Supporting Information

The 1,1-Dioxonaphtho[1,2-b]thiophene-2-methyloxycarbonyl (α-Nsmoc) and 3,3-Dioxonaphtho[2,1-b]thiophene-2-methyloxycarbonyl (β-Nsmoc) Amino-Protecting Groups

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IV. Spectral Data for Key Intermediates

I. 1. General:

Melting points were obtained in open capillary tubes with a Mel-Temp melting point apparatus and all are uncorrected. In general solvents were evaporated with the aid of a rotary evaporator under reduced pressure using a water aspirator at 40°C. Distillations at reduced pressure were conducted with the use of a heating mantle or an oil bath heated by means of a hot plate fitted with a magnetic stirrer. Column chromatography was performed with Silica Gel 60 (Merck, mesh size 230-400). Thin layer chromatography was performed on aluminum-backed Merck Silica Gel 60 F_{254} plates, spots being visualized by means of a universal UV lamp model 51402 operating at 254 nm. All moisture-sensitive compounds were dried by means of a vacuum pump prior to storage and kept in a freezer in well-sealed containers.

2. Spectral Data:

Infrared (IR) spectra were recorded using a Perkin Elmer Model 1600 FT IR spectrometer. Neat spectra were recorded as films on NaCl plates (liquids) or as KBr pellets. Solution spectra were recorded using a NaCl cell with a path length near 0.1 mm.

^{1}H NMR spectra were recorded at 60 MHz on a Hitachi Model R-1200, at 200 MHz on a Bruker AC-200 and at 500 MHz on a Bruker AMX-500 instrument using tetramethylsilane (TMS) as an internal reference with chemical shifts reported in ppm relative to TMS.

HPLC analyses were obtained on an automated Waters system controlled by a NEC powermate computer using a millennium 2010 chromatography manager software system with the following components: two solvent delivery systems (6000A and 510 pumps), a Wisp model 712 automatic injector, a 996 photodiode array detector (PDA) and a Novapak C_{18} 60 A° column (3.9 x 150 mm, 4 μm). The mobile phase was generated by mixing two solutions: A (0.1% TFA in water) and B (0.1% TFA in CH_3CN).

3. Mass spectral analyses were acquired on a JMS-700 “M. Station” (Jeol-Tokyo-Japan) two-sector mass spectometer. All spectra were acquired in FABMS mode at a resolution of 1000. CSI was used as external calibrant in all experiments which were performed by Dmitry Gumerov under the supervision of Dr. Igor Kaltashov at the University of Massachusetts Mass Spectrometry Center.

4. Elemental analyses were performed at the University of Massachusetts Microanalysis laboratory under the direction of Dr. Gregory Dabkowski.

5. References: all reference citations are to the reference list of the paper

II. Additional Experimental Details for the Synthesis of **11** and **17**

1-Chloro-3,4-dihydronaphthalene-2-carboxaldehyde 8. Phosphoryl chloride (26.32 g; 16 ml; 0.171 mol) was added dropwise with stirring and cooling at °C to dry DMF (47.2 g; 59 ml; 0.645 mol) at such a rate that the temperature did not exceed 5°C. 3,4- Dihydronaphthalene-1(2H)-one (25 g; 22.74 ml; 0.174 mol) was added dropwise to the resulting solution at 0 to 5°C. The mixture was stirred for 0.5 h at 0°C and for 1.5 h at 80°C, and poured into cold aqueous sodium acetate (25% w/v; 300 ml). Extraction with ether (3 x 150 ml), drying over $MgSO_4$ and evaporation of the ether gave a residual oil which was distilled to give an unstable pale green oil (25 g, 76.6%) which later solidified on cooling, b.p 167-170°C at ~ 6 mm Hg (lit.[7] 145-153°C at 5 mm Hg); IR (NaCl) 1667.9 cm^{-1}(C = O); ^1H NMR ($CDCl_3$) δ 2.6-2.97 (m, 4), 7.29-7.87 (m, 4), 10.43 (s, 1).

2-Bromo-3,4-dihydronaphthalene-1-carboxaldehyde. Dry DMF (30 g; 32 ml; 410 mmol) was cooled to 0°C in dry chloroform (600 ml) and phosphorous tribromide 43.88 g, (32.6 ml; 342 mmol) was added dropwise. The mixture was stirred at 0°C for 1 h to give a pale yellow solution. A solution of 20 g (18.08 ml; 36.8 mmol) of 3,4 dihydronaphthalene-2(1H)-one in 100 ml of chloroform was added dropwise at 0° to -5°C. The resulting mixture was refluxed for 1.5 h. It was then cooled to 0°C and cold aqueous saturated sodium bicarbonate was very slowly added until the effervescence had subsided. The mixture was extracted with DCM (3 x 200 ml) and the extract dried over $MgSO_4$ and evaporated to give a yellow oil (30 g). Flash chromatography of 3 g of the oil using ether/petroleum ether (1/4) as eluent gave 2.5 g; 83.3% (lit.[15] 84%) of the aldehyde as a yellow oil which solidified on cooling; IR (NaCl) 1682 cm^{-1}(C = O); ^1H NMR ($CDCl_3$) δ 2.75-3.0 (m, 4), 7.19-8.03 (m, 4), 10.34 (s, 1).

Ethyl 4,5-dihydronaphtho[1,2-*b*]thiophene-2-carboxylate 9. Ethyl mercapto-acetate (15.69 g; 14.31 ml; 130.3 mmol) was added to a cooled, stirred solution of sodium (3.77 g; 0.16 g atom) in dry ethanol (58 ml). During 30 min at 0-5°C 25 g (129.8 mmol) of 1-chloro-3,4-dihydronaphthalene-2-carboxaldehyde was added dropwise. The mixture was stirred overnight at room temperature, boiled for 30 min., cooled, and poured into 300 ml of water. The ester was filtered off, decolorized and recrystallized from ethanol and obtained as off-white crystals (17.06 g, 65.8%) m.p 82-83°C (lit.[7] 81-82°C) IR (KBr) 1696 cm^{-1} (C = O);^1H NMR($CDCl_3$) δ 1.34-1.41 (t, 3), 2.77-3.00 (m, 4) 4.29-4.40 (q, 2), δ 7.22-7.59 (m, 5).

5-(1-Naphthylidene)rhodanine 13. A hot solution (70-75°C) of 20 g (150.16 mmol) of rhodanine and 37.5 g (450 mmol) of fused sodium acetate in 100 ml of glacial acetic acid was stirred while 25 g (22 ml; 160 mmol) of 1-naphthaldehyde was slowly added. The mixture was then refluxed for 15 min and poured into 4 l of ice-cold water. The red precipitate, when collected and dried weighed 35 g (86%). Two recrystallizations from absolute ethanol gave 31.40 g (77.16%) of the rhodanine as dark red needles, mp 225-227°C (lit.[9] 224-225); IR (KBr) 1691 cm^{-1} (C = O); ^1H NMR ($CDCl_3$) δ 2.74 (s, 1), 7.6 (m,3), 7.9 (t, 2), 8.17 (d, 2) 8.5 (s, 1).

β-1-Naphthyl-α-mercaptoacrylic acid 14. To a rapidly stirred ice-cold solution of 26 ml of 10% NaOH in 300 ml of water was added 15 g of crude 5-(naphthylidene)rhodanine. After 15 min. the yellow precipitate of the sodium salt was collected and stirred directly into a warm (60°C) solution of 90 ml of 10% NaOH and 1200 ml of water. The mixture was heated to 60-65°C for 20 min, 2 g of charcoal was added and the mixture heated at the same temperature for an additional 20 min and filtered. The filtrate was stirred rapidly and 80 ml of 6N HCl was added in one portion. The yellow precipitate weighed 9.39 g when dried; recrystallization from toluene gave 8.1 g (63.62%) of the acid, mp 186-188°C (lit.[9] 169-171°C before recrystallization); IR (KBr) 1675 cm^{-1} (C = O); ^{1}H NMR ($CDCl_3$+ DMSO-d_6) δ 4.42 (s, 1), 7.63 (q,3), 7.9 (m, 4), 8.17 (d, 2) 8.45 (s, 1).

Naphtho[2,1-*b*]thiophene-2-carboxylic acid 15. A solution of 10 g (43.47 mmol) of β-1-naphthyl-α-mercaptoacrylic acid and 40 g of iodine in 400 ml of dioxane was maintained at 45°C for 24 hours. The solution was then poured into 2 l of water, and the mixture stirred for 10 min., decolorized at room temperature with sodium bisulfate and the brown precipitate collected. The crude acid was dissolved in 50 ml of 10% NaOH and 450 ml of water, boiled for 10 min (not soluble at room temperature), treated with 1.5 g of charcoal and the mixture boiled for a further 20 min for decolorization. The resulting mixture was filtered and the filtrate saturated with NaCl and the gelatinous precipitate extracted with ethyl acetate (3 x 400 ml). The extracts were dried over $MgSO_4$ and evaporated at reduced pressure to give a brown precipitate. After decolorization and recrystallization from *p*-xylene there was obtained 5.8 g (79.26%) of the pure acid as silvery-white needles, mp 277-279°C (lit.[9] 277-278°C). IR (KBr) 1666 (CO) cm^{-1}; ^{1}H NMR ($CDCl_3$+ DMSO-d_6) δ 7.37-8.67 (m, 7).

III. Characterization Data for α- and β-Nsmoc Amino Acids

α-Nsmoc-Gly-OH. The acid was obtained as an off-white solid from DCM/hexane in 90% yield, mp 191-193°C; IR (KBr): 1151, 1295 (SO_2), 1728 (CO, acid; urethane), 3412 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$ + TFA) δ 4.17 (d, 2), 5.32 (d, 2), 6.0 and 6.8 (d, 1), 7.45 (d, 1), 7.49 (d, 1), 7.66 (t, 1), 7.76 (t, 1), 7.98 (d, 1), 8.13 (d, 1), 8.2 (dd, 1). Anal. Calcd for $C_{16}H_{13}NO_6S$: C, 55.34; H, 3.74; N, 4.03. Found: C, 55.30; H, 3.68; N, 3.97

α-Nsmoc-Ala-OH. The product was obtained as an off-white solid from DCM/hexane in 86.2% yield, mp 120-125°C; IR (KBr): 1151, 1295 (SO_2), 1728 (CO, acid; urethane), 3412 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$) δ 1.46 (d, 3), 4.37 (q, 1), 5.17 (s, 2), 5.56 and 6.7 (d, 1), 7.2 (s, 1), 7.3 (d, 1), 7.54 (t, 1), 7.65 (t, 1), 7.85 (d, 1), 7.89 (d, 1), 8.22 (d, 1). Anal. Calcd for $C_{17}H_{15}NO_6S$: C, 56.53; H, 4.15, N, 3.87. Found: C. 56.56; H, 4.24; N, 3.76

α-Nsmoc-Val-OH. The acid was obtained as an off-white solid after evaporation to dryness of the DCM/hexane mixture in 75.4% yield, mp 138-139°C; IR (KBr): 1151, 1301 (SO_2), 1723 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$) δ 0.95

(d, 3), 1.01 (d, 3) 2.45 (m, 1), 4.33 (q, 1), 5.19 (s, 2), 5.46 (d, 1), 7.25 (s, 1), 7.38 (d, 1) 7.6 (t, 1), 7.72 (t, 1), 7.92 (d, 1), 8.05 (d, 1), 8.31 (d, 1). Anal. Calcd for $C_{19}H_{19}NO_6S$: C, 58.63; H, 4.88; N, 3.59. Found: C, 58.82; H, 5.08; N, 3.52

α-Nsmoc-Leu-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 84.6% yield, mp 75-96°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3359 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 0.93 (d, 6), 1.58 (m, 1), 1.64-1.74 (m, 2), 4.33-4.44 (m, 1), 5.18 (s, 2), 5.38 (d, 1), 7.23 (s, 1), 7.37 (d, 1), 7.55 (t, 1), 7.70 (t, 1), 8.05 (d, 1), 8.57 (d, 1), 8.25 (d, 1). Anal. Calcd for $C_{20}H_{21}NO_6S$: C, 59.56; H, 5.20; N, 3.47. Found: C, 59.80; H, 5.42; N, 3.40

α-Nsmoc-Ile-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 88.46% yield, mp 148-150°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3369 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 0.88 (t, 3), .97 (d, 3) 1.25 (m, 1), 1.46 (m, 1), 1.95 (m, 1), 4.35 (q, 1), 5.18 (s, 2), 5.49 (d, 1) 7.24 (s, 1), 7.31 (d, 1), 7.55 (t, 1), 7.73 (t, 1), 7.91 (d, 1), 8.01 (d, 1), 8.3 (d, 1). Anal. Calcd for $C_{20}H_{21}NO_6S$: C, 59.56; H, 5.20; N, 3.47. Found: C, 59.47; H, 5.32; N, 3.39

α-Nsmoc-Pro-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 77.6% yield, mp 192-195°C; IR (KBr): 1151, 1301 (SO_2), 1669, 1750 (CO, acid; urethane), 3134 (OH) cm^{-1}; ^1H NMR ($CDCl_3$ + TFA) δ 2.01 (m, 2), 2.2 (m, 1), 2.4 (m, 1) 3.65 (m, 2), 4.51 and 4.59 (2q, 1), 5.32 (m, 2), 7.38 (d, 1), 7.48 (d, 1), 7.63 (t, 1), 7.75 (t, 1) 7.95 (d, 1), 8.12 (d, 1) 8.27 (dd, 1). Anal. Calcd for $C_{19}H_{17}NO_6S$: C, 58.92; H, 4.39; N, 3.61. Found: 58.94; H, 4.48; N, 3.45

α-Nsmoc-Phe-OH. The acid was obtained as an off-white solid from DCM/hexane in 89.2% yield, mp 81-135°C; IR (KBr): 1151, 1295 (SO_2), 1723 (CO, acid; urethane), 3337 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 3.0-3.2 (m, 2), 4.68 (q, 1), 5.11 (s, 2), 5.53 and 6.0 (d, 1), 7.11-7.4 (m, 7), 7.54 (t, 1), 7.65 (t, 1), 7.85 (d, 1), 7.96 (d, 1), 8.25 (d, 1). Anal. Calcd for $C_{23}H_{19}NO_6S$: C, 63.16; H, 4.34; N, 3.20. Found: C, 62.93; H, 4.10; N, 3.03

α-Nsmoc-Met-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 80.8% yield, mp 55-117°C; IR (KBr): 1151, 1295 (SO_2), 1723 (CO, acid; urethane), 3337 (OH) cm^{-1}; ^1H NMR ($CDCl_3$ + TFA) δ 2.13-2.37 (m, 5), 2.68 (m, 2), 4.65 (m, 1), 5.30 (dd, 2), 6.25 and 6.85 (d, 1), 7.42 (s, 1), 7.5 (d, 1), 7.65 (t, 1), 7.81 (t, 1), 8.0 (d, 1), 8.15 (d, 1), 8.22 (d, 1). Anal. Calcd for $C_{19}H_{19}NO_6S$: C, 54.16; H, 4.50; N, 3.32. Found: C, 54.09; H, 4.65; N, 3.23

α-Nsmoc-Trp-OH. The acid was obtained as an off-white solid from DCM/hexane in 85.6% yield, mp 107-160°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3401 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 3.30 (d, 2), 4.6 (q, 1), 5.09 (s, 2) 5.51 (d, 1), 6.91-7.23 (m, 5), . Anal. Calcd for $C_{25}H_{20}NO_6S$: C, 63.04; H, 4.19; N, 5.87. Found: C, 62.91; H, 4.43; N, 5.73

α-Nsmoc-Ser(t-Bu)-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 82.0% yield, mp 76-135°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.18 (s, 9), 3.58 (q, 1), 3.92 (q, 1), 4.47 (m, 1), 5.2 (s, 2), 5.77 (d, 1) 7.27 (s, 1), 7.43 (d, 1) 7.61 (t, 1), 7.7 (t, 1), 7.9 (d, 1), 8.05 (d, 1) 8.28 (d, 1). Anal. Calcd for $C_{21}H_{23}NO_7S$: C, 58.21; H, 5.30; N, 3.23. Found: C, 58.14; H, 5.31; N, 3.16

α-Nsmoc-Thr(t-Bu)-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 82.8% yield, mp 85-107°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3433 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.16 (d, 3), 1.20 (s, 9), 4.32 (m, 2), 5.16 (s, 2), 5.87 (d, 1), 7.24 (s, 7), 7.43 (d, 1), 7.6 (t, 1), 7.7 (t, 1), 7.91 (d, 1), 8.01 (d, 1), 8.27 (d, 1). Anal. Calcd for $C_{22}H_{25}NO_7S$: C, 59.01; H, 5.58; N, 3.12. Found: C, 59.21; H, 5.52; N, 3.06

α-Nsmoc-Tyr(t-Bu)-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 81.8% yield, mp 134-136°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3369 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.3 (s, 9), 3.19 (m, 2), 4.65 (q, 1), 5.19 (s, 2), 5.42 (d, 1), 7.05 (dd, 4), 7.15 (s, 1), 7.45 (d, 1), 7.61 (t, 1), 7.73 (t, 1), 7.95 (d, 1), 8.0 (d, 1), 8.32 (d, 1).. Anal. Calcd for $C_{27}H_{27}NO_7S$: C, 63.66; H, 5.30; N, 2.74. Found: C, 63.51; H, 5.43; N, 2.78

α-Nsmoc-Asp(O-t-Bu)-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 84.0% yield, mp 67-142°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3337 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.42 (s, 9), 2.73-3.05 (m, 2), 4.60 (m, 1), 5.19 (s, 2), 5.6 (d, 1), 7.17 (s, 1), 7.41 (d, 1), 7.59 (t, 1), 7.73 (t, 1), 7. 91 (d, 1), 8.03 (d, 1), 8.29 (d, 1). Anal. Calcd for $C_{22}H_{23}NO_8S$: C, 57.27; H, 4.98; N, 3.03. Found: C, 57.59; H, 5.07; N, 2.97

α-Nsmoc-Glu(O-t-Bu)-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 46.13% yield, mp 69-128°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.43 (s, 9), 1.95-2.51 (m, 4), 4.35 (m, 1), 5.18 (s, 2), 5.82 (d, 1), 7.18 (s, 1), 7.4 (d, 1), 7.6 (t, 1), 7.75 (t, 1), 7.9 (d, 1), 8.05 (d, 1), 8.29 (d, 1). Anal. Calcd for $C_{23}H_{25}NO_8S$: C, 58.11; H, 5.25; N, 2.94. Found: C, 58.14; H, 5.28; N, 2.95

α-Nsmoc-Lys(Boc)-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 72.0% yield, mp 83-125°C; IR (KBr): 1157, 1301 (SO_2), 1717 (CO, acid; urethane), 3380 (OH, NH) cm^{-1}; ^1H NMR (DMSO,d_6) δ 1.25 (m, 3), 1.34 (s, 10), 1.57 (m, 1), 1.7 (m, 1), 2.85 (q, 2), 3.81 (m, 1), 5.06 (s, 2), 6.73 (t, 1), 7.17 (bs, 1), 7.67 (s, 1),7.70 (t, 1), 7.76 (d, 1), 7.82 (t, 1), 8.1 (d, 1), 8.15 (d, 1), 8.30 (d, 1). Anal. Calcd for $C_{25}H_{30}N_2O_8S$: C, 57.92; H, 5.78; N, 5.40. Found: C, 58.14; H, 5.91; N, 5.34

α-Nsmoc-Phg-OH. The acid was obtained as an off-white solid after evaporation of DCM/hexane to dryness in 78.8% yield, mp 93-146°C; IR (KBr): 1151, 1301 (SO_2), 1728 (CO, acid; urethane), 3423 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 5.11

(m, 2), 5.41 (q, 1), 6.04 (d, 1), 7.22 (s, 1), 7.35 (m, 5), 7.45 (d, 1), 7.55 (t, 1), 7.67 (t, 1), 7.85 (d, 1), 7.98 (d, 1), 8.01 (d, 1), 8.25 (d, 1). Anal. Calcd for $C_{22}H_{17}NO_6S$: C, 62.42; H, 4.01; N, 3.30. Found: C, 62.48; H, 4.13; N, 3.21

α-Nsmoc-Aib-OH. The acid was obtained as an off-white solid from DCM/hexane in 84.4% yield, mp 181-182°C; IR (KBr): 1151, 1290 (SO_2), 1728 (CO, acid; urethane), 3359 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$ +TFA) δ 1.6 (s, 6), 5.25 (s, 2), 6.0 and 6.9 (d, 1), 7.38 (s, 1), 7.45 (d, 1), 7.65 (t, 1), 7.8 (t, 1), 7. 98 (d, 1), 8.15 (d, 1), 8.25 (d, 1) . Anal. Calcd for $C_{18}H_{17}NO_6S$: C, 57.61; H, 4.53; N, 3.73. Found: C, 57.40; H, 4.48; N, 3.21

α-Nsmoc-Asn(Trt)-OH. The acid was obtained as a white solid from DCM/hexane after column chromatography in 49.74% yield, mp 170-200°C; IR (KBr): 1151, 1295 (SO_2), 1669 (CO, amide), 1728 (CO, acid; urethane), 3391 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 2.64 (m, 2), 4.21 (q, 1), 5.1 (s, 2), 7.15 (m, 15), 7.67 (s, 1), 7.7 (d, 1), 7.74 (d, 1), 7.83 (t, 1), 8.06 (d, 1), 8.17 (d, 1) 8.3 (d, 1). Anal. Calcd for $C_{37}H_{30}N_2S.H_2O$: C, 66.87; H, 4.81; N, 4.21. Found: C, 66.60; H, 4.66; N, 4.27

α-Nsmoc-Gln(Trt)-OH. The acid was obtained as a white solid from DCM/hexane after column chromatography in 56.8% yield, mp 120-160°C; IR (KBr): 1151, 1295 (SO_2), 1723 (CO, acid; urethane), 3369 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.7 (m, 1), 1.93 (m, 1), 2.39 (m, 2), 3.4 (q, 1), 5.1 (q, 2), 7.2 (m, 16), 7.7 (m, 2), 7.79 (m, 2), 8.08 (d, 1), 8.17 (d, 1), 8.3 (d, 1). Anal. Calcd for $C_{38}H_{32}N_2O_7S$: C, 69.10; H, 4.88; N, 4.24. Found: C, 68.87; H, 4.74; N, 4.14

β-Nsmoc-Gly-OH. The acid was obtained as a cream-colored solid from DCM/hexane in 89.20% yield, mp 76-151°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3412 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$ + TFA) δ 4.17 (d, 2), 5.35 (d, 2), 5.9 and 6.8 (d, 1), 7.71 (quintet, 1), 7.76 (d, 1), 7.88 (d, 1), 7.95 (d, 1), 8.05 (d, 2). Anal. Calcd for $C_{16}H_{13}NO_6S$: C, 55.34; H, 3.74; N, 4.03. Found: C, 55.10; H, 3.85; N, 3.87

β-Nsmoc-Ala-OH. The acid was obtained as a cream-colored solid from DCM/hexane in 82.7% yield, mp 89-109°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3359 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.51 (d, 3), 4.5 (quentet, 1), 5.21 (s, 2), 5.58, 6.30 (d, 1), 7.63 (t, 2), 7.75 (t, 2), 7.86 (d, 1), 7.93 (d, 1), 8.01 (d, 1). Anal. Calcd for $C_{17}H_{15}NO_6S$: C, 56.53; H, 4.15; N, 3.87. Found: C, 56.75; H, 4.24; N, 3.73

β-Nsmoc-Val-OH. The acid was obtained as a cream-colored solid from DCM/hexane in 73.3% yield, mp 89-115°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3359 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 0.91 (d, 3), 1.05 (d, 1) 2.25 (m, 1), 4.33 (q, 1), 5.21, (s, 2), 5.49 (d, 1) 7.61 (t, 2), 7.74 (t, 2), 7.83 (d, 1), 7.91 (d, 1), 8.05 (1, d) Anal. Calcd for $C_{19}H_{19}NO_6S$: C, 58.62; H, 4.88; N, 3.59. Found: C, 58.88; H, 5.15; N, 3.42

β-Nsmoc-Leu-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 83.8% yield, mp 78-105°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3359 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$) δ 0.93 (d, 6), 1.57 (m, 1), 1.65-1.77 (m, 2), 4.33 (m, 1), 5.20, (s, 2), 5.7 (d, 1), 7.61(m, 2), 7.67 (t, 2), 7.85 (d, 1), 7.89 (d, 1), 7.97 (d, 1). Anal. Calcd for $C_{20}H_{21}NO_6S$: C, 59.56; H, 5.20; N, 3.47. Found: C, 59.76; H, 5.44; N, 3.41

β-Nsmoc-Ile-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 84.0% yield, mp 76-123°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3359 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$)) δ 0.88 (t, 3), .98 (d, 3) 1.25 (m, 1), 1.46 (m, 1), 2.0 (m, 1), 4.34 (q, 1), 5.22 (s, 2), 5.5 (d, 1) 7.6 (m, 2), 7.69 (t, 2). Anal. Calcd for $C_{20}H_{21}NO_6S$: C, 59.56; H, 5.20; N, 3.47. Found: C, 59.27; H, 5.06; N, 3.42

β-Nsmoc-Pro-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 80.0% yield, mp 91-146°C; IR (KBr): 1157, 1301 (SO_2), 1712 (CO, acid; urethane), 3359 (OH) cm^{-1}; ^{1}H NMR ($CDCl_3$) δ δ 1.93 (m, 2), 2.25 (m, 2), 3.6 (m, 2), 4.41 and 4.54 (2q, 1), 5.25 (m, 2), 6.7 (bs, 1), 7.60-7.85(m, 4), 7.88 (t, 1), 7.95 (d, 1), 8.01 (d, 1), 7.97 (d, 1). Anal. Calcd for $C_{19}H_{17}NO_6S$: C, 58.92; H, 4.39; N, 3.61. Found: C, 58.89; H, 4.37; N, 3.40

β-Nsmoc-Phe-OH. The acid was obtained as a cream-colored solid from DCM/hexane in 91.8% yield, mp 81-158°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$) δ 3.03-3.26 (m, 2), 4.68 (q, 1), 5.16 (s, 2), 5.48, (d, 1), 7.14 (m, 3), 7.24 (d, 2), 7.63 (m, 3), 7.7 (d, 1), 7.88 (d, 1), 7.96 (d, 2). Anal. Calcd for $C_{23}H_{19}NO_6S$: C, 63.16; H, 4.34; N, 3.20. Found: C, 63.04; H, 4.50; N, 3.11

β-Nsmoc-Met-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 73.52% yield, mp 74-143°C; IR (KBr): 1154, 1301 (SO_2), 1723 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$) δ 2.15 (s, 3), 2.25 (m, 2), 2.58 (t, 2) 2.58 (m, 2), 4.56 (m, 1), 5.21 (s, 2) 5.93 (d, 1) 7.55 (t, 3), 7.7 (d, 1) 7.81 (d, 1), 7.9 (d, 1), 8.0 (d, 1). Anal. Calcd for $C_{19}H_{19}NO_6S$: C, 54.16; H, 4.50; N, 3.32. Found: C, 54.22; H, 4.62; N, 3.24

β-Nsmoc-Trp-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 85.7% yield, mp 119-204°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3401 (OH, NH) cm^{-1}; ^{1}H NMR (DMSO-d_6) δ 3.47 (d, 2), 4.87 (m, 1), 5.28 (d, 2), 5.79 (d, 1) 6.96 (t, 1),7.05 (t, 1), 7.33 (d, 1), 7.54 (d, 1), 7.78 (m, 3), 7.94 (d, 1), 8.14 (d, 1) 8.25 (t, 2), 8.34 (d, 1). Anal. Calcd for $C_{25}H_{20}NO_6S$: C, 63.04; H, 4.19; N, 5.87. Found: C, 62.99; H, 4.24; N, 5.69

β-Nsmoc-Ser(t-Bu)-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 78.5% yield, mp 79-139°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3358 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$) δ 1.17 (s, 9), 3.58 (q, 1), 3.91 (dd, 1)δ 4.47 (m, 1), 5.23 (d, 2), 5.85 (d, 1) 7.65 (q, 3), 7.73 (d, 2), 7.9

(d, 1), 7.97 (d, 1), 8.04 (d, 1). Anal. Calcd for $C_{21}H_{23}NO_7S$: C, 58.21; H, 5.30; N, 3.23. Found: C, 58.46; H, 5.55; N, 3.10

β-Nsmoc-Thr(t-Bu)-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 86.3% yield, mp 88-119°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3433 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.17 (d, 3), 1.29 (s, 9), 4.31 (m, 2), 5.23 (s, 2) 5.89 (d, 1) 7.66 (m, 2), 7.73 (t, 2), 7.9 (d, 1), 7.98 (d, 1), 8.05 (d, 1). Anal. Calcd for $C_{22}H_{25}NO_7S$: C, 59.01; H, 5.58; N, 3.12. Found: C, 59.19; H, 5.72; N, 3.00

β-Nsmoc-Tyr(t-Bu)-OH. The acid was obtained as a cream-colored solid from DCM/hexane in 87.16% yield, mp 96-162°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.3 (s, 9), 3.07 (dd, 1), 3.18 (dd, 1) 4.65 (q, 1), 5.19 (d, 2), 5.42 (d, 1), 6.9 (d, 2), 7.07 (d, 2), 7.64 (m, 3), 7.71 (d, 1), 7.9 (d, 1), 7.96 (d, 1), 8.05 (d, 1), 8.32 (d, 1). Anal. Calcd for $C_{27}H_{27}NO_7S$: C, 63.66; H, 5.30; N, 2.74. Found: C, 63.42; H, 5.17; N, 2.76

β-Nsmoc-Asp(O-t-Bu)-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 83.0% yield, mp 85-151°C; IR (KBr): 1157, 1301 (SO_2), 1728 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.44 (s, 9), 3.0 (2dd, 1), 4.6 (m, 1), 5.23 (s, 2) 6.0 (d, 1) 7.63 (m, 2), 7.75 (t, 2), 7.85 (d, 1), 7.93 (d, 1), 8.05 (d, 1).). Anal. Calcd for $C_{22}H_{23}NO_8S$: C, 57.27; H, 4.98; N, 3.03. Found: C, 56.99; H, 4.86; N, 2.94

β-Nsmoc-Glu(O-t-Bu)-OH. The acid was obtained as a cream-colored solid from DCM/hexane in 52.0% yield, mp 77-164°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.43 (s, 9), 2.03 (m, 1), 2.21 (m, 1), 2.42 (m, 2) 4.41 (m, 1), 5.20 (q, 2), 5.83 (d, 1), 7.59 (m, 2) 7.67 (d, 2), 7.84 (d, 1), 7.9 (d, 1), 8.0 (d, 1). Anal. Calcd for $C_{23}H_{25}NO_8S$: C, 58.11; H, 5.25; N, 2.94. Found: C, 57.93; H, 5.04; N, 2.93

β-Nsmoc-Lys(Boc)-OH. The acid was obtained as a cream-colored solid after evaporation of DCM/hexane to dryness in 68.50% yield, mp 86-149°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3380 (OH, NH) cm^{-1}; ^1H NMR (DMSO-d_6) δ 1.1.7-1.34 (bm, 13), 1.59 (m, 1), 1.69 (m, 1), 2.86 (q, 2), 3.85 (m, 1), 5.1 (s, 2), 6.74 (t, 1) 7.46 (m, 1), 7.77 (m, 2), 7.93 (d, 1), 8.12 (d, 1), 8.23 (d, 1), 8.30 (s, 1), 8.4 (d, 1). Anal. Calcd for $C_{25}H_{30}N_2O_8S$: C, 57.92; H, 5.78; N, 5.40. Found: C, 58.04; H, 5.79; N, 5.26

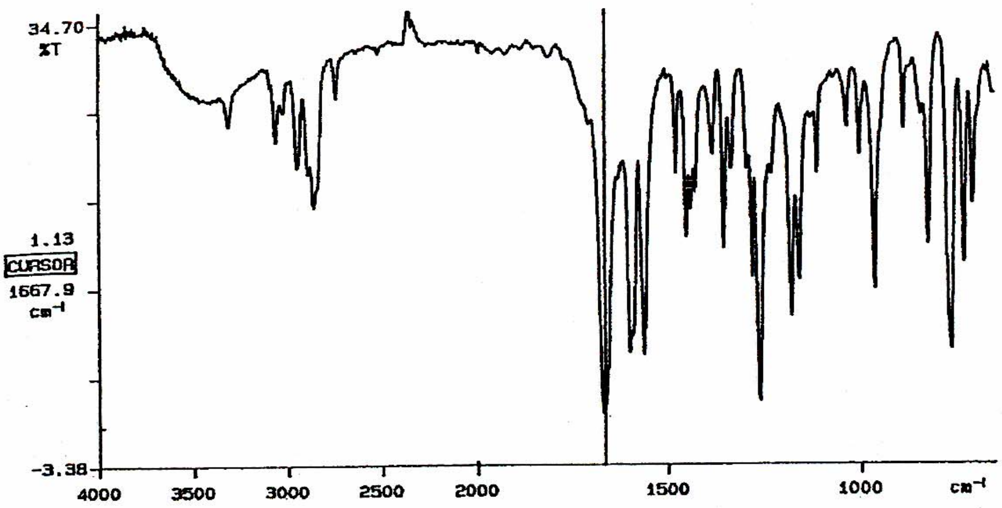
β-Nsmoc-Phg-OH. The acid was obtained as a creamy solid from DCM/hexane in 80.3% yield, mp 98-159°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3359 (OH, NH) cm^{-1}; ^1H NMR ($CDCl_3$) δ 5.17 (q, 2), 5.39 (t, 1), 6.2 (d, 1), 7.35 (m, 5), 7.67 (m, 4), 7.93 (m, 3). Anal. Calcd for $C_{22}H_{17}NO_6S$: C, 62.42; H, 4.01; N, 3.30. Found: C, 62.62; H, 4.26; N, 3.16

β-Nsmoc-Aib-OH (105). The acid was obtained as a cream-colored solid from DCM/hexane in 77.8% yield, mp 184-187°C; IR (KBr): 1157, 1301 (SO_2), 1723 (CO, acid; urethane), 3348 (OH, NH) cm^{-1}; ^{1}H NMR ($CDCl_3$ + TFA) δ 1.61 (s, 6), 5.30 (s, 2), 6.0 (bs, 1) 6.95 (m, 4), 7.9 (d, 1), 7.97 (d, 1), 8.03 (d, 1). Anal. Calcd for $C_{18}H_{17}NO_6S$: C, 57.61; H, 4.53; N, 3.73. Found: C, 57.33; H, 4.39; N, 3.52

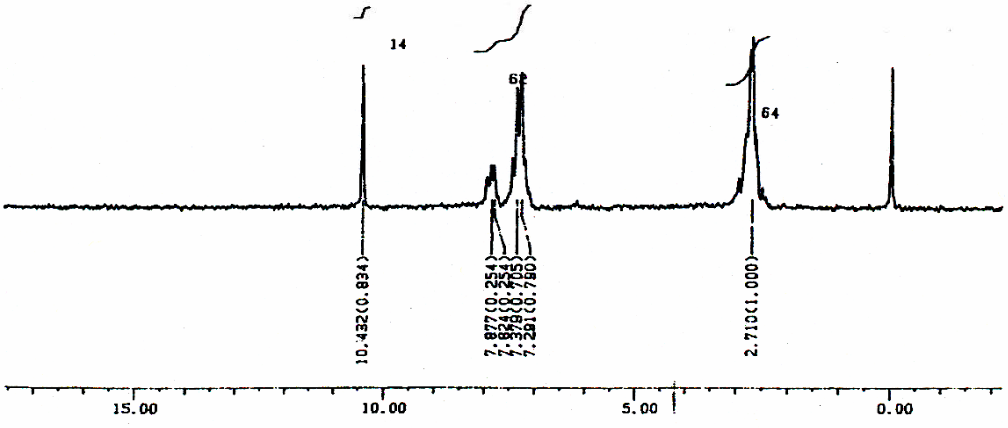
β-Nsmoc-Asn(Trt)-OH. The acid was obtained as a white solid from DCM/hexane after column chromatography in 47.8% yield, mp 77-164°C; IR (KBr): 1151, 1295 (SO_2), 1669 (CO, amide), 1712 (CO acid; urethane) 3391 (OH, NH) cm^{-1}; ^{1}H NMR (DMSO-d_6) δ 2.66 (m, 2), 4.2 (m, 1), 5.1 (s, 2), 7.2 (m, 18), 7.4 (bs, 1), 7.77 (m, 2), 7.85 (t, 1), 8.5 (d, 1), 8.8 (d, 1), 8.5 (d, 1). Anal. Calcd for $C_{37}H_{30}N_2O_7S.1.5.H_20$: C, 65.98; H, 4.90; N, 4.15. Found: C, 65.76; H, 4.81; N, 4.03

β-Nsmoc-Gln(Trt)-OH. The acid was obtained as a white solid from DCM/hexane after column chromatography in 56.3% yield, mp 238-240°C; IR (KBr): 1141, 1301 (SO_2), 1712 (CO acid; urethane) 3320 (OH, NH) cm^{-1}; ^{1}H NMR (DMSO-d_6) δ 1.73 (m, 1), 1.93 (m, 1), 2.37 (m, 2), 3.98 (m, 1) 5.13 (m, 2), 7.18 (m, 15), 7.75 (m, 2), 7.9 (d, 1), 8.01 (m. 1), 8.23 (d, 1), 8.3 (s, 1), 8.45 (m, 1). Anal. Calcd for $C_{38}H_{32}N_2O_7S$: C, 69.10; H, 4.84; N, 4.24. Found: C, 68.88; H, 5.06; N, 4.12

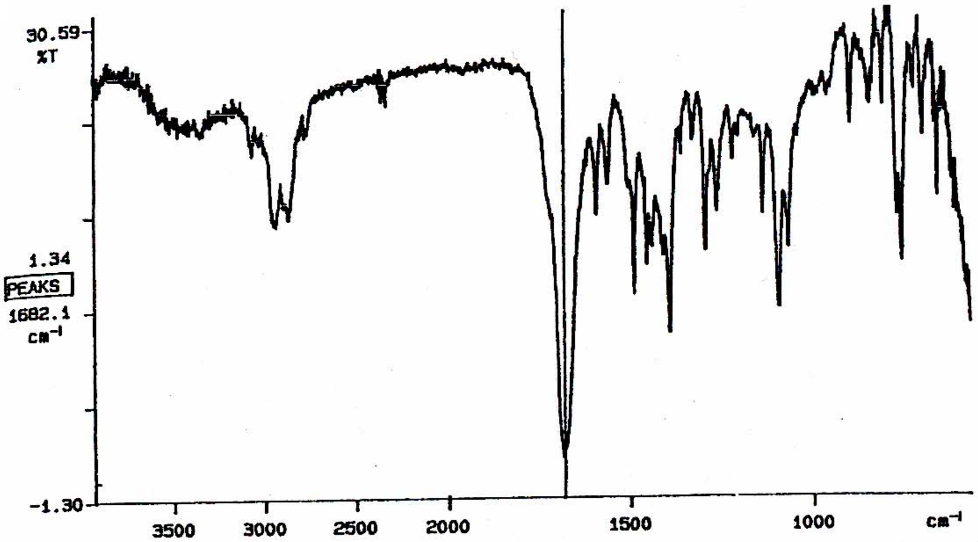
IV. Spectral Data for Key Intermediates



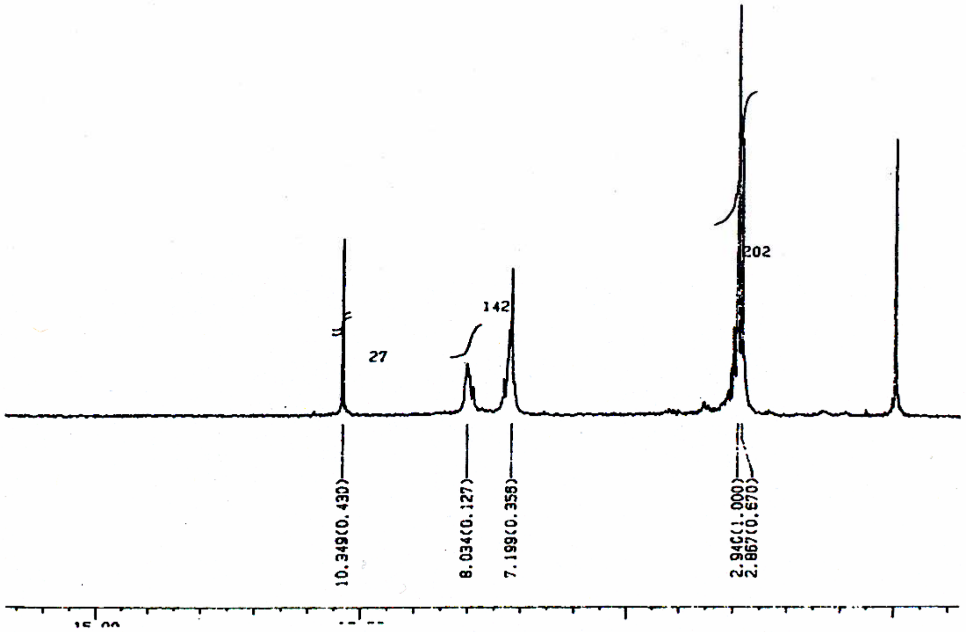
IR (NaCl) for 1-Chloro-3,4-dihydronaphthalene-2-carboxaldeyde **8**



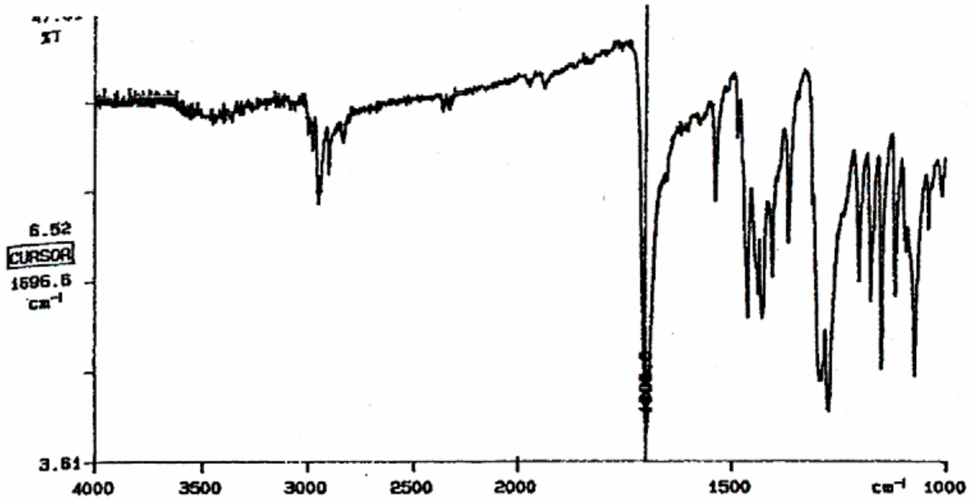
^{1}H NMR ($CDCl_3$, 60 MHz) for 1-Chloro-3,4-dihydronaphthalene-2-carboxaldeyde **8**



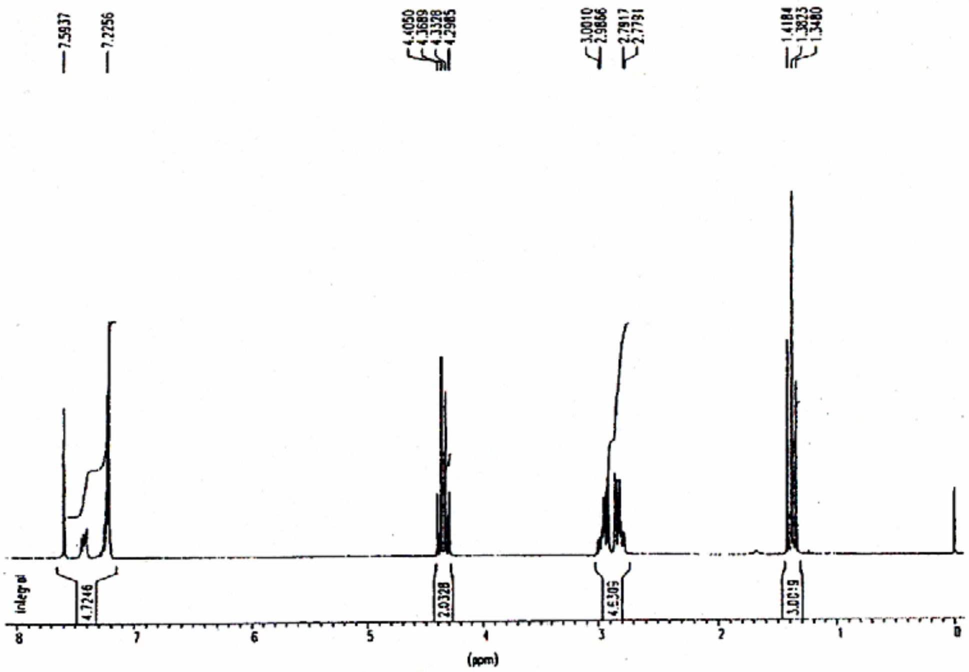
IR (NaCl) for 2-Bromo-3,4-dihydronaphthalene-1-carboxaldehyde



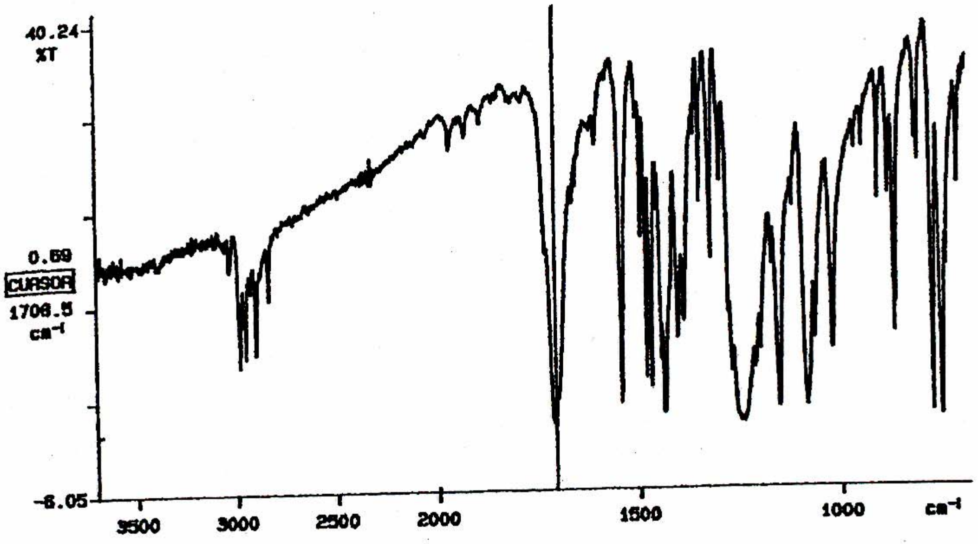
^{1}H NMR (CDCl$_3$, 60 MHz) for 2-Bromo-3,4-dihydronaphthalene-1-carboxaldehyde



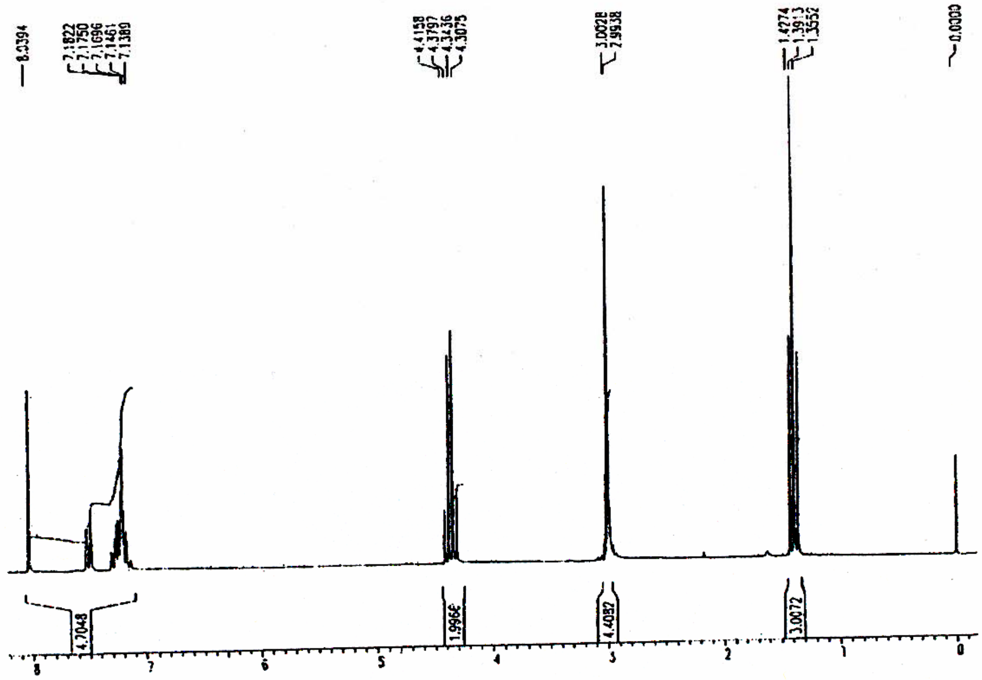
IR (KBr) for Ethyl 4,5-dihydronaphtho[1,2-*b*]thiophene-2-Carboxylate **9**



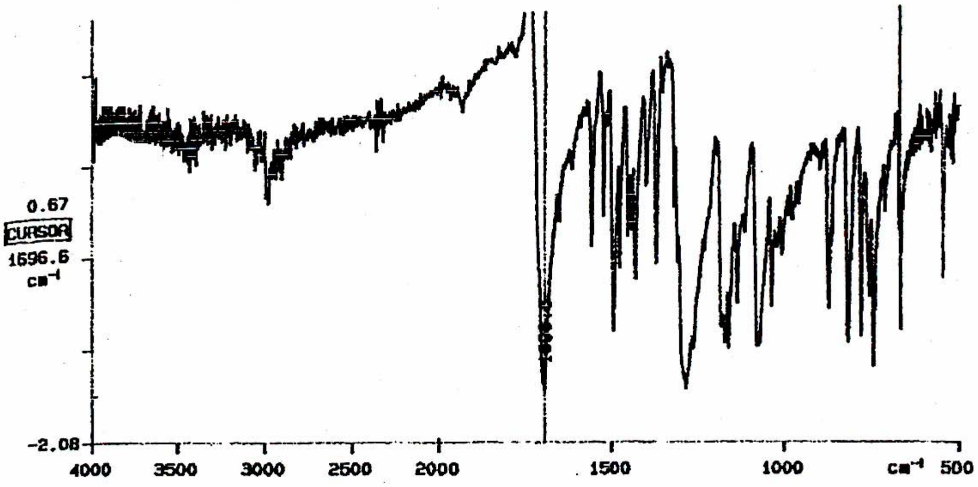
^{1}H NMR ($CDCl_3$) for Ethyl 4,5-dihydronaphtho[1,2-*b*]thiophene-2-Carboxylate **9**



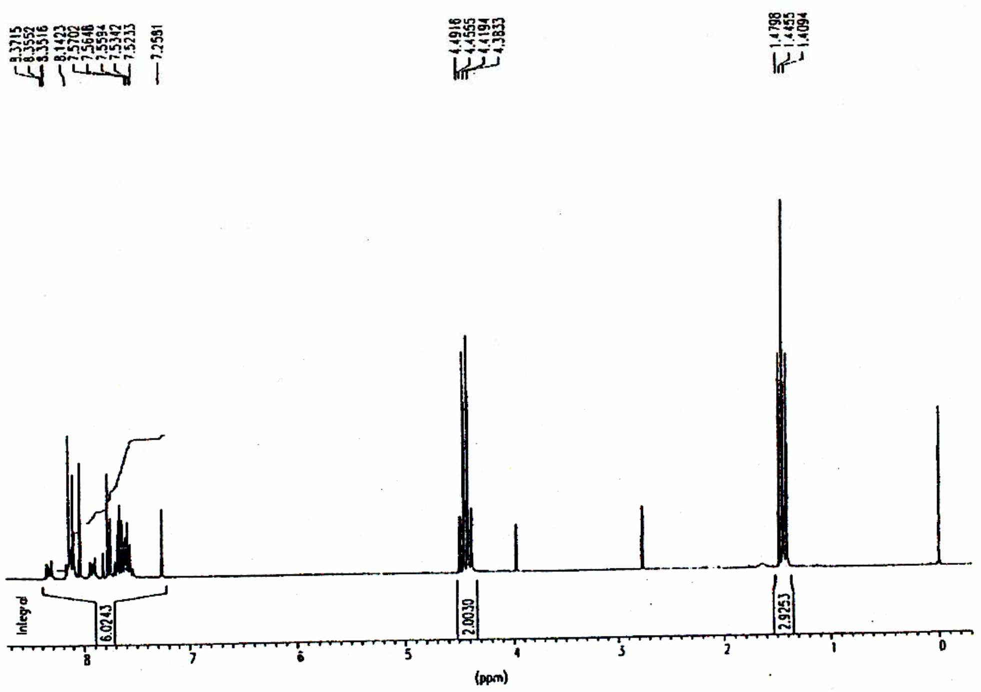
IR (KBr) for Ethyl 4,5-dihydronaphtho[2,1-*b*]thiophene-2-carboxylate



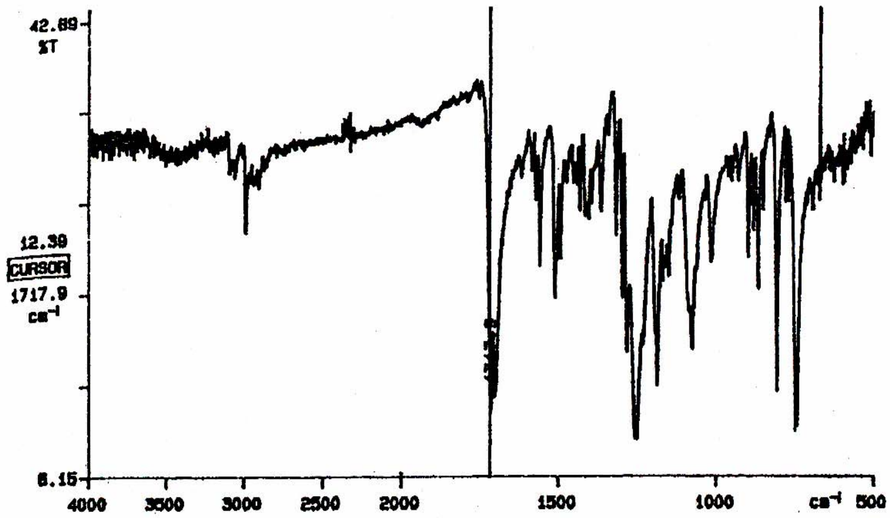
^{1}H NMR ($CDCl_3$) for Ethyl 4,5-dihydronaphtho[2,1-*b*]thiophene-2-carboxylate



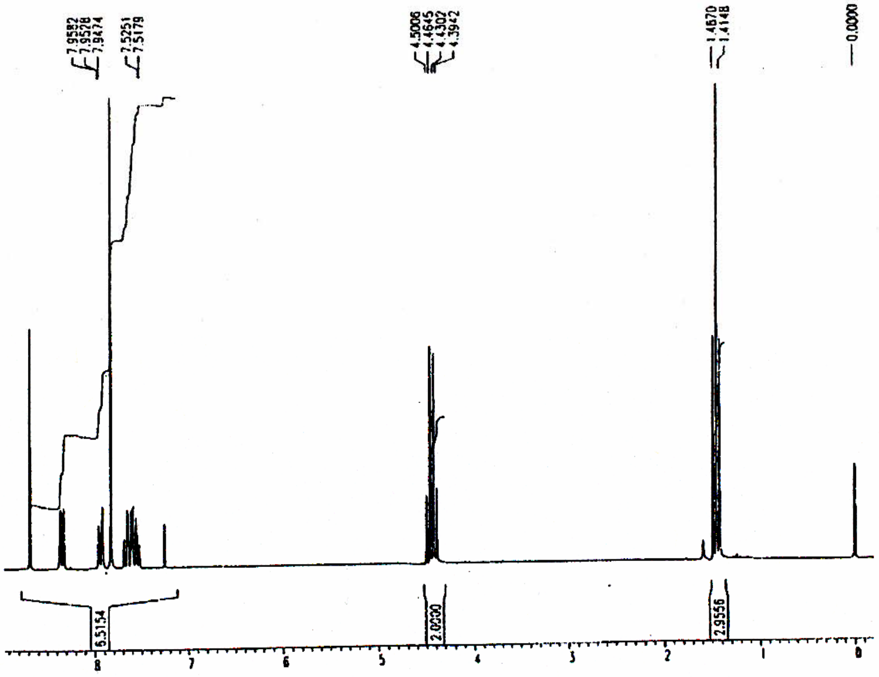
IR (KBr) for Ethyl naphtho[1,2-*b*]thiophene-2-carboxylate **10**



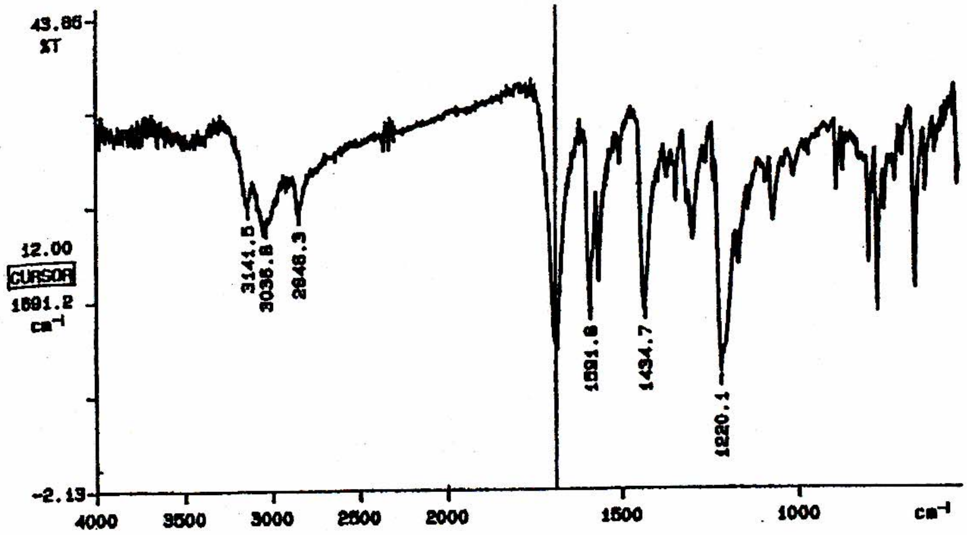
^{1}H NMR ($CDCl_3$) for Ethyl naphtho[1,2-*b*]thiophene-2-carboxylate **10**



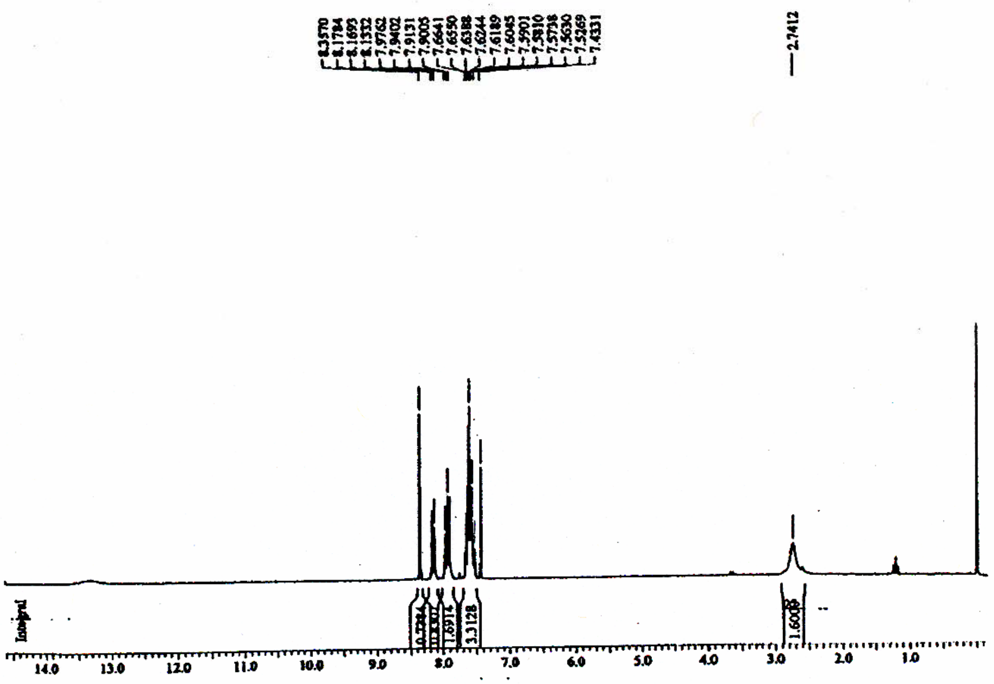
IR (KBr) for Ethyl naphtho[2,1-*b*]thiophene-2-carboxylate **16**



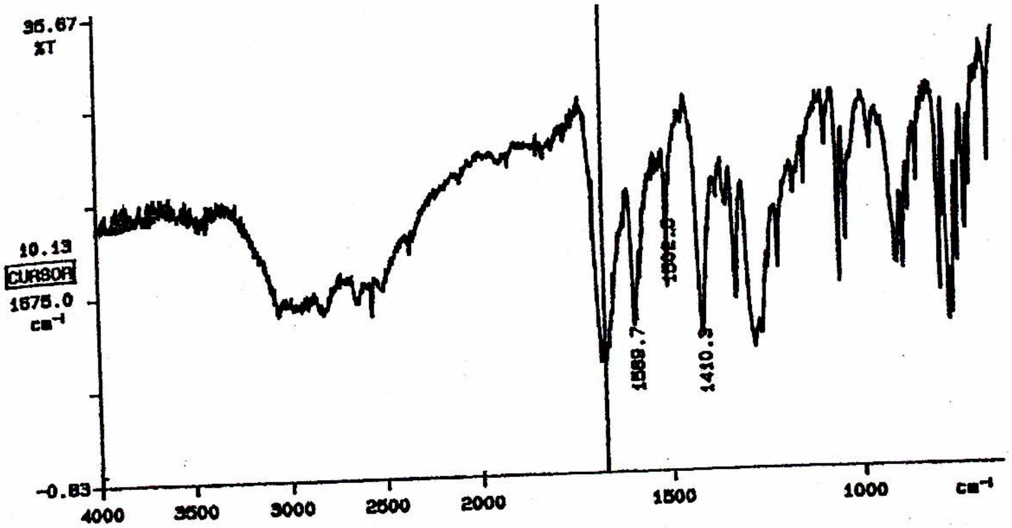
^{1}H NMR ($CDCl_3$) for Ethyl naphtho[2,1-*b*]thiophene-2-carboxylate **16**



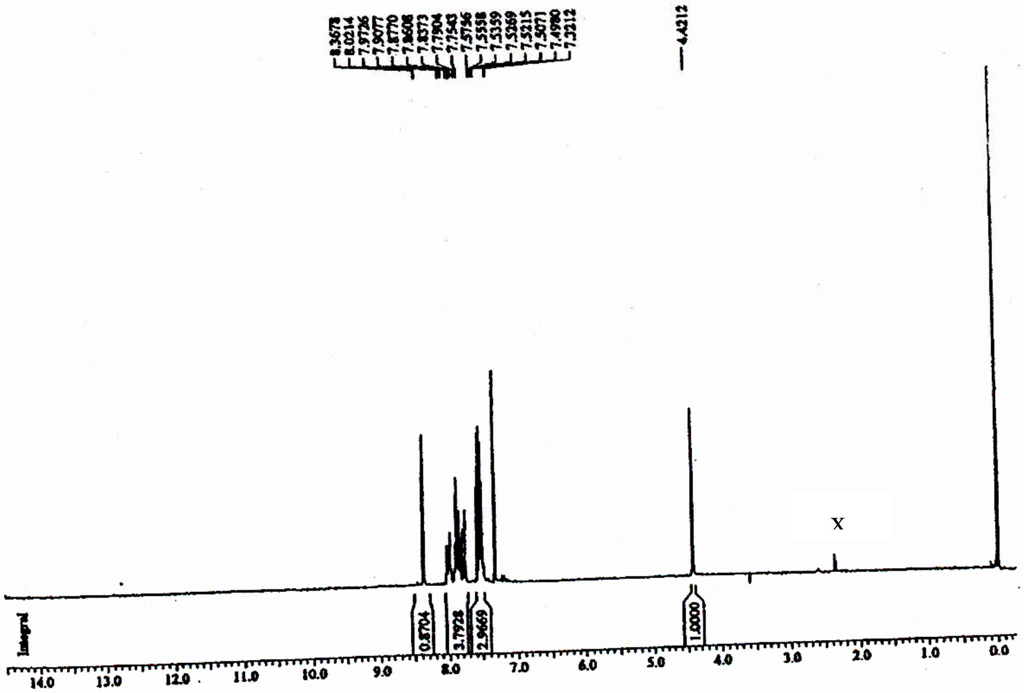
IR (KBr) for 5-(1-naphthylidene)rhodanine **13**



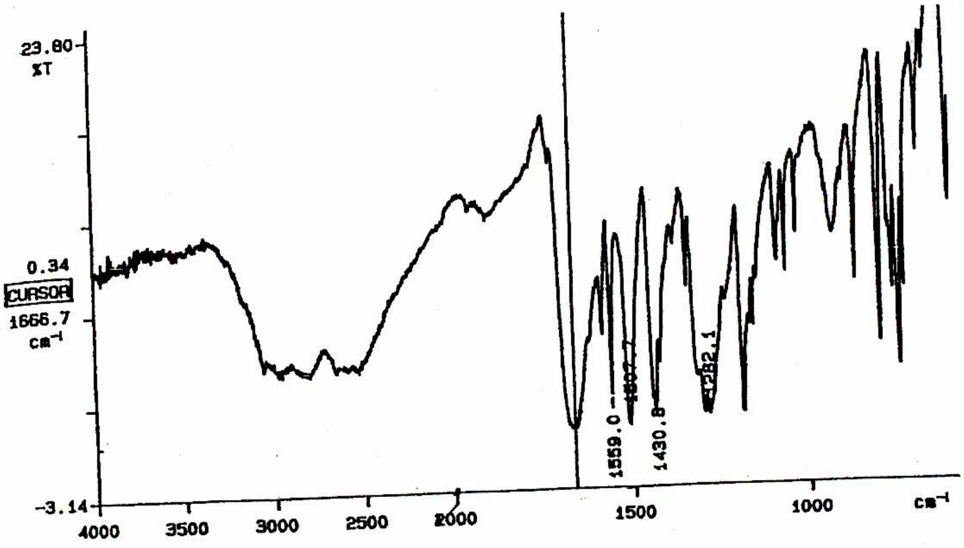
^{1}H NMR (CDCl3) for 5-(1-naphthylidene)rhodanine **13**



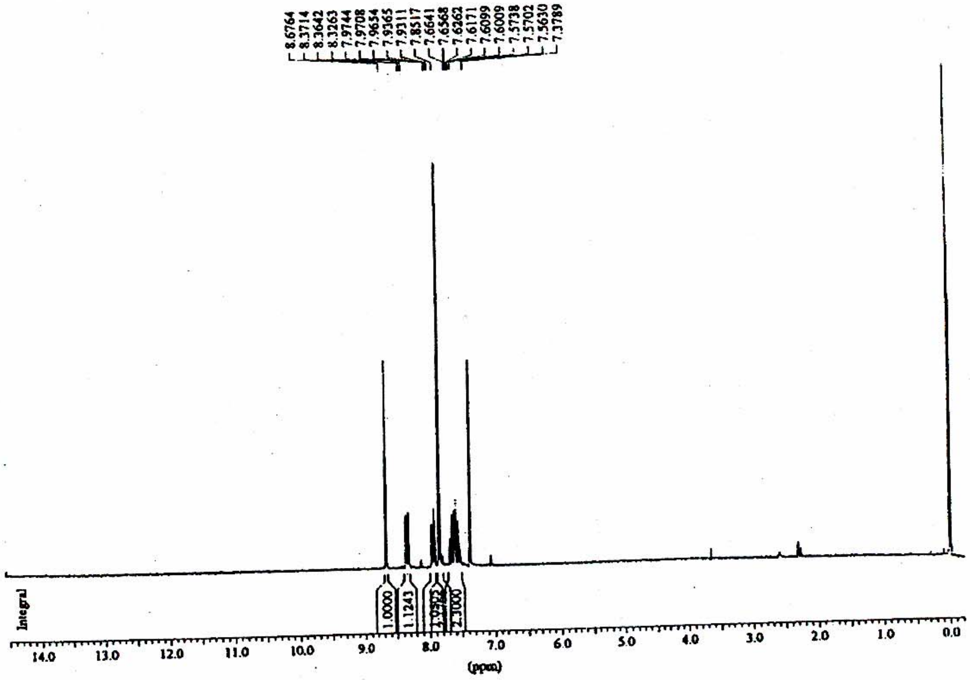
IR (KBr) for β-1-naphthyl-α-mercaptoacrylic acid **14**



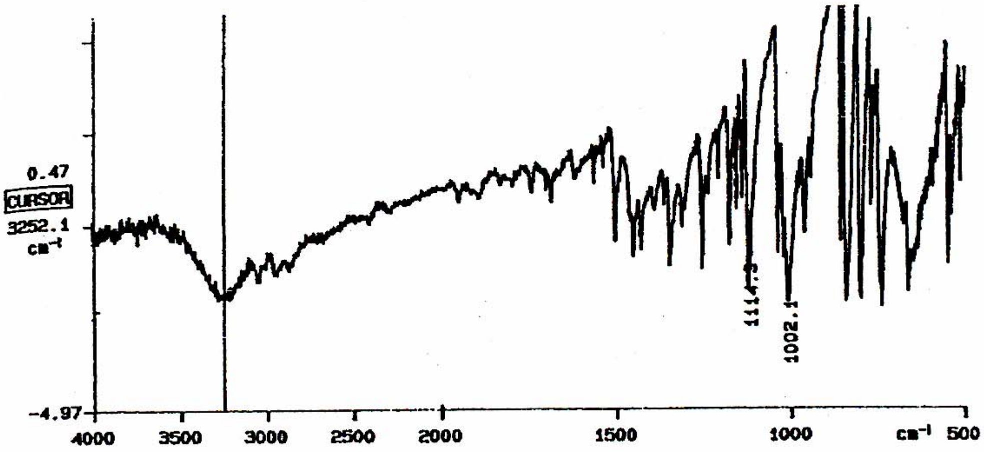
^{1}H NMR ($CDCl_3$+DMSO-d_6) for β-1-naphthyl-α-mercaptoacrylic acid **14**



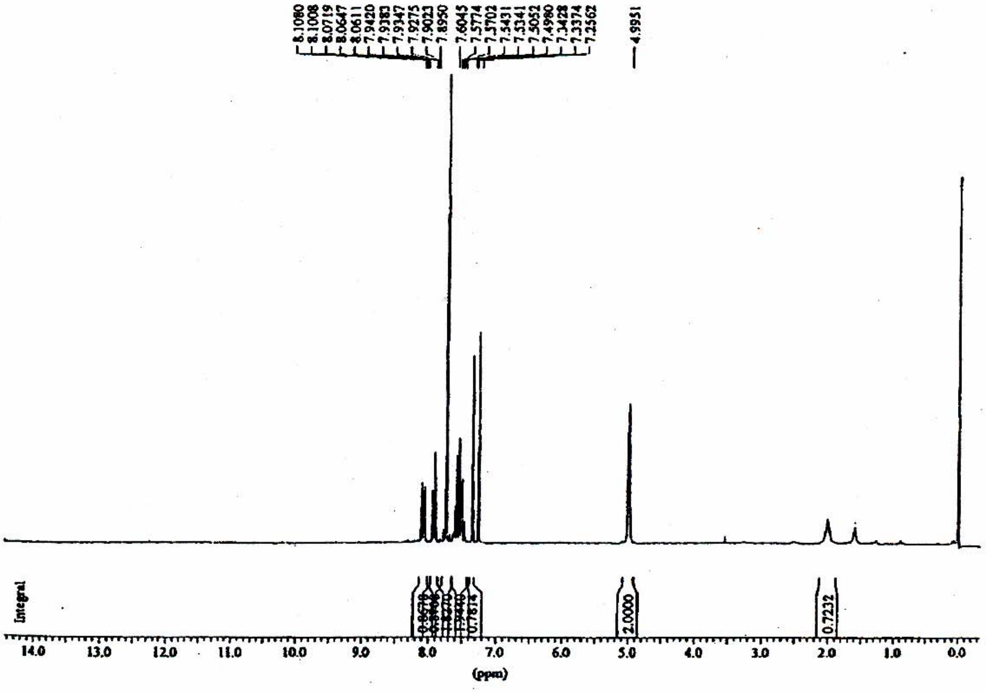
IR (KBr) for Naphtho[2,1-*b*]thiophene-2-carboxylic acid **15**



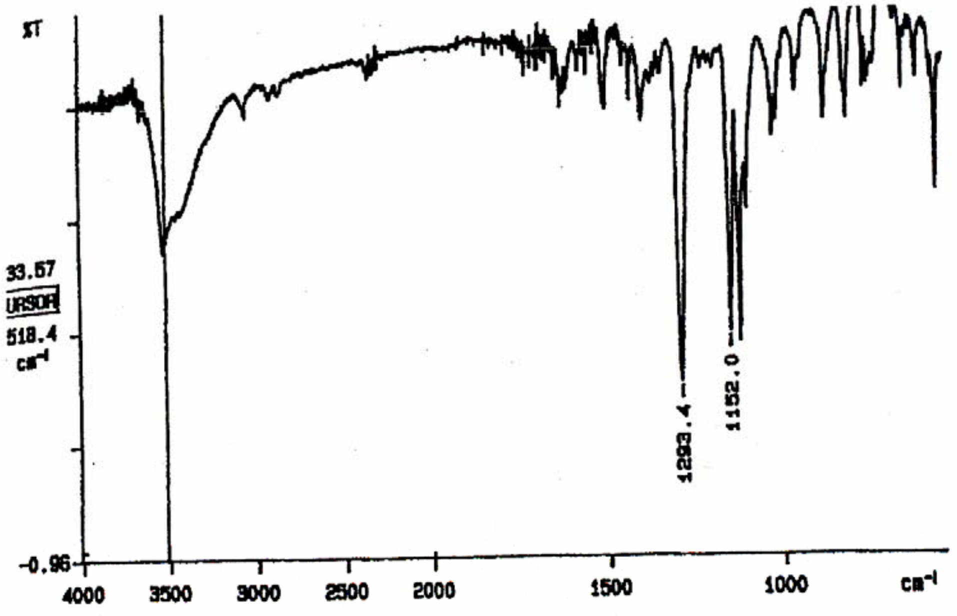
^{1}H NMR ($CDCl_3$+DMSO-d_6) for Naphtho[2,1-*b*]thiophene-2-carboxylic acid **15**



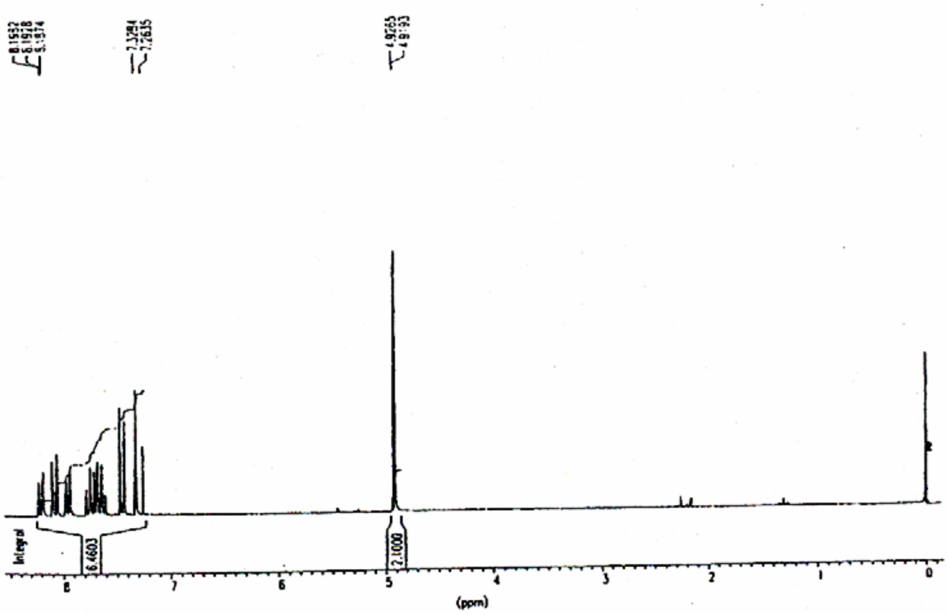
IR (KBr) for 2-(Hydroxymethyl)naphtho[1,2-*b*]thiophene **5**



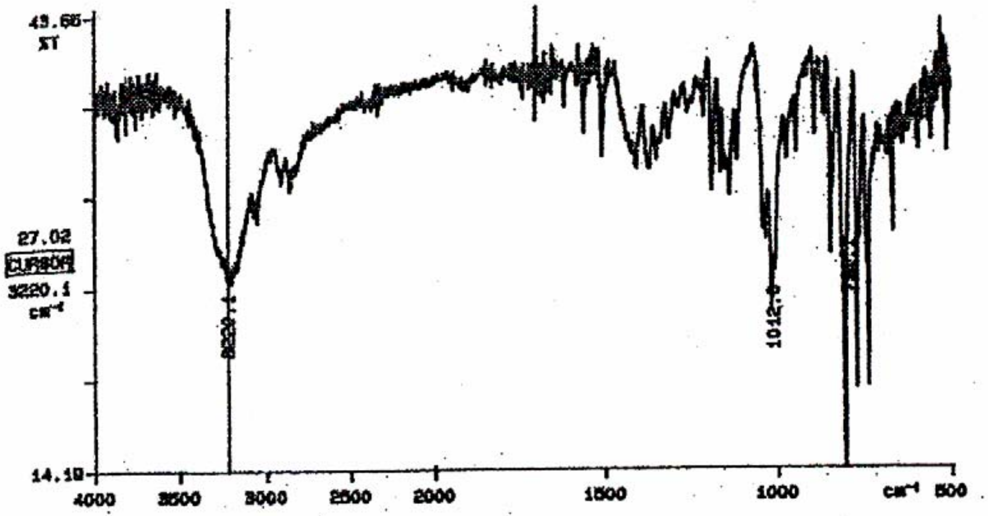
^{1}**H NMR** for 2-(Hydroxymethyl)naphtho[1,2-*b*]thiophene **5**



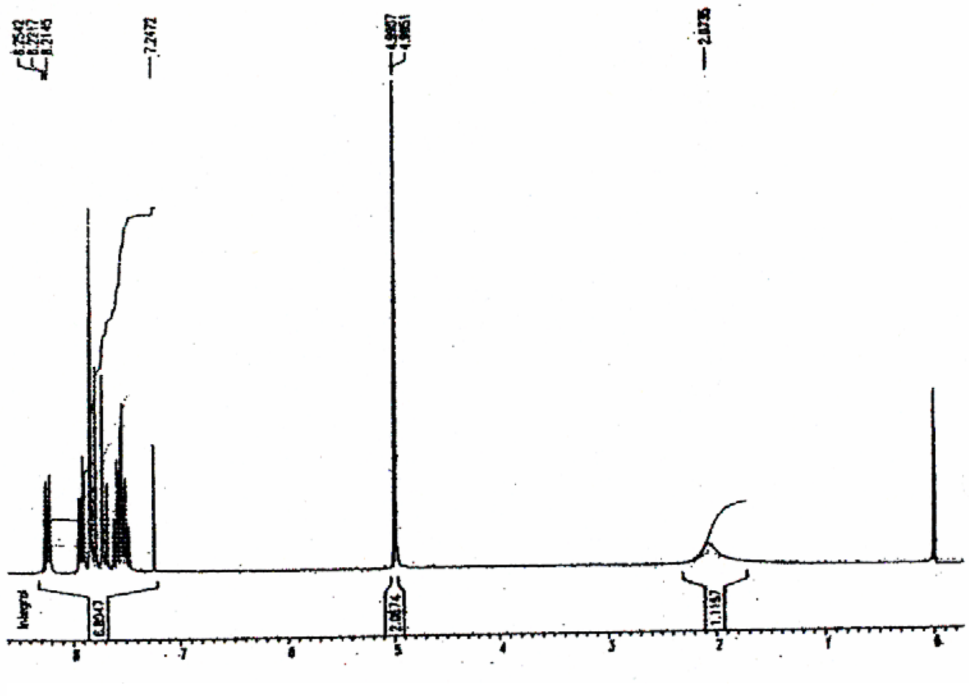
IR (KBr) 1,1-Dioxo-2-(hydroxymethyl)naphtha[1,2-*b*]thiophene **11**



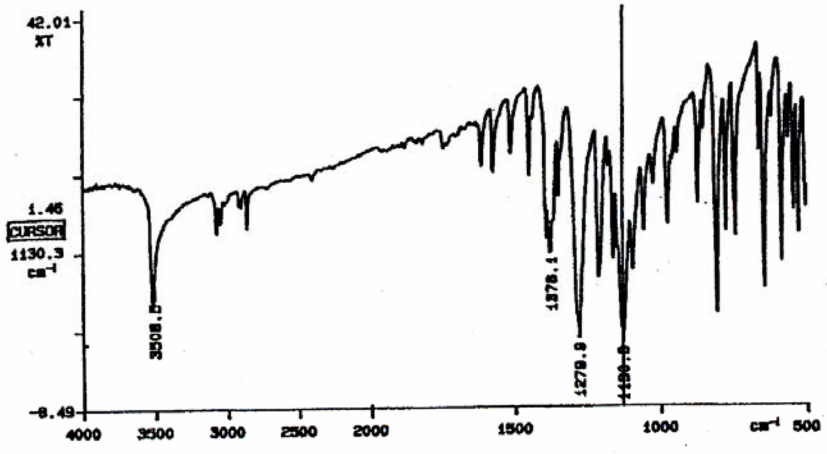
^{1}**HNMR (CDCl$_3$+TFA)** 1,1-Dioxo-2-(hydroxymethyl)naphtha[1,2-*b*]thiophene **11**



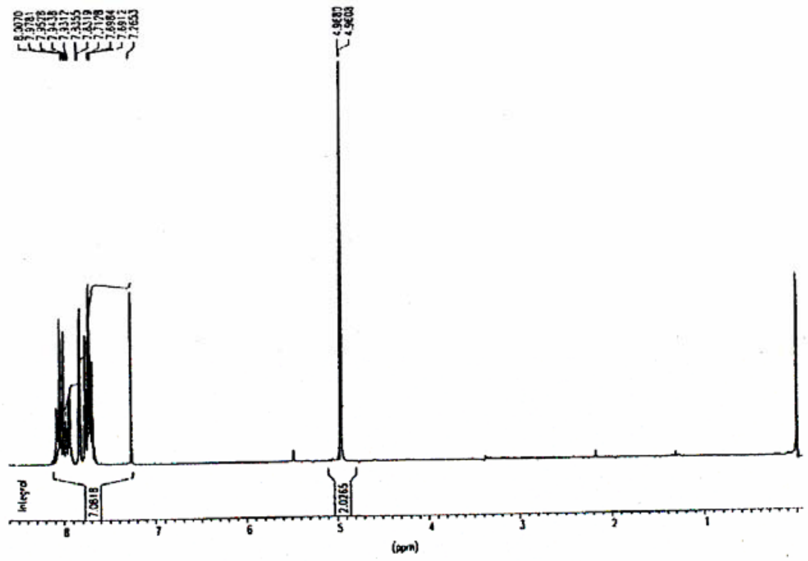
IR (KBr) for 2-(Hydroxymethyl)naphtho[2,1-*b*]thiophene **6**



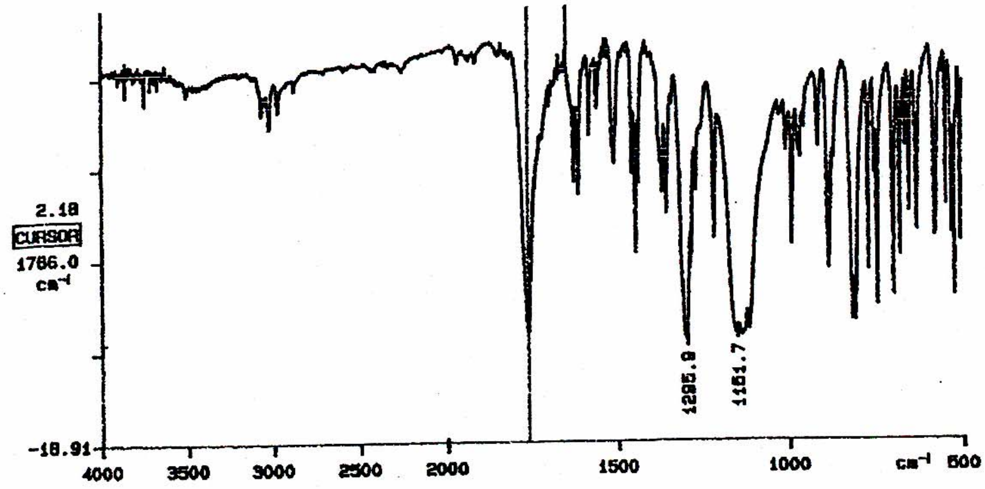
^{1}**H NMR (CDCl$_3$)** for 2-(Hydroxymethyl)naphtho[2,1-*b*]thiophene **6**



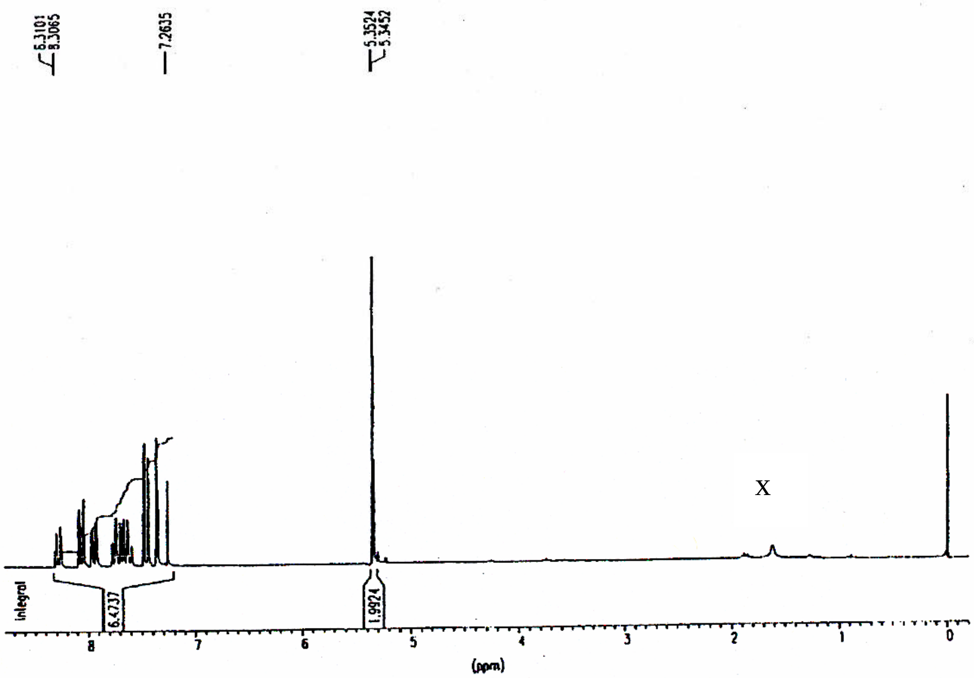
IR (KBr) for 3,3-Dioxo-2-(hydroxymethyl)naphtho[2,1-*b*]thiophene **17**



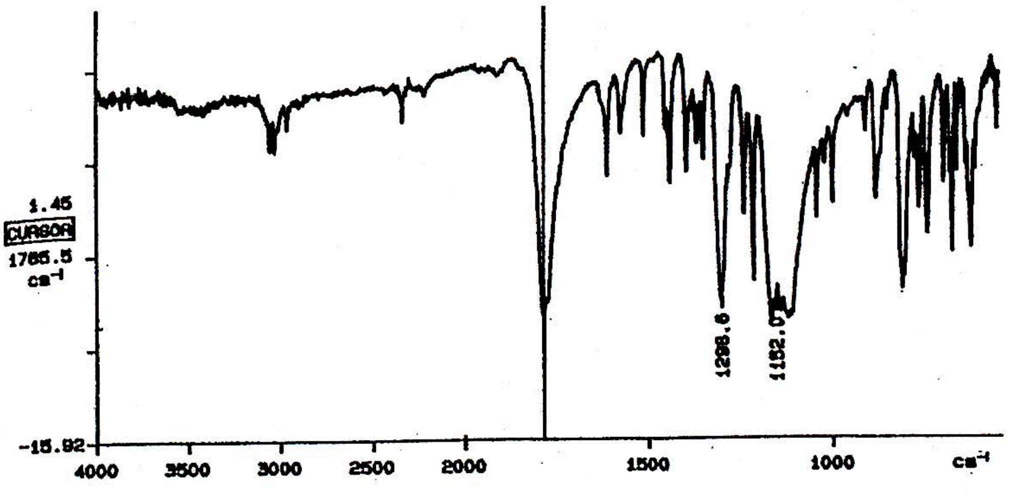
^{1}H NMR ($CDCl_3$) for 3,3-Dioxo-2-(hydroxymethyl)naphtho[2,1-*b*]thiophene **17**



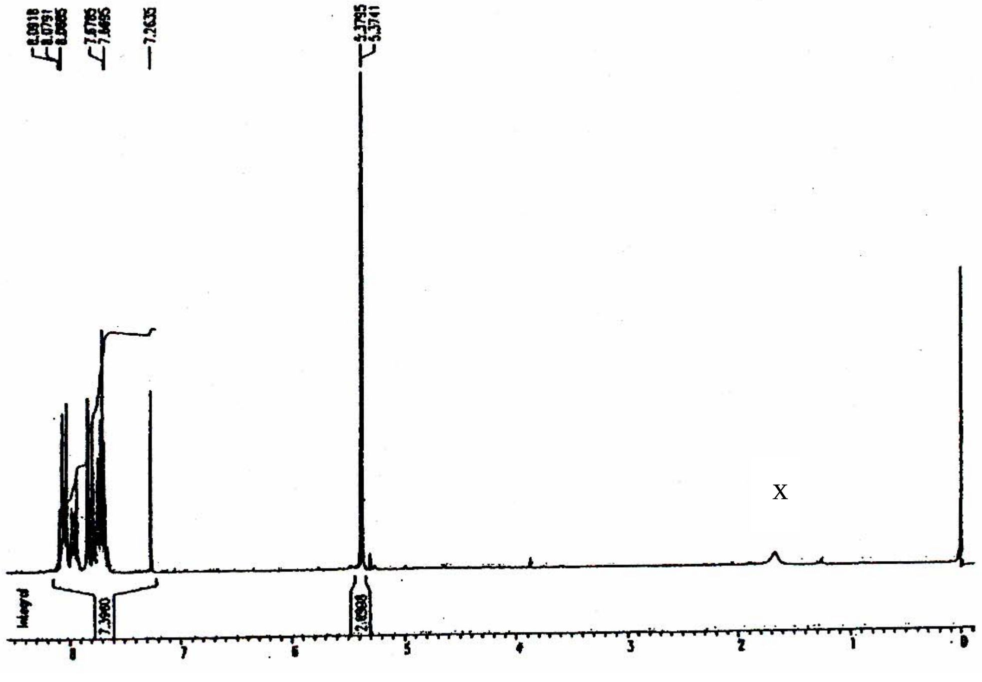
IR (KBr) for 1,1-Dioxonaphtho[1,2-*b*]thiophene chloroformate **18**



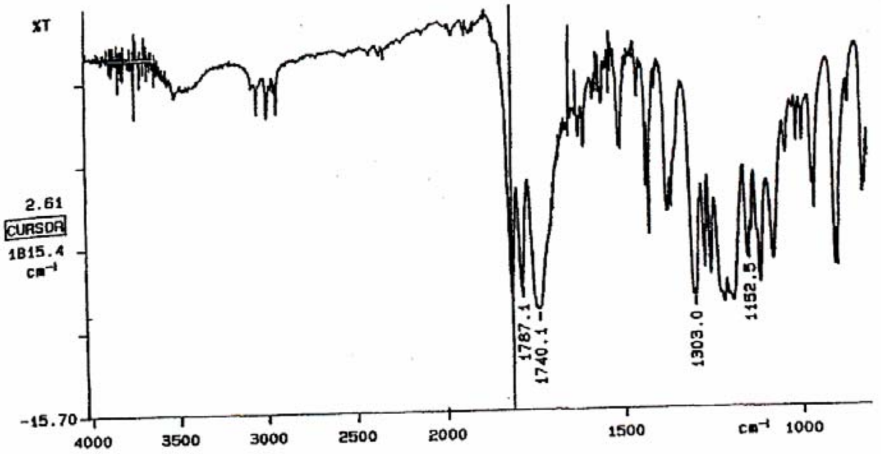
^{1}H NMR ($CDCl_3$) for 1,1-Dioxonaphtho[1,2-*b*]thiophene chloroformate **18**



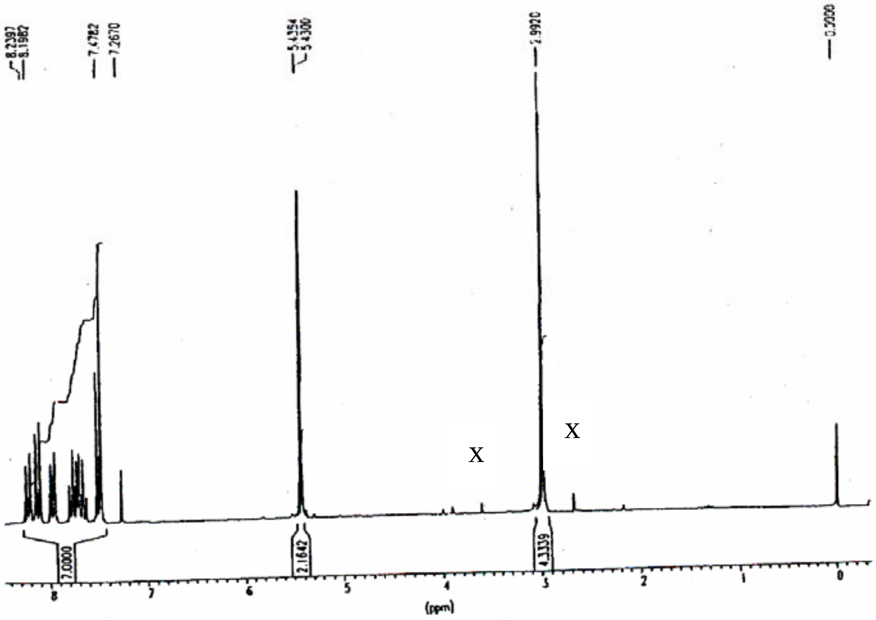
IR (KBr) for 3,3-Dioxonaphtho[2,1-*b*]thiophene-2-methyl chloroformate **19**



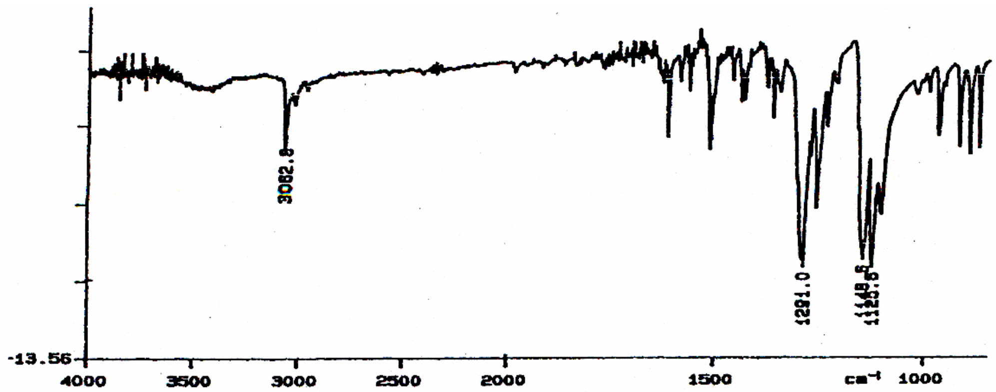
^{1}**H NMR ($CDCl_3$)** for 3,3-Dioxonaphtho[2,1-*b*]thiophene-2-methyl chloroformate **19**



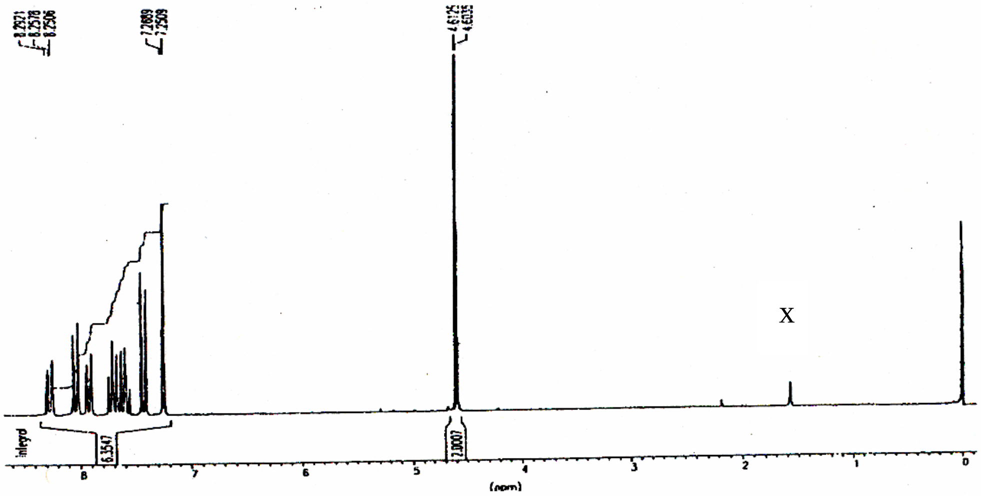
IR (KBr) for 1,1-Dioxonaphtho[1,2-*b*]thiophene-2-methyl N-succinimidyl carbonate



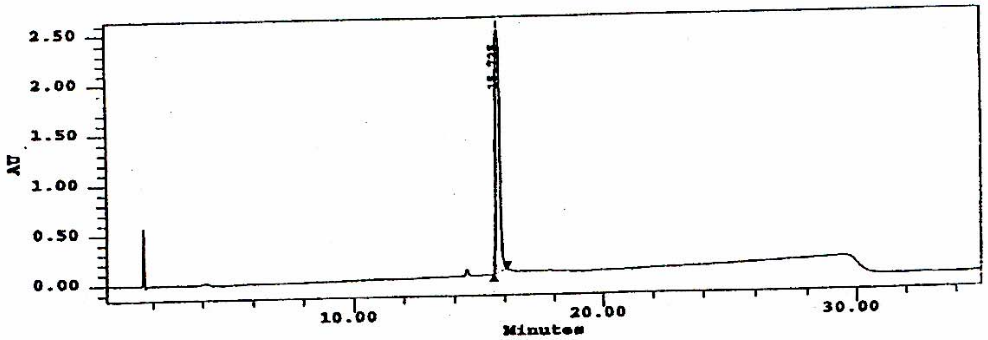
^{1}H NMR ($CDCl_3$+TFA) for 1,1-Dioxonaphtho[1,2-*b*]thiophene-2-methyl N-succinimidyl carbonate



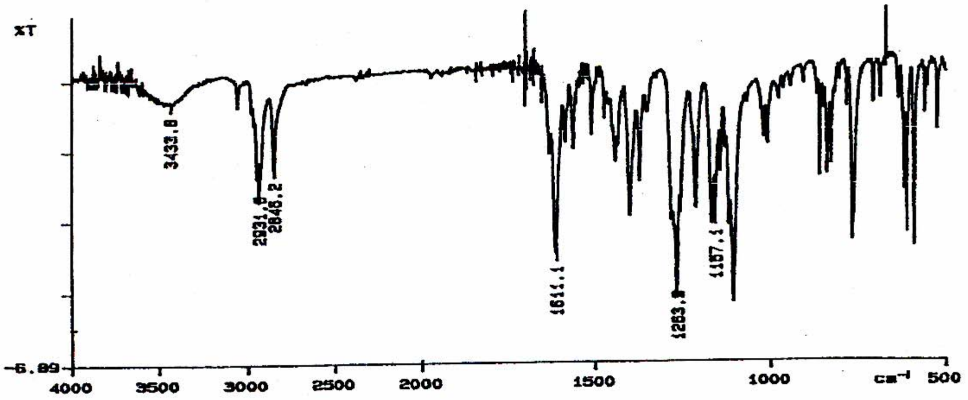
IR (KBr) for 1,1-Dioxo-2-(chloromethyl)naphtho[1,2-*b*]thiophene **23**



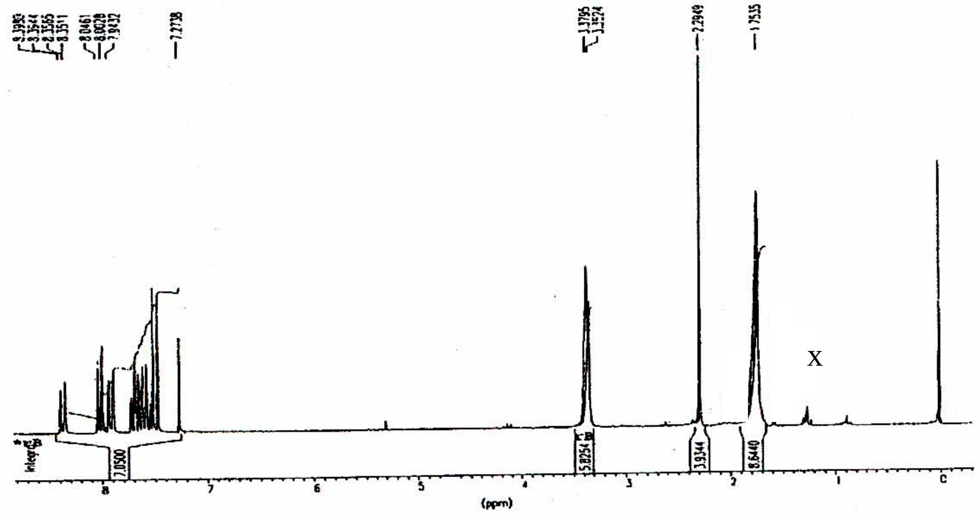
^{1}H NMR (CDCl$_3$) for 1,1-Dioxo-2-(chloromethyl)naphtho[1,2-*b*]thiophene **23**



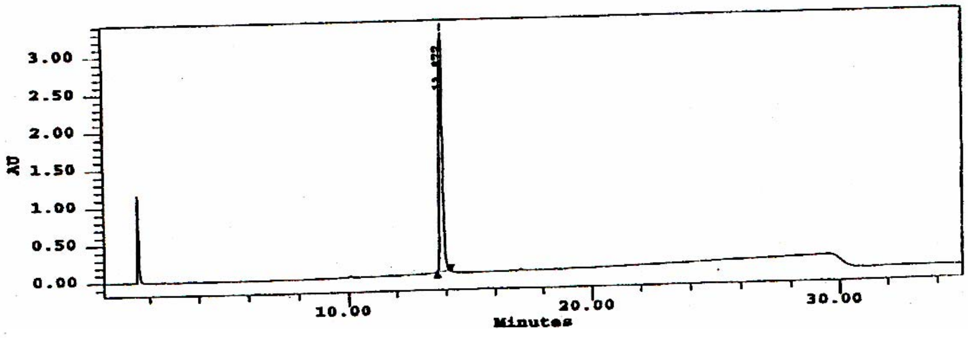
HPLC trace for 1,1-Dioxo-2-(chloromethyl)naphtho[1,2-*b*]thiophene **23**



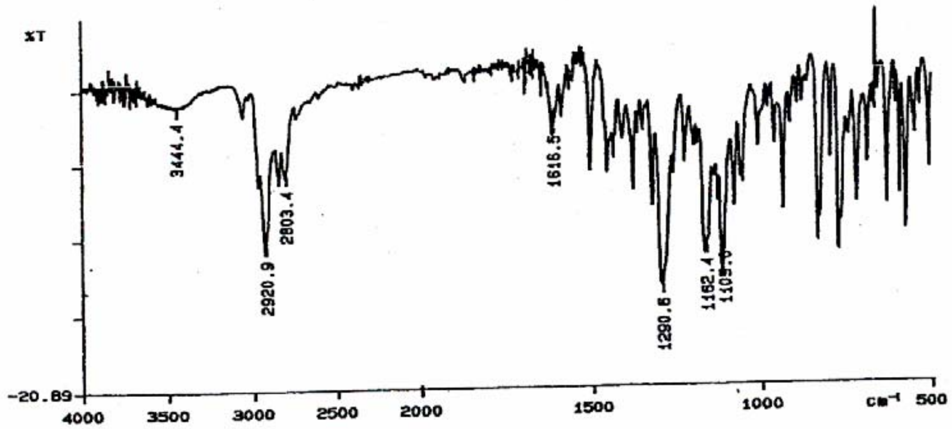
IR (KBr) for 1,1-Dioxo-2-(piperidinomethyl)naphtho[1,2-*b*]thiophene **22**



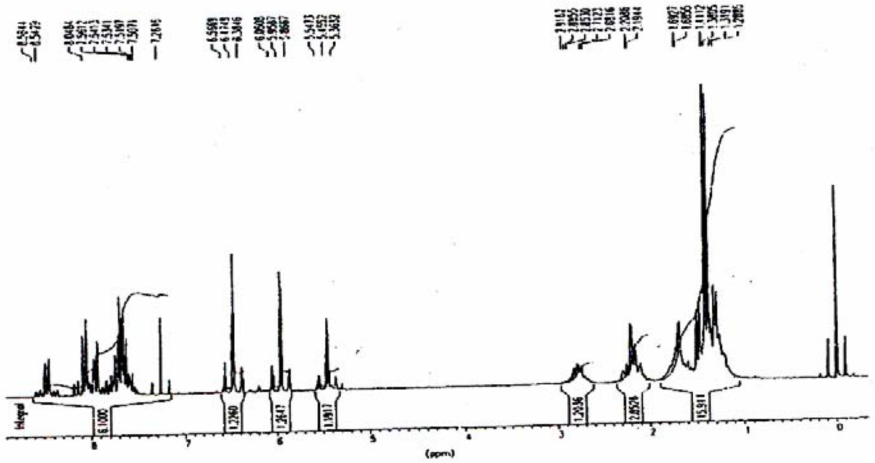
^{1}**H NMR (CDCl$_3$)** for 1,1-Dioxo-2-(piperidinomethyl)naphtho[1,2-*b*]thiophene **22**



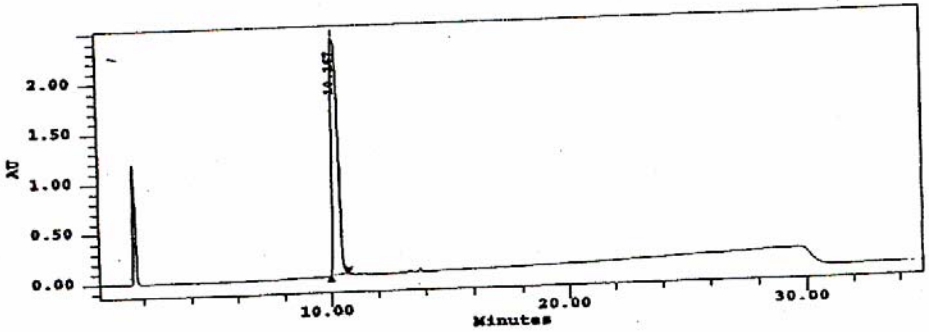
HPLC trace for 1,1-Dioxo-2-(piperidinomethyl)naphtho[1,2-*b*]thiophene **22**



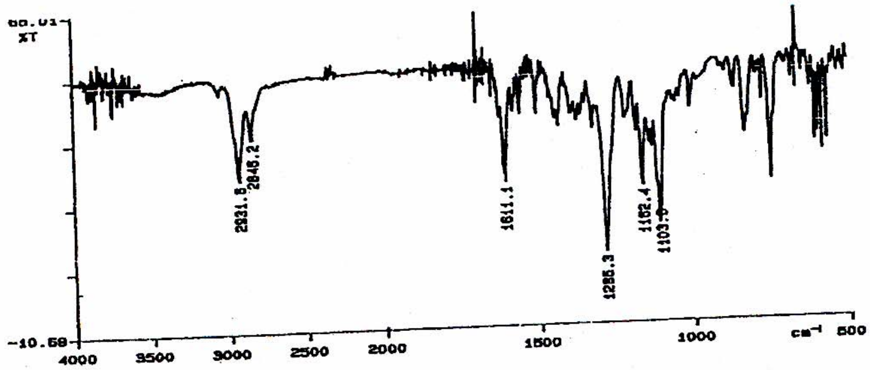
IR (KBr) for the initial α–Nsmoc/2-methylpiperidine adduct



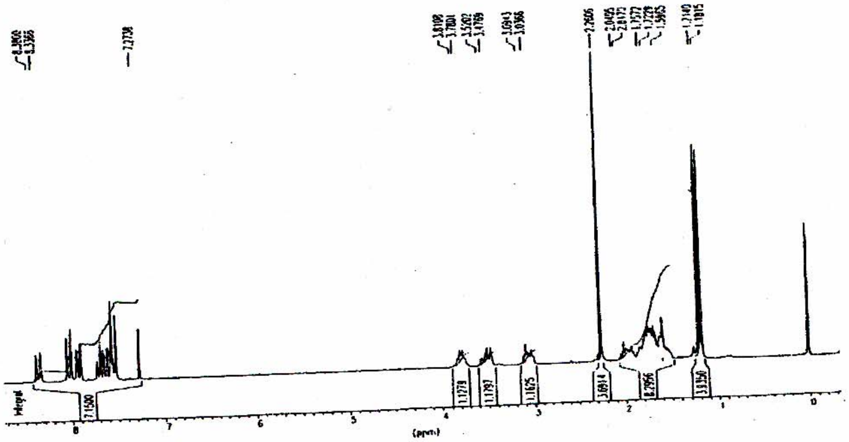
^{1}**H NMR ($CDCl_3$)** for the initial α–Nsmoc/2-methylpiperidine adduct



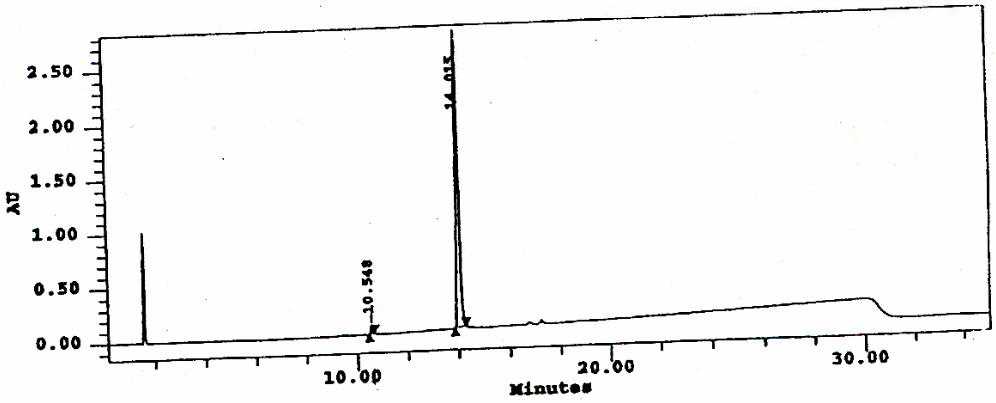
HPLC trace for the initial α–Nsmoc/2-methylpiperidine adduct



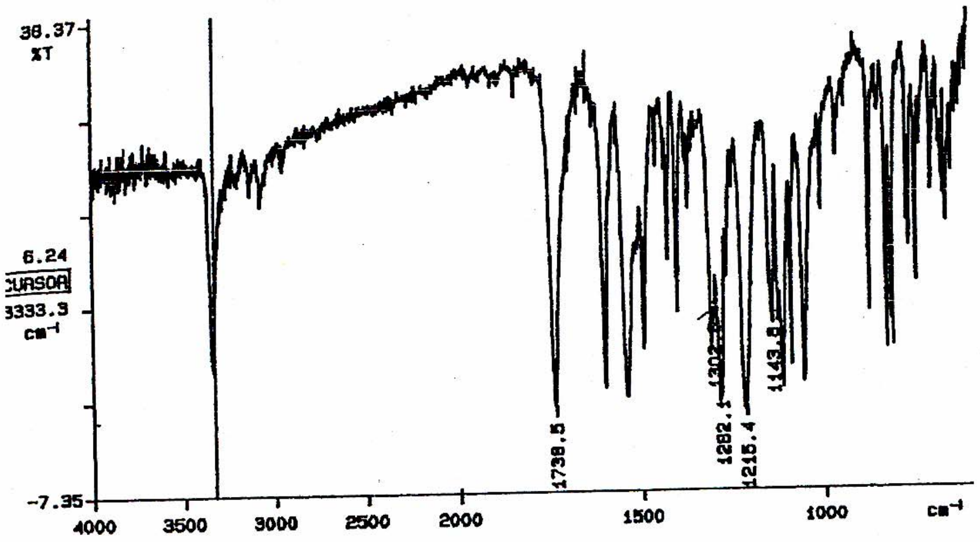
IR (KBr) for the final α–Nsmoc/2-methylpiperidine adduct



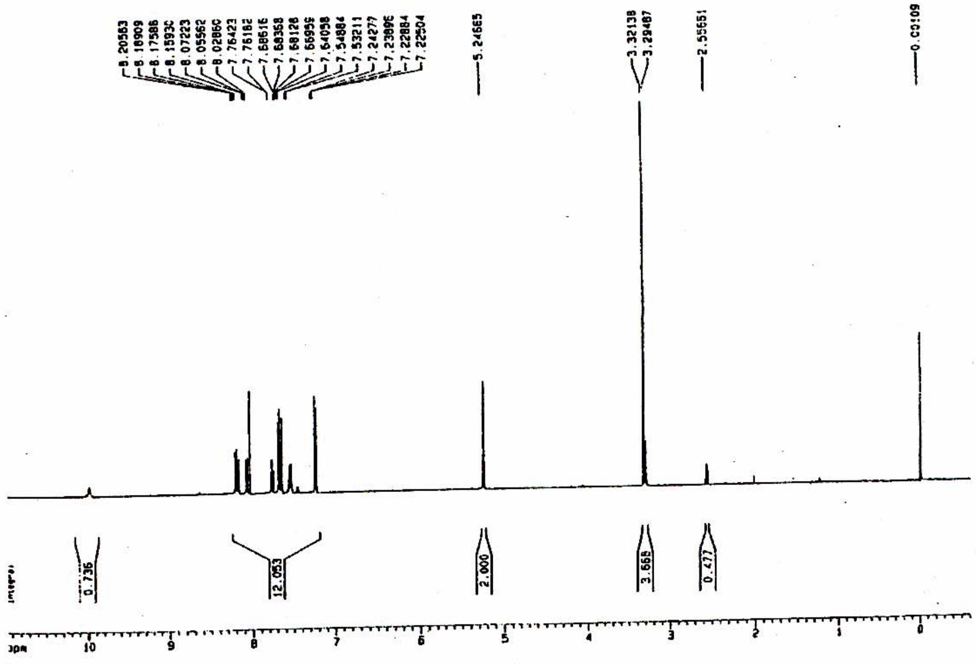
^{1}**H NMR (CDCl$_3$)** for the final stable α–Nsmoc/2-methylpiperidine adduct



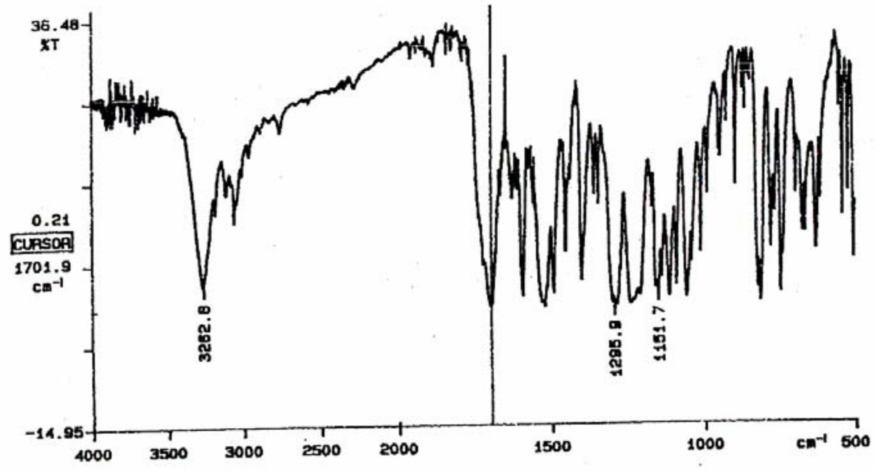
HPLC trace for the final stable α–Nsmoc/2-methylpiperidine adduct



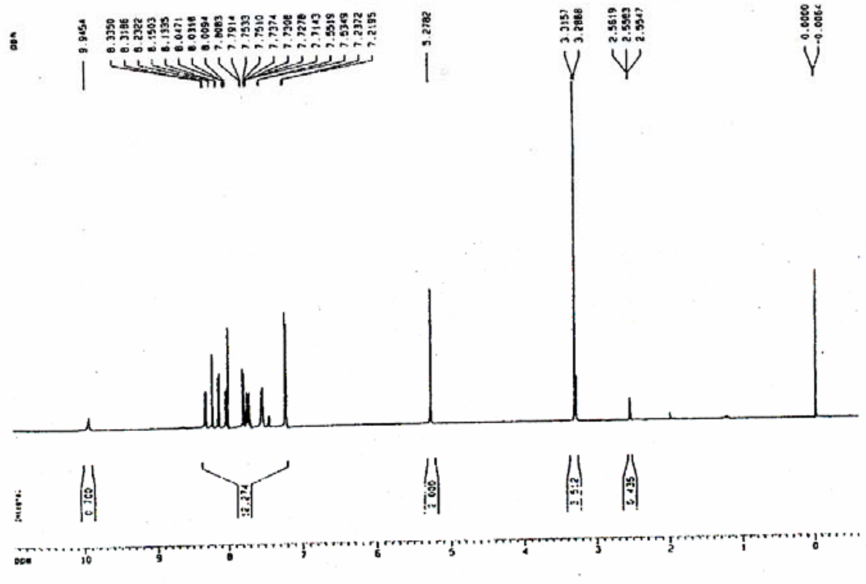
IR (KBr) for 1,1-Dioxonaphtho[1,2-b]thiophene-2-methyl N-*p*-chlorophenyl carbamate **20b**



^{1}**H NMR (CDCl$_3$+DMSO-d$_6$.500MHz)** for 1,1-Dioxonaphtho[1,2-*b*]thiophene-2-methyl N-*p*-chlorophenyl carbamate **20b**

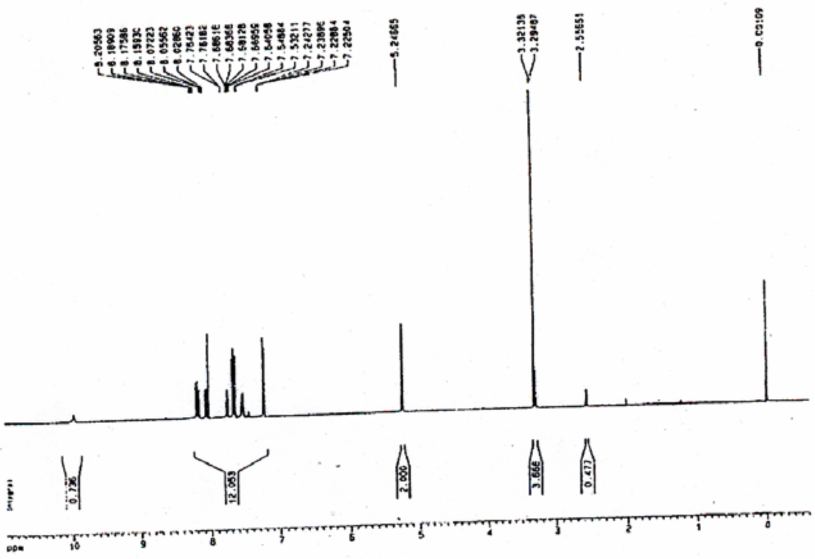


IR (KBr) for 3,3-Dioxonaphtho[2,1-*b*]thiophene-2-methyl N-*p*-chlorophenyl carbamate **20c**



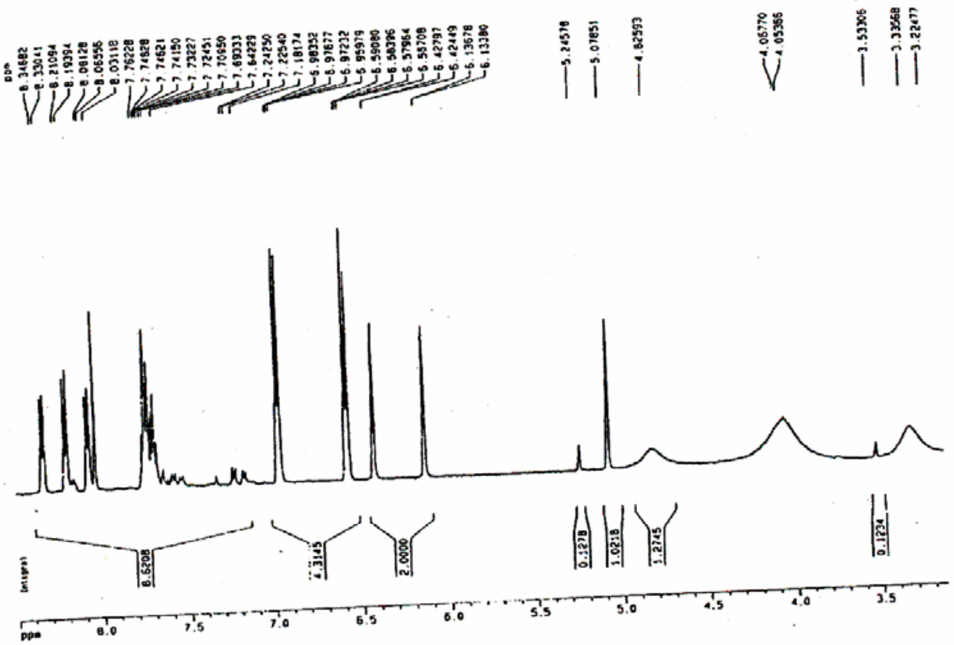
^{1}H NMR ($CDCl_3$+DMSO-d_6, 500 MHz) for 3,3-Dioxonaphtho[2,1-*b*]thiophene-2-methyl N-*p*-chlorophenyl carbamate **20c**

VI. A. Course of the deblocking of α-Nsmoc-PCA/piperidine

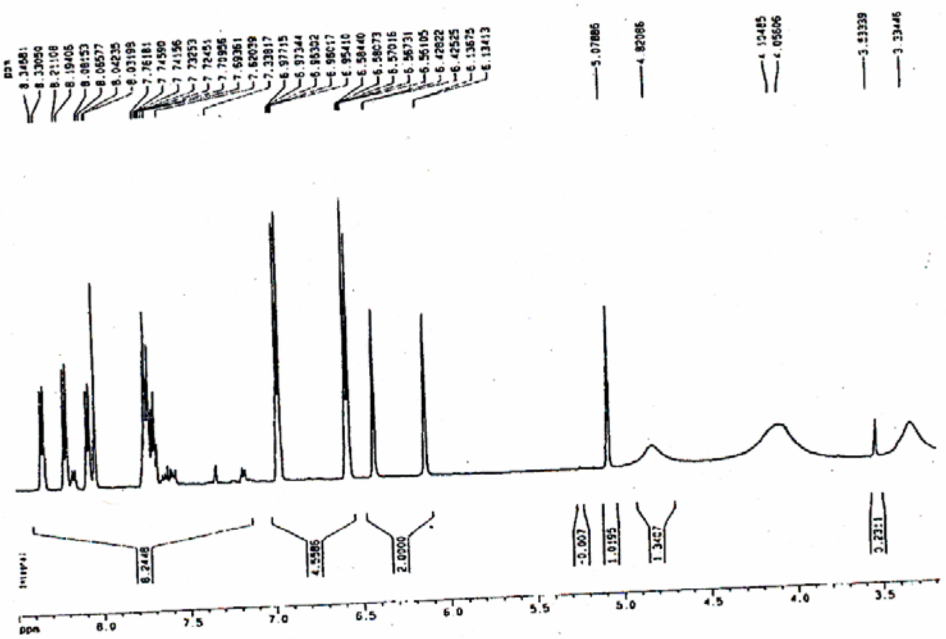


^{1}H NMR ($CDCl_3$+DMSO-d_6, 500 MHz) for 1,1-Dioxonaphtho[1,2-b]thiophene-2-methyl N-*p*-chlorophenyl carbamate **20b**

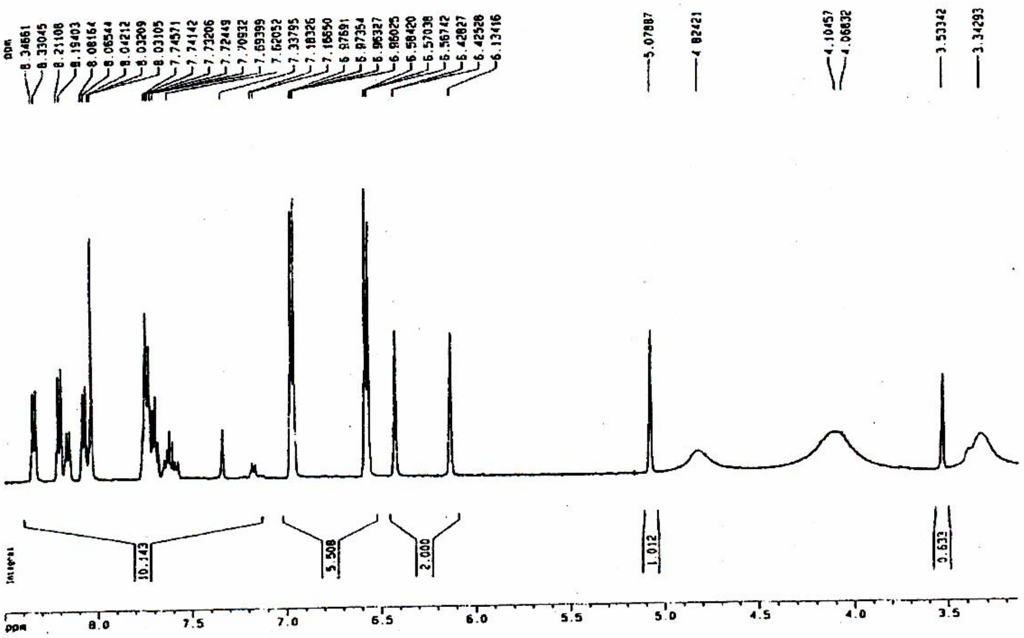
Before addition of 2 equiv. of piperidine



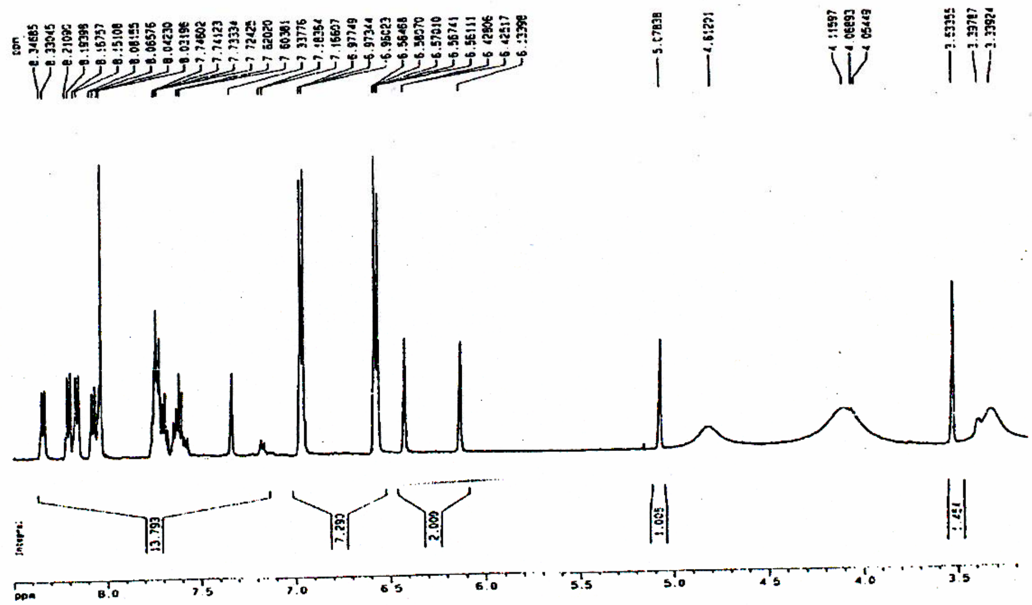
Snapshot after 3 min. of the ^{1}H NMR ($CDCl_3$ + DMSO-d_6, 500MHz) spectrum for the deblocking of α-Nsmoc-PCA **20b** by means of piperidine



Snapshot after 7 min. of the ^{1}H NMR ($CDCl_3$ + DMSO-d_6, 500MHz) spectrum for the deblocking of α-Nsmoc-PCA **20b** by means of piperidine

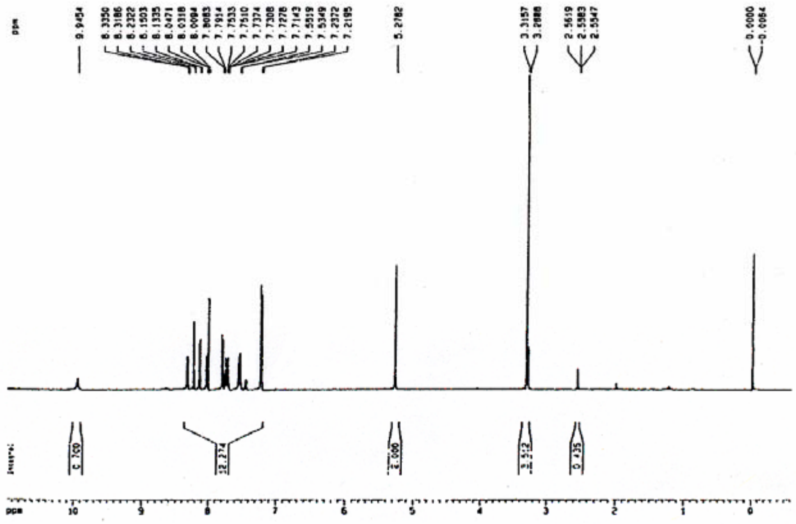


Snapshot after 21 min. of the ^{1}H NMR (CDCl$_3$ + DMSO-d$_6$, 500MHz) spectrum for the deblocking of α-Nsmoc-PCA **20b** by means of piperidine



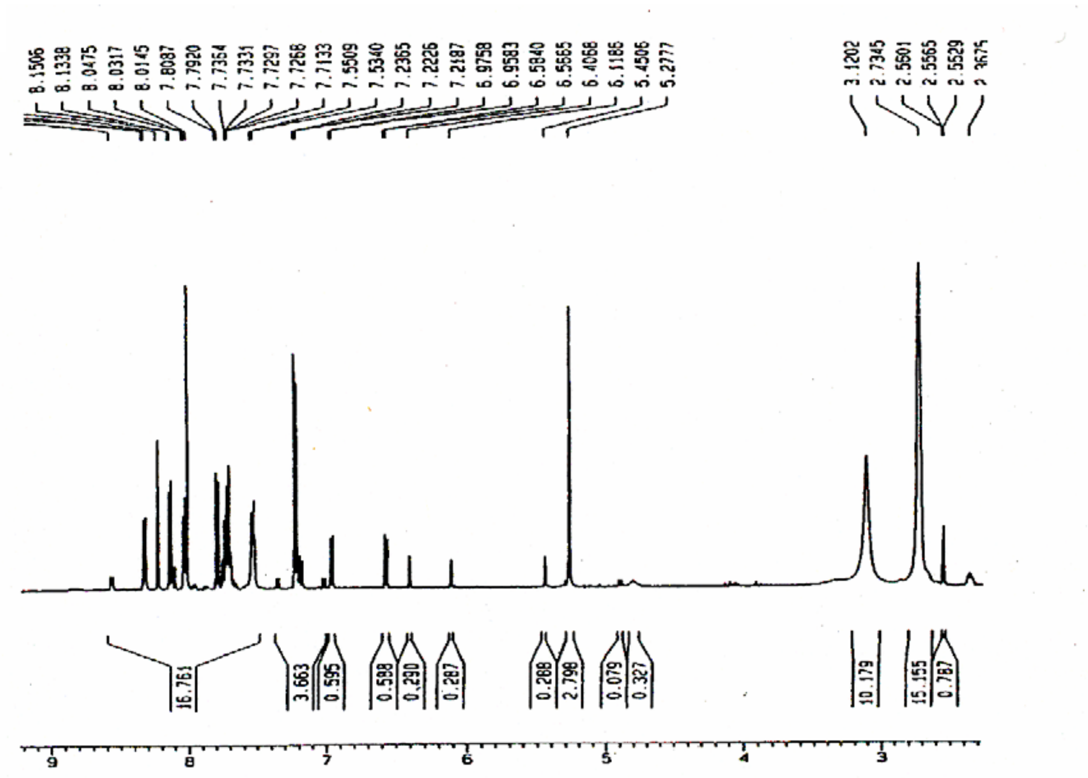
Snapshot after 41 min. of the ^{1}H NMR (CDCl$_3$ + DMSO-d$_6$, 500MHz) spectrum for the deblocking of α-Nsmoc-PCA **20b** by means of piperidine

V. B. Course of the deblocking of β-Nsmoc-PCA/piperidine

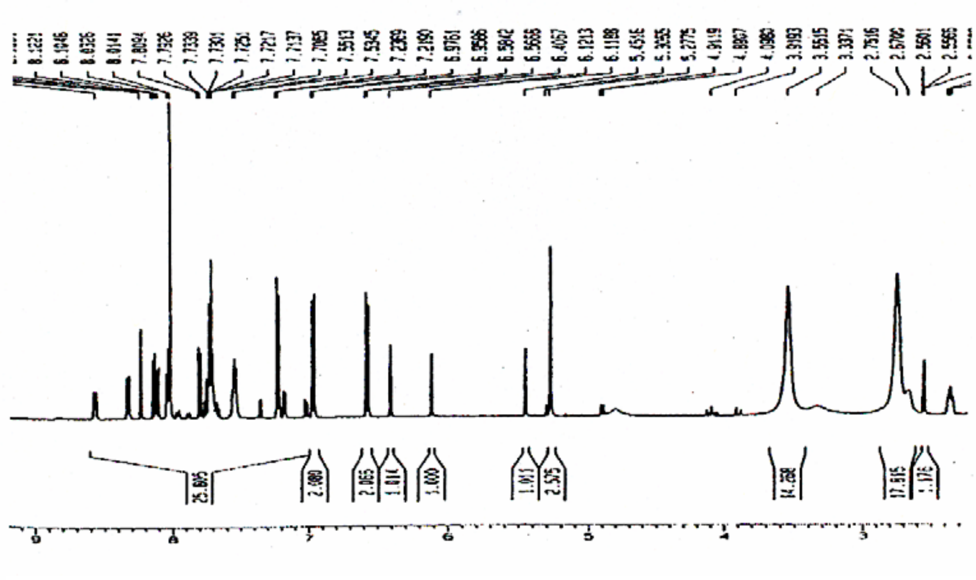


^{1}H NMR ($CDCl_3$+DMSO-d_6, 500 MHz) for 3,3-Dioxonaphtho[2,1-*b*]thiophene-2-methyl N-*p*-chlorophenyl carbamate **20c**

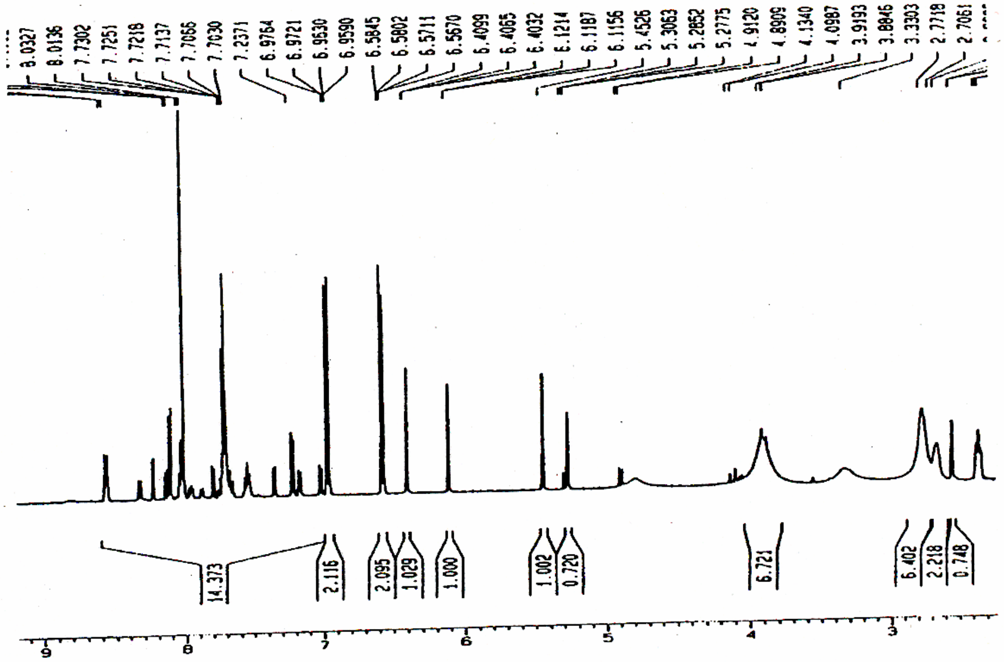
Before addition of 2 equiv. of piperidine



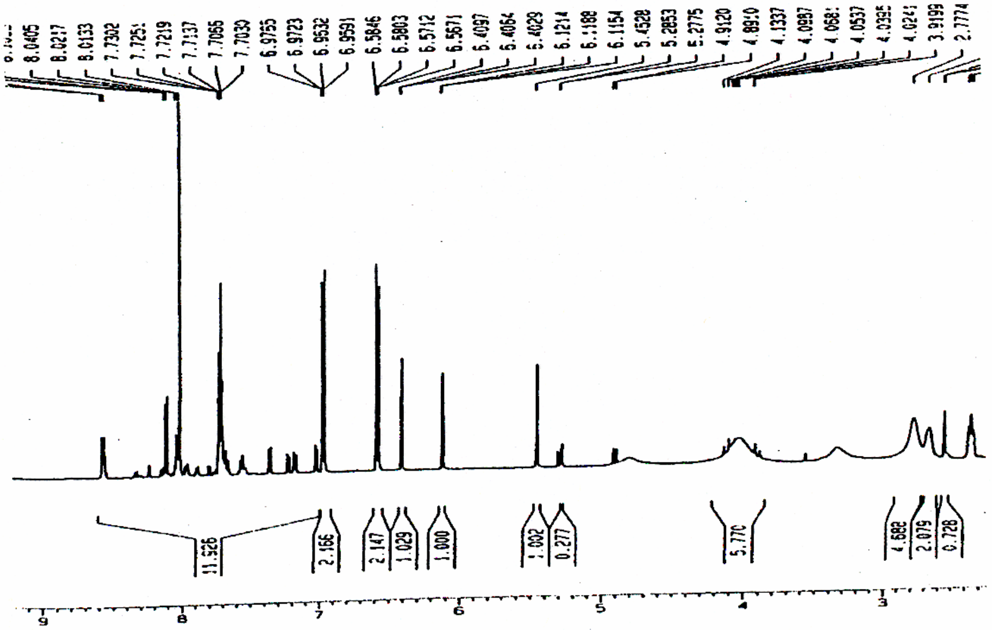
Snapshot after 2 min. of the ^{1}H NMR (CDCl$_3$ + DMSO-d$_6$, 500MHz) spectrum for the deblocking of β-Nsmoc-PCA **20c** by means of piperidine



Snapshot after 7 min. of the ^{1}H NMR (CDCl$_3$ + DMSO-d$_6$, 500MHz) spectrum for the deblocking of β-Nsmoc-PCA **20c** by means of piperidine

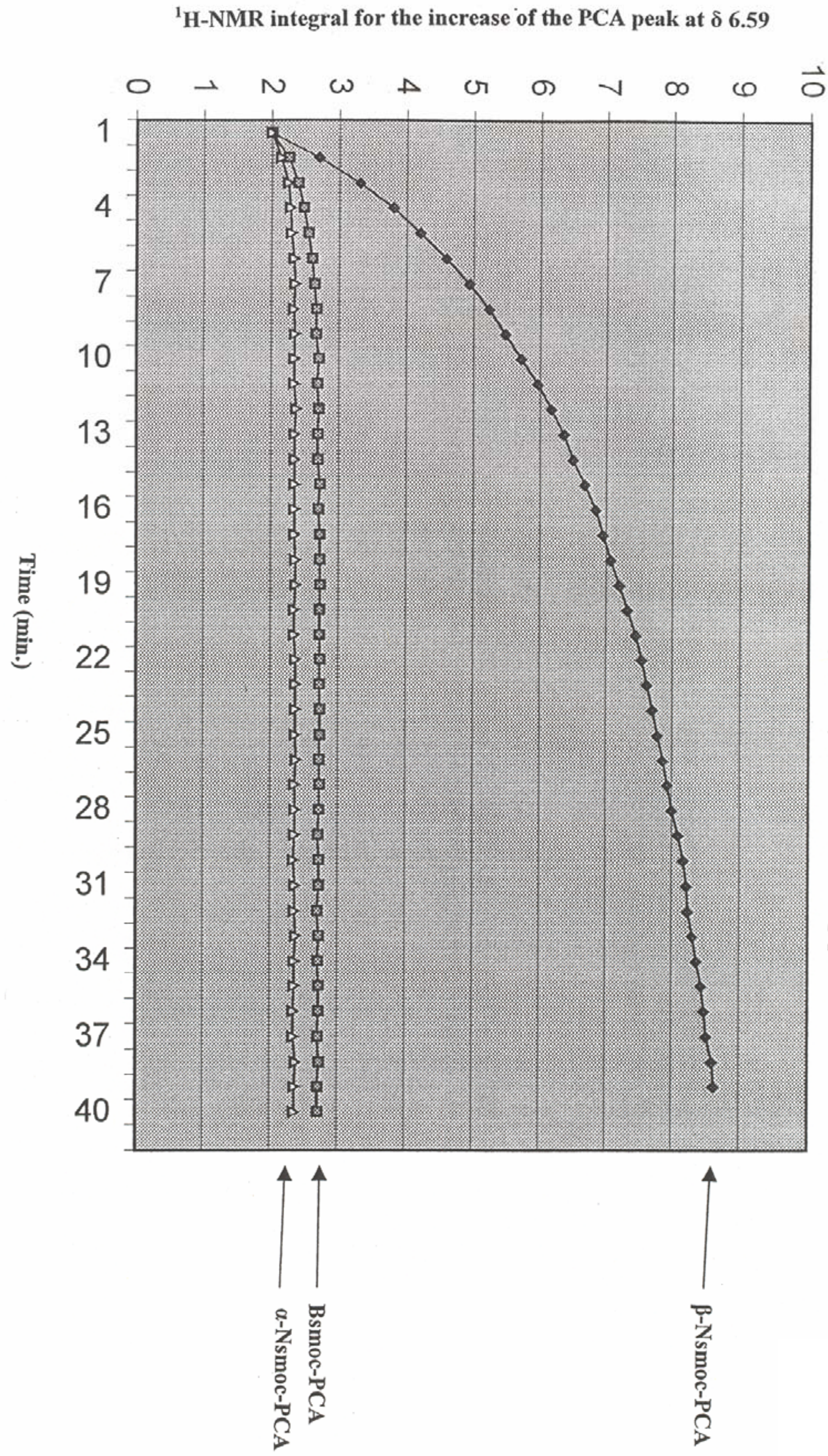


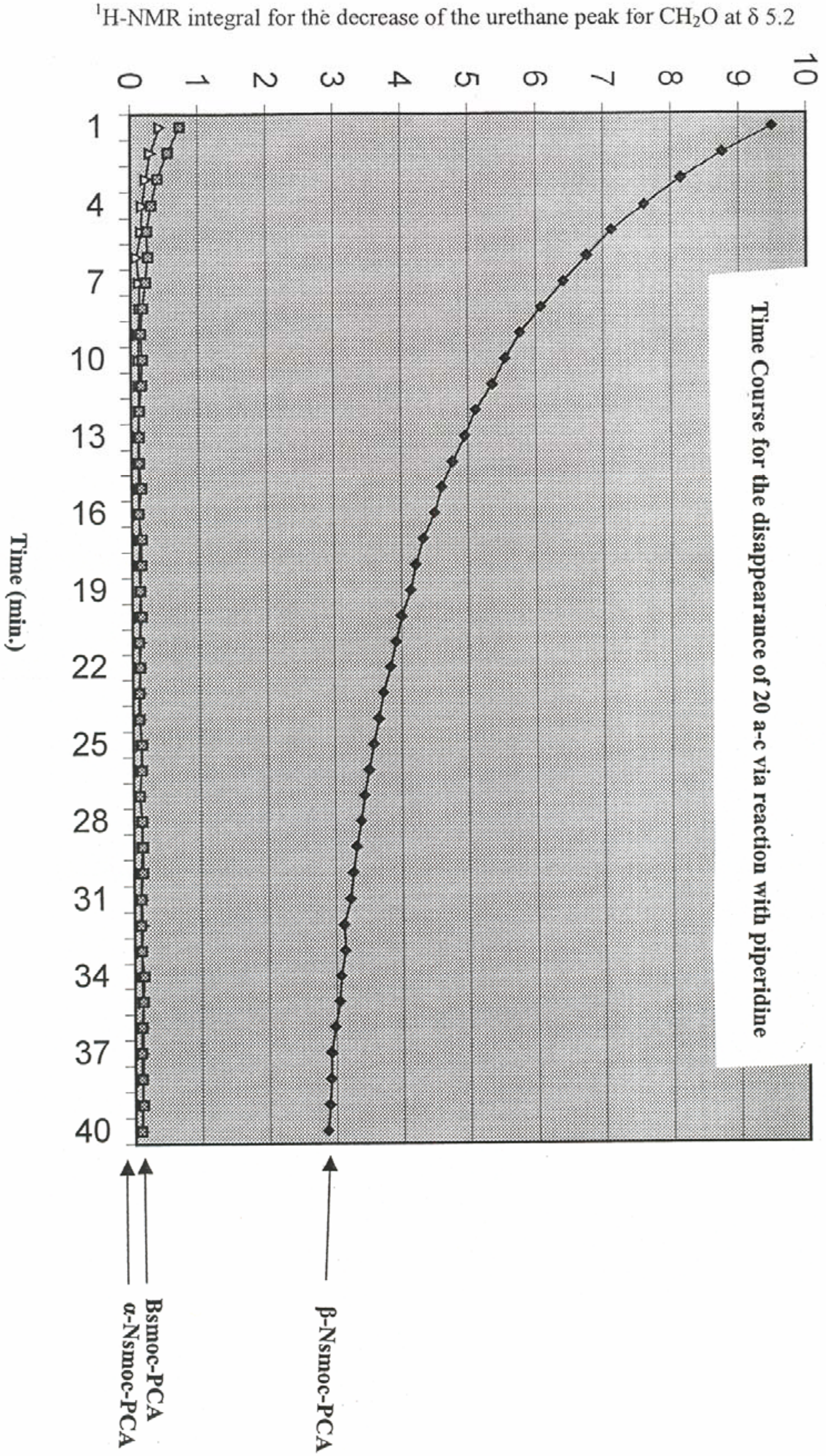
Snapshot after 21 min. of the ^{1}H NMR (CDCl$_3$ + DMSO-d$_6$, 500MHz) spectrum for the deblocking of β-Nsmoc-PCA **20c** by means of piperidine



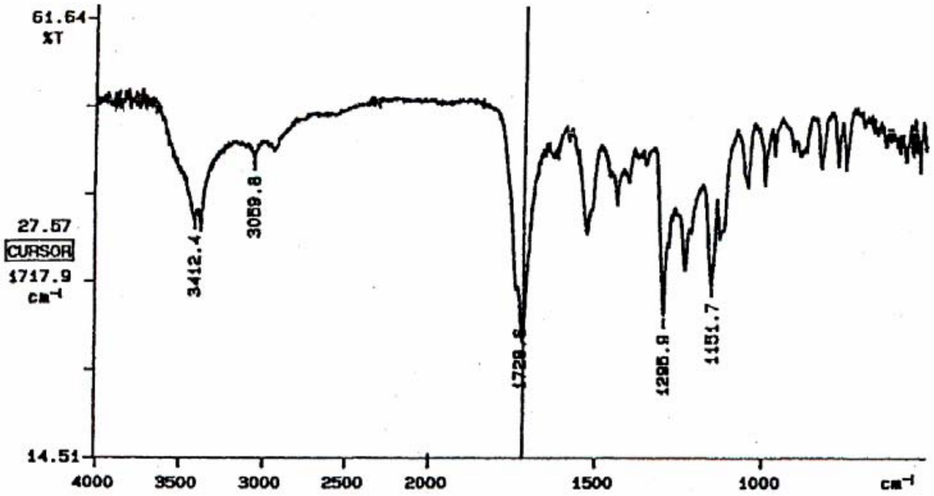
Snapshot after 41 min. of the ^{1}H NMR (CDCl$_3$ + DMSO-d$_6$, 500MHz) spectrum for the deblocking of β-Nsmoc-PCA **20c** by means of piperidine

Time Course for the release of *p*-chloroaniline via reaction of 20 a-c with piperidine

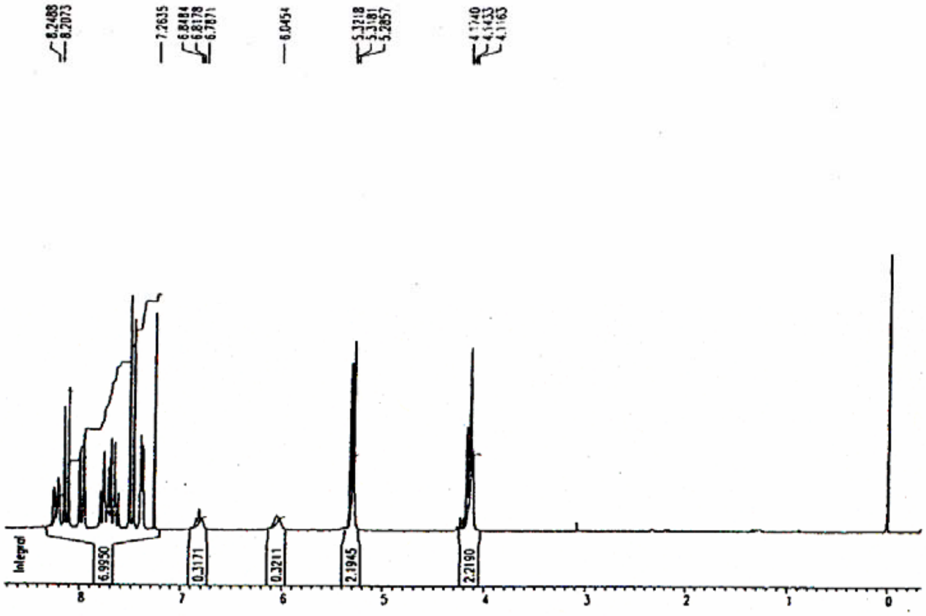


Time Course for the disappearance of 20 a-c via reaction with piperidine
^{1}H-NMR integral for the decrease of the urethane peak for CH_2O at δ 5.2
0
1
2
3
4
5
6
7
8
9
10
Time (min.)
1
4
7
10
13
16
19
22
25
28
31
34
37
40
β-Nsmoc-PCA
Bsmoc-PCA
α-Nsmoc-PCA

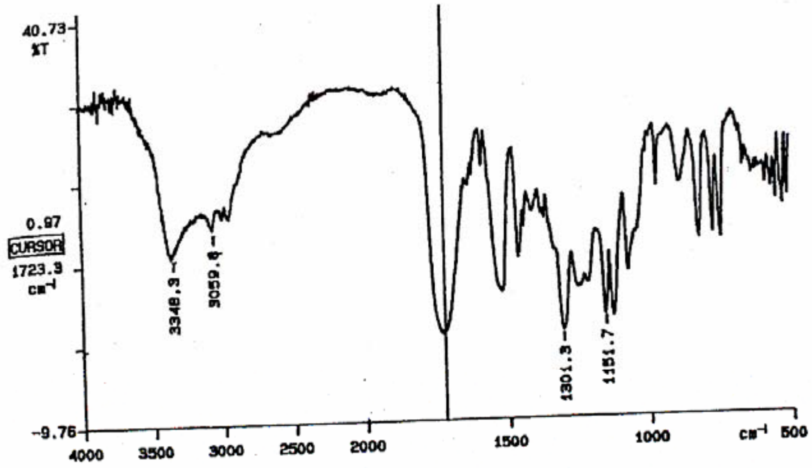
VII. ^{1}H NMR and IR Spectral Data for α- and β-Nsmoc Amino Acids



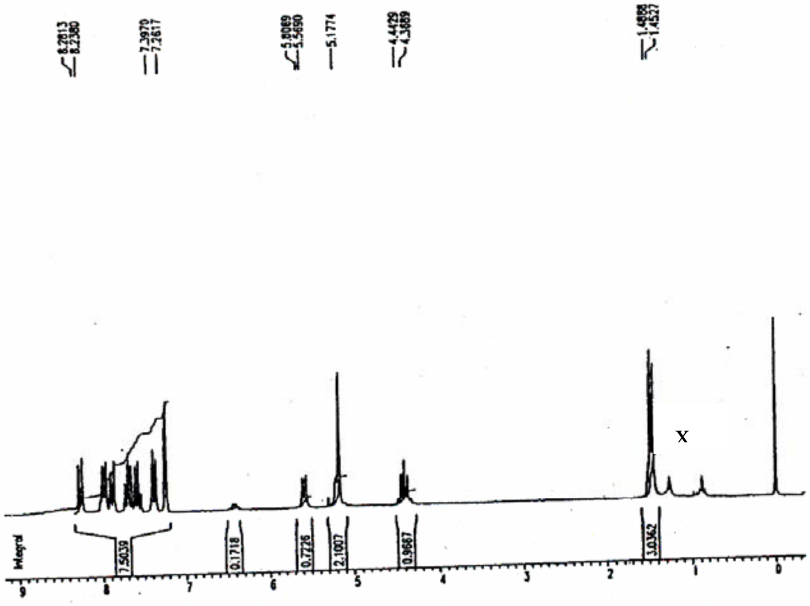
IR (KBr) for α-Nsmoc-Gly-OH



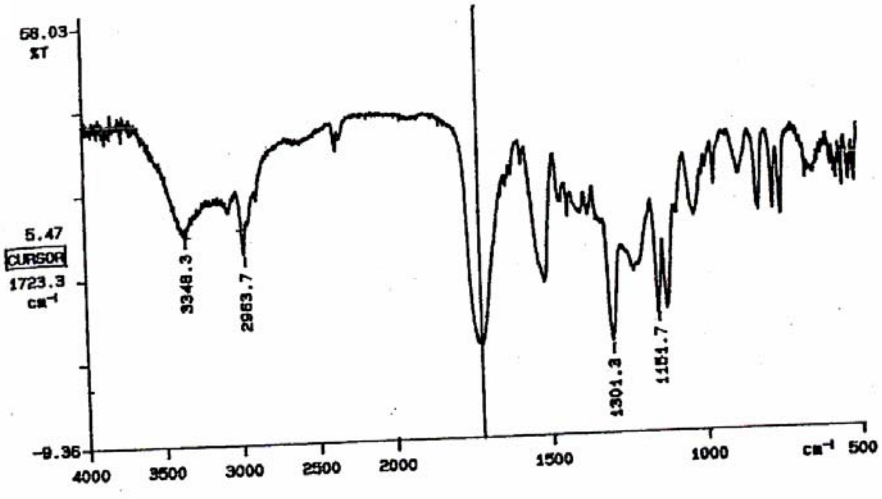
^{1}H NMR ($CDCl_3$ + TFA) for α-Nsmoc-Gly-OH



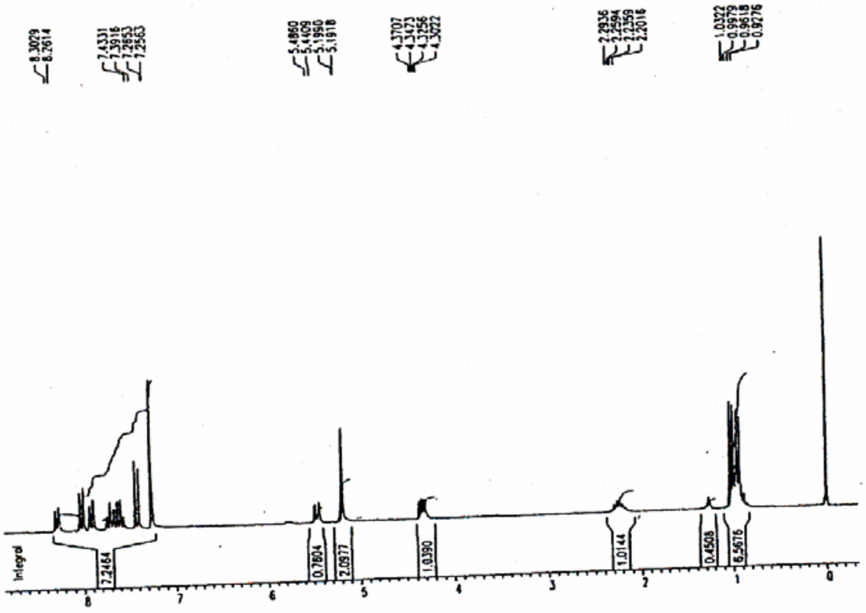
IR (KBr) for α–Nsmoc-Ala-OH



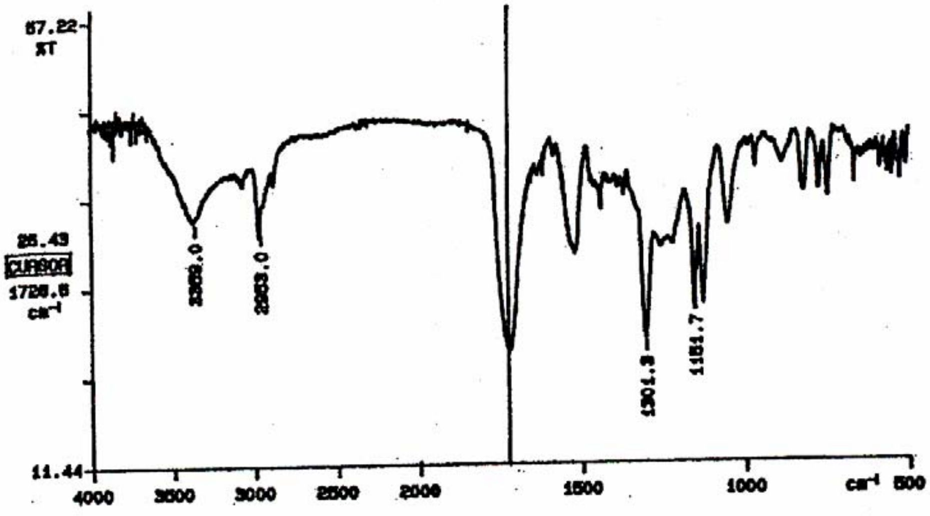
^{1}H NMR (CDCl3) for α–Nsmoc-Ala-OH



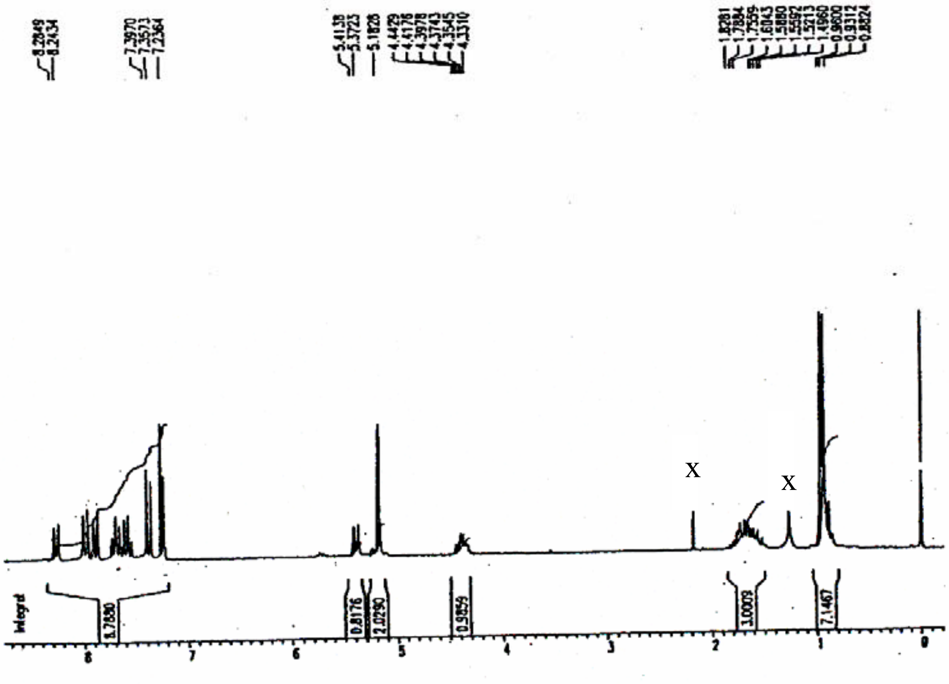
IR (KBr) for α–Nsmoc-Val-OH



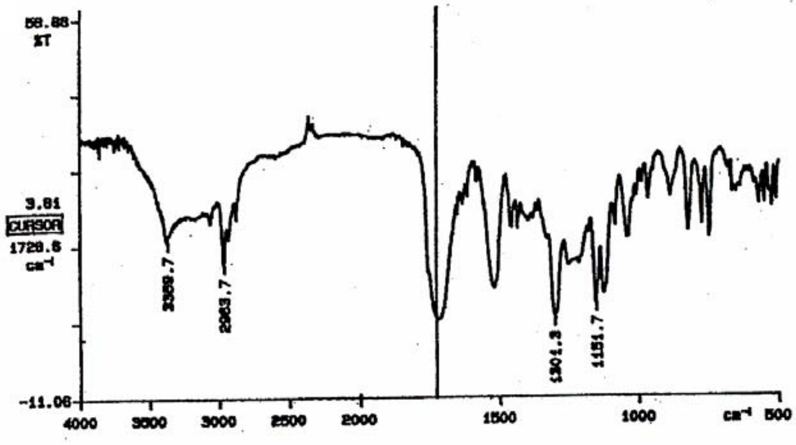
^{1}H NMR ($CDCl_3$) for α–Nsmoc-Val-OH



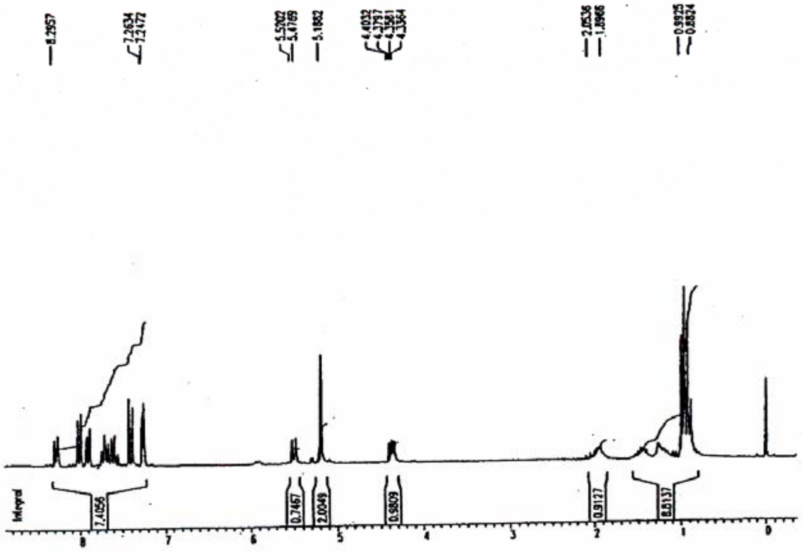
IR (KBr) for α–Nsmoc-Leu-OH



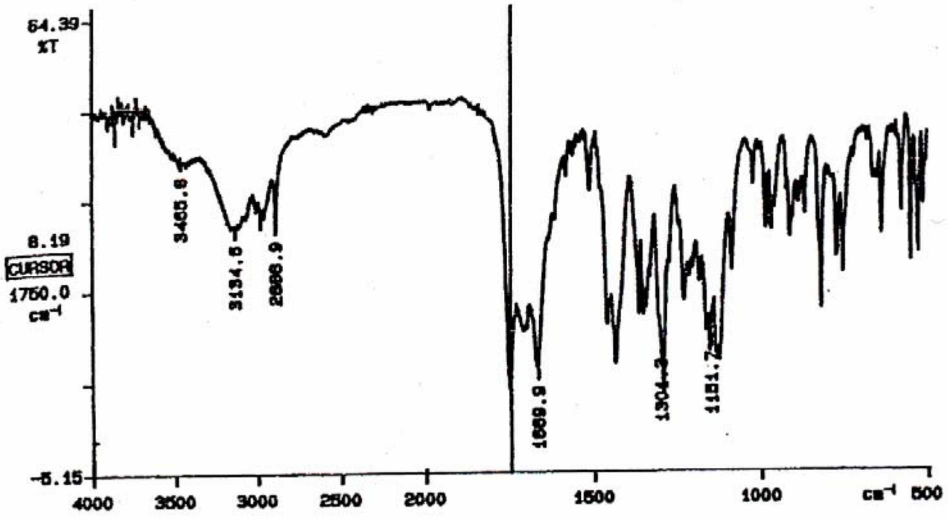
^{1}H NMR (CDCl$_3$) for α–Nsmoc-Leu-OH



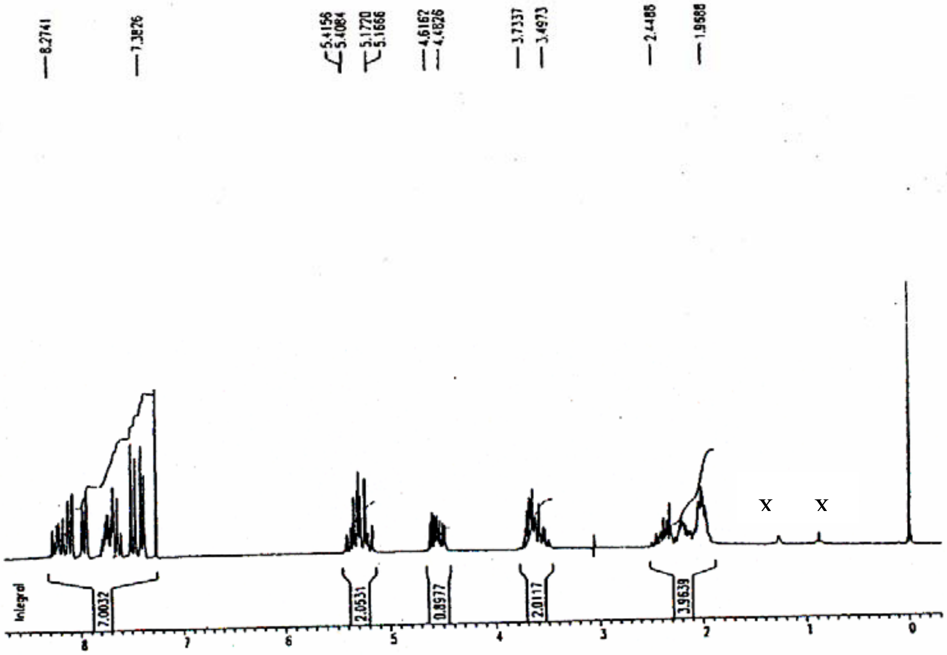
IR (KBr) for α–Nsmoc-Ile-OH



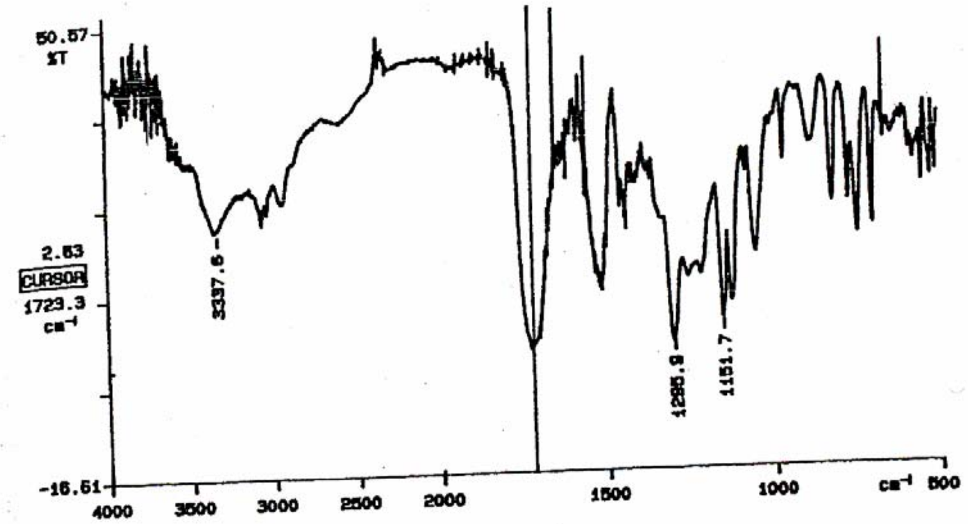
^{1}H NMR ($CDCl_3$) for α–Nsmoc-Ile-OH



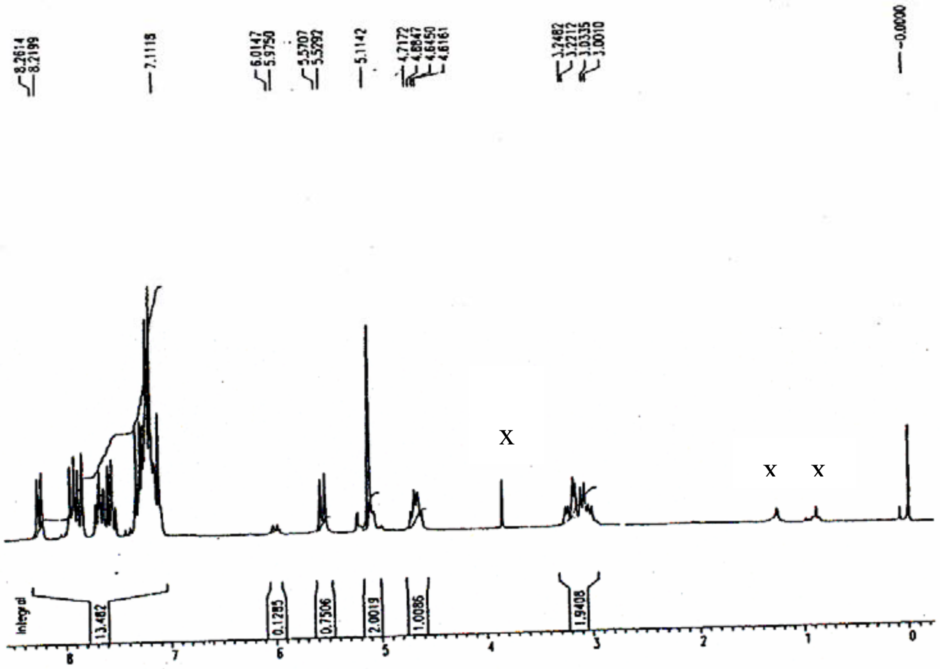
IR (KBr) for α–Nsmoc-Pro-OH



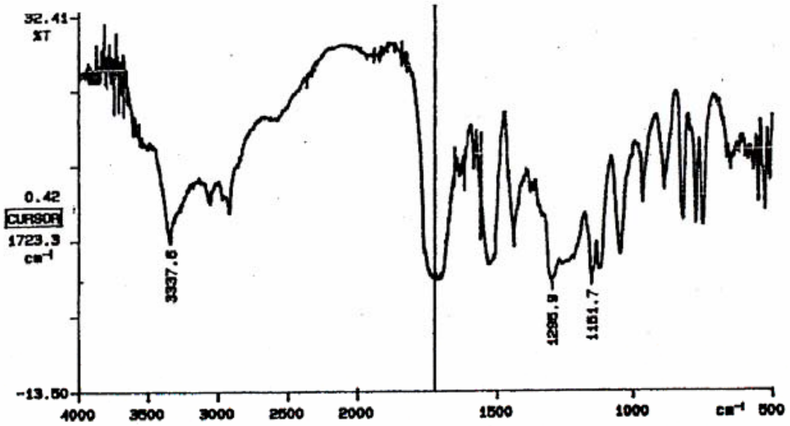
^{1}H NMR ($CDCl_3$) for α–Nsmoc-Pro-OH



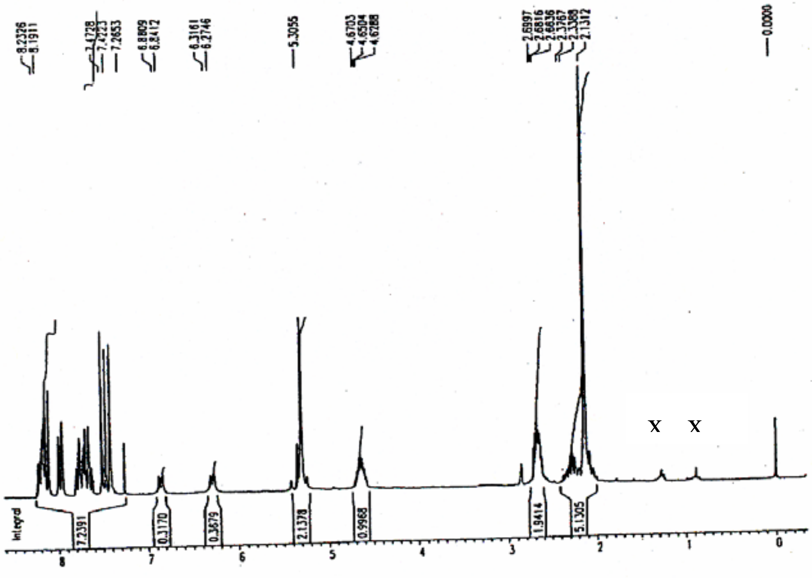
IR (KBr) for α–Nsmoc-Phe-OH



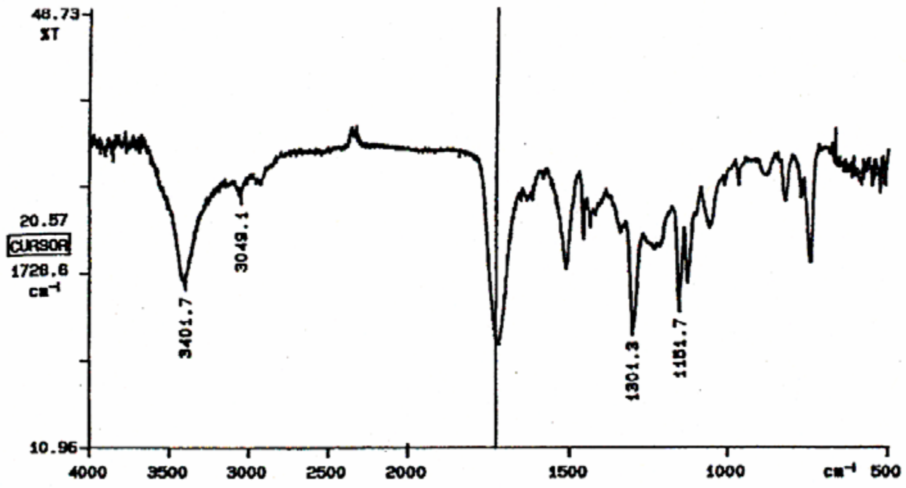
^{1}H NMR (CDCl$_3$) for α–Nsmoc-Phe-OH



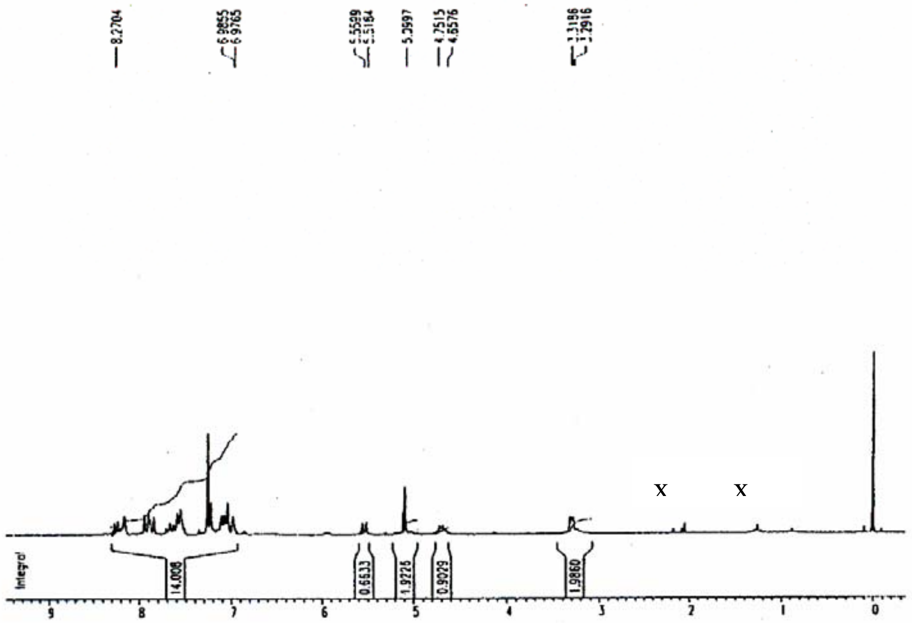
IR (KBr) for α–Nsmoc-Met-OH



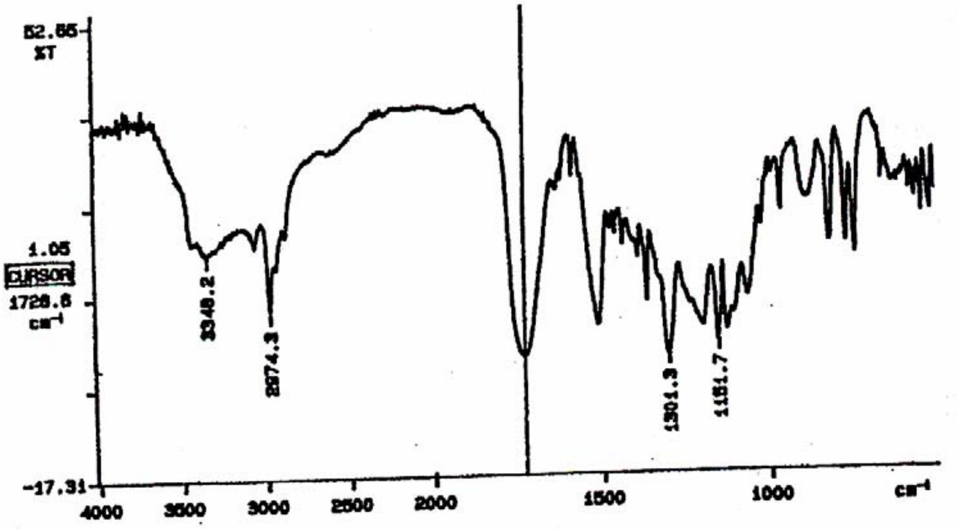
^{1}H NMR ($CDCl_3$ + TFA) for α–Nsmoc-Met-OH



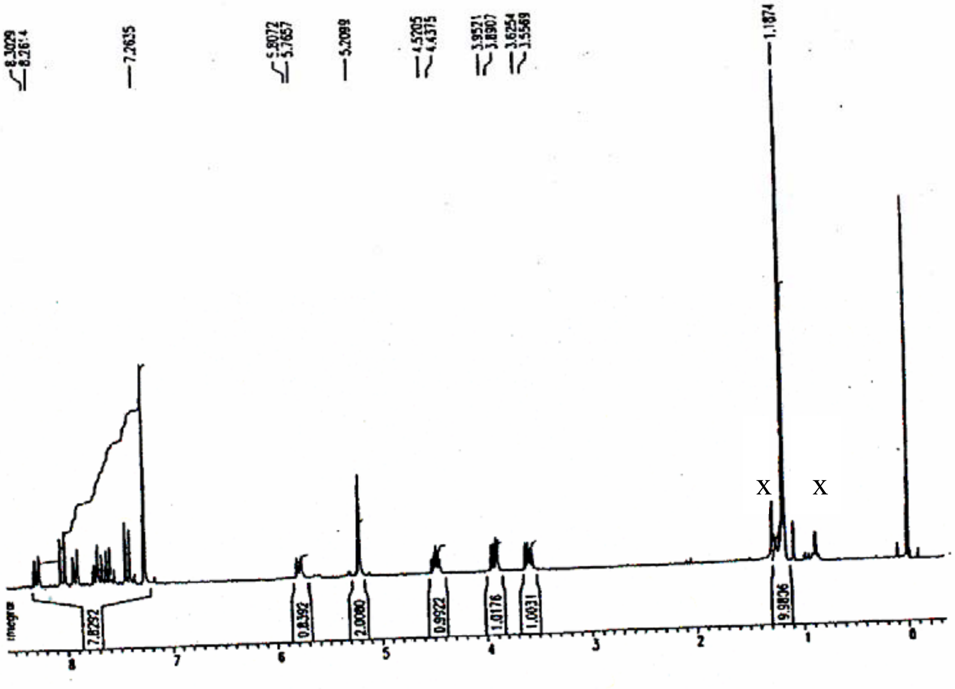
IR (KBr) for α–Nsmoc-Trp-OH



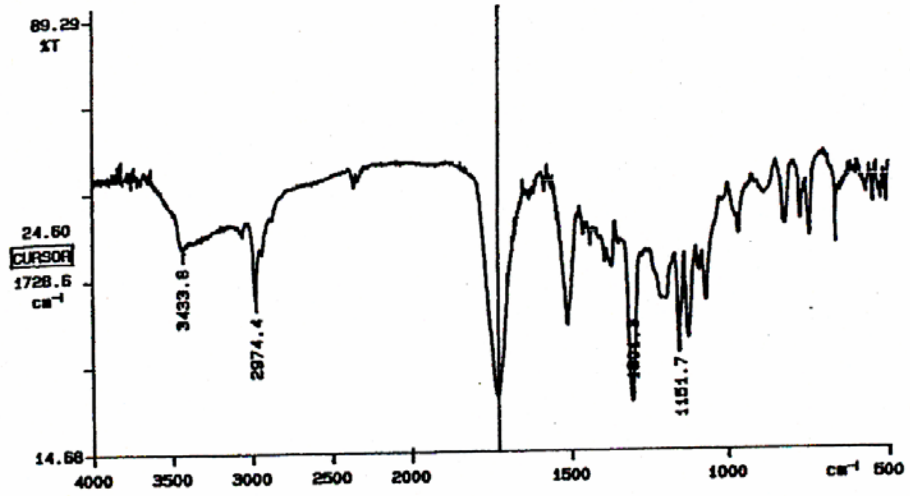
^{1}H NMR (CDl3) for α–Nsmoc-Trp-OH



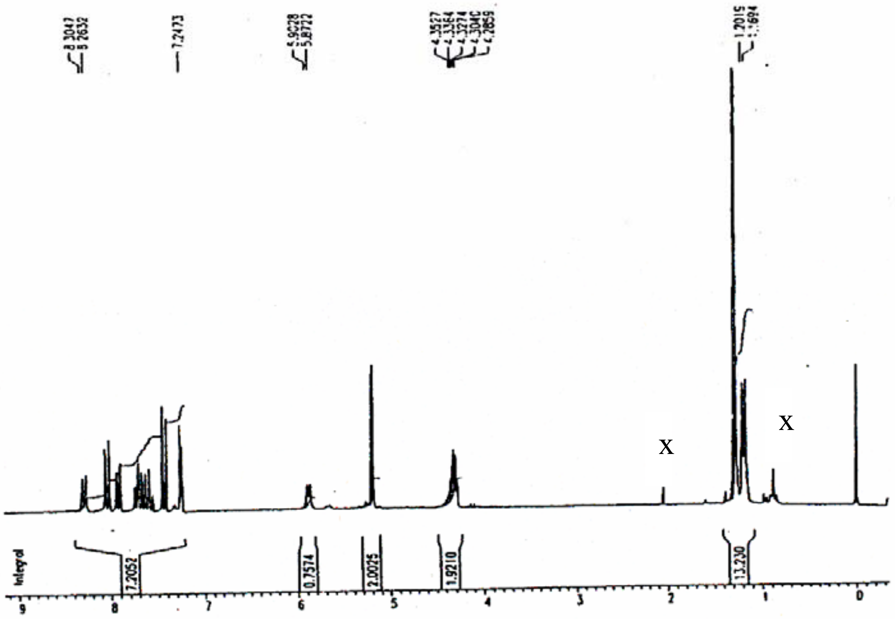
IR (KBr) for α–Nsmoc-Ser(t-Bu)-OH



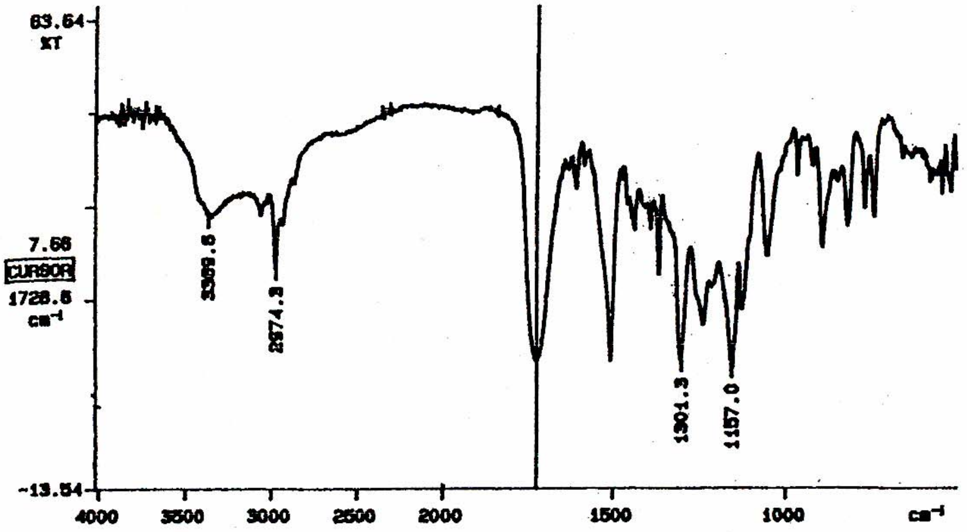
^{1}H NMR (CDCl$_3$) for α–Nsmoc-Ser(t-Bu)-OH



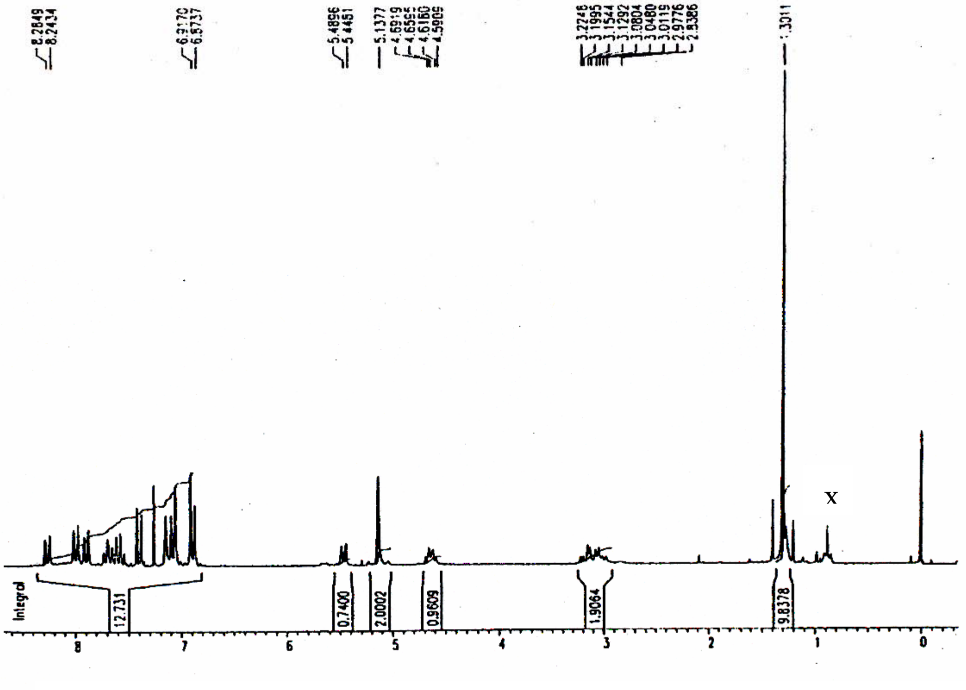
IR (KBr) for α–Nsmoc-Thr(t-Bu)-OH



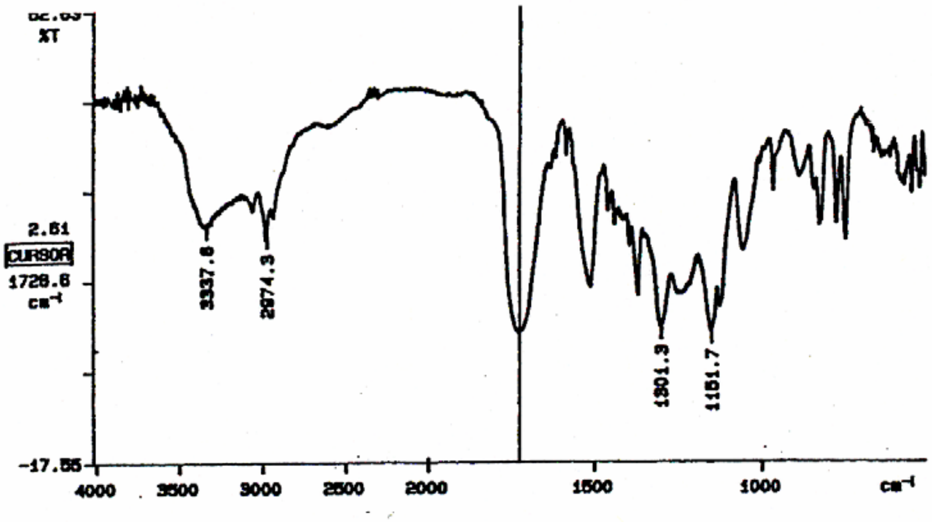
^{1}H NMR ($CDCl_3$) for α–Nsmoc-Thr(t-Bu)-OH



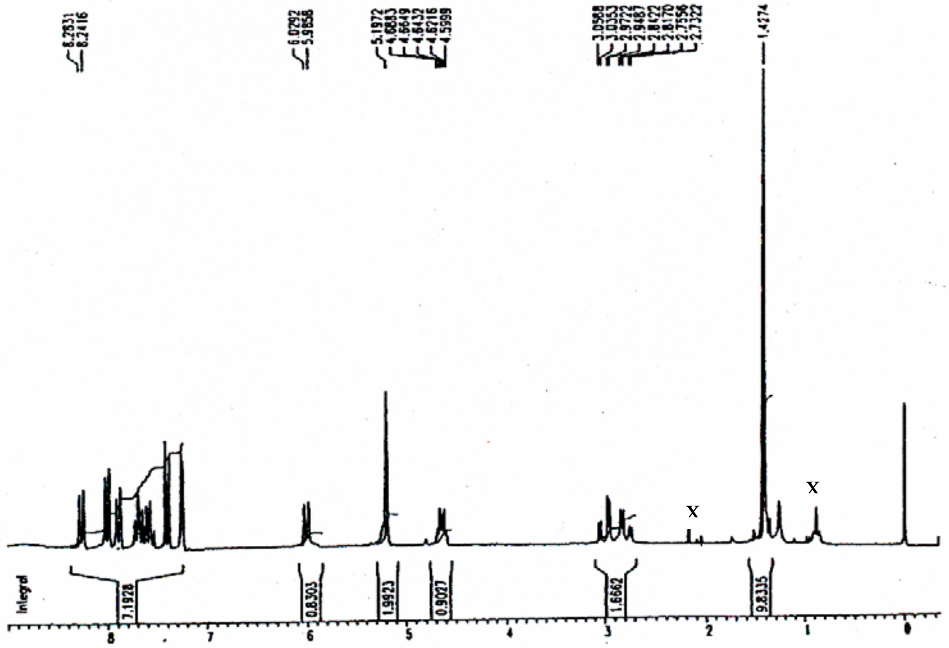
IR (KBr) for α–Nsmoc-Tyr(t-Bu)-OH



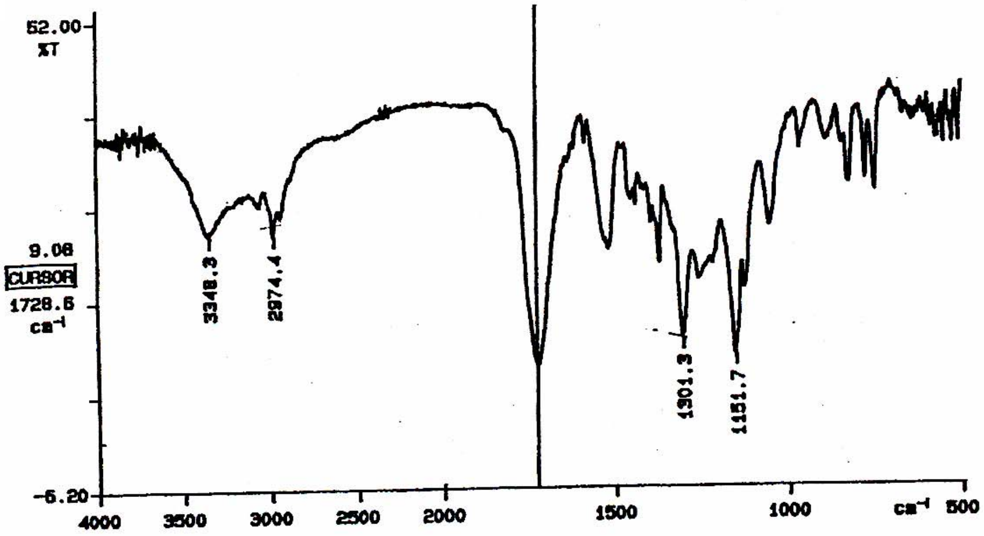
^{1}H NMR ($CDCl_3$) for α–Nsmoc-Tyr(t-Bu)-OH



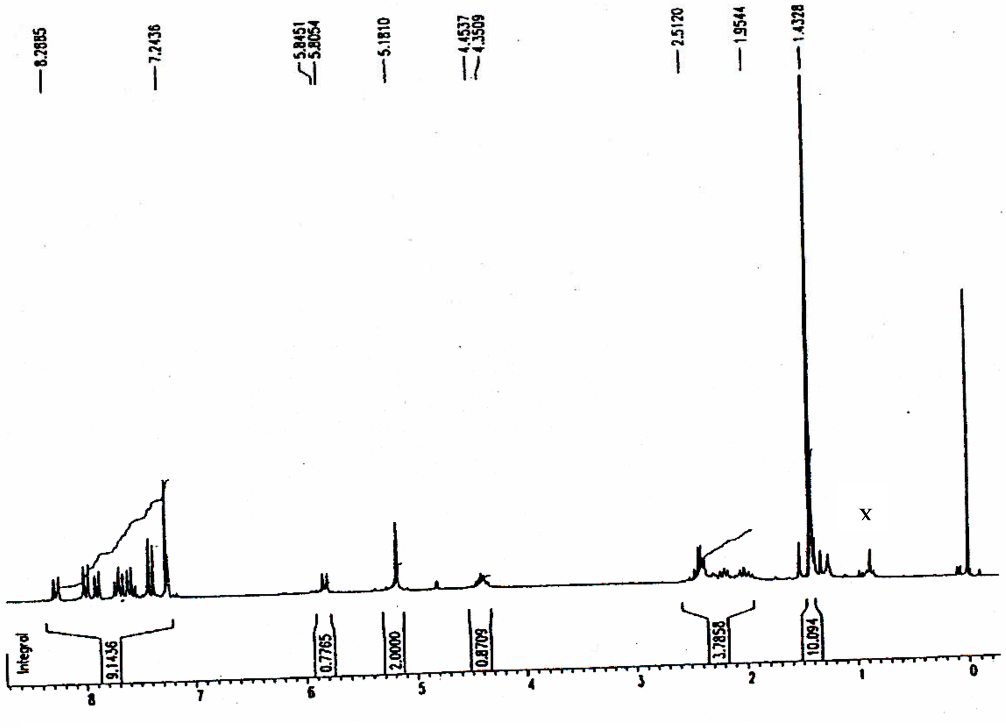
IR (KBr) for α–Nsmoc-Asp(O-t-Bu)-OH



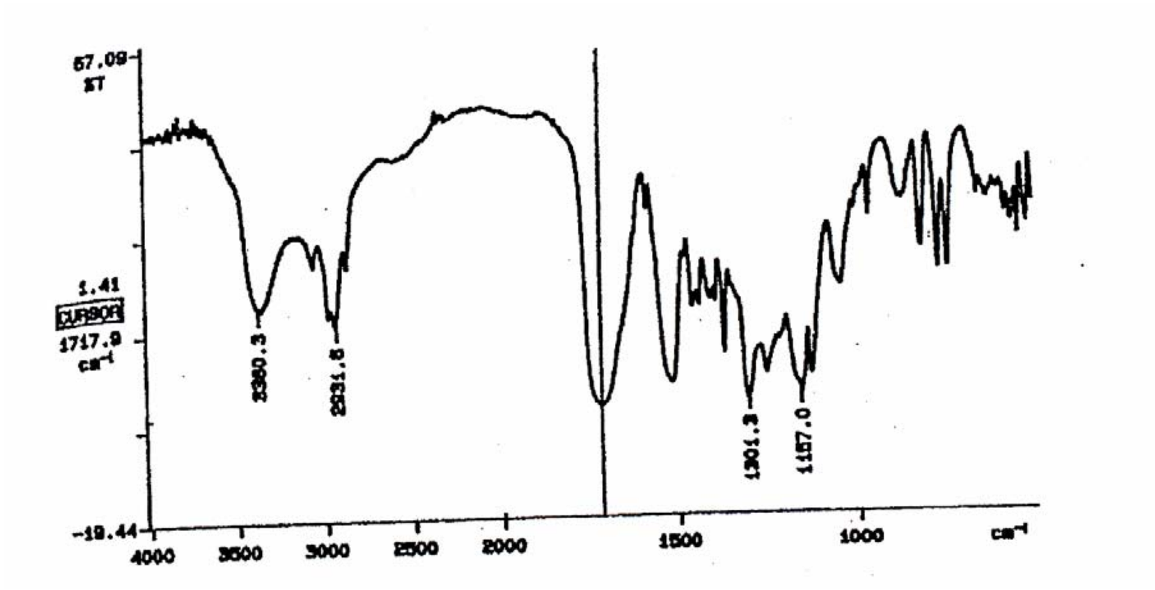
¹H NMR (CDCl₃) for α–Nsmoc-Asp(O-t-Bu)-OH



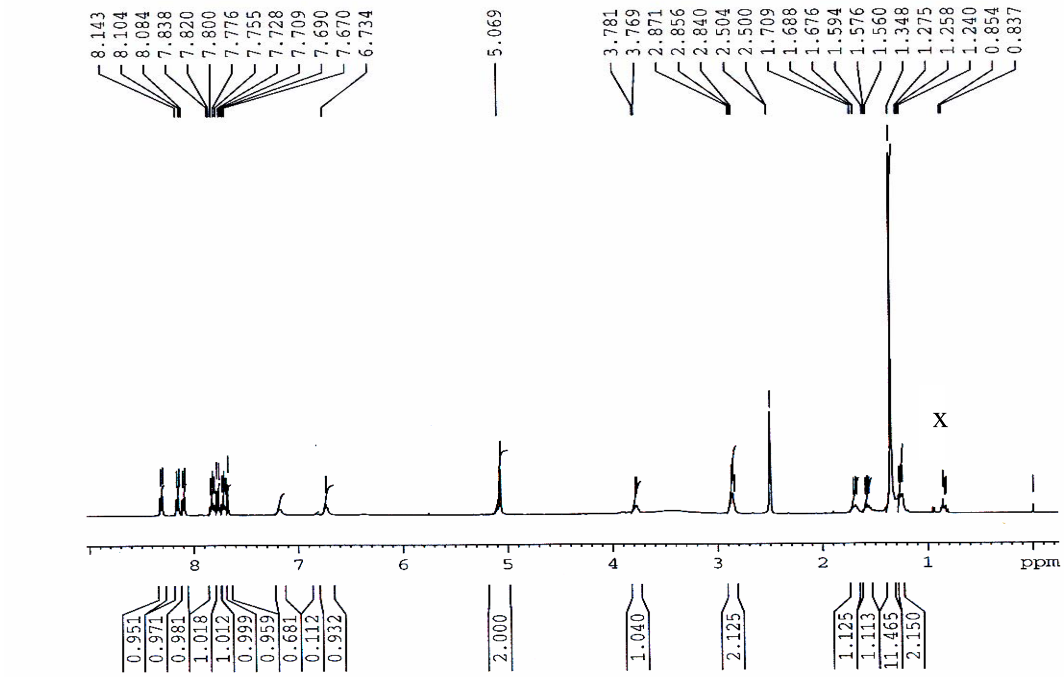
IR (KBr) for α–Nsmoc-Glu(O-t-Bu)-OH



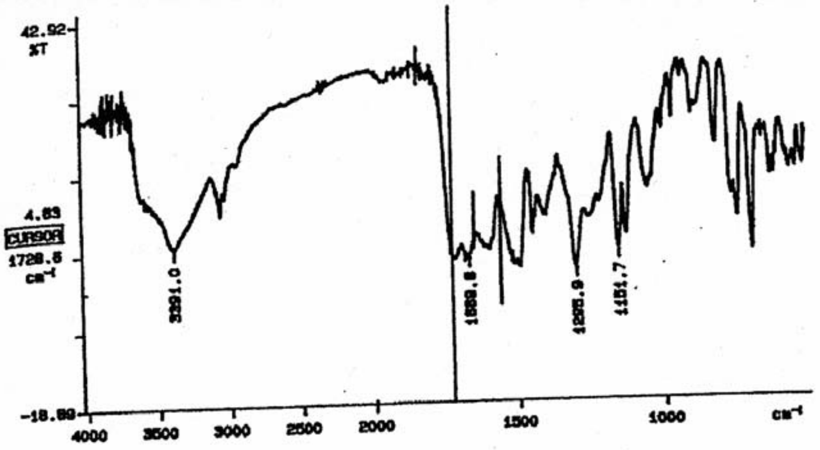
^{1}H NMR ($CDCl_3$) for α–Nsmoc-Glu(O-t-Bu)-OH



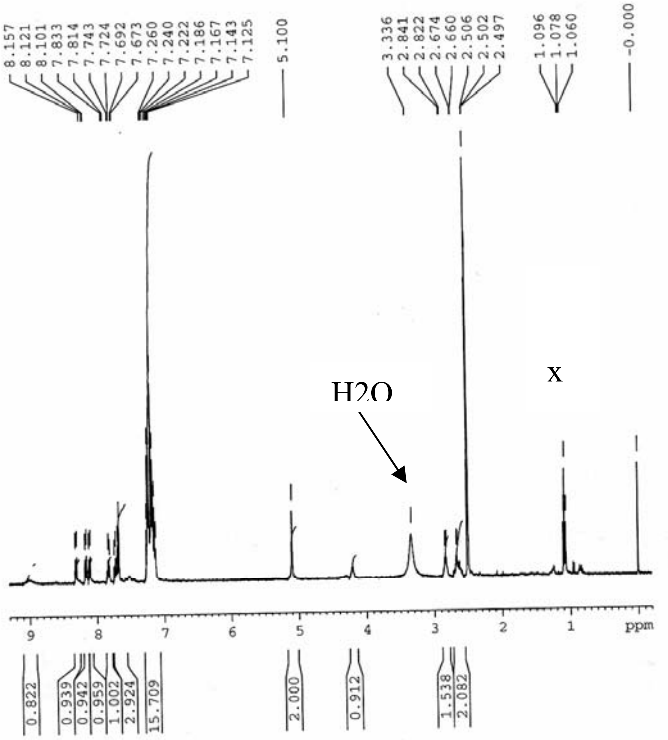
IR (KBr) for α-Nsmoc-Lys(Boc)-OH



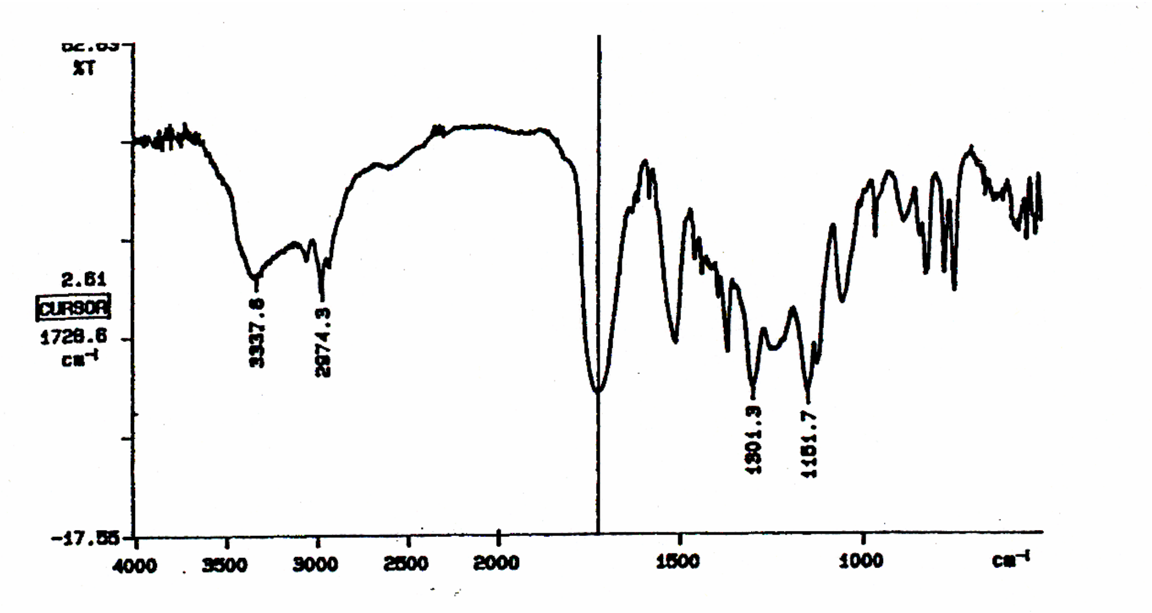
^{1}**H NMR (DMSO-d$_6$)** for α-Nsmoc-Lys(Boc)-OH



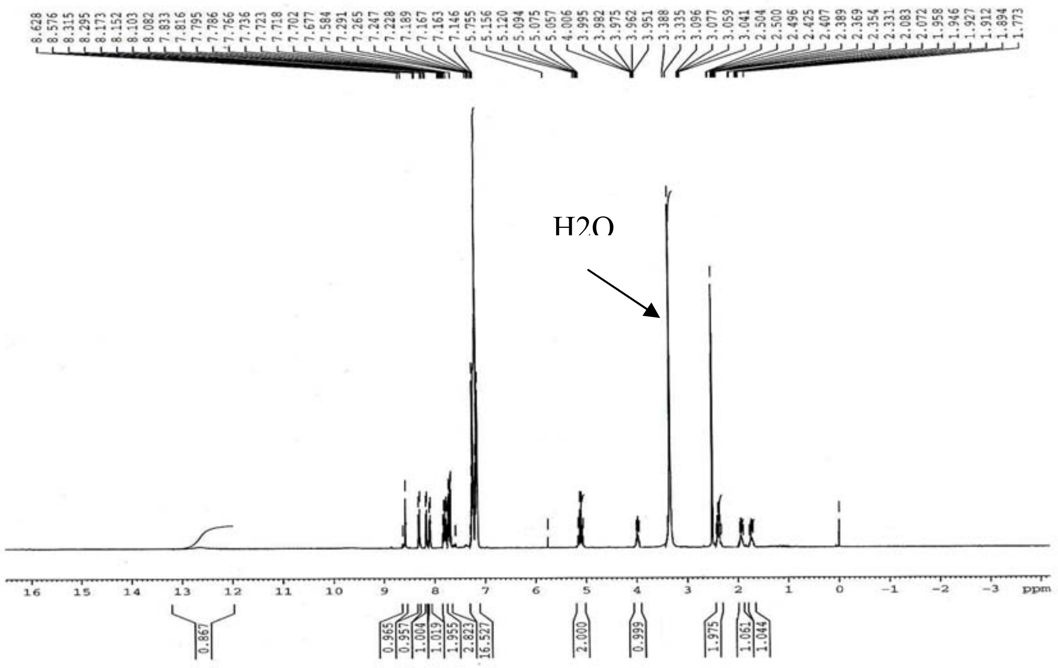
IR (KBr) for α–Nsmoc-Asn(Trt)-OH



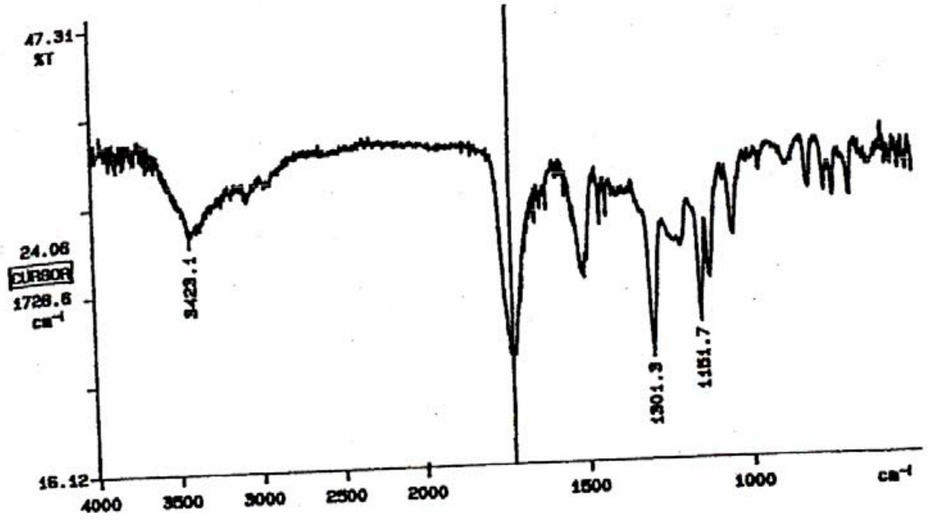
^{1}H NMR (DMSO-d_6) for α–Nsmoc-Asn(Trt)-OH



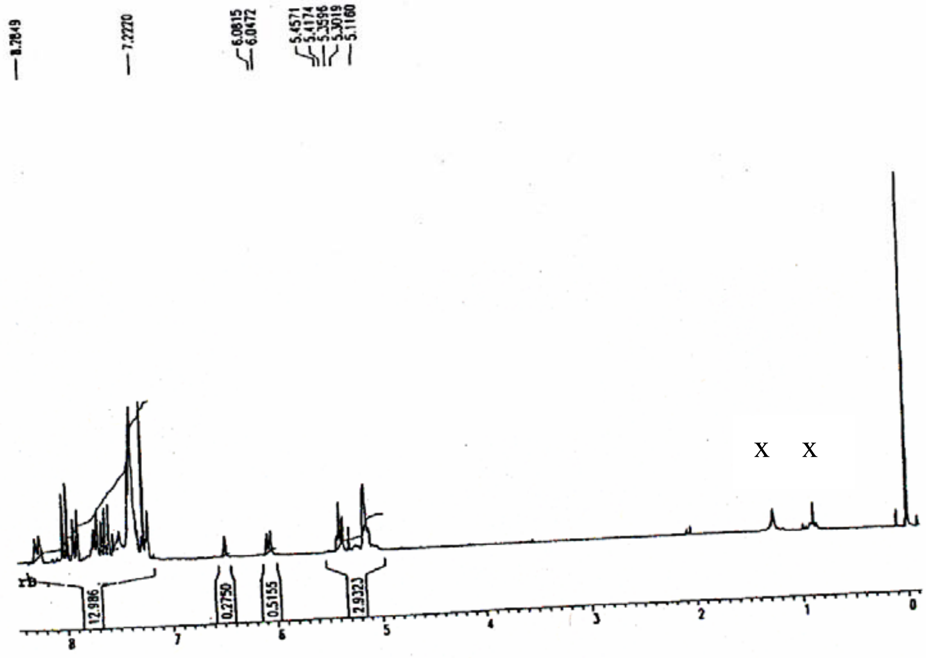
IR (KBr) for α-Nsmoc-Gln(Trt)-OH



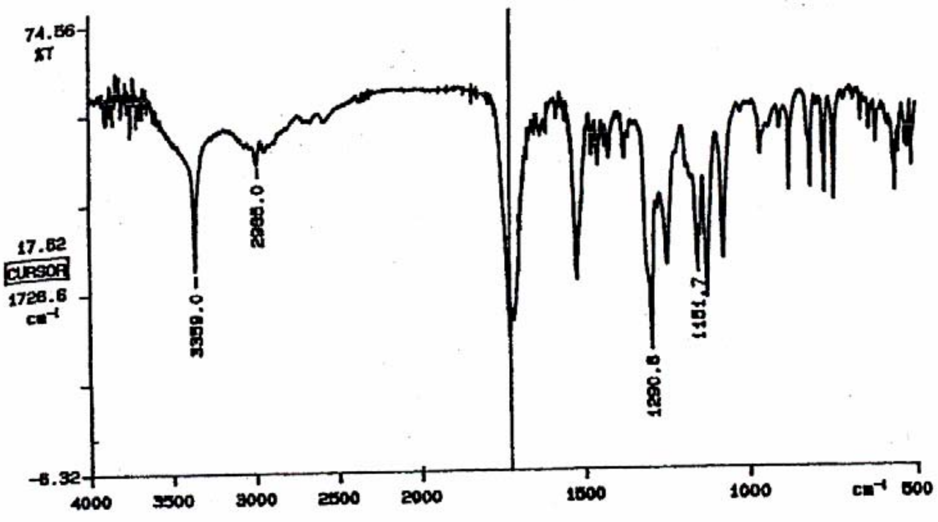
^{1}H NMR (DMSO-d$_6$) for α-Nsmoc-Gln(Trt)-OH



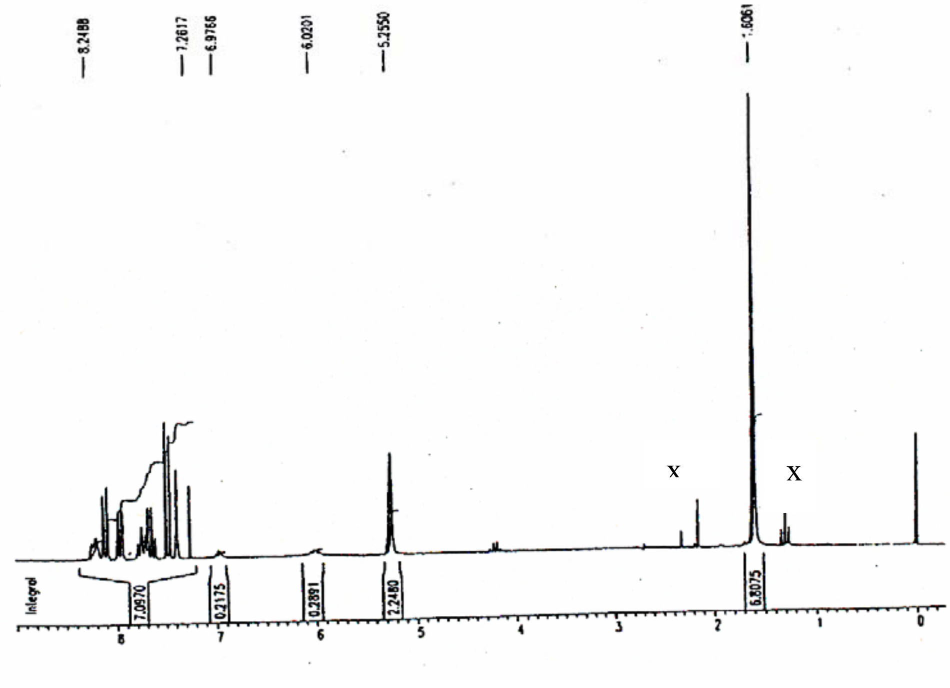
IR (KBr) for α–Nsmoc-Phg-OH



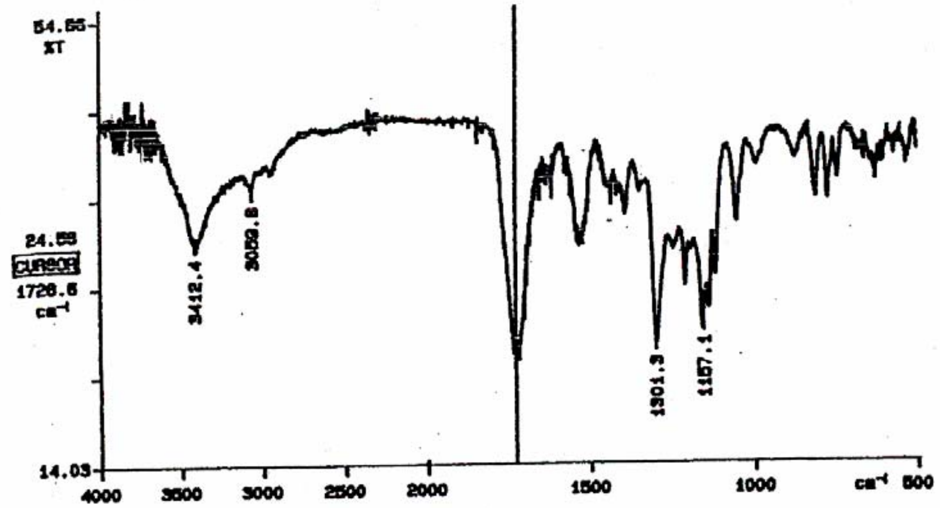
^{1}H NMR ($CDCl_3$) for α–Nsmoc-Phg-OH



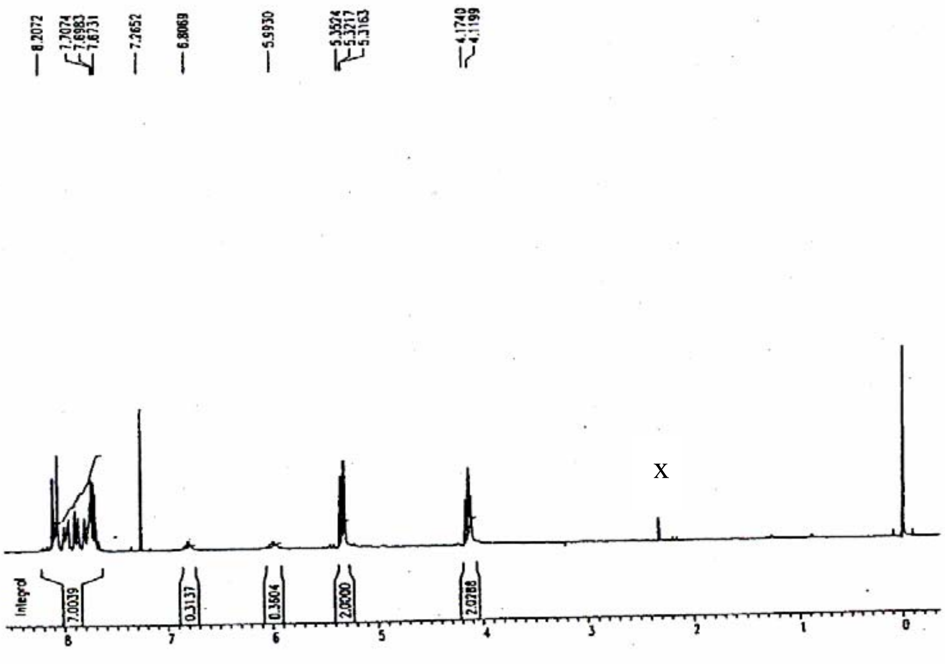
IR (KBr) for α–Nsmoc-Aib-OH



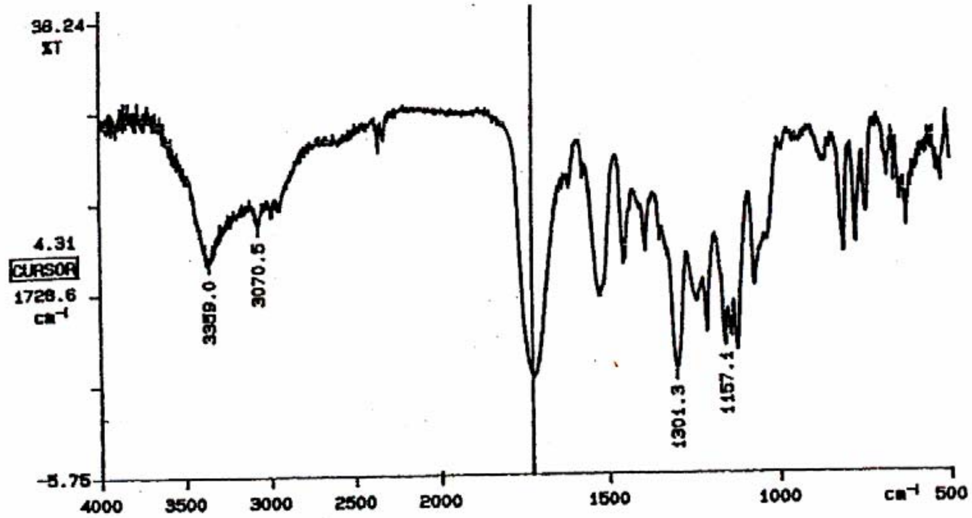
^{1}H NMR (CDCl3 + TFA) for α–Nsmoc-Aib-OH



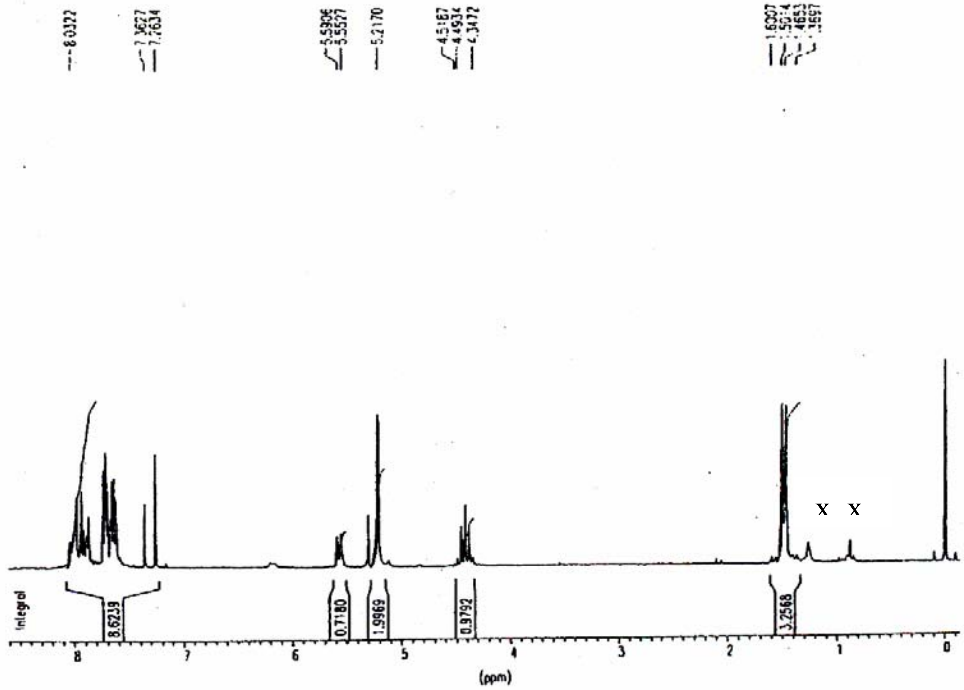
IR (KBr) for β–Nsmoc-Gly-OH



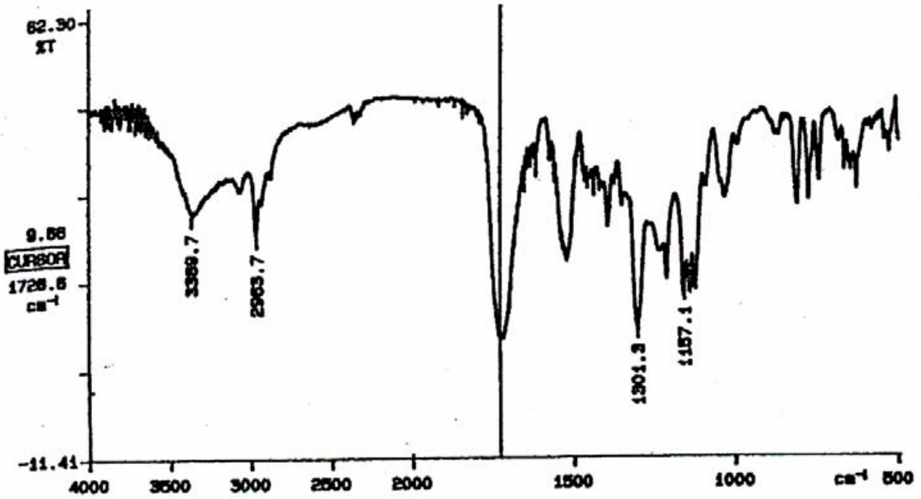
^{1}H NMR ($CDCl_3$ + TFA) for β–Nsmoc-Gly-OH



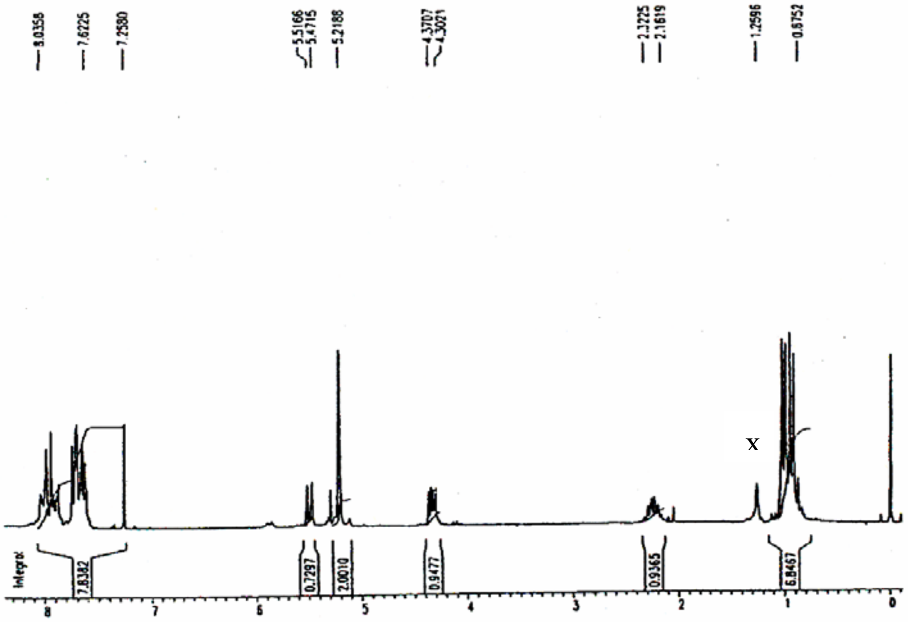
IR (KBr) for β–Nsmoc-Ala-OH



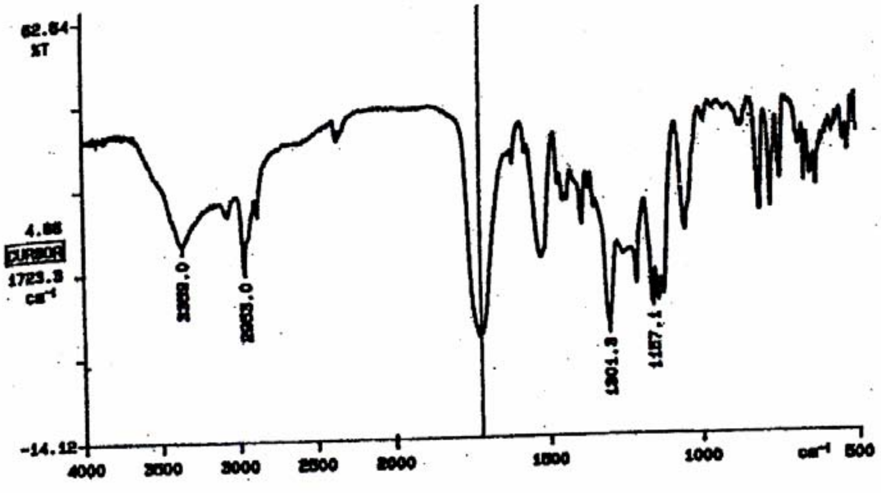
^{1}HNMR (CDCl$_3$) for β–Nsmoc-Ala-OH



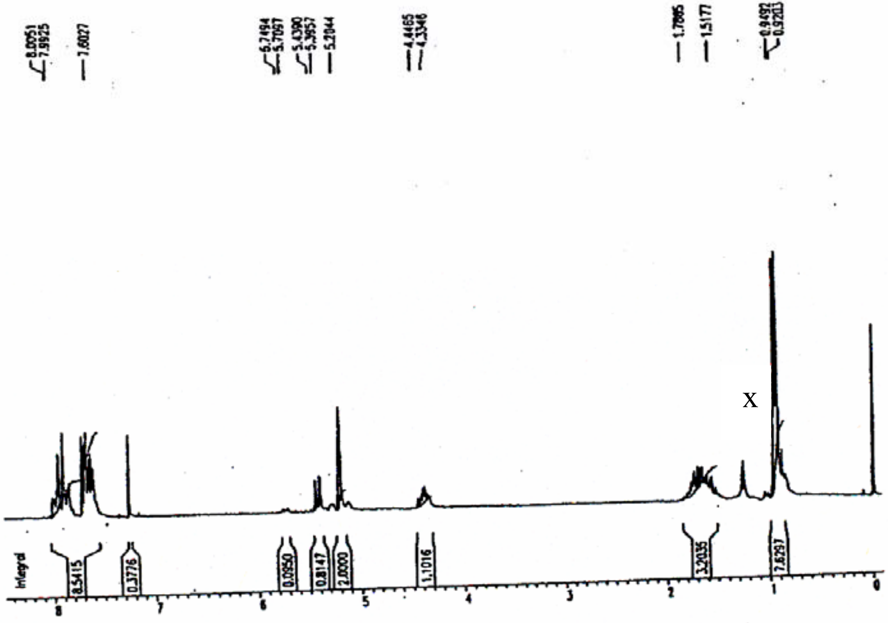
IR (KBr) for β–Nsmoc-Val-OH



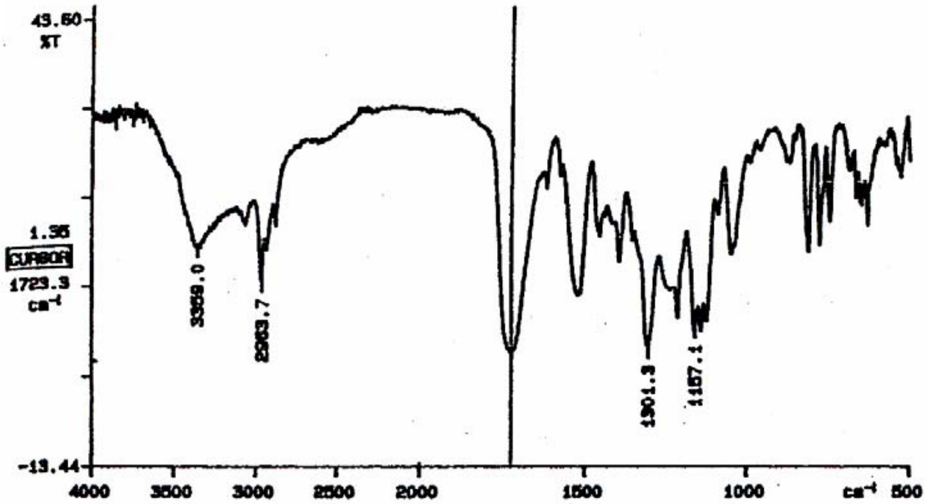
^{1}H NMR (CDCl$_3$) for β–Nsmoc-Val-OH



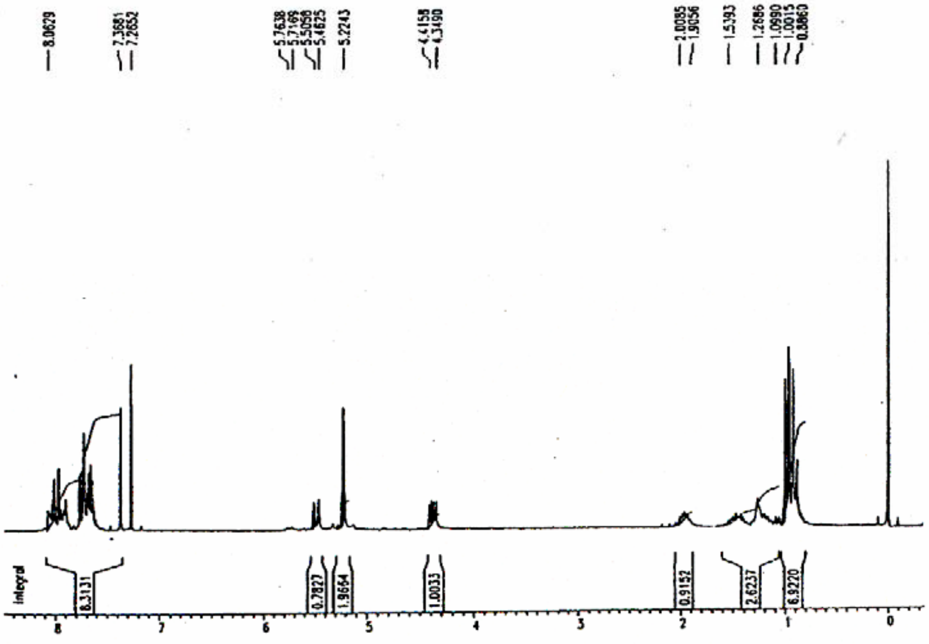
IR (KBr) for β–Nsmoc-Leu-OH



^{1}H NMR (CDCl$_3$) for β–Nsmoc-Leu-OH



IR (KBr) for β–Nsmoc-Ile-OH



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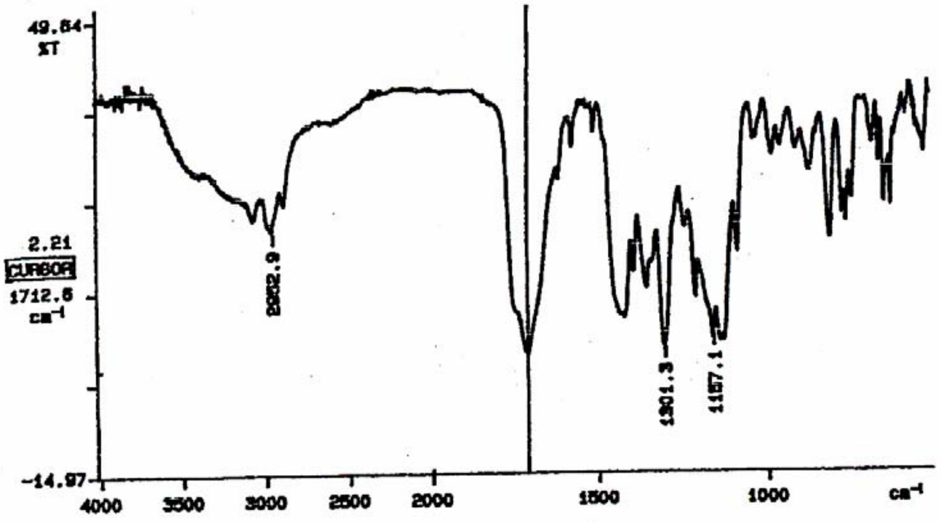
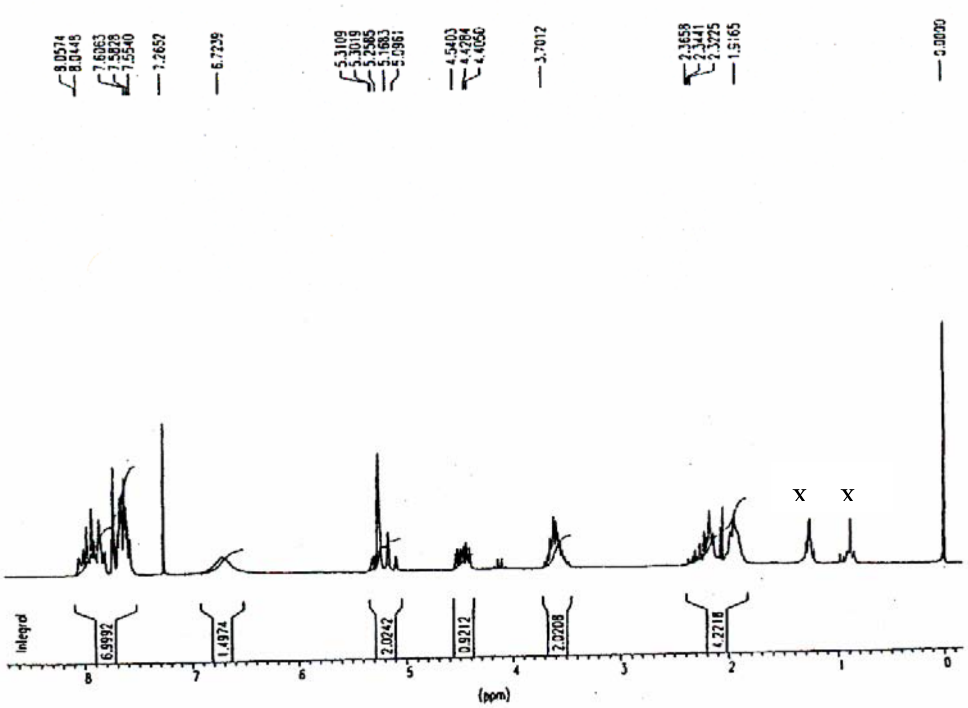
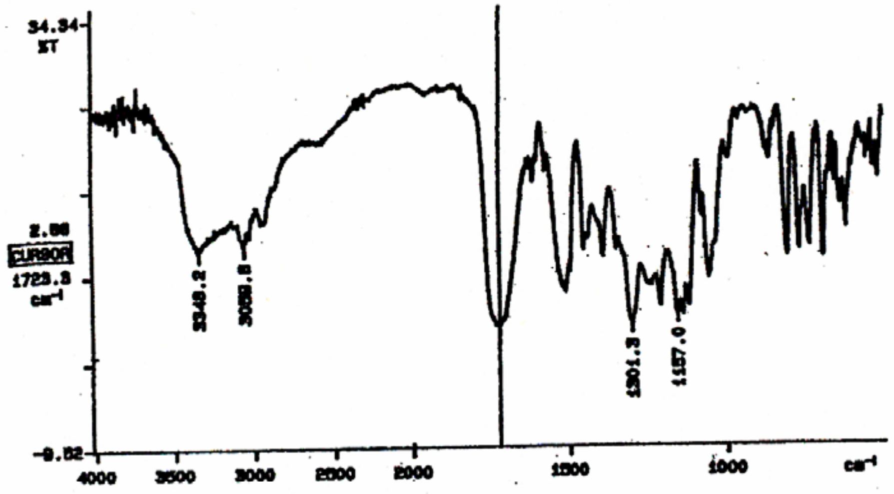


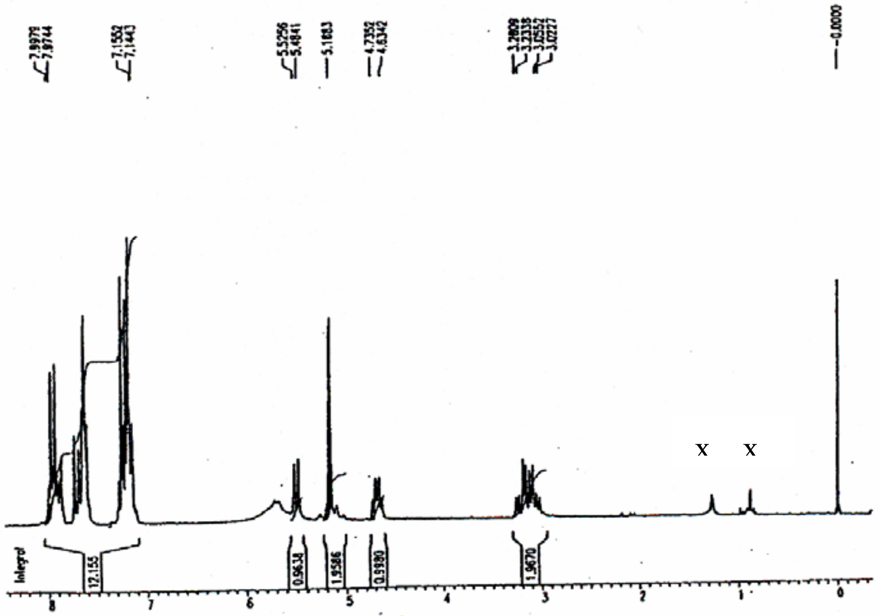
IR (KBr) for β–Nsmoc-Pro-OH



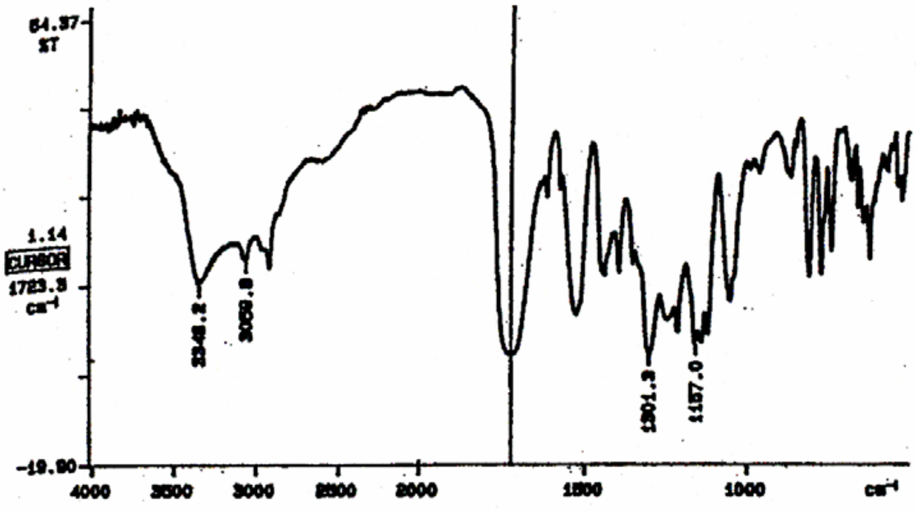
^{1}H NMR (CDCl$_3$) for β–Nsmoc-Pro-OH



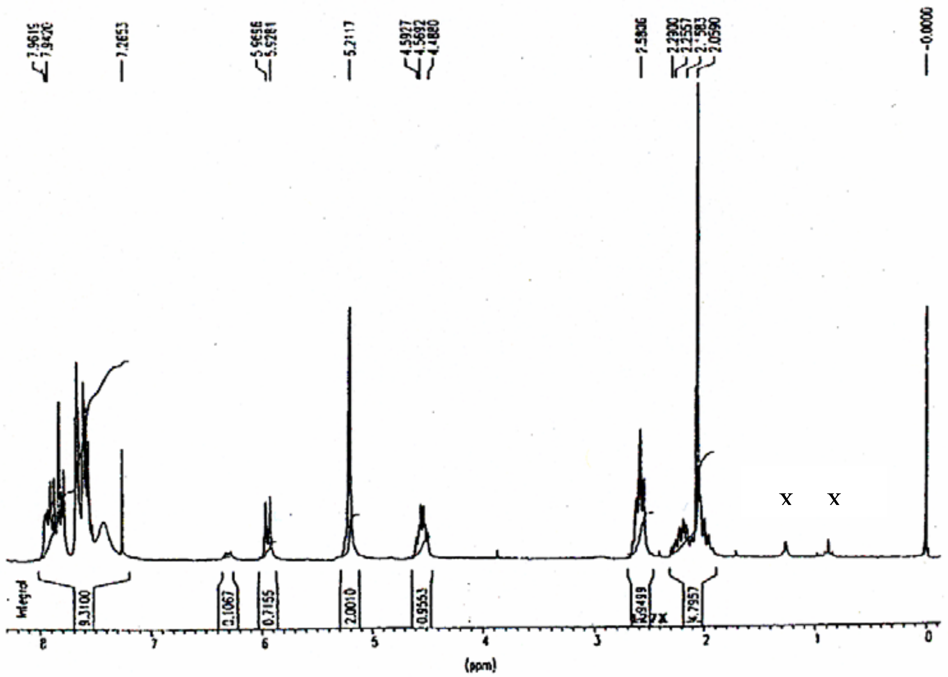
IR (KBr) for β–Nsmoc-Phe-OH



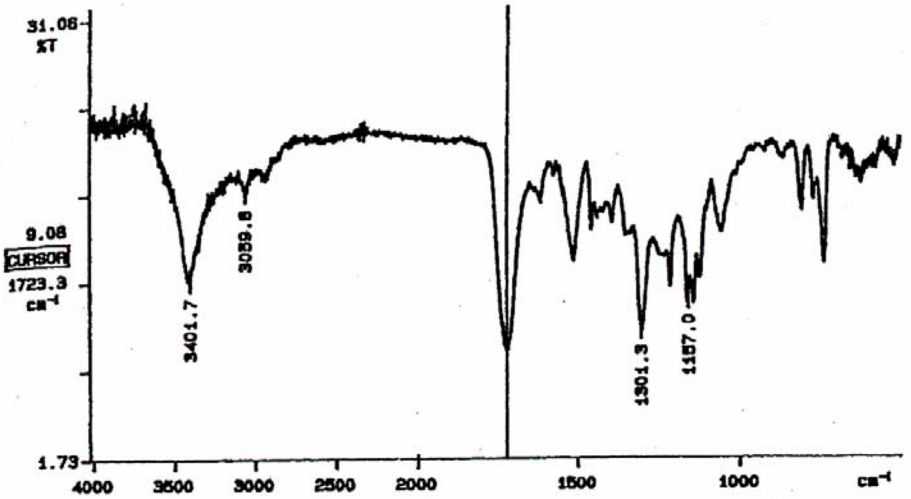
^{1}H NMR ($CDCl_3$) for β–Nsmoc-Phe-OH



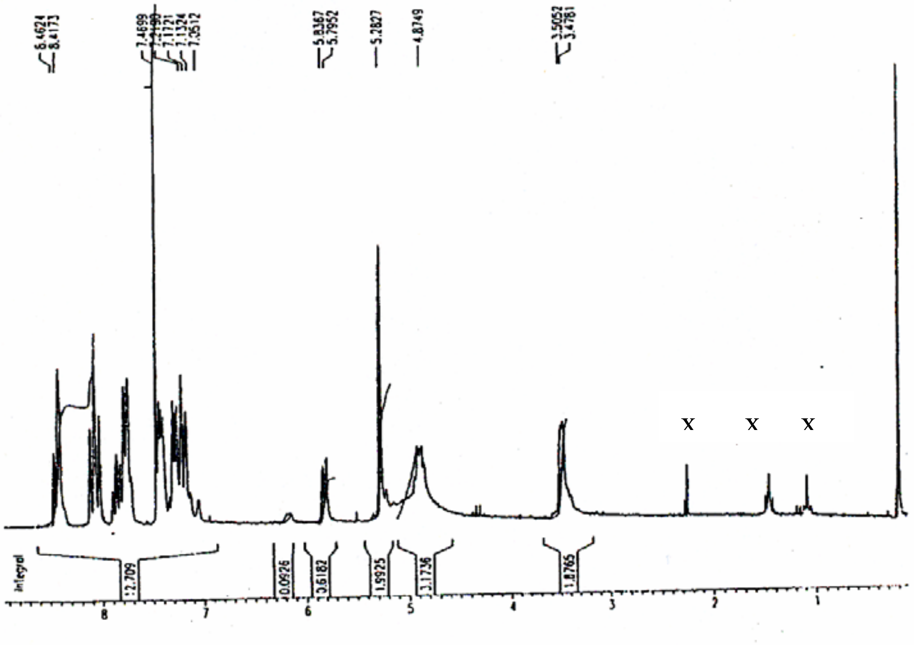
IR (KBr) for β–Nsmoc-Met-OH



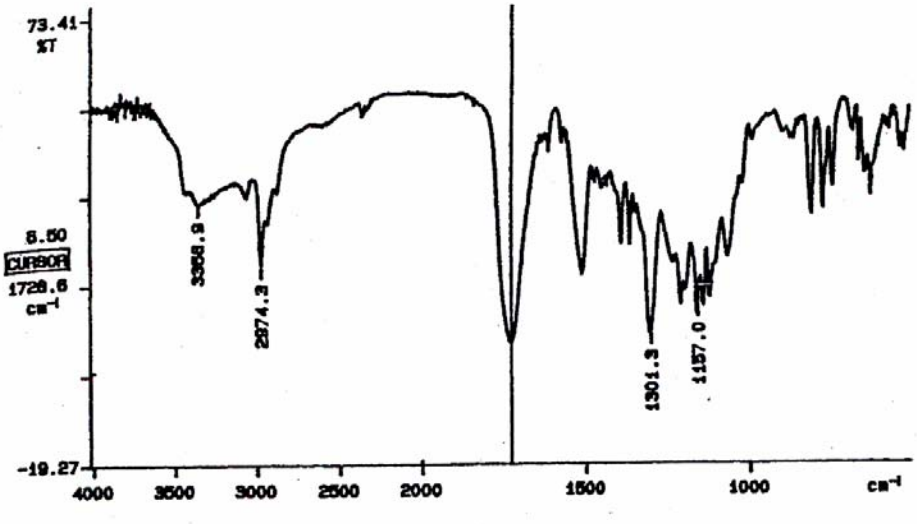
^{1}H NMR ($CDCl_3$) for β–Nsmoc-Met-OH



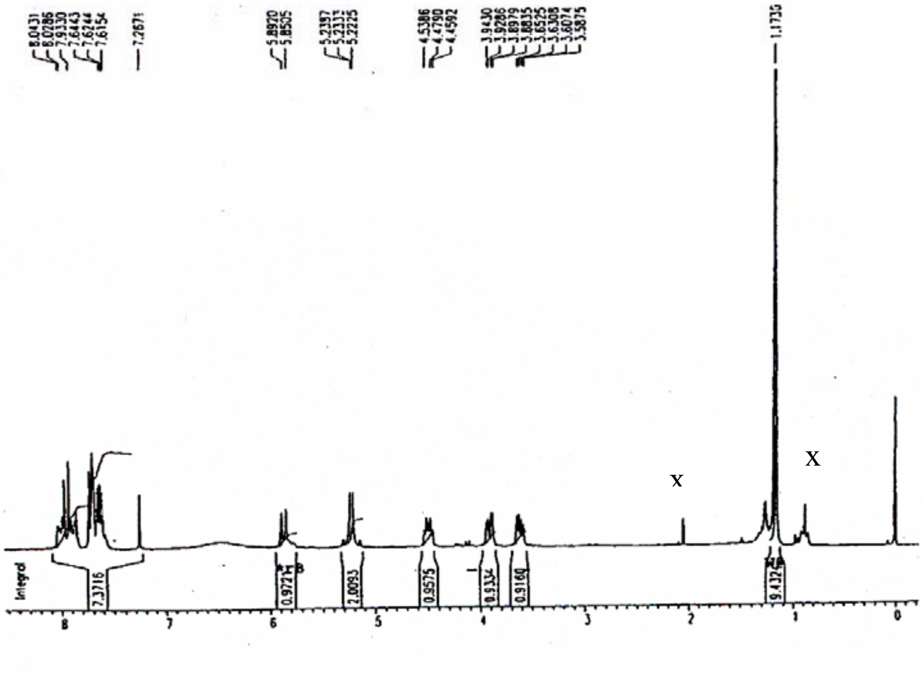
IR (KBr) for β–Nsmoc-Trp-OH



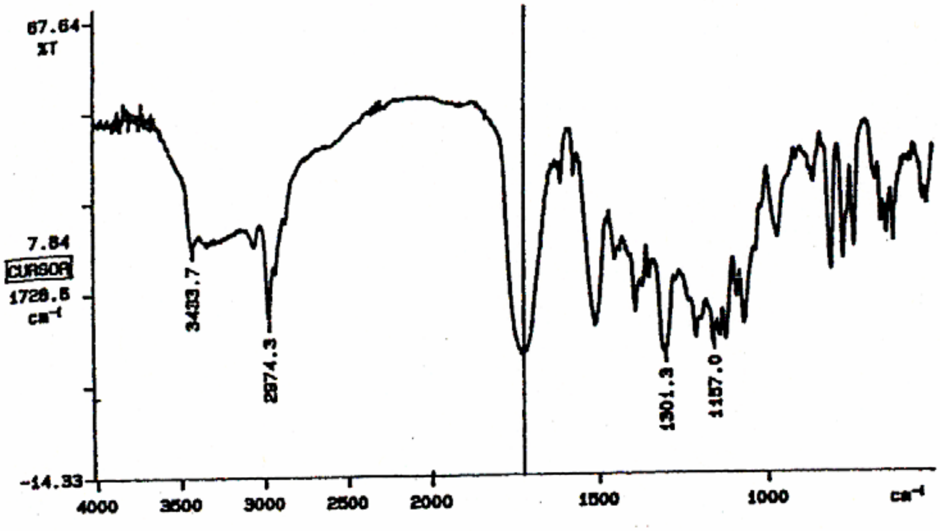
^{1}H NMR (CDCl$_3$) for β–Nsmoc-Trp-OH



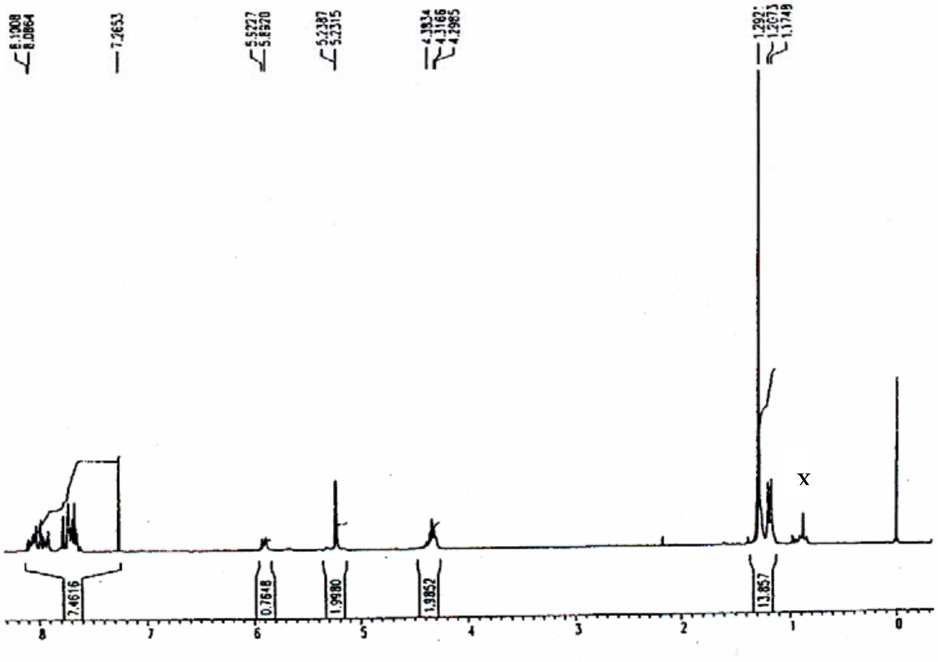
IR (KBr) for β–Nsmoc-Ser(t-Bu)-OH



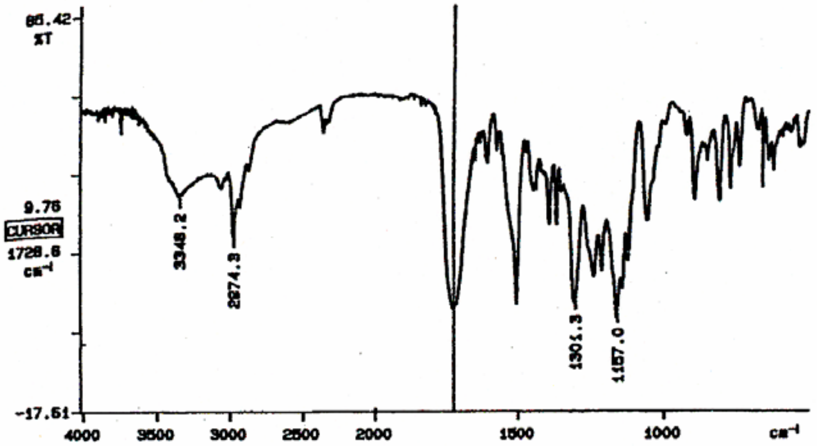
^{1}H NMR ($CDCl_3$) for β–Nsmoc-Ser(t-Bu)-OH



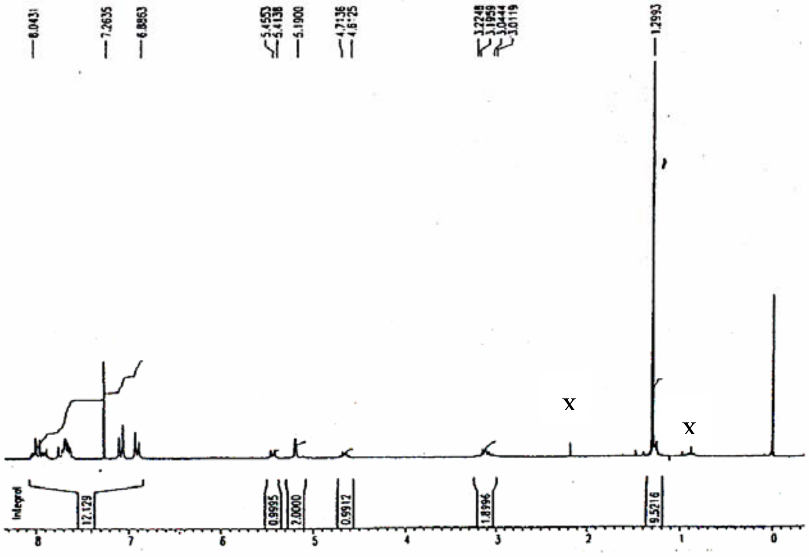
IR (KBr) for β–Nsmoc-Thr(t-Bu)-OH



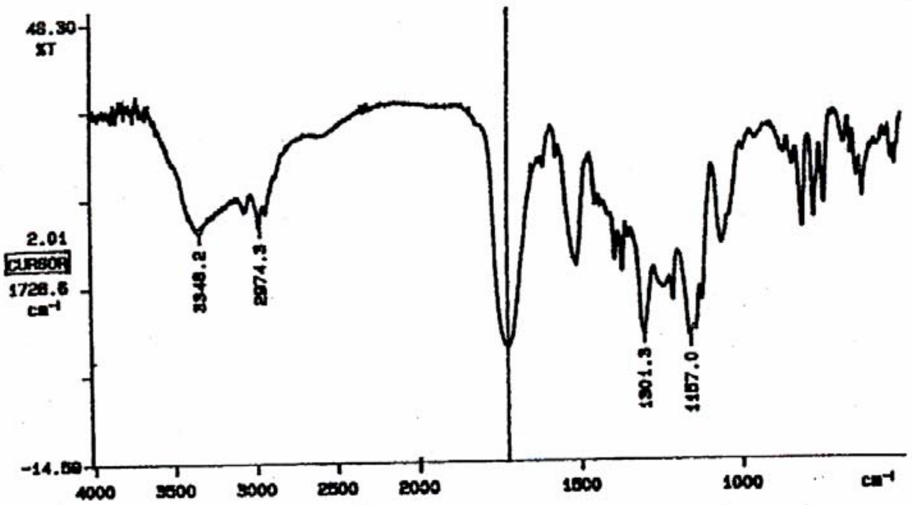
^{1}H NMR (CDCl$_3$) for β–Nsmoc-Thr(t-Bu)-OH



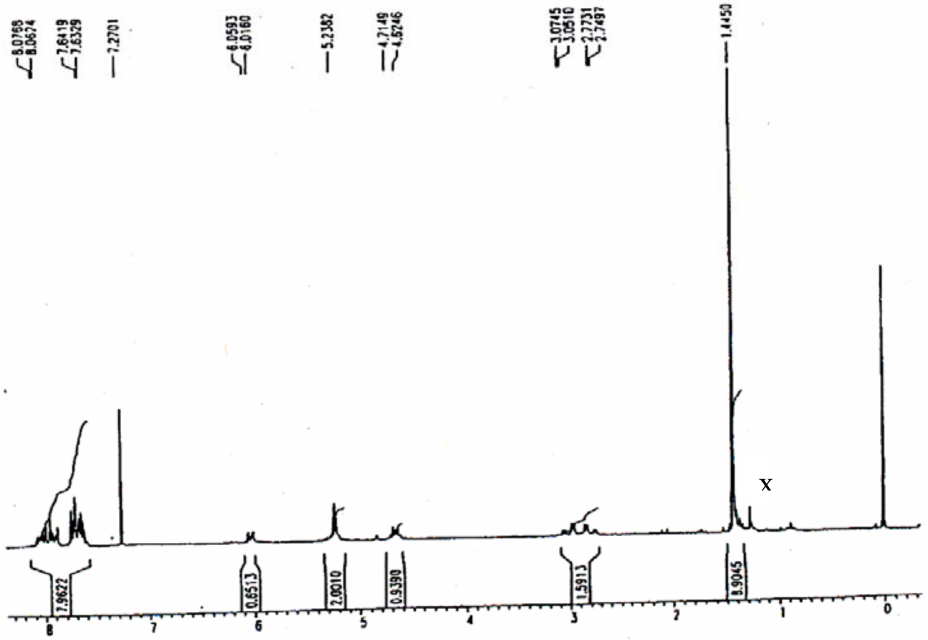
IR (KBr) for β–Nsmoc-Tyr(t-Bu)-OH



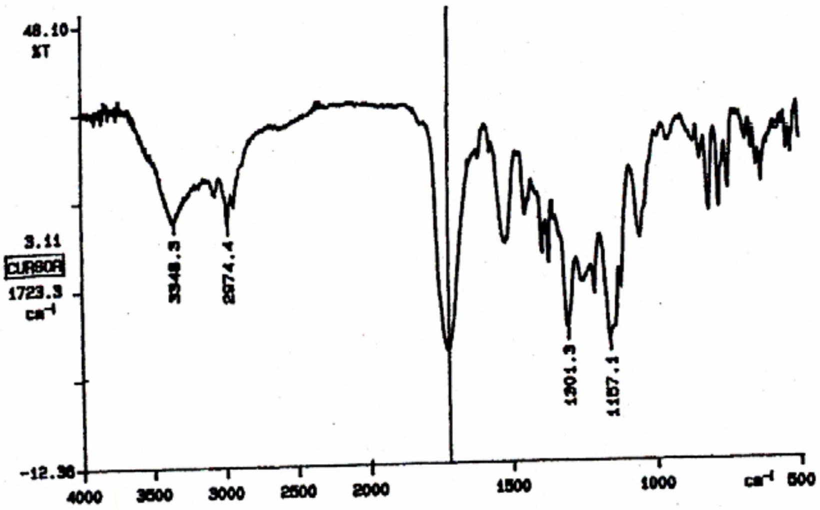
^{1}H NMR ($CDCl_3$) for β–Nsmoc-Tyr(t-Bu)-OH



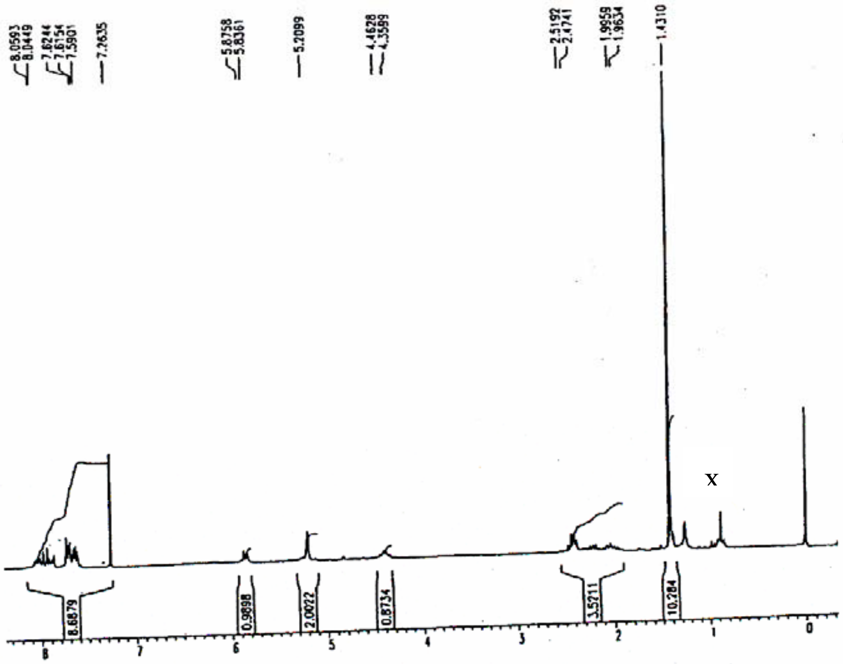
IR (KBr) for β–Nsmoc-Asp(O-t-Bu)-OH



^{1}H NMR (CDCl$_3$) for β–Nsmoc-Asp(O-t-Bu)-OH



IR (KBr) for β–Nsmoc-Glu(O-t-Bu)-OH



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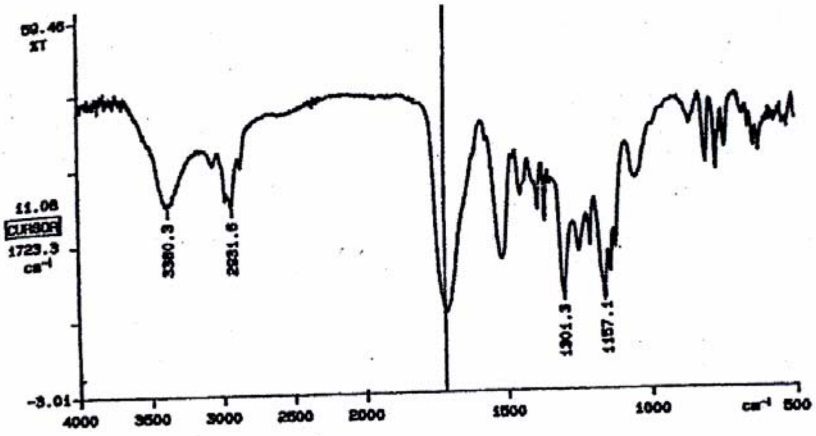
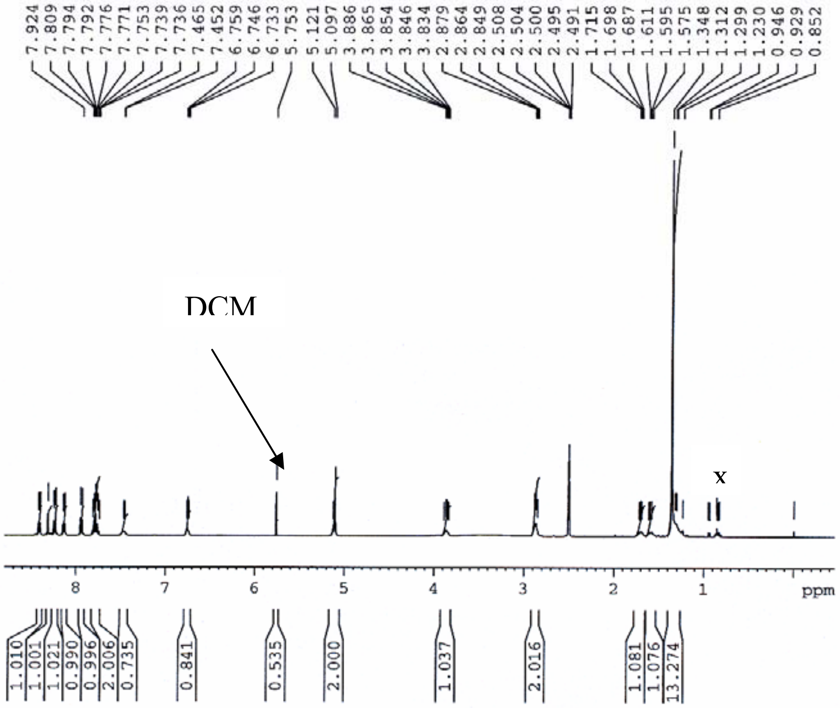
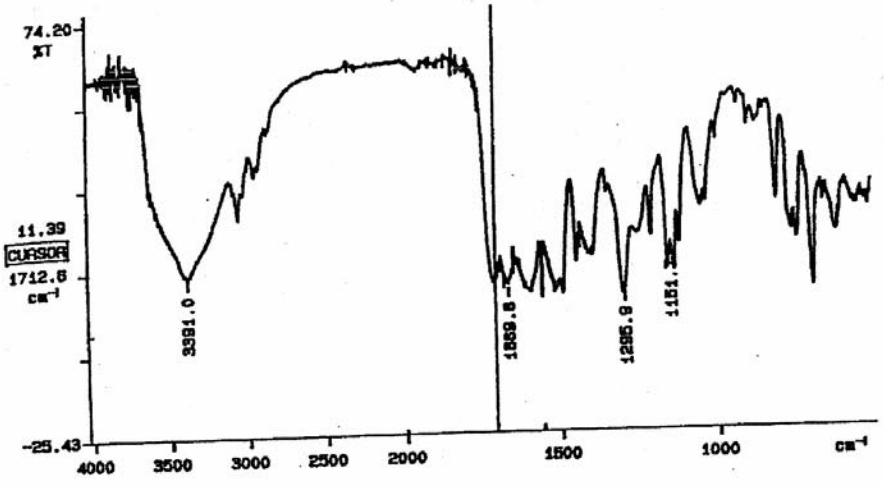


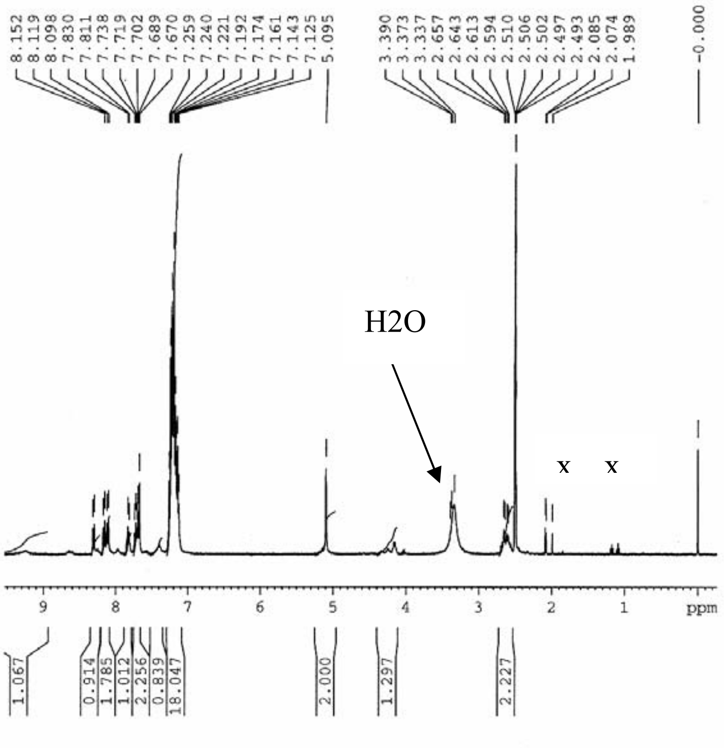
IR (KBr) for β–Nsmoc-Lys(Boc)-OH



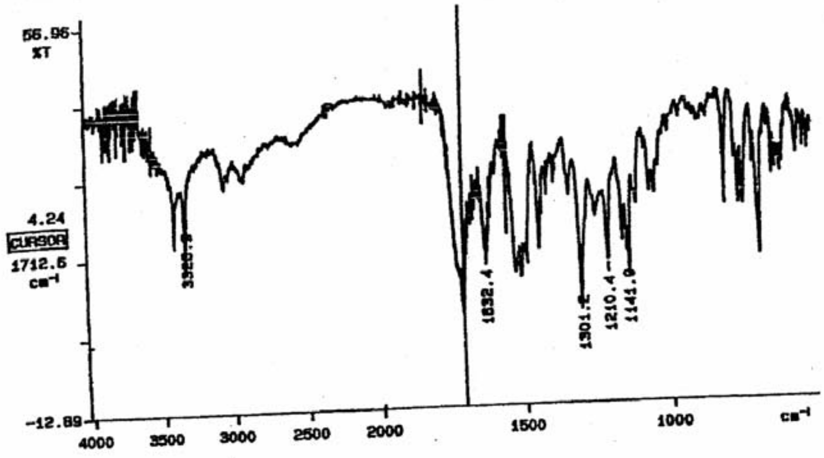
^{1}H NMR (DMSO-d$_6$) for β–Nsmoc-Lys(Boc)-OH



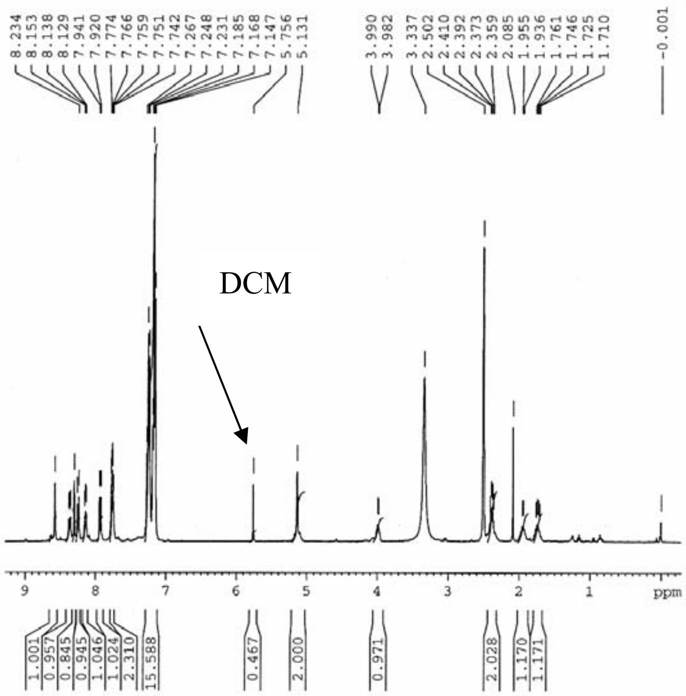
IR (KBr) for β–Nsmoc-Asn(Trt)-OH



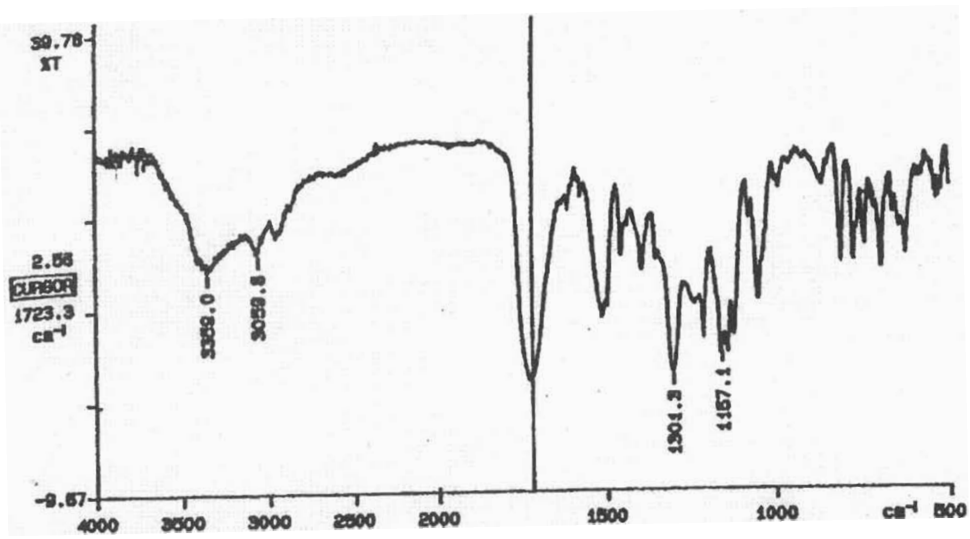
^{1}H NMR (DMSO-d$_{6}$) for β–Nsmoc-Asn(Trt)-OH



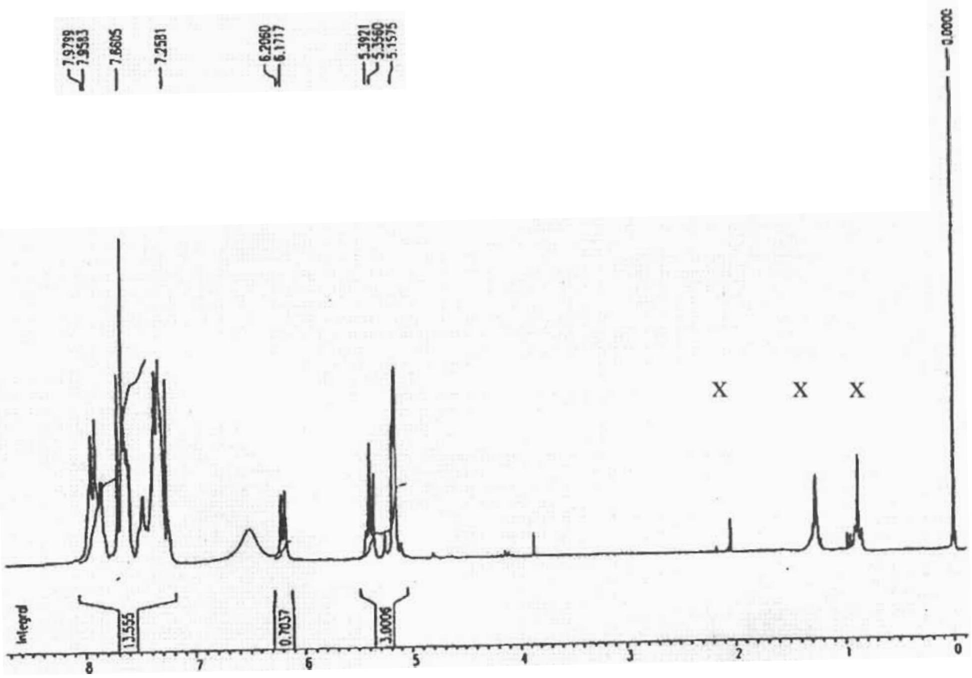
IR (KBr) for β-Gln(Trt)-OH



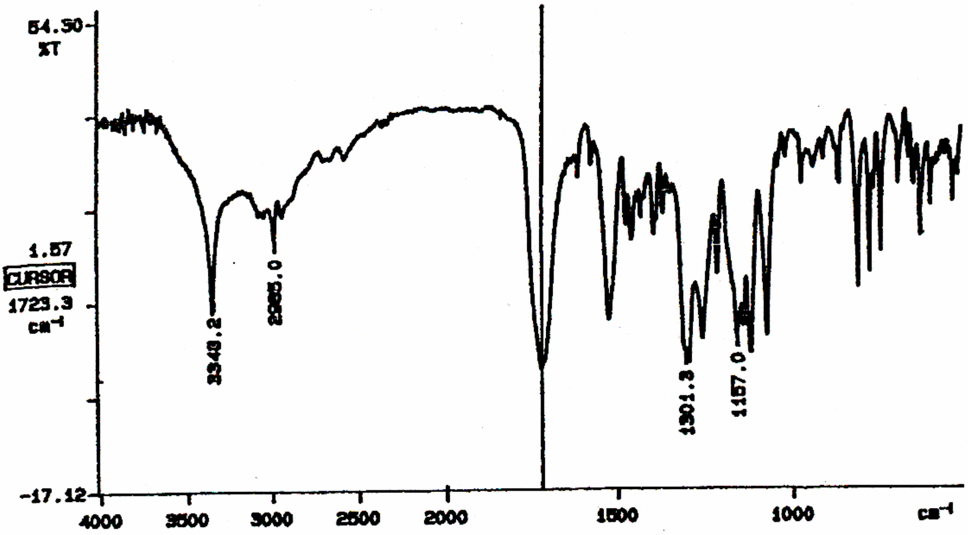
^{1}H NMR (DMSO-d_6) for β-Gln(Trt)-OH



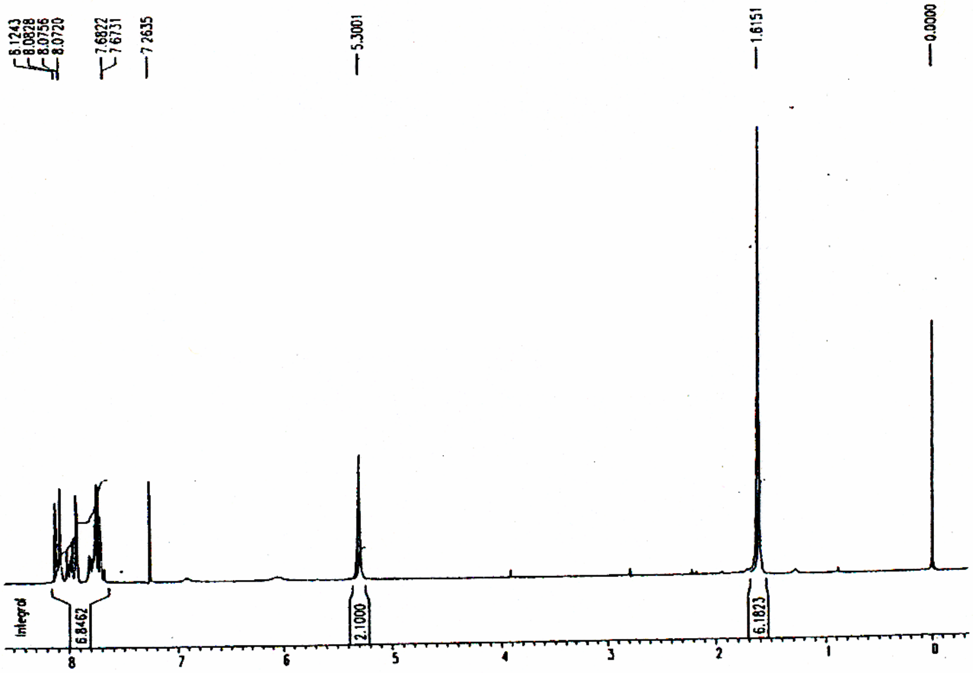
IR (KBr) for β–Nsmoc-Phg-OH



^{1}H NMR (CDCl$_3$) for β–Nsmoc-Phg-OH



IR (KBr) for β–Nsmoc-Aib-OH



^{1}H NMR ($CDCl_3$ + TFA) for β–Nsmoc-Aib-OH

VIII. Racemization tests

Fig. VIII a. ^{1}H-NMR spectrum of a roughly 50-50 mixture of LL- and LD-α-Nsmoc-Phg-Ala-OMe.
Fig. VIII b. ^{1}H-NMR spectrum of the crude sample of α-Nsmoc-Phg-Ala-OMe prepared from H-Ala-OMe.HCl via N-HATU coupling. Integration at δ 3.71 shows that no more than 1.46% of the DL- form could be present.
Fig. VIII c. ^{1}H-NMR spectrum of the crude sample of α-Nsmoc-Phg-Ala-OMe prepared via crude α-Nsmoc-Phg-F and H-Ala-OMe.HCl via (1) the two-phase method in the presence of $NaHCO_3$ and (2) the one phase method in the presence of DIEA. Integration at δ 3.71 shows that no more than 1.23% or 0.6% respectively of the DL- form could have been present.

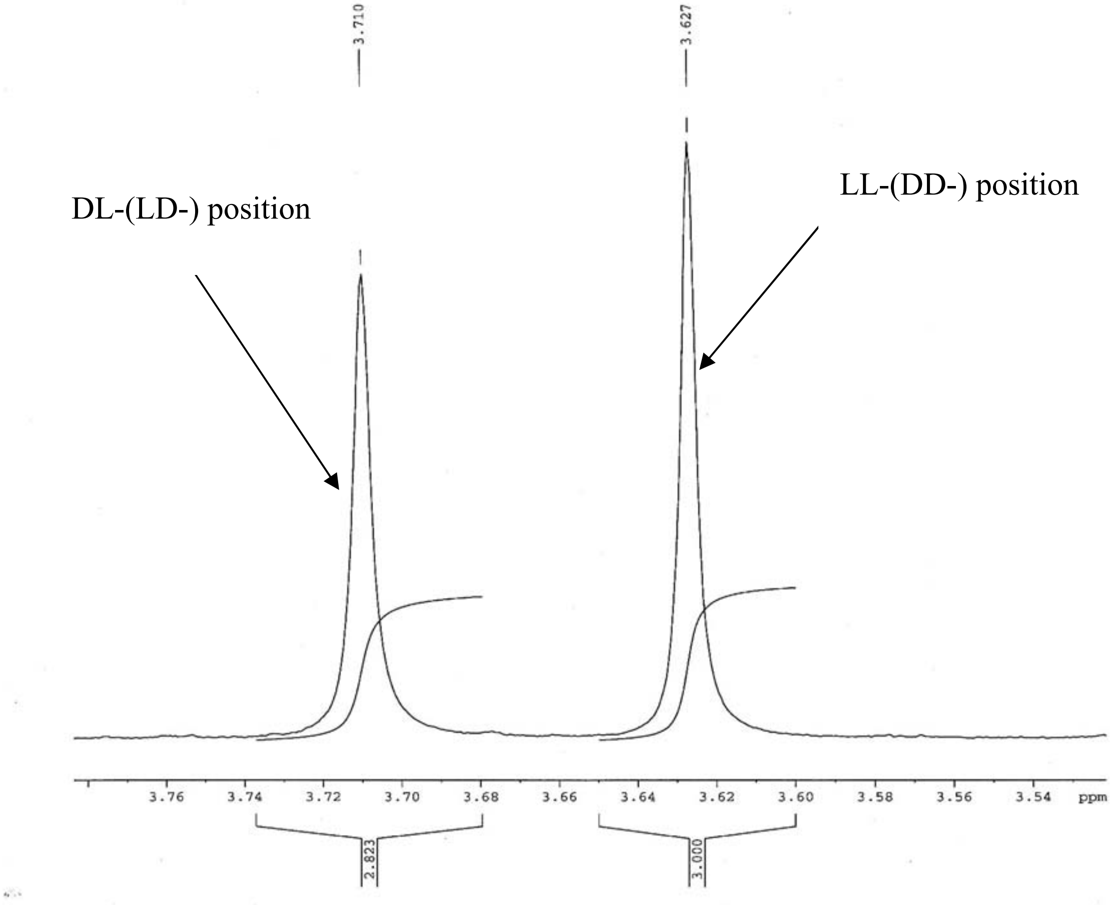
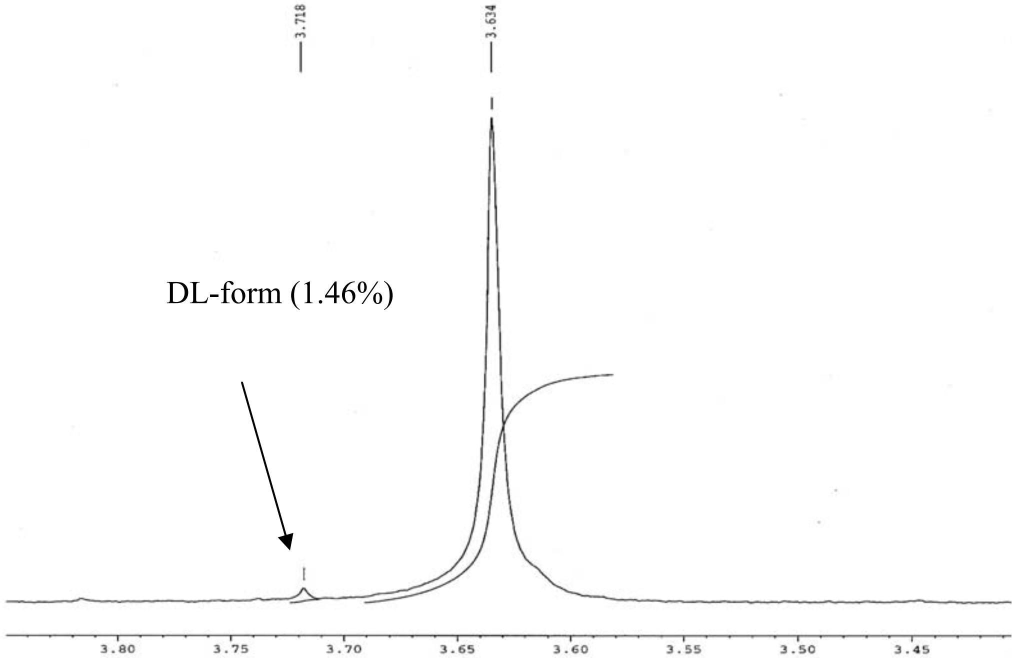
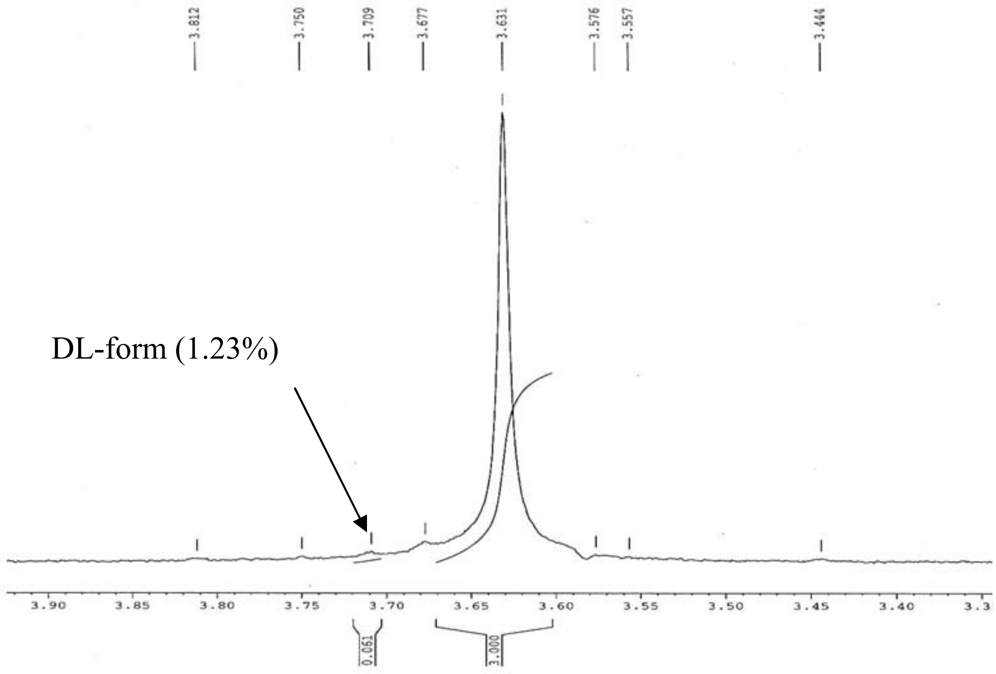


Fig. VIII a. ^{1}H-NMR spectrum of a roughly 50-50 mixture of LL- and LD-α-Nsmoc-Phg-Ala-OMe.



DL-form (1.46%)

Fig. VIII b. ^{1}H-NMR spectrum of the crude sample of α-Nsmoc-Phg-Ala-OMe prepared from H-Ala-OMe.HCl Via N-HATU coupling



DL-form (1.23%)

Fig. VIII c1. ^{1}H-NMR spectrum of the crude sample of α-Nsmoc-Phg-Ala-OMe prepared via crude α-Nsmoc-Phg-F and H-Ala-OMe.HCl via the two-phase method in the presence of $NaHCO_3$.

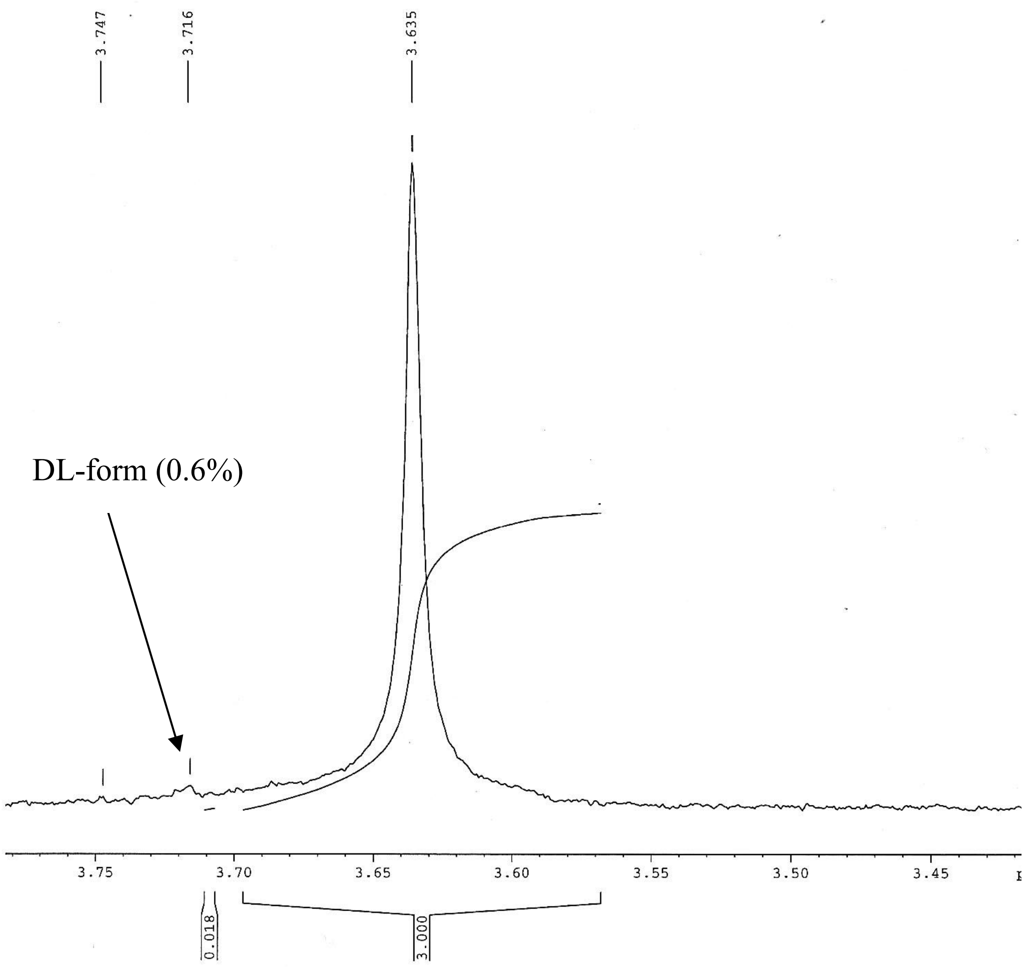


Fig. VIII c2. ^{1}H-NMR spectrum of the crude sample of α-Nsmoc-Phg-Ala-OMe prepared via crude α-Nsmoc-Phg-F and H-Ala-OMe.HCl via the one phase method in the presence of DIEA.