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**Supporting Information**

# Design and Synthesis of an *s*-Triazene based Asymmetric Organocatalyst and its Application in Enantioselective Alkylation

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Table of Contents

General methods……..Pg. S1

Experimental Procedures and Characterization.....…… Pg. S2

$^{1}$H NMR ,$^{13}$C NMR and mass spectra .....……...Pg. S9

HPLC traces…….Pg. S29

## General methods

All the chemicals used in synthesis were of analytical grade and purchased from Sigma-Aldrich, USA. All moisture sensitive reactions were carried out under an anhydrous argon atmosphere in dry and freshly distilled solvents under anhydrous conditions. Commercially available ethyl acetate, DMF, DCM, acetone and ethanol were dried and stored under an argon atmosphere prior to use. All intermediates were purified by silica gel column chromatography. Analytical thin layer chromatography was performed on precoated 250 μm layer thickness silica gel 60 $F_{254}$ plates. $^{1}$H NMR (400 MHz) and $^{13}$C NMR (100 MHz) spectra were recorded on JEOL spectrometer. HPLC purification was done on Shimadzu analytical HPLC system of synthesized amino acids using CHIRALCEL OD-H Chiral Column. The identities of peaks corresponding to minor enantiomers were established with the aid of racemic samples.
For enantiomeric excess, CHIRALCEL OD-H column was used and analysis were done at 90:10 (Hexane: IPA) solvent system with flow rate 1ml/min.

**Table sT1:** Table: Screening of chiral catalyst sT1 with different mol % of base

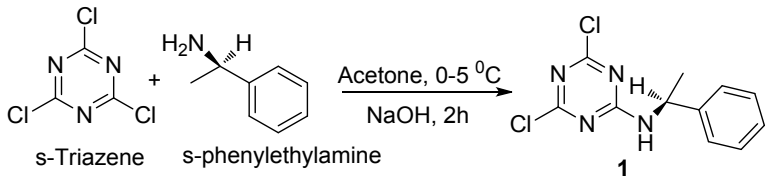
| **S. No.** | Temp (°C) | % of Base | Solvent | Mol % of Catalyst | Yield (%) | ee (%) |
|---|---|---|---|---|---|---|
| **1** | -10 | 5 % KOH | Toluene + $CHCl_3$ | 10 mol % of sT1 | NR | ------- |
| **2** | -10 | 10 | Toluene + $CHCl_3$ | 10 mol % of sT1 | NR | ------- |
| **3** | -10 | 20 | Toluene + $CHCl_3$ | 10 mol % of sT1 | 24 | 85 |
| **4** | -10 | 30 | Toluene + $CHCl_3$ | 10 mol % of sT1 | 32 | 84 |
| **5** | -10 | 40 | Toluene + $CHCl_3$ | 10 mol % of sT1 | 53 | 85 |
| **6** | -10 | 50 | Toluene + $CHCl_3$ | 10 mol % of sT1 | 90 | 82 |
| **7** | -10 | 60 | Toluene + $CHCl_3$ | 10 mol % of sT1 | 32 | 86 |
| **8** | -10 | 70 | Toluene + $CHCl_3$ | 10 mol % of sT1 | NR | ------ |
| **9** | -10 | 50 | Xylene | 10 mol % of sT1 | 65 | 86 |
| **10** | -10 | 50 | Xylene + $CHCl_3$ | 10 mol % of sT1 | 62 | 78 |
| **11** | -10 | 50 | MeOH | 10 mol % of sT1 | 32 | 81 |
| **12** | -10 | 50 | Ethanol | 10 mol % of sT1 | 43 | 62 |
| **13** | -10 | 50 | DMF | 10 mol % of sT1 | 22 | 58 |

## Experimental Procedures:

## Synthesis of chiral catalysts sT1, sT2 and sT3

## Step 1.

## (4,6-Dichloro-[1,3,5]triazin-2-yl)-(1-phenyl-ethyl)-amine (1).



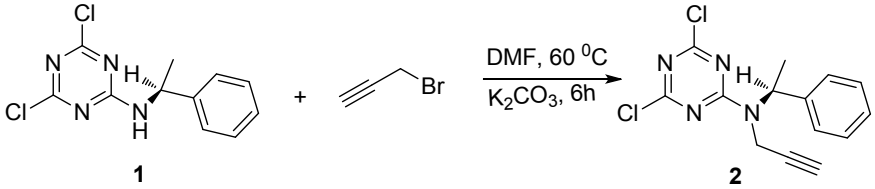

A mixture of cyanuric chloride (1.84gm, 10mmol) in dry acetone (20 ml) was cooled to 0 $^0$C and then s-phenylethyl amine (1.2 ml, 10 mmol) was added. The pH of the reaction mixture was adjusted to 9-10 using 1N NaOH and continued to stirr at 0°C until the completion of the reaction, as monitored by TLC. After usual work up, the reaction gave quantitative product. Yield-2.41gm (90%)

$^1$H NMR: (400 MHz, $CDCl_3$); δ 7.53-7.31(m, 5H), 6.11-6.09 (d, 1H J=4Hz), 5.25-5.23 (m, 1H), 1.65-1.58 (d, 3H; J=5.5 Hz): $^{13}$C NMR: (400 MHz, $CDCl_3$); δ 171.01, 169.94, 164.96, 141.36, 128.91, 127.99, 126.06, 51.05, 21.66. HRMS (ESI-TOF) Calcd: 269.0382 $(M+H)^+$; found: 269.0355; $[\alpha]_{D^{25}}$= -8.6

Reference: R. J. Mattson, *et al, Bio Org. & Med. Chem. Lett.* 2004, **14**, 4245-4248.

**Step 2.**

## (4,6-Dichloro-[1,3,5]triazin-2-yl)-(1-phenyl-ethyl)-prop-2-ynyl-amine 2

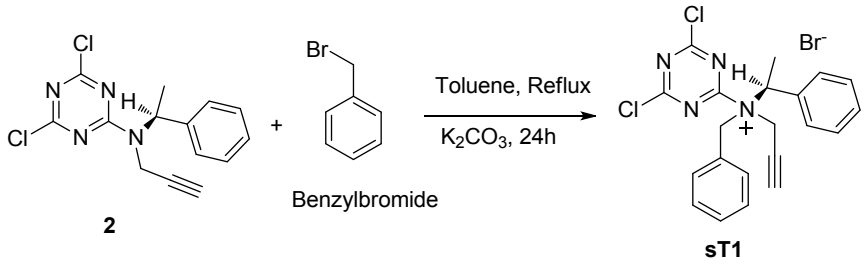



Compound **1** (1.38gm, 5mmol) was added to a suspension of 60% sodium hydride (washed with hexane) (10 mmol) in dry DMF (20 ml). This reaction mixture was stirred until the solids dissolved, then propargyl bromide (0.85 ml, 6mmol) was added and stirring continued for another 12 hr at 60 °C. The completion of the reaction was monitored by TLC. After completion of the reaction, DMF was removed in vacuo and purified by silica gel column chromatography using hexane:EA (7:3) as eluent to get compound **2** as dense oil **(**1.07gm), yield 70%.

$^1$H NMR: (400 MHz, $CDCl_3$); δ 7.37-7.27 (m, 5H), 6.07 (q, 1H; J=3.7 Hz), 4.80 (d, 2H; J=Hz), 1.90-1.89 (d, 3H; J=6.8 Hz); $^{13}$C NMR: (400 MHz, $CDCl_3$); δ 153.87, 149.50, 145.47, 137.96, 128.90, 128.31, 127.48, 126.70, 77.88, 71.21, 52.47, 31.54, 17.80. HRMS (ESI-TOF) Calcd: 307.0439 $(M+H)^+$; found: 307.0899 $[\alpha]_{D^{25}}$= -11.6

**Step 3 (i):**

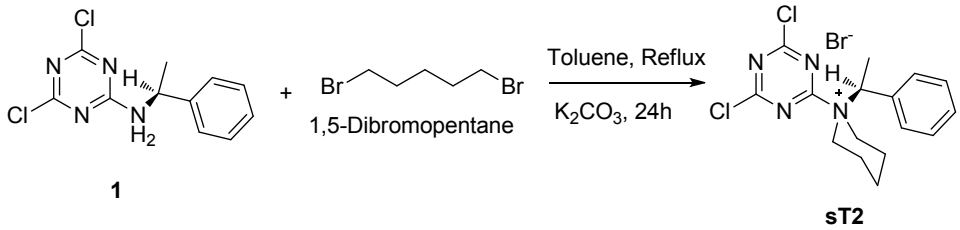
**Quaternary Ammonium Salt (sT1):**




Quaternary ammonium salt **sT1 was** synthesized by refluxing compound **2 (610 mg, 2mmol),** benzyl bromide (0.6 ml, 3 mmol) and $K_2CO_3$ (100 mg, 2.5 mmol) as base in toluene for 24 h. After this period, solvent was removed under vacuo to get the cationic quaternary salt **sT1 . Yield** 0.72 gm, 60%.

$^1$H NMR: (400MHz, $CDCl_3$); δ 7.34-7.29 (m, 10H); δ 5.24-5.21 (q, 1H; J=4.8 Hz); 3.47 (s, 2H); 3.47 (d, 2H; J=7.8 Hz); 2.27 (s, 1H); 1.37-1.34 (d, 3H; J=2.5Hz). $^{13}$C NMR: (400MHz, $CDCl_3$); δ 168.5, 164.96, 164.34, 143.7, 143.4, 132.05, 129.78, 128.47, 127.11, 125.89, 81.45, 74.12, 60.29, 50.61, 36.36, 22.55. HRMS (ESI-TOF) Calcd: 398.7654 (M+H-Br); found: 398.0161 (M+H-Br) $[\alpha]_{D^{25}}$= -7.4

**Quaternary Ammonium Salt sT2:**

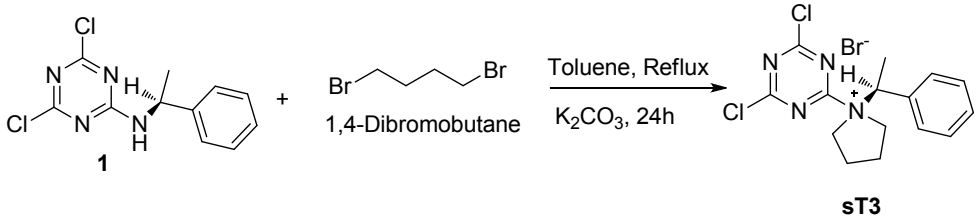



Quaternary ammonium salt **sT2** was prepared by refluxing compound **1** (0.7 gm, 2.5 mmol) and excess of 1,4-dibrompentane (1.8 ml, 7.5 mmol) as substrates and $K_2CO_3$ (100 mg, 2.5 mmol) as base in toluene for 24h. **sT2** was obtained as dense oil. Yield 0.68 gm, (50%).

$^1$H NMR: (400MHz, $CDCl_3$); δ 7.34-7.28 (m, 5H); 6.14-6.11 (q, 1H; J=7.5 Hz); 3.39-3.28 (m, 4H); 2.19 (m, 6H); 1.73-1.58 (d, 3H; J=13.6 Hz). $^{13}$C NMR (400MHz, $CDCl_3$); δ 170.11, 169.85, 164.34, 138.98, 128.6, 128.13, 127.40, 53.66, 43.79, 33.36, 31.89, 29.66, 26.73, 23,55, 16.52. HRMS (ESI-TOF) calcd: 419.0220 (M+H), found: 419.0210 (M+H).

$[\alpha]_{D^{25}}$= -3.4

**Quaternary Ammonium Salt sT3:**

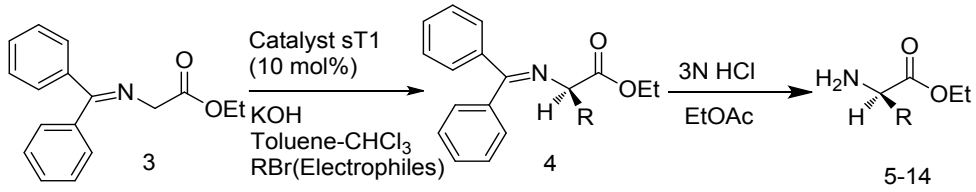


The catalyst **sT3** was synthesized from compound 1( 0.7 gm, 2.5 mmol) in a similar fashion adopted for the synthesis of sT2. Compound sT3 was obtained as dense oil. Yield 0.7 gm, 50%. HRMS (ESI-TOF) calcd for $C_{13}H_{18}Cl_3N_4$: 359.2552 ($M^+$), found: 359.2552 ($M^+$).

$^1$HNMR: (400MHz, $CDCl_3$); δ 7.32-7.24 (m, 5H); 6.15-6.13 (q, 1H; J=4.1 Hz); 3.40-3.28 (t, 4H; J=12.6 Hz); 1.88-1.84 (m, 6H); 1.64 (d, 3H; J=8Hz); 1.57 (m, 2H); $^{13}$C NMR (100MHz, $CDCl_3$); δ 168.6, 164.9, 164.3, 143.76, 132.00, 128.8, 125.4, 125.11, 50.66, 36.94, 22.55, 14.13.

$[\alpha]_{D^{25}}$= -2.32

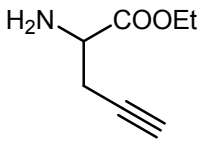
**General procedure for the Enantioselective Catalytic Alkylation of Protected Glycinnate Schiff Base.**




Alkyl bromide (12 mmol) was added to a solution of substrate **3** (10 mmol) and quaternary salt sT1(10 mol %) in toluene and $CHCl_3$ Mixture (1:1). 0.5 ml 50% KOH solution ( 5gm in dissolved water and make up 10 ml solution, w/v ) in water was added to the reaction mixture at -10 $^o$C and stirred for 6h. The reaction mixture was diluted with ethyl acetate (20 ml), washed with brine (3 X 5ml), dried over $Na_2SO_4$, filtered and concentrated under vaccum. The residue was purified by column chromatography and deprotect the Schiff base by 3N HCl to afford **5** to **15** respectively. The enantioselectivity was determined by chiral HPLC analysis.

**Characterization of alkylated products:**

**(5) Ethyl 2-aminopent-4-ynoate**

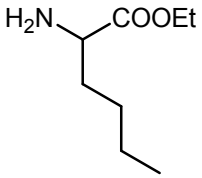



$^1$H NMR: (400 MHz, DMSO-d6); δ 8.65 (brs, 2H); 4.23-4.21 (q, 2H, J= 5 Hz), 4.21 (m, 1H); 3.12 (s, 1H); 2.88(d, 2H); 1.29 (t, 2H).

$^{13}$C NMR: (100 MHz, DMSO-d6): δ 169.18, 77.05, 75.65, 55.6, 50.22, 30.21, 18.92.

$[\alpha]_{D^{25}}$= -2.67

**(6) Ethyl 2-aminohexanoate**

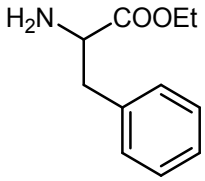



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.50 (brs, 2H); 4.18-4.14 (t, 1H; J=10 Hz); 3.89-3.88 (q, 2H; J= 2.5 Hz); 1.36 (m, 2H); 1.29 (m, 4H); 1.21 (t, 3H; J= 3.6 Hz); 0.83-0.81 (t, 3H; J=5 Hz).

$^{13}$C NMR: (100 MHz, DMSO-d6); δ 168.01, 60.90, 60.17, 39.22, 32.69, 28.23, 22.52, 14.41.

$[\alpha]_{D^{25}}$= -1.33

**(7) Ethyl 2-amino-3-phenylpropanoate**

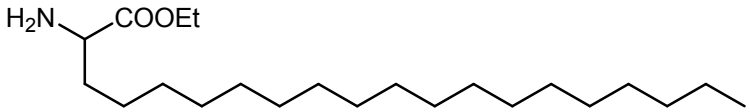



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.61 (brs, 2H); 7.33-7.24 (m, 5H); 4.31 (m, 1H); 4.24-4.18 (q, 2H; J=2Hz); 3.21-3.19 (m, 2H); 1.09-1.06 (t, 3H, J=3.2 Hz).

$^{13}$C NMR: (100 MHz, DMSO-d6); δ 169.01; 134.6; 129.56; 128.52; 127.16; 61.52; 52.71; 38.87; 13.71.

$[\alpha]_{D^{25}}$= -0.87

**(8) Ethyl 2-aminoicosanoate**

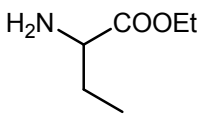



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.22 (brs, 2H); 4.18-4.13 (m, 1H); 4.18-4.13 (q, 2H; J=3.2 Hz); 3.7-3.4 (m, 2H); 1.22 (s, 32H); 1.20-1.18 (t, 3H; J=5 Hz); 0.93-0.83 (t, 3H; J= Hz)

$^{13}$C NMR: (100 MHz, DMSO-d6): δ 168.5; 61.8; 61.5; 29.47; 29.48; 22.67; 14.4; 13.8.

$[\alpha]_{D^{25}}$= -4.11

**(9) Ethyl 2-aminobutanoate**

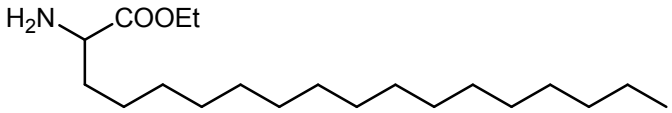



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.56 (brs, 2H); 4.23-4.20 (t, 1H; J=7.4 Hz); 3.98-3.93 (q, 2H; J=2.5 Hz); 1.92-1.91 (m, 2H); 1.18-1.20 (t, 3H; J=2.5 Hz), 1.09-.0.98 (t, 3H; J=4 Hz).

$^{13}$C NMR: (100 MHz, DMSO-d6); δ 170.82; 61.93; 60.26; 21.12; 14.50; 14.29.

$[\alpha]_{D^{25}}$= -1.11

**(10) Ethyl 2-aminooctadecanoate**

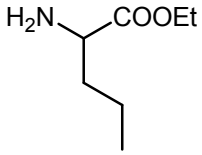



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 7.93 (brs, 2H); 4.16-4.10 (m, 3H); 2.73-2.48 (m, 2H); 1.22 (s, 28H); 1.05-1.01 (t, 3H; J=2.5 Hz); 0.85-0.81 (t, 3H; J=4 Hz).

$^{13}$C NMR: (100 MHz, DMSO-d6); δ 166.11, 60.90; 55.71; 40.12; 31.30; 29.06; 28.89; 28.62; 28.57; 22.10; 14.13; 13.61.

$[\alpha]_{D^{25}}$= -0.46

**(11) Ethyl 2-aminopentanoate**

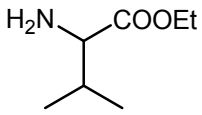



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.60 (brs, 2H); 4.19-4.14 (t, 1H; J=2 Hz); 3.75 (q, 2H; J=2.5 Hz); 2.48-2.26 (m, 2H); 1.21 (m, 2H); 1.20-1.19 (t, 3H; J= 2 Hz); 0.83-0.81 (t, 3H; J= 2.4 Hz).

$^{13}$C NMR: (100 MHz, DMSO-d6); δ 167.52; 61.52; 51.78; 30.10; 13.89; 22.32; 13.91; 13.65.

$[\alpha]_{D^{25}}$= -2.21

**(12) Ethyl 2-amino-3-methylbutanoate**

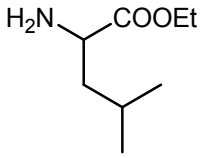



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.56 (brs, 2H); 4.14-4.12 (q, 2H; J= 2.5 Hz); 3.72-3.69 (m, 2H); 1.17-1.15 (t, 3H; J= 2 Hz); 0.98-0.96 (d, 6H; J=10 Hz).

$^{13}$C NMR: (100 MHz, DMSO-d6); δ 167.98; 62.46; 61.98; 40.14; 25.92; 14.44.

$[\alpha]_{D^{25}}$ = -1.33

**(13) Ethyl 2-amino-4-methylpentanoate**

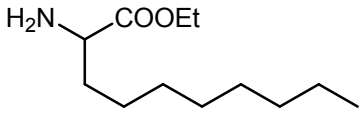



$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.46 (brs, 2H); 4.14-4.12 (q, 2H; J=2.5 Hz); 3.72- 3.67 (m, 1H); 2.83 (m, 1H); 2.28-1.96 (m, 2H); 1.17-1.15 (t, 3H; J=2.5 Hz); 0.98-0.93 (d, 6H; J=8 Hz)

$^{13}$C NMR: (100 MHz, DMSo-d6): δ 167.84; 6189; 51.52; 30.38; 23.71; 22.29; 13.52.

$[\alpha]_{D}^{25}$= -1.37

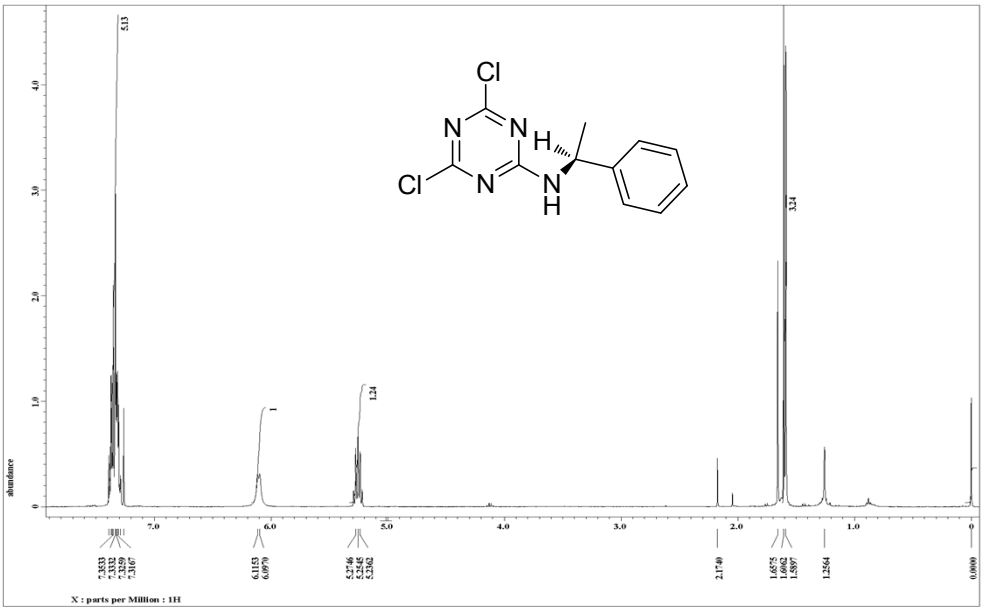
**(14) Ethyl 2-aminodecanoate**



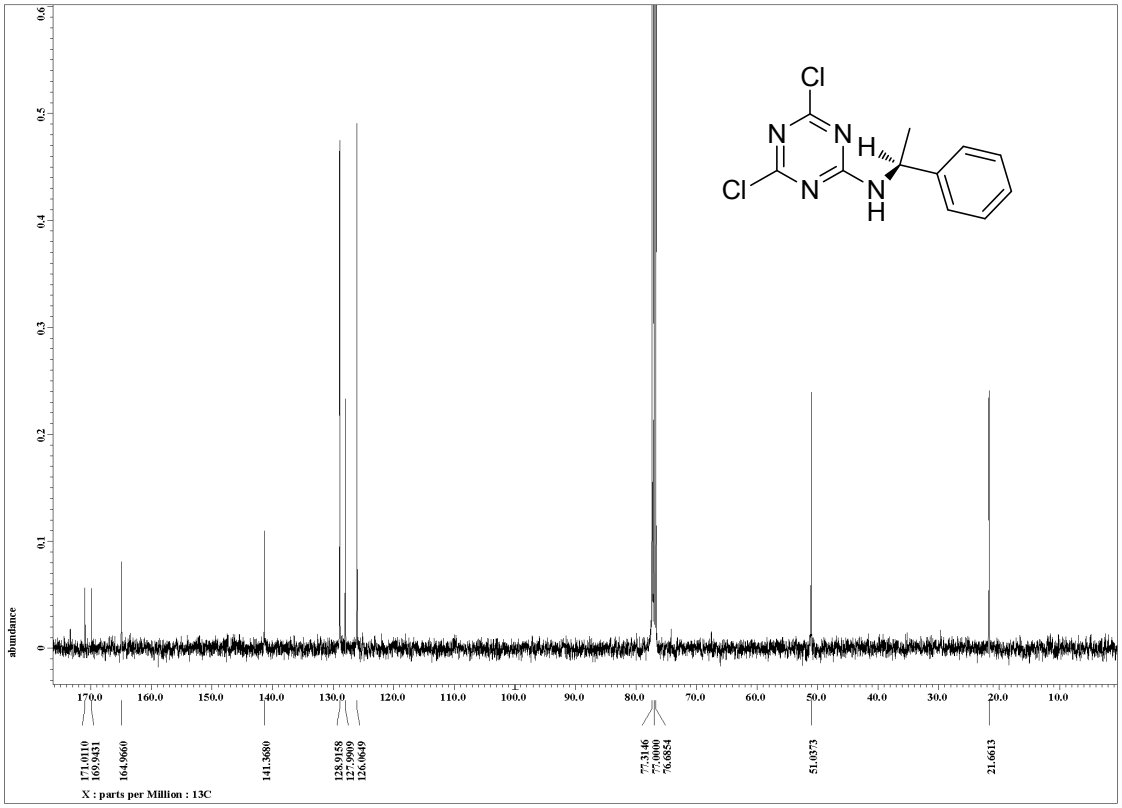

$^{1}$H NMR: (400 MHz, DMSO-d6); δ 8.00 (brs, 2H); 4.00-3.94 (m, 1H); 4.00-3.94 (q, 2H; J=3 Hz); 3.12 (m, 2H); 1.68 (s, 10H); 1.12-1.06 (t, 3H; J=4.5 Hz); 0.75- 0.71 (t, 3H; J=3.5 Hz).

$^{13}$C NMR: (100 MHz, DMSO-d6); δ 174.18; 59.86; 55.97; 40.36; 30.64; 31.26; 30.62; 28.84; 28.71; 26.28; 22.13; 13.91; 12.59. $[\alpha]_{D}^{25}$= -1.89

## $^{1}$H NMR spectra of compound 1.




## $^{13}$C NMR spectra of compound 1



# Mass spectra of Compound 1

## Qualitative Compound Report

| | | | |
|---|---|---|---|
| **Data File** | ST 01.d | **Sample Name** | ST 01 |
| **Sample Type** | Sample | **Position** | P2-C9 |
| **Instrument Name** | Instrument 1 | **User Name** | |
| **Acq Method** | 29.10.2014.m | **Acquired Time** | 11-05-2015 15:48:49 |
| **IRM Calibration Status** | Success | **DA Method** | Default.m |
| **Comment** | | | |

**Info.**

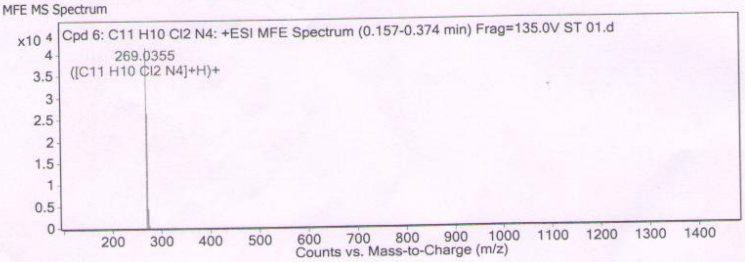
| | |
|---|---|
| **Sample Group** | |
| **Acquisition SW Version** | 6200 series TOF/6500 series Q-TOF B.05.01 (B5125) |

**Compound Table**

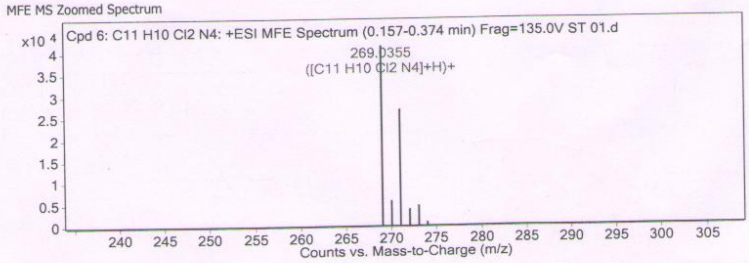
| Compound Label | RT | Mass | Formula | MFG Formula | MFG Diff (ppm) | DB Formula |
|---|---|---|---|---|---|---|
| Cpd 6: C11 H10 Cl2 N4 | 0.209 | 268.0285 | C11 H10 Cl2 N4 | C11 H10 Cl2 N4 | -1.03 | C11 H10 Cl2 N4 |

| Compound Label | *m/z* | RT | Algorithm | Mass |
|---|---|---|---|---|
| Cpd 6: C11 H10 Cl2 N4 | 269.0355 | 0.209 | Find by Molecular Feature | 268.0285 |

MFE MS Spectrum




MFE MS Zoomed Spectrum

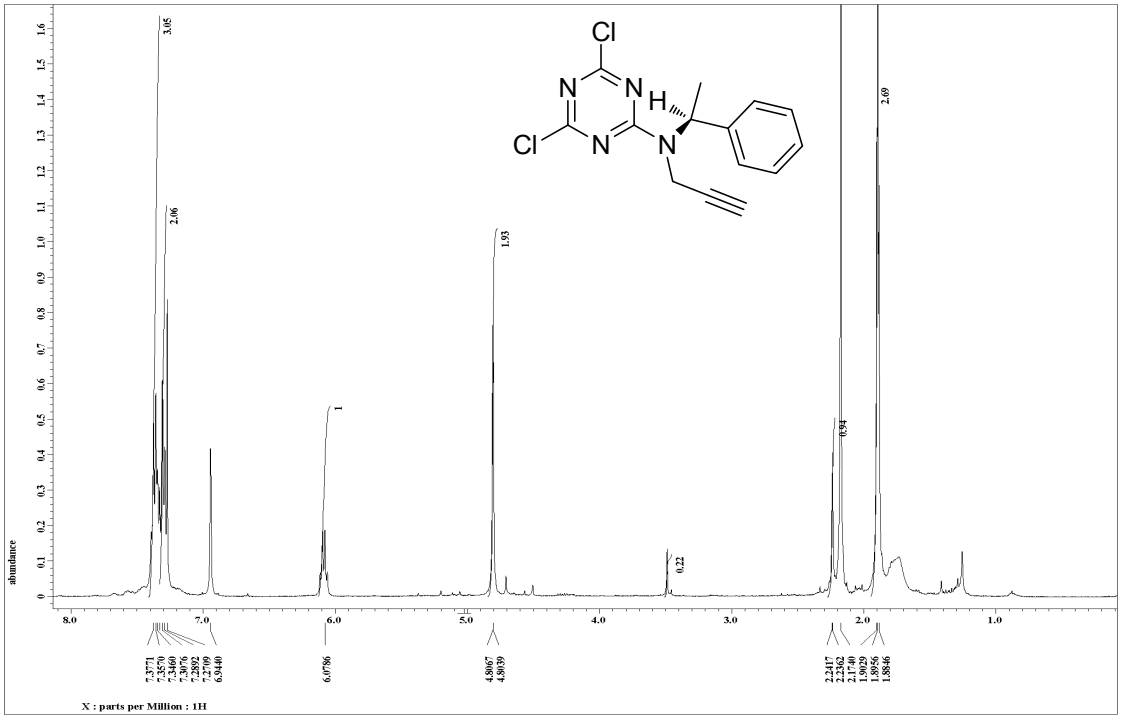



**MS Spectrum Peak List**

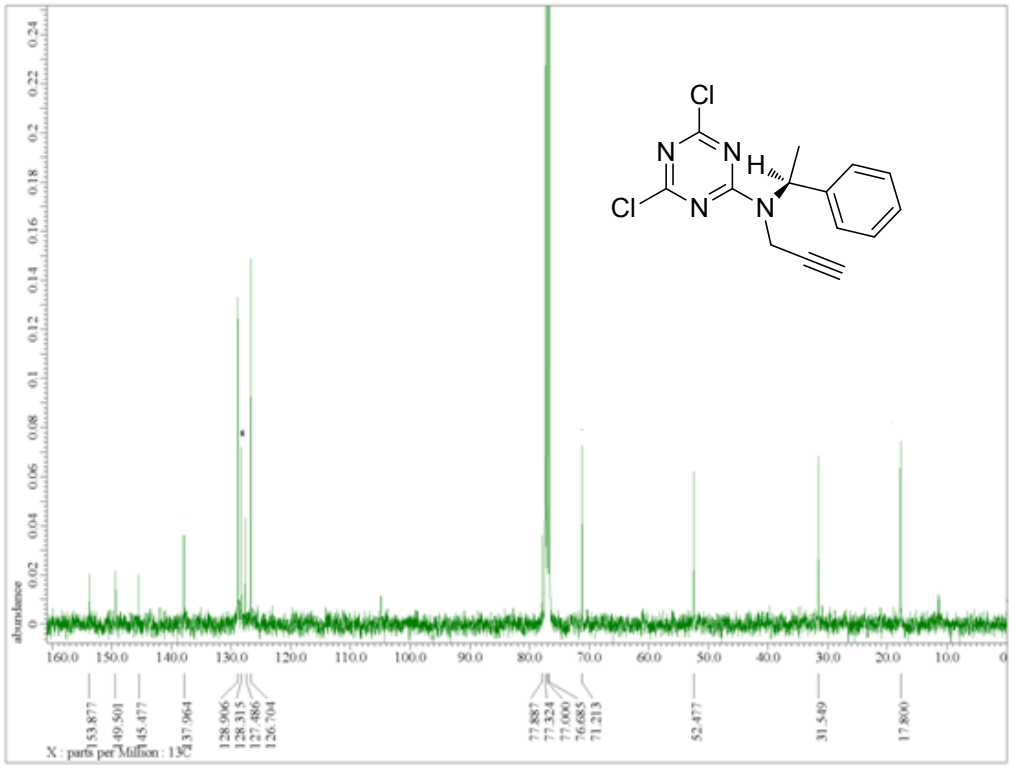
| *m/z* | z | Abund | Formula | Ion |
|---|---|---|---|---|
| 269.0355 | 1 | 41527.85 | C11 H10 Cl2 N4 | (M+H)+ |
| 270.0381 | 1 | 5702.59 | C11 H10 Cl2 N4 | (M+H)+ |
| 271.0334 | 1 | 26608.13 | C11 H10 Cl2 N4 | (M+H)+ |
| 272.0361 | 1 | 3594.1 | C11 H10 Cl2 N4 | (M+H)+ |
| 273.0298 | 1 | 4517.17 | C11 H10 Cl2 N4 | (M+H)+ |
| 274.0337 | 1 | 561.22 | C11 H10 Cl2 N4 | (M+H)+ |

--- End Of Report ---

## $^{1}$H NMR spectra of compound 2




## $^{13}$C NMR spectra of compound 2

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# Mass spectra of compound 2

## Qualitative Compound Report

| | | | |
|---|---|---|---|
| **Data File** | .ST 11.d | **Sample Name** | ST 11 |
| **Sample Type** | Sample | **Position** | P2-F5 |
| **Instrument Name** | Instrument 1 | **User Name** | |
| **Acq Method** | 29.10.2014.m | **Acquired Time** | 13-05-2015 16:08:59 |
| **IRM Calibration Status** | Success | **DA Method** | Default.m |
| **Comment** | | | |

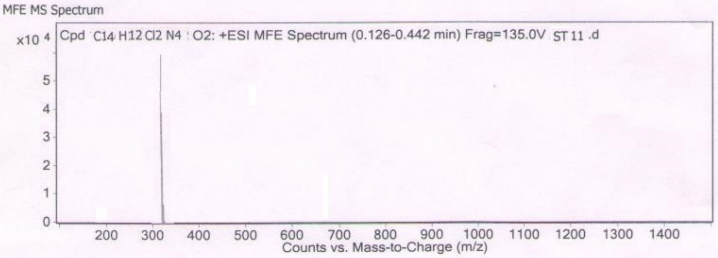
| | | | |
|---|---|---|---|
| **Sample Group** | | **Info.** | |
| **Acquisition SW Version** | 6200 series TOF/6500 series Q-TOF B.05.01 (B5125) | | |

**Compound Table**

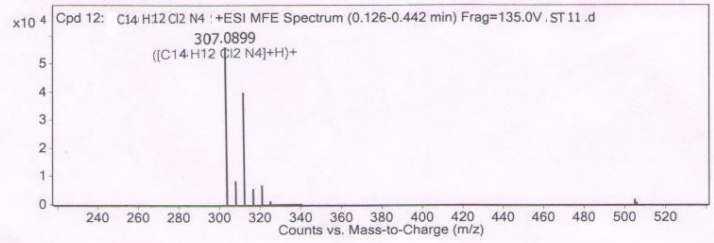
| Compound Label | RT | Mass | Formula | MFG Formula | MFG Diff (ppm) | DB Formula |
|---|---|---|---|---|---|---|
| Cpd 6: C14 H12 Cl2 N4 | 0.206 | 307.0899 | C14 H12 Cl2 N4 | C14 H12 Cl2 N4 | 0.03 | C14 H12 Cl2 N4 |

| Compound Label | *m/z* | RT | Algorithm | Mass |
|---|---|---|---|---|
| Cpd 12: C14 H12 Cl2 N4 | 253.0971 | 0.206 | Find by Molecular Feature | 307.0899 |

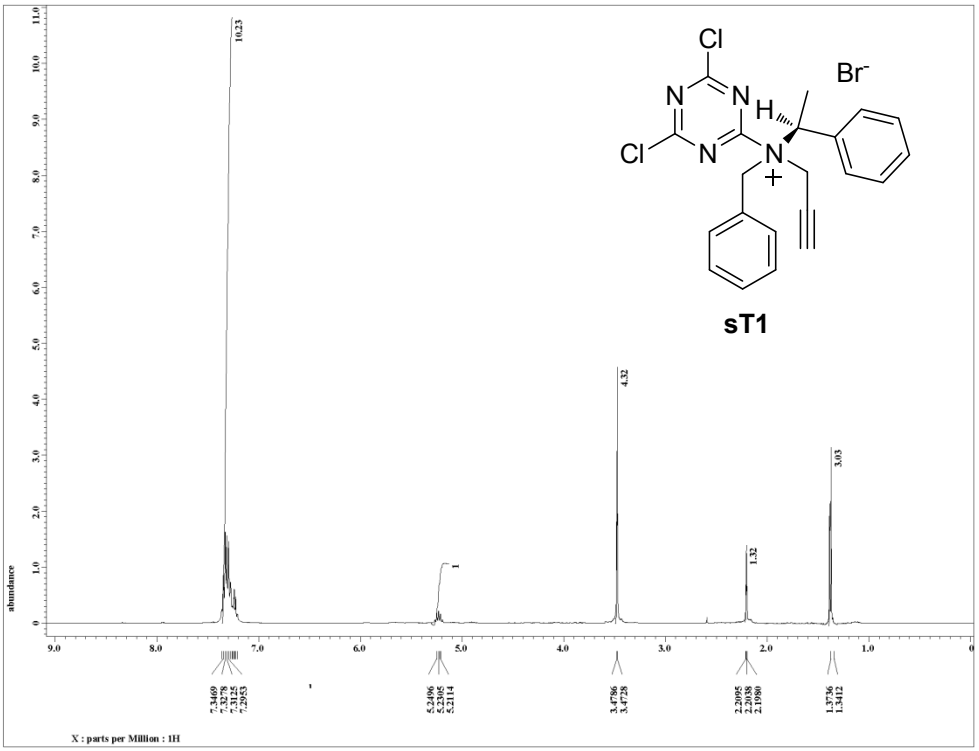
MFE MS Spectrum



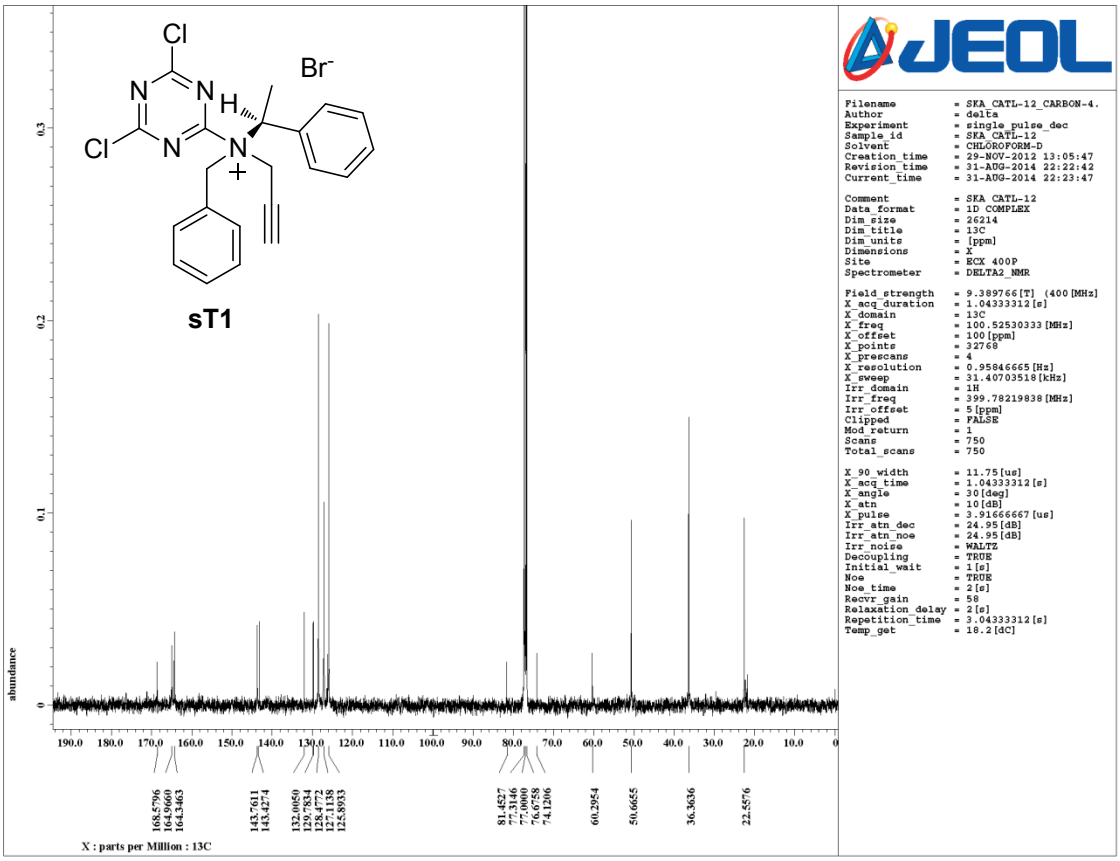

MFE MS Zoomed Spectrum



## $^{1}$H NMR spectra of compound sT1




## $^{13}$C NMR spectra of compound sT1

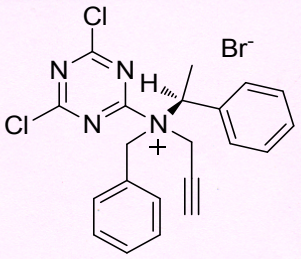


# Mass Specta of compound sT1

## Qualitative Compound Report

| | | | |
|---|---|---|---|
| **Data File** | ST-6C.d | **Sample Name** | ST-6C |
| **Sample Type** | Sample | **Position** | P1A4 |
| **Instrument Name** | 6530 QTOF LCMS | **User Name** | lcmsdu-PC\admin |
| **Acq Method** | Union.m | **Acquired Time** | 11-05-2015 15:03:23 |
| **IRM Calibration Status** | Success | **DA Method** | Default.m |
| **Comment** | | | |

| | |
|---|---|
| **Sample Group** | **Info.** |
| **Acquisition SW Version** | 6200 series TOF/6500 series Q-TOF B.05.01 (B5125) |



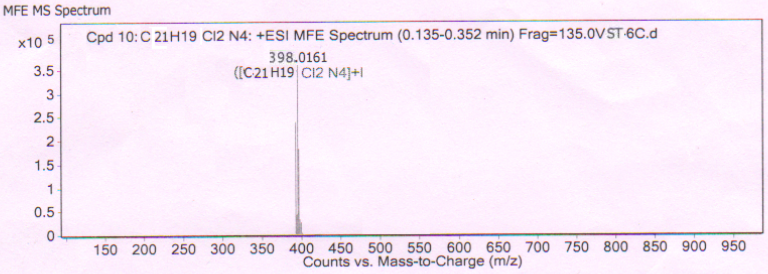

**sT1**

**Compound Table**

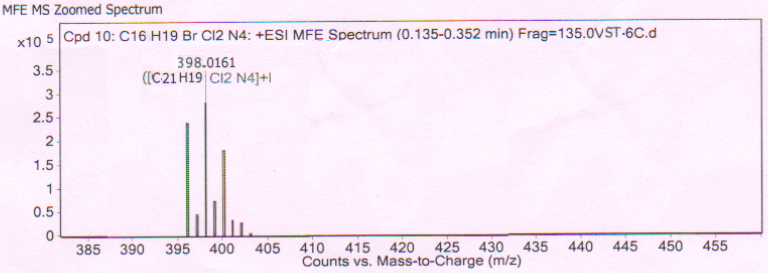
| Compound Label | RT | Mass | Formula | MFG Formula | MFG Diff (ppm) | DB Formula |
|---|---|---|---|---|---|---|
| Cpd 10: C21 H19 Cl2 N4 | 0.192 | 398.0161 | C21 H19 Cl2 N4 | C21 H19 Cl2 N4 | 2.29 | C21 H19 Cl2 N4 |

| Compound Label | *m/z* | RT | Algorithm | Mass |
|---|---|---|---|---|
| Cpd 10: C21 H19 Cl2 N4 | 399.0233 | 0.192 | Find by Molecular Feature | 398.0161 |

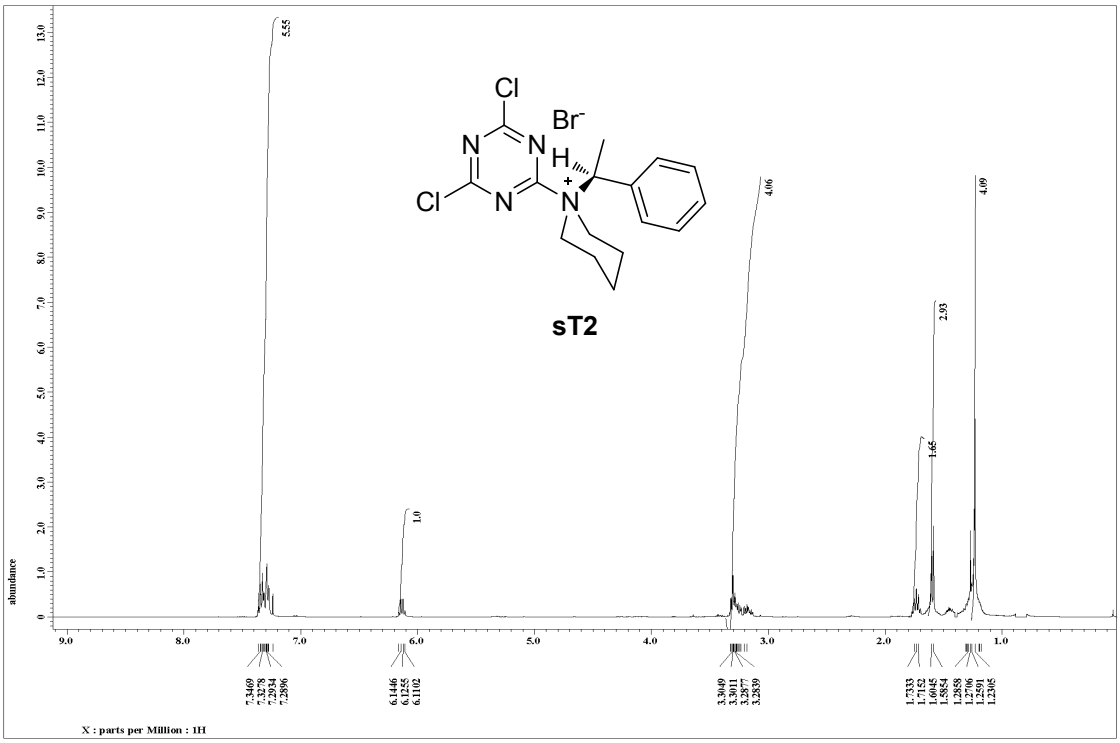
MFE MS Spectrum



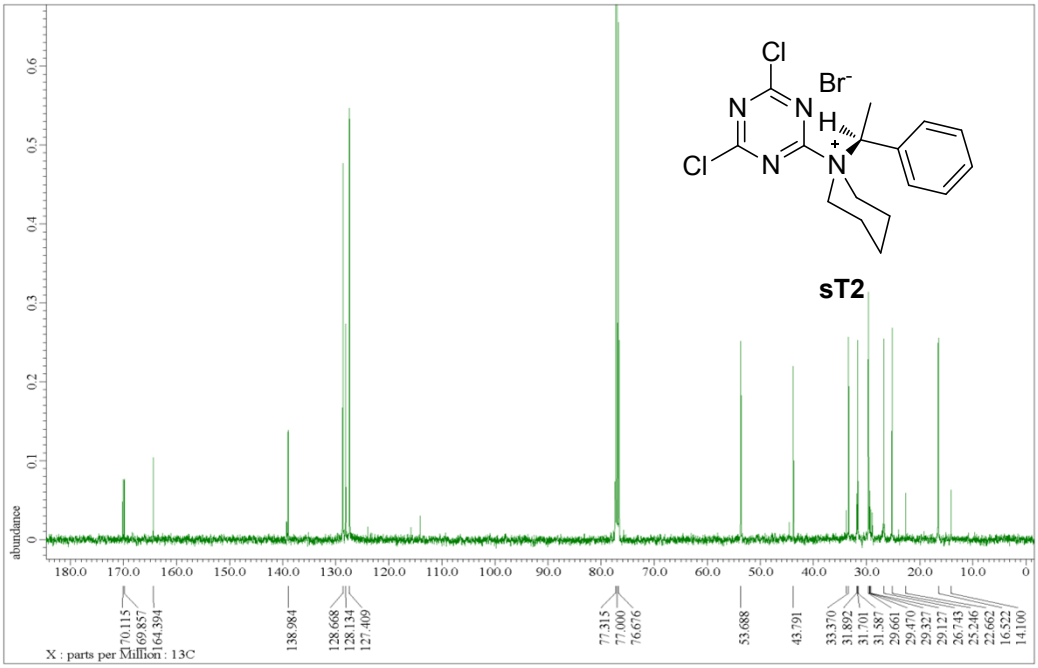

MFE MS Zoomed Spectrum



## $^{1}$H NMR Spectra of compound sT2




## 13C NMR Spectra of sT2

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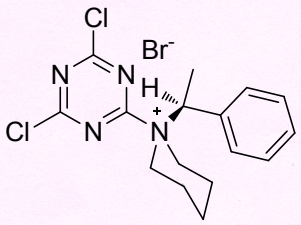
# Mass Spectra of sT2

## Qualitative Compound Report

| | | | |
|---|---|---|---|
| **Data File** | Q-6C.d | **Sample Name** | Q-6C |
| **Sample Type** | Sample | **Position** | P1A4 |
| **Instrument Name** | 6530 QTOF LCMS | **User Name** | lcmsdu-PC\admin |
| **Acq Method** | Union.m | **Acquired Time** | 09-09-2014 15:03:23 |
| **IRM Calibration Status** | Success | **DA Method** | Default.m |
| **Comment** | | | |

| | |
|---|---|
| **Sample Group** | **Info.** |
| **Acquisition SW Version** | 6200 series TOF/6500 series Q-TOF B.05.01 (B5125) |



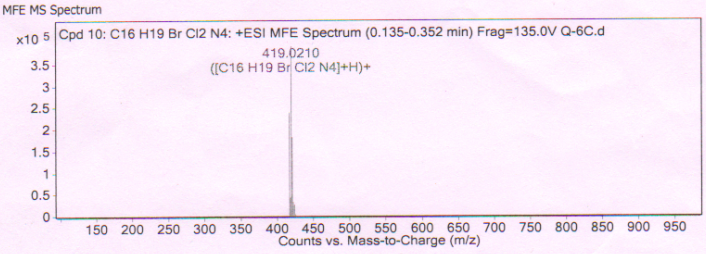

**sT2**

**Compound Table**

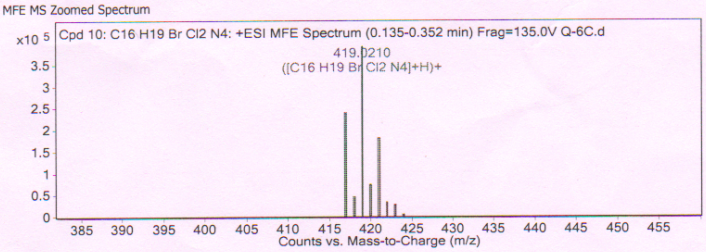
| Compound Label | RT | Mass | Formula | MFG Formula | MFG Diff (ppm) | DB Formula |
|---|---|---|---|---|---|---|
| Cpd 10: C16 H19 Br Cl2 N4 | 0.192 | 416.0161 | C16 H19 Br Cl2 N4 | C16 H19 Br Cl2 N4 | 2.29 | C16 H19 Br Cl2 N4 |

| Compound Label | *m/z* | RT | Algorithm | Mass |
|---|---|---|---|---|
| Cpd 10: C16 H19 Br Cl2 N4 | 417.0233 | 0.192 | Find by Molecular Feature | 416.0161 |

MFE MS Spectrum




MFE MS Zoomed Spectrum

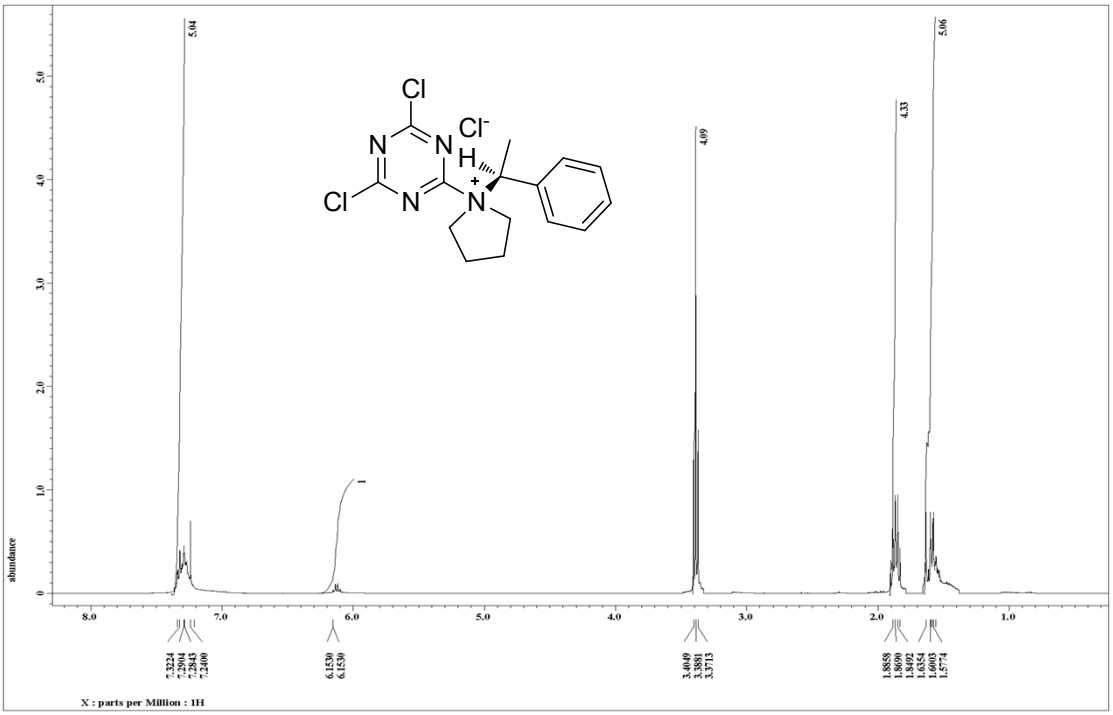



**MS Spectrum Peak List**

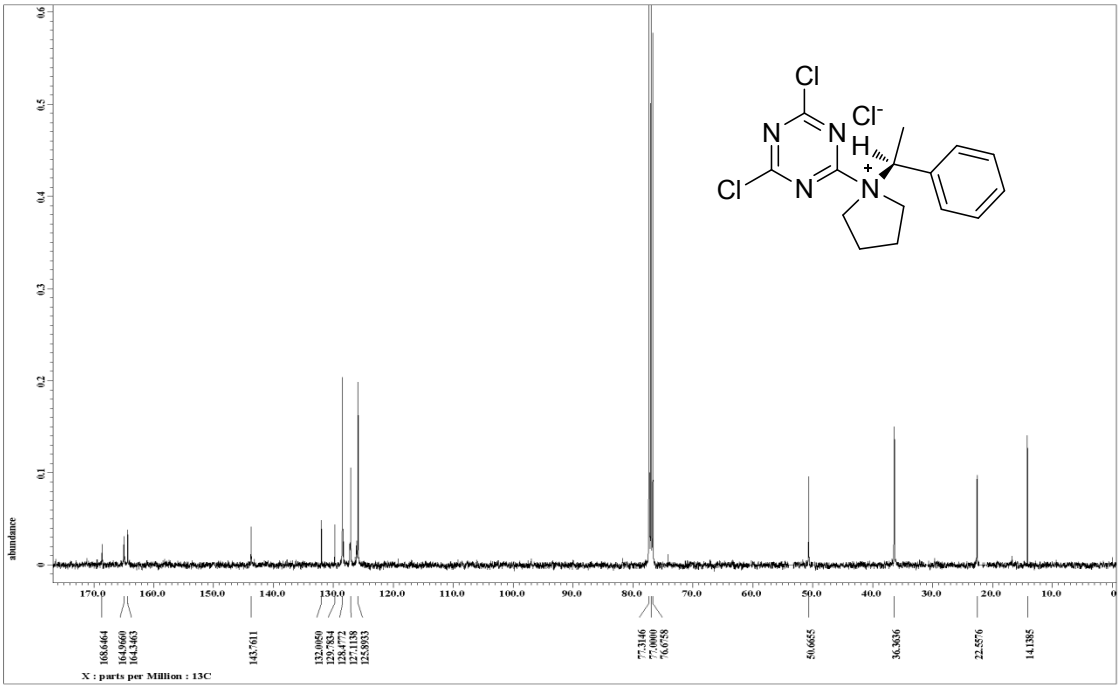
| *m/z* | z | Abund | Formula | Ion |
|---|---|---|---|---|
| 417.0233 | 1 | 239485.94 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 418.0262 | 1 | 43137.15 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 419.021 | 1 | 392155.13 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 420.0239 | 1 | 72592.36 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 421.0185 | 1 | 181707.64 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 422.0212 | 1 | 32557.84 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 423.0173 | 1 | 25940.88 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 424.0193 | 1 | 4585.62 | C16 H19 Br Cl2 N4 | (M+H)+ |
| 425.028 | 1 | 292.23 | C16 H19 Br Cl2 N4 | (M+H)+ |

--- End Of Report ---

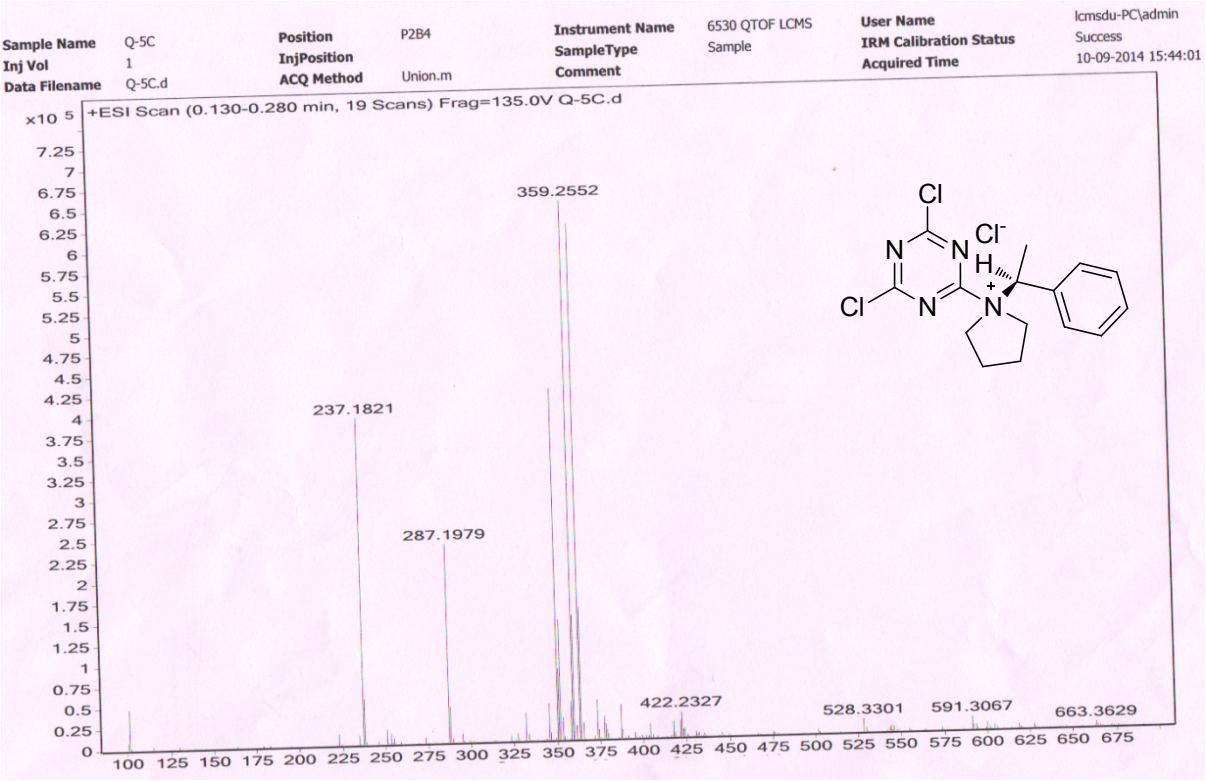
## $^{1}$H NMR spectra of compound sT3



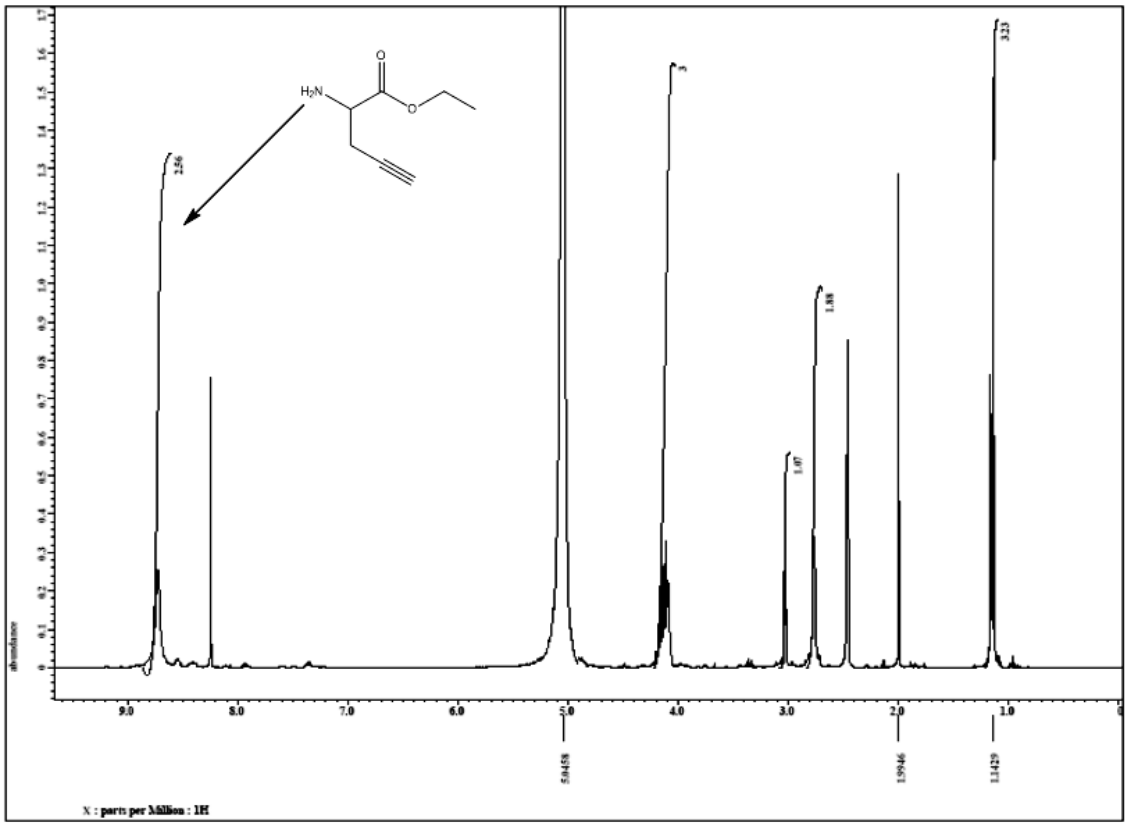

## $^{13}$C NMR of compound sT3



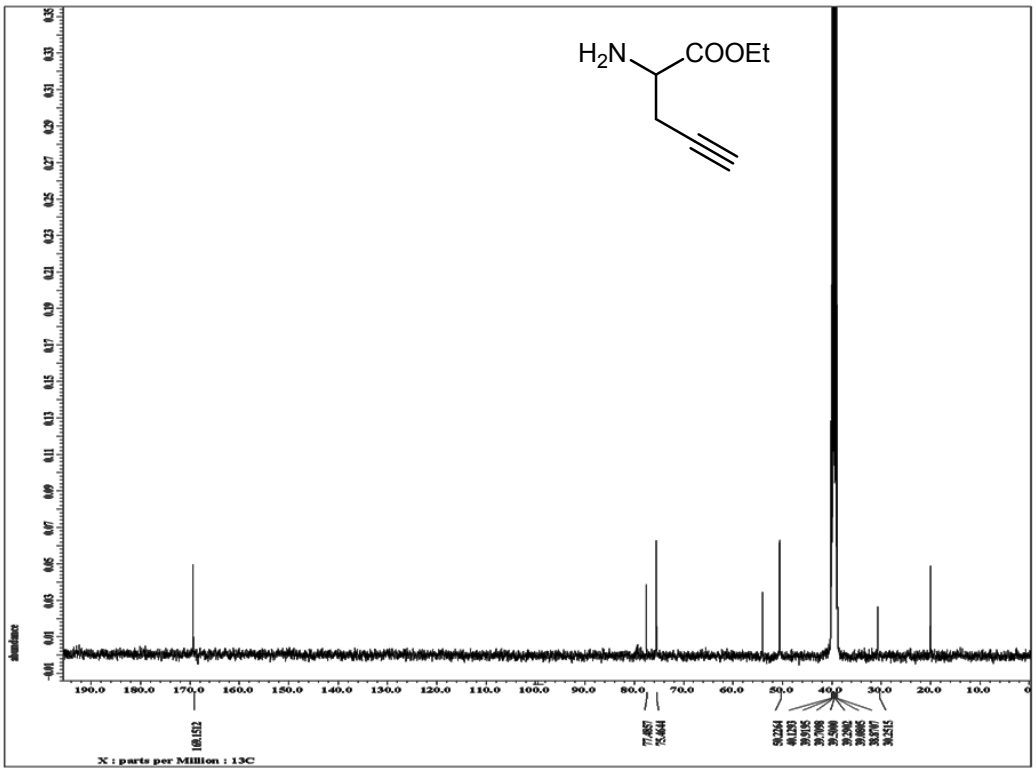
## Mass spectra of sT3



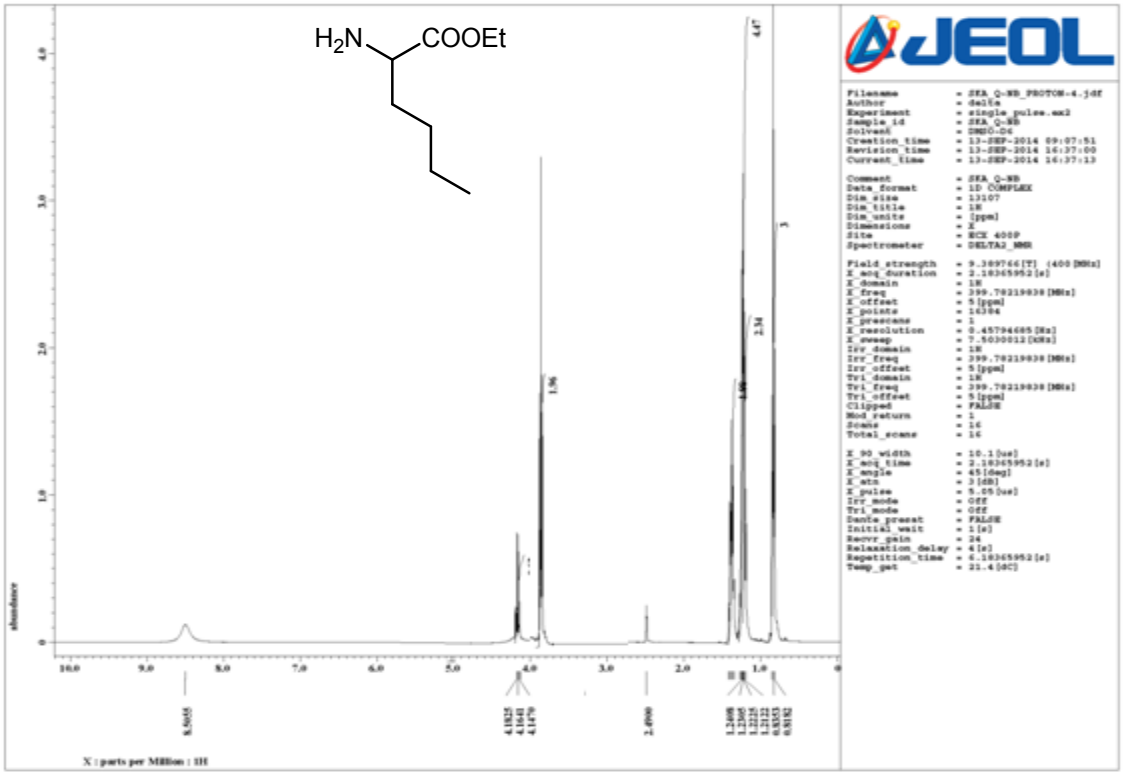

## $^{1}$H NMR spectra of product 5



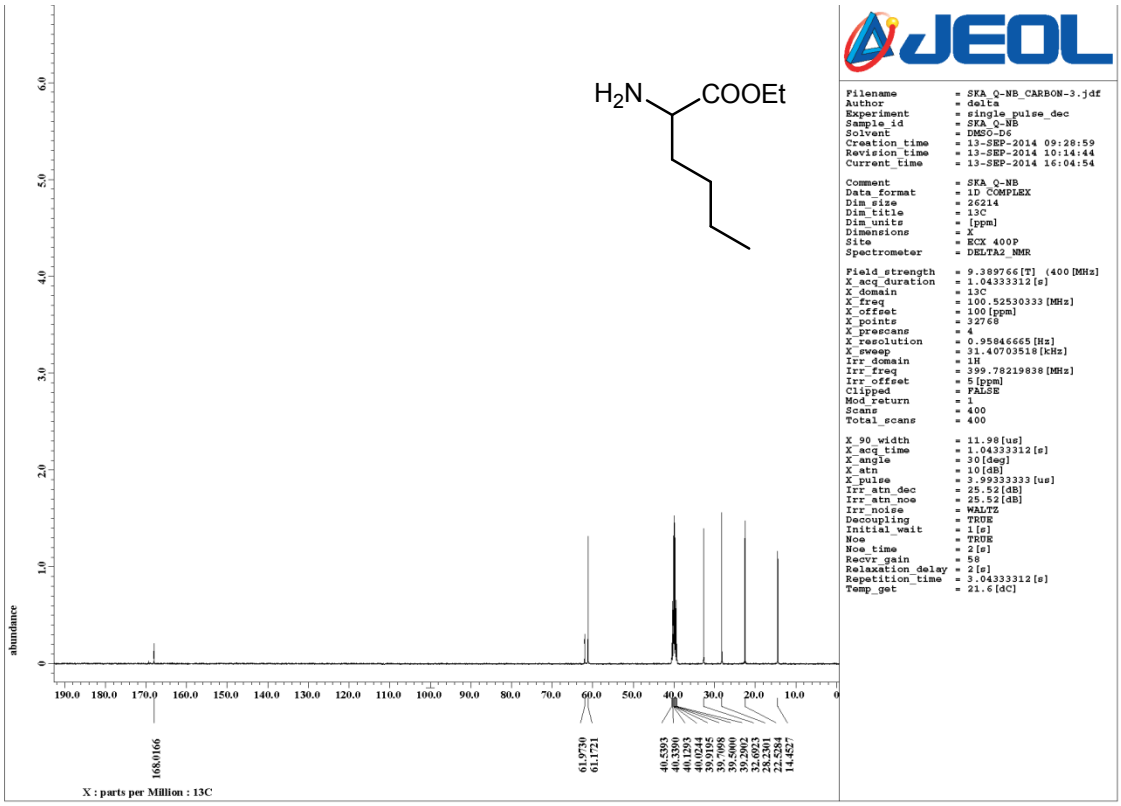
## $^{13}$C NMR spectra of product 5



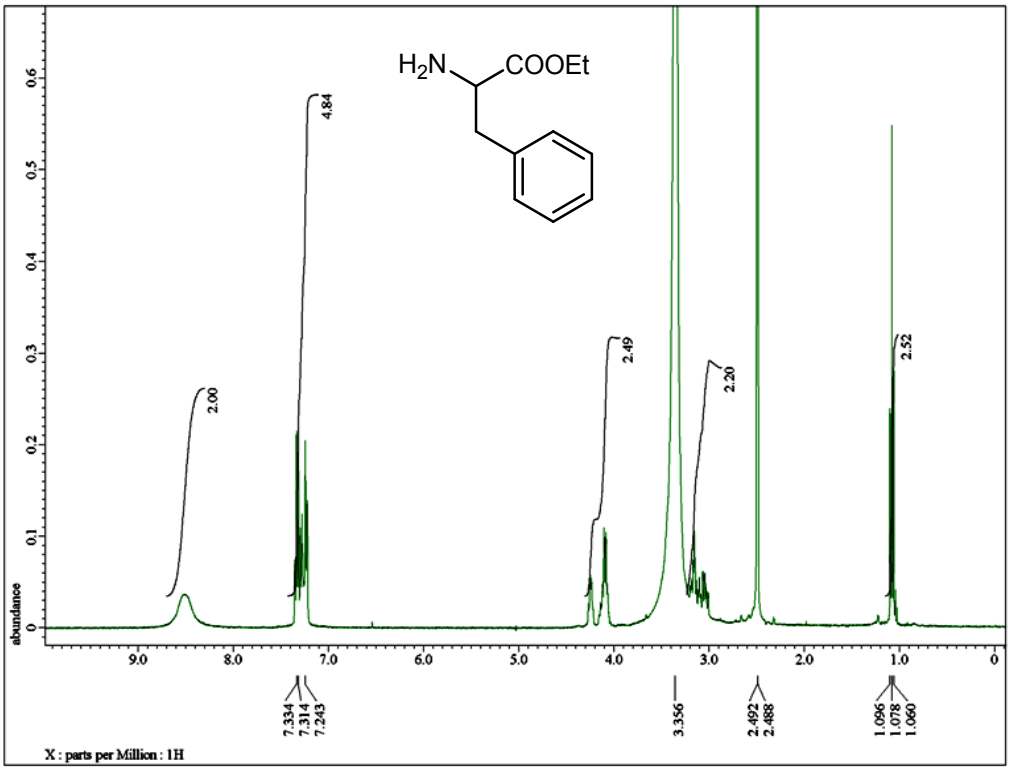

## $^{1}$H NMR spectra of product 6



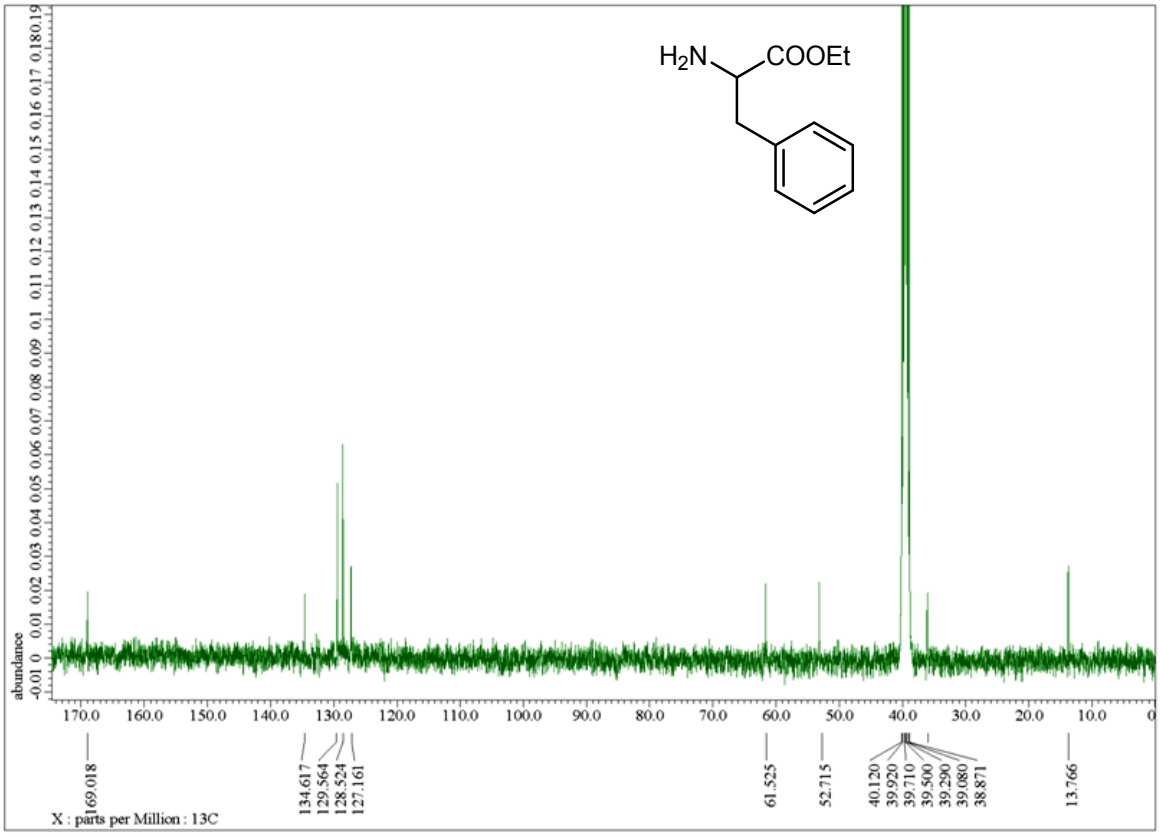
## $^{13}$C NMR spectra of product 6




## $^{1}$H NMR spectra of product 7



## $^{13}$C NMR spectra of product 7

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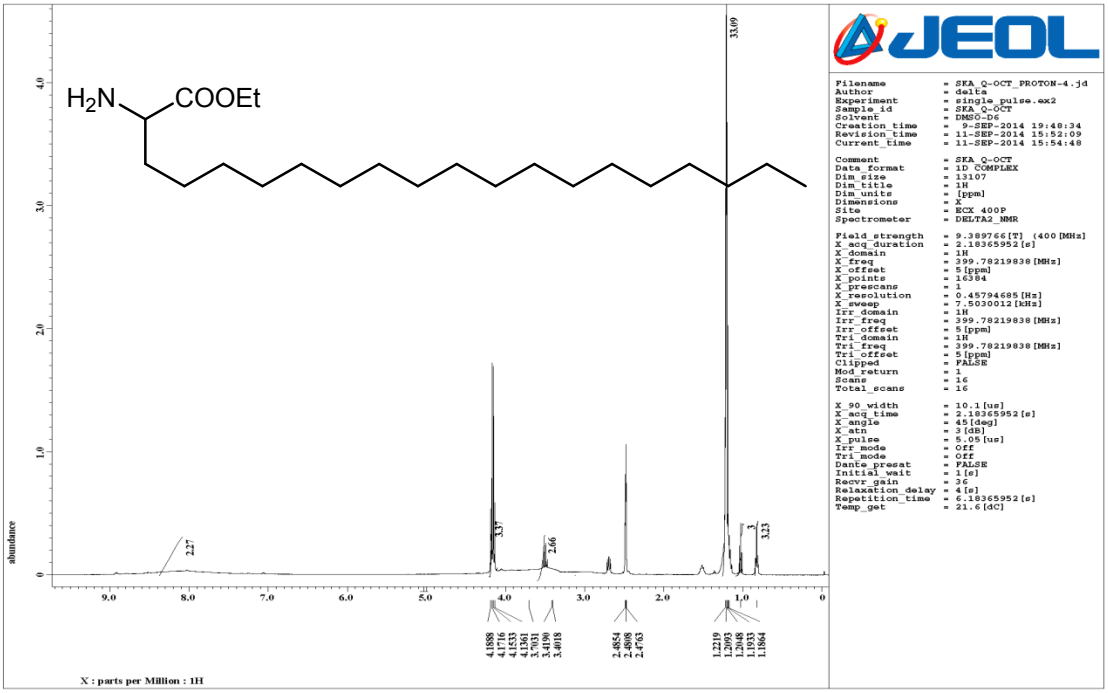
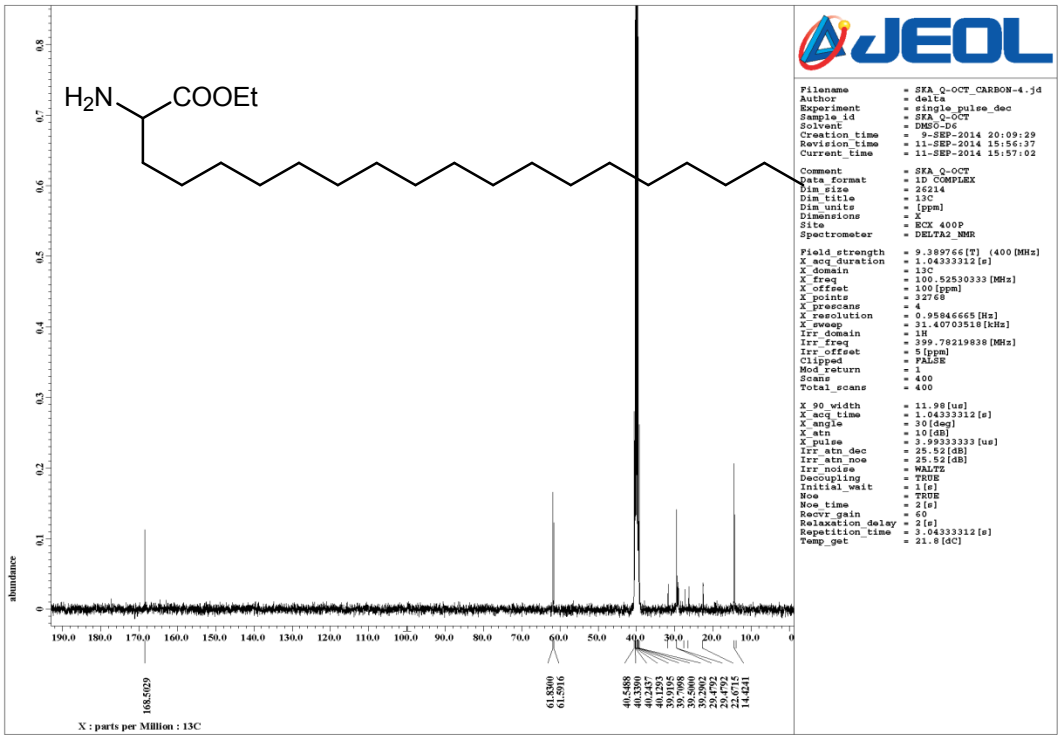
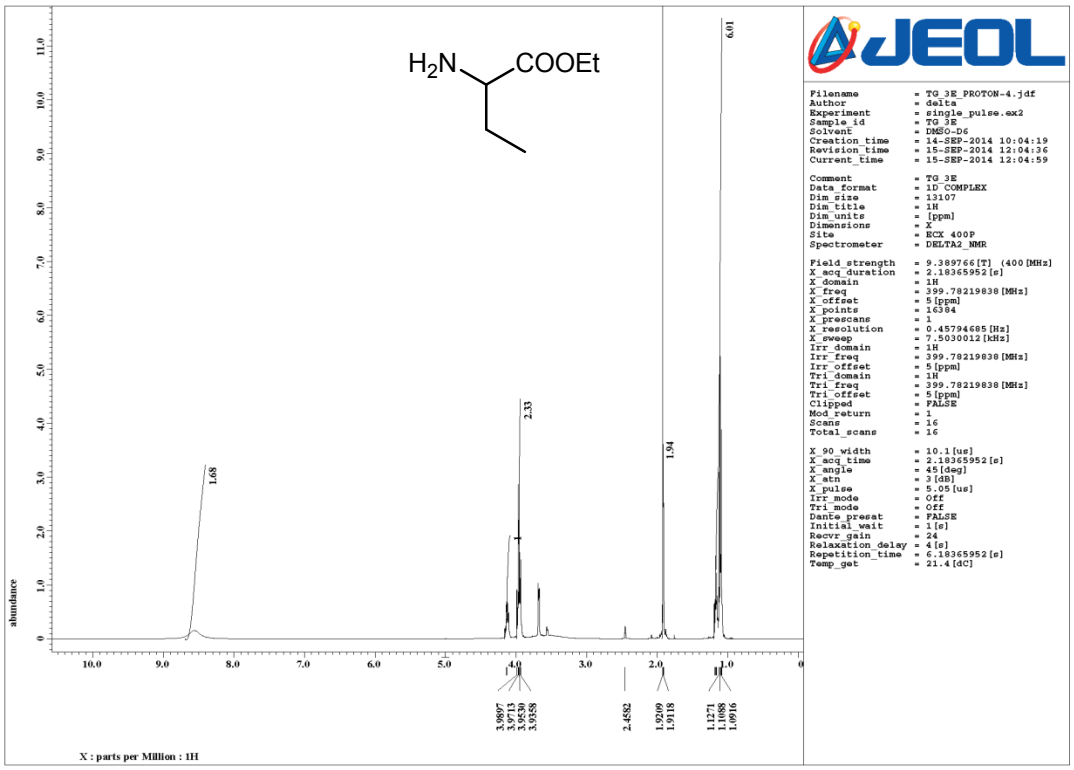
## $^{1}$H NMR spectra of product 8



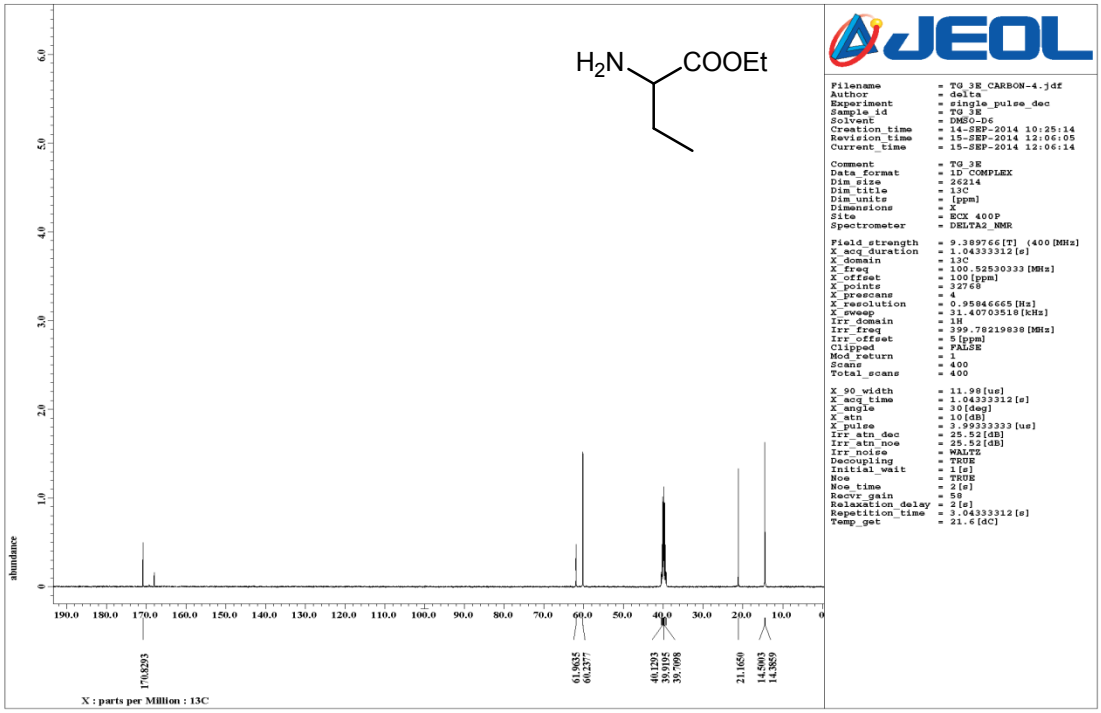
## $^{13}$C NMR spectra of product 8



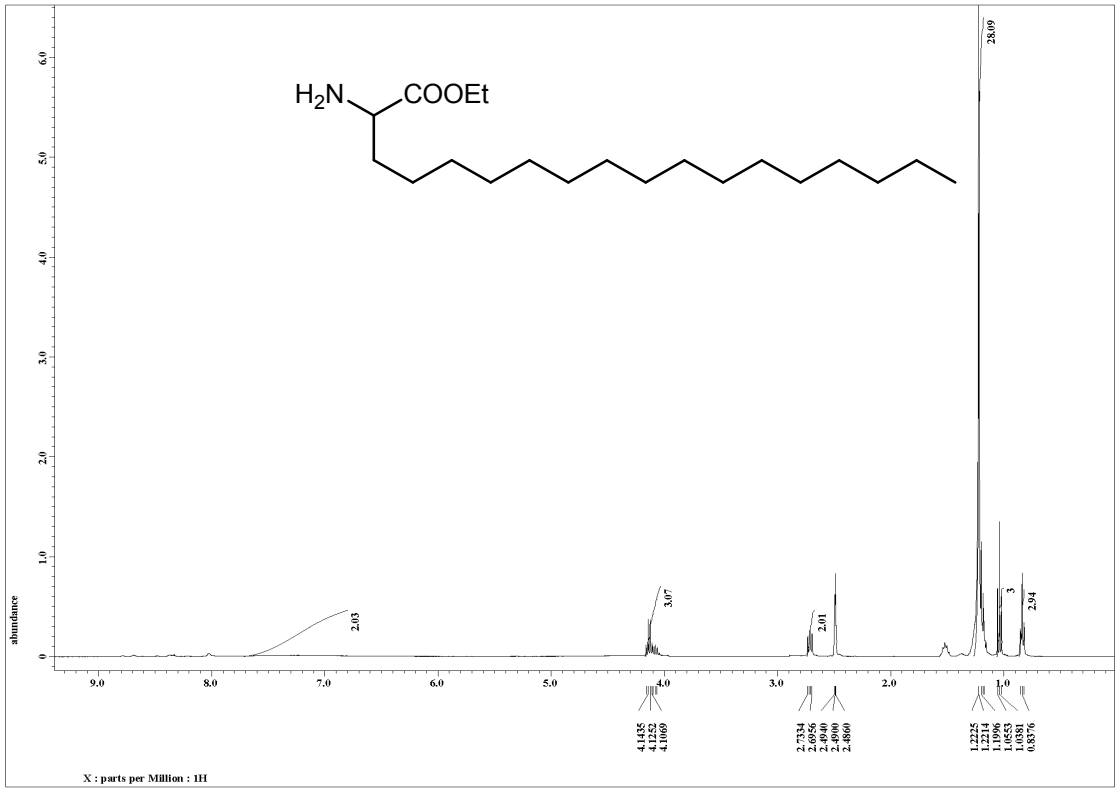

## $^{1}$H NMR spectra of product 9



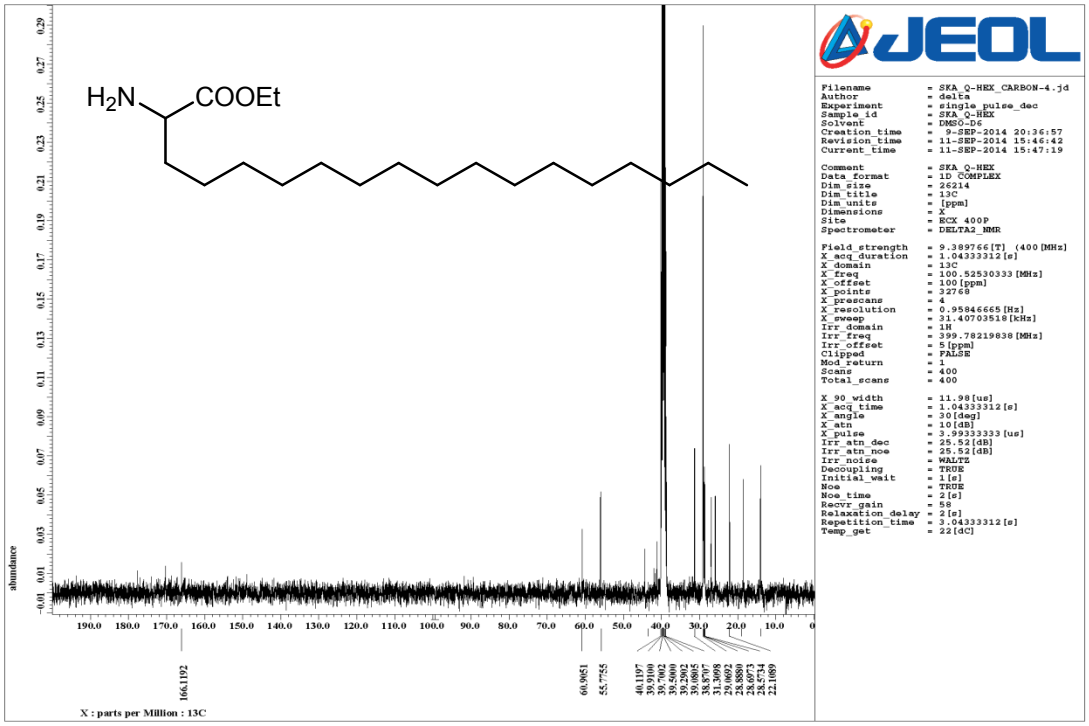
## $^{13}$C NMR spectra of product 9



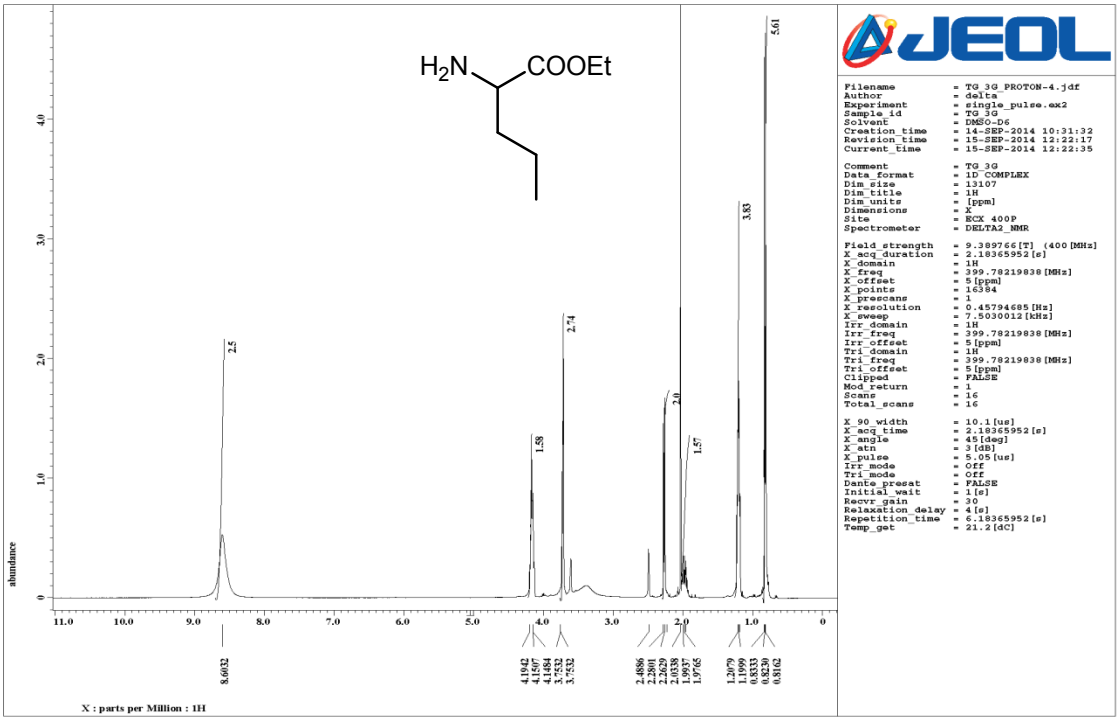

## $^{1}$HNMR spectra of product 10



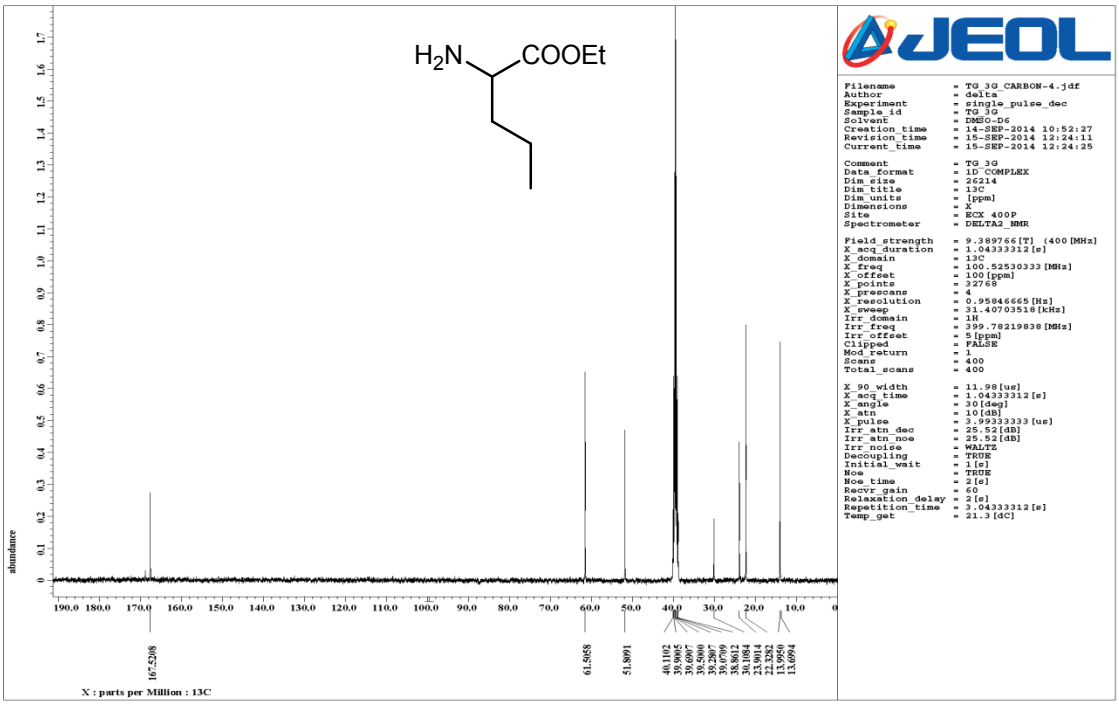
## $^{13}$C NMR spectra of product 10



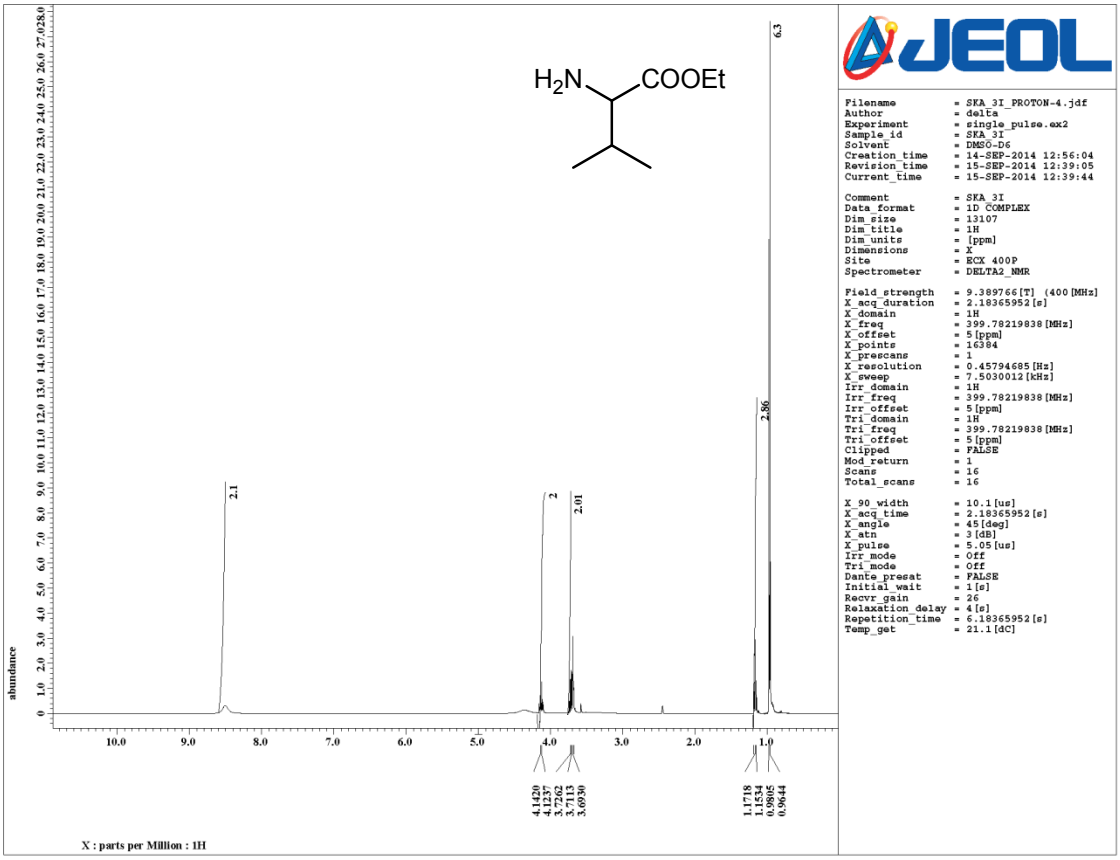

## $^{1}$H NMR spectra of product 11



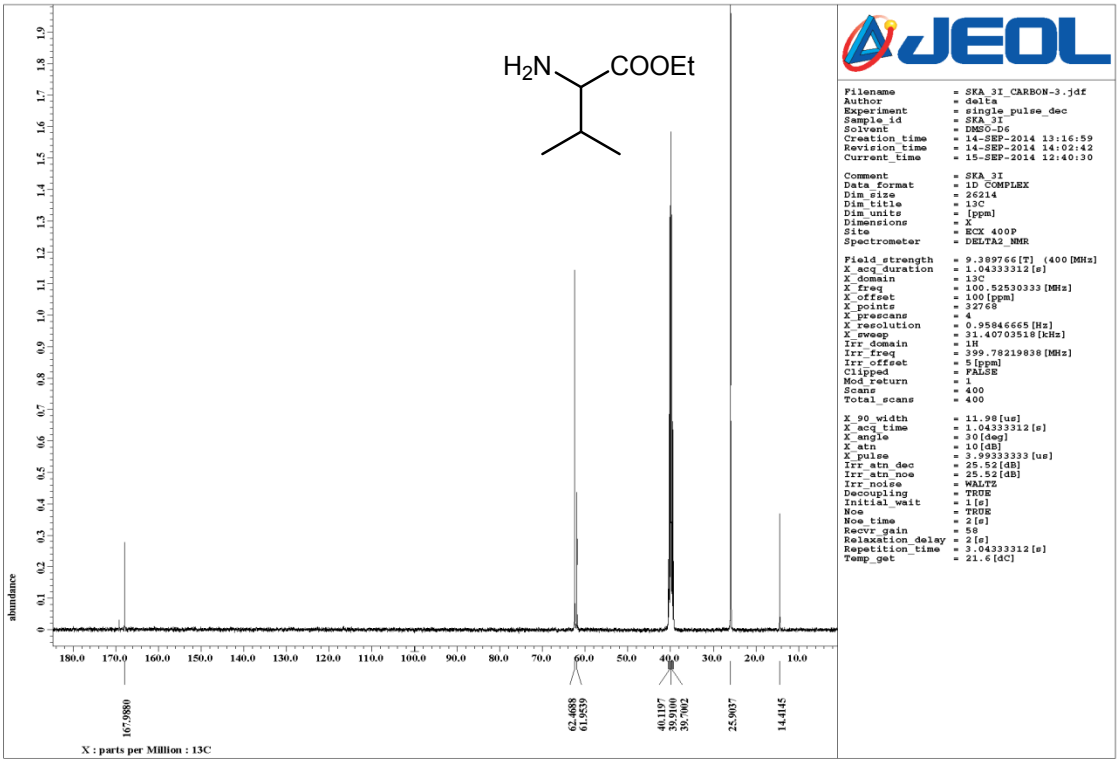
## $^{13}$C NMR spectra of product 11



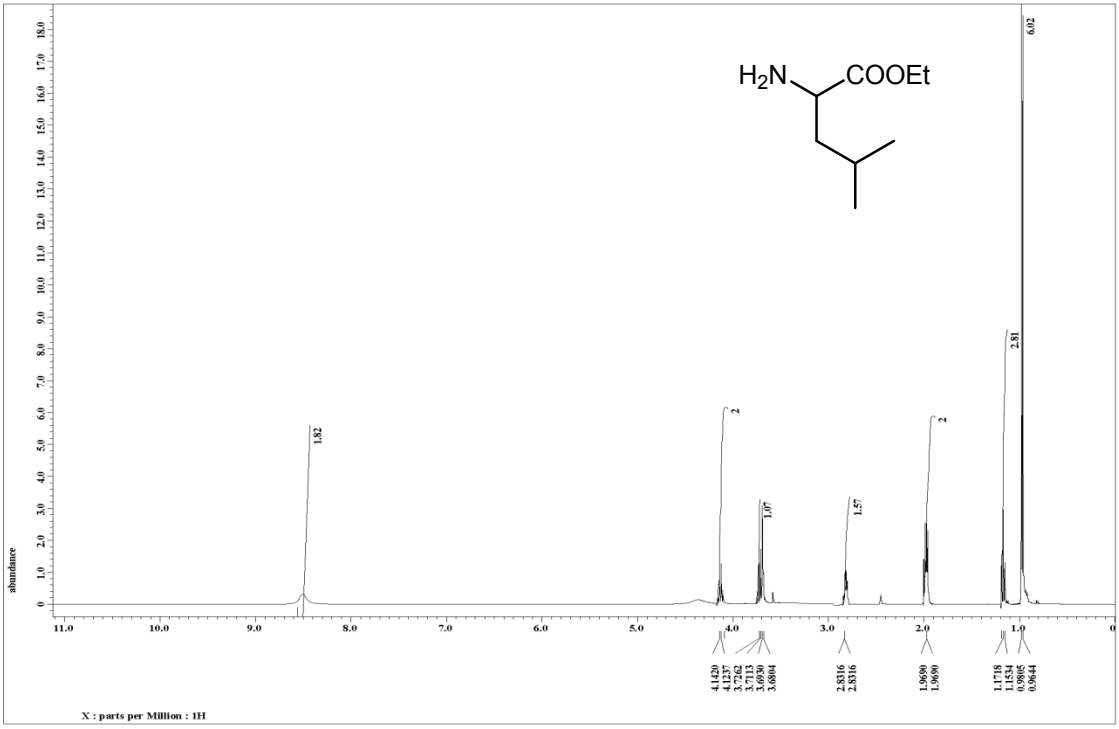

## $^{1}$H NMR spectra of product 12



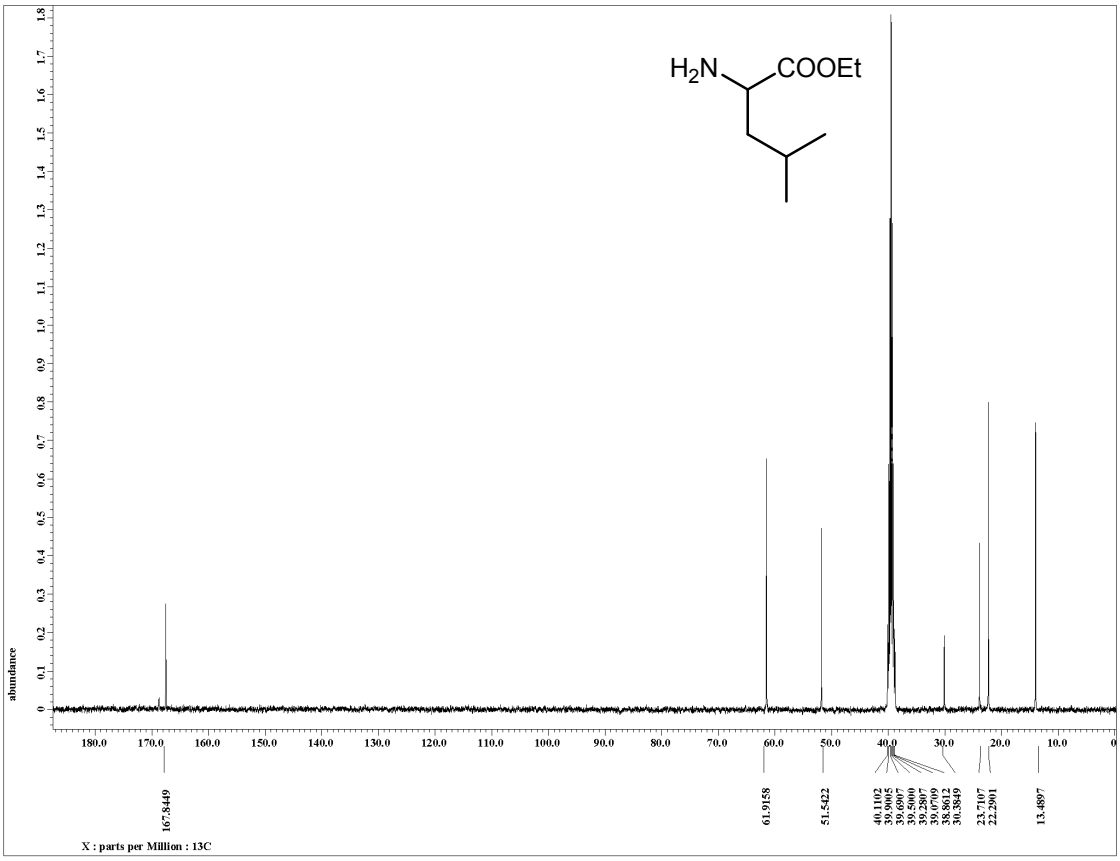
## $^{13}$C NMR spectra of product 12



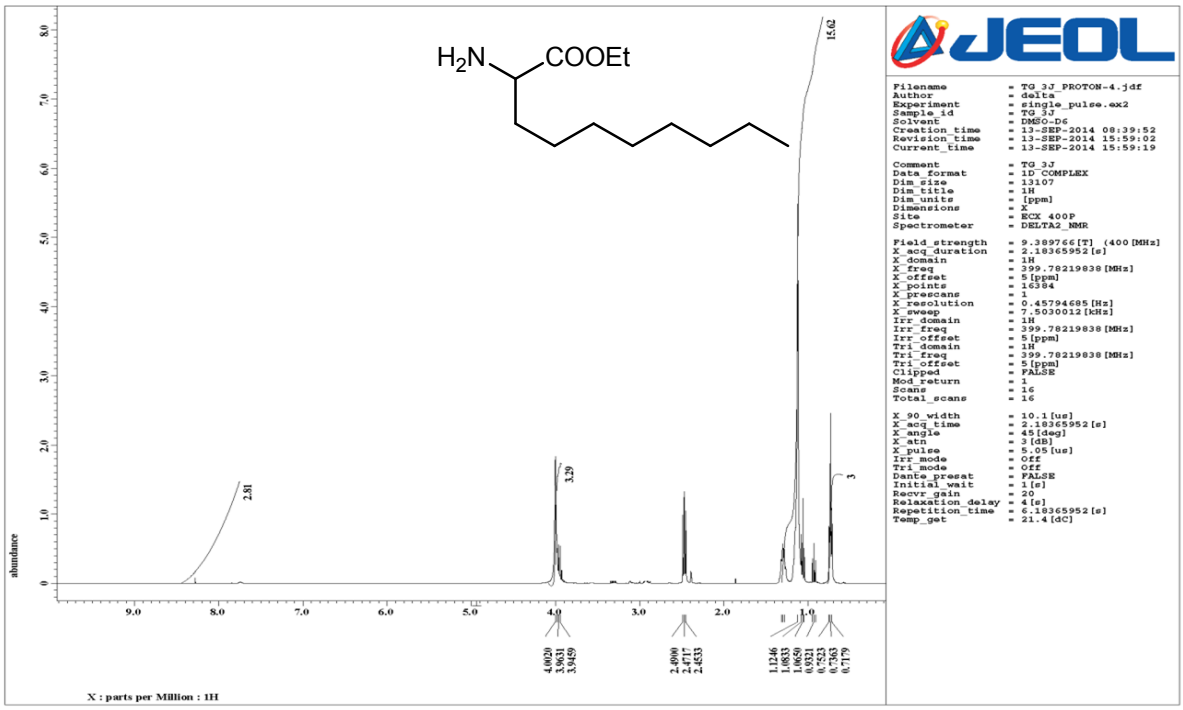

## $^{1}$H NMR spectra of product 13



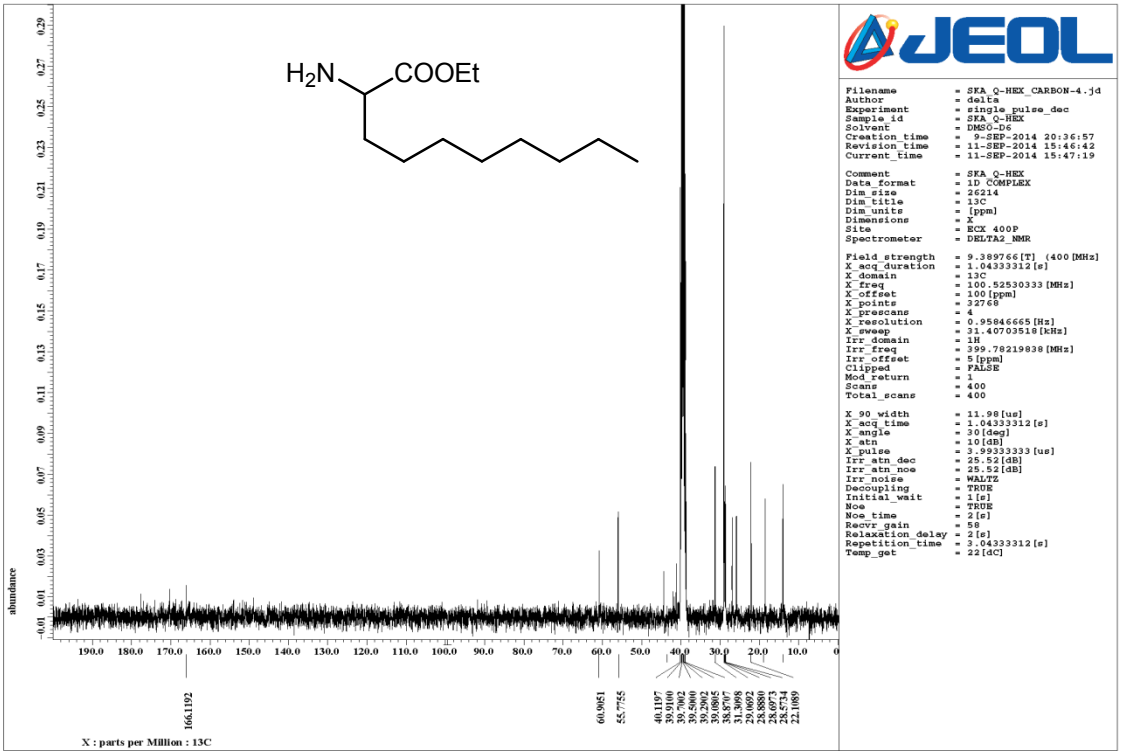
## $^{13}$C NMR spectra of product 13




## $^{1}$H NMR spectra of product 14



# $^{13}$C NMR specta of product 14



**HPLC traces:**

**HPLC chromatogram of racemic product of table 1.**

**Table 1, Entry 3**

1/1/2007 04

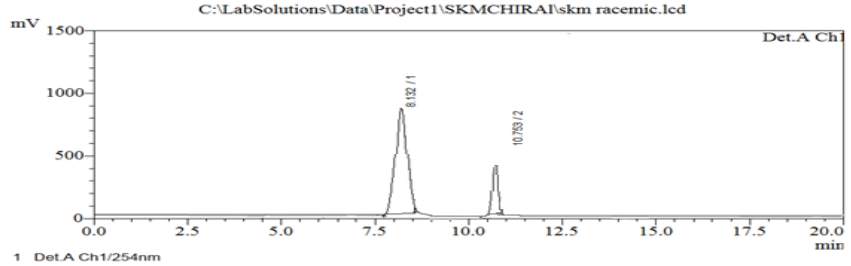
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 5:34:28 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 33059985 | 1435072 | 73.532 | 64.330 | 1 |
| 2 | 10.753 | 11900025 | 794838 | 26.468 | 35.670 | 2 |
| Total | | 44960010 | 2229910 | 100.000 | 100.000 | |

**Table 1, Entry 6:**

1/1/2007 04:49:24 1 / 1

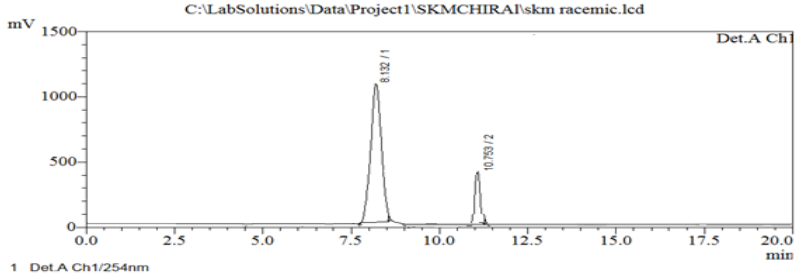
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P0 |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 6:20:00 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 35972494 | 1663877 | 80.010 | 70.549 | 1 |
| 2 | 10.753 | 9008227 | 477586 | 19.990 | 30.451 | 2 |
| Total | | 44980721 | 2141463 | 100.000 | 100.000 | |

## Table 1, Entry 9:

1/1/2007 04

**==== Shimadzu LCsolution Analysis Report ====**

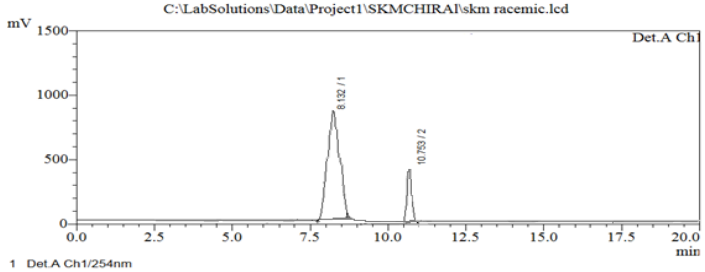
C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P 1 |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 5:54:20 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

83

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 38223641 | 1466955 | 85.330 | 65.000 | 1 |
| 2 | 10.753 | 3400007 | 604040 | 14.670 | 35.000 | 2 |
| Total | | 41623648 | 2070995 | 100.000 | 100.000 | |

## Table 1, Entry 13:

1/1/2007 04:49:24 1 / 1

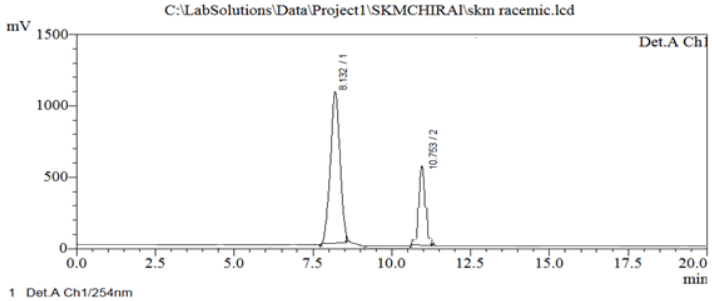
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 5:34:28 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 22495495 | 1260722 | 75.070 | 66.999 | 1 |
| 2 | 10.753 | 12475529 | 1170086 | 24.930 | 33.001 | 2 |
| Total | | 34971024 | 2330808 | 100.000 | 100.000 | |

## Table 1, Entry 15:



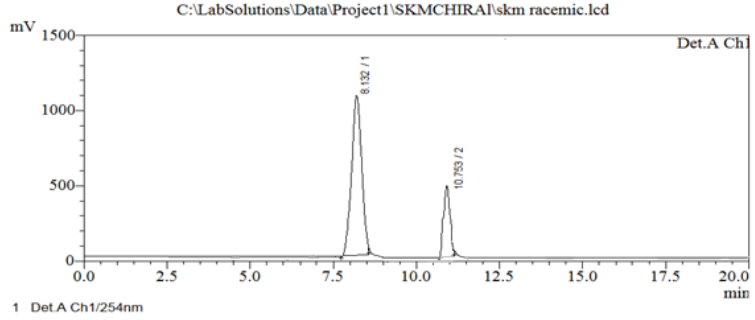
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAL\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P5 |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 7:04:18 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAL\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 39328603 | 1459284 | 69.800 | 66.200 | 1 |
| 2 | 10.753 | 13760527 | 693731 | 30.200 | 33.800 | 2 |
| Total | | 43089130 | 2153015 | 100.000 | 100.000 | |

## Table 1, Entry 18:



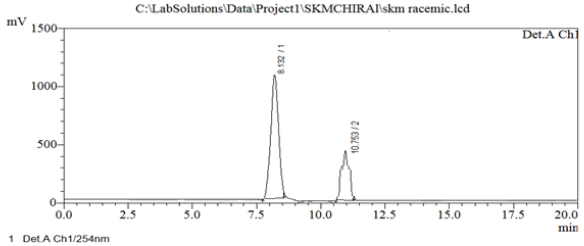
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAL\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P4 |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 8:34:25 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAL\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 22484496 | 1260272 | 75.720 | 75.559 | 1 |
| 2 | 10.753 | 12475528 | 570047 | 24.280 | 24.441 | 2 |
| Total | | 4960024 | 2830319 | 100.000 | 100.000 | |

## Table 1, Entry 19:



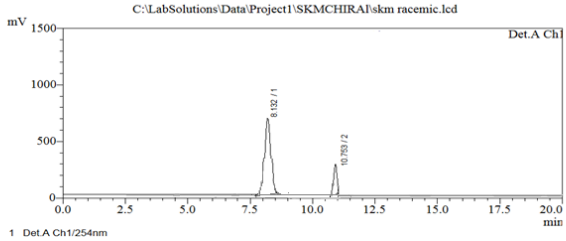
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P 8 |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 16:34:18 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 31028000 | 1437492 | 69.000 | 66.100 | 1 |
| 2 | 10.753 | 13760130 | 638533 | 31.000 | 33.900 | 2 |
| Total | | 44788130 | 2076025 | 100.000 | 100.000 | |

## HPLC chromatogram of product 5 (Racemic) without catalyst



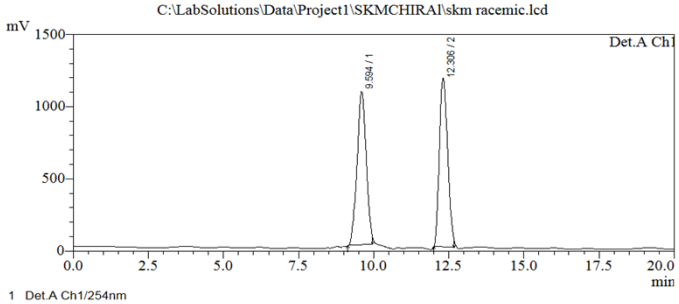
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 5:34:28 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 9.594 | 22484495 | 1060722 | 50.010 | 47.549 | 1 |
| 2 | 12.306 | 22475528 | 1170086 | 49.990 | 52.451 | 2 |
| Total | | 44960024 | 2230808 | 100.000 | 100.000 | |

# HPLC chromatogram of product 5 using catalyst sT1



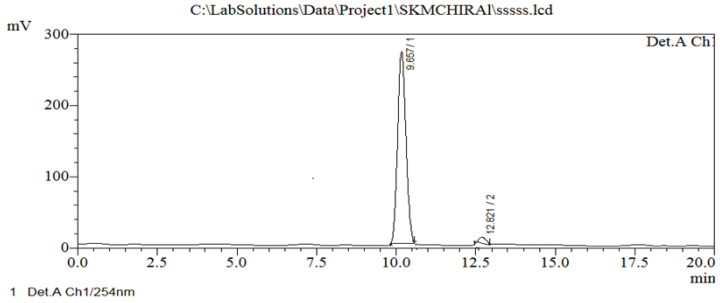
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\sssss.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : sssss.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 3:49:44 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\sssss.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 9.657 | 4872667 | 269331 | 97.636 | 97.002 | 1 |
| 2 | 12.821 | 117980 | 8325 | 2.364 | 2.998 | 2 |
| Total | | 4990647 | 277656 | 100.000 | 100.000 | |

# HPLC chromatogram of product 6 using catalyst sT1



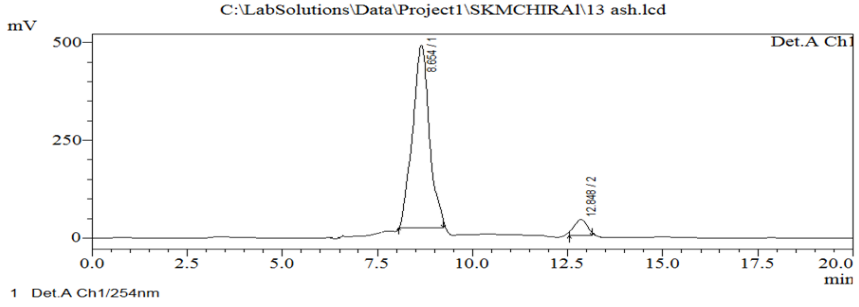
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\13 ash.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : 13 ash.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 7:35:13 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\13 ash.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.654 | 14367132 | 466976 | 93.706 | 91.908 | 1 |
| 2 | 12.848 | 965083 | 41114 | 6.294 | 8.092 | 2 |
| Total | | 15332215 | 508090 | 100.000 | 100.000 | |

## HPLC chromatogram of Compoud 7 racemic mixture without catalyst

1/1/2007 04:49:24 1 / 1

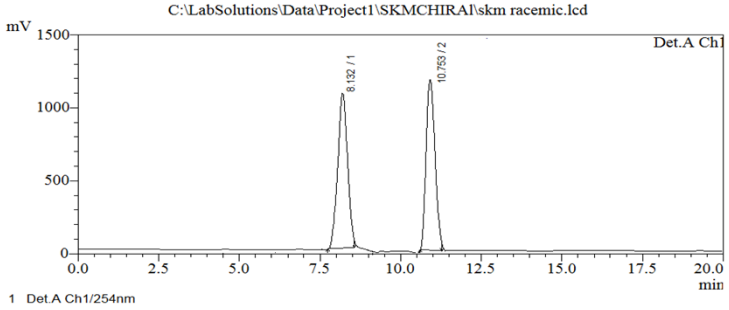
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAL\skm racemic.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : skm racemic.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 5:34:28 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAL\skm racemic.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 22484495 | 1060722 | 50.010 | 47.549 | 1 |
| 2 | 10.753 | 22475528 | 1170086 | 49.990 | 52.451 | 2 |
| Total | | 44960024 | 2230808 | 100.000 | 100.000 | |

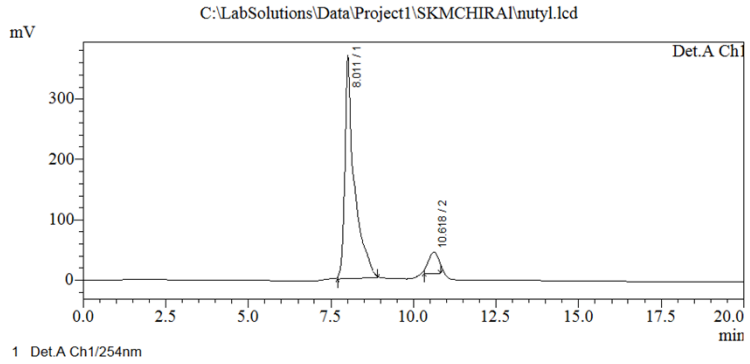
## HPLC chromatogram of compound 7 using catalyst sT1

**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAL\nutyl.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : nutyl.lcd |
| Method File Name | : 1.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/4/2007 4:20:48 PM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**




PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.011 | 7399281 | 369679 | 90.861 | 91.206 | 1 |
| 2 | 10.618 | 744269 | 35642 | 9.139 | 8.794 | 2 |
| Total | | 8143551 | 405321 | 100.000 | 100.000 | |

## HPLC chromatogram of Compond 7 using catalyst sT2

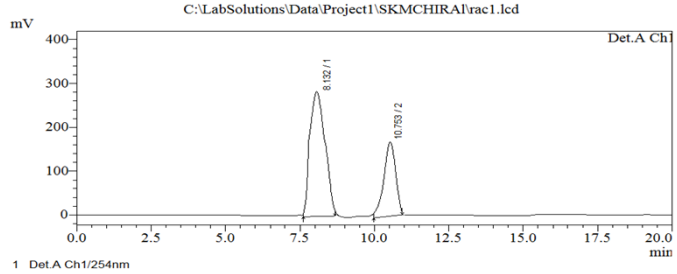


**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAL\rac1.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : rac1.lcd |
| Method File Name | : 1.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/2/2007 3:11:43 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**




PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.132 | 10401109 | 381775 | 69.073 | 69.291 | 1 |
| 2 | 10.753 | 4656979 | 169201 | 30.927 | 30.709 | 2 |
| Total | | 15058088 | 550977 | 100.000 | 100.000 | |

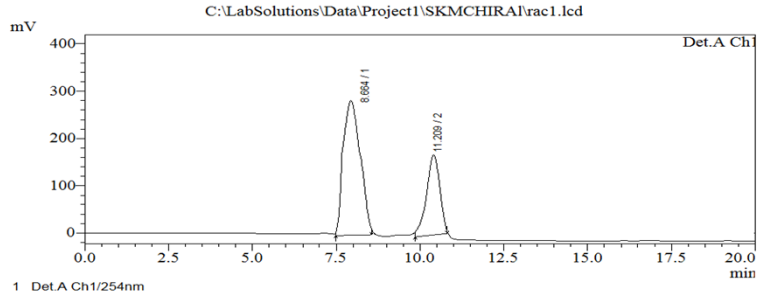
## HPLC chromatogram of compound 7 using catalyst sT3

**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\rac1.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : rac1.lcd |
| Method File Name | : 1.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/2/2007 3:11:43 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**




PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.664 | 10401109 | 381775 | 69.073 | 69.291 | 1 |
| 2 | 11.209 | 4656979 | 169201 | 30.927 | 30.709 | 2 |
| Total | | 15058088 | 550977 | 100.000 | 100.000 | |

# HPLC chromatogram of compound 8 using catalyst sT1

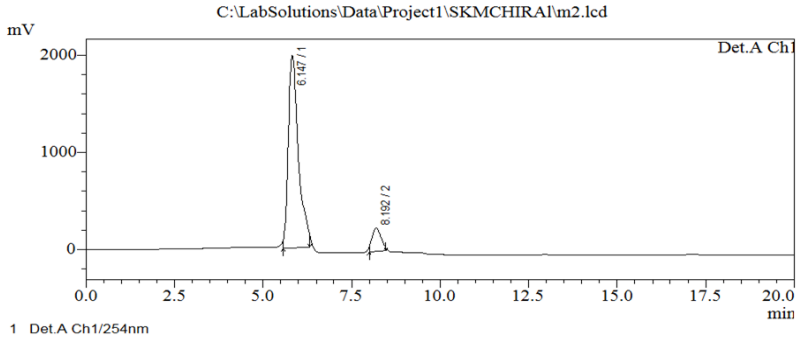


**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\m2.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : m2.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 12:34:31 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**




PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 6.147 | 39363408 | 1981418 | 90.363 | 89.241 | 1 |
| 2 | 8.192 | 4198039 | 238882 | 9.637 | 10.759 | 2 |
| Total | | 43561447 | 2220300 | 100.000 | 100.000 | |

# HPLC chromatogram of compound 9 using catalyst sT1

1/1/2007 07:40:29 1 / 1

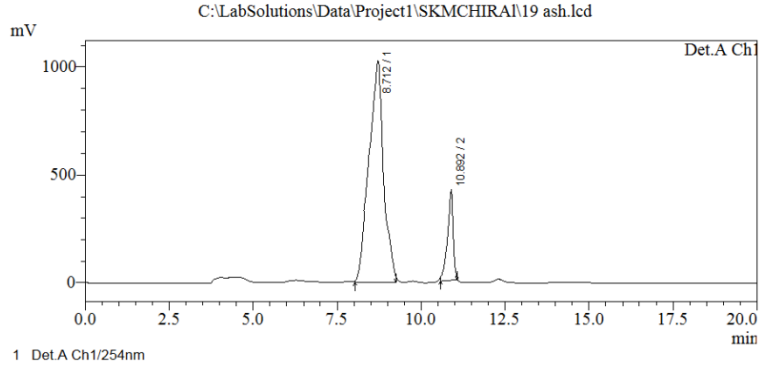
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\19 ash.lcd

Acquired by :
Sample Name : SKMCHIRAL
Sample ID : P
Injection Volume : 50 uL
Data File Name : 19 ash.lcd
Method File Name : 20-8.lcm
Report File Name : Default.lcr
Data Acquired : 1/1/2007 7:15:24 AM
Data Processed : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\19 ash.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.712 | 32618967 | 1058107 | 87.033 | 71.634 | 1 |
| 2 | 10.892 | 4859892 | 418985 | 12.967 | 28.366 | 2 |
| Total | | 37478858 | 1477091 | 100.000 | 100.000 | |

# HPLC chromatogram of compound 10 using catalyst sT1

1/1/2007 05:43:23 1 / 1

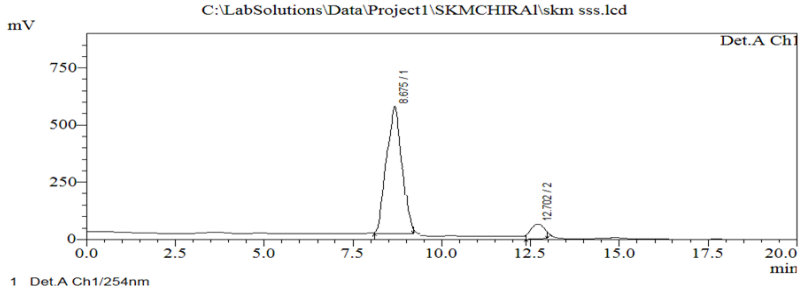
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm sss.lcd

Acquired by :
Sample Name : SKMCHIRAL
Sample ID : P
Injection Volume : 50 uL
Data File Name : skm sss.lcd
Method File Name : 20-8.lcm
Report File Name : Default.lcr
Data Acquired : 1/1/2007 5:13:10 AM
Data Processed : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\skm sss.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 8.675 | 20466191 | 578126 | 92.316 | 89.926 | 1 |
| 2 | 12.702 | 1703560 | 64763 | 7.684 | 10.074 | 2 |
| Total | | 22169751 | 642888 | 100.000 | 100.000 | |

# HPLC chromatogram of complound 11 using catalyst sT1

1/1/2007 07:58:42 1 / 1

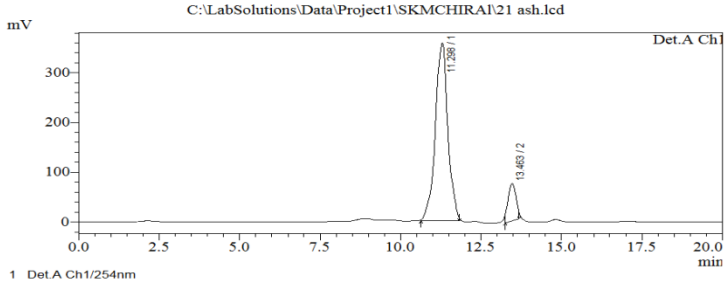
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\21 ash.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : 21 ash.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 7:35:47 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\21 ash.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 11.298 | 9735696 | 357902 | 88.429 | 82.649 | 1 |
| 2 | 13.463 | 1273914 | 75135 | 11.571 | 17.351 | 2 |
| Total | | 11009610 | 433037 | 100.000 | 100.000 | |

# HPLC chromatogram of compound 12 using catalyst sT1

1/1/2007 08:22:07 1 / 1

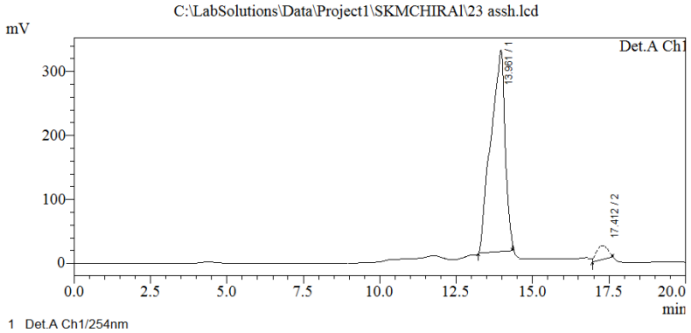
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\23 assh.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : 23 assh.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 7:56:18 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\23 assh.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 13.961 | 10197610 | 315112 | 93.797 | 92.467 | 1 |
| 2 | 17.412 | 674388 | 25672 | 6.203 | 7.533 | 2 |
| Total | | 10871998 | 340784 | 100.000 | 100.000 | |

# HPLC chromatogram of compound 13 using catalyst sT1

1/1/2007 08:18:31 1 / 1

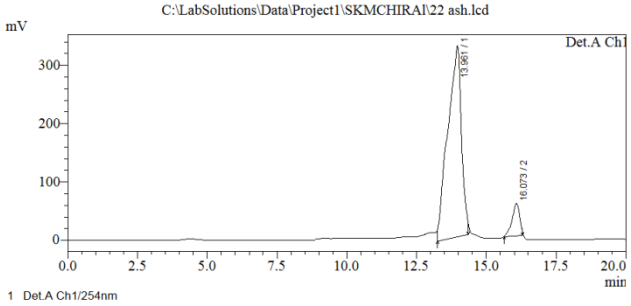
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\22 ash.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : 22 ash.lcd |
| Method File Name | : 20-8.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/1/2007 7:56:18 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\22 ash.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 13.961 | 11099713 | 327621 | 91.434 | 85.552 | 1 |
| 2 | 16.073 | 1039929 | 55327 | 8.566 | 14.448 | 2 |
| Total | | 12139642 | 382949 | 100.000 | 100.000 | |

# HPLC chromatogram of compound 14 using catalyst sT1

1/1/2007 00:03:50 1 / 1

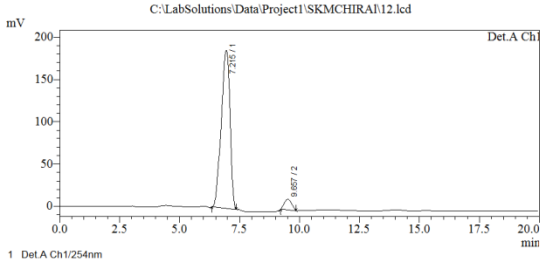
**==== Shimadzu LCsolution Analysis Report ====**

C:\LabSolutions\Data\Project1\SKMCHIRAl\12.lcd

| | |
|---|---|
| Acquired by | : |
| Sample Name | : SKMCHIRAL |
| Sample ID | : P |
| Injection Volume | : 50 uL |
| Data File Name | : 12.lcd |
| Method File Name | : pk1.lcm |
| Report File Name | : Default.lcr |
| Data Acquired | : 1/4/2007 11:16:42 AM |
| Data Processed | : Report Name$Acquisition Time$Acquisition Time$Acquisition Time$Report Name$ |

**<Chromatogram>**

C:\LabSolutions\Data\Project1\SKMCHIRAl\12.lcd




1 Det.A Ch1/254nm

PeakTable

Detector A Ch1 254nm

| Peak# | Ret. Time | Area | Height | Area % | Height % | Name |
|---|---|---|---|---|---|---|
| 1 | 7.215 | 4753648 | 186770 | 94.727 | 93.823 | 1 |
| 2 | 9.657 | 264615 | 12296 | 5.273 | 6.177 | 2 |
| Total | | 5018263 | 199066 | 100.000 | 100.000 | |