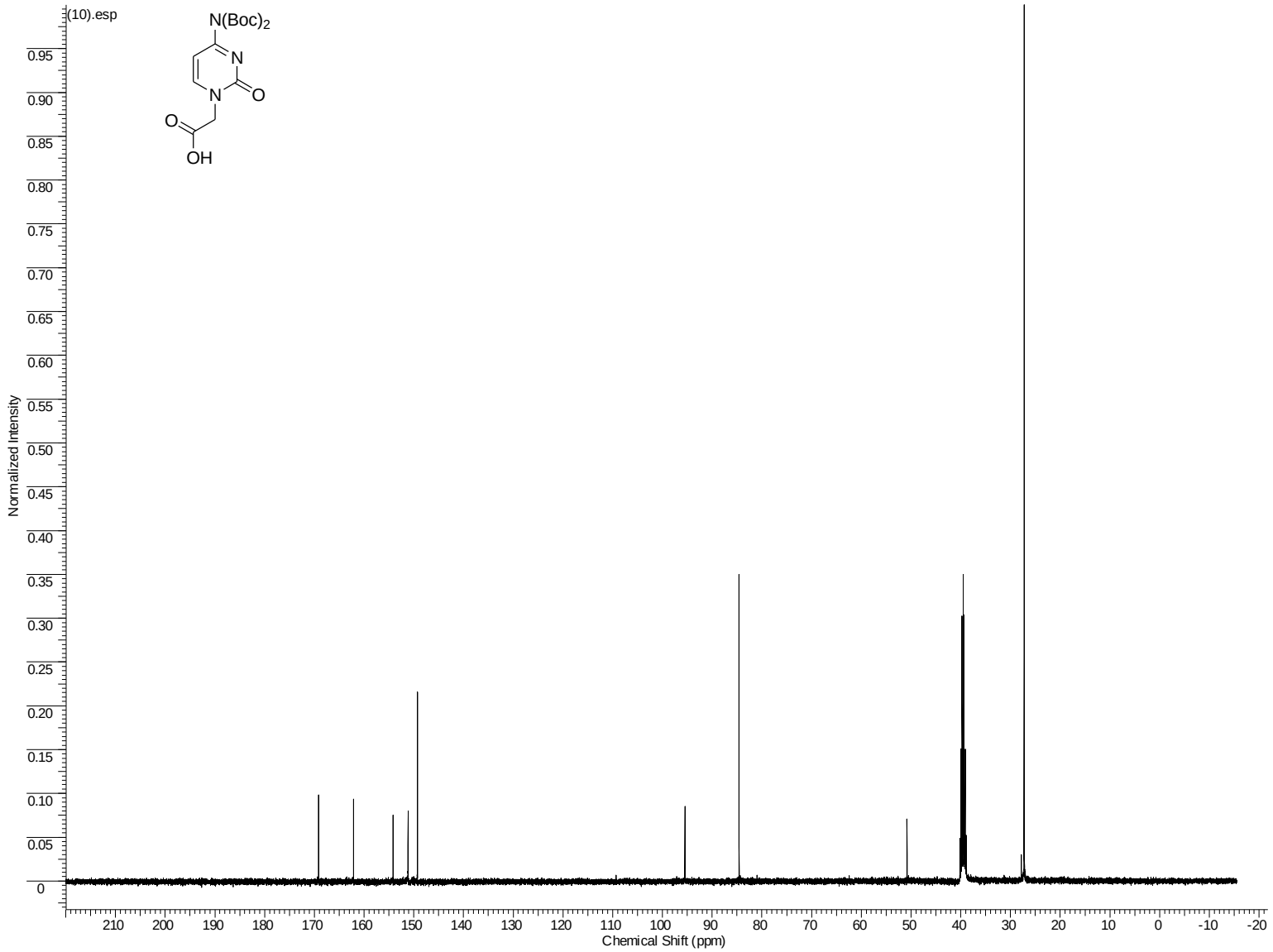
^{13}C NMR (100 MHz, $CDCl_3$) of **9**, Ethyl [N^4,N^4-bis(*tert*-butoxycarbonyl)cytosin-1-yl]acetate



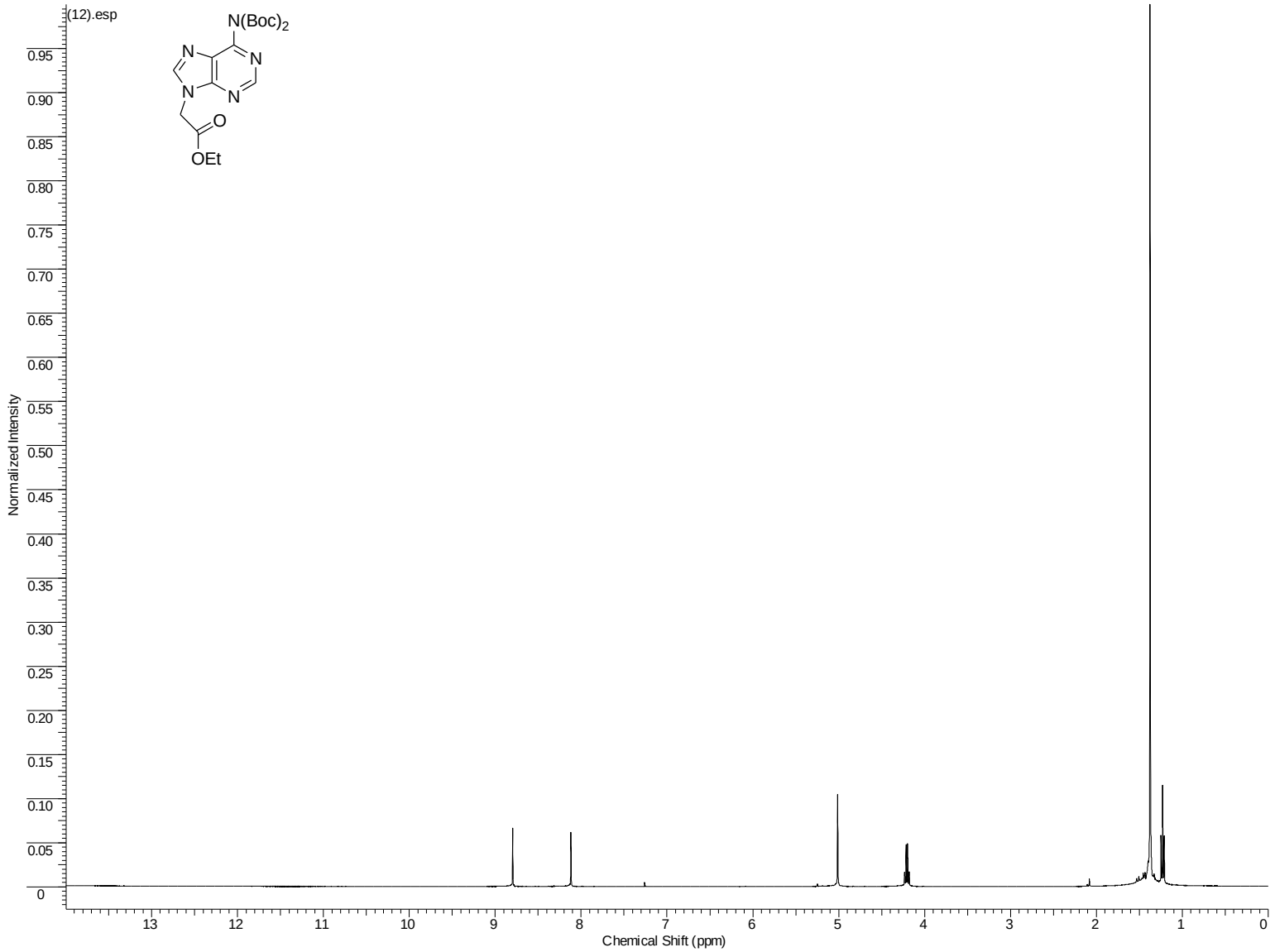
^{1}H NMR (400 MHz, $CDCl_3$) of **10**, [N^4,N^4-bis(*tert*-Butoxycarbonyl)cytosin-1-yl]acetic acid



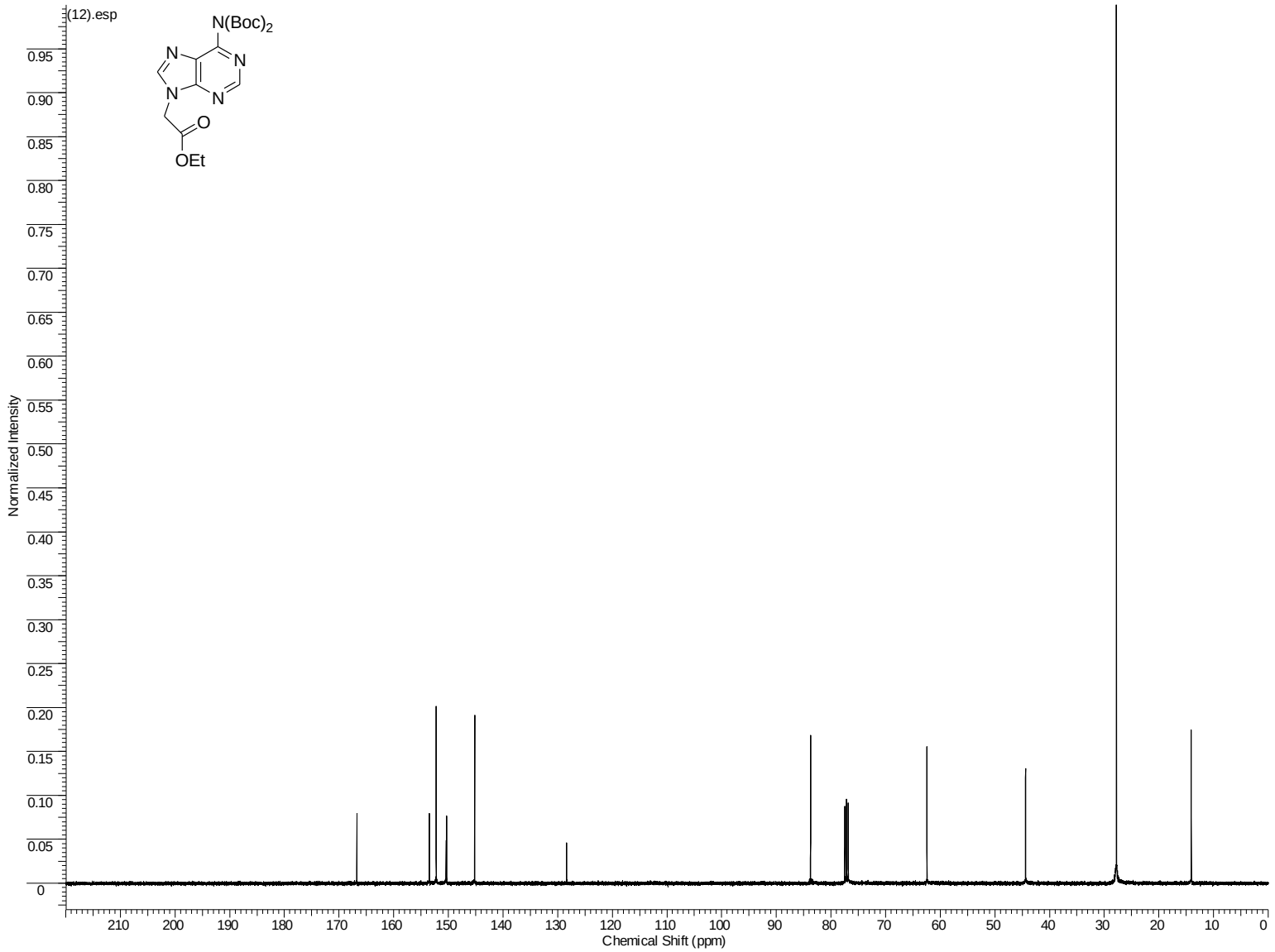
^{13}C NMR (100 MHz, $CDCl_3$) of **10**, [N^4,N^4-bis(*tert*-Butoxycarbonyl)cytosin-1-yl]acetic acid



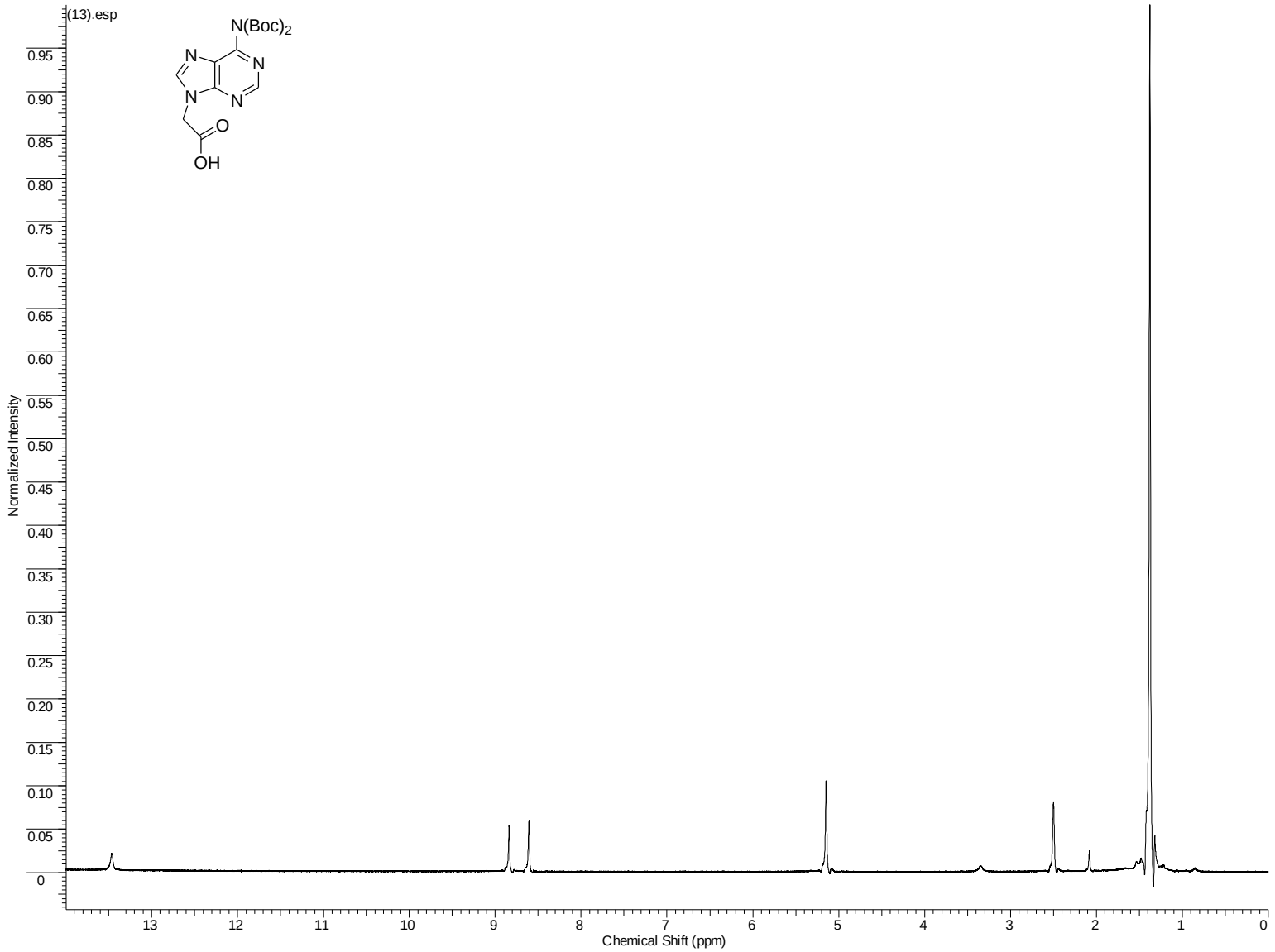
^{1}H NMR (400 MHz, $CDCl_3$) of **12**, Ethyl [N^6,N^6-bis(*tert*-butoxycarbonyl)adenin-9-yl]acetate



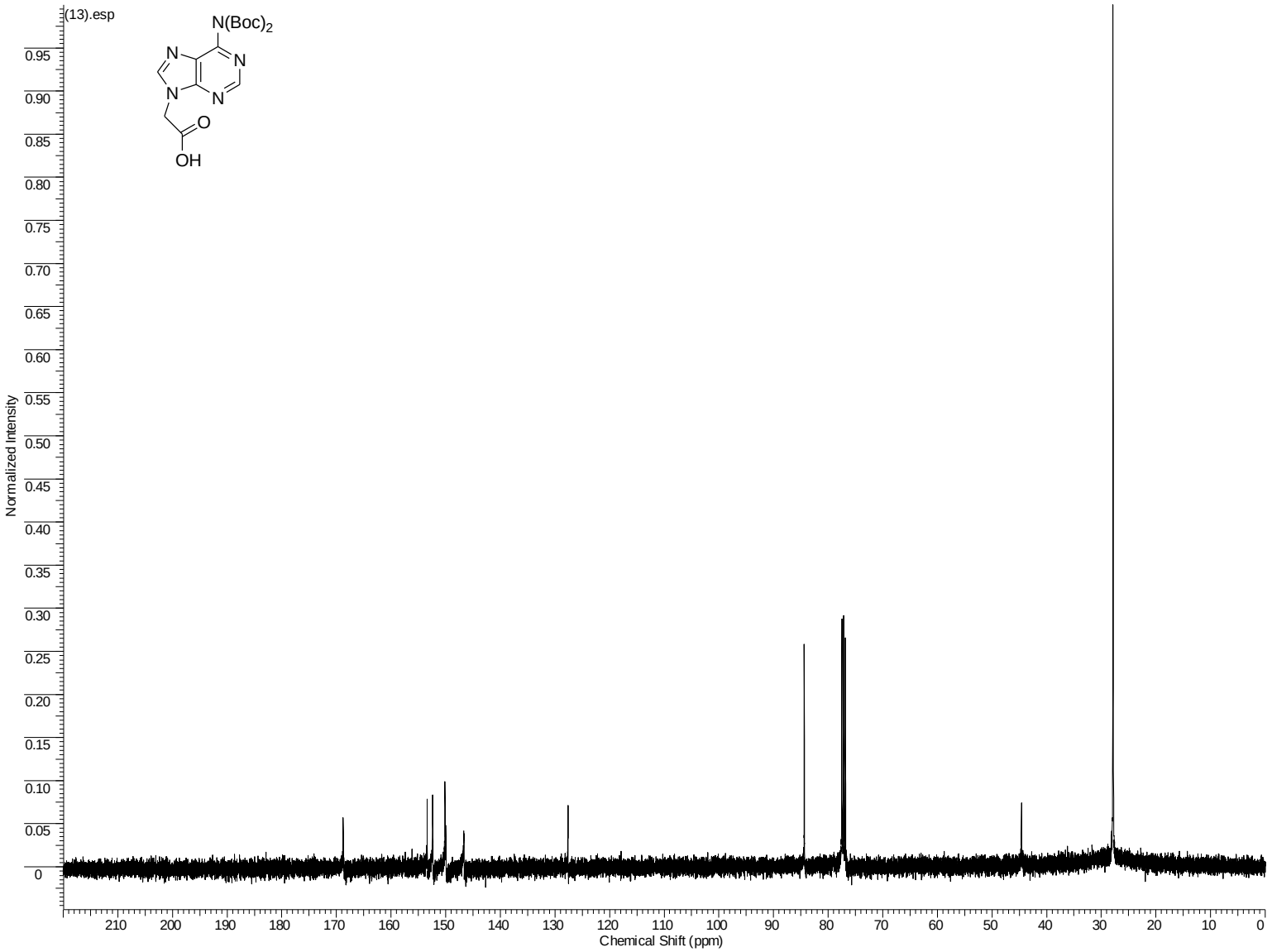
^{13}C NMR (100 MHz, $CDCl_3$) of **12**, Ethyl [N^6,N^6-bis(*tert*-butoxycarbonyl)adenin-9-yl]acetate



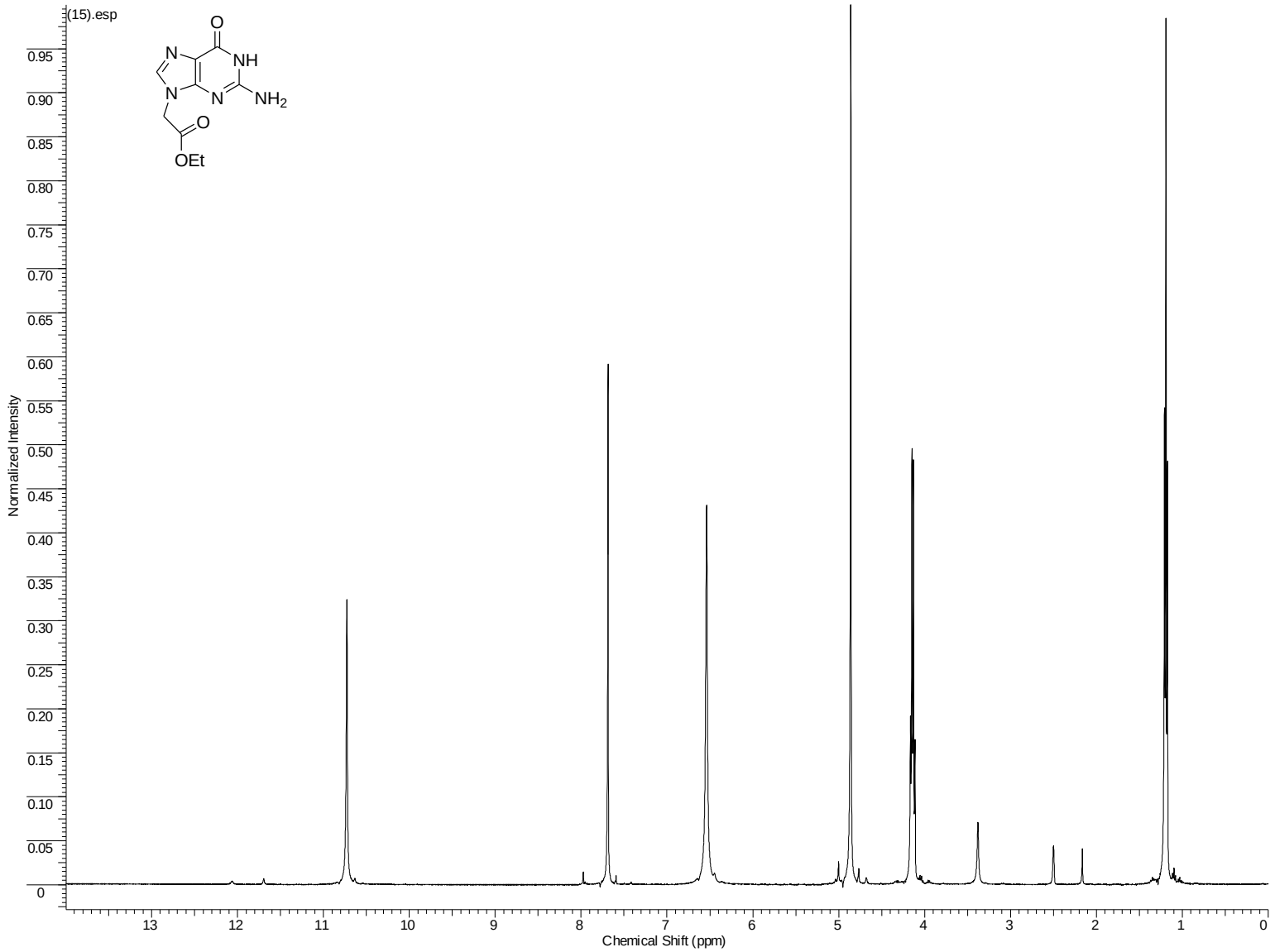
^{1}H NMR (400 MHz, $CDCl_3$) of **13**, [N^6,N^6-bis(*tert*-Butoxycarbonyl)adenin-9-yl]acetic acid



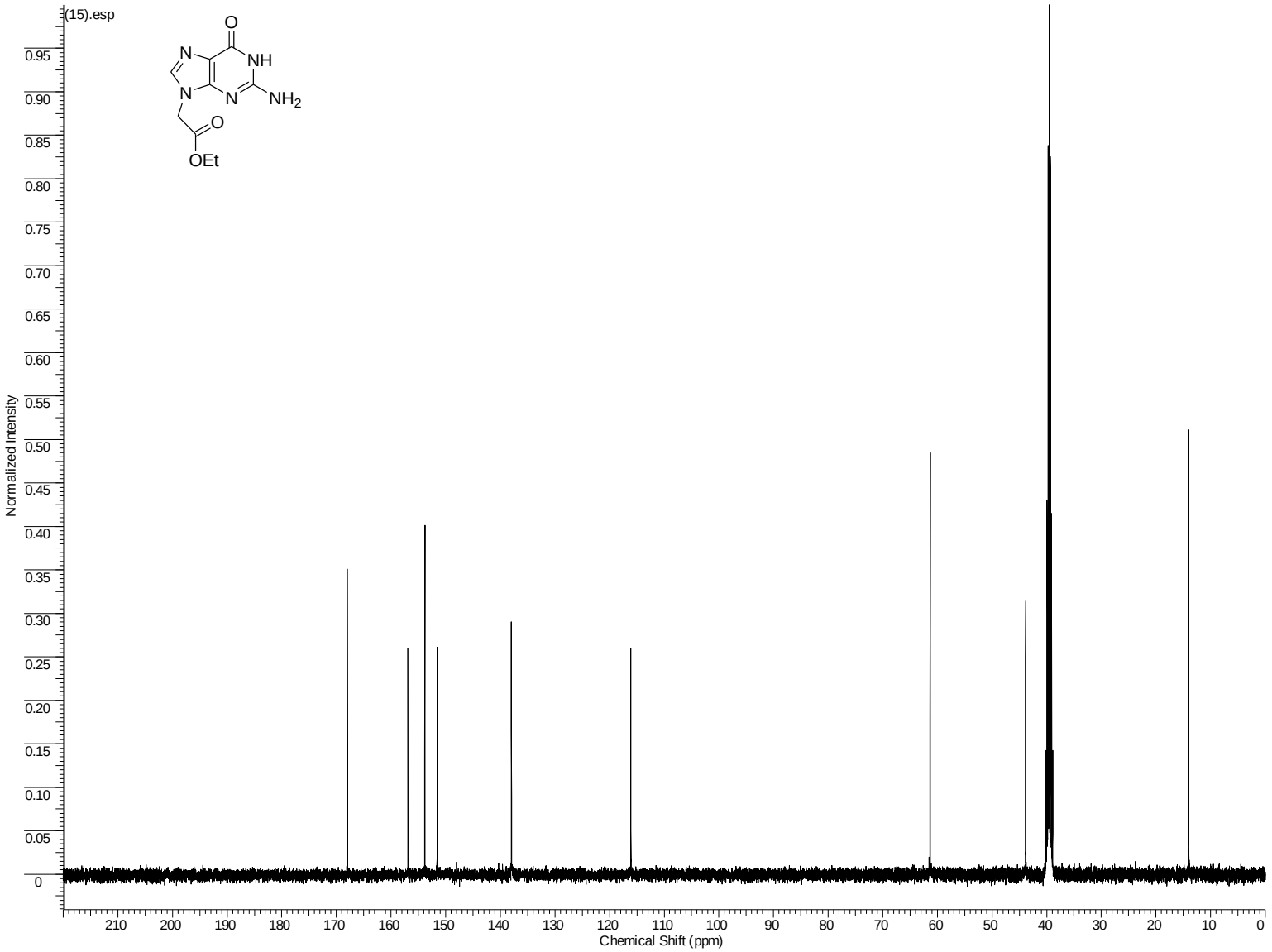
^{13}C NMR (100 MHz, $CDCl_3$) of **13**, [N^6,N^6-bis(*tert*-Butoxycarbonyl)adenin-9-yl]acetic acid



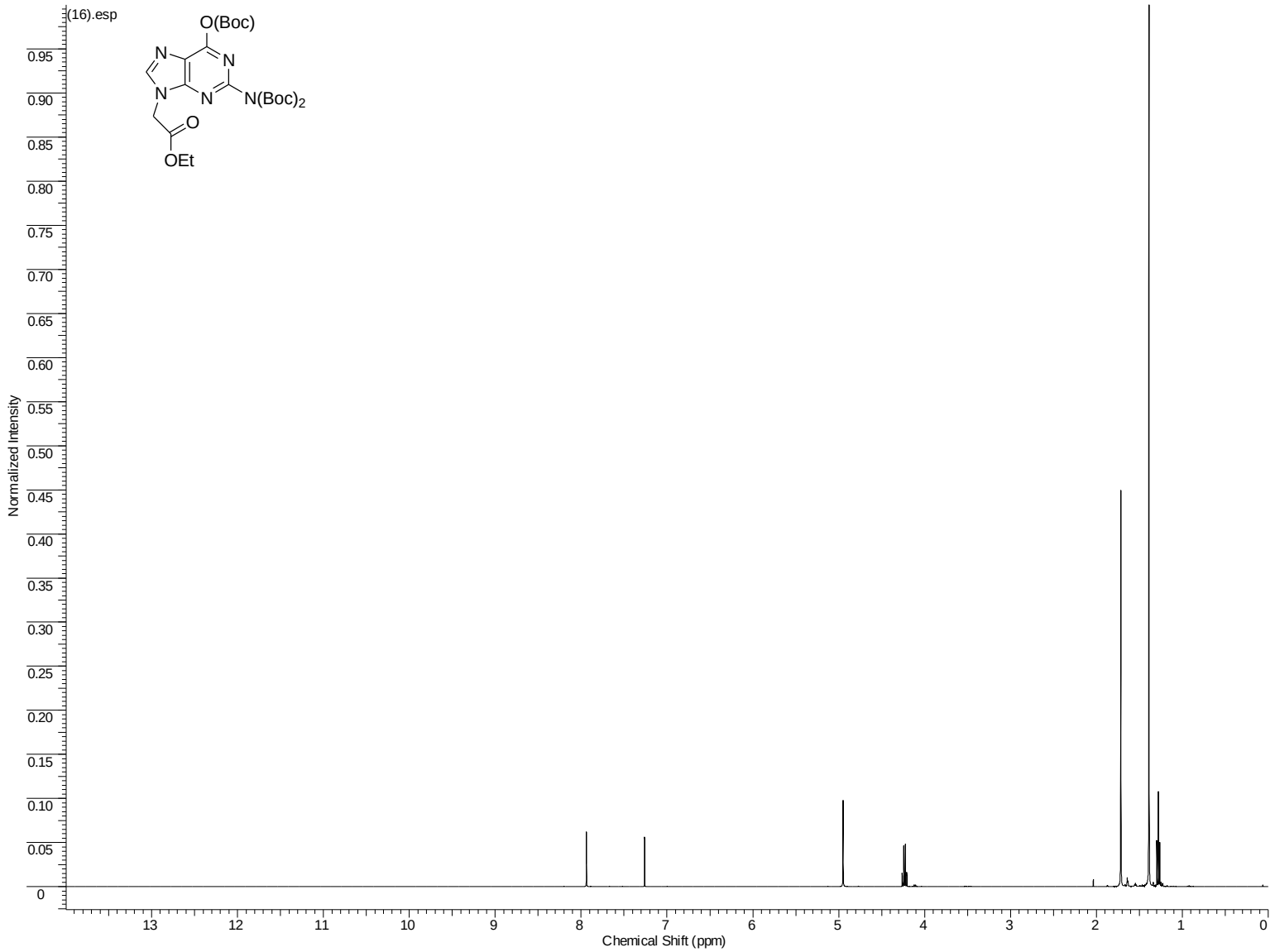
^{1}H NMR (400 MHz, DMSO-d_6) of **15**, Ethyl guanin-9-ylacetate



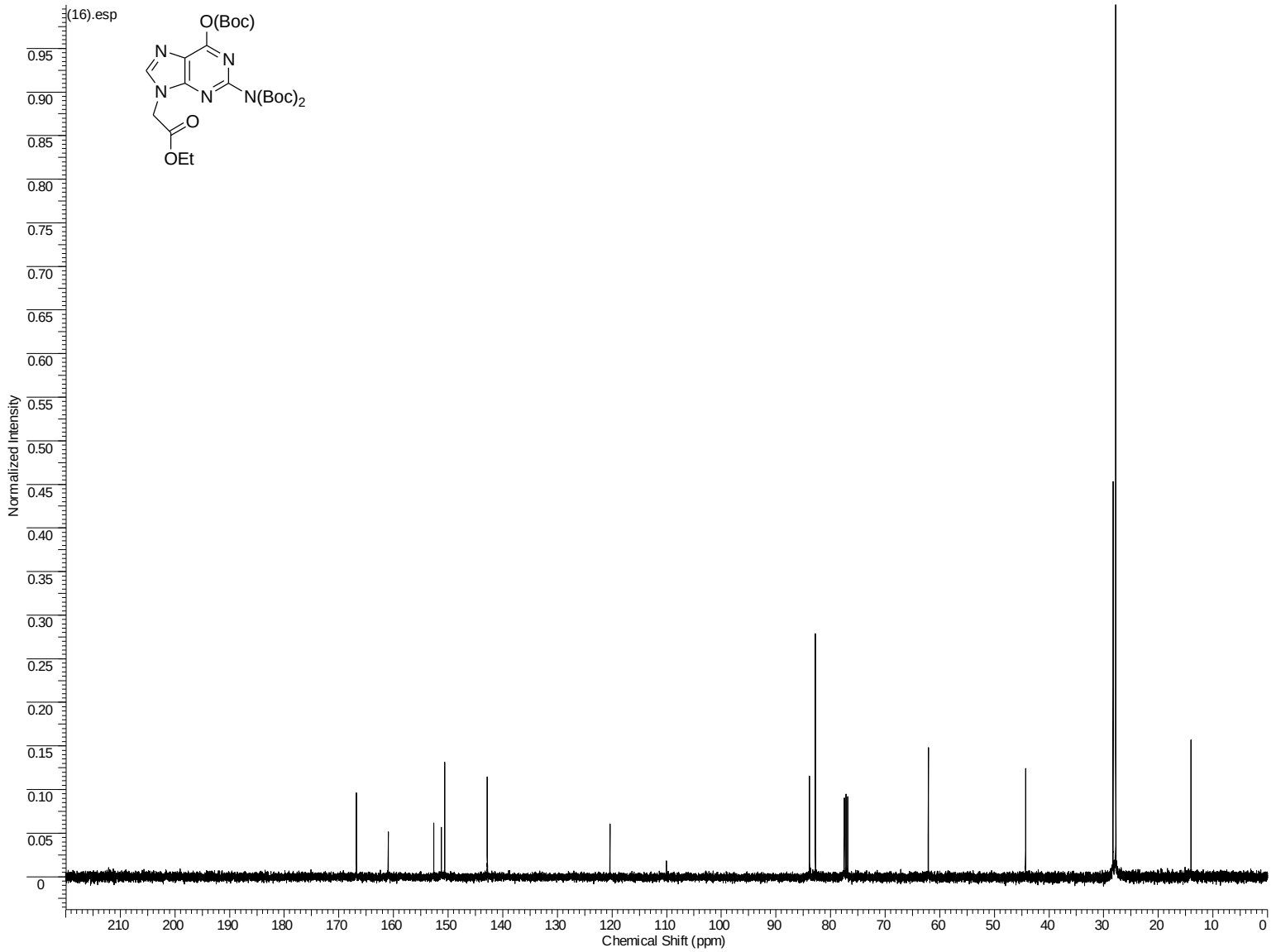
^{13}C NMR (100 MHz, DMSO-d_6) of **15**, Ethyl guanin-9-ylacetate



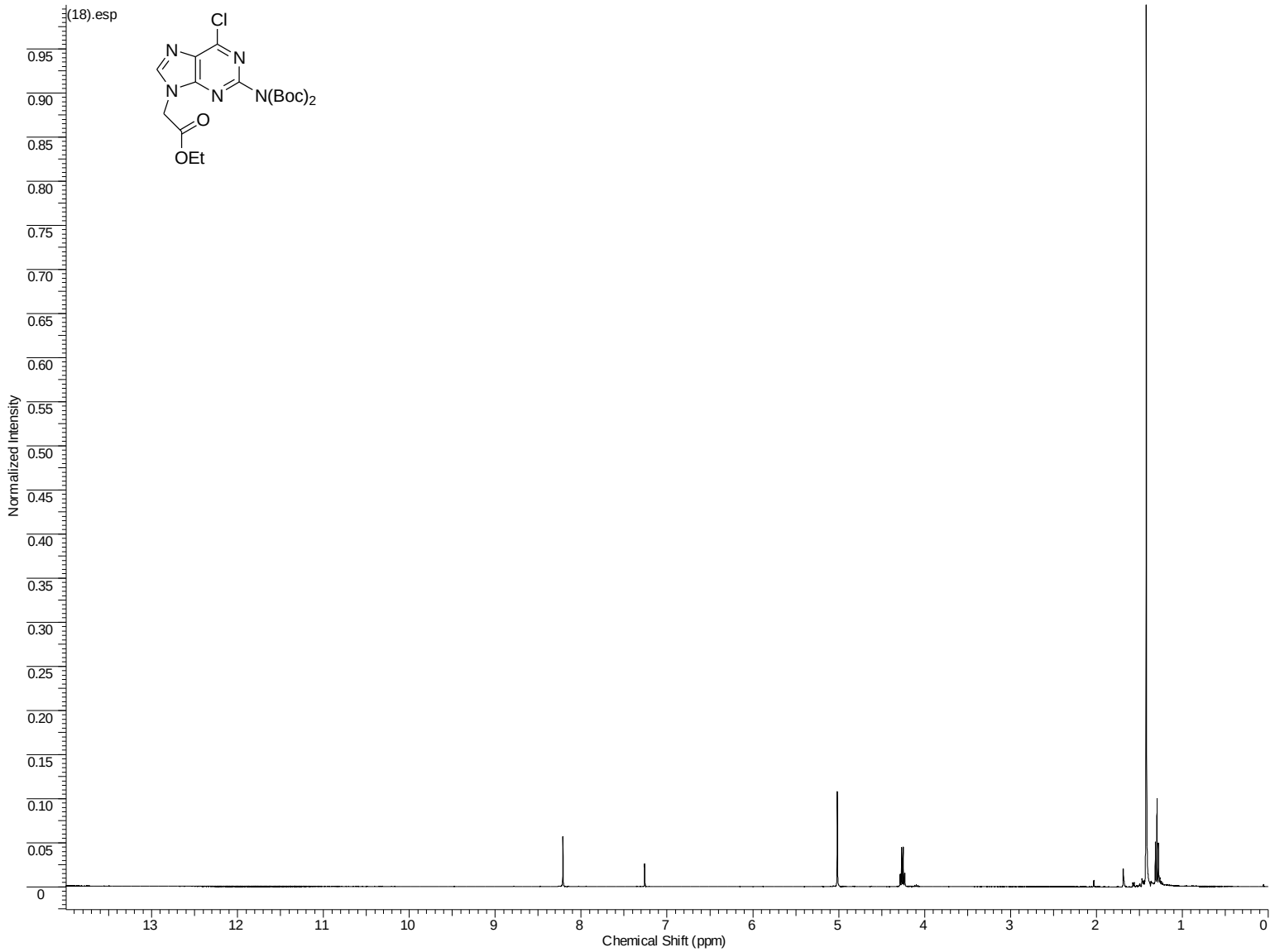
^{1}H NMR (400 MHz, $CDCl_3$) of **16**, Ethyl [N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-(*tert*-butoxycarbonyl)guanin-9-yl]acetate



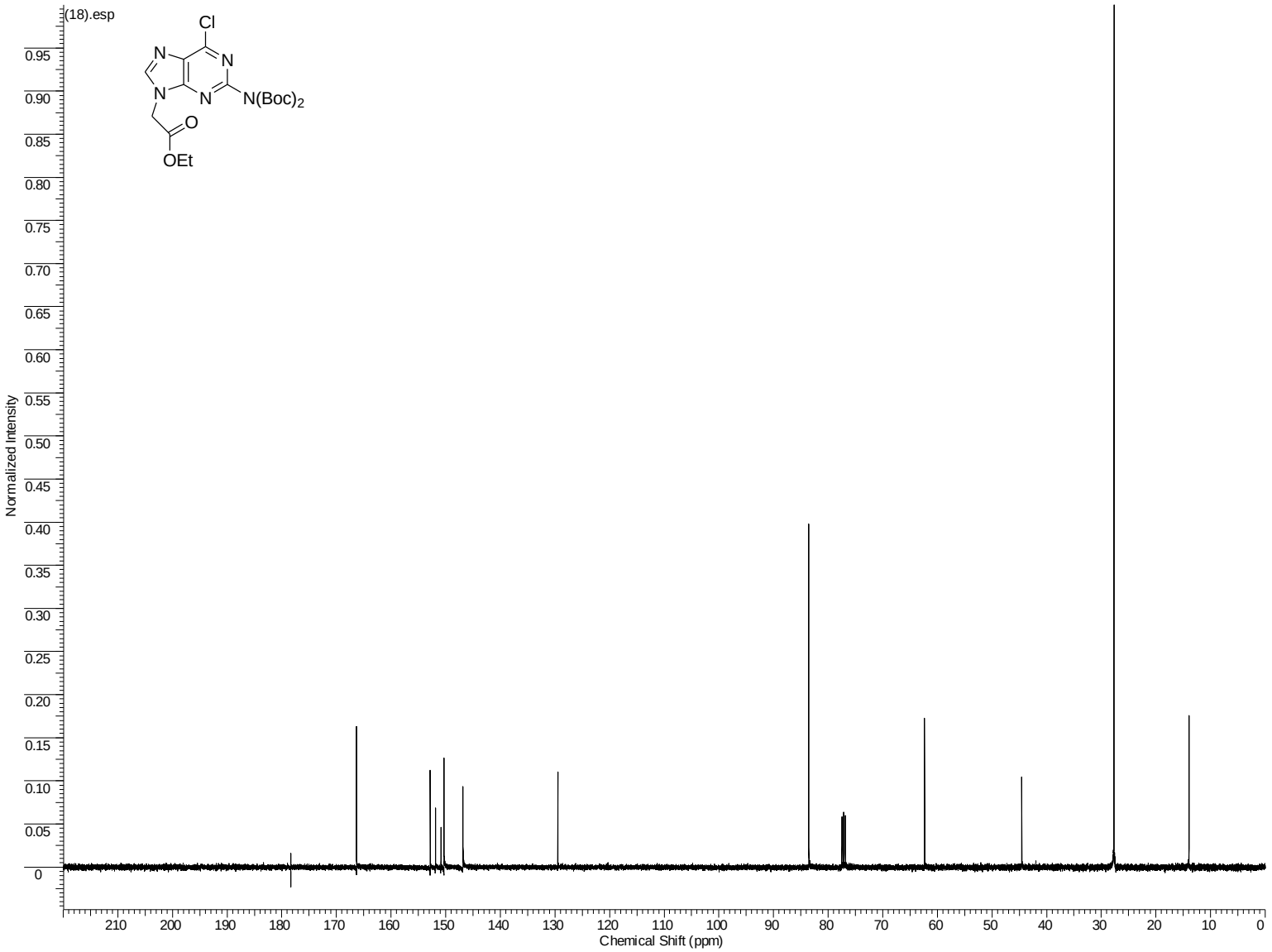
^{13}C NMR (100 MHz, $CDCl_3$) of **16**, Ethyl [N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-(*tert*-butoxycarbonyl)guanin-9-yl]acetate



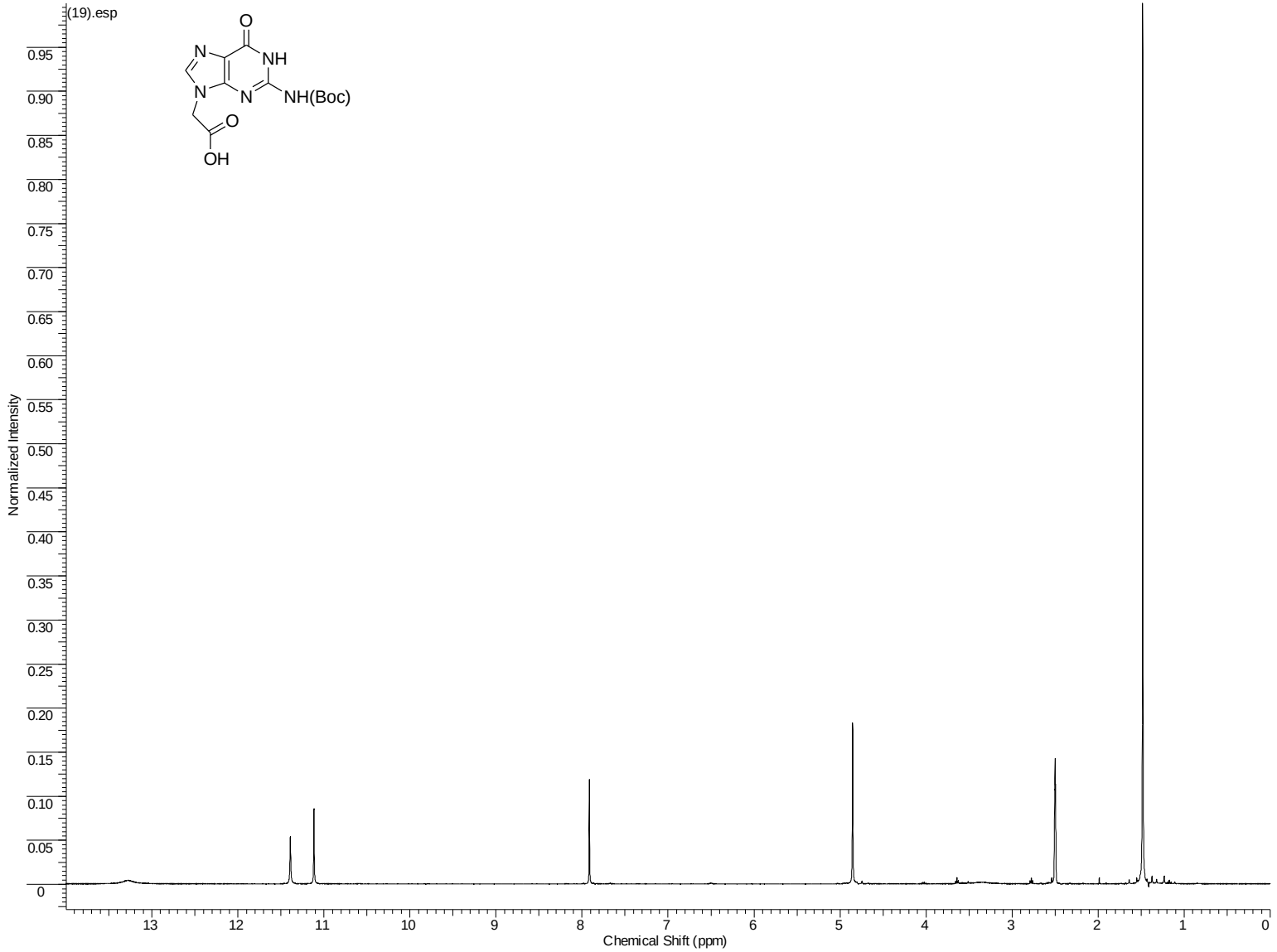
^{1}H NMR (400 MHz, $CDCl_3$) of **18**, Ethyl [N^2,N^2-(bis(*tert*-butoxycarbonyl)amino)-6-chloropurin-9-yl]acetate



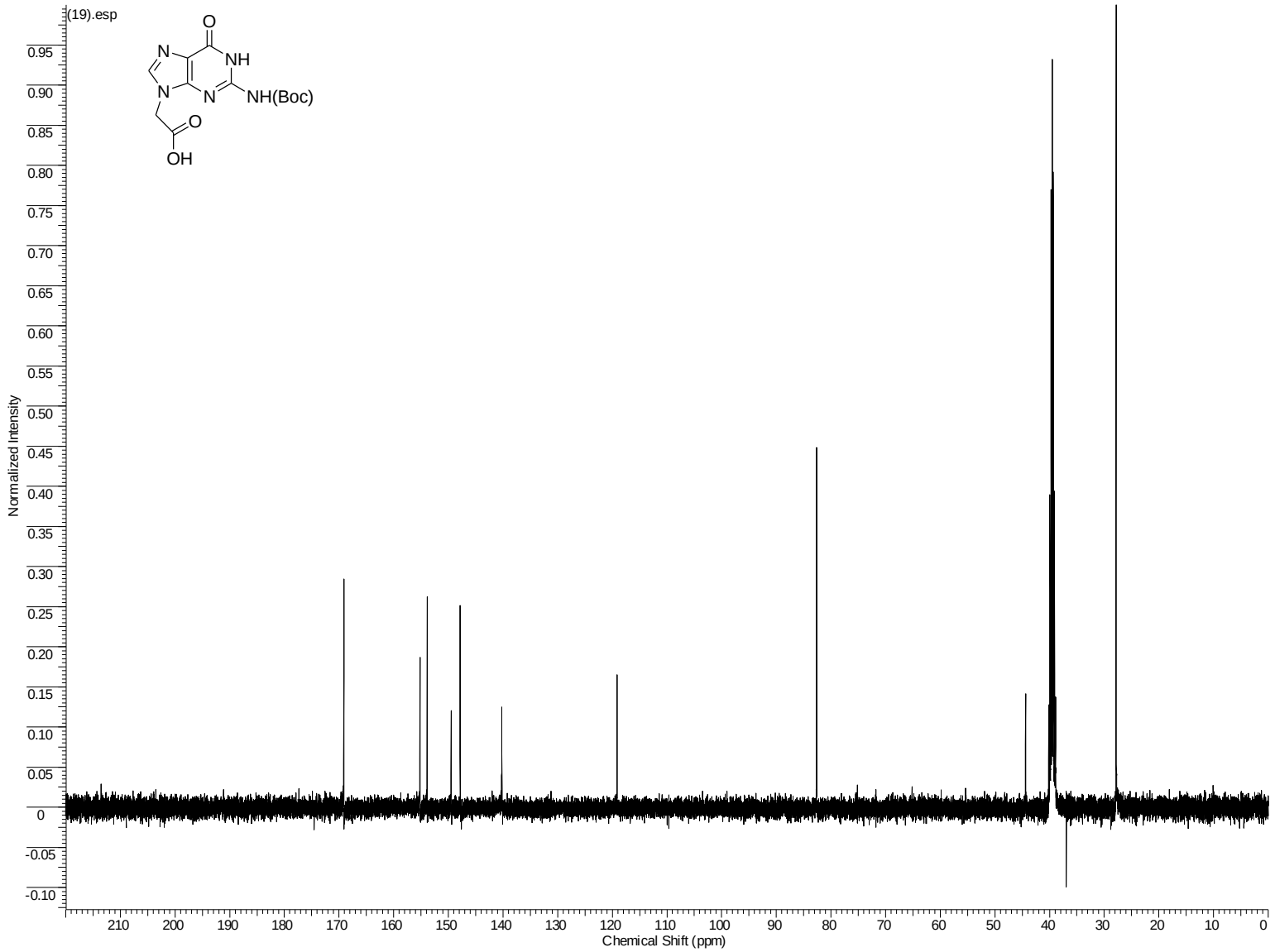
^{13}C NMR (100 MHz, $CDCl_3$) of **18**, Ethyl [N^2,N^2-(bis(*tert*-butoxycarbonyl)amino)-6-chloropurin-9-yl]acetate



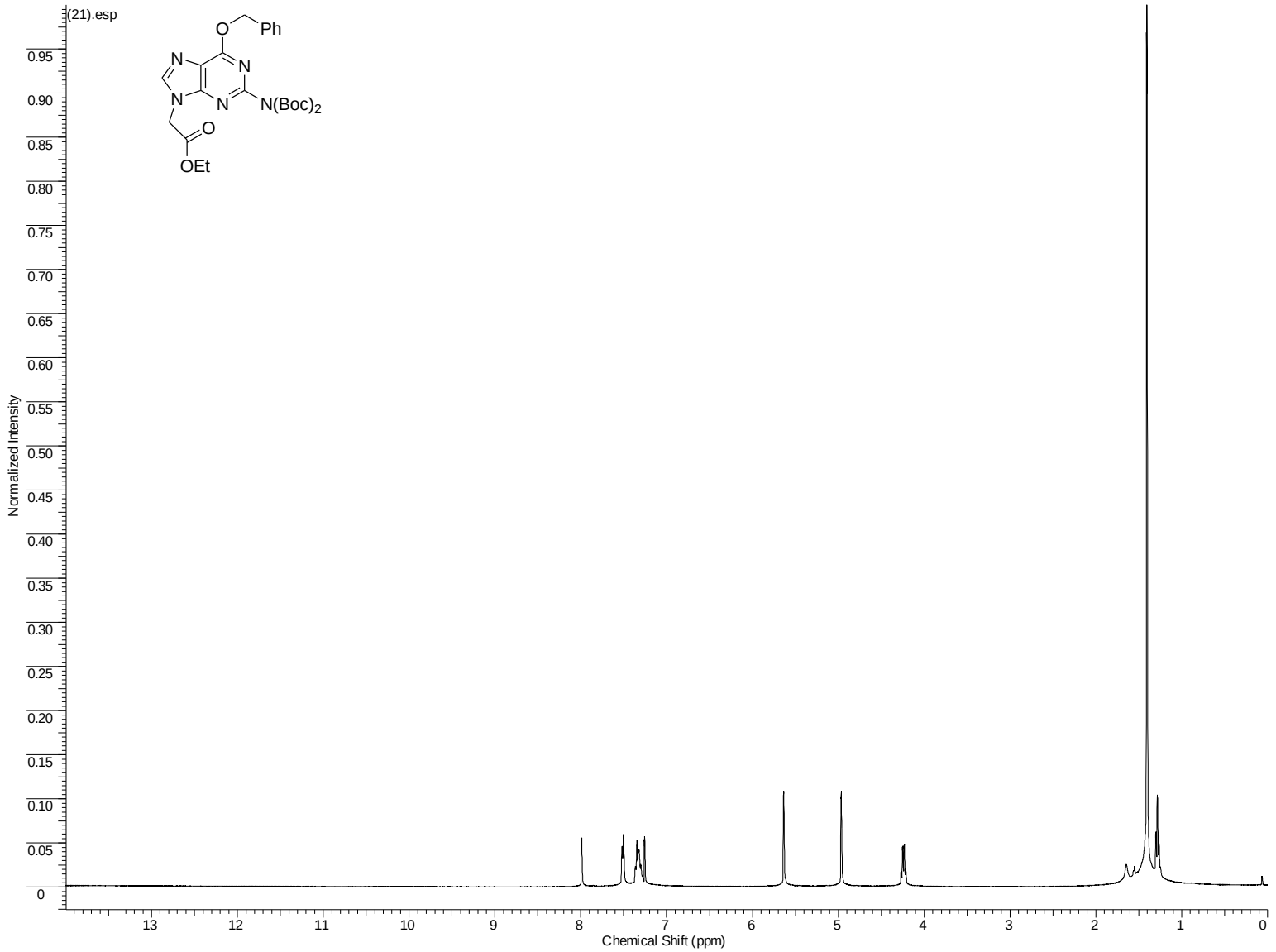
^{1}H NMR (400 MHz, DMSO-d_6) of **19**, [N^2-(*tert*-butoxycarbonyl)guanin-9-yl]acetic acid



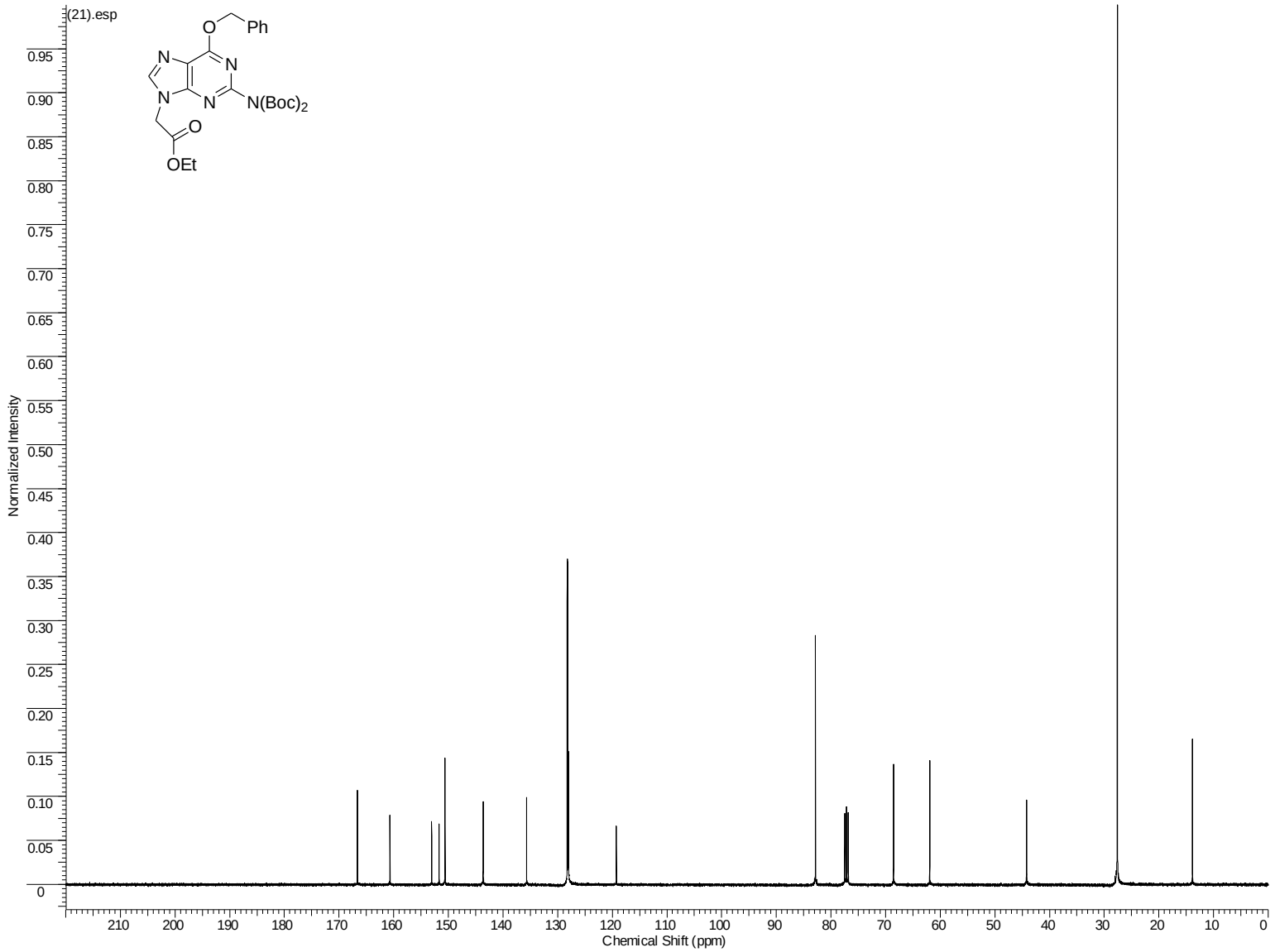
^{13}C NMR (100 MHz, DMSO-d_6) of **19**, [N^2-(*tert*-butoxycarbonyl)guanin-9-yl]acetic acid



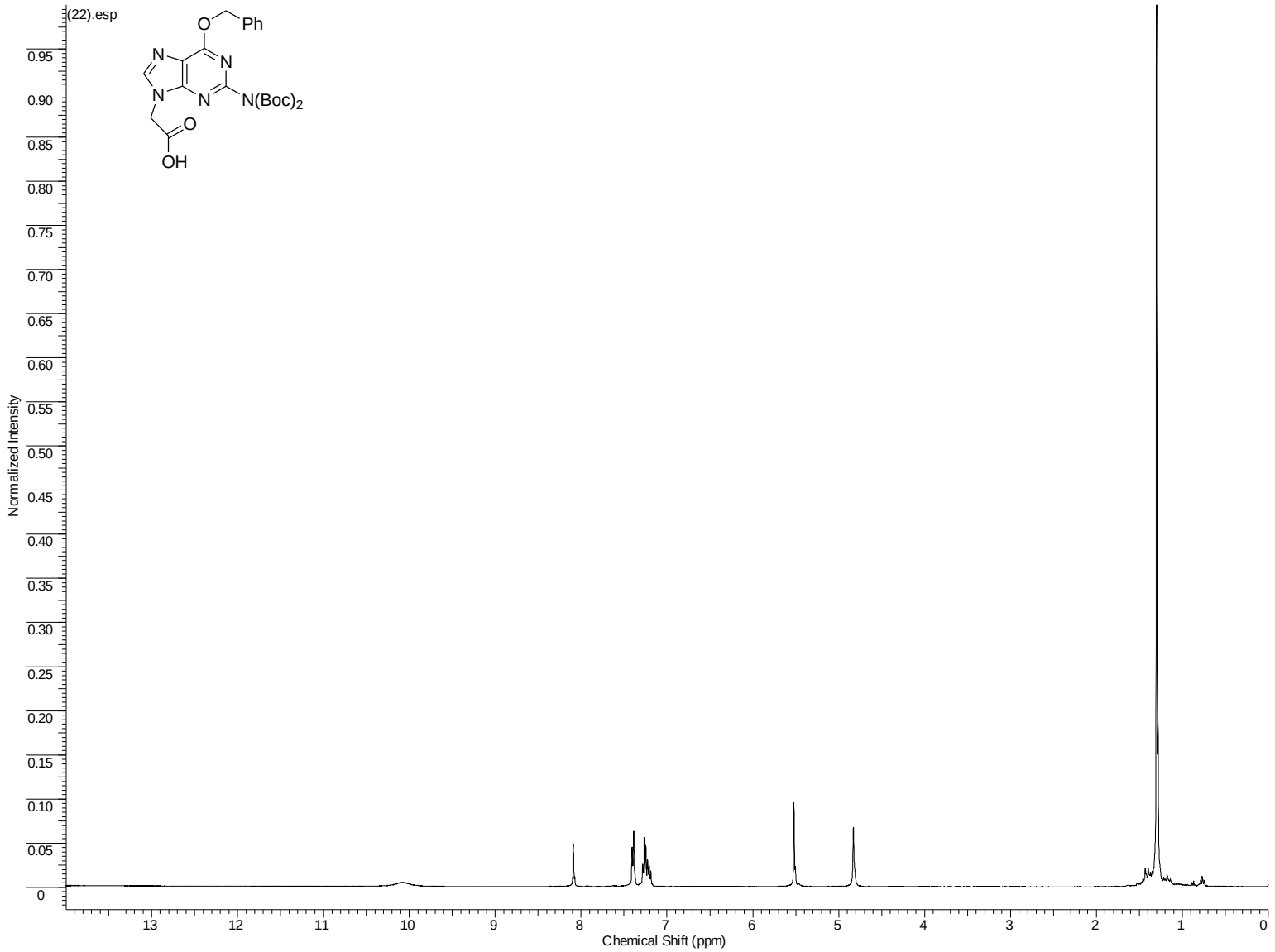
^{1}H NMR (400 MHz, $CDCl_3$) of **21**, Ethyl [N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl]acetate



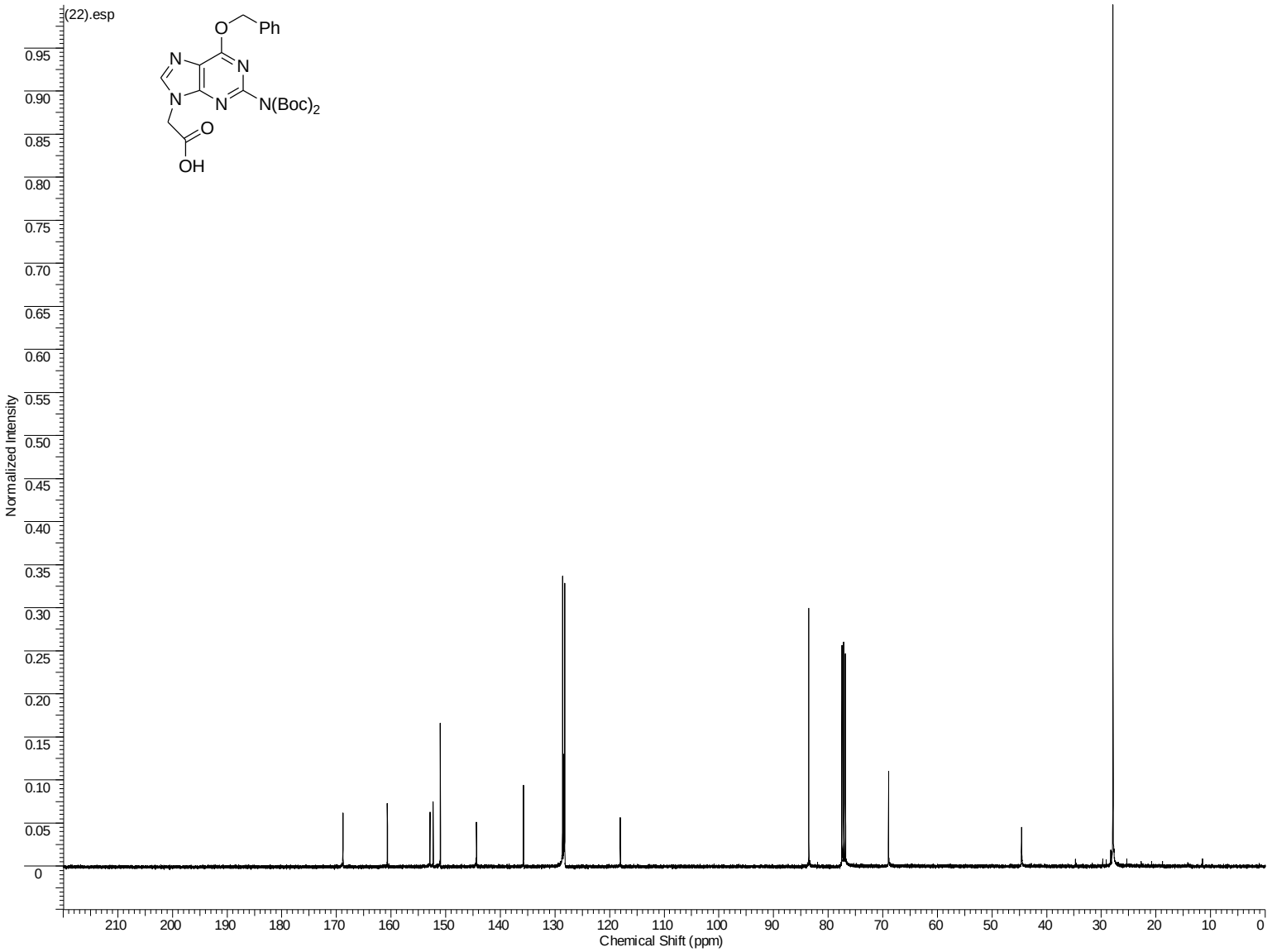
^{13}C NMR (100 MHz, $CDCl_3$) of **21**, Ethyl [N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl]acetate



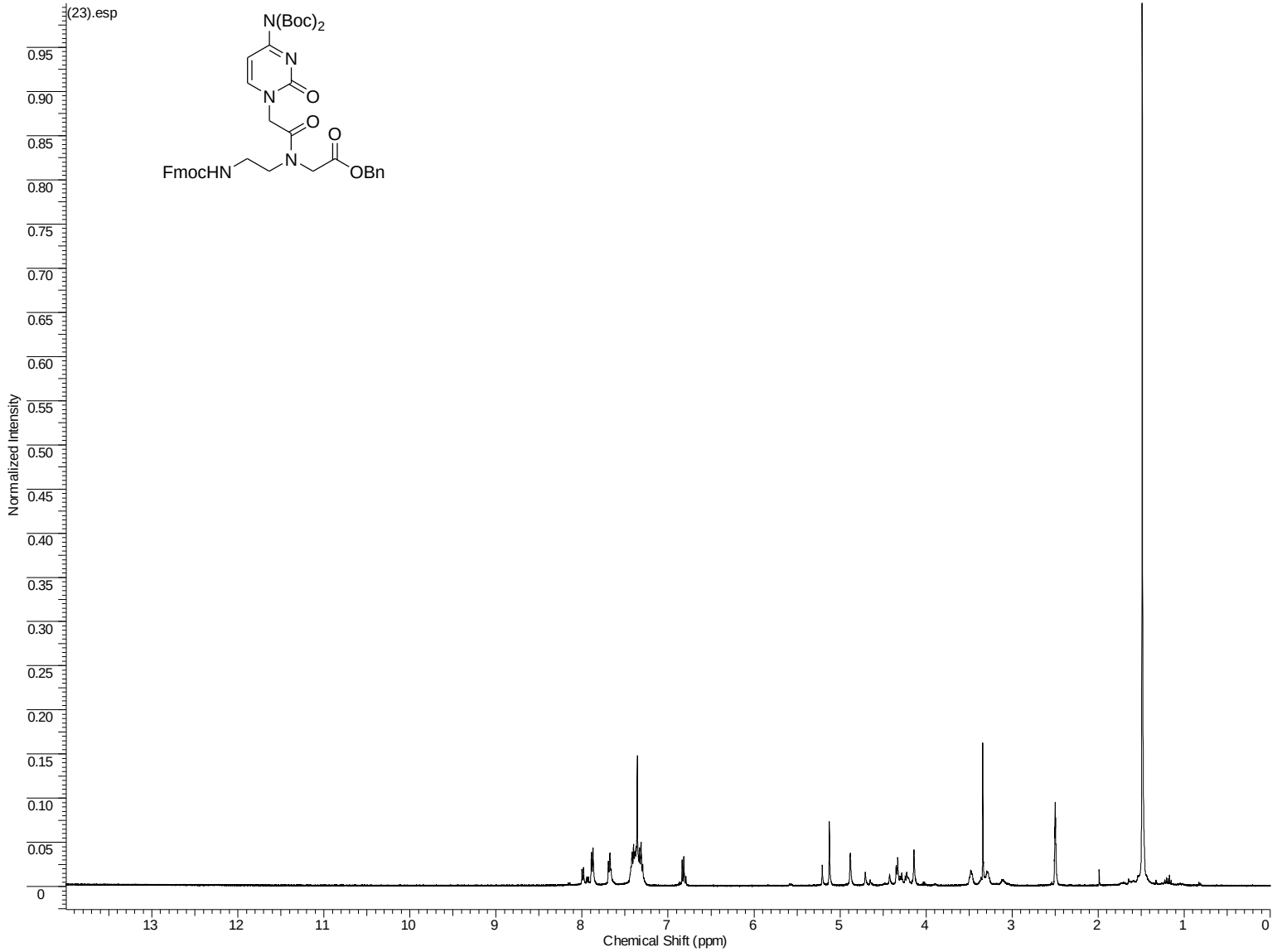
^{1}H NMR (400 MHz, $CDCl_3$) of **22**, [N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl]acetic acid



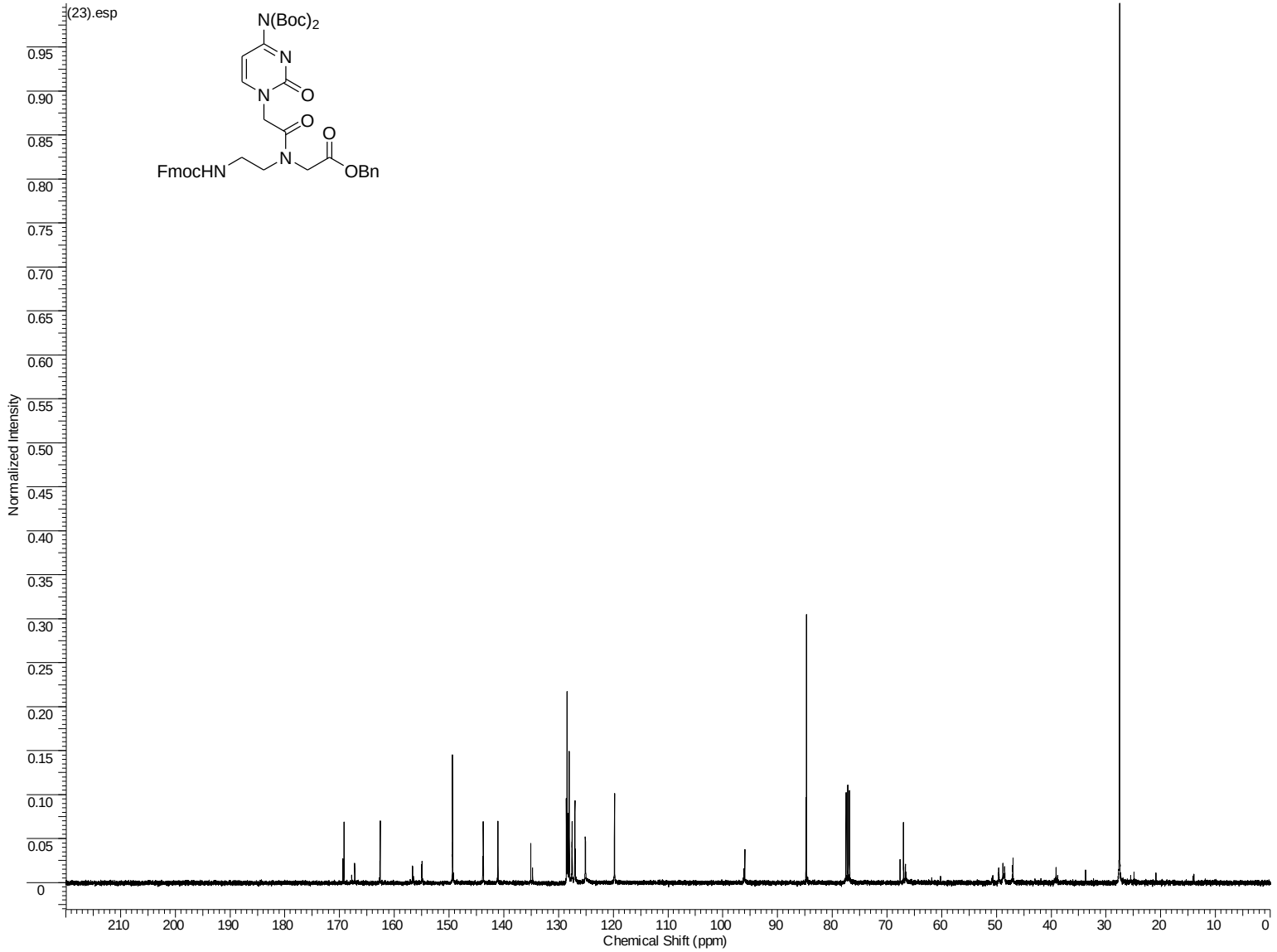
^{13}C NMR (100 MHz, $CDCl_3$) of **22**, [N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl]acetic acid



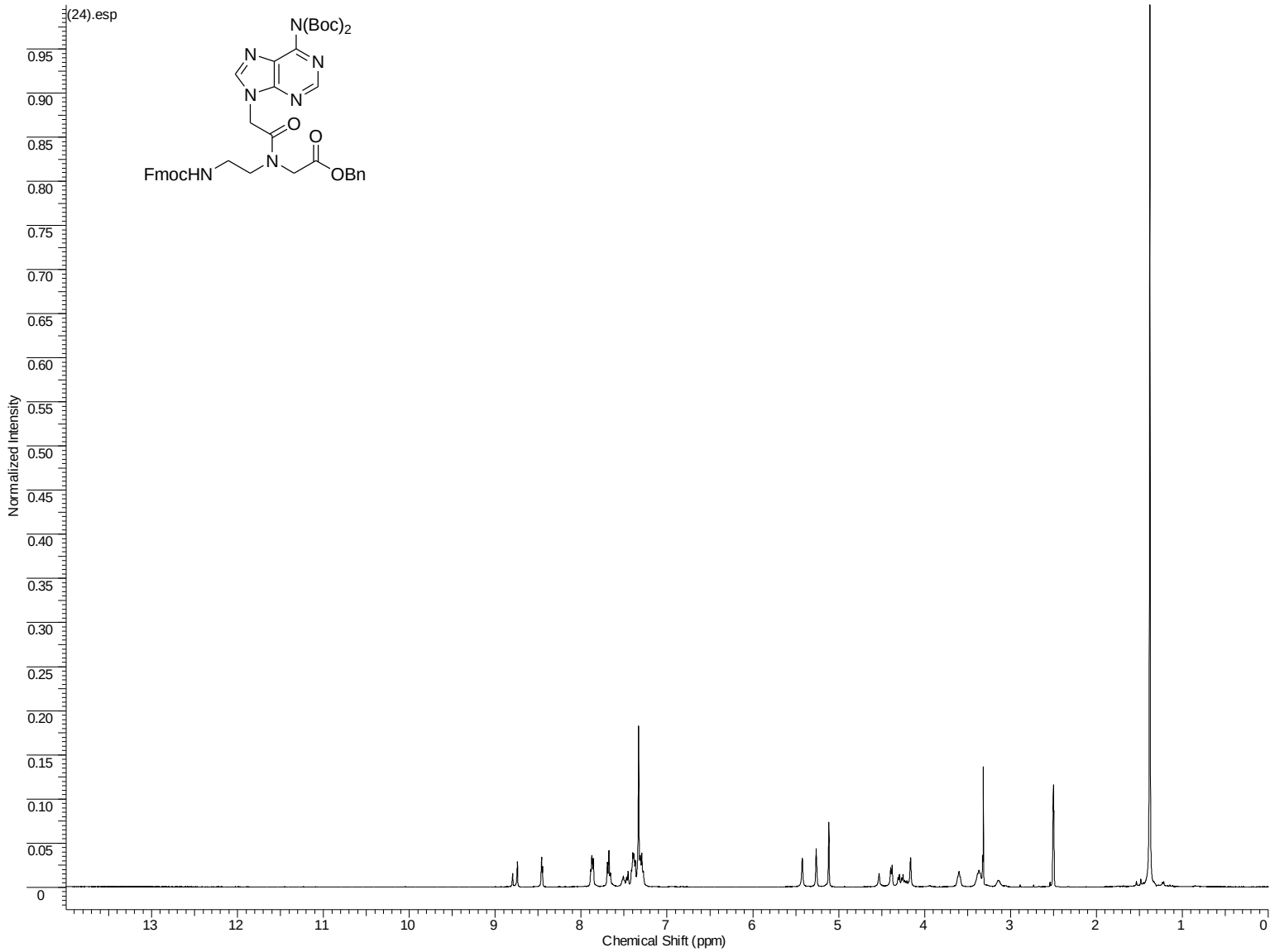
^{1}H NMR (400 MHz, DMSO-d_6) of **23**, Benzyl *N*-[2-(*N*-9-fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(*N*^{4},*N*^{4}-bis(*tert*-butoxycarbonyl)-cytosin-1-yl)acetyl]glycinate



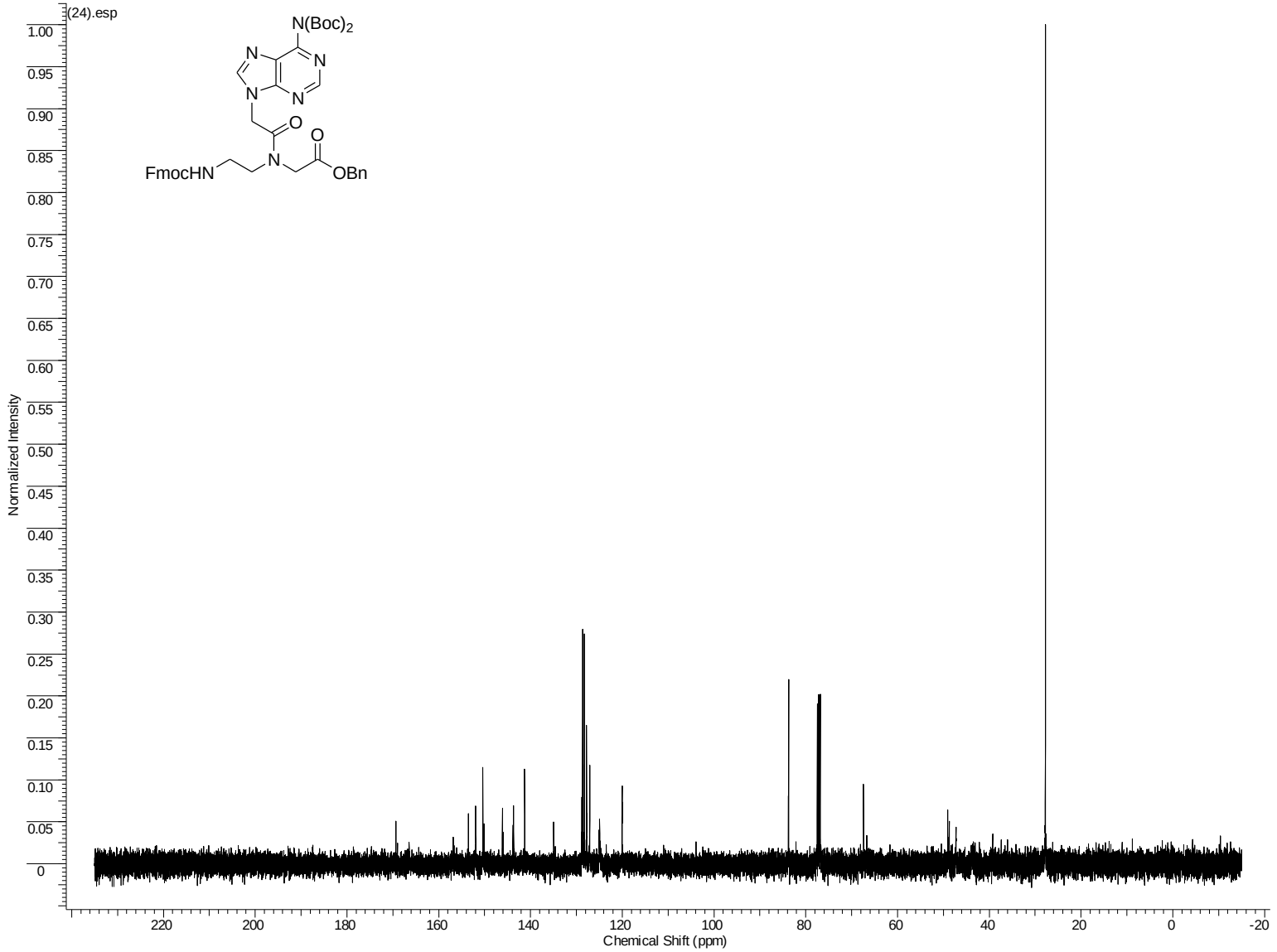
^{13}C NMR (100 MHz, $CDCl_3$) of **23**, Benzyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(*N*^{4},*N*^{4}-bis(*tert*-butoxycarbonyl)cytosin-1-yl)acetyl]glycinate



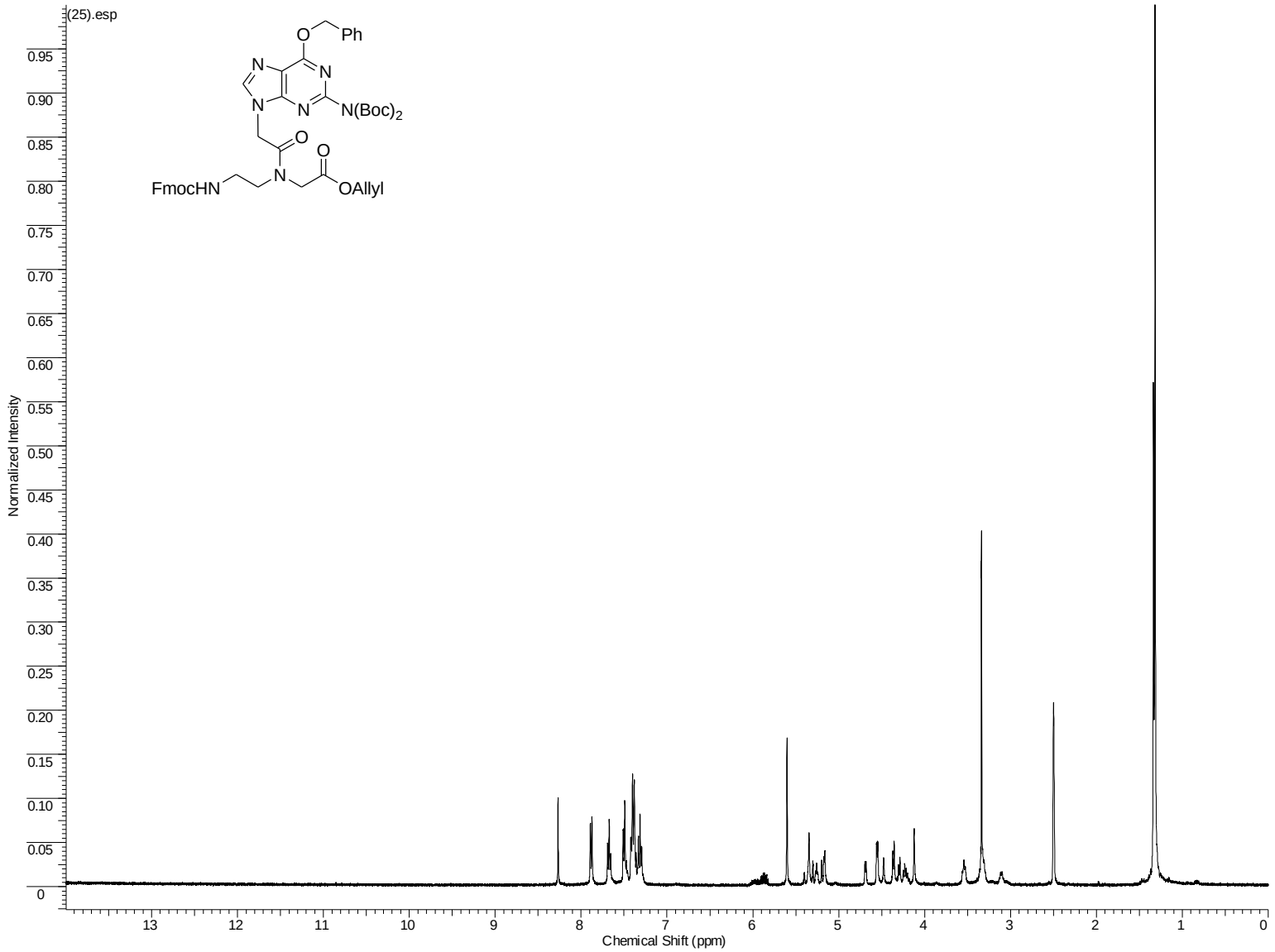
^{1}H NMR (400 MHz, DMSO-d$_6$) of **24**, Benzyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(N^6,N^6-bis(*tert*-butoxycarbonyl)-adenin-9-yl)acetyl]glycinate



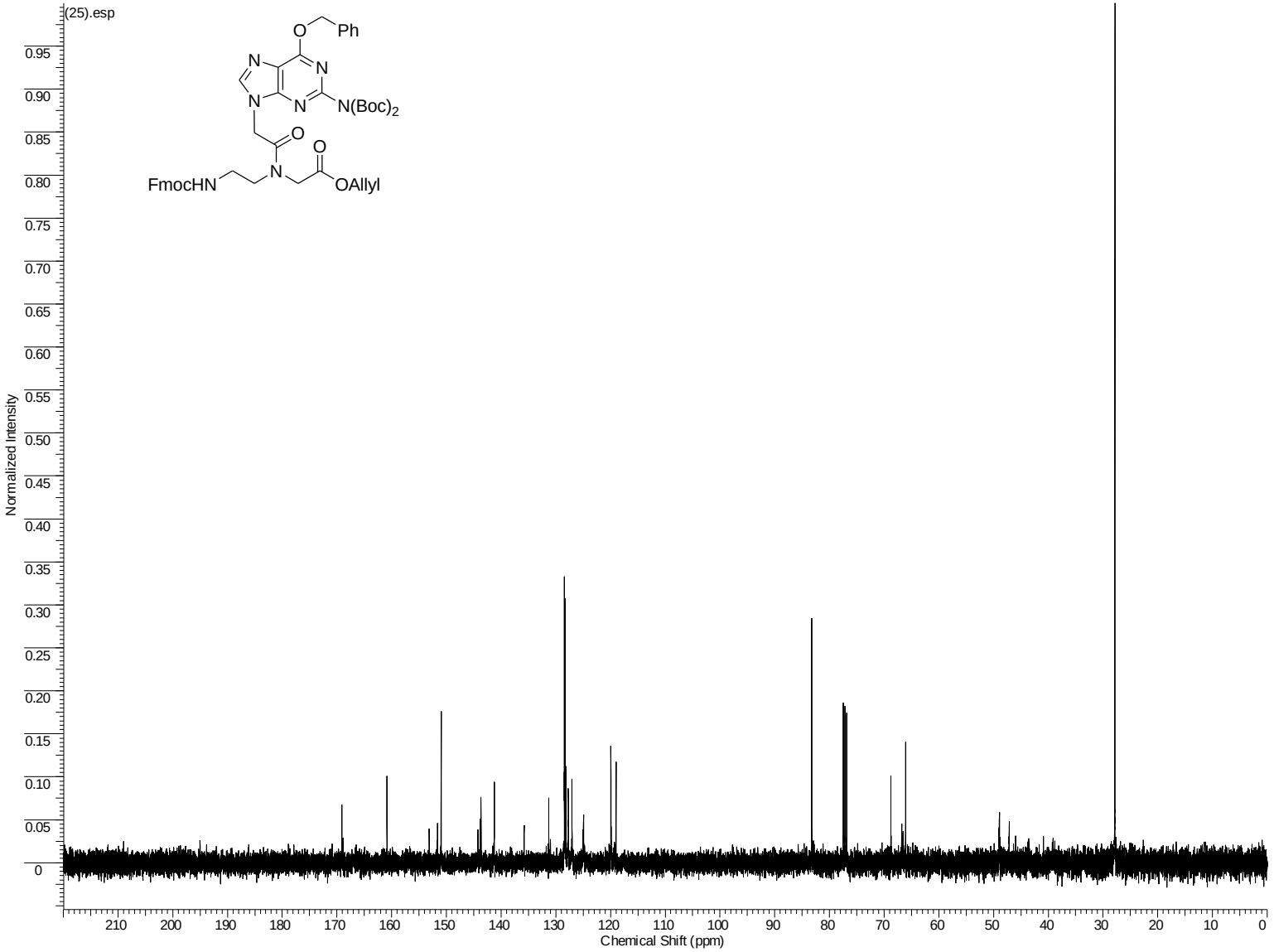
^{13}C NMR (100 MHz, $CDCl_3$) of **24**, Benzyl *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(N^6,N^6-bis(*tert*-butoxycarbonyl)adenin-9-yl)acetyl]glycinate



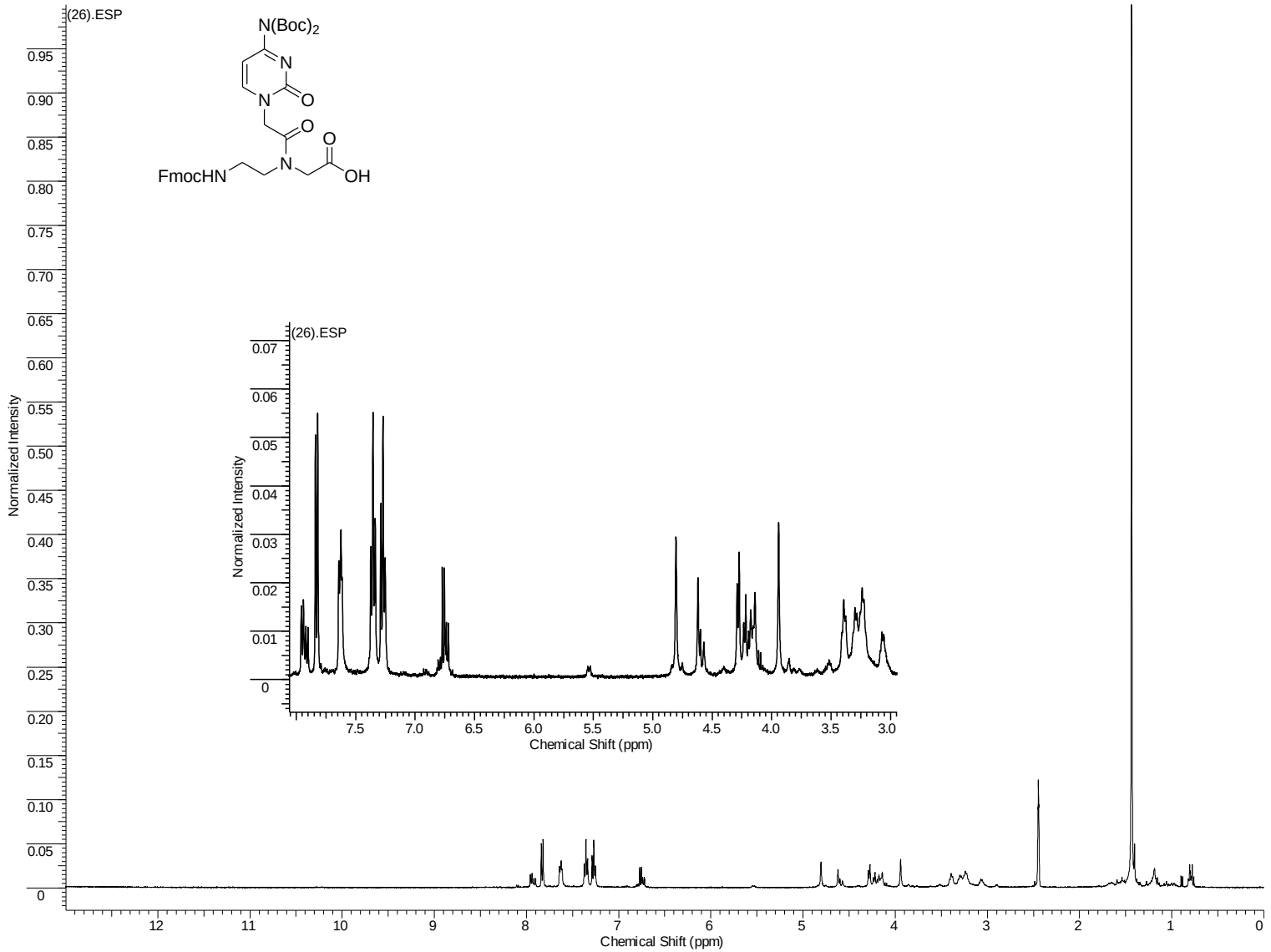
^{1}H NMR (400 MHz, DMSO-d_6) of **25**, Allyl *N*-[2-(fluorenylmethoxycarbonyl)-aminoethyl]-*N*-[N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl)acetyl]glycinate



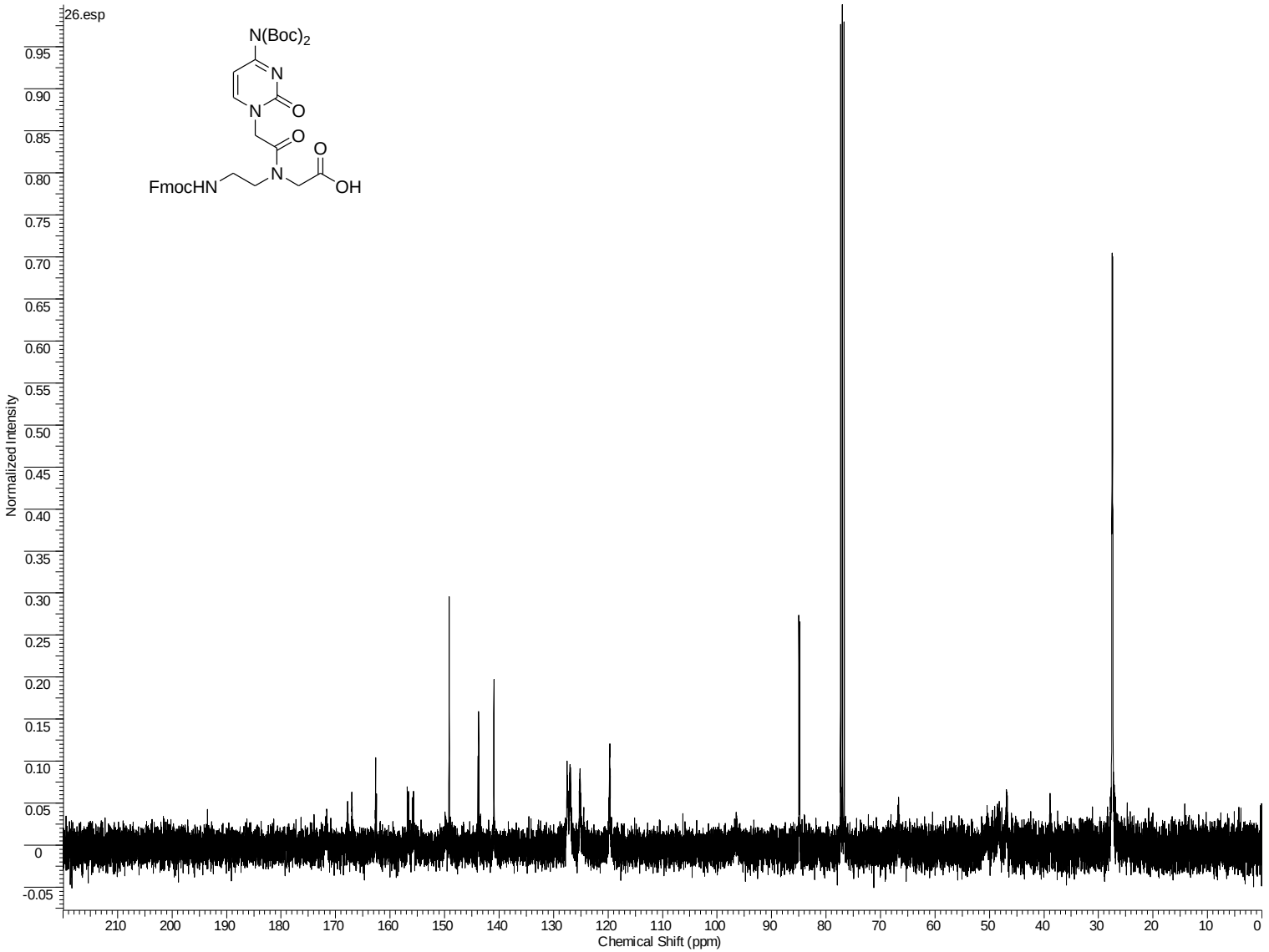
^{13}C NMR (100 MHz, $CDCl_3$) of **25**, Allyl *N*-[2-(fluorenylmethoxycarbonyl)-aminoethyl]-*N*-[N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl)acetyl]glycinate



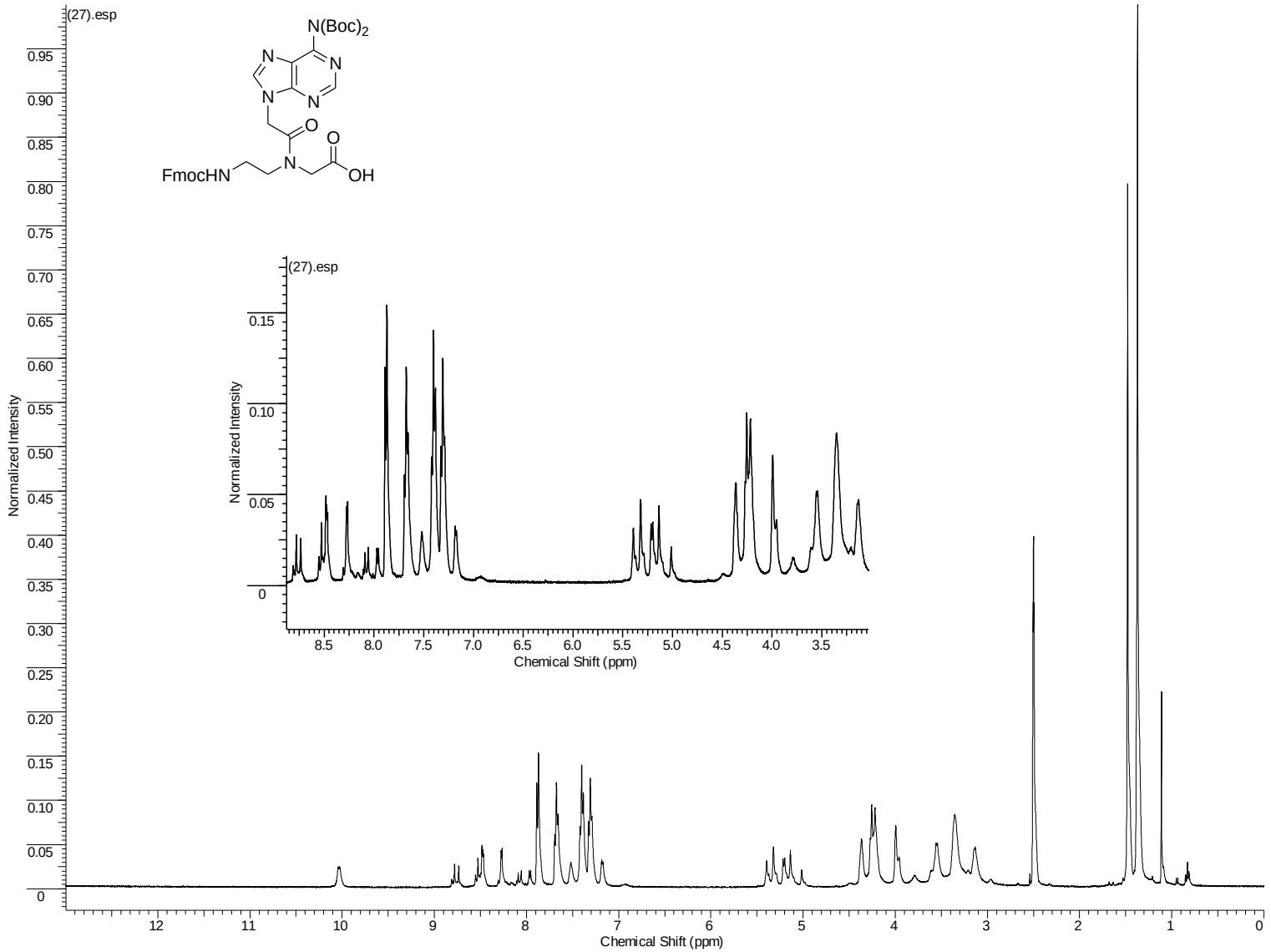
^{1}H NMR (400 MHz, DMSO-d$_6$) of **26**, *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(*N*^{4},*N*^{4}-bis(*tert*-butoxycarbonyl)cytosin-1-yl)acetyl]glycine



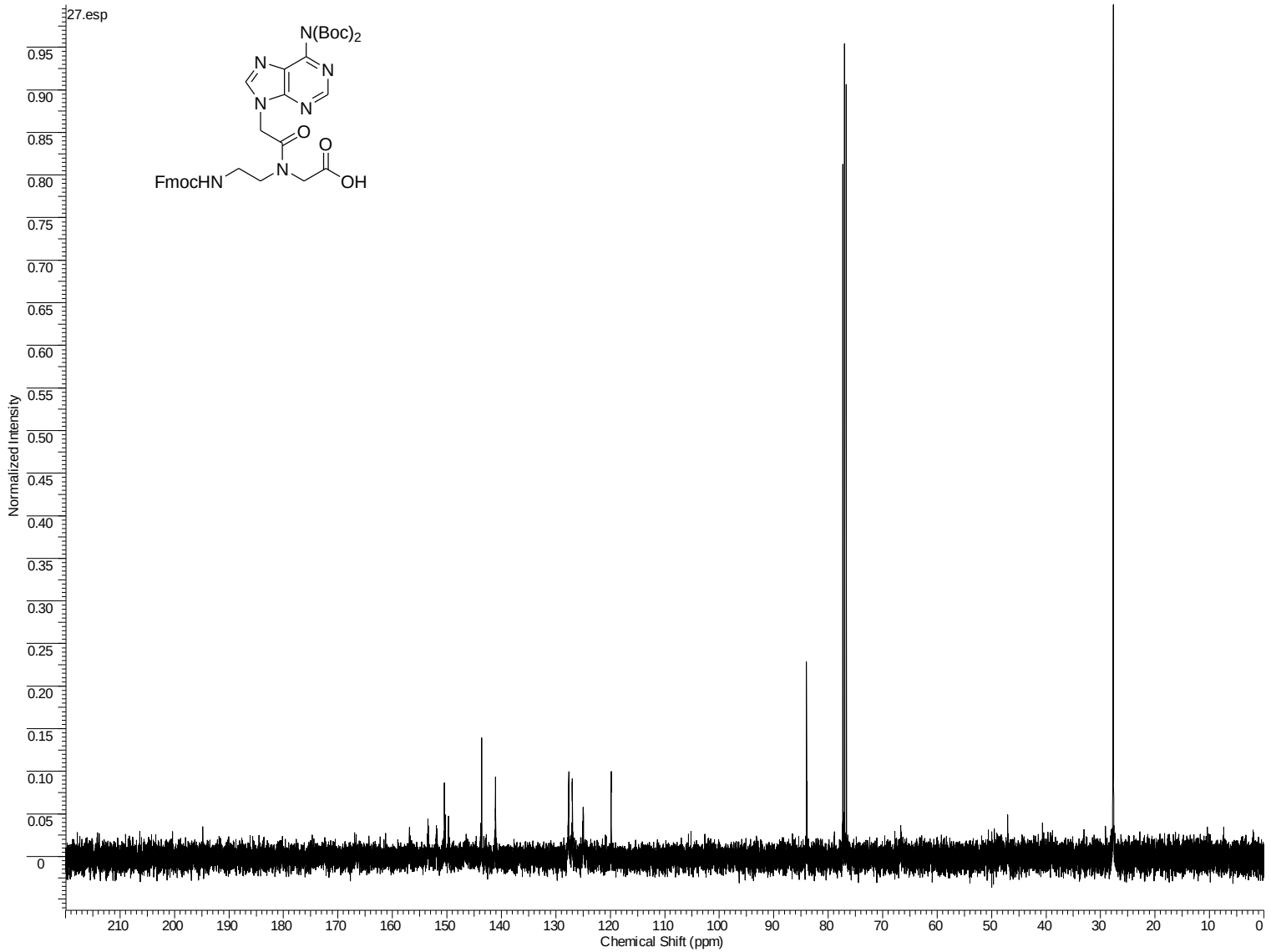
^{13}C NMR (100 MHz, $CDCl_3$) of **26**, *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(*N*^{4},*N*^{4}-bis(*tert*-butoxycarbonyl)cytosin-1-yl)acetyl]glycine



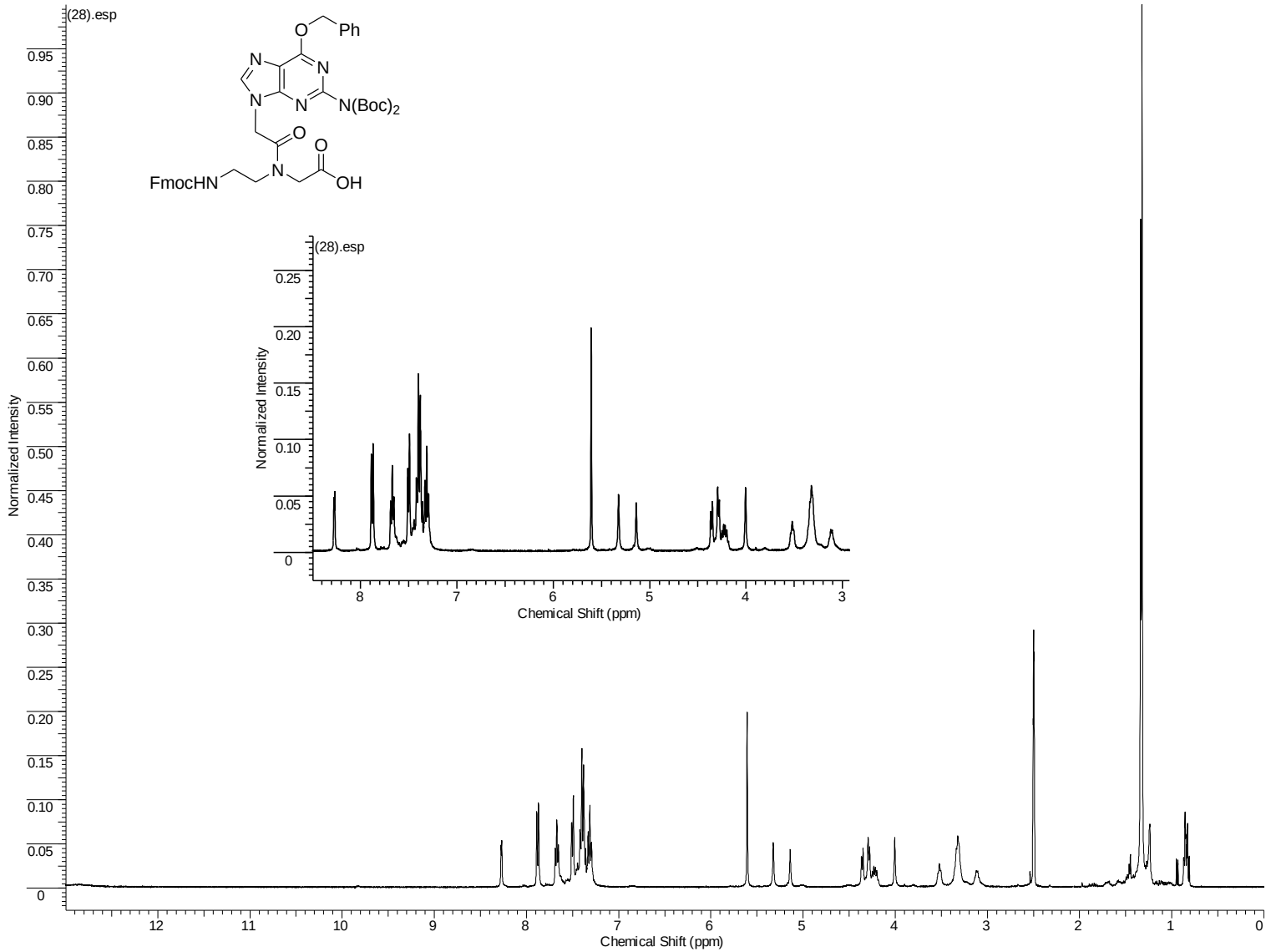
^{1}H NMR (400 MHz, DMSO-d_6) of **27**, *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(N^6,N^6-bis(*tert*-butoxycarbonyl)adenin-9-yl)acetyl]glycine



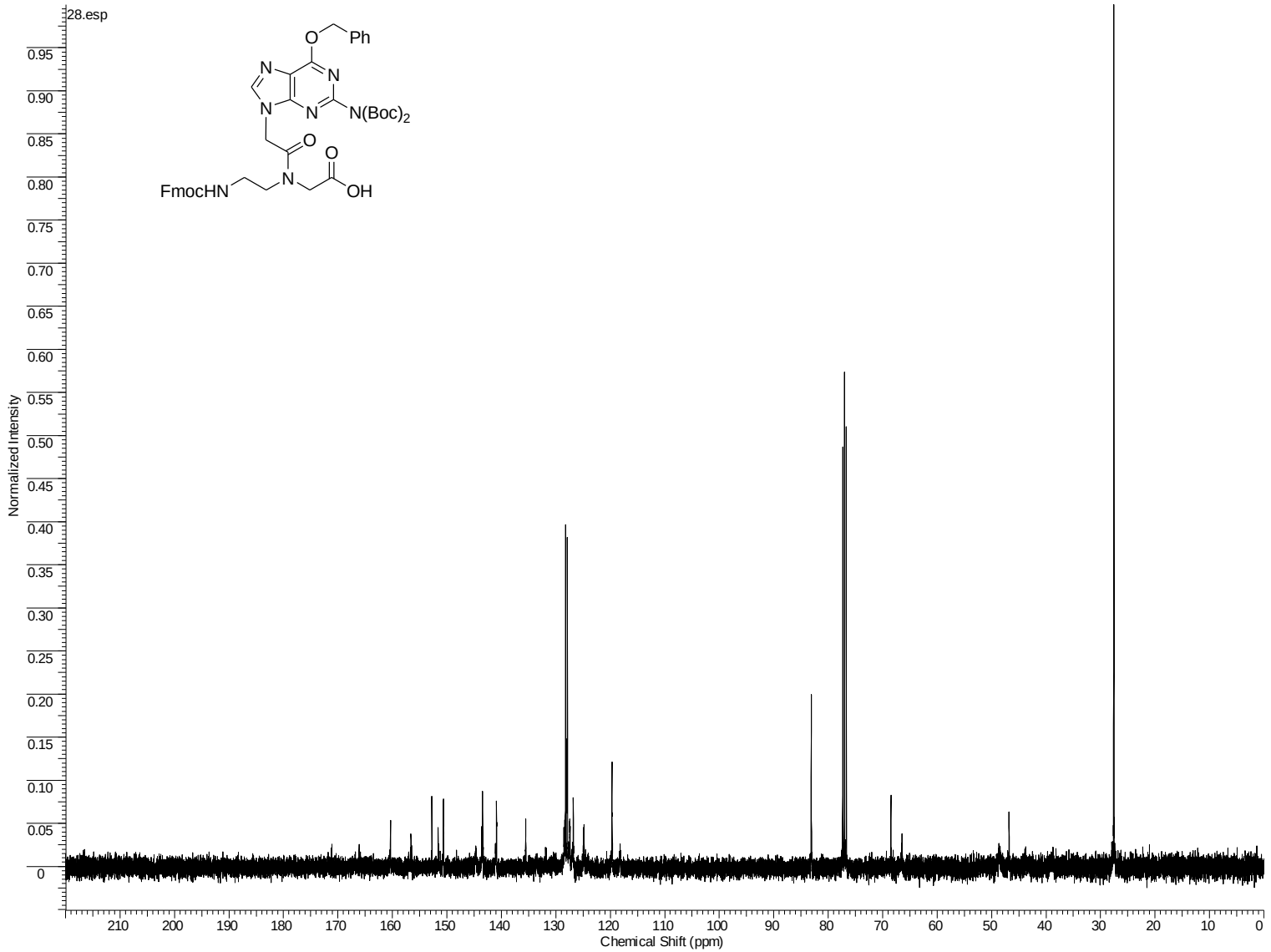
^{13}C NMR (100 MHz, $CDCl_3$) of **27**, *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[(*N*^{6},*N*^{6}-bis(*tert*-butoxycarbonyl)adenin-9-yl)acetyl]glycine

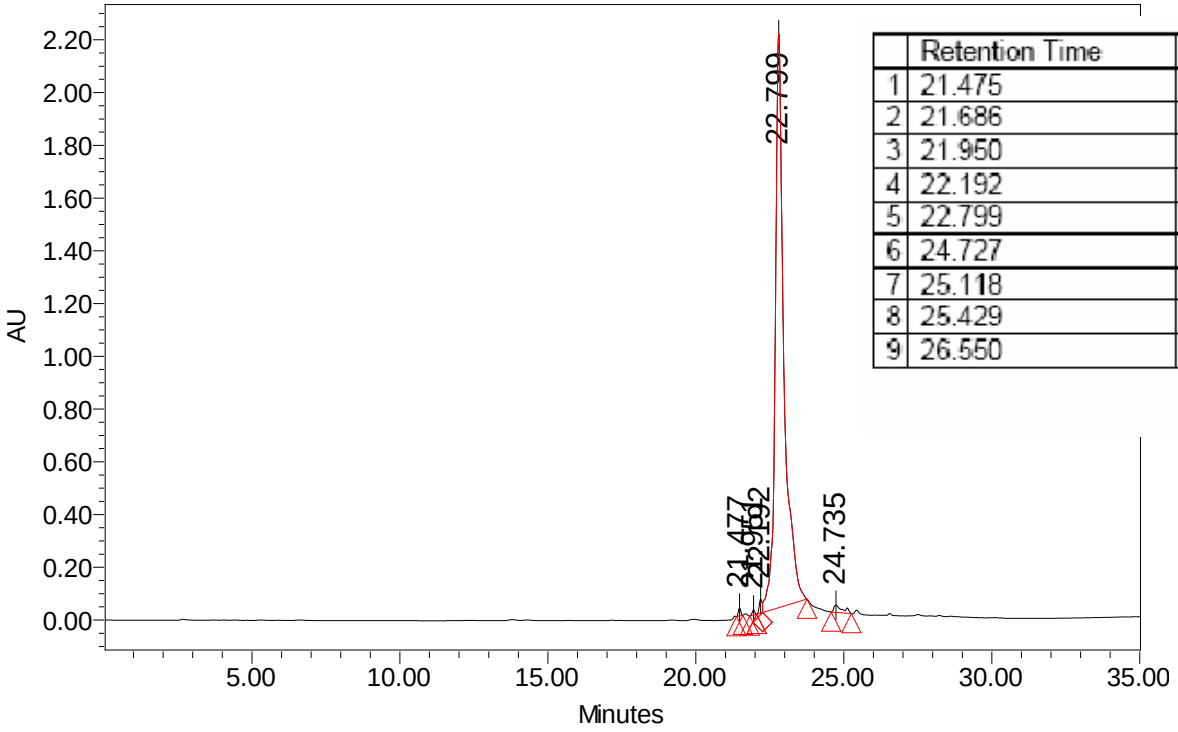


^{1}H NMR (400 MHz, DMSO-d_6) of **28**, *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl)acetyl]glycine



^{13}C NMR (100 MHz, $CDCl_3$) of **28**, *N*-[2-(fluorenylmethoxycarbonyl)aminoethyl]-*N*-[N^2,N^2-bis(*tert*-butoxycarbonyl)-O^6-benzylguanin-9-yl)acetyl]glycine





	Retention Time	Area	% Area	Height
1	21.475	547048	1.00	56189
2	21.686	224847	0.41	20514
3	21.950	347242	0.64	39642
4	22.192	628835	1.15	83732
5	22.799	51922360	95.04	2341693
6	24.727	543443	0.99	34411
7	25.118	209091	0.38	28571
8	25.429	158431	0.29	18950
9	26.550	53376	0.10	8701

Fig. S1. HPLC chromatogram H-**GTA GA**T **CAC** T-Lys-NH_2