Electronic Supplementary Material (ESI) for RSC Advances
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Supporting Information

General and efficient copper-catalyzed aerobic oxidative synthesis of *N*-fused heterocycles using amino acids as the nitrogen sources

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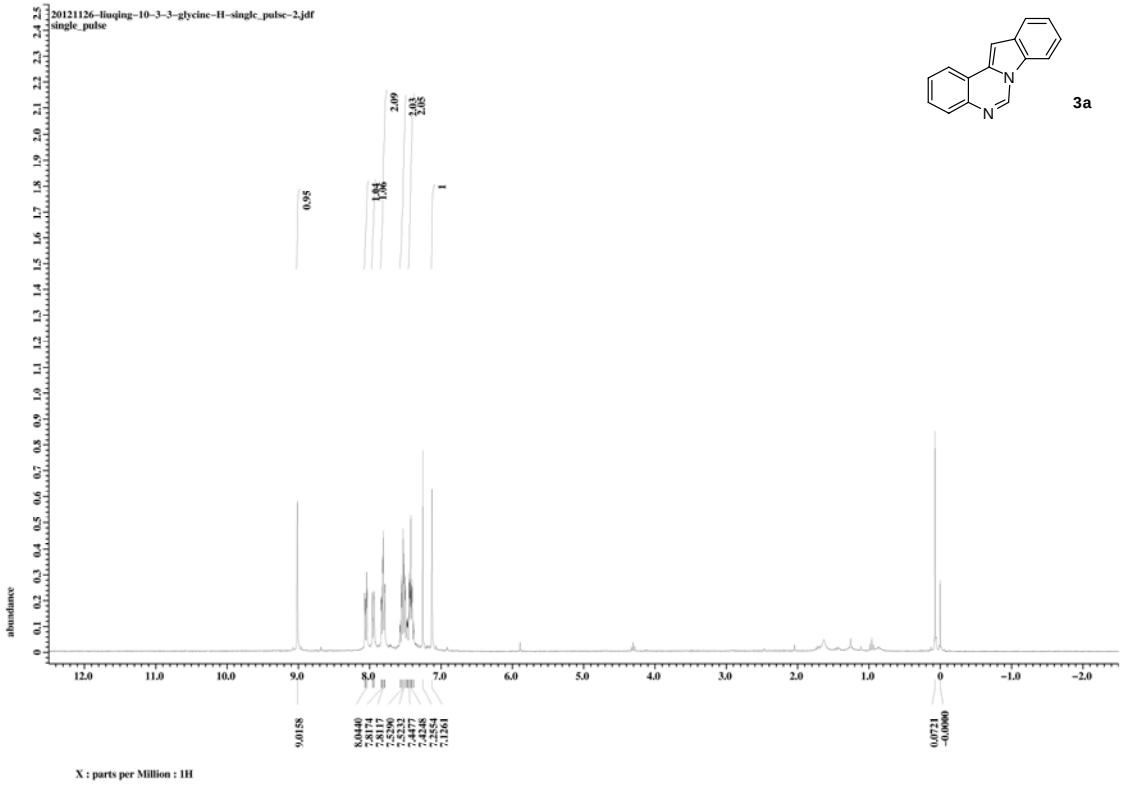
The ^{1}H and ^{13}C NMR spectra of compounds 3**a-y, 5a-l, 7a-d** S1-S41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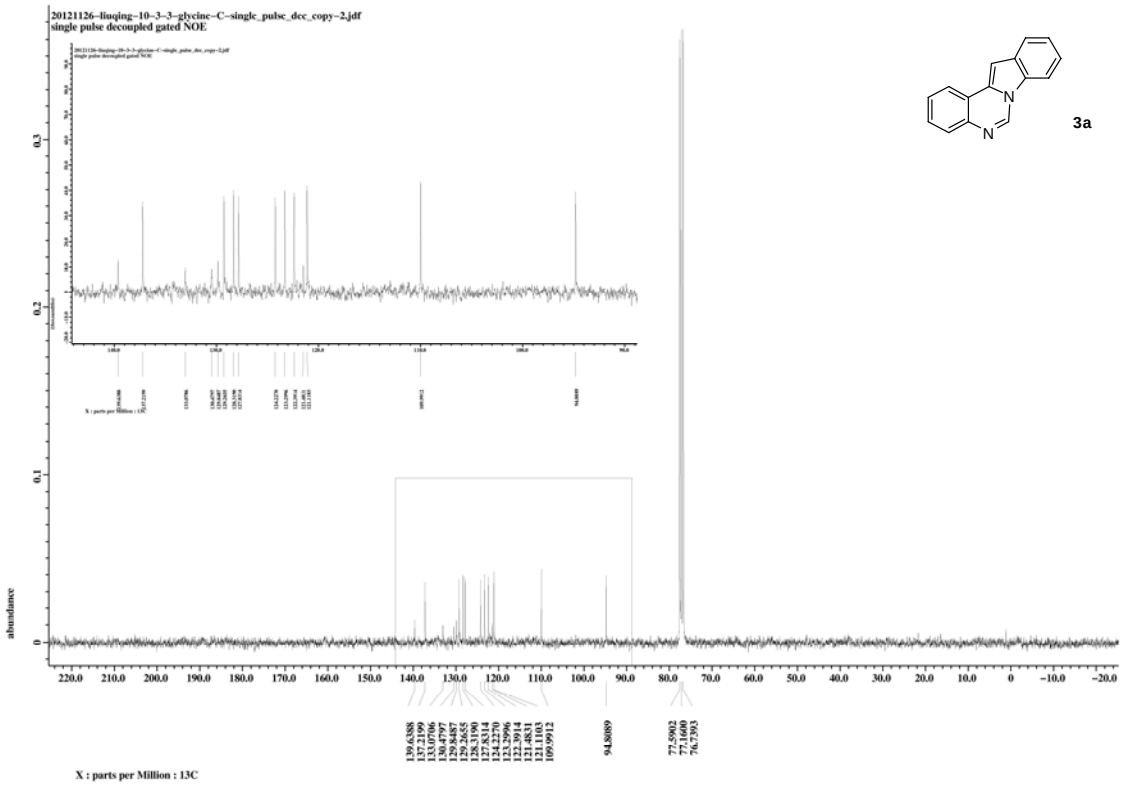
single_pulse
3a
X : parts per Million : 1H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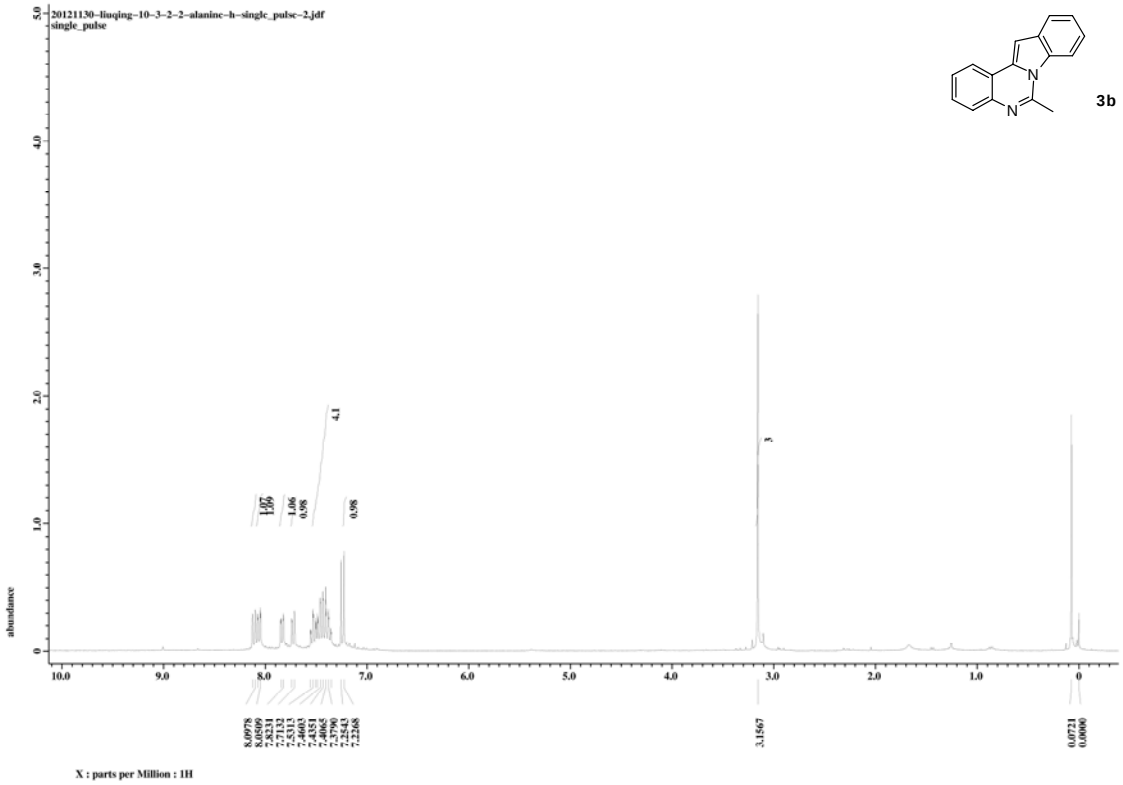
3a
X : parts per Million : 13C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abundance
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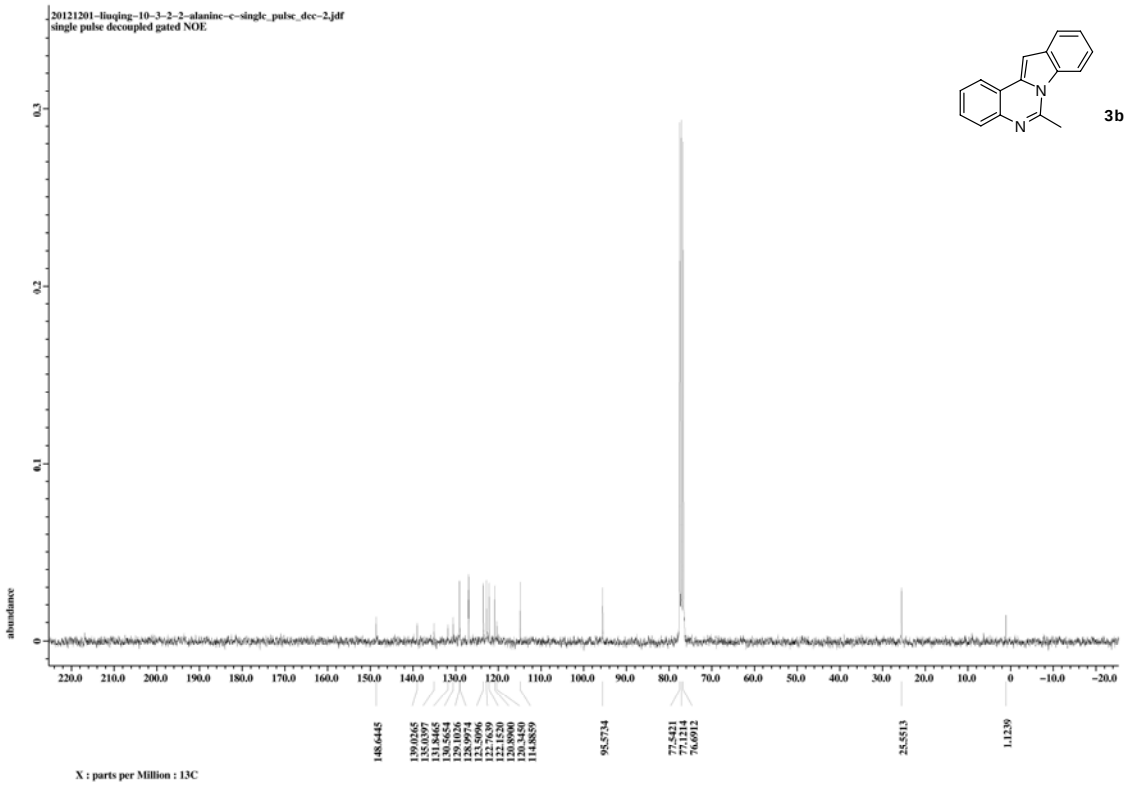
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abundance
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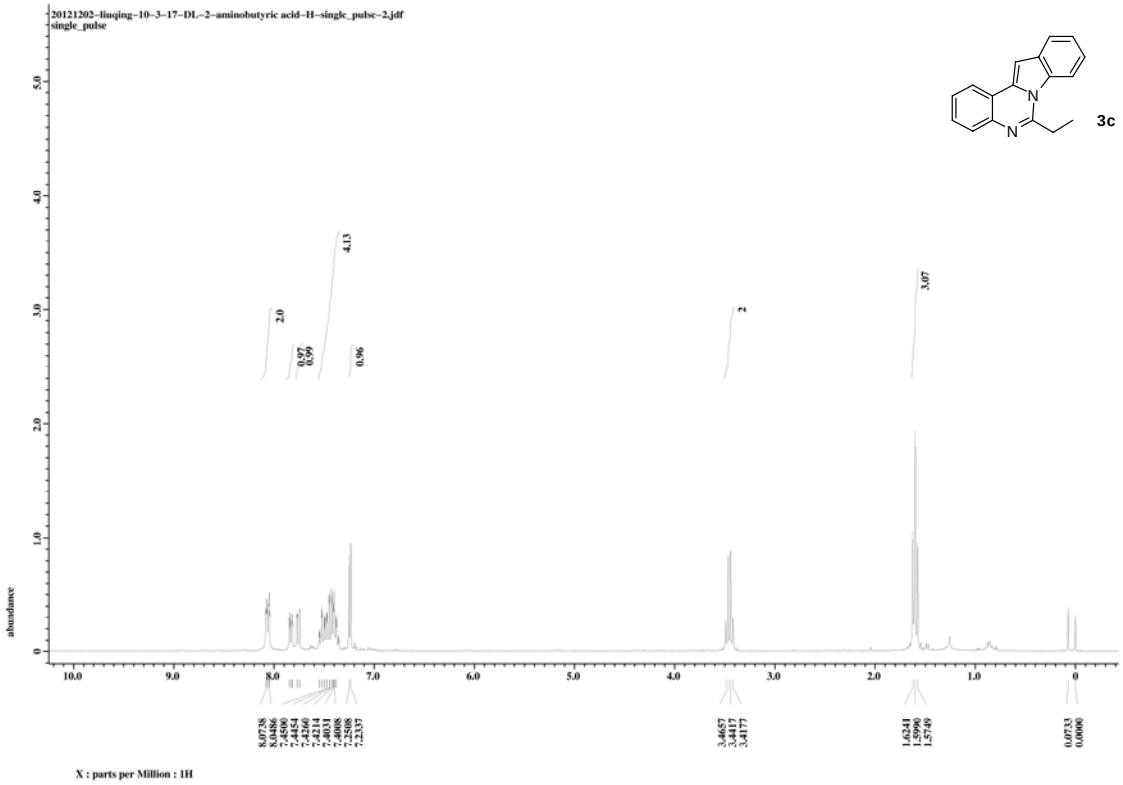
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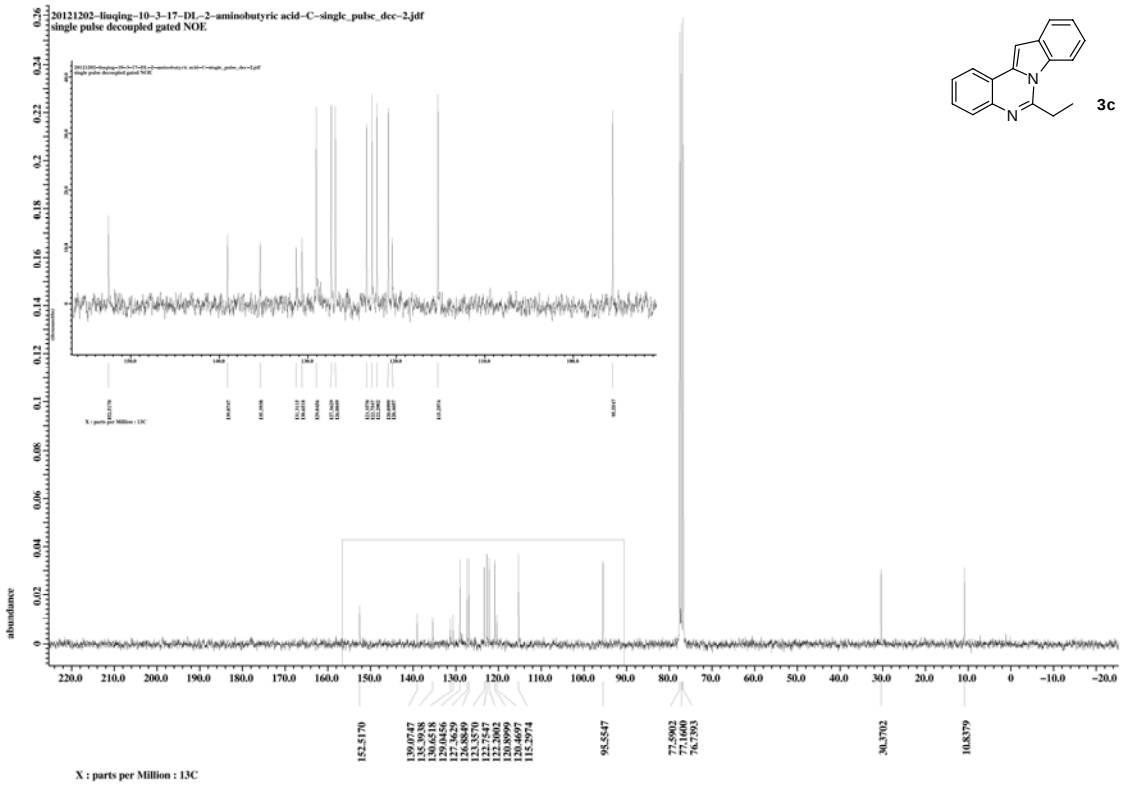
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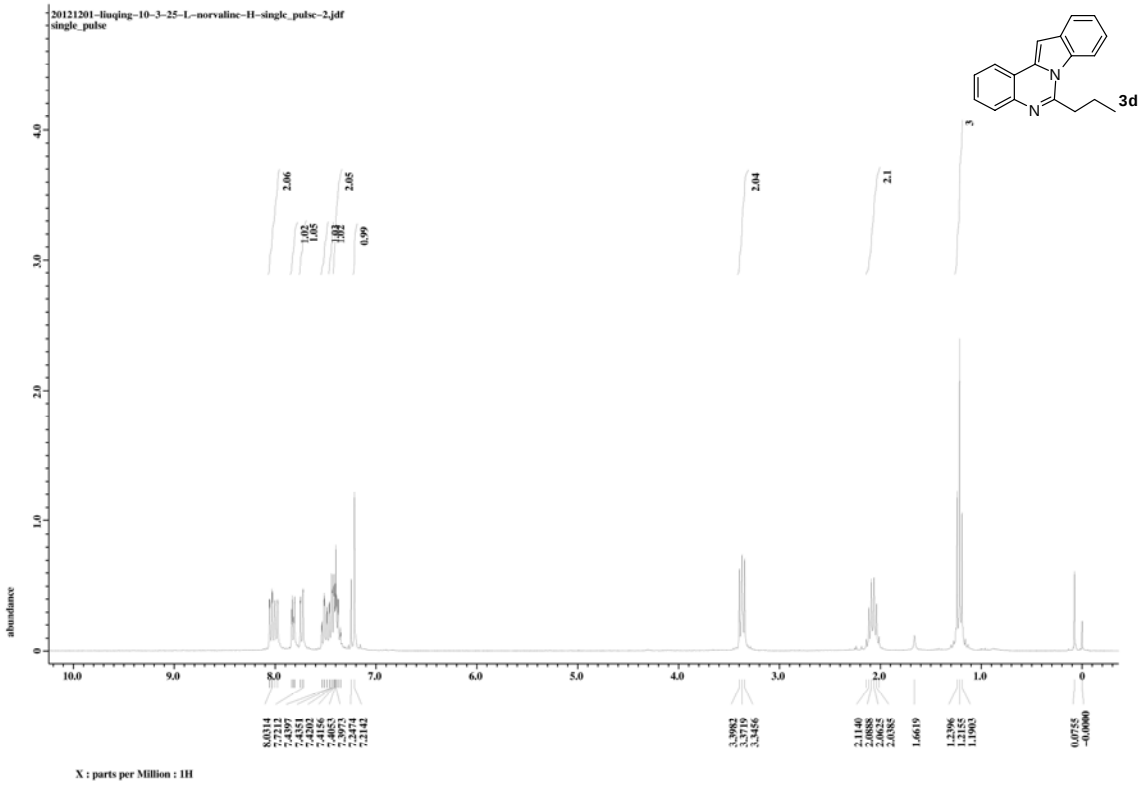
abundance
X : parts per Million : 13C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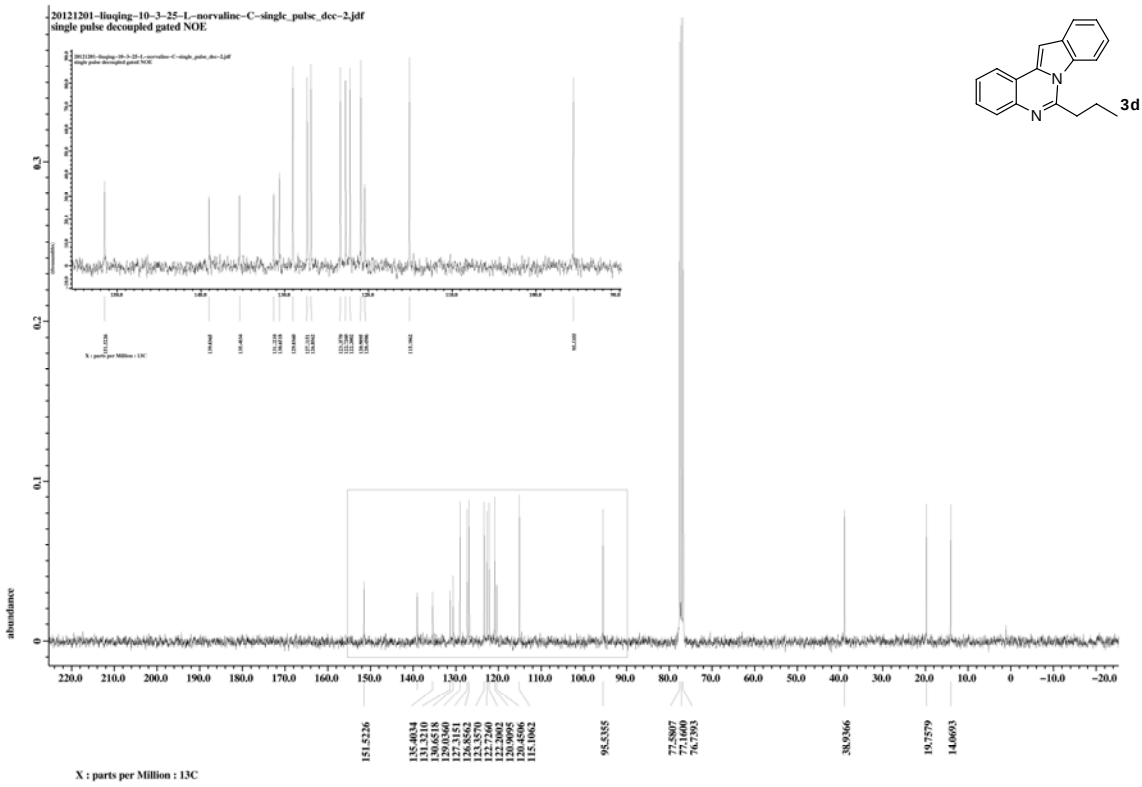
single_pulse
3d
abundance
X : parts per Million : 1H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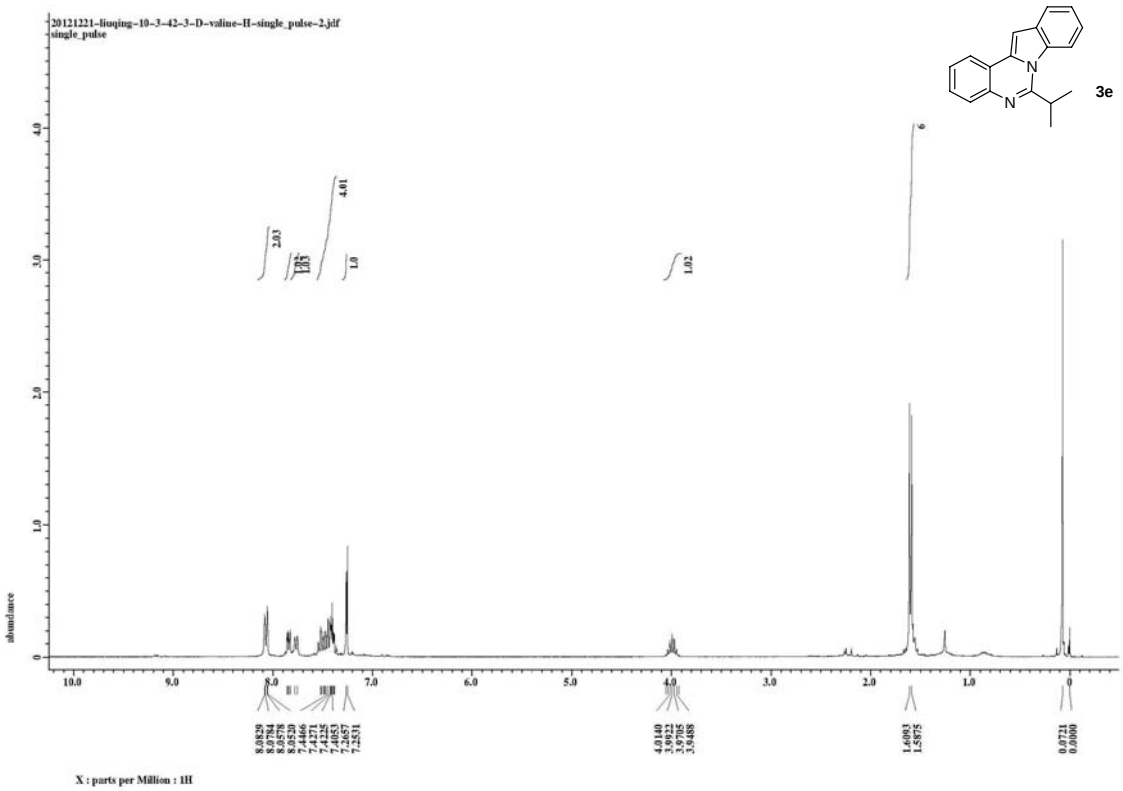
3d
abundance
X : parts per Million : 13C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abundance
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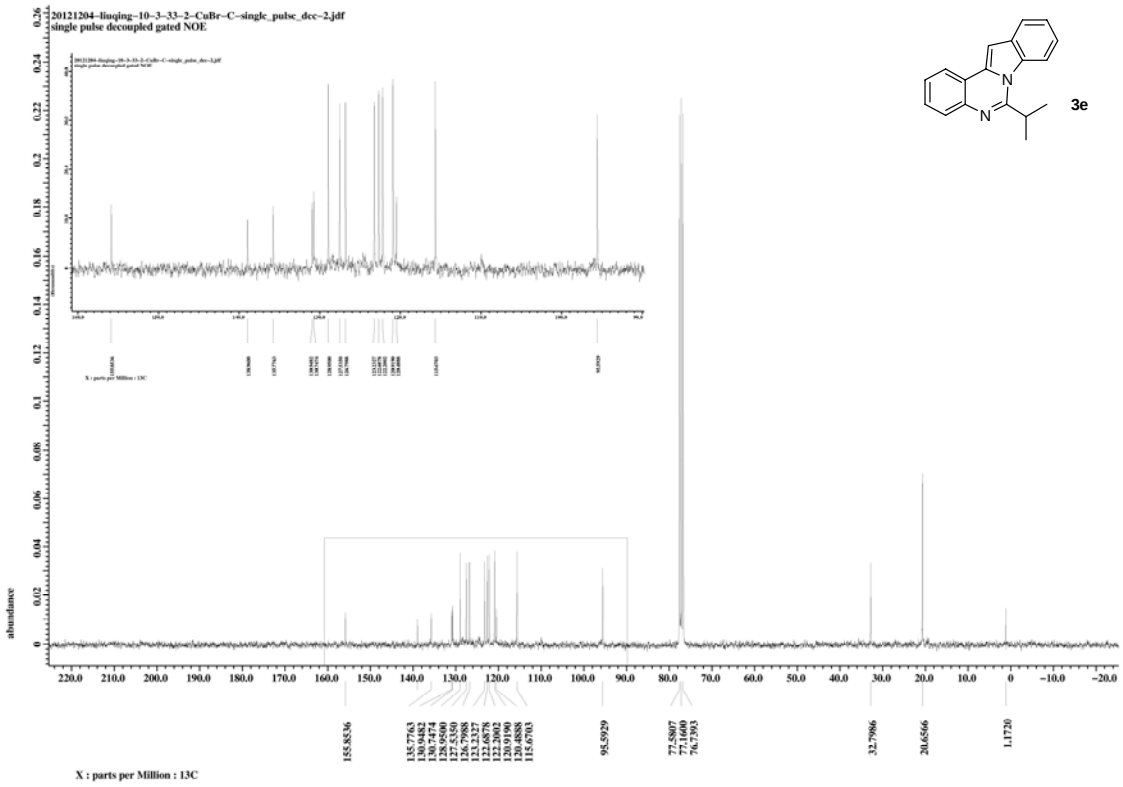
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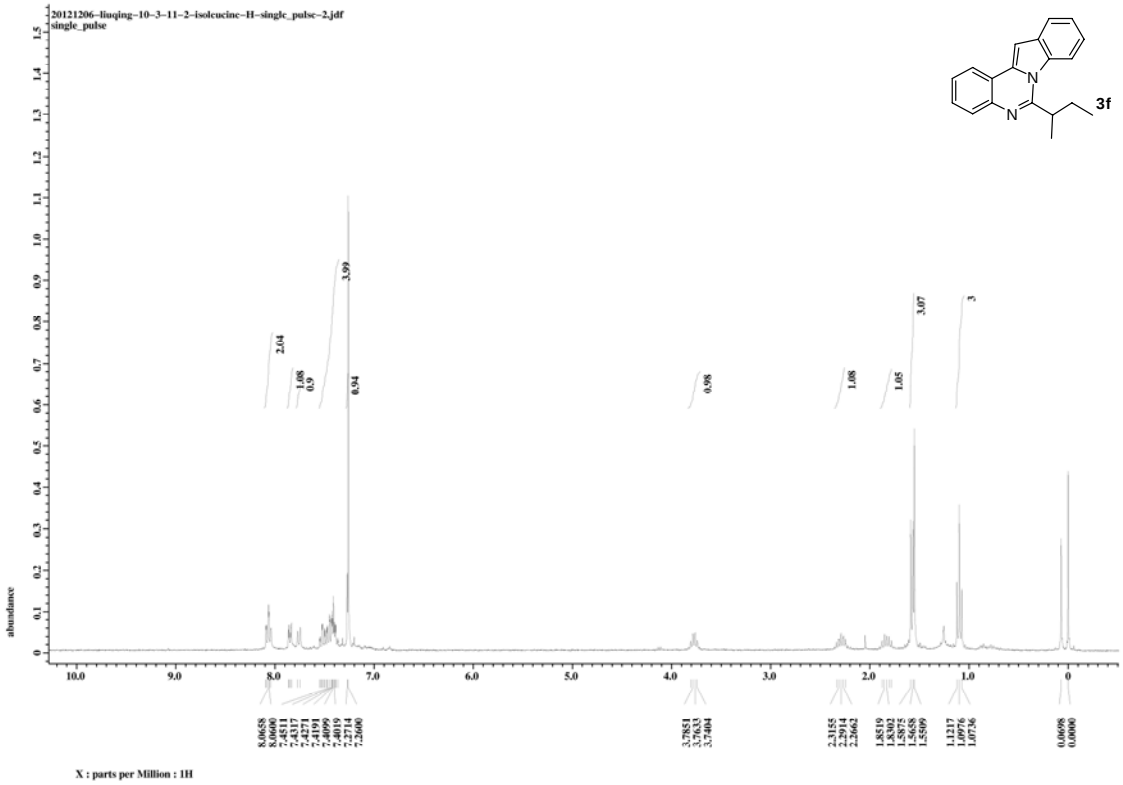
single pulse decoupled gated NOE
3e
abundance
X : parts per Million : 13C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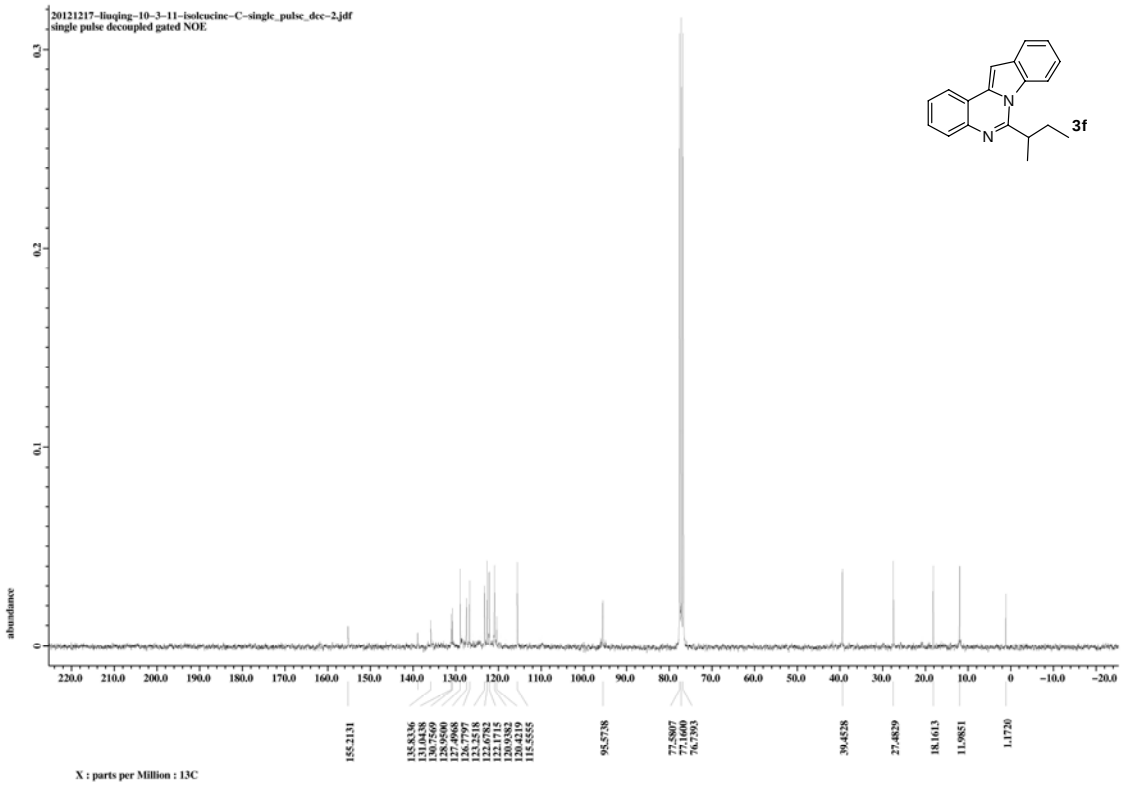
single_pulse
3f
abundance
X : parts per Million : 1H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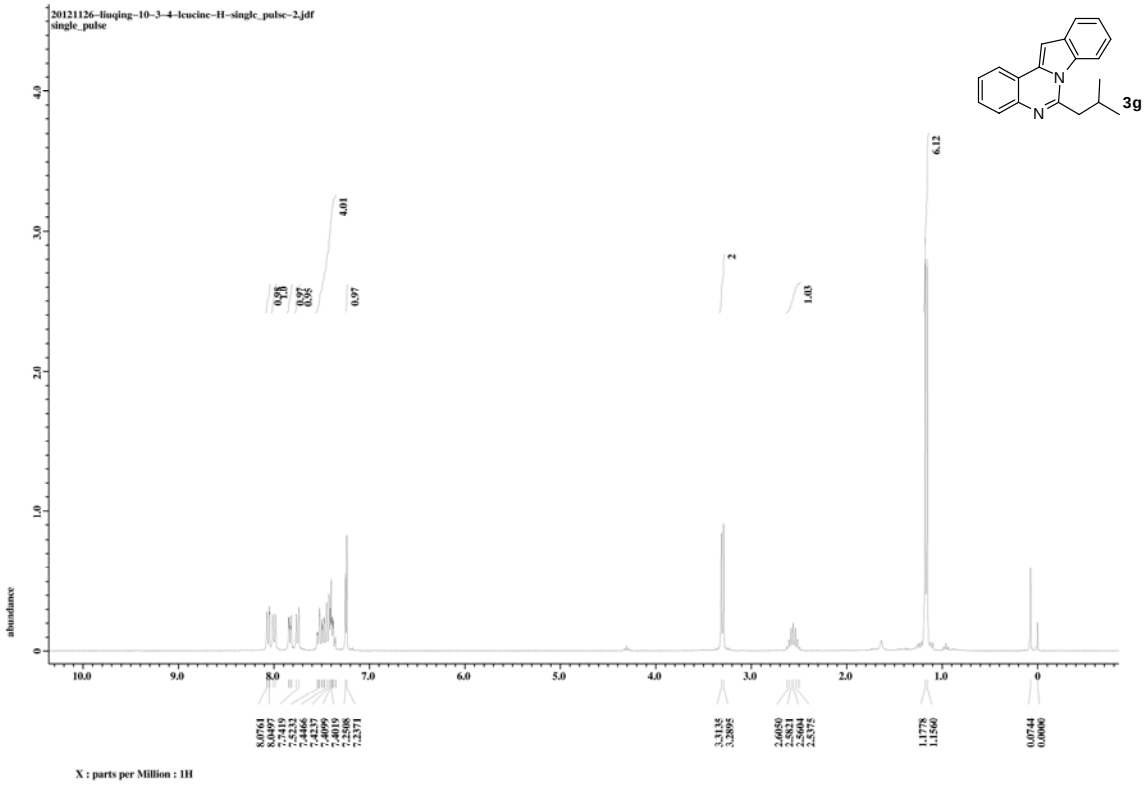
single pulse decoupled gated NOE
3f
abundance
X : parts per Million : 13C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3g
abundance
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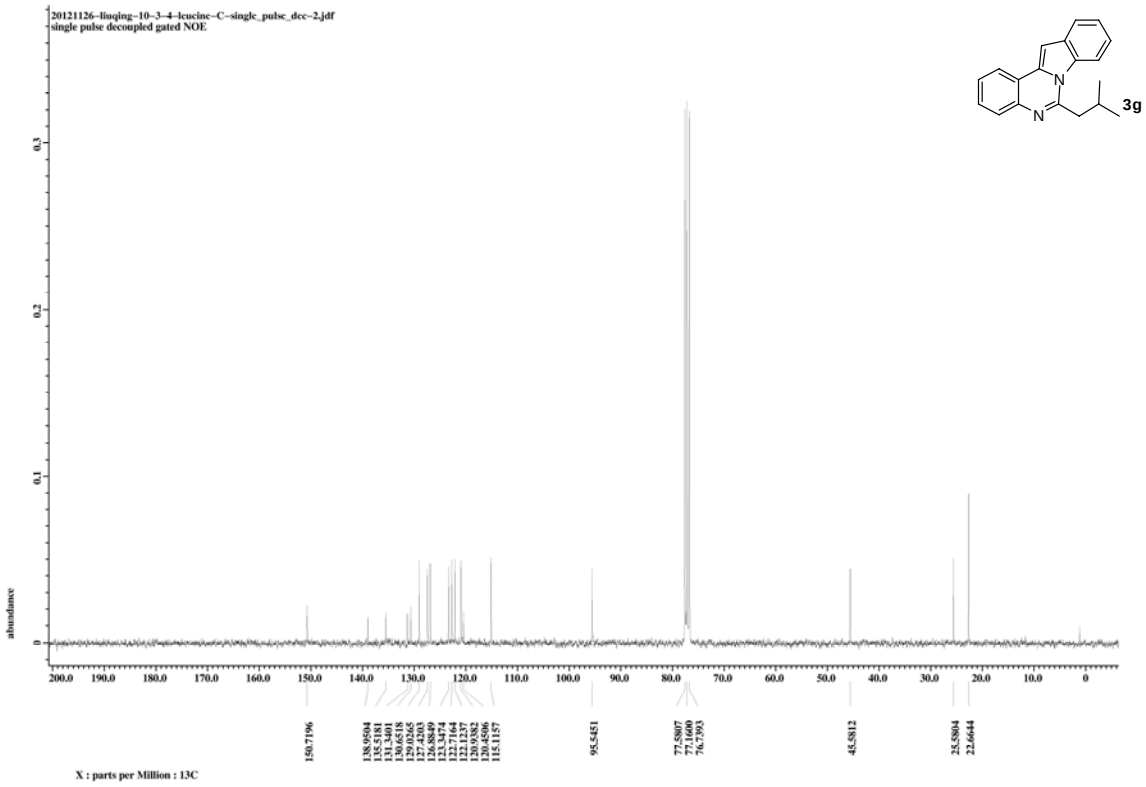
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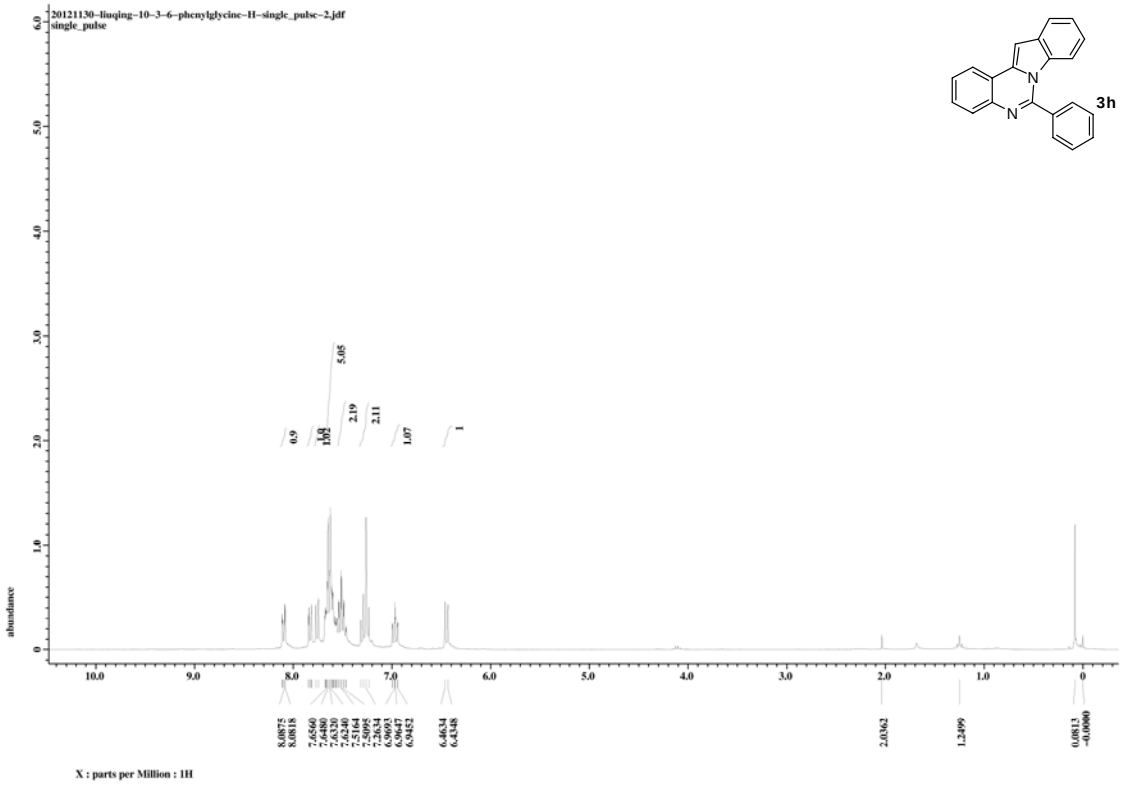
3g
abundance
X : parts per Million : 13C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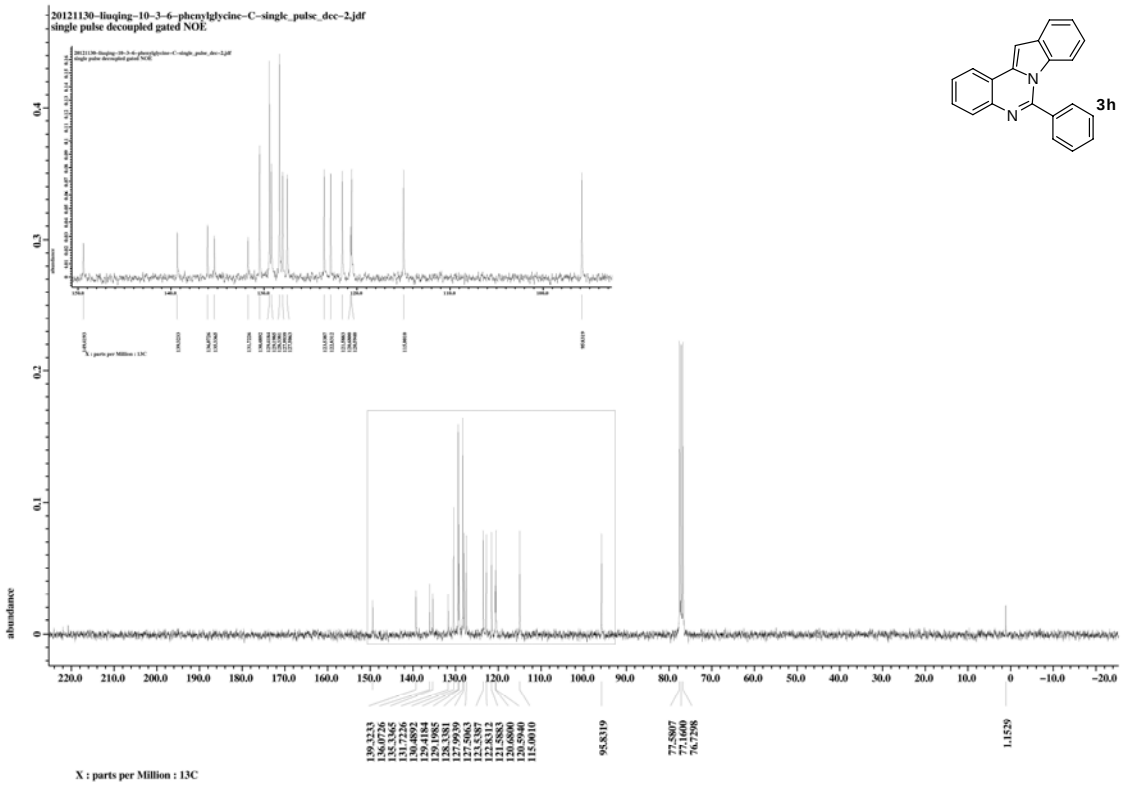
single_pulse
3h
N
N
abundance
X : parts per Million : 1H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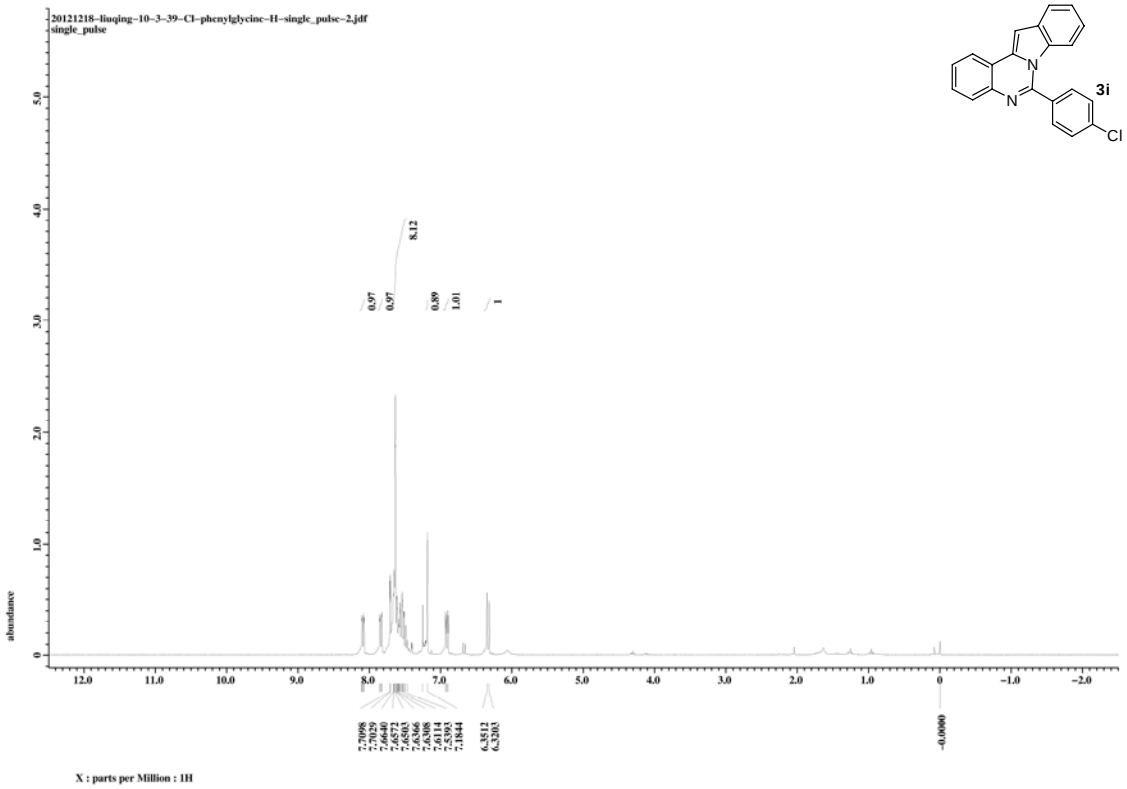
single pulse decoupled gated NOE
3h
N
N
abundance
X : parts per Million : 13C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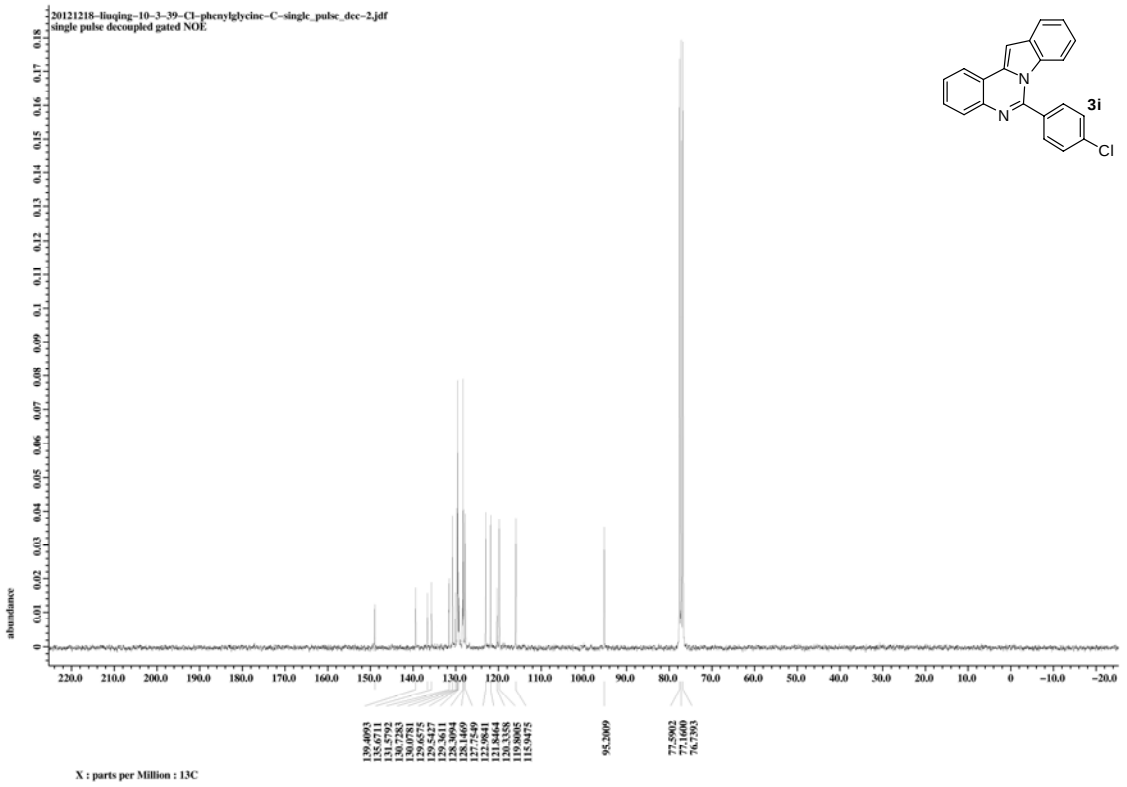
single_pulse
3i
Cl
N
N
8.12
0.97
0.97
0.89
1.01
1
abundance
X : parts per Million : 1H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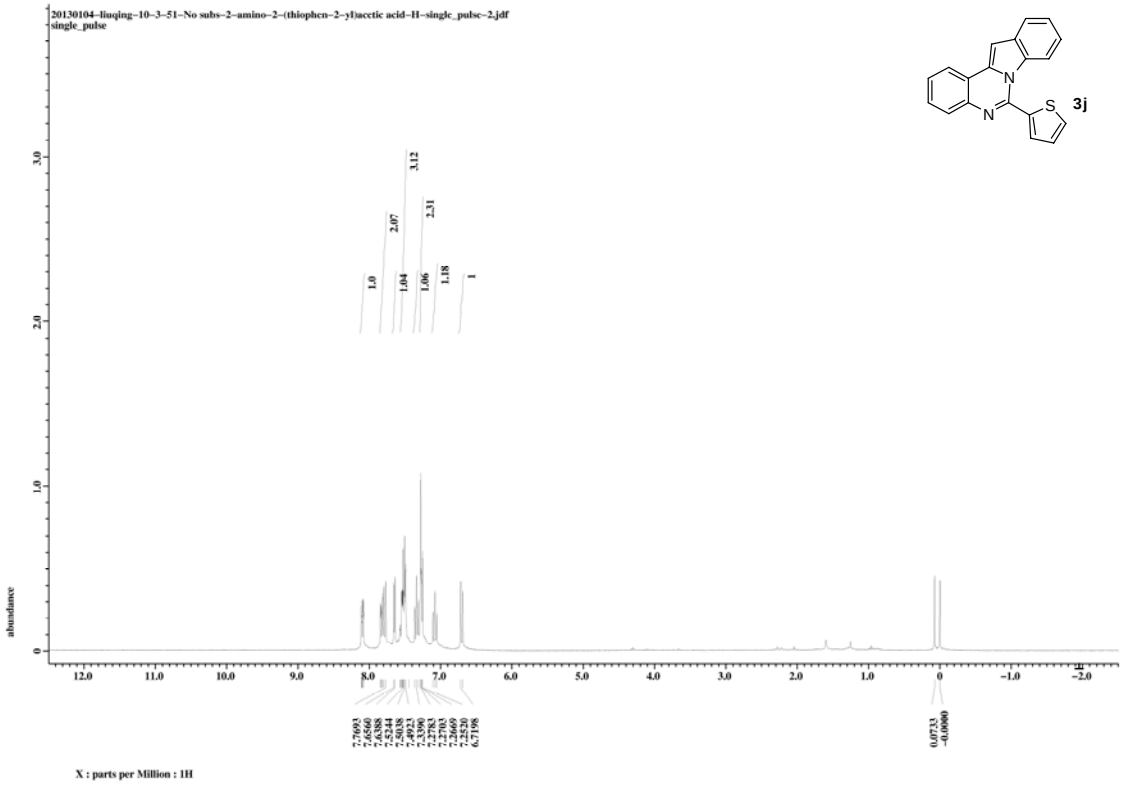
single pulse decoupled gated NOE
3i
Cl
N
N
abundance
X : parts per Million : 13C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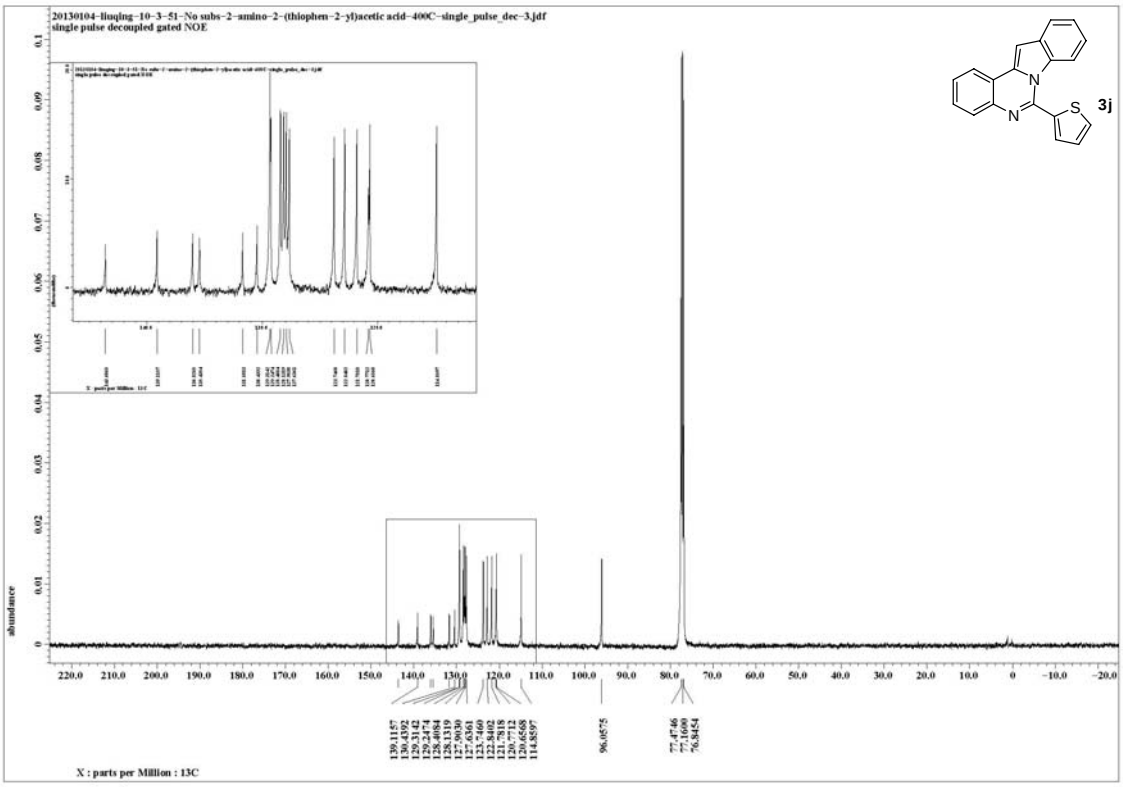
single_pulse
3j
abundance
X : parts per Million : 1H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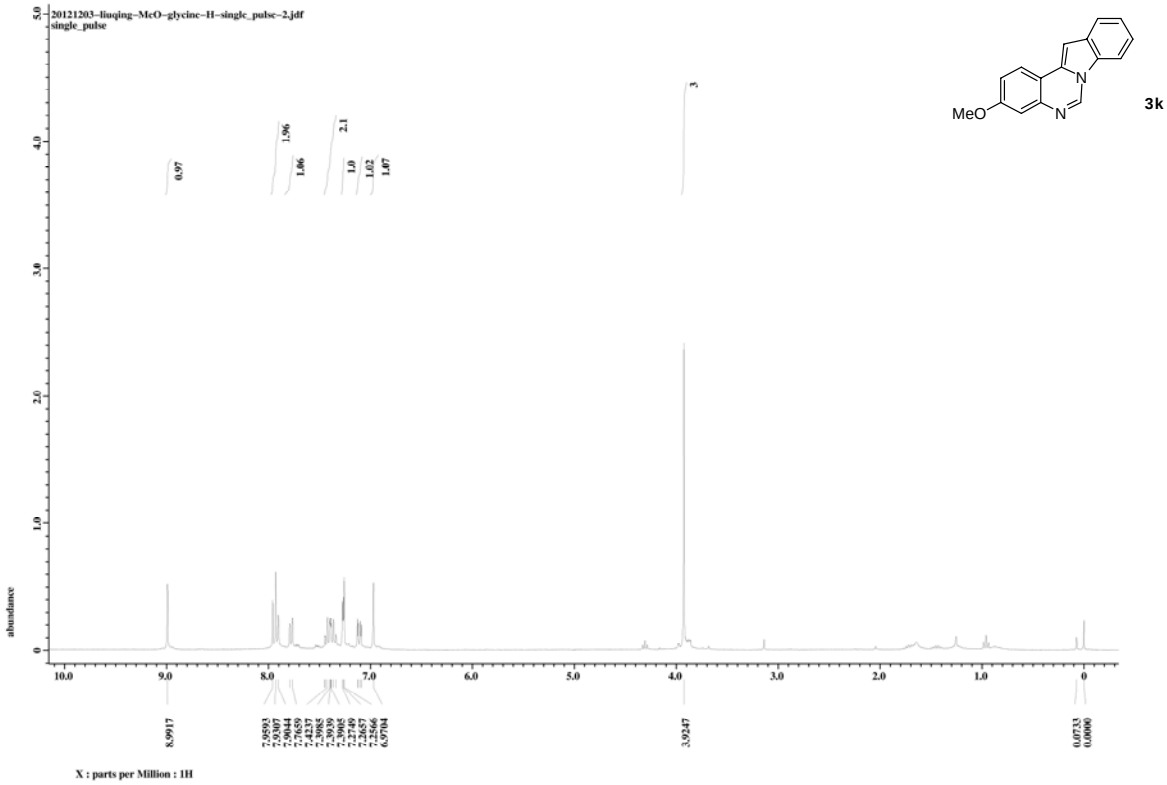
single pulse decoupled gated NOE
3j
abundance
X : parts per Million : 13C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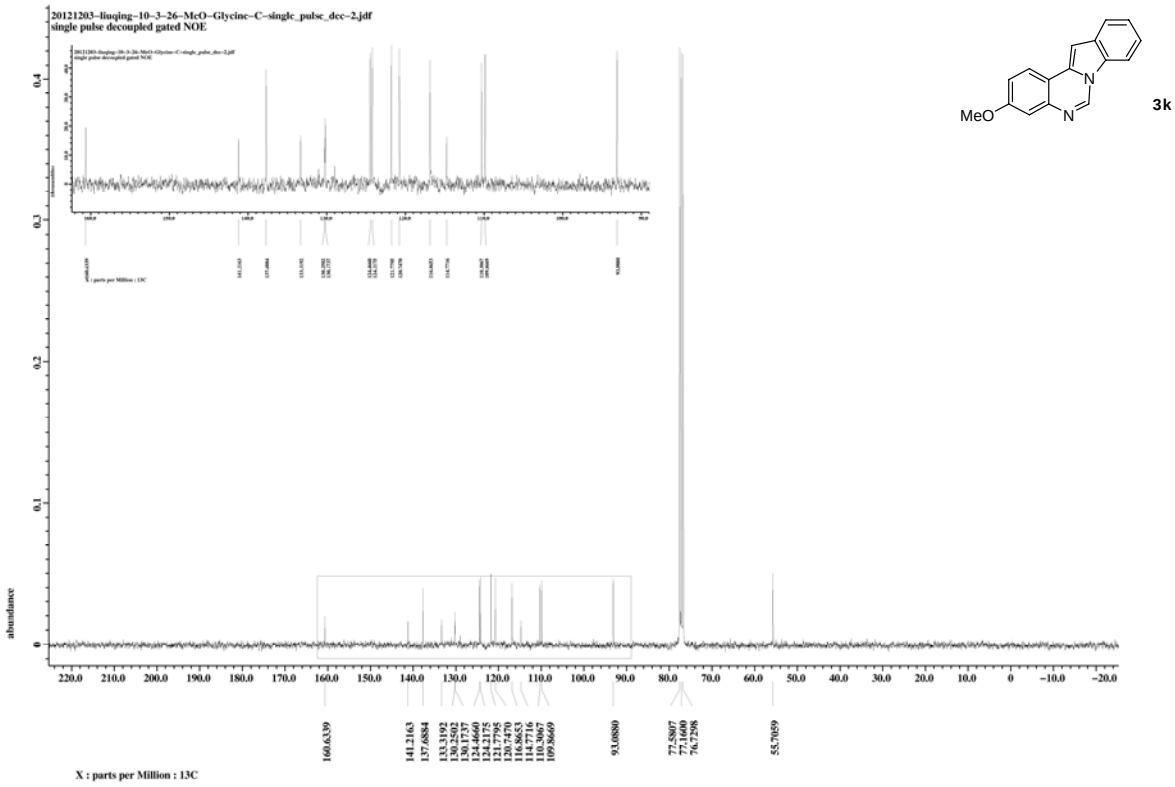
single_pulse
MeO
N
N
3k
abundance
X : parts per Million : 1H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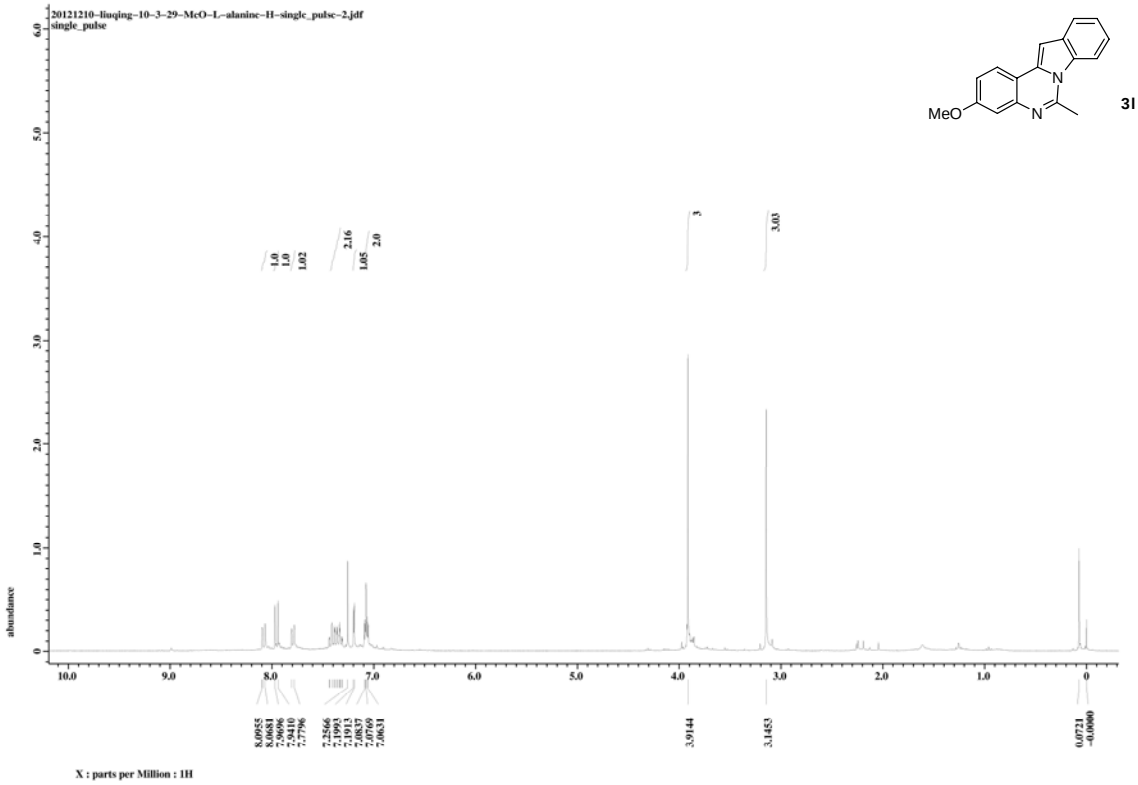
MeO
N
N
3k
abundance
X : parts per Million : 13C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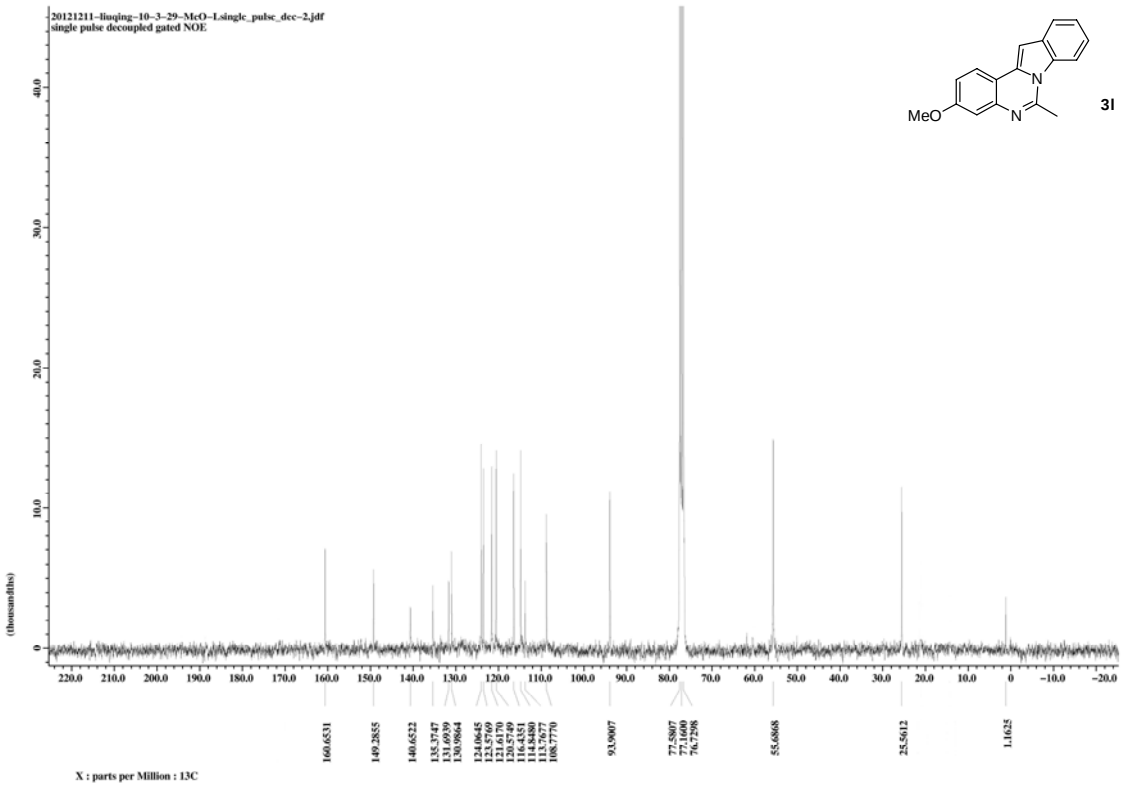
single_pulse
MeO
N
N
3l
abundance
X : parts per Million : 1H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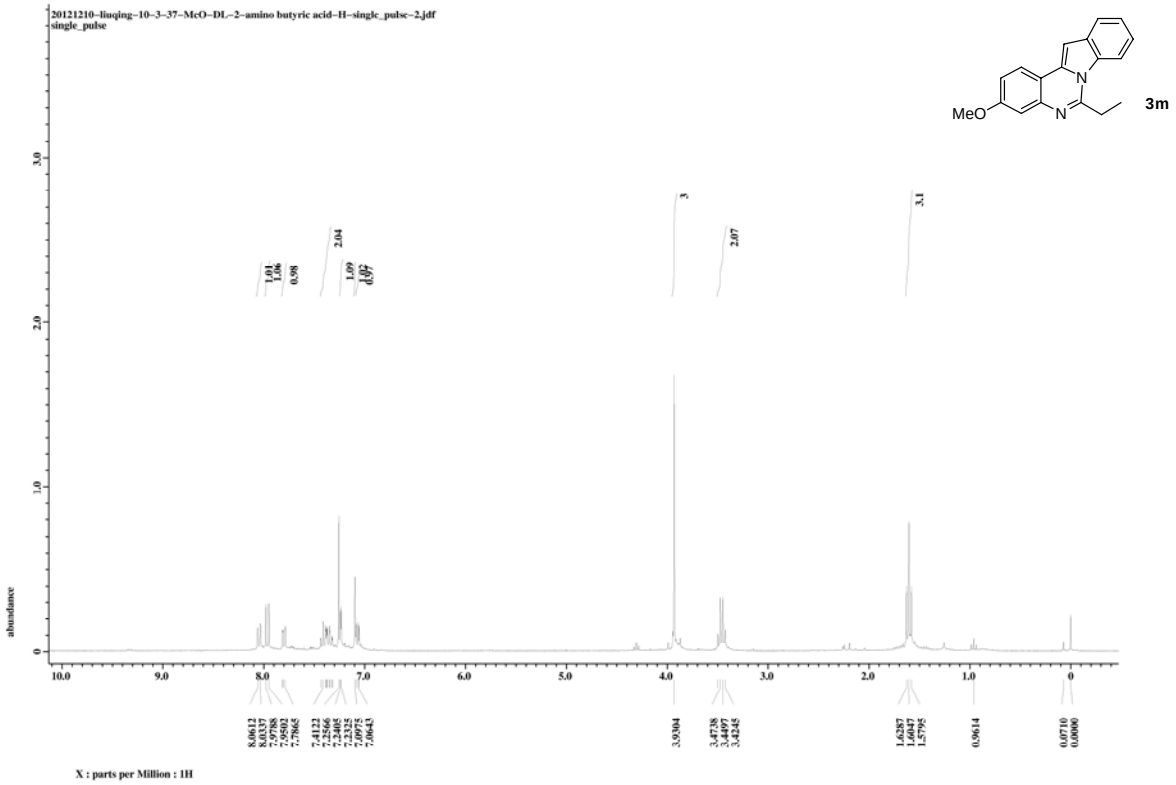
single pulse decoupled gated NOE
MeO
N
N
3l
(thousandths)
X : parts per Million : 13C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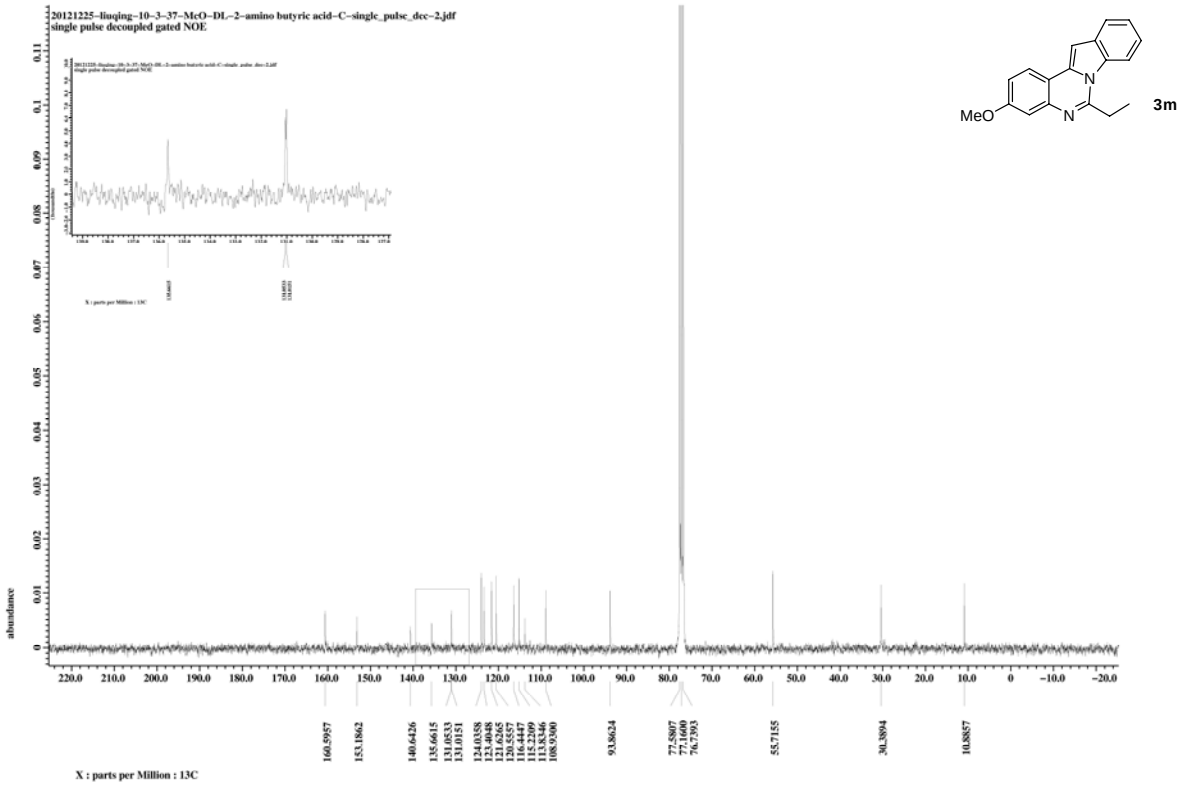
MeO
N
N
3m
abundance
X : parts per Million : 1H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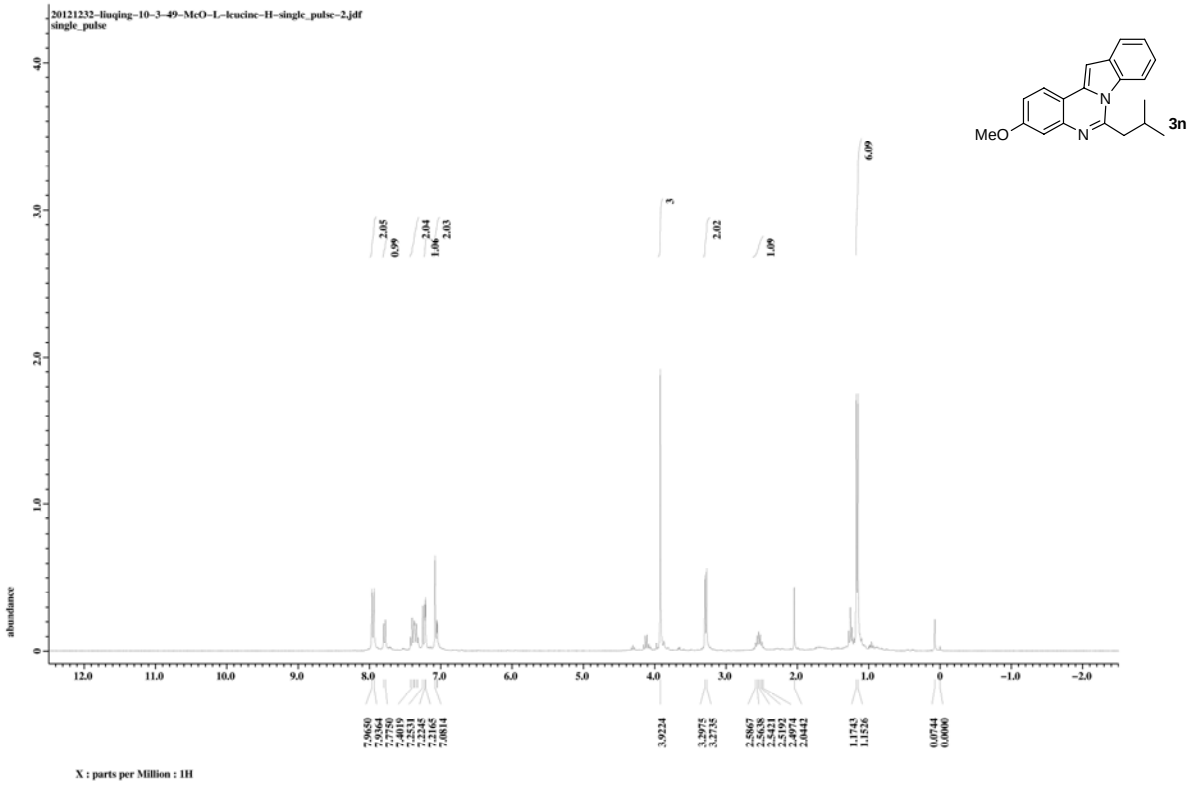
MeO
N
N
3m
abundance
X : parts per Million : 13C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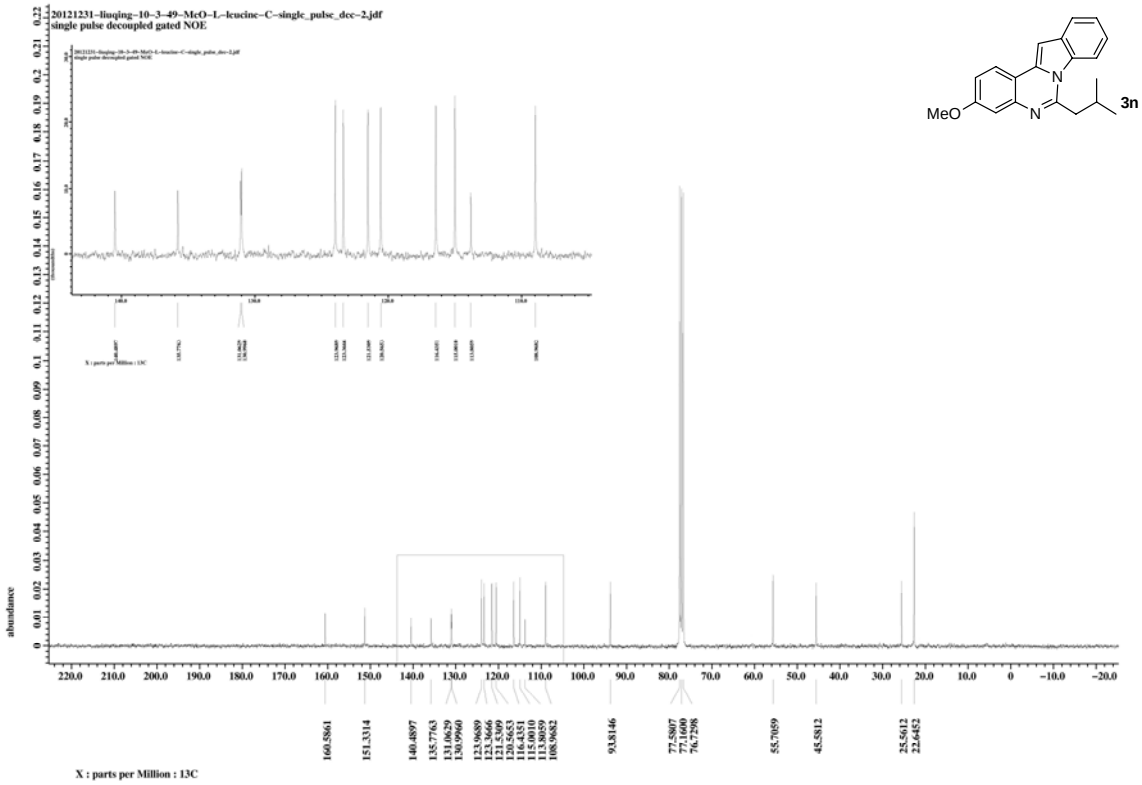
single_pulse
MeO
N
N
3n
abundance
X : parts per Million : 1H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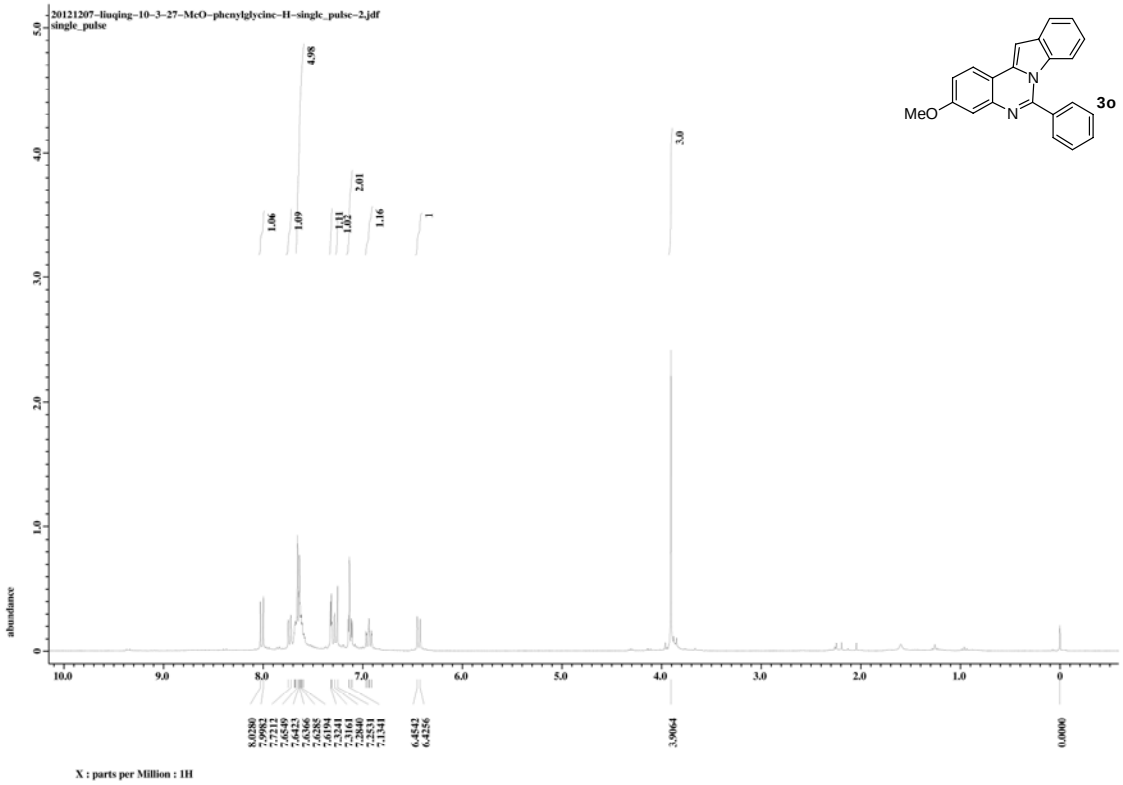
MeO
N
N
3n
abundance
X : parts per Million : 13C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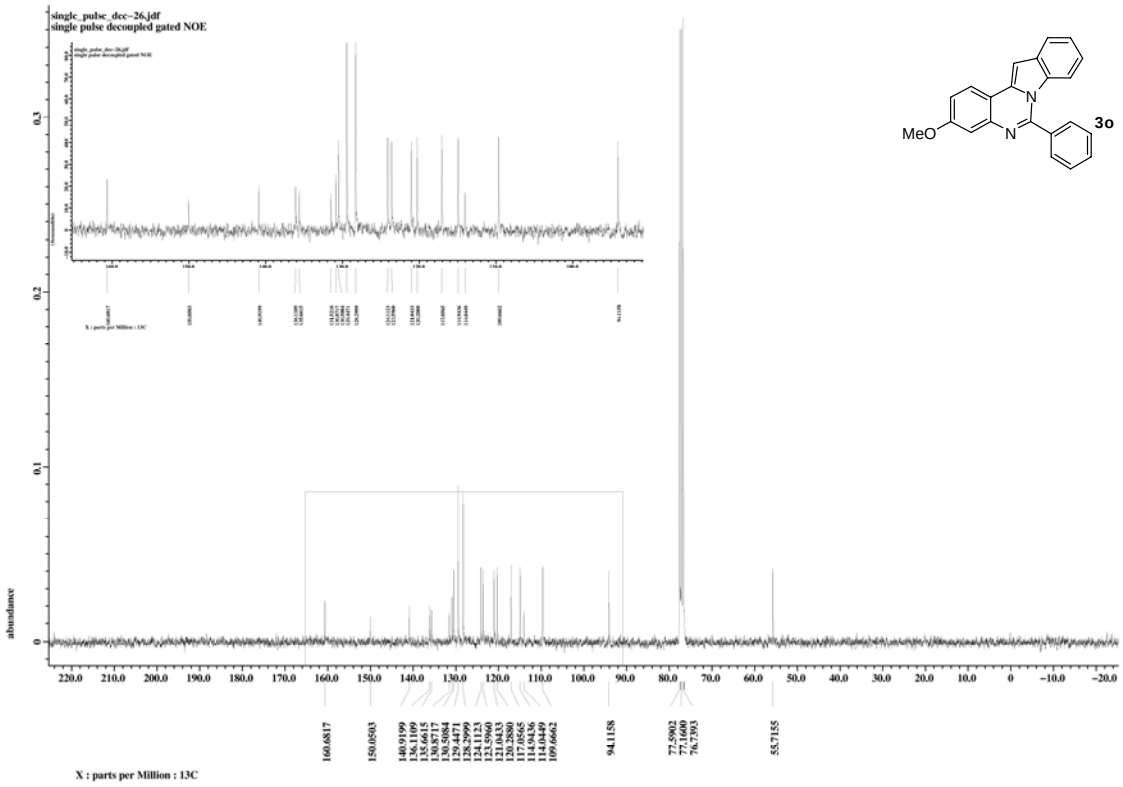
MeO
N
N
3o
X : parts per Million : 1H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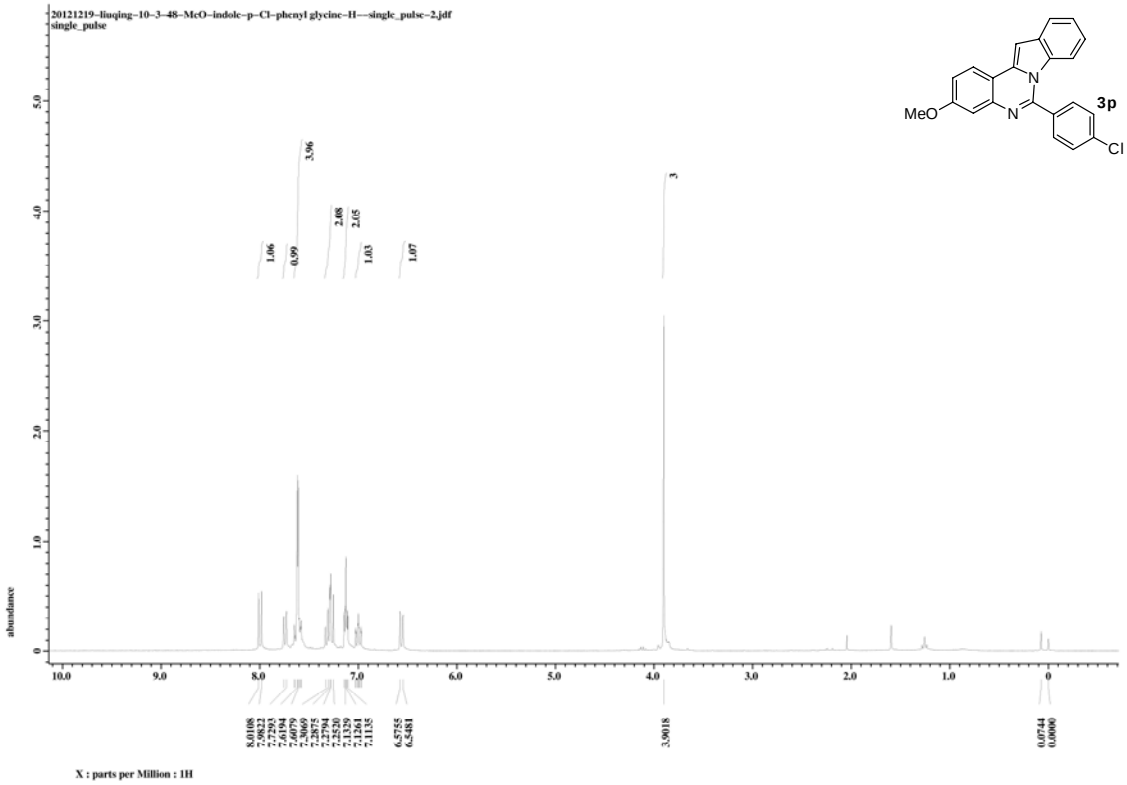
single pulse decoupled gated NOE
MeO
N
N
3o
X : parts per Million : 13C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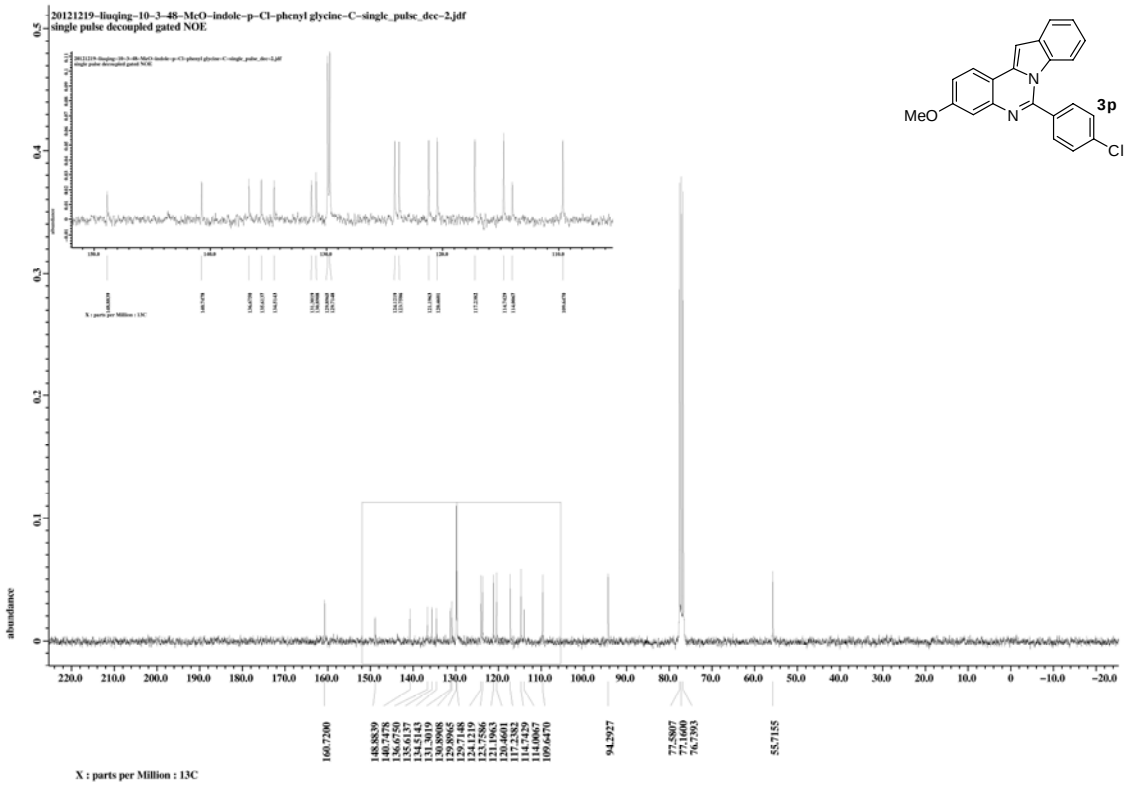
single_pulse
MeO
N
N
3p
Cl
abundance
X : parts per Million : 1H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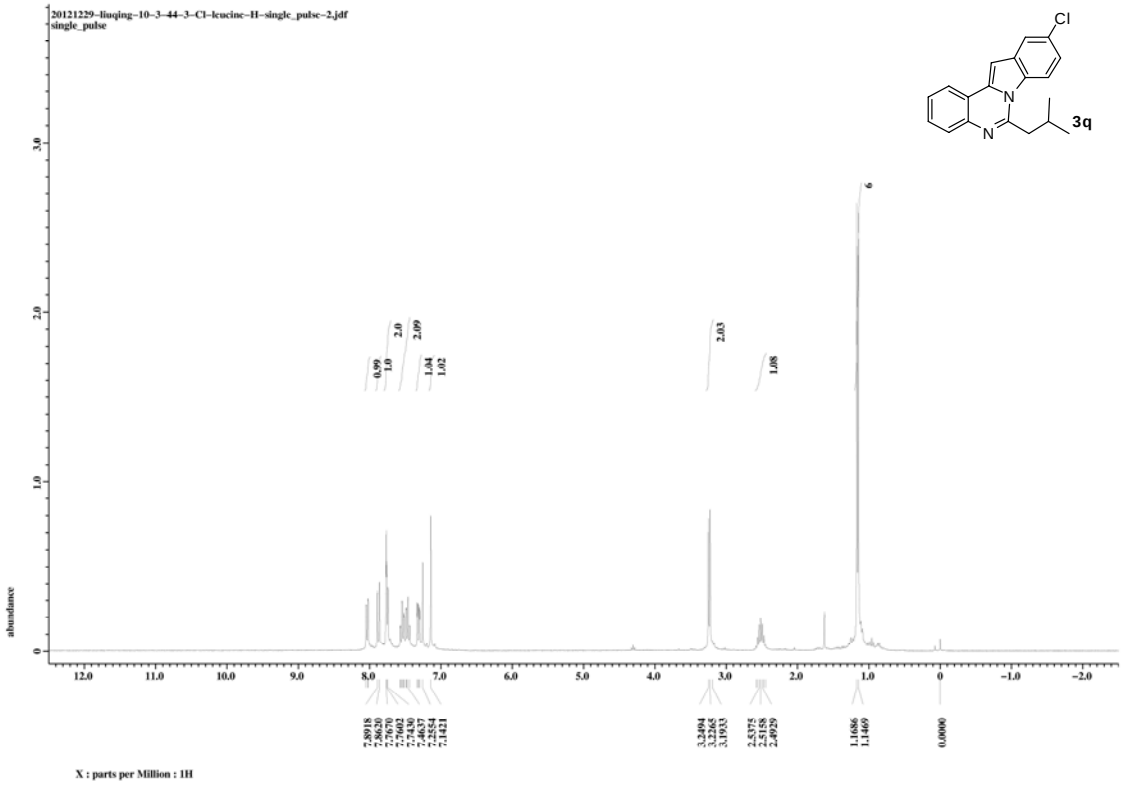
single pulse decoupled gated NOE
MeO
N
N
3p
Cl
abundance
X : parts per Million : 13C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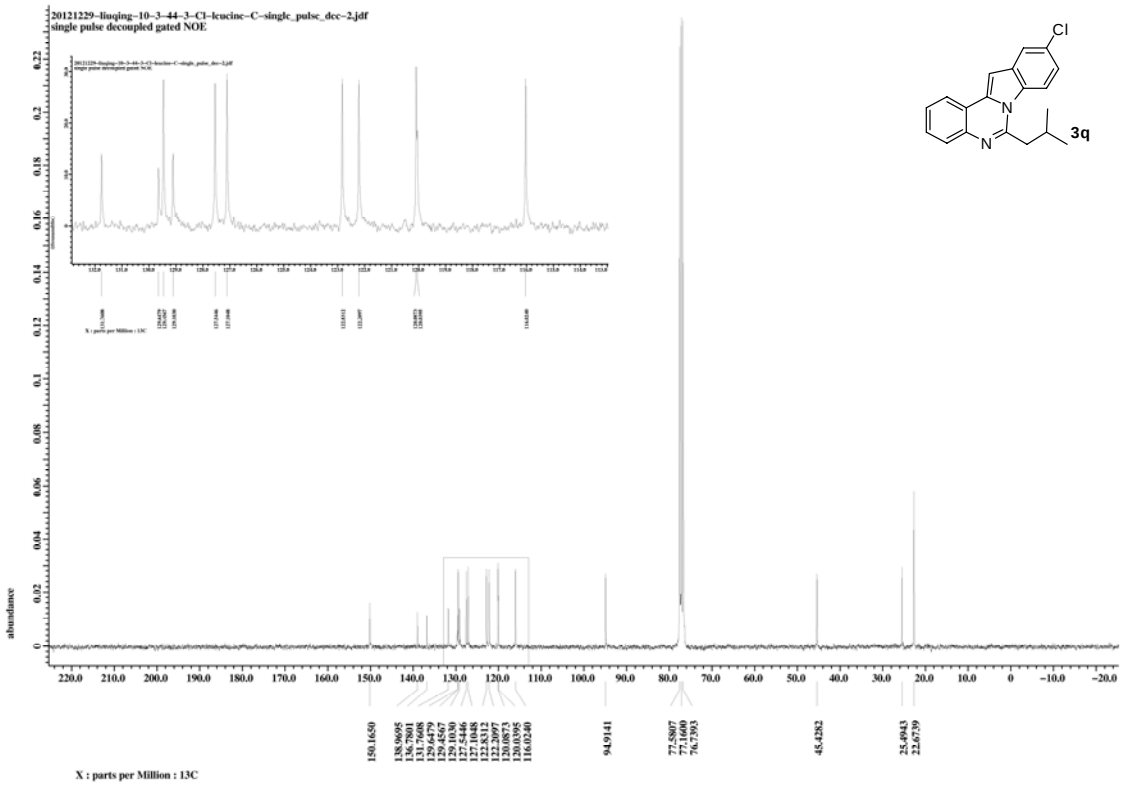
single_pulse
Cl
N
N
3q
abundance
X : parts per Million : 1H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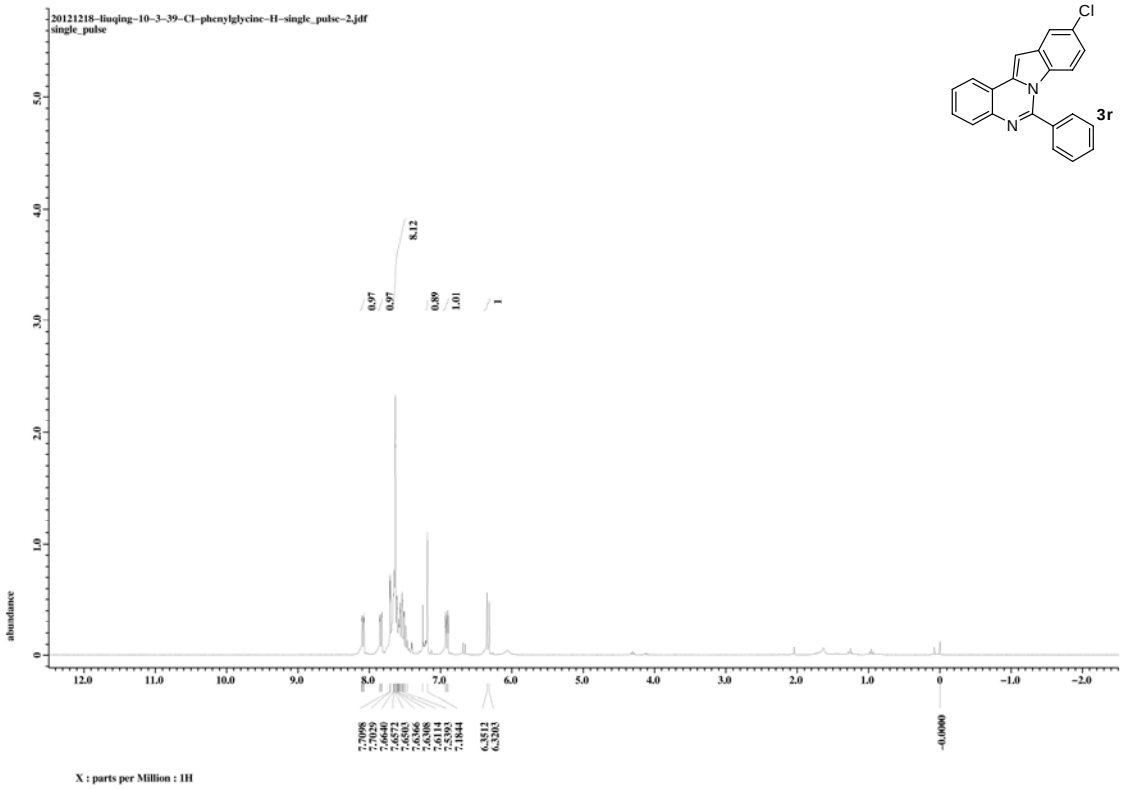
single pulse decoupled gated NOE
Cl
N
N
3q
abundance
X : parts per Million : 13C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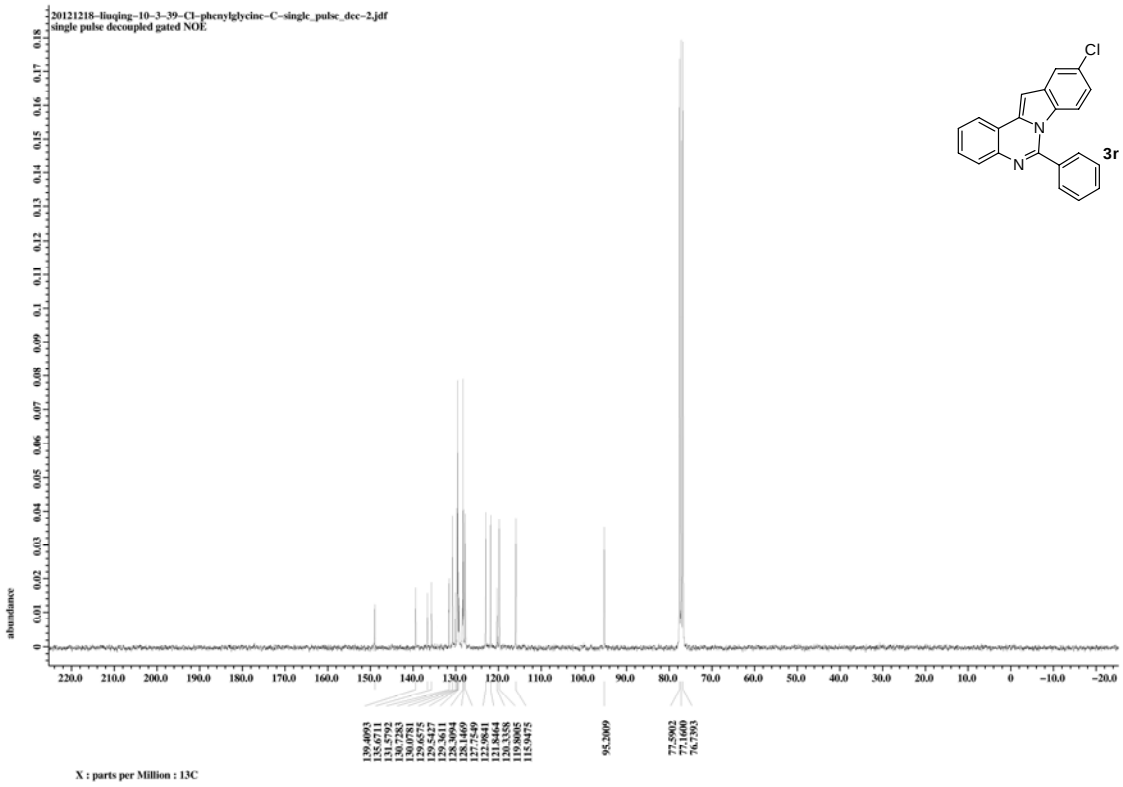
single_pulse
Cl
N
N
3r
8.12
0.97
0.97
0.89
1.01
1
abundance
X : parts per Million : 1H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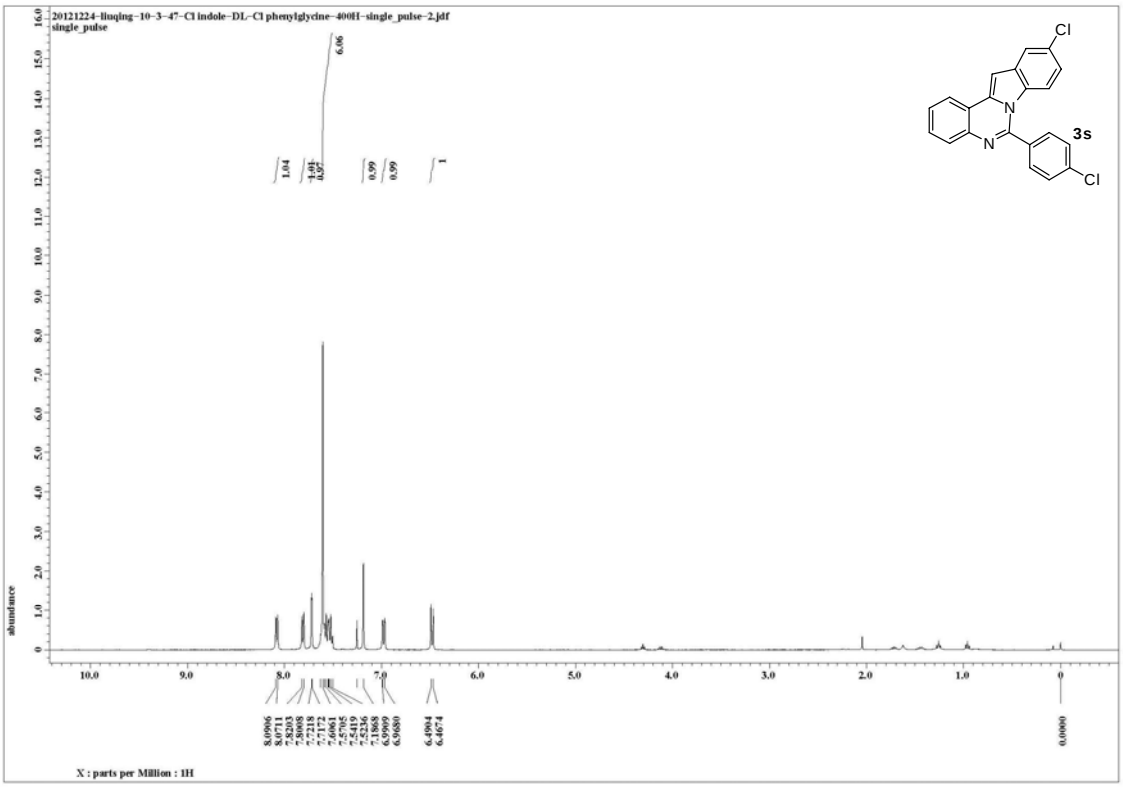
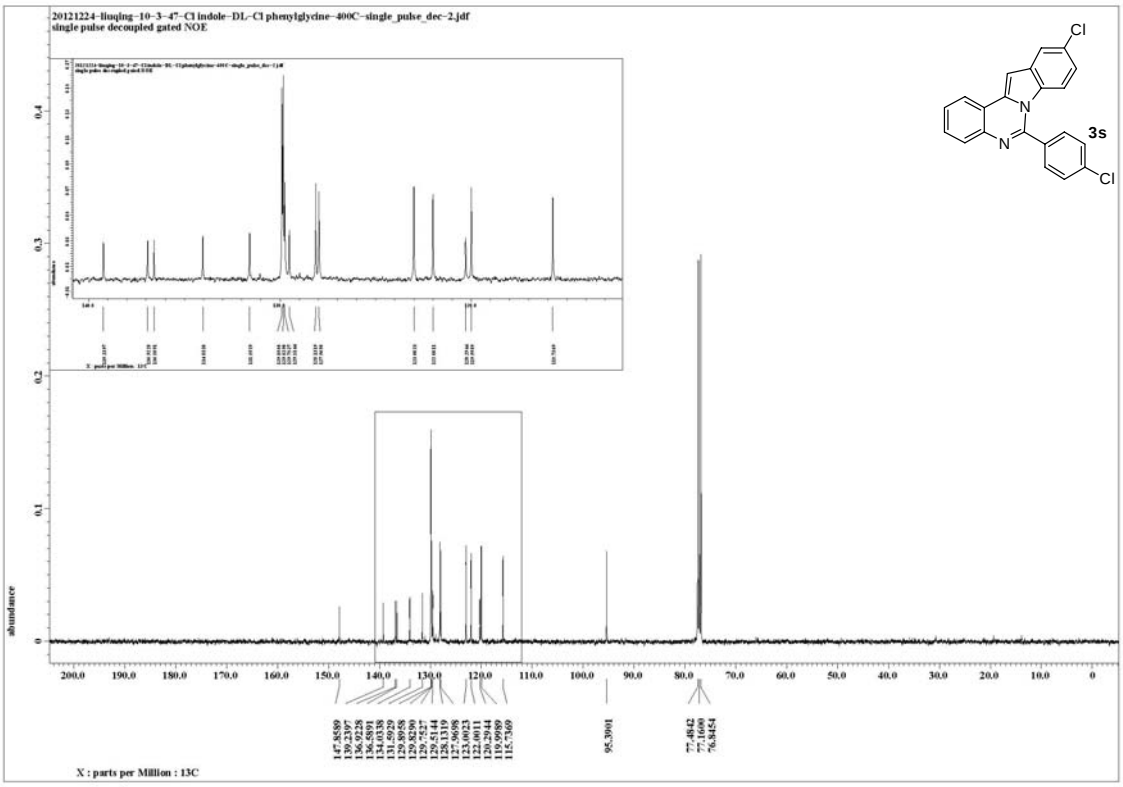
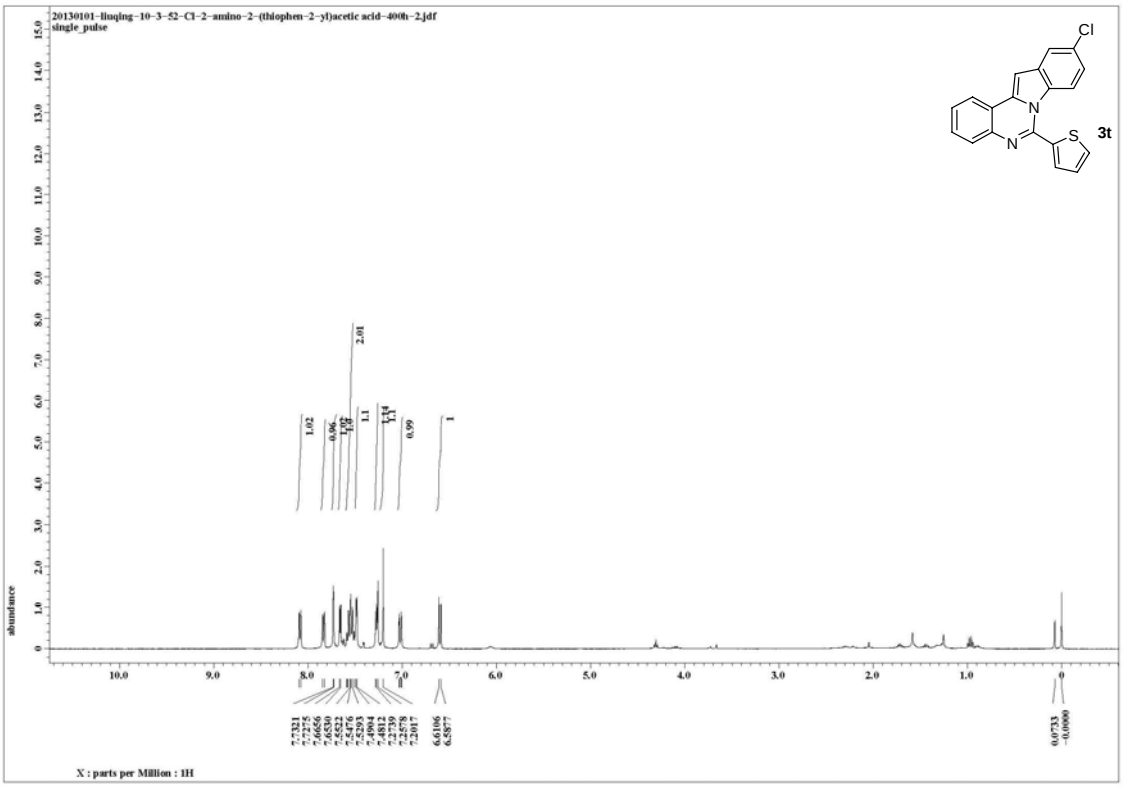
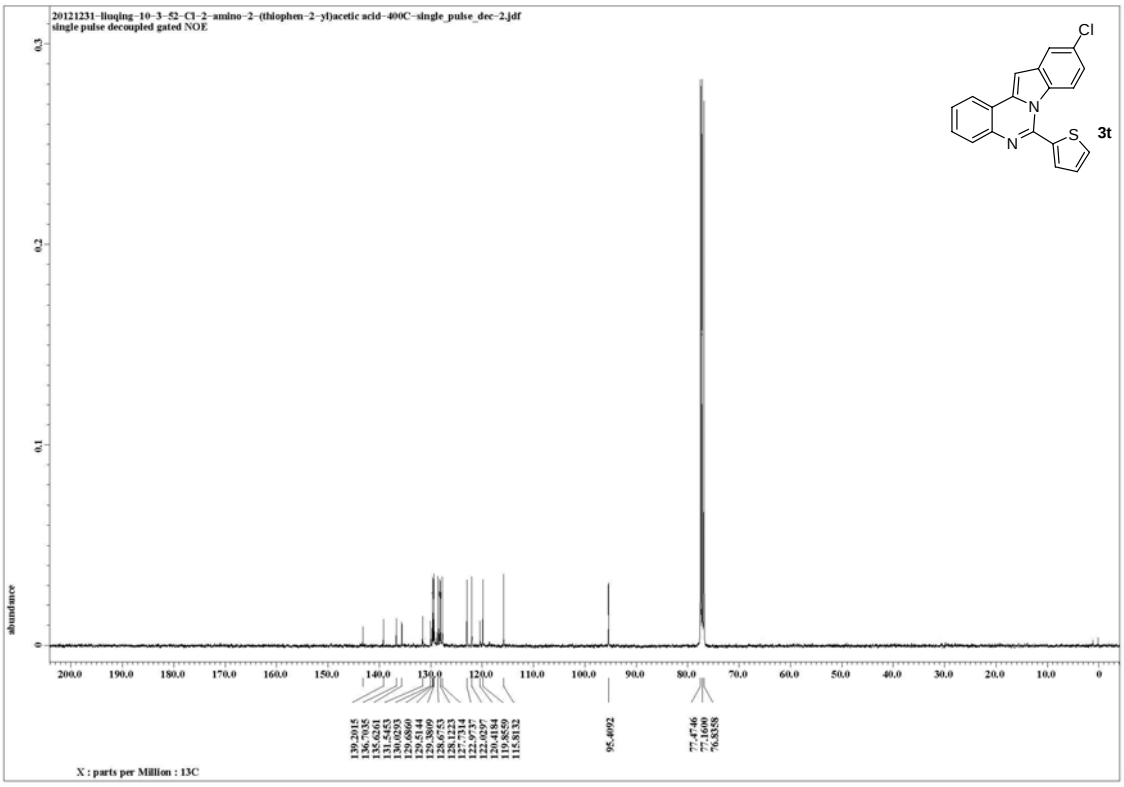
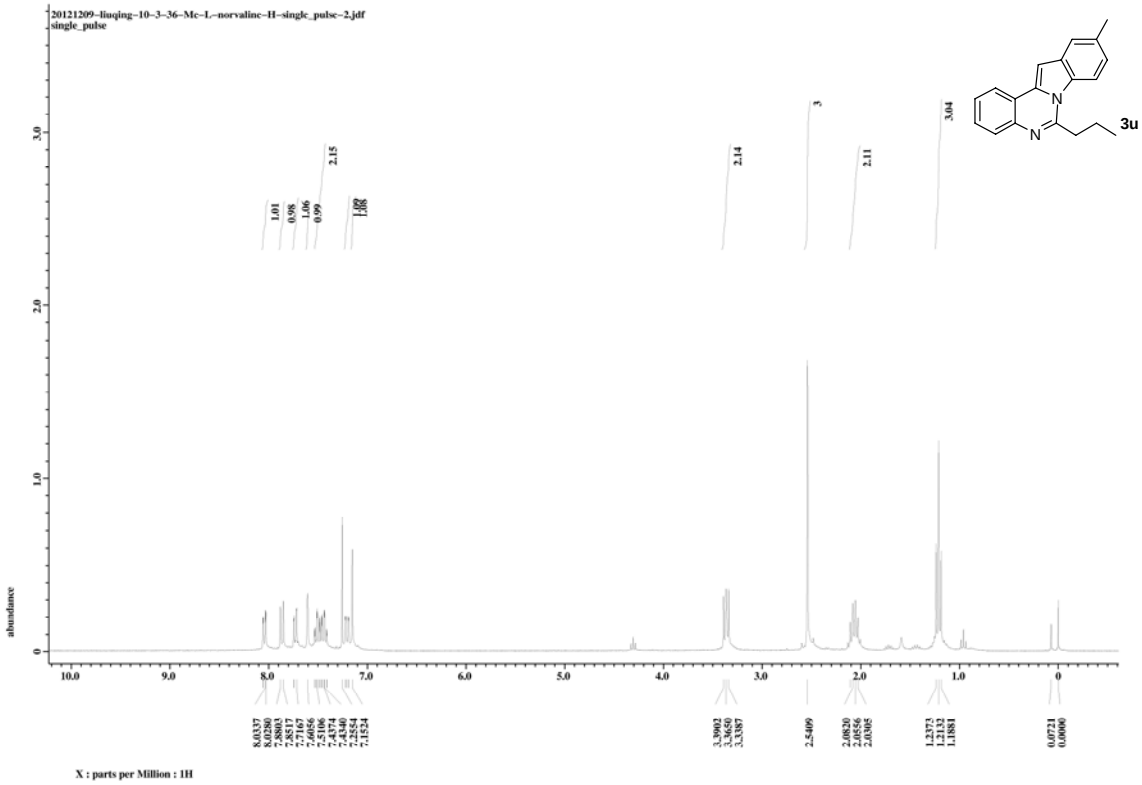
single pulse decoupled gated NOE
Cl
N
N
3r
abundance
X : parts per Million : 13C

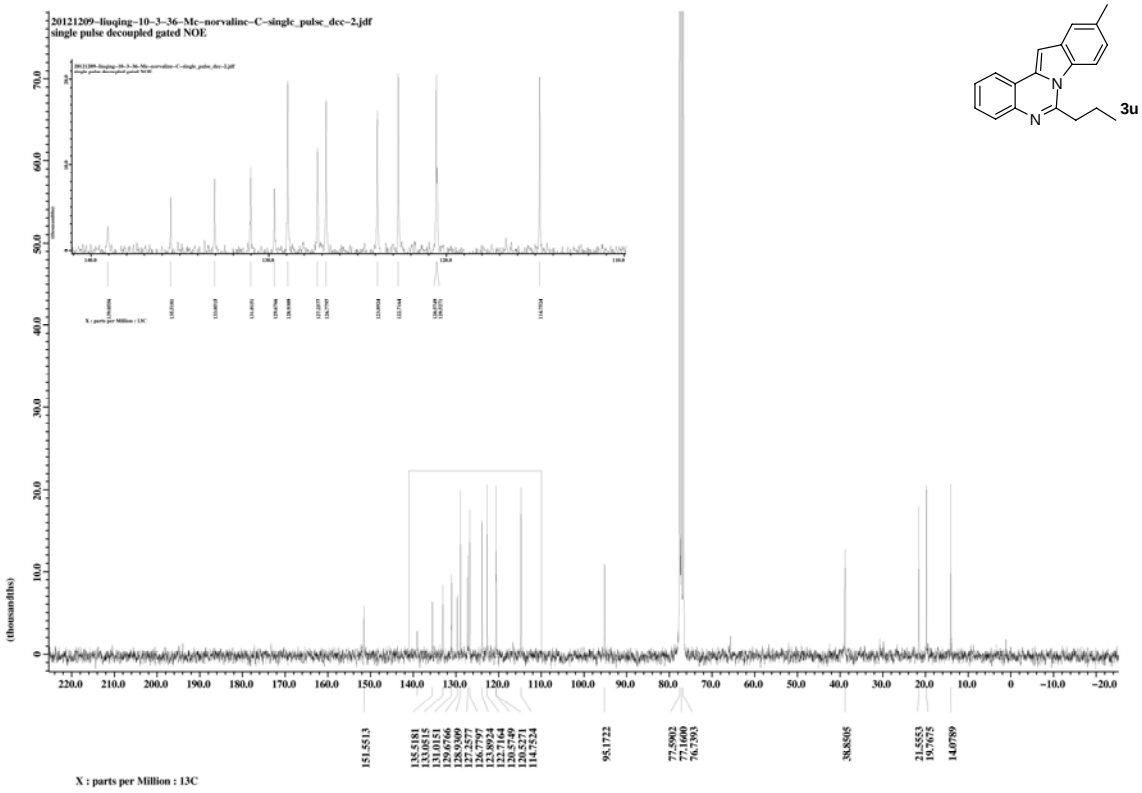

20121224-liuqing-10-3-47-Cl indole-DL-Cl phenylglycine-400H-single_pulse-2.jdf
single_pulse
Cl
N
N
3s
Cl
abundance
X : parts per Million : 1H

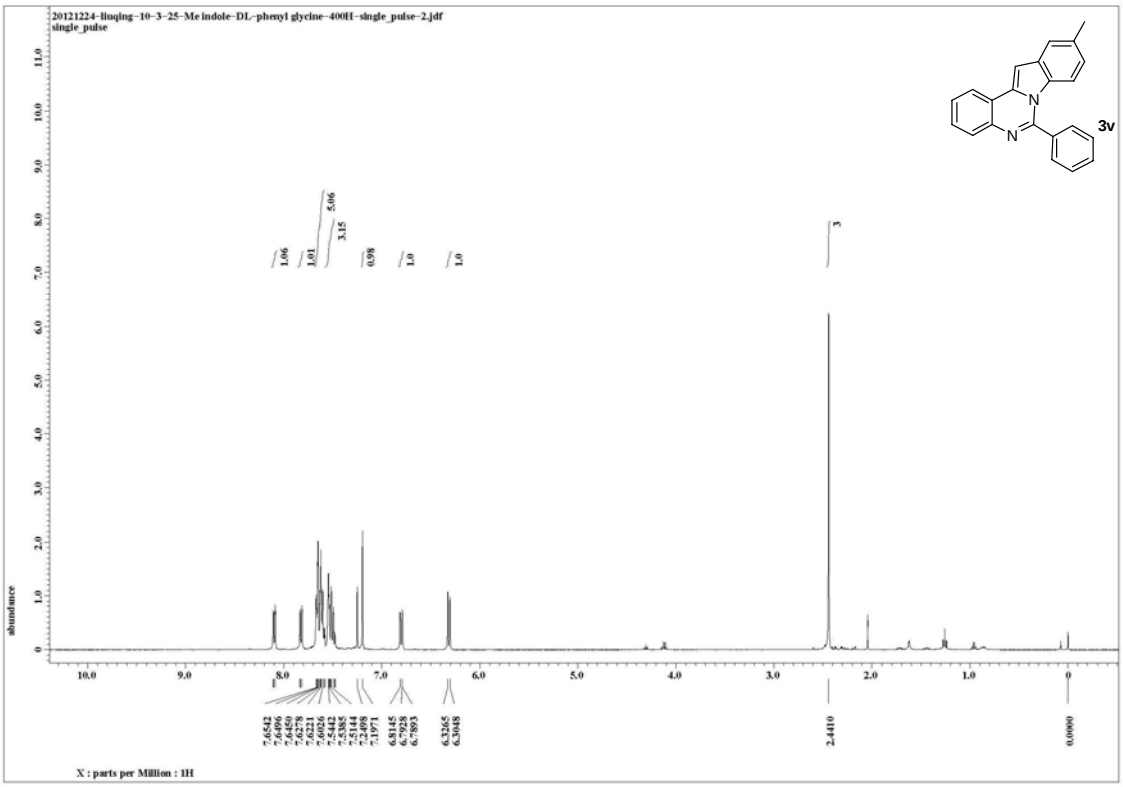

20121224-liuqing-10-3-47-Cl indole-DL-Cl phenylglycine-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
Cl
N
N
3s
Cl
abundance
X : parts per Million : 13C

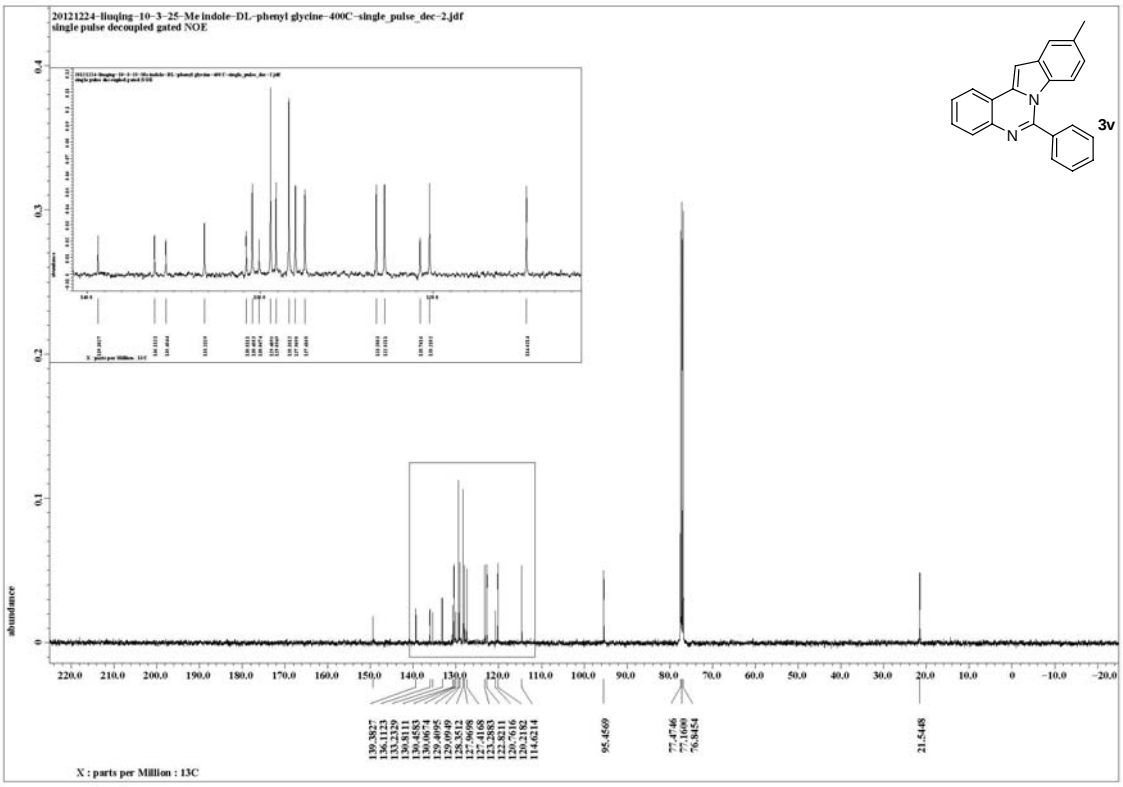

20130101-liuqing-10-3-52-Cl-2-amino-2-(thiophen-2-yl)acetic acid-400h-2.jdf
single_pulse
Cl
N
N
S
3t
abundance
X : parts per Million : 1H

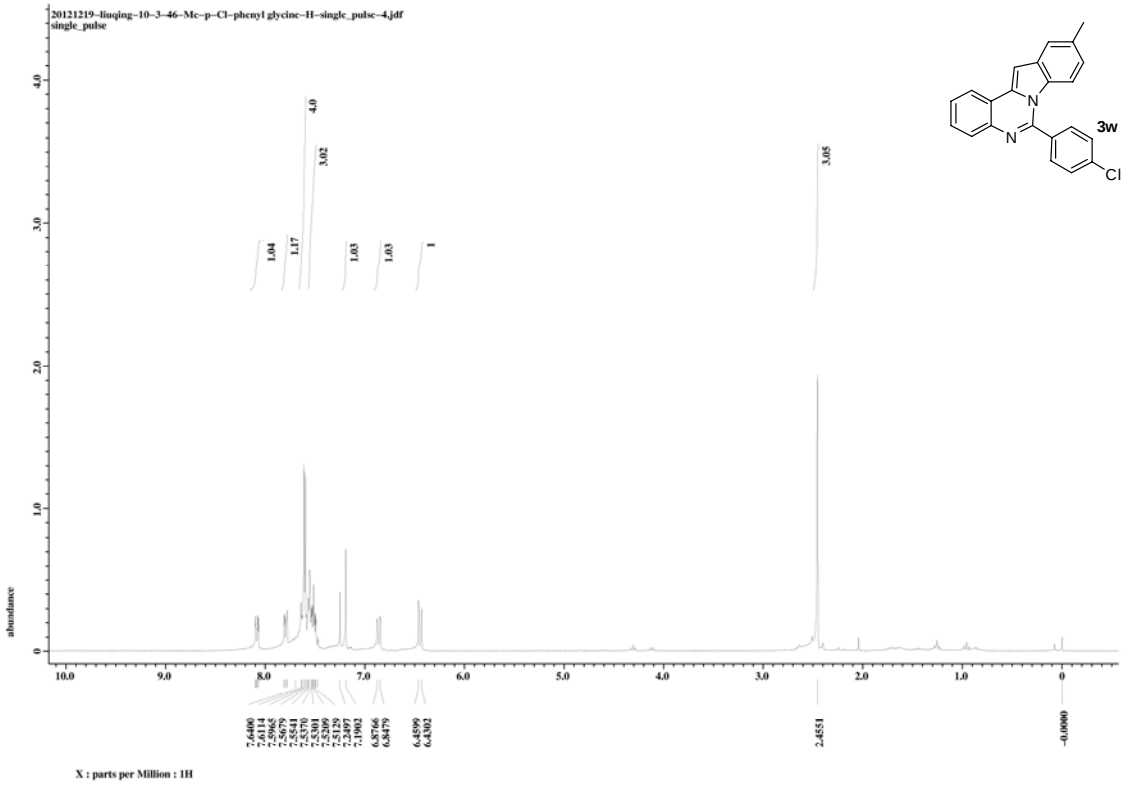

20121231-liuqing-10-3-52-Cl-2-amino-2-(thiophen-2-yl)acetic acid-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
Cl
N
N
S
3t
abundance
X : parts per Million : 13C

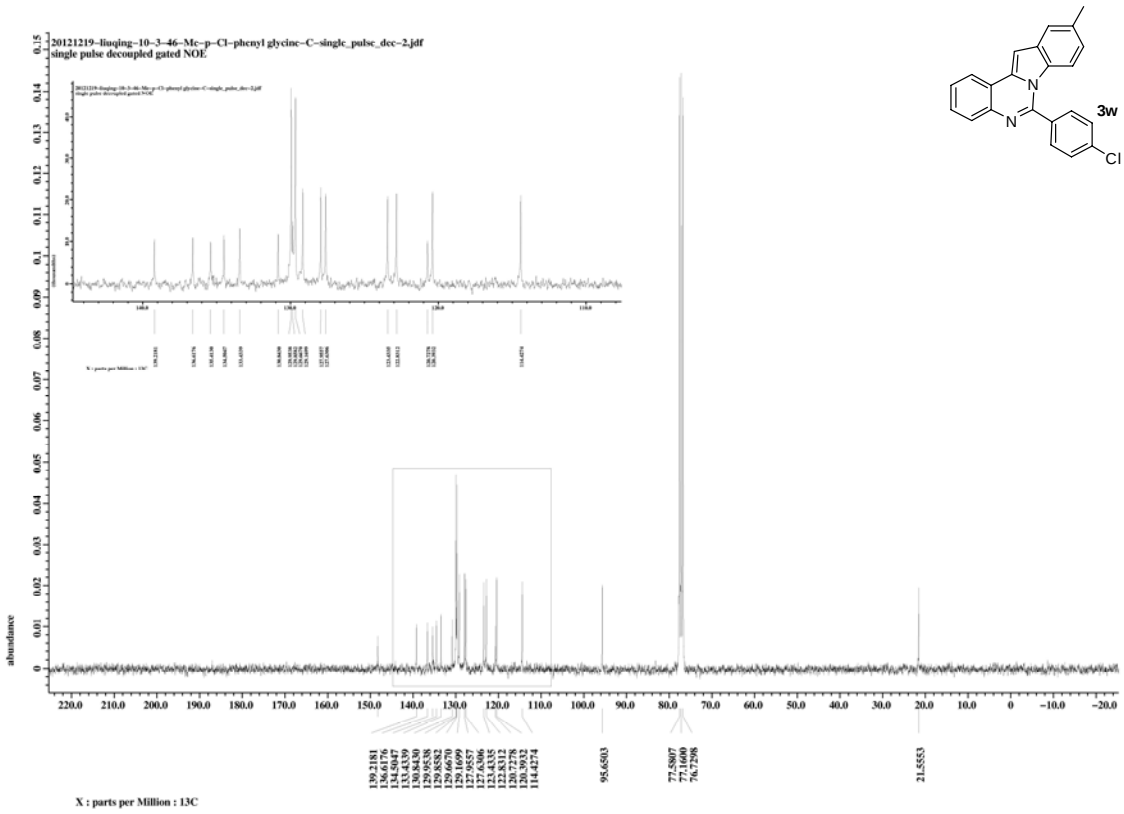

20121209-liuqing-10-3-36-Mc-L-norvalinc-H-singlc_pulsc-2.jdf
single_pulse
3u
abundance
X : parts per Million : 1H

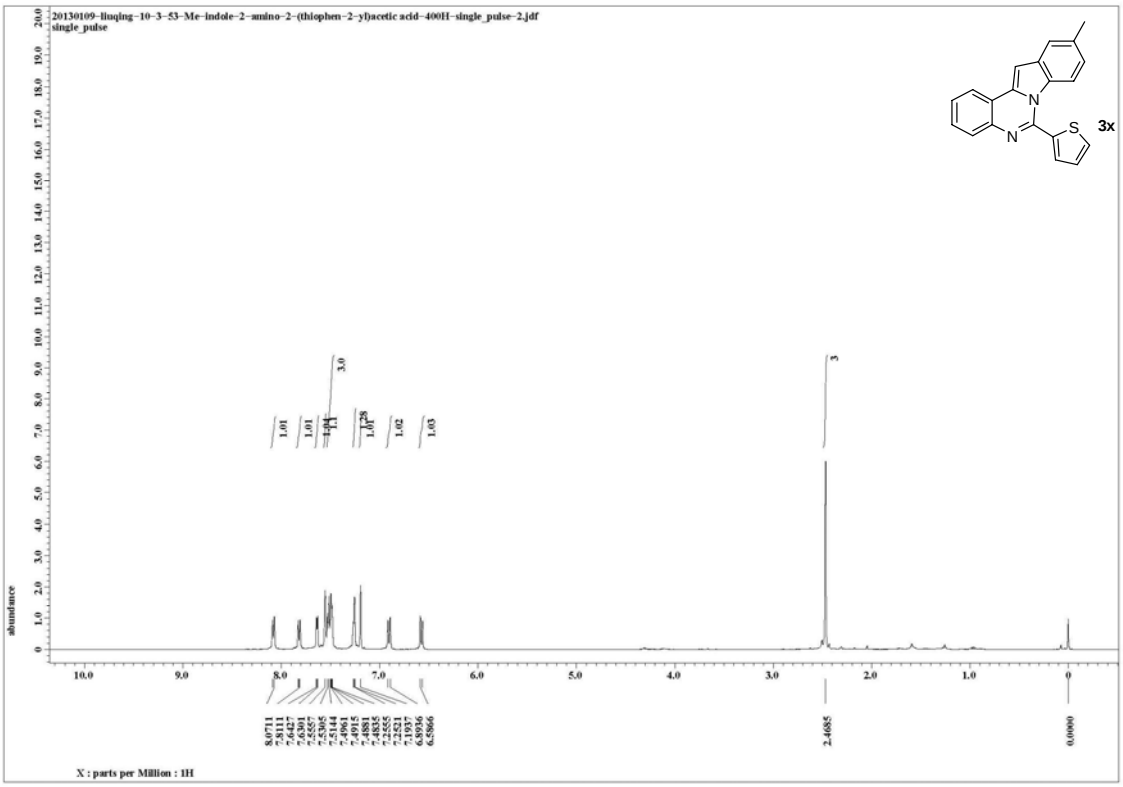

20121209-liuqing-10-3-36-Mc-norvalinc-C-singlc_pulsc_dcc-2.jdf
single pulse decoupled gated NOE
3u
(thousands/hz)
X : parts per Million : 13C

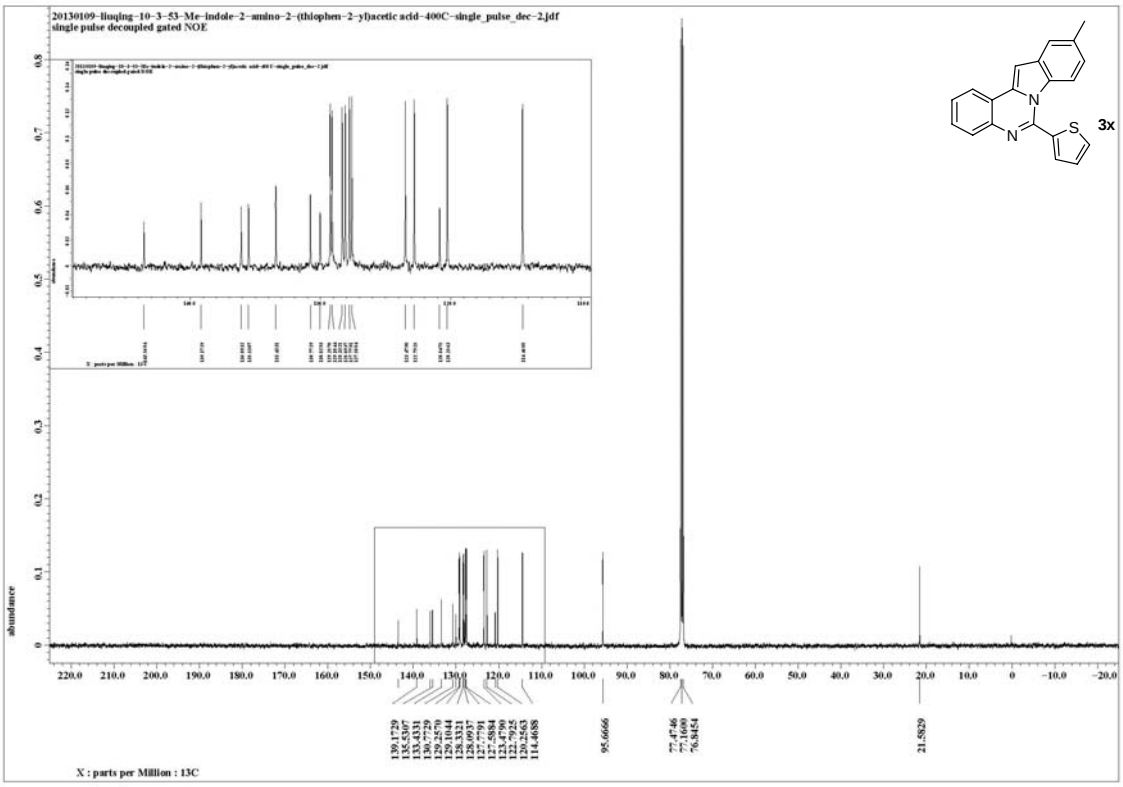

20121224-liuqing-10-3-25-Me indole-DL-phenyl glycine-400H-single_pulse-2.jdf
single_pulse
3v
X : parts per Million : 1H

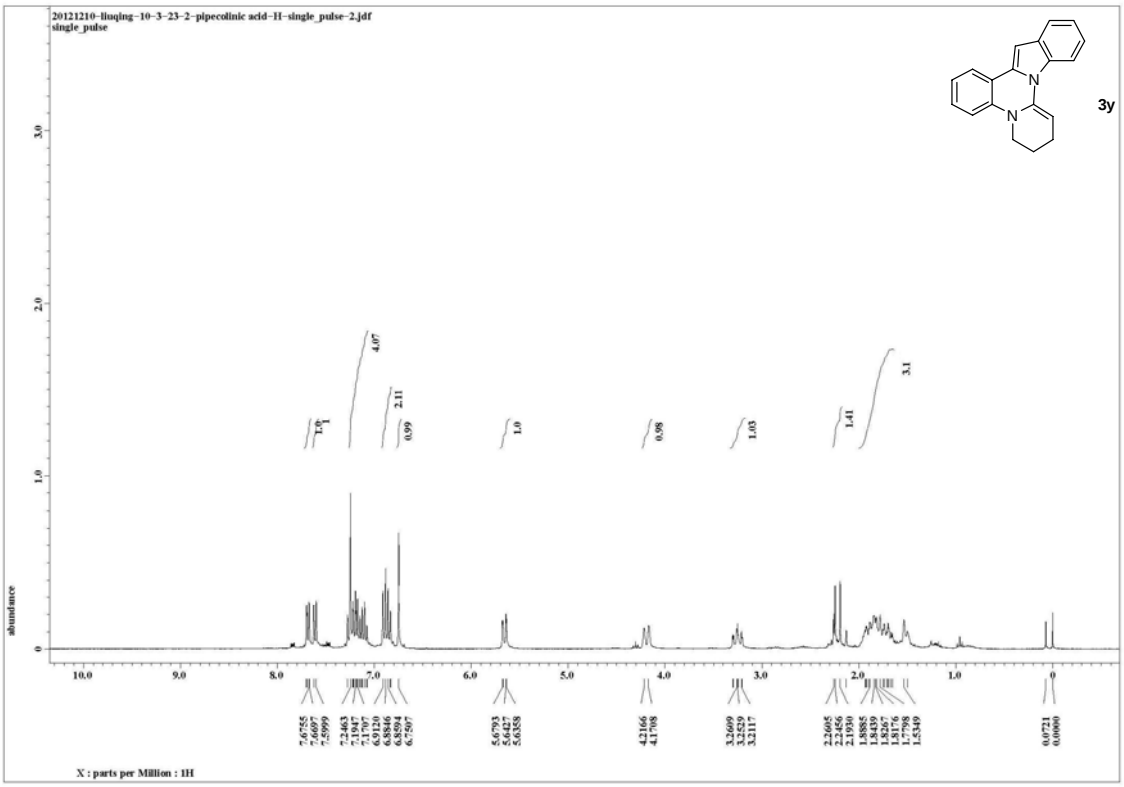

20121224-liuqing-10-3-25-Me indole-DL-phenyl glycine-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
3v
X : parts per Million : 13C

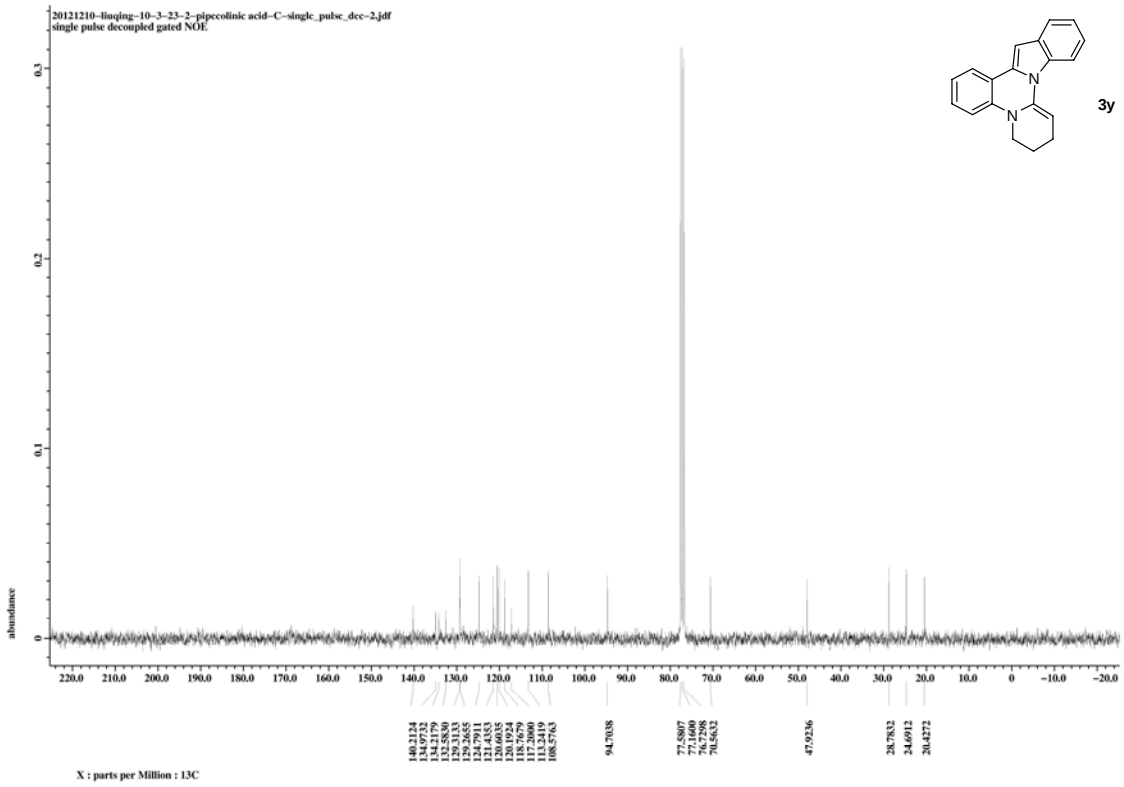

20121219-liuqing-10-3-46-Me-p-Cl-phenyl glycine-H-single_pulse-4.jdf
single_pulse
3w
Cl
N
N
abundance
X : parts per Million : 1H

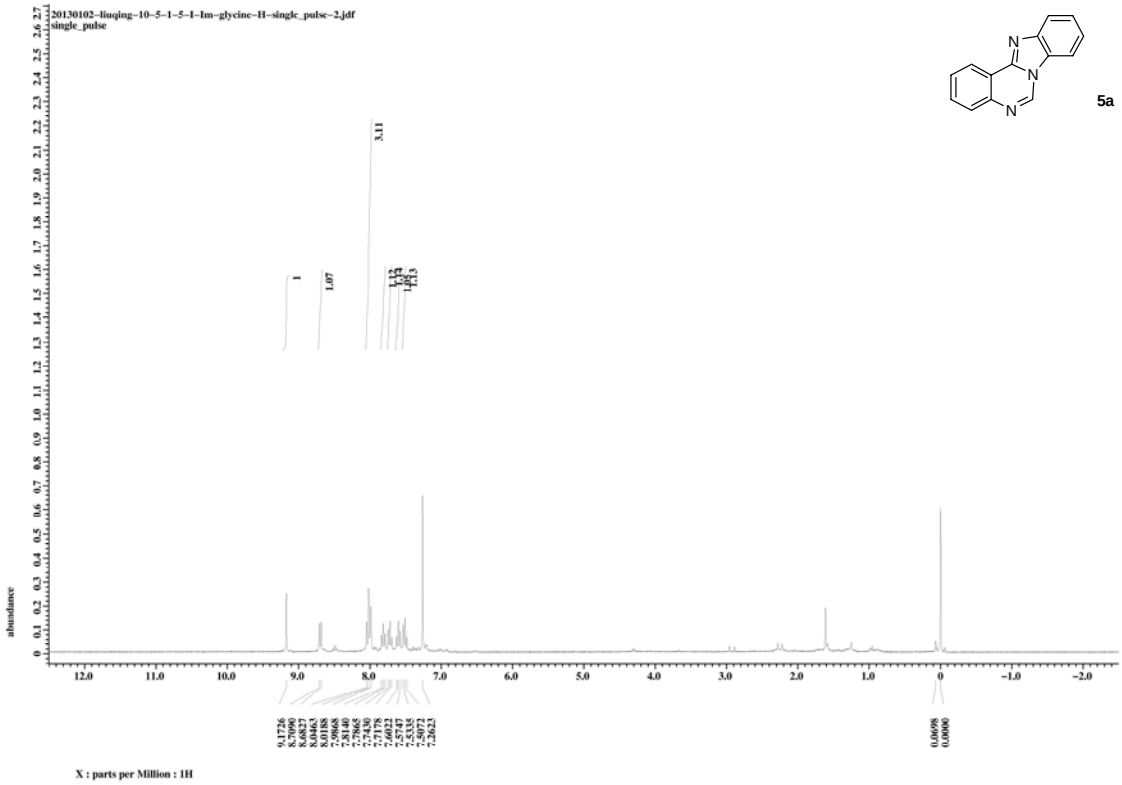

20121219-liuqing-10-3-46-Me-p-Cl-phenyl glycine-C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
3w
Cl
N
N
abundance
X : parts per Million : 13C

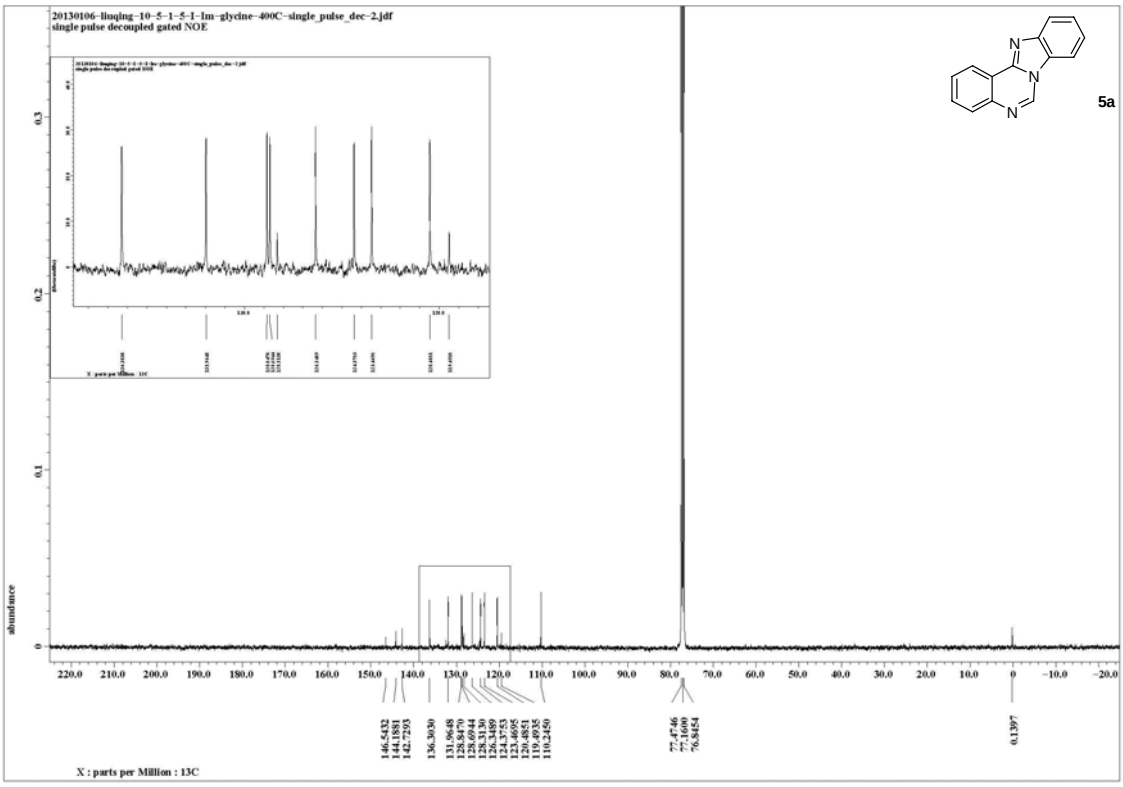

20130109-liuqing-10-3-53-Me-indole-2-amino-2-(thiophen-2-yl)acetic acid-400H-single_pulse-2.jdf
single_pulse
3x
abundance
X : parts per Million : 1H

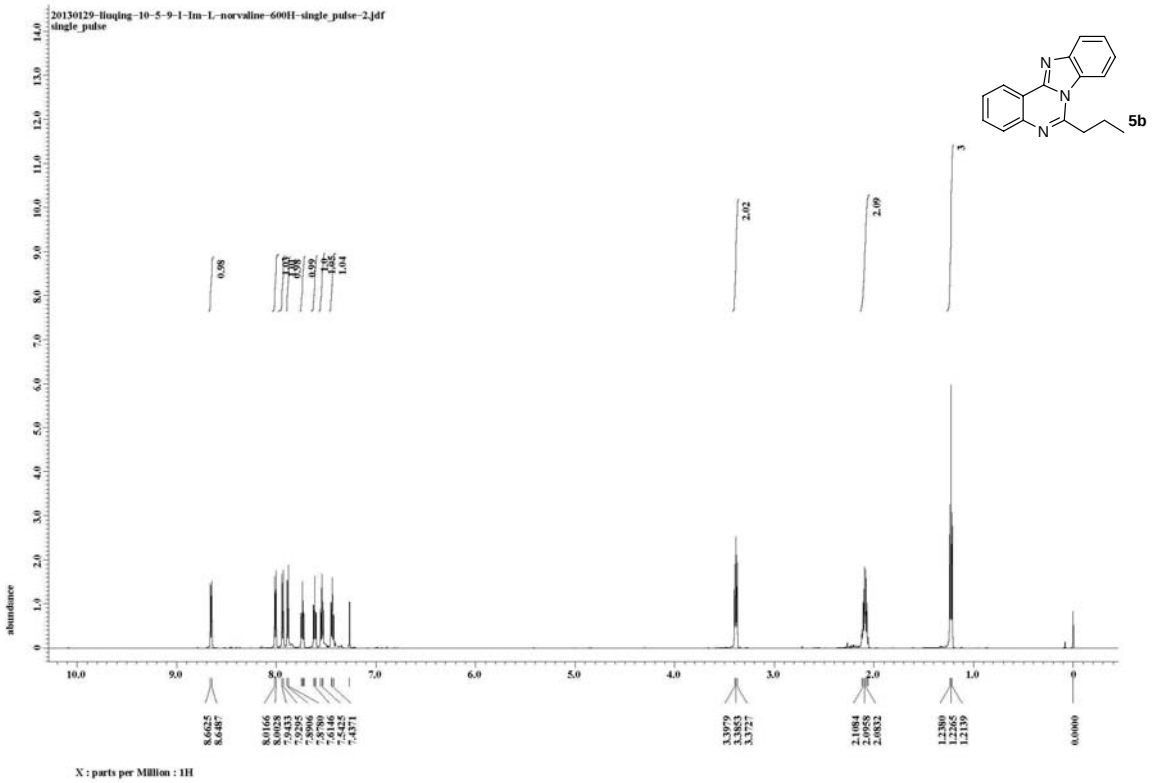

20130109-liuqing-10-3-53-Me-indole-2-amino-2-(thiophen-2-yl)acetic acid-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
3x
abundance
X : parts per Million : 13C

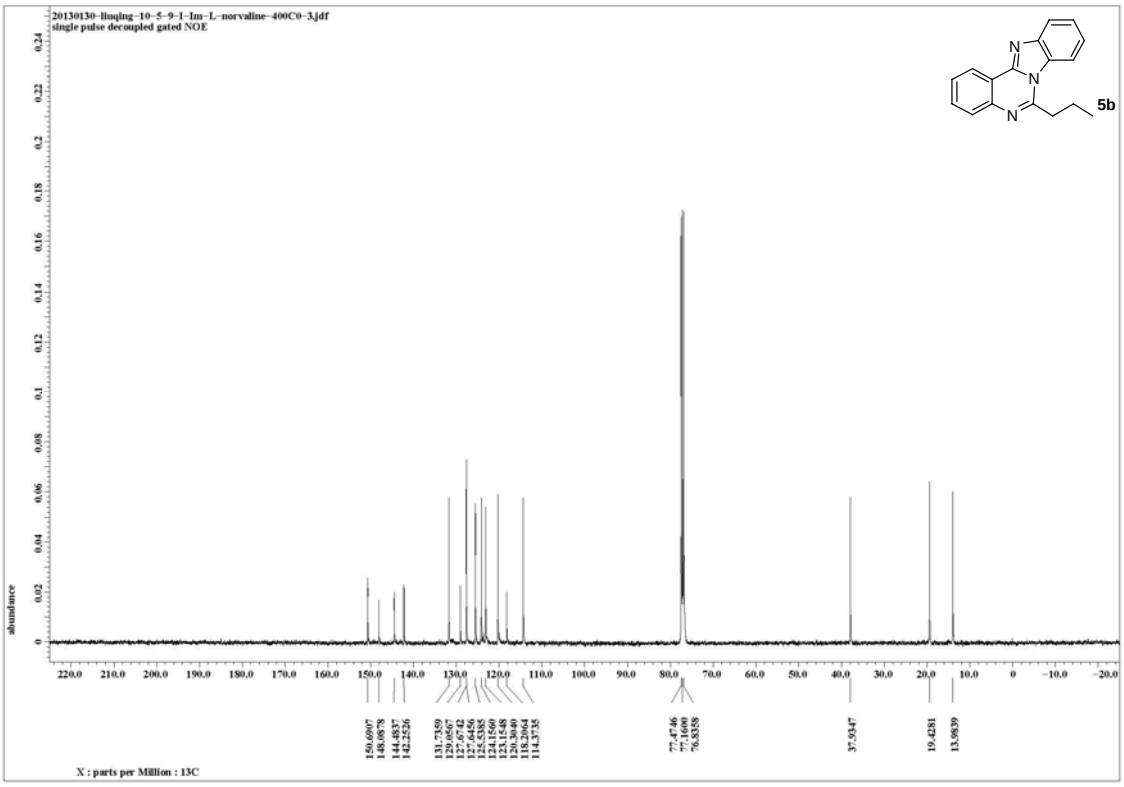

20121210-liuqing-10-3-23-2-pipecolinic acid-H-single_pulse-2.jdf
single_pulse
3y
abundance
X : parts per Million : 1H

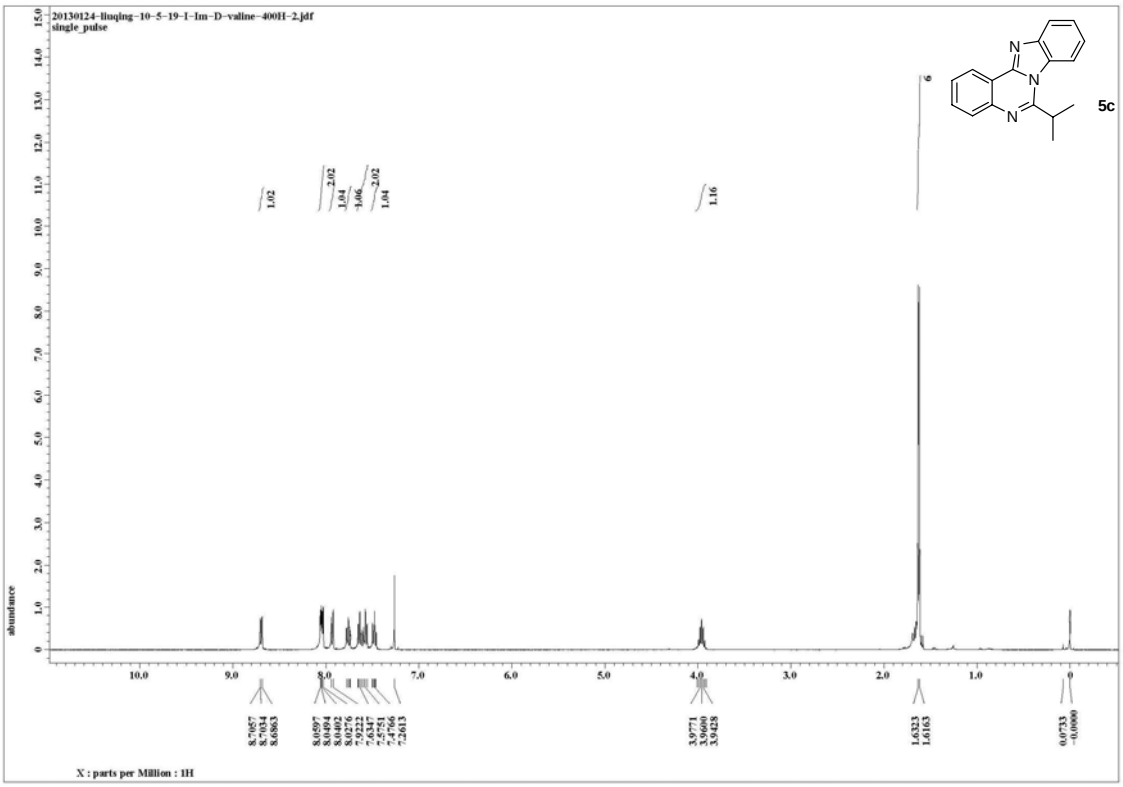

20121210-liuqing-10-3-23-2-pipecolinic acid-C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
3y
abundance
X : parts per Million : 13C

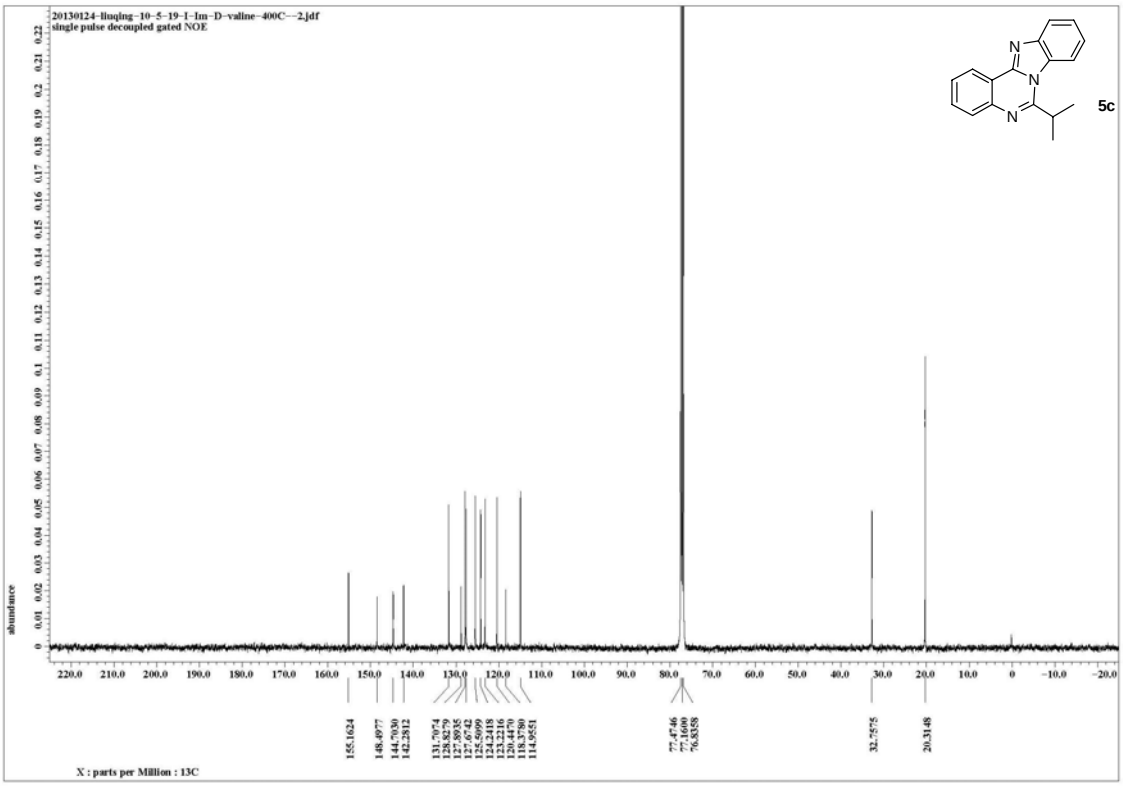

20130102-liuqing-10-5-1-5-1-Im-glycine-H-single_pulse-2.jdf
single_pulse
5a
X : parts per Million : 1H

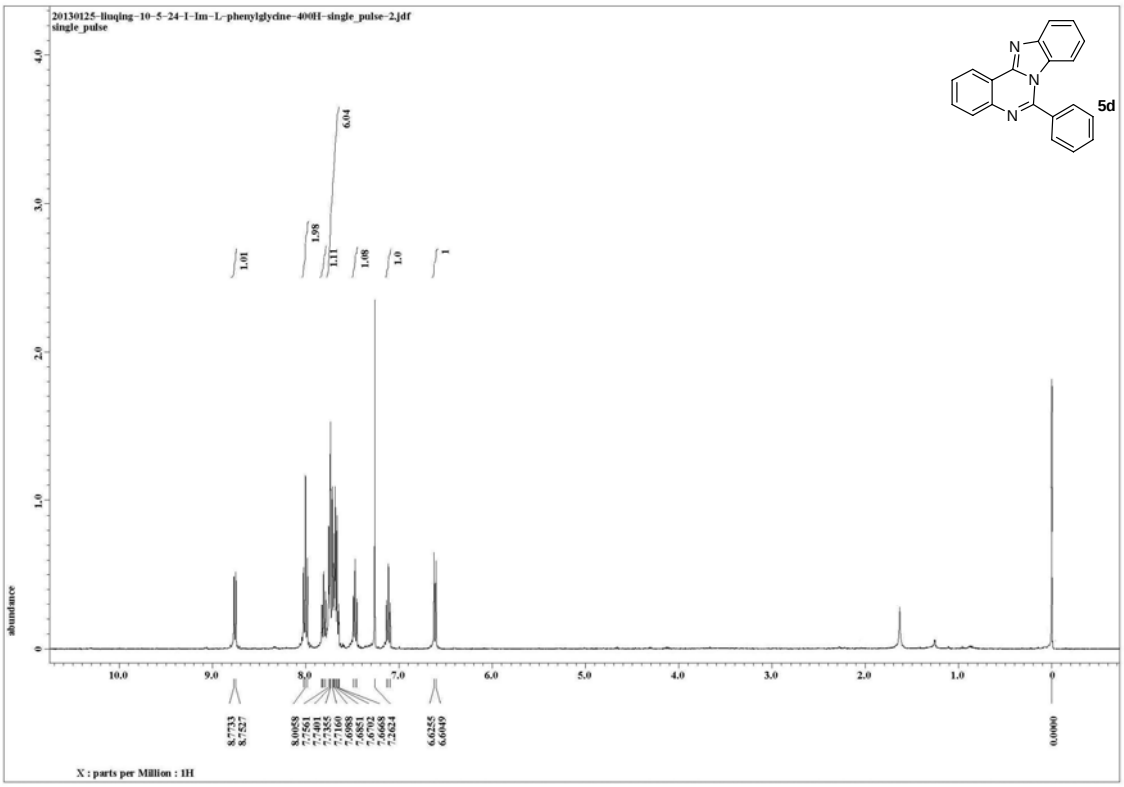

20130106-liuqing-10-5-1-5-1-Im-glycine-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
5a
X : parts per Million : 13C

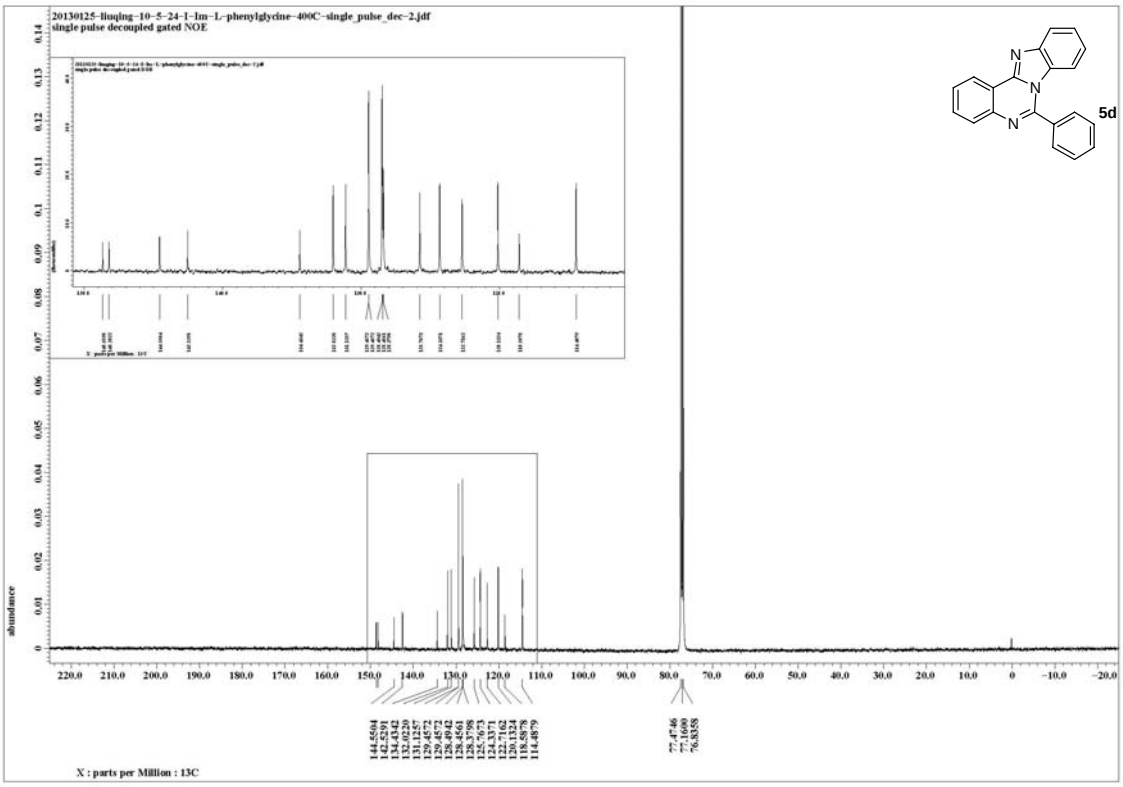

20130129-liuqing-10-5-9-1-Im-L-norvaline-600H-single_pulse-2.jdf
single_pulse
5b
X : parts per Million : 1H

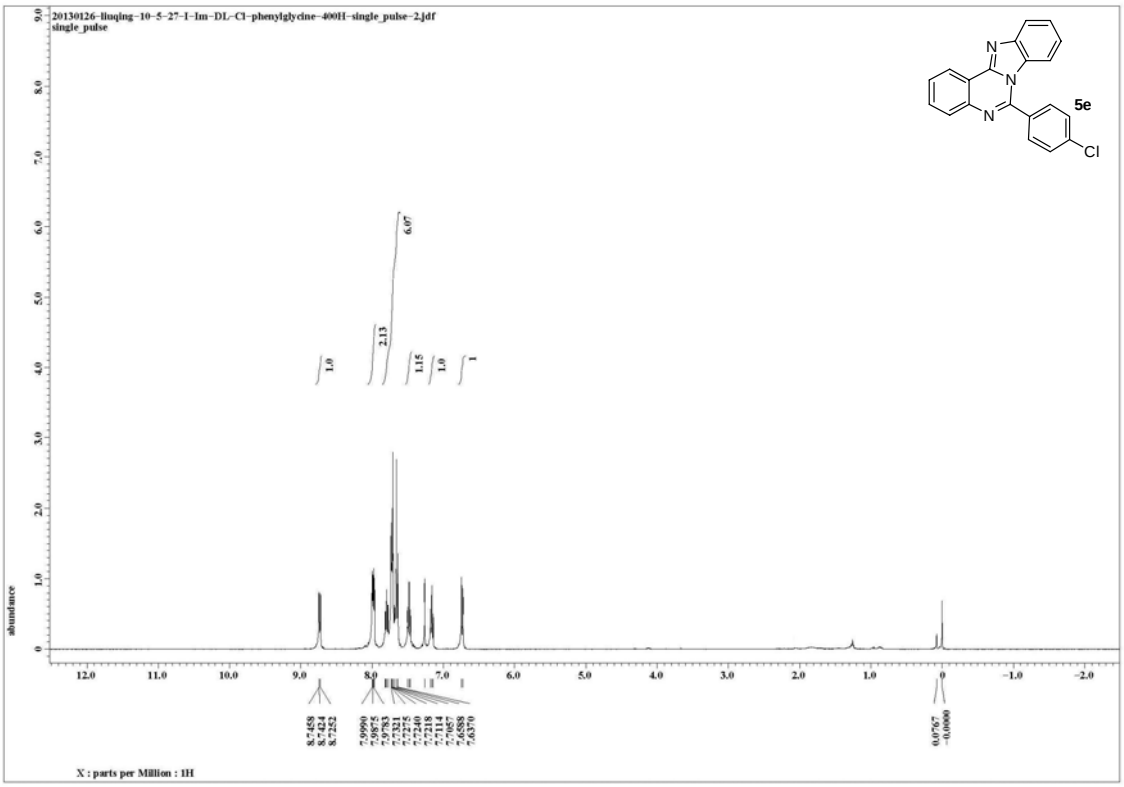

20130130-liuqing-10-5-9-1-Im-L-norvaline-400C0-3.jdf
single pulse decoupled gated NOE
5b
X : parts per Million : 13C

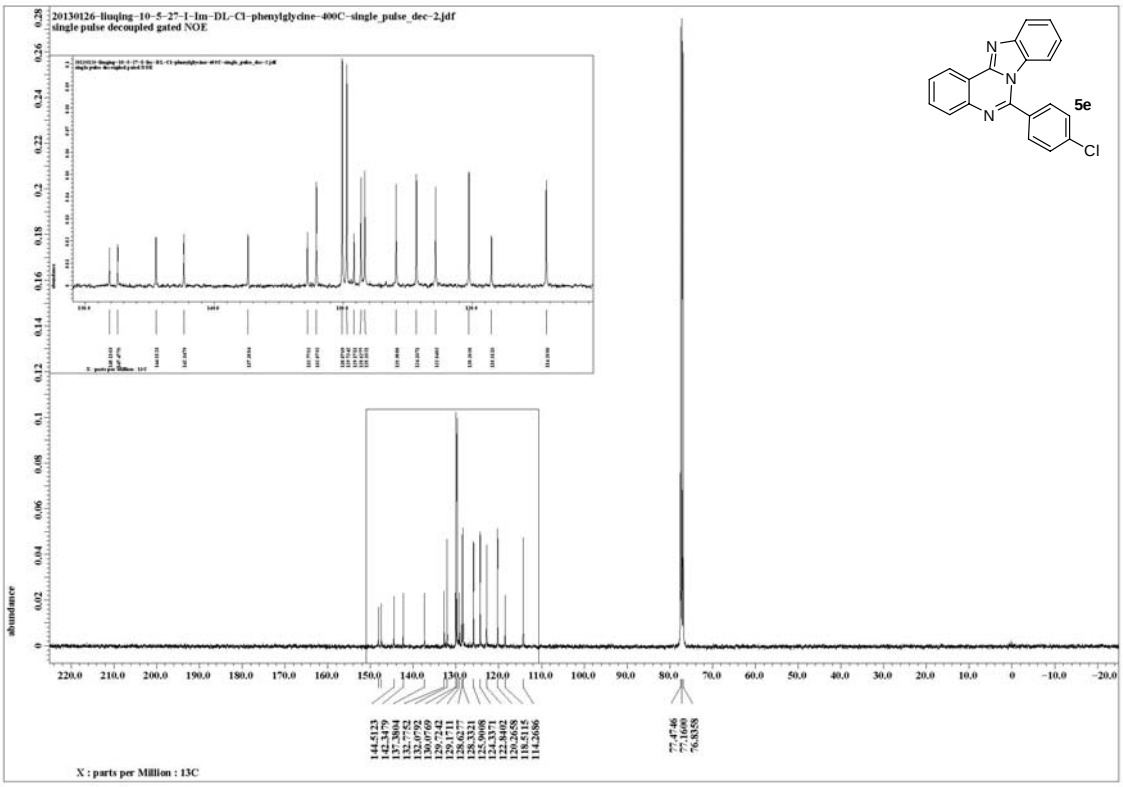

20130124-liuqing-10-5-19-I-Im-D-valine-400H-2.jdf
single_pulse
5c
X : parts per Million : 1H

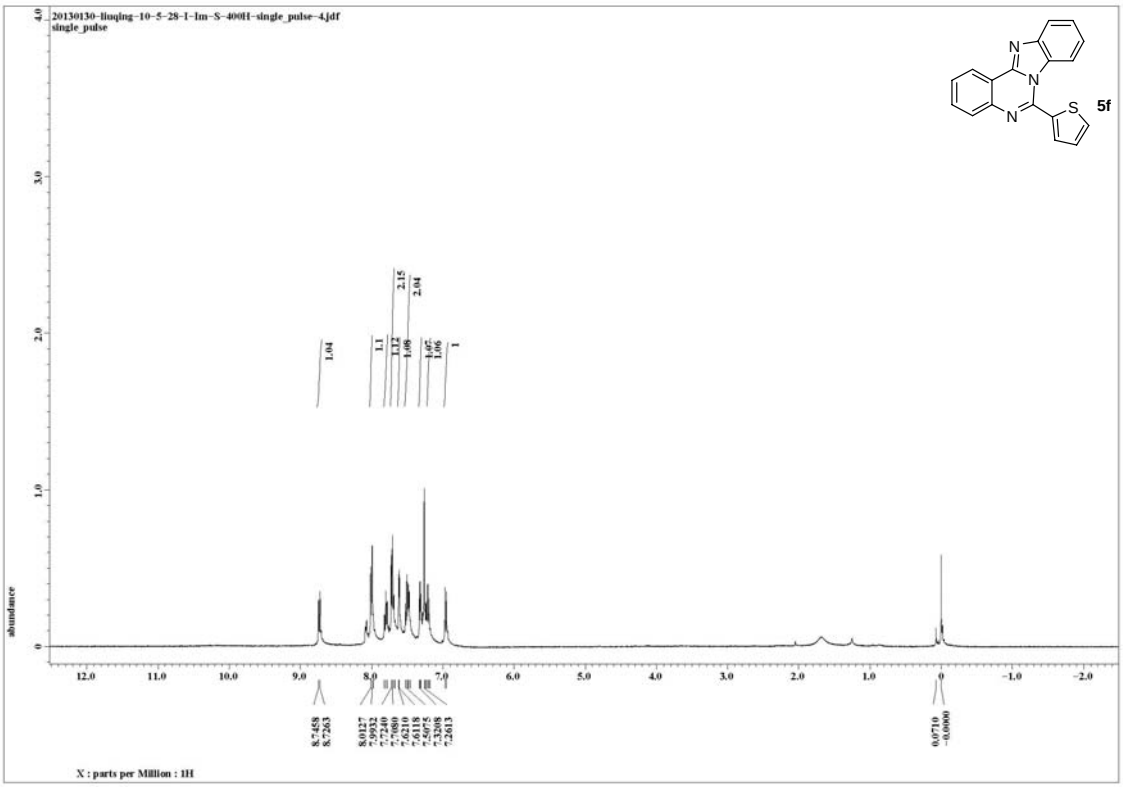

20130124-liuqing-10-5-19-I-Im-D-valine-400C--2.jdf
single pulse decoupled gated NOE
5c
X : parts per Million : 13C

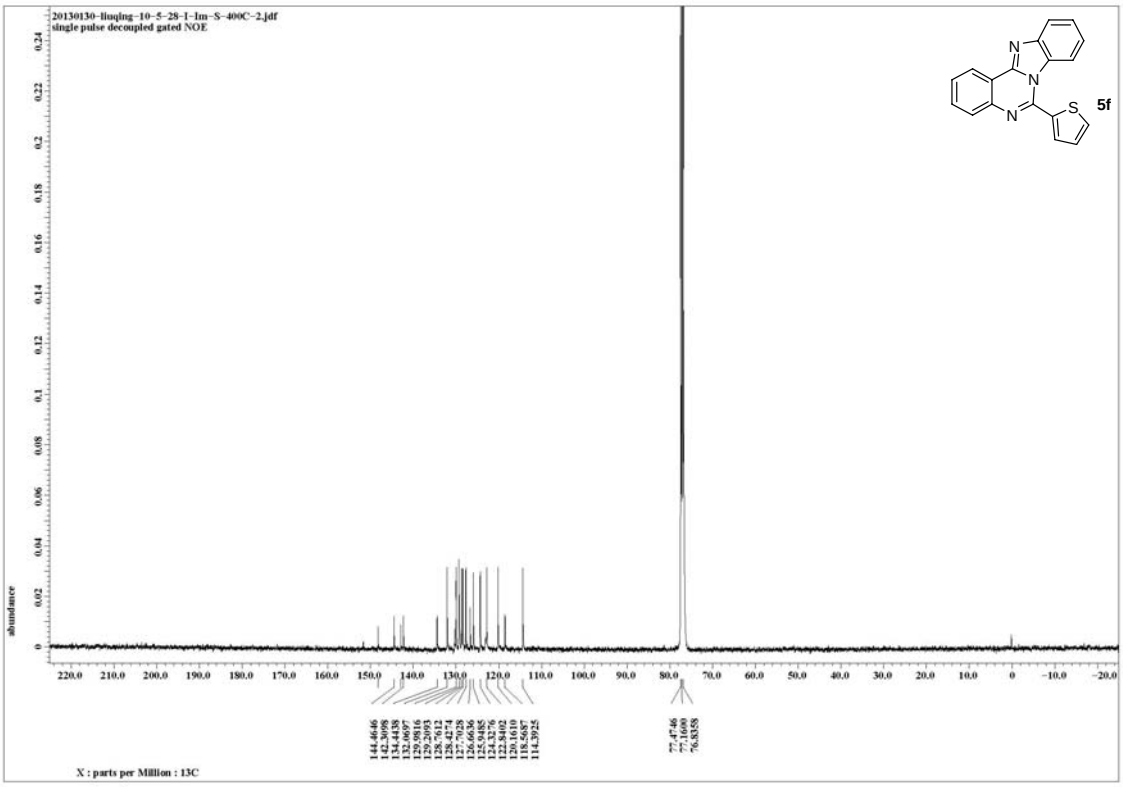

20130125-liuqing-10-5-24-1-Im-L-phenylglycine-400H-single_pulse-2.jdf
single_pulse
5d
X : parts per Million : 1H


20130125-liuqing-10-5-24-1-Im-L-phenylglycine-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
5d
X : parts per Million : 13C


20130126-liuqing-10-5-27-I-Im-DL-Cl-phenylglycine-400H-single_pulse-2.jdf
single_pulse
5e
Cl
abundance
X : parts per Million : 1H


20130126-liuqing-10-5-27-I-Im-DL-Cl-phenylglycine-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
5e
Cl
abundance
X : parts per Million : 13C


20130130-liuqing-10-5-28-1-Im-S-400H-single_pulse-4.jdf
single_pulse
5f
abundance
X : parts per Million : 1H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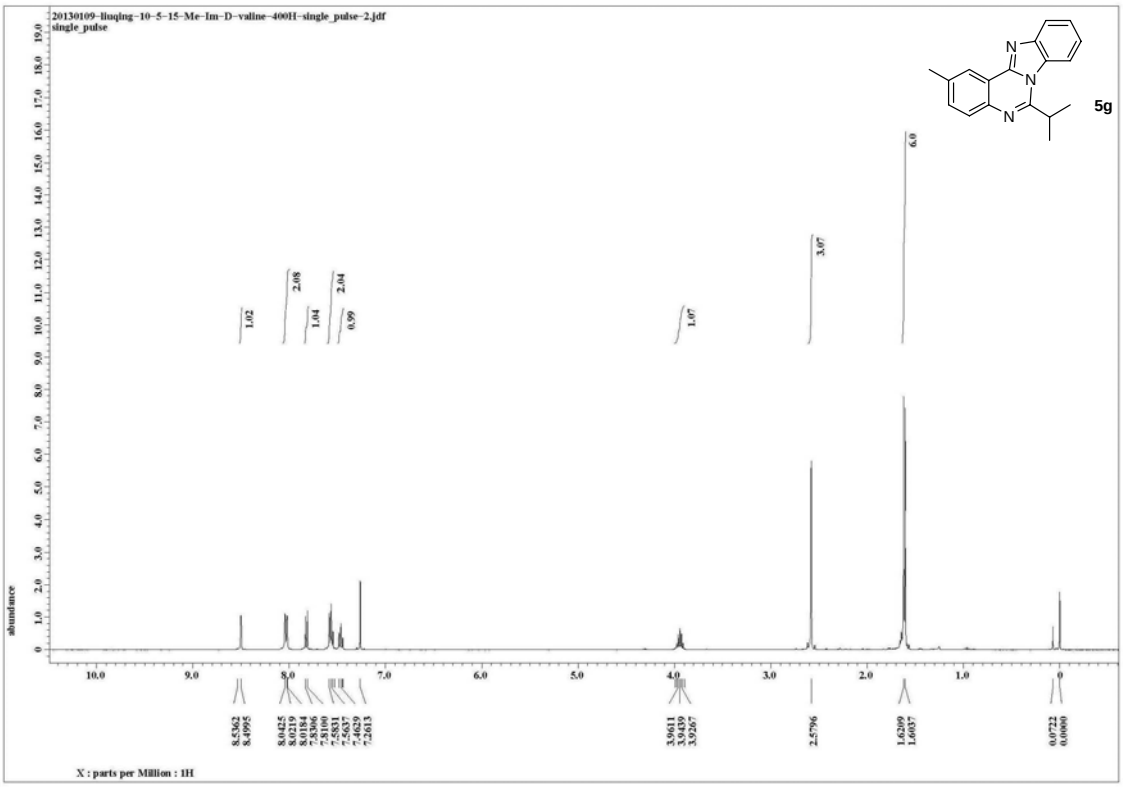
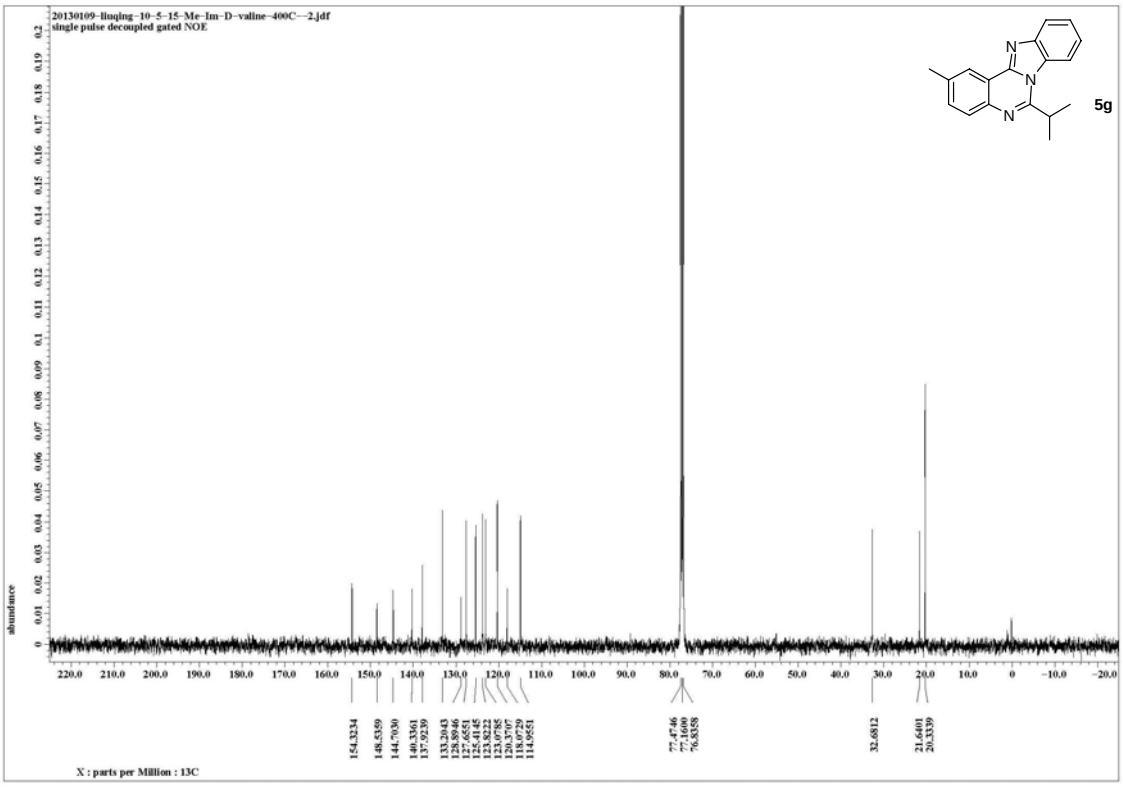
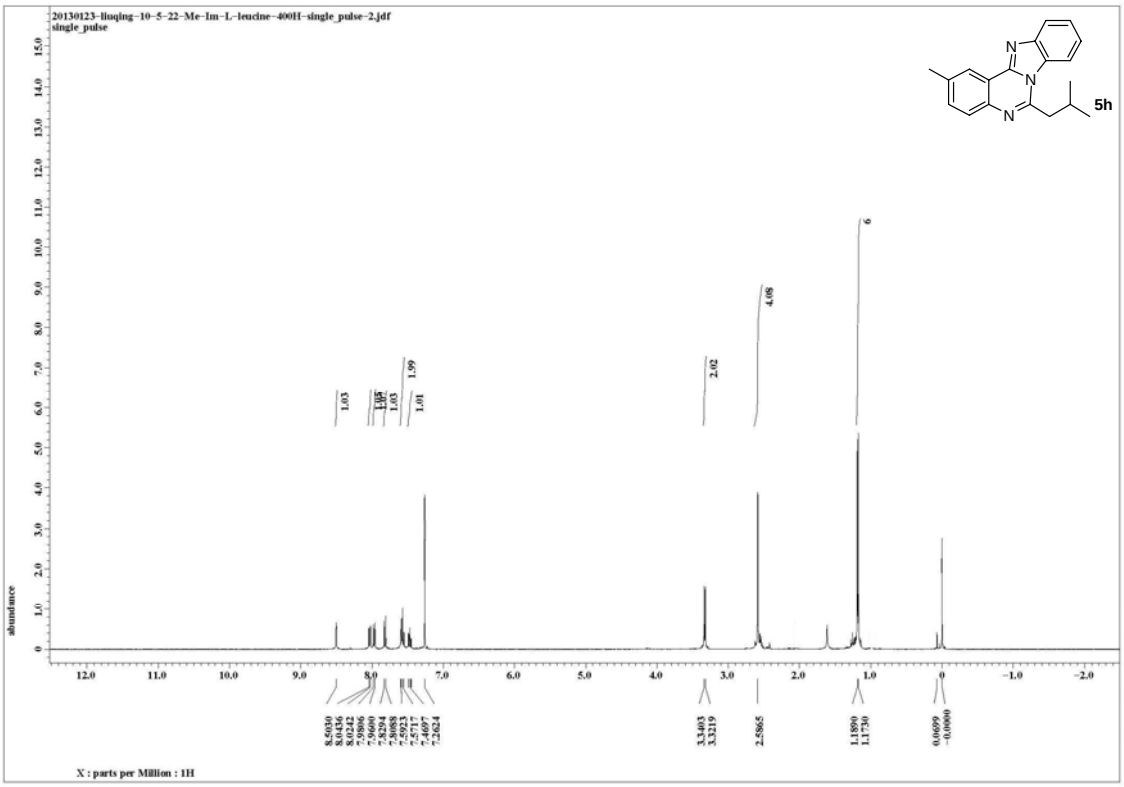
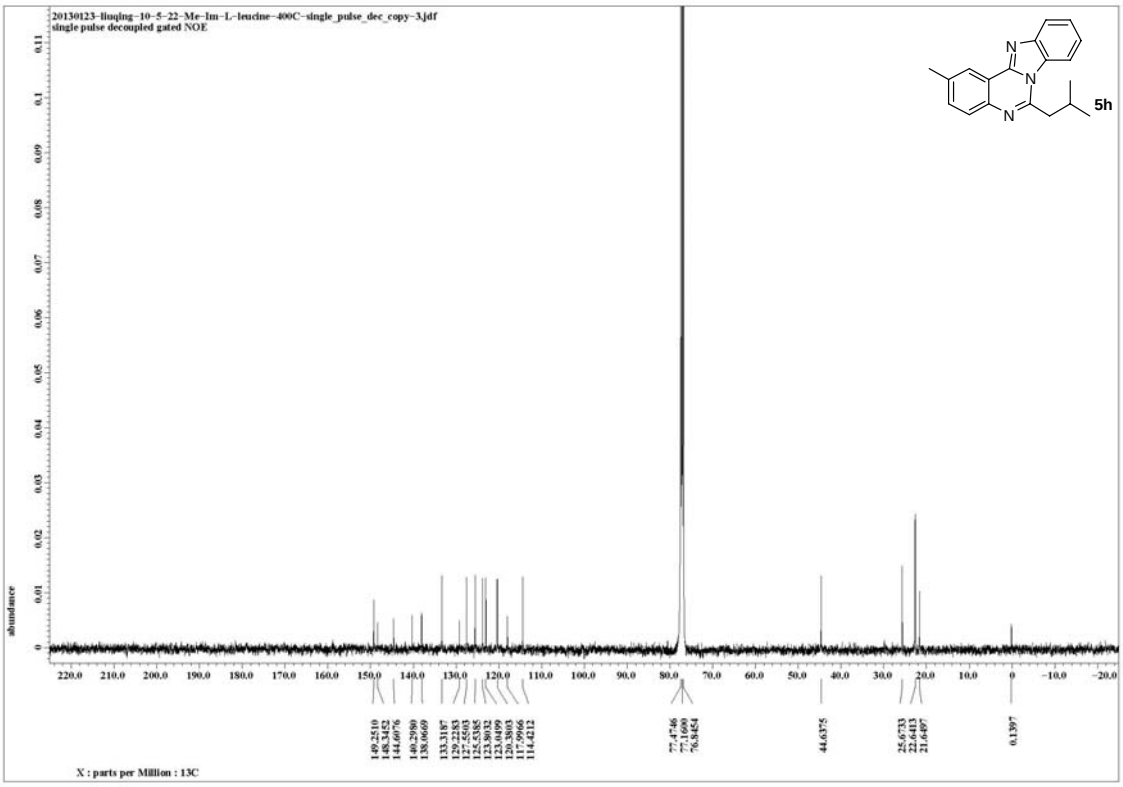
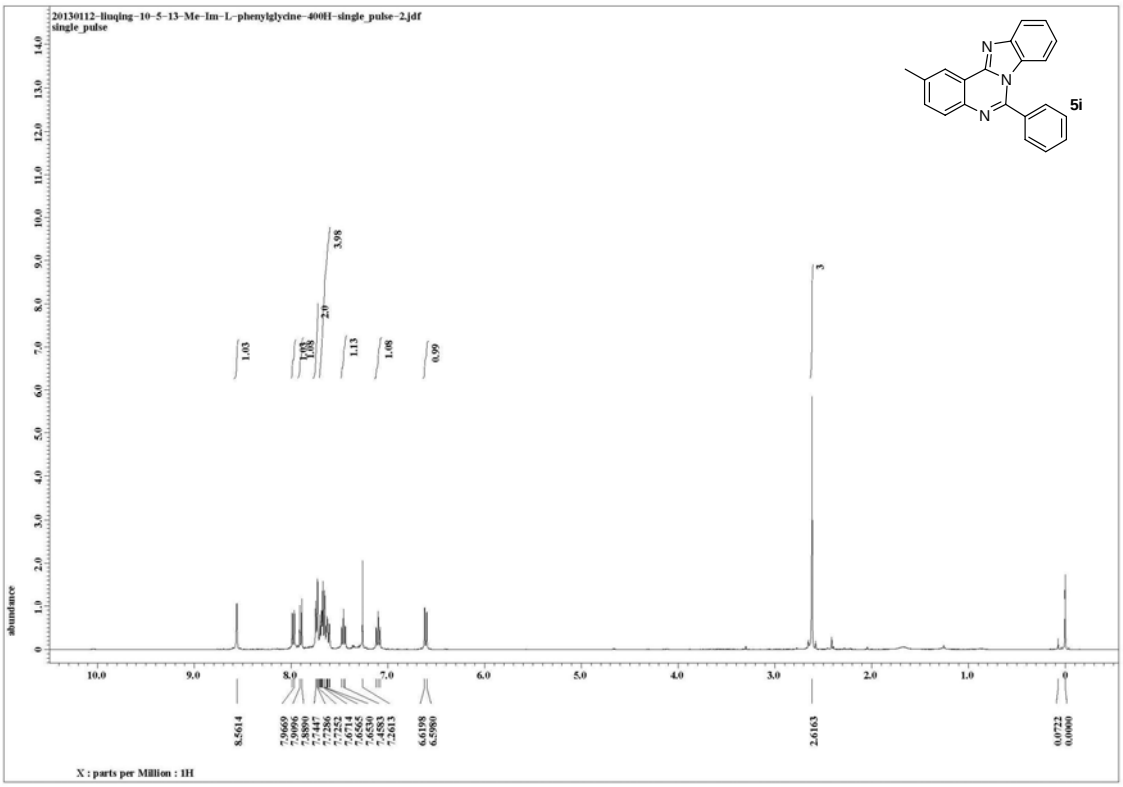
single pulse decoupled gated NOE
5f
abundance
X : parts per Million : 13C

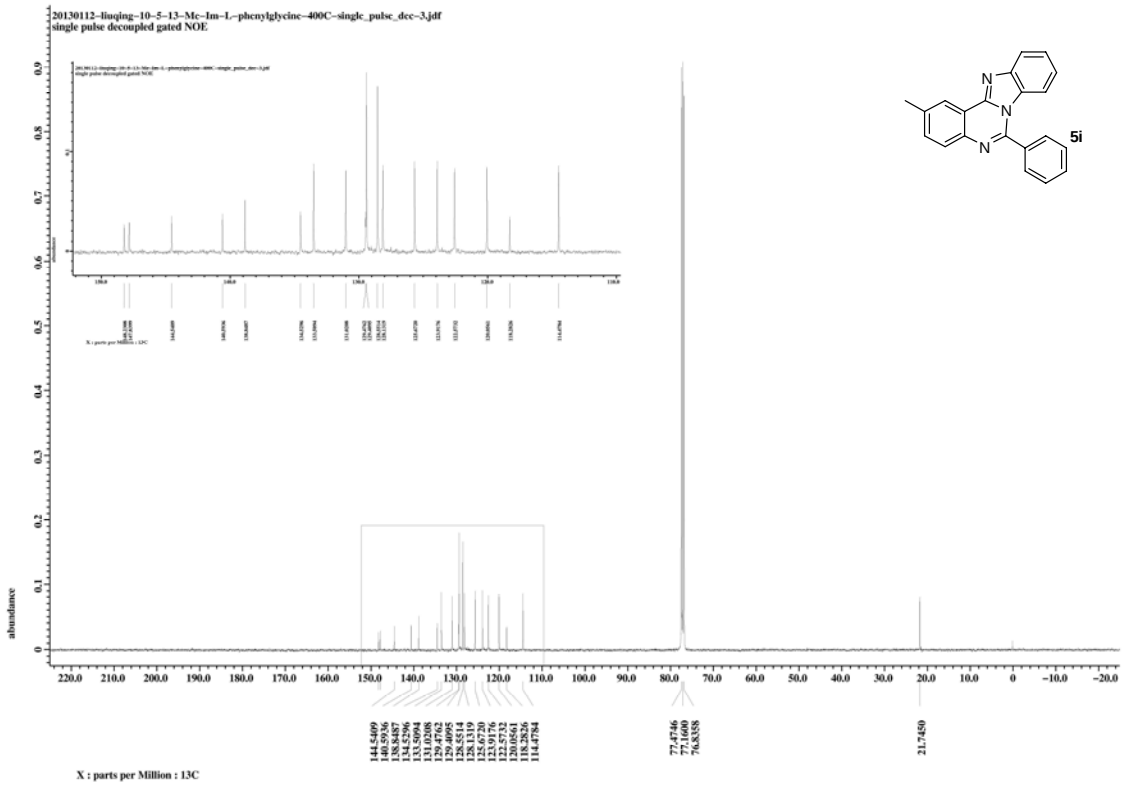

20130109-liuqing-10-5-15-Me-Im-D-valine-400H-single_pulse-2.jdf
single_pulse
5g
X : parts per Million : 1H

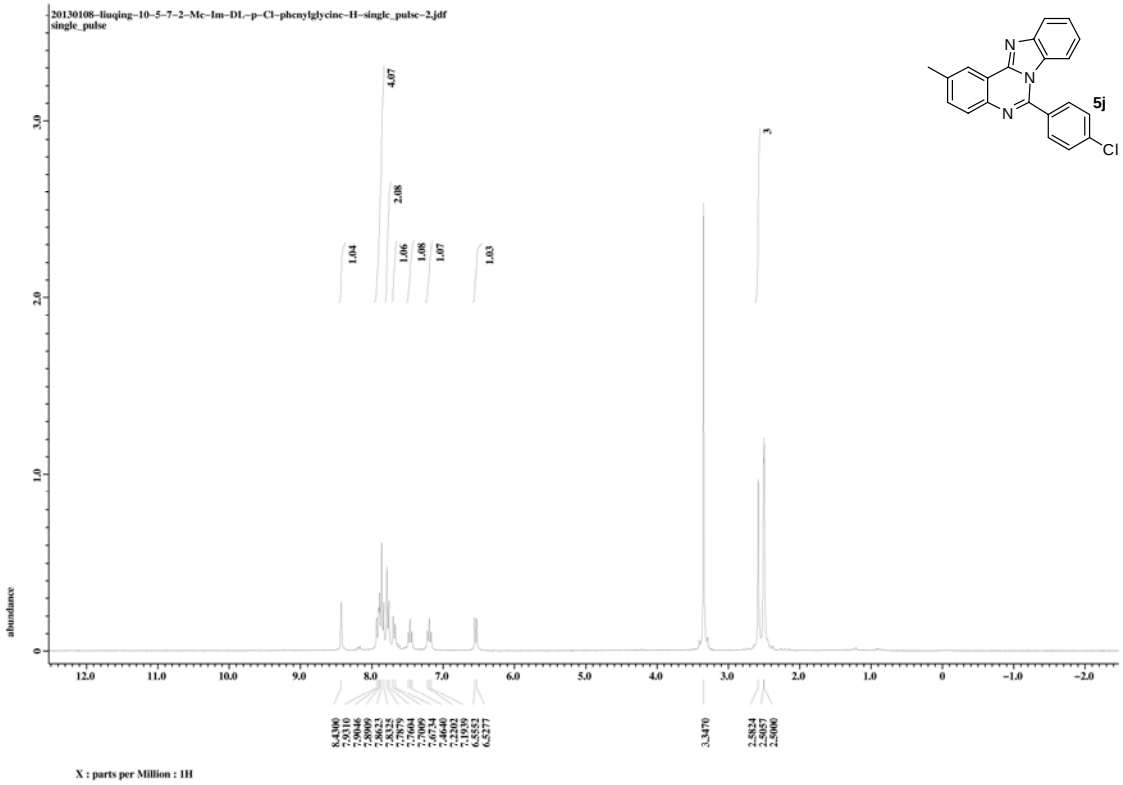

20130109-liuqing-10-5-15-Me-Im-D-valine-400C--2.jdf
single pulse decoupled gated NOE
5g
X : parts per Million : 13C

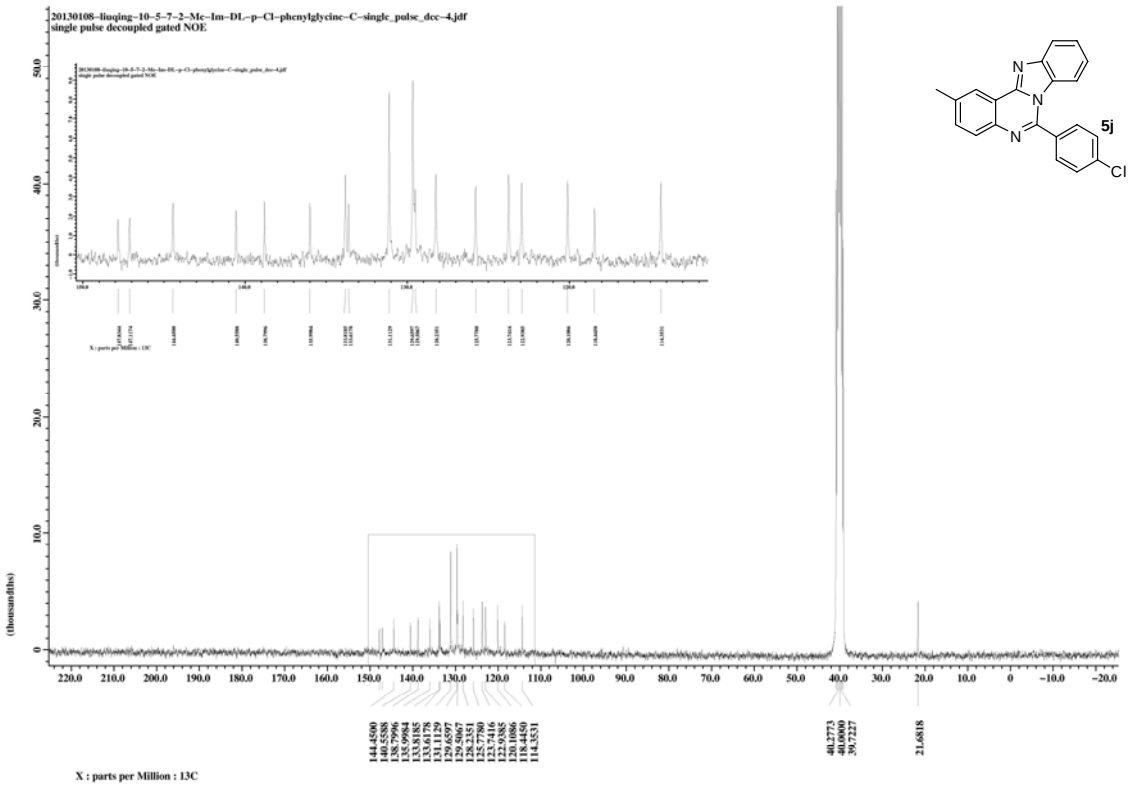

20130123-liuqing-10-5-22-Me-Im-L-leucine-400H-single_pulse-2.jdf
single_pulse
5h
X : parts per Million : 1H

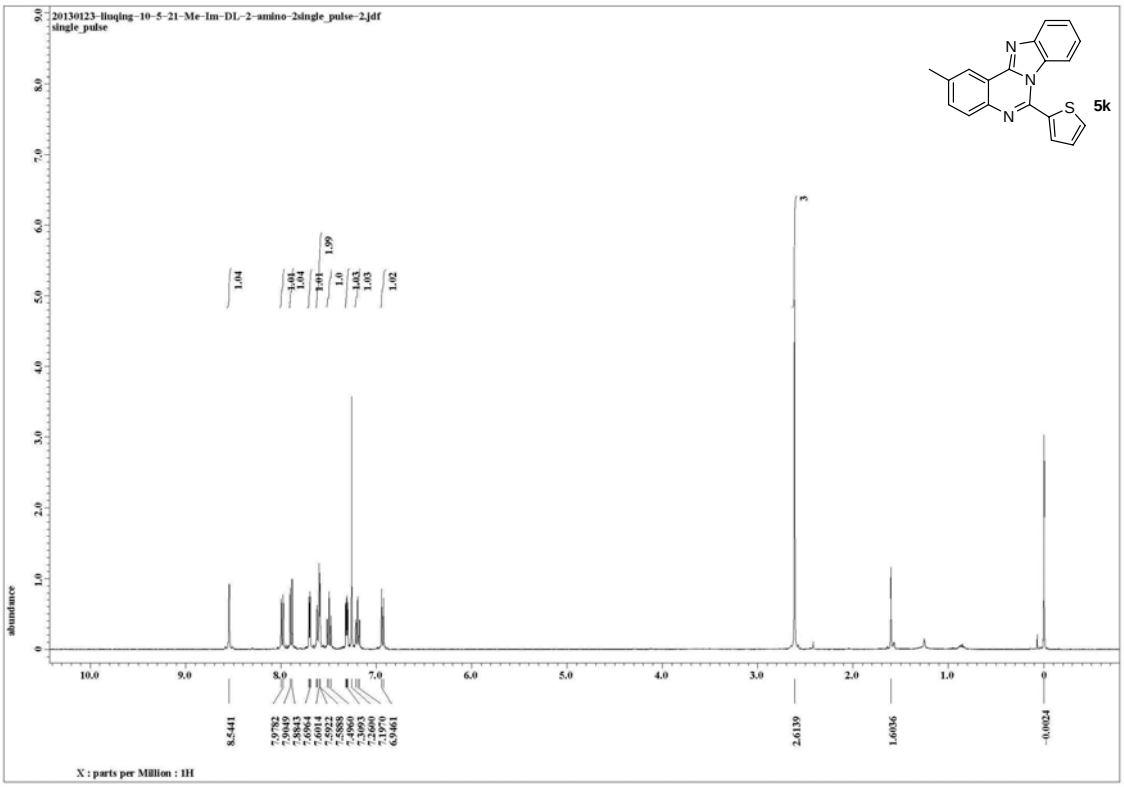

20130123-liuqing-10-5-22-Me-Im-L-leucine-400C-single_pulse_dec_copy-3.jdf
single pulse decoupled gated NOE
5h
X : parts per Million : 13C

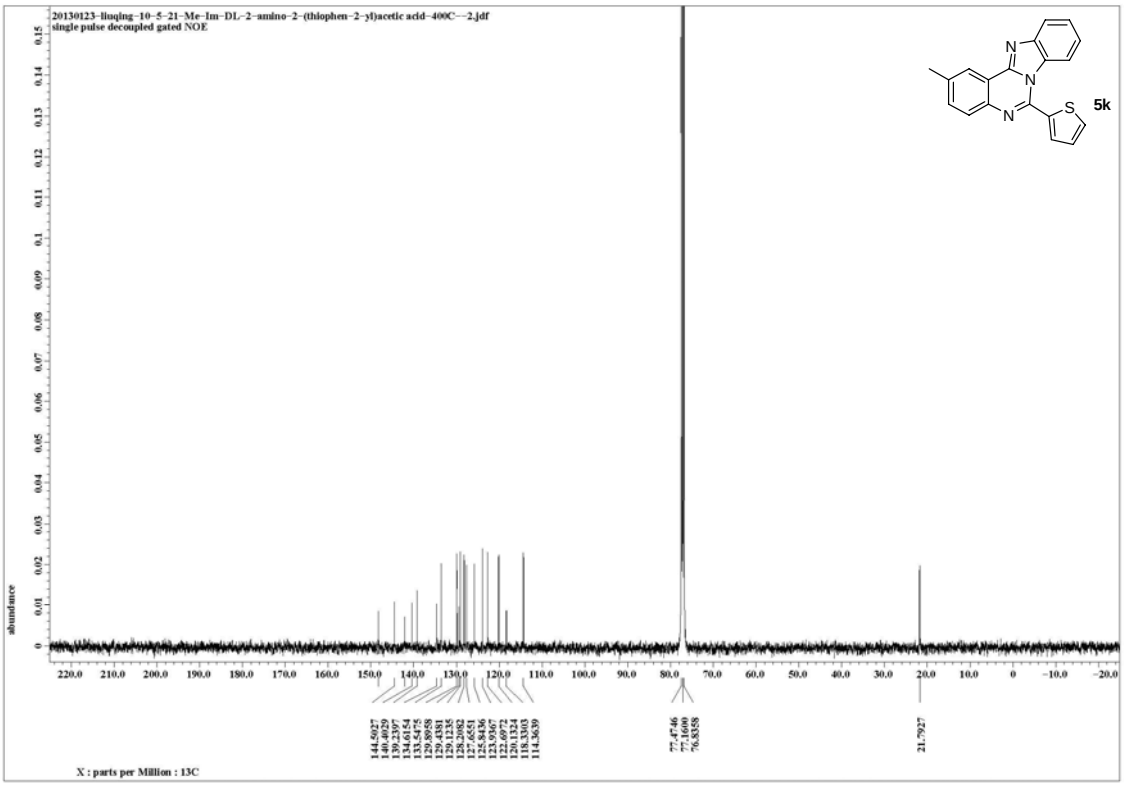

20130112-liuqing-10-5-13-Me-Im-L-phenylglycine-400H-single_pulse-2.jdf
single_pulse
5i
abundance
X : parts per Million : 1H

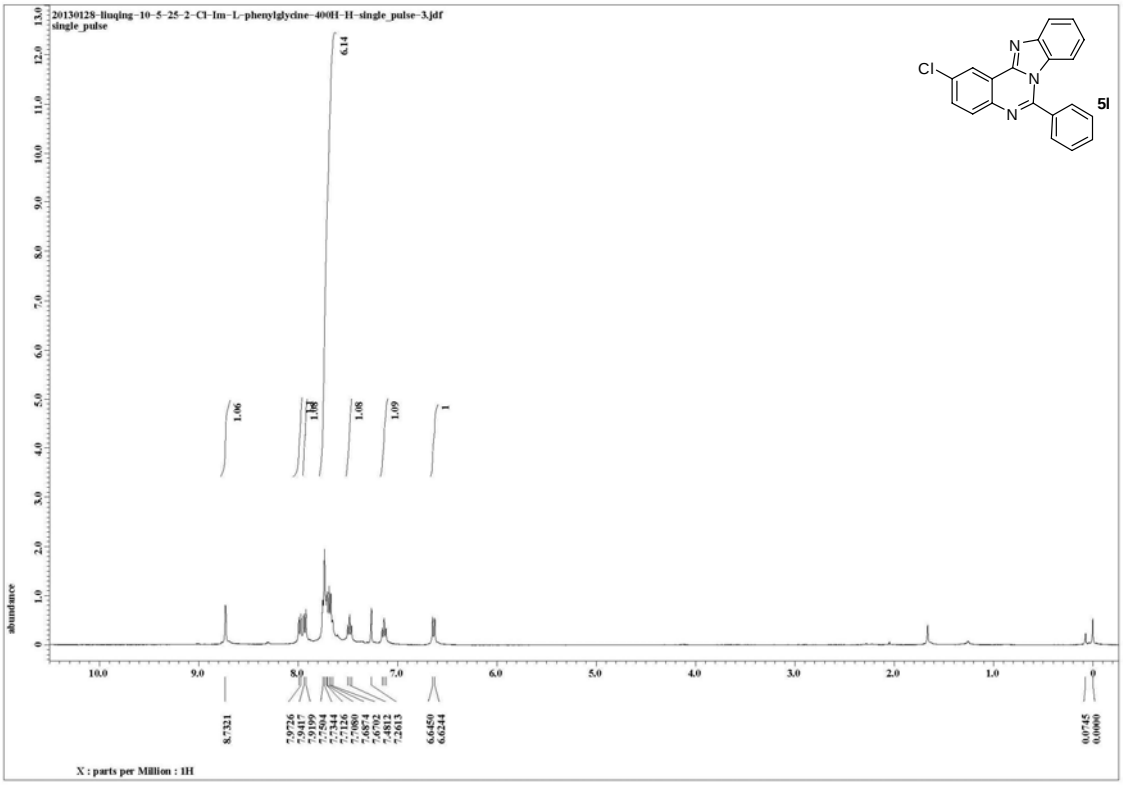

20130112-liuqing-10-5-13-Me-Im-L-phenylglycine-400C-single_pulse_dec-3.jdf
single pulse decoupled gated NOE
5i
abundance
X : parts per Million : 13C

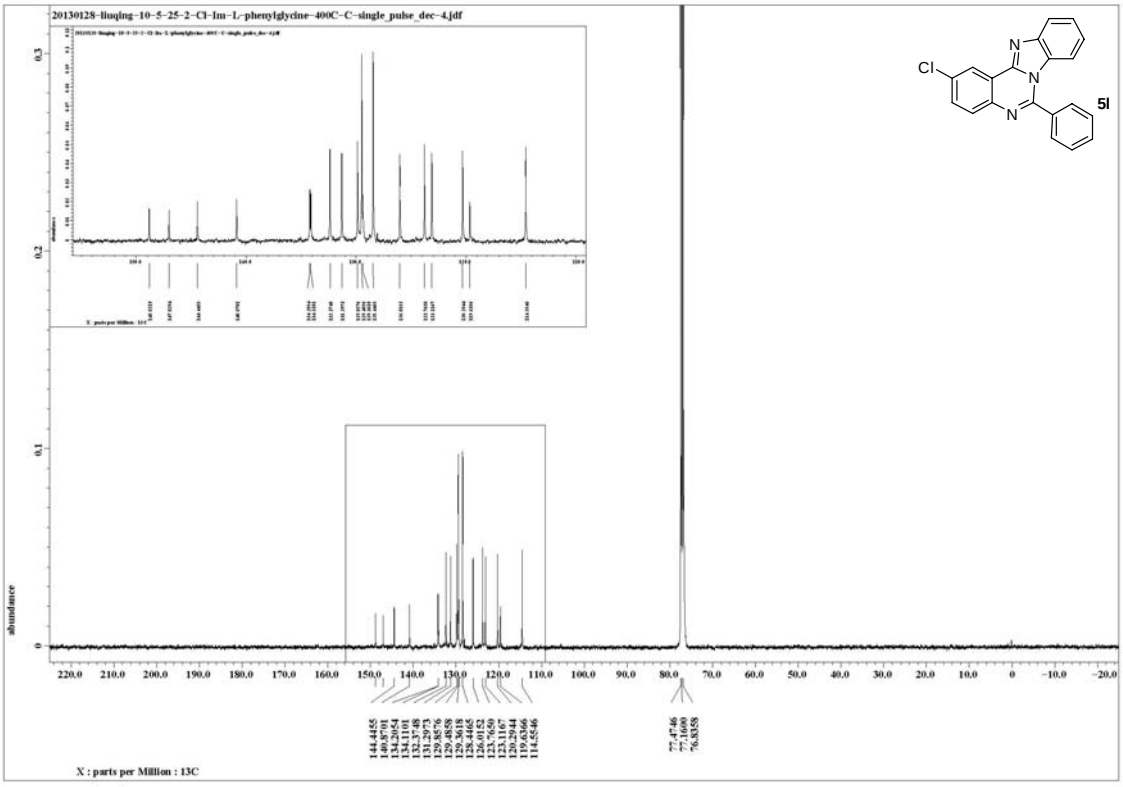

20130108–liuqing–10–5–7–2–Me–Im–DL–p–Cl–phenylglycine–H–single_pulse–2.jdf
single_pulse
5j
Cl
X : parts per Million : 1H

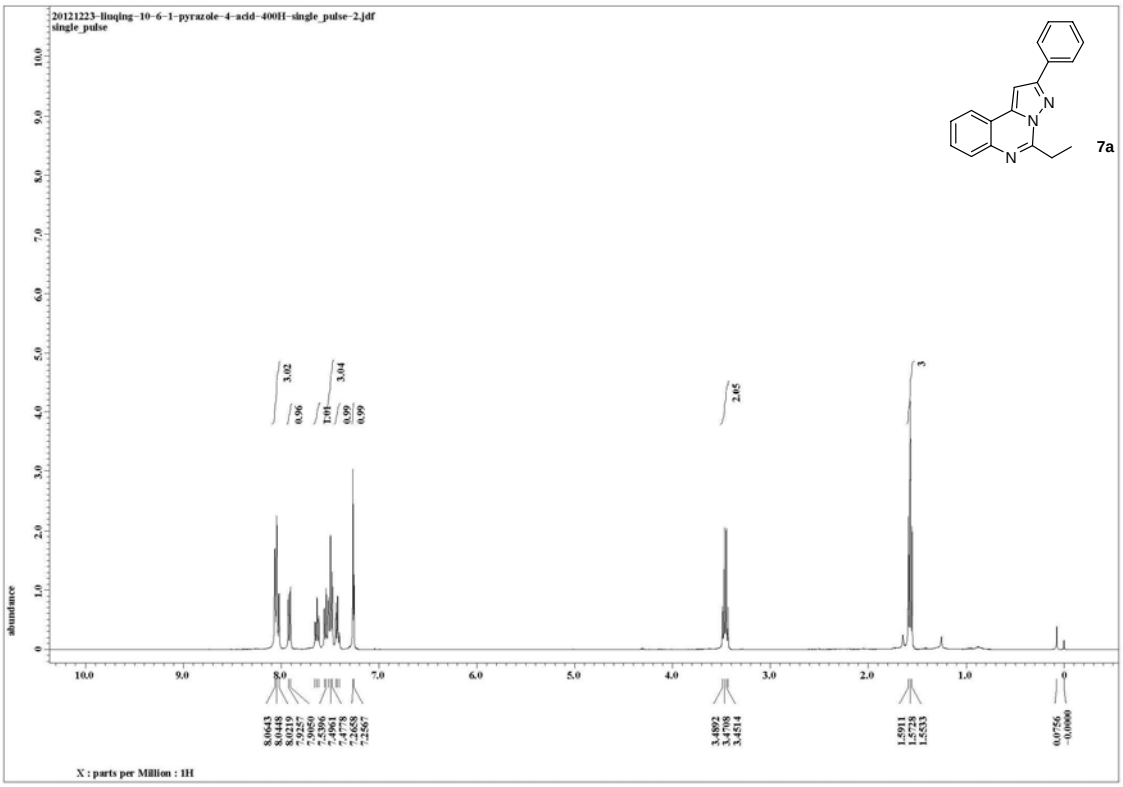

20130108–liuqing–10–5–7–2–Me–Im–DL–p–Cl–phenylglycine–C–single_pulse_dcc–4.jdf
single pulse decoupled gated NOE
5j
Cl
X : parts per Million : 13C

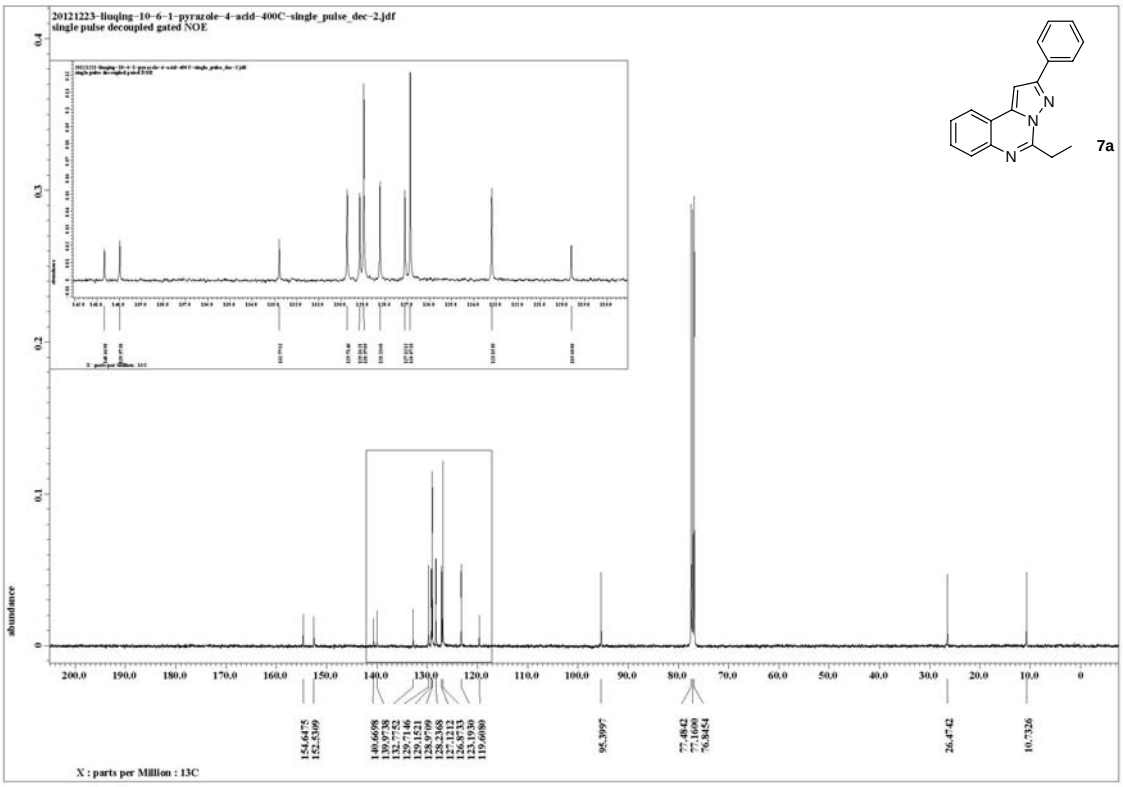

20130123-liuqing-10-5-21-Me-Im-DL-2-amino-2single_pulse-2.jdf
single_pulse
5k
abundance
X : parts per Million : 1H

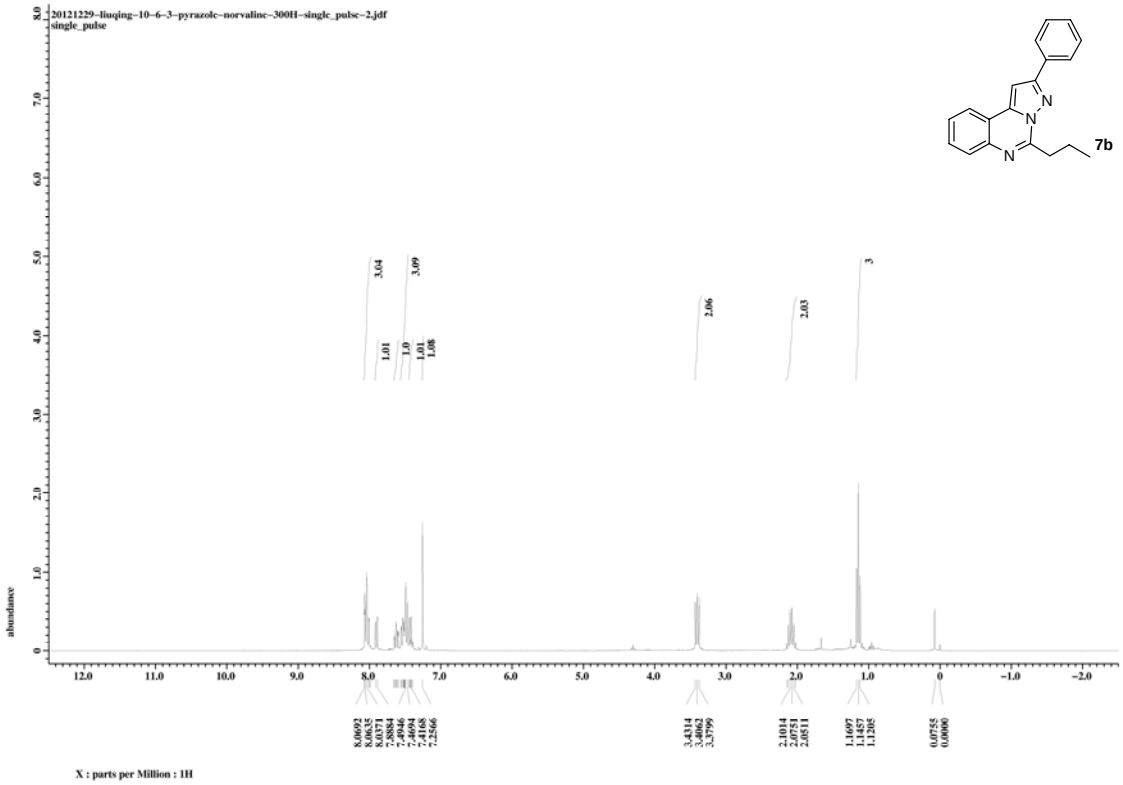

20130123-liuqing-10-5-21-Me-Im-DL-2-amino-2-(thiophen-2-yl)acetic acid-400C--2.jdf
single pulse decoupled gated NOE
5k
abundance
X : parts per Million : 13C

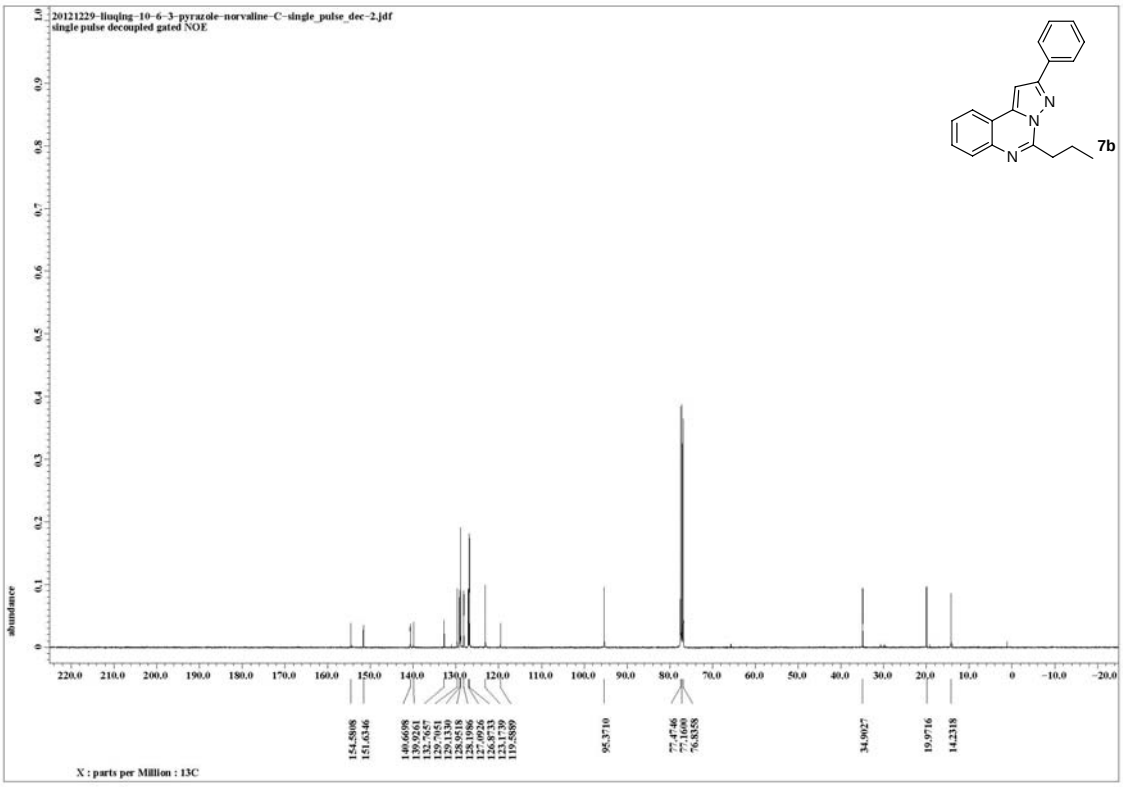

20130128-liuqing-10-5-25-2-Cl-Im-L-phenylglycine-400H-H-single_pulse-3.jdf
single_pulse
Cl
N
N
N
5l
abundance
X : parts per Million : 1H


20130128-liuqing-10-5-25-2-Cl-Im-L-phenylglycine-400C-C-single_pulse_dec-4.jdf
Cl
N
N
N
5l
abundance
X : parts per Million : 13C


20121223-liuqing-10-6-1-pyrazole-4-acid-400H-single_pulse-2.jdf
single_pulse
7a
abundance
X : parts per Million : 1H


20121223-liuqing-10-6-1-pyrazole-4-acid-400C-single_pulse_dec-2.jdf
single pulse decoupled gated NOE
7a
abundance
X : parts per Million : 13C


20121229-liuqing-10-6-3-pyrazolc-norvalinc-300H-singlc_pulsc-2.jdf
single_pulse
7b
abundance
X : parts per Million : 1H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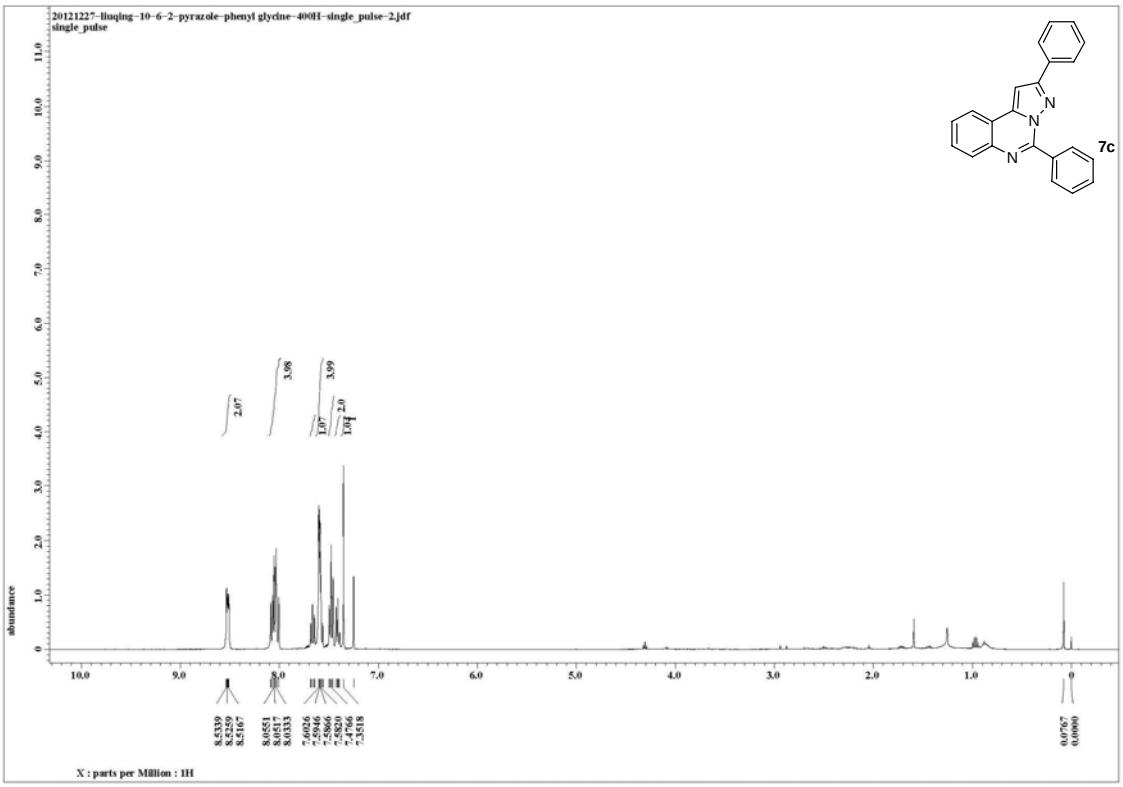
single pulse decoupled gated NOE
7b
abundance
X : parts per Million : 13C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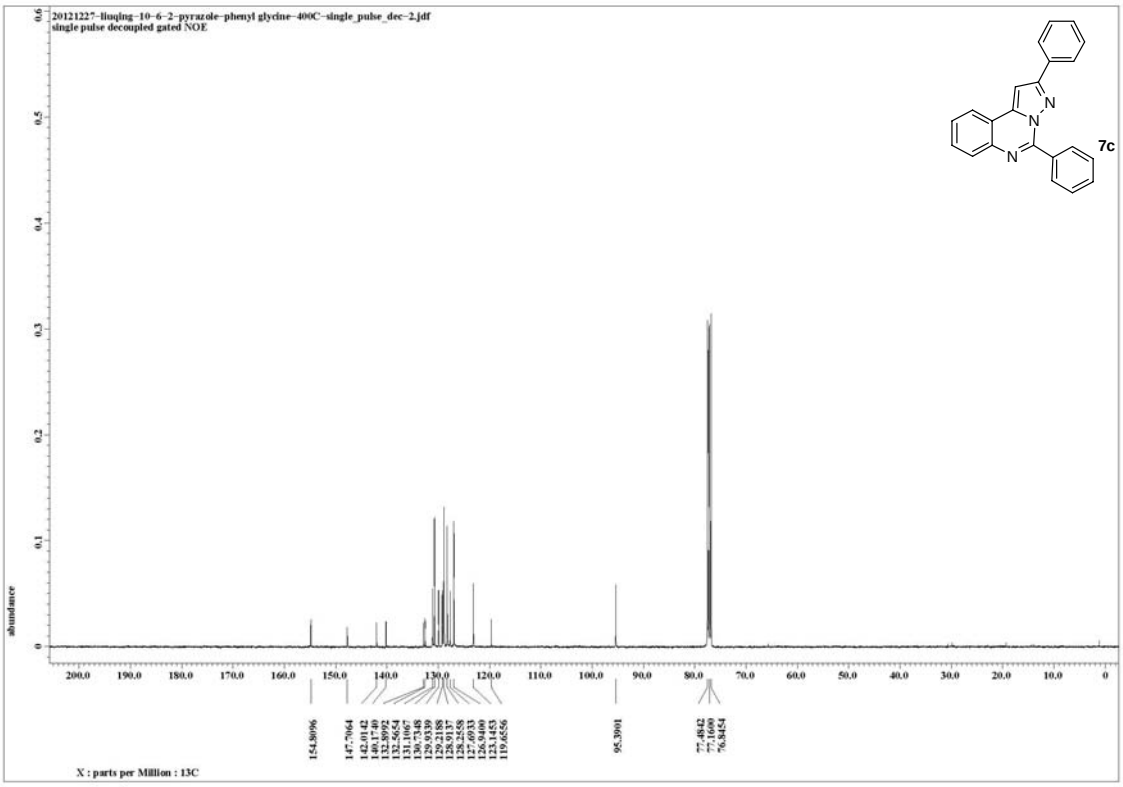
single_pulse
7c
X : parts per Million : 1H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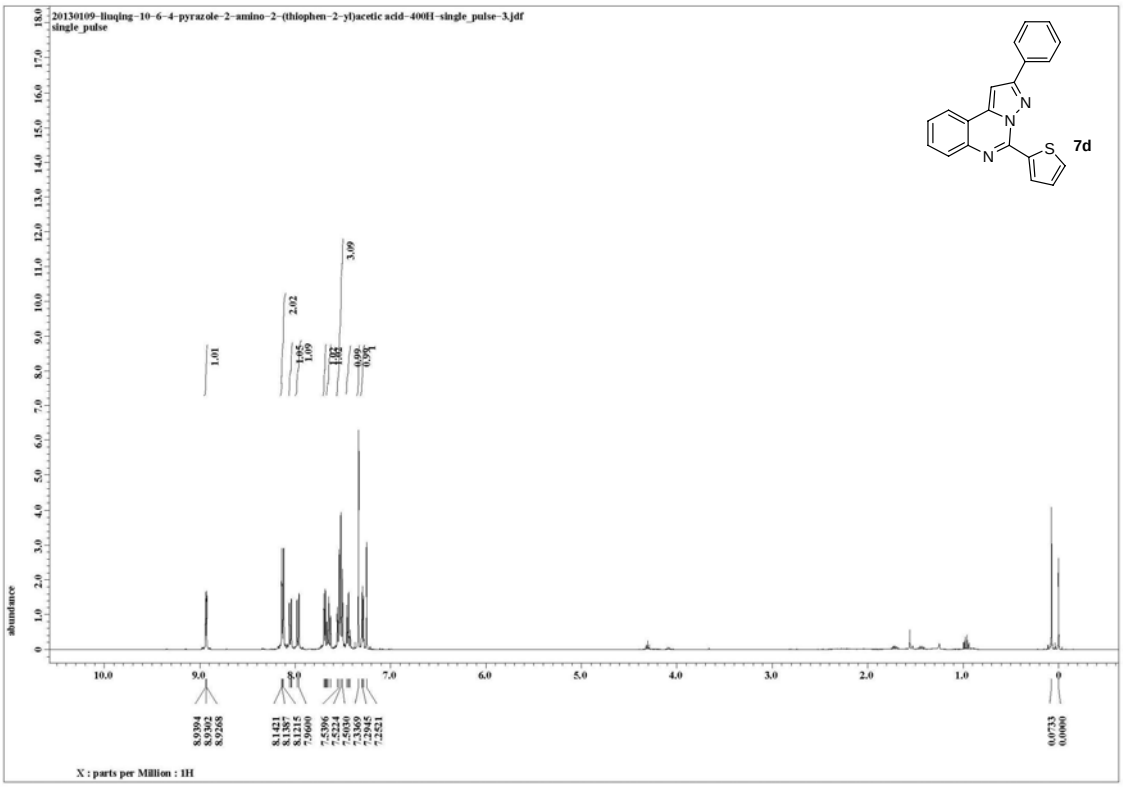
7c
X : parts per Million : 13C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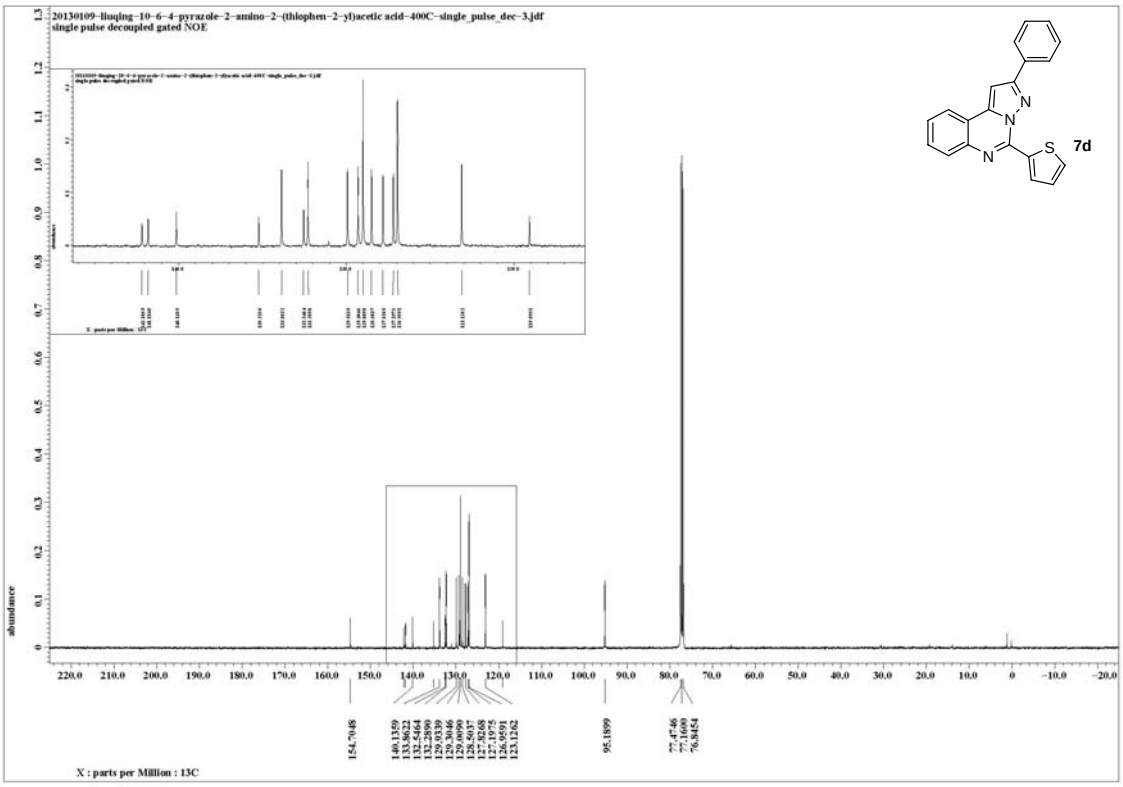
single_pulse
7d
X : parts per Million : 1H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single pulse decoupled gated NOE
7d
X : parts per Million : 13C