

Supplementary Material

Efficient synthesis of novel bis(dihydropyrano[2,3-*c*]pyrazoles), bis(4*H*-chromenes) and bis(dihydropyrano[3,2-*c*]chromenes) with amide functionality

Amna M. Abdella,^a Amr M. Abdelmoniem,^a Holger Butenschön,^b Ismail A. Abdelhamid,^{a*} and

Ahmed H. M. Elwahy^{a*}

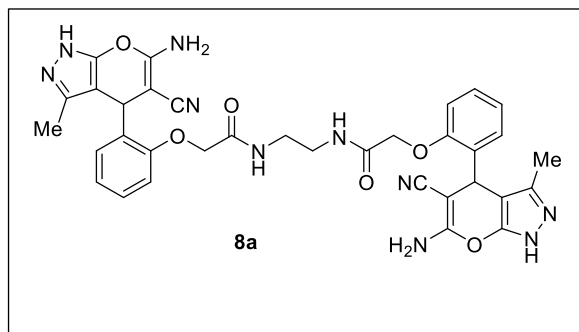
^a *Department of Chemistry, Faculty of Science, Cairo University, 12613 Giza, A. R. Egypt*

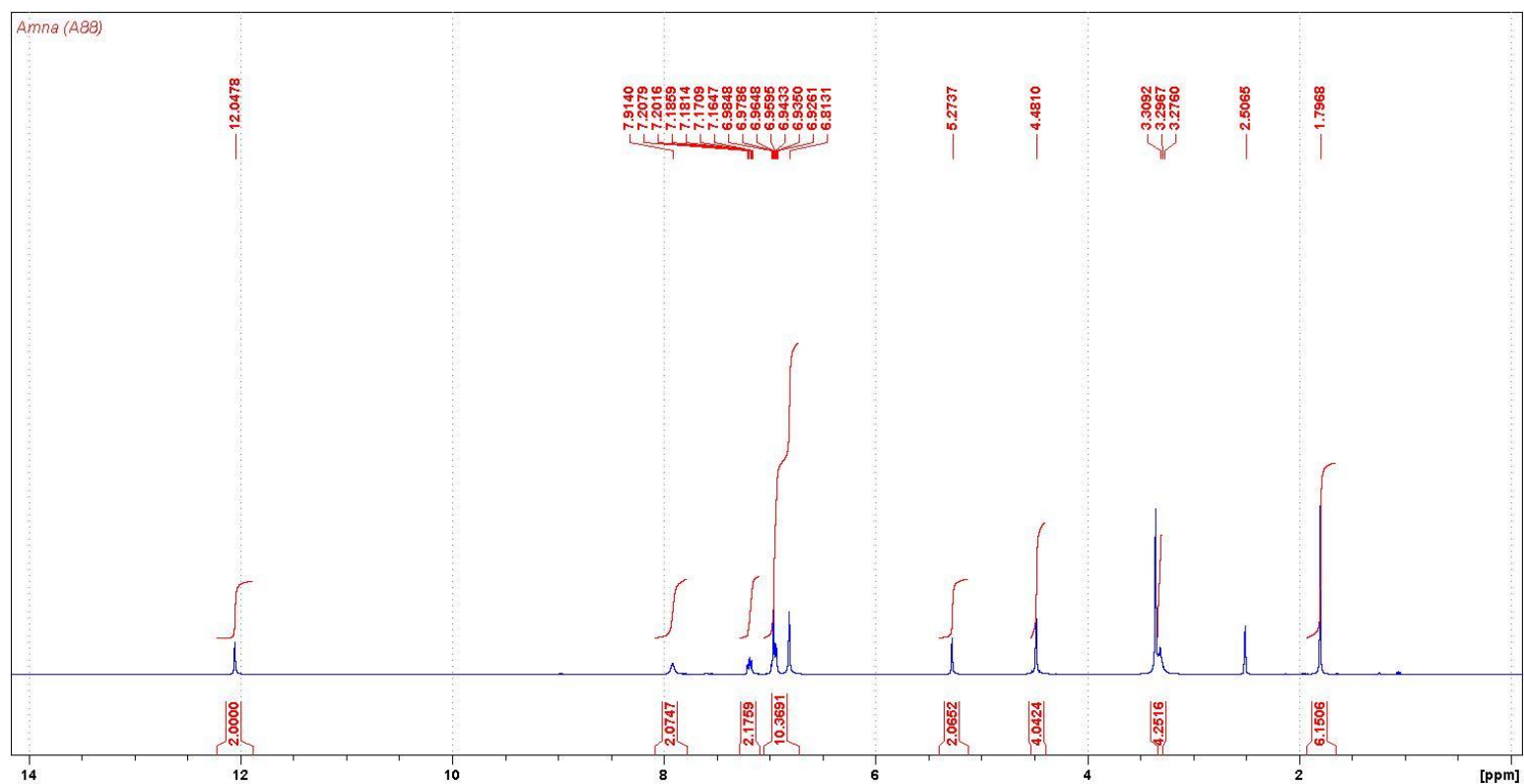
^b *Institut für Organische Chemie, Leibniz Universität Hannover, Schneiderberg 1B, 30167 Hannover, Germany*

E-mail: aelwahy@hotmail.com ismail.shafy@yahoo.com

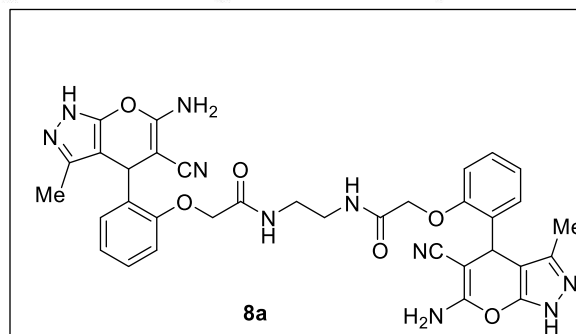
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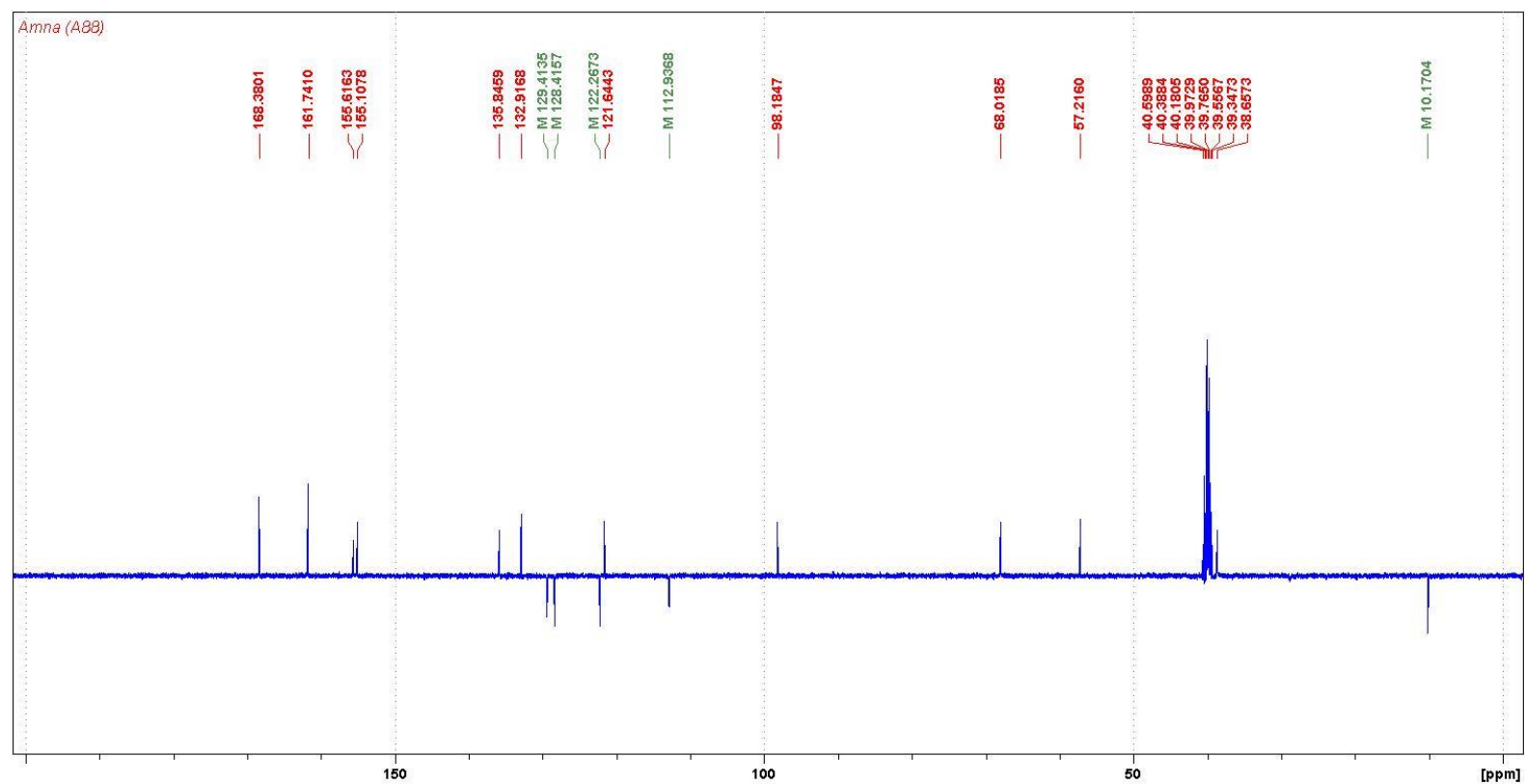
¹ H- and ¹³ C-NMR spectra	S2
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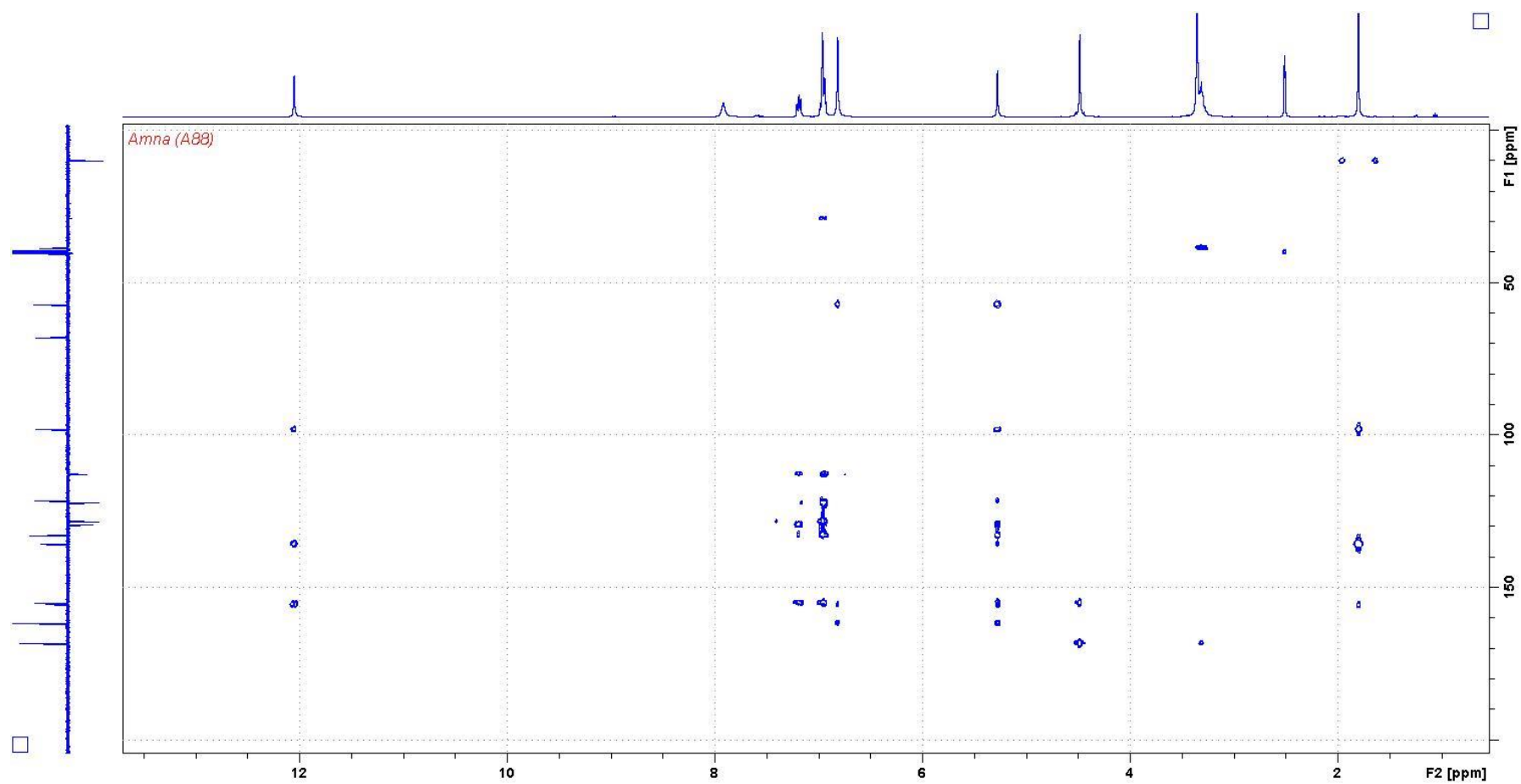
^1H NMR of compound 8a



¹³CNMR of compound 8a







HMBC of compound 8a

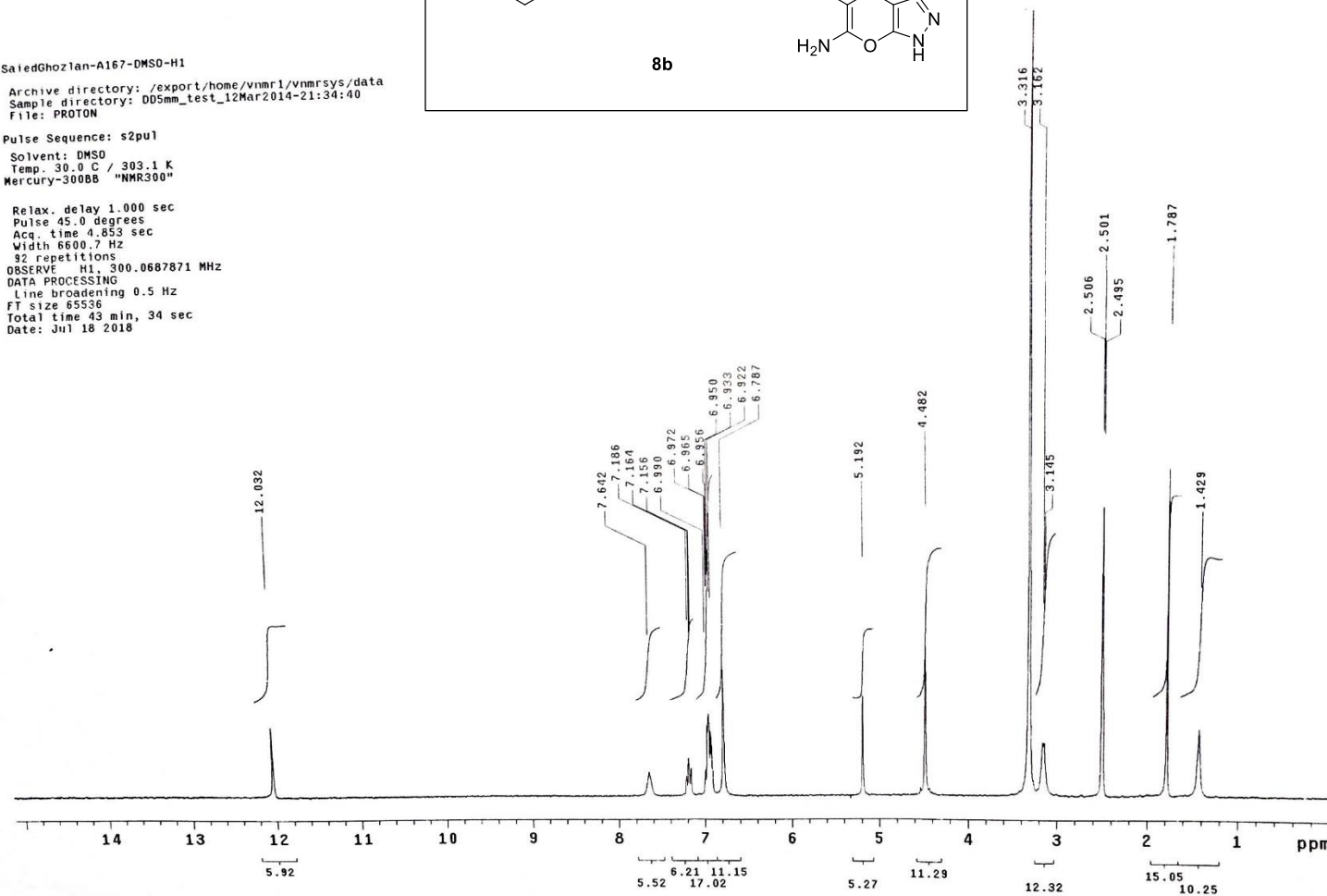
SaiedGhozlan-A167-DMSO-H1

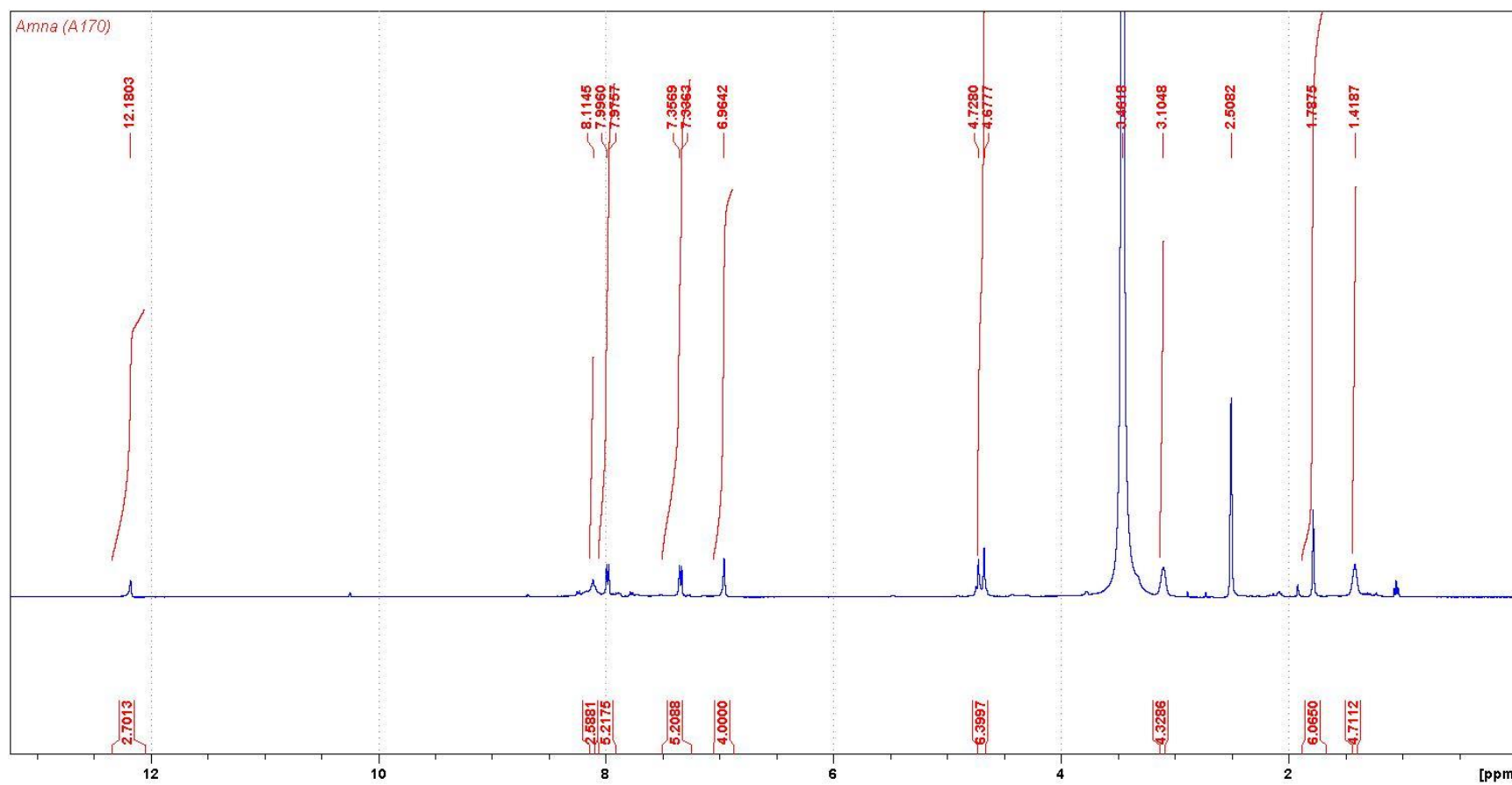
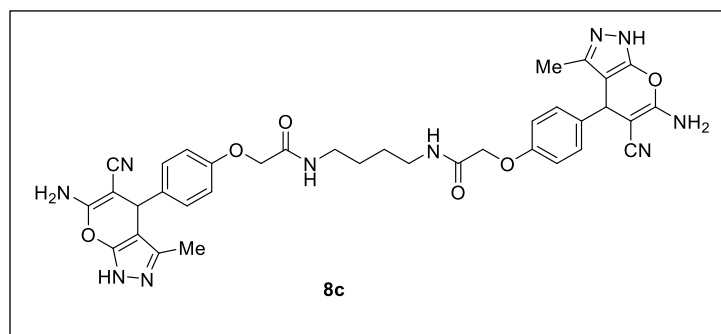
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Pulse Sequence: s2pu1

Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
32 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 43 min, 34 sec
Date: Jul 18 2018

¹H NMR of compound 8b

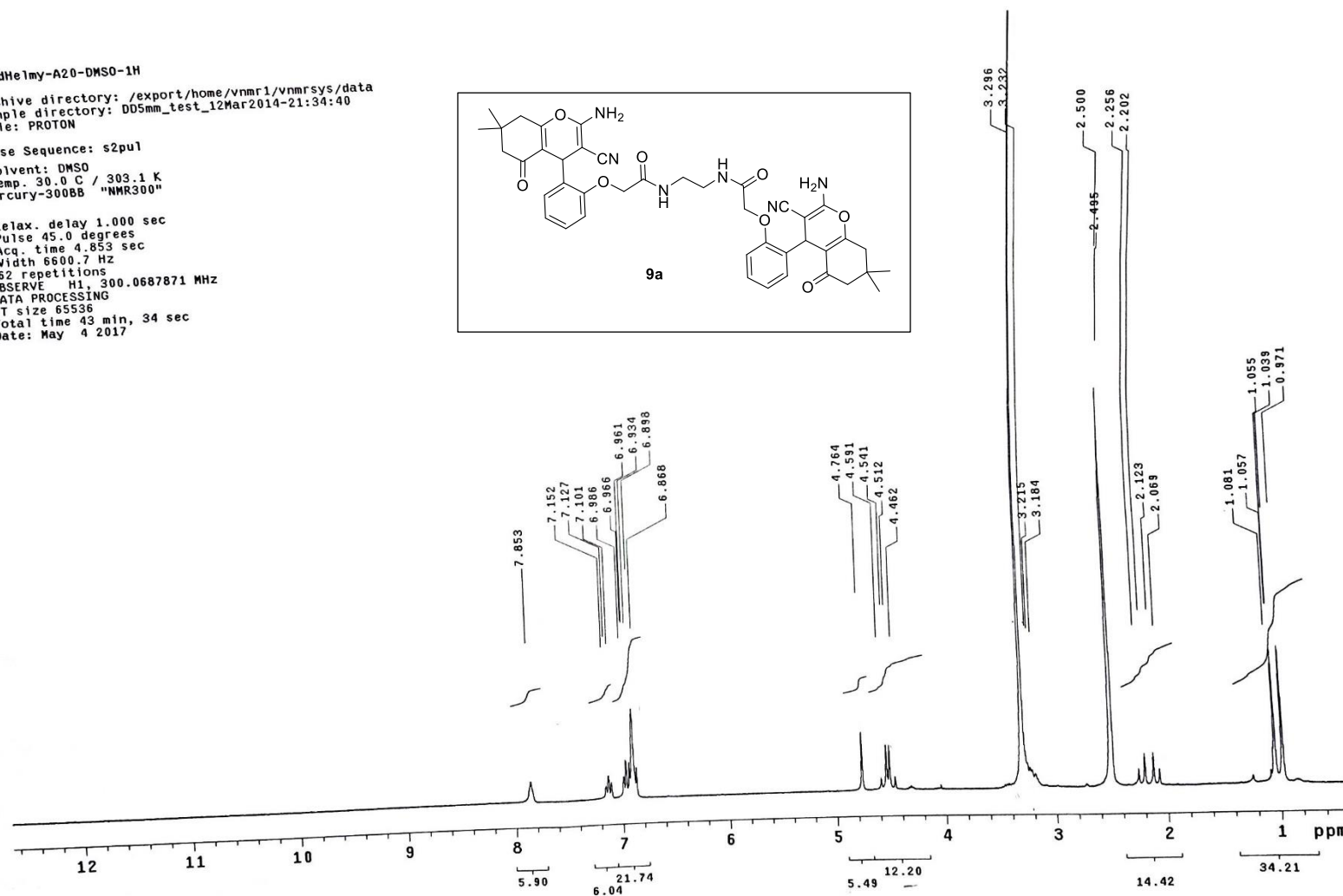
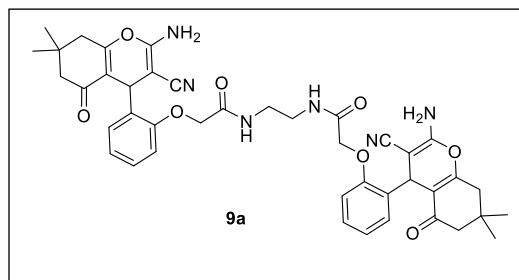
¹H NMR of compound 8c

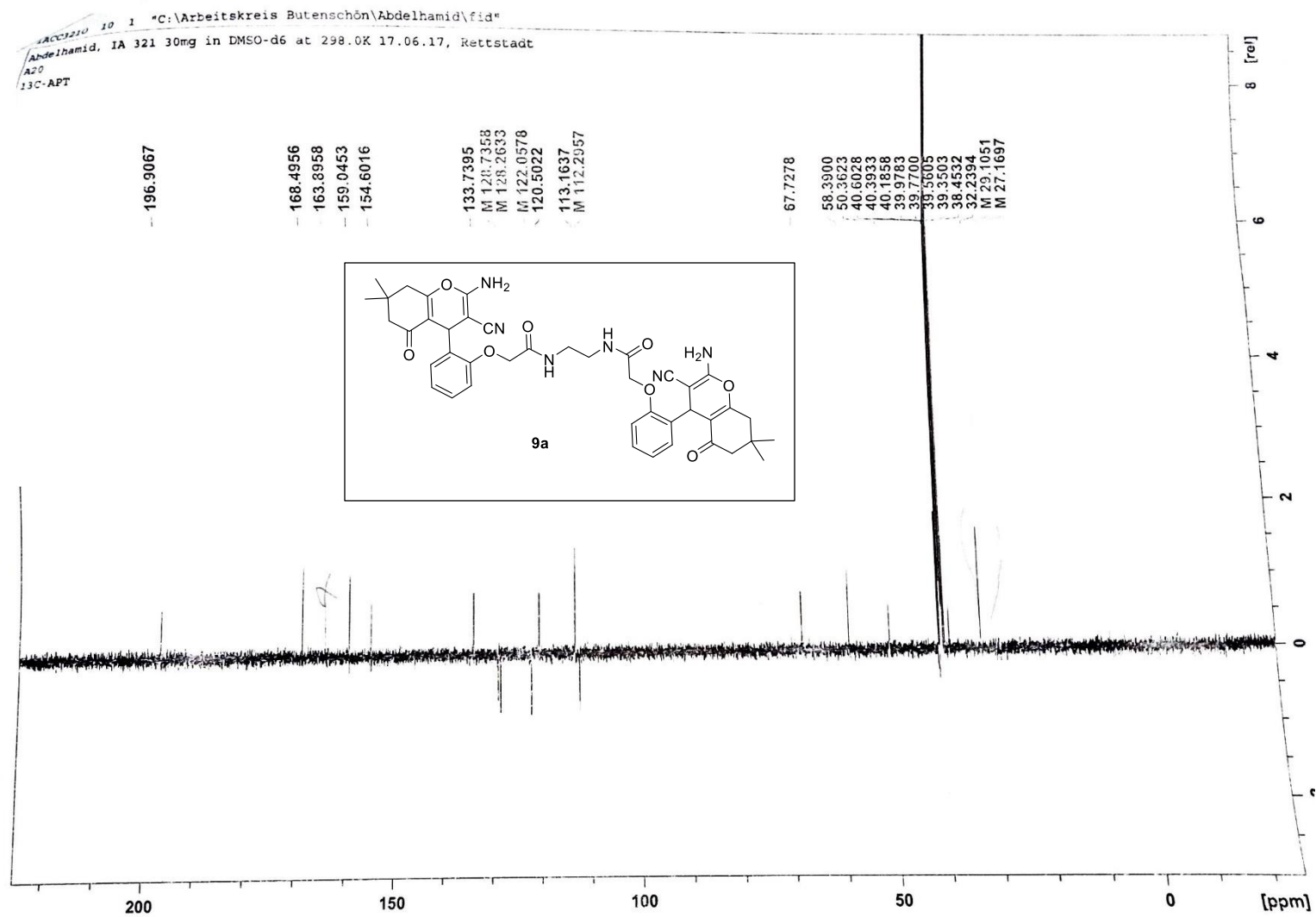
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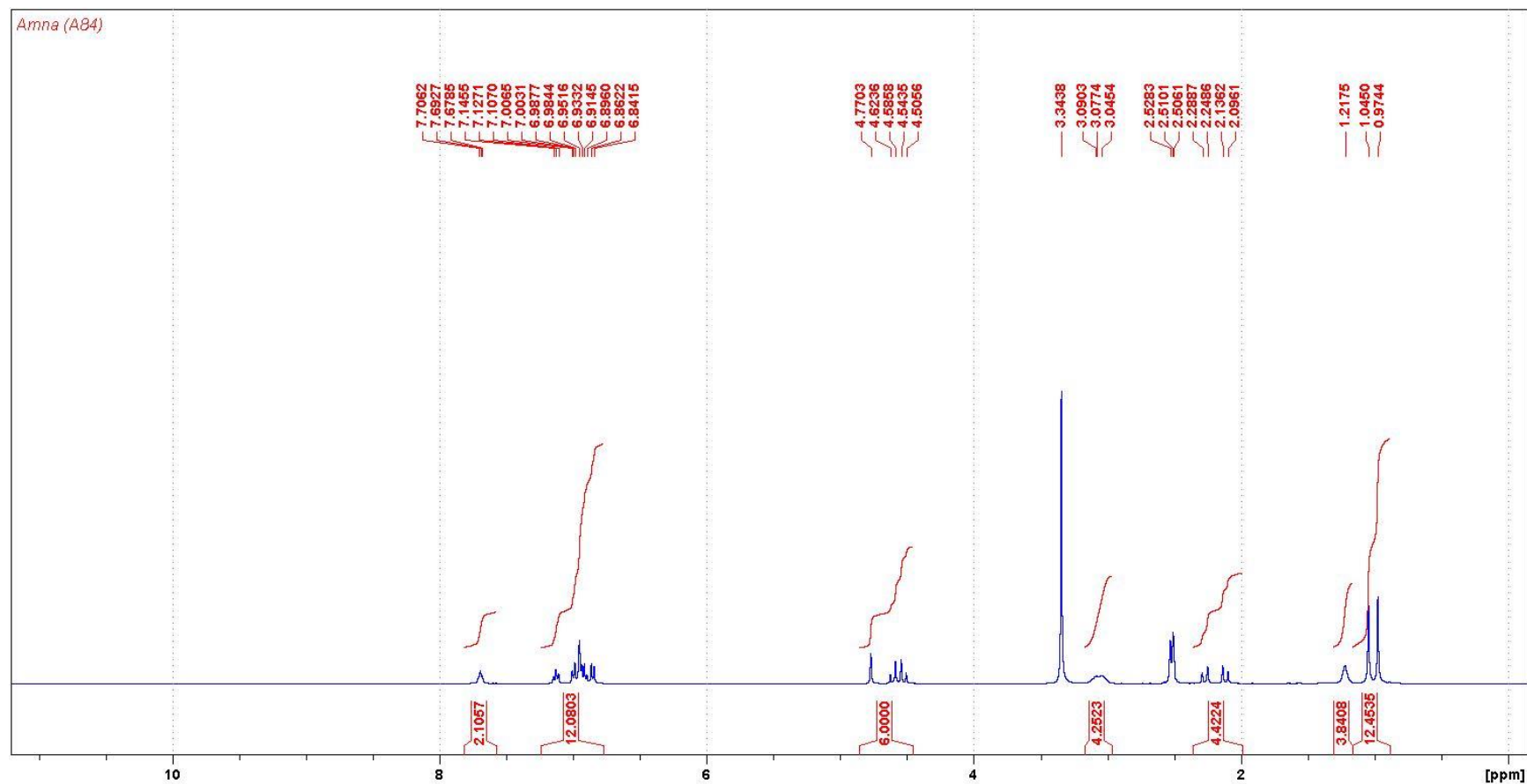
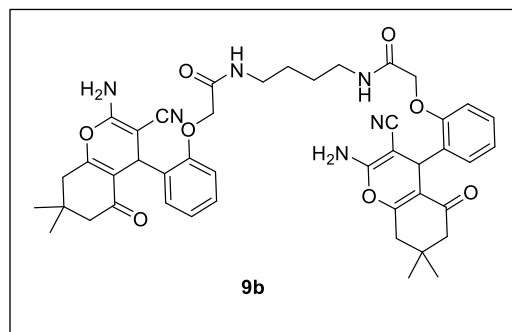
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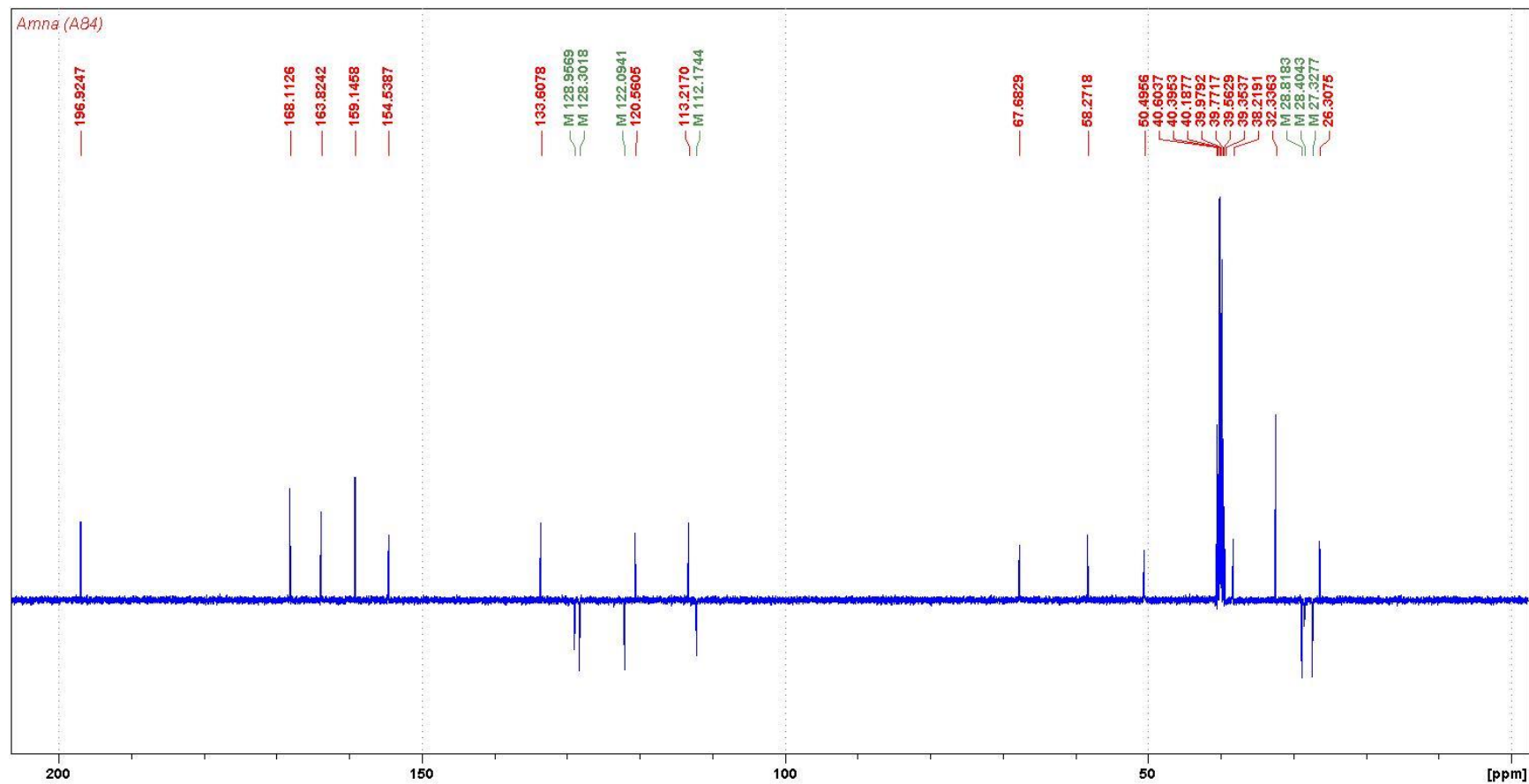
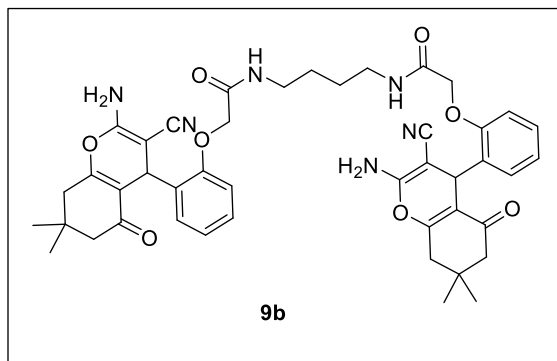
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Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
62 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
FT size 65536
Total time 43 min, 34 sec
Date: May 4 2017

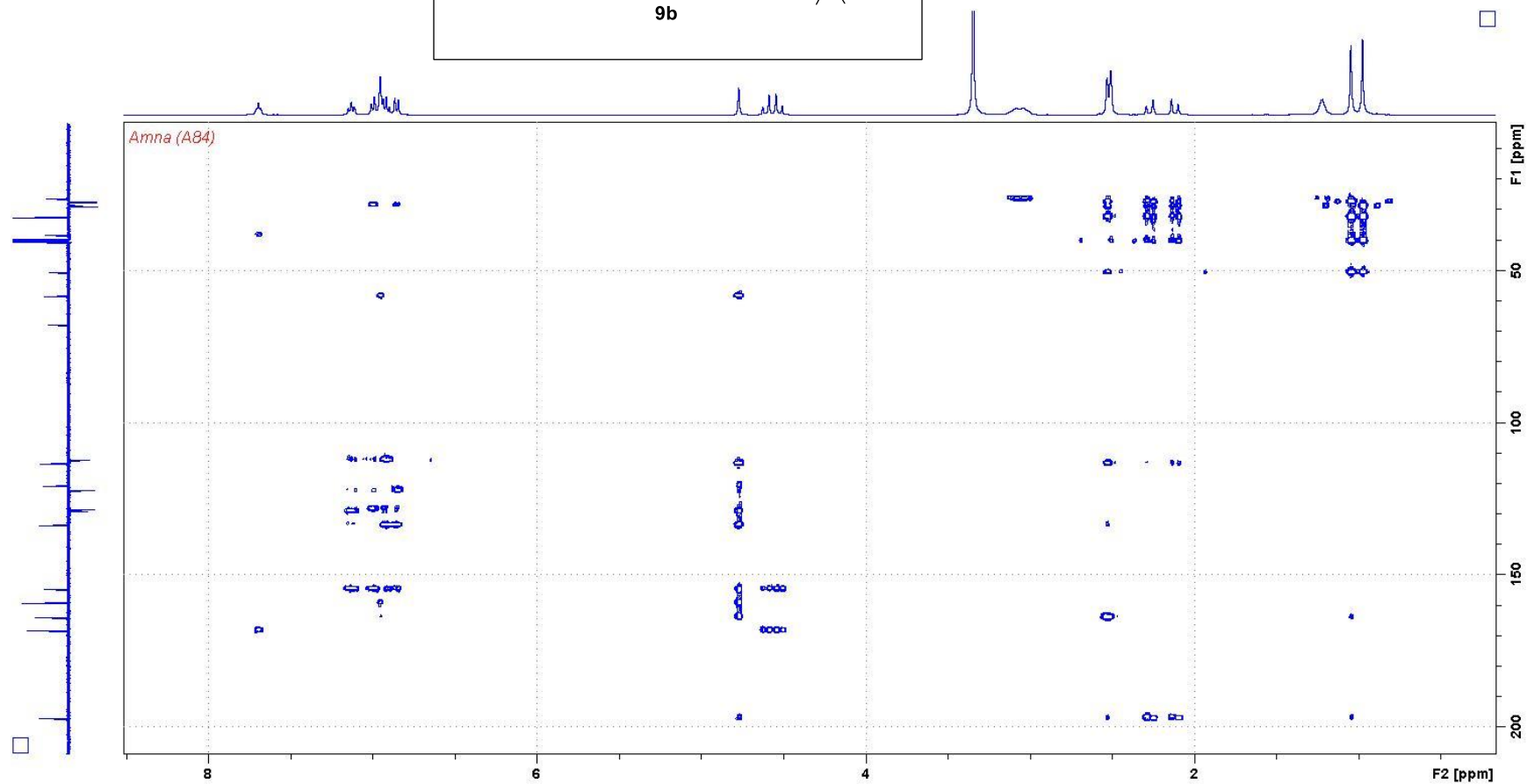
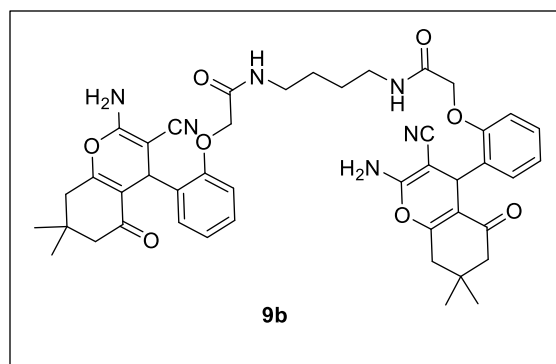




¹H NMR of compound **9b**



¹³C NMR of compound 9b



HMBC of compound 9b

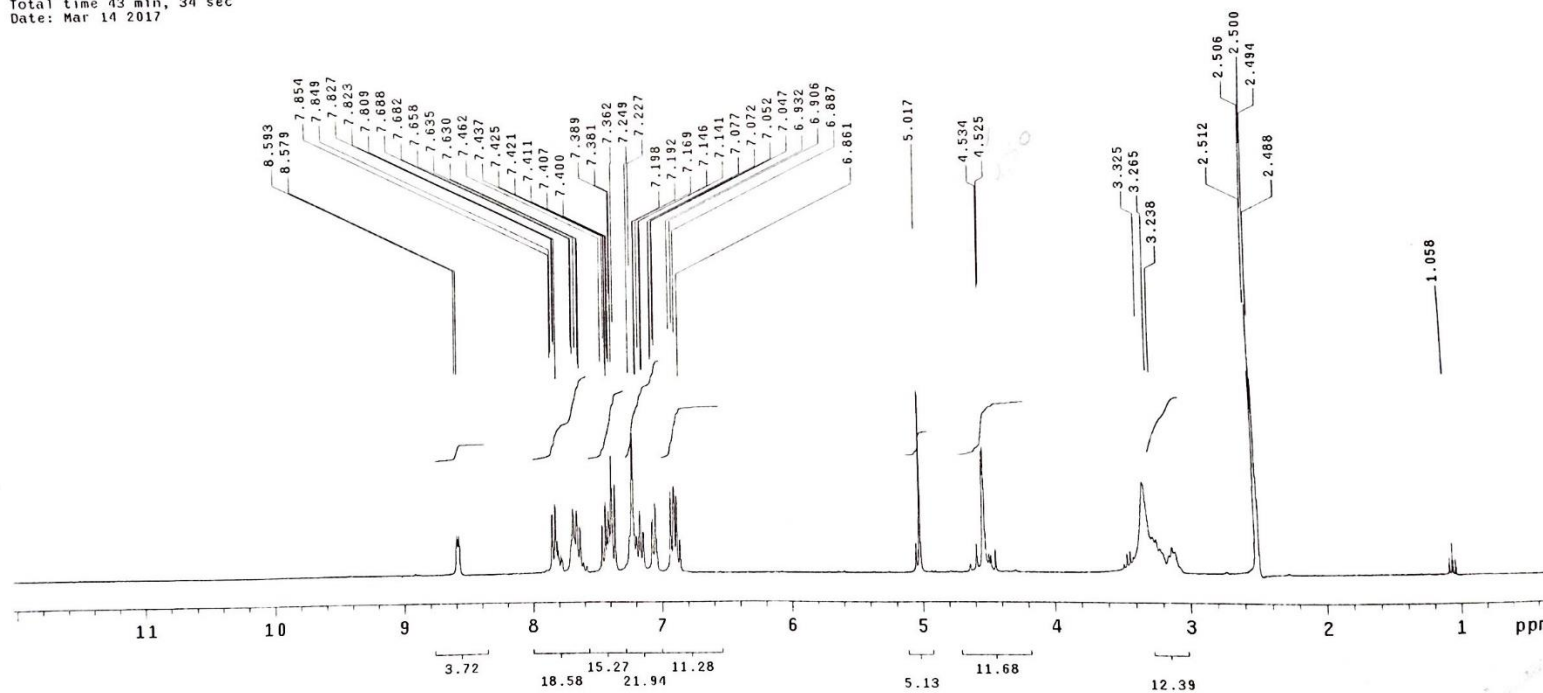
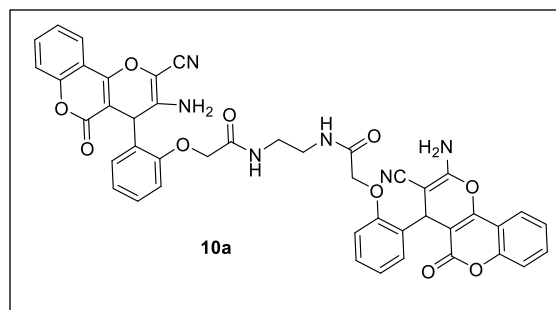
AhmadHelmy-A32-DMSO-1H

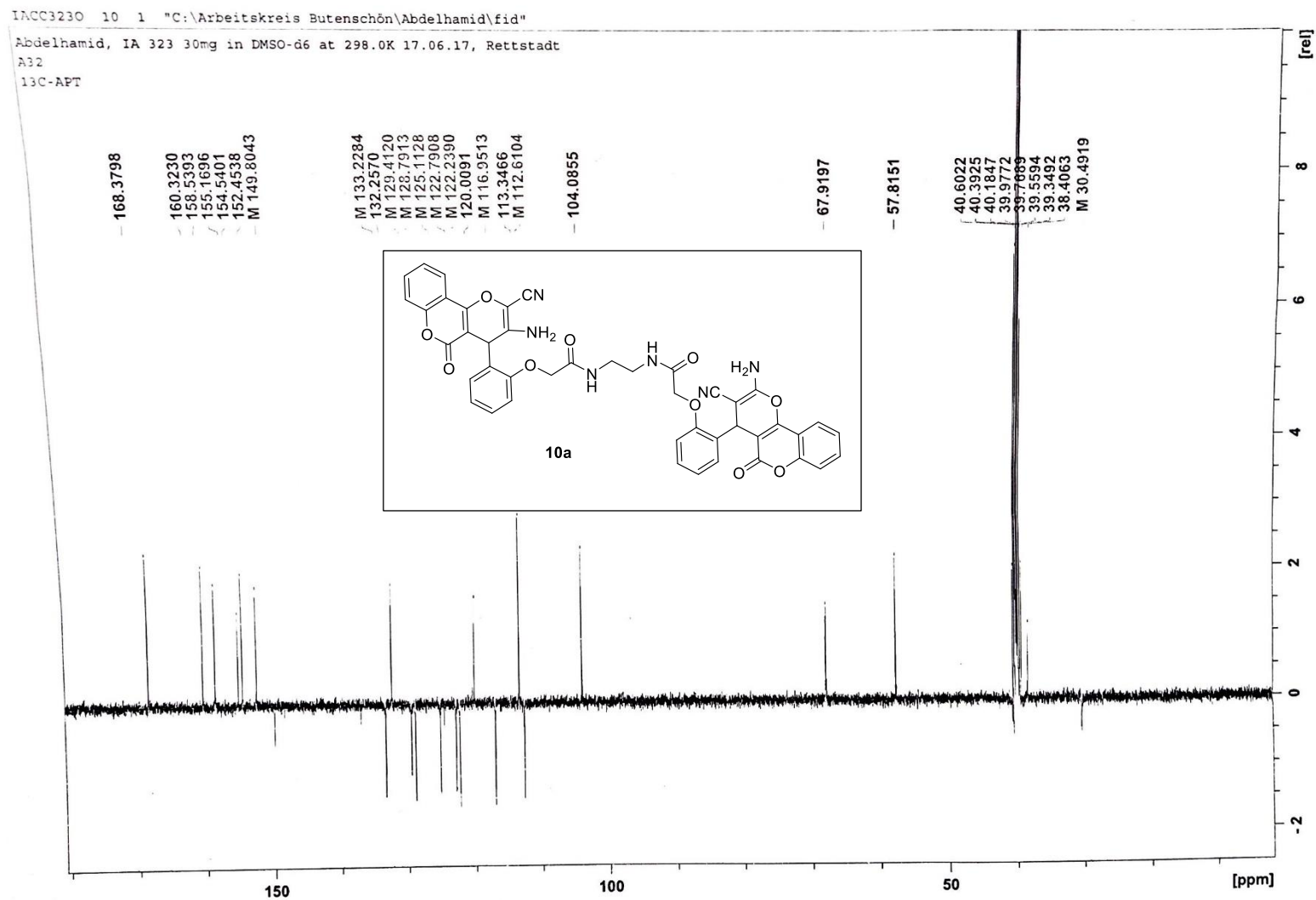
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Pulse Sequence: s2pul1

Solvent: DMSO
Temp: 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
46 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
F1 size 65536
Total time 43 min, 34 sec
Date: Mar 14 2017

¹H NMR of compound 10a

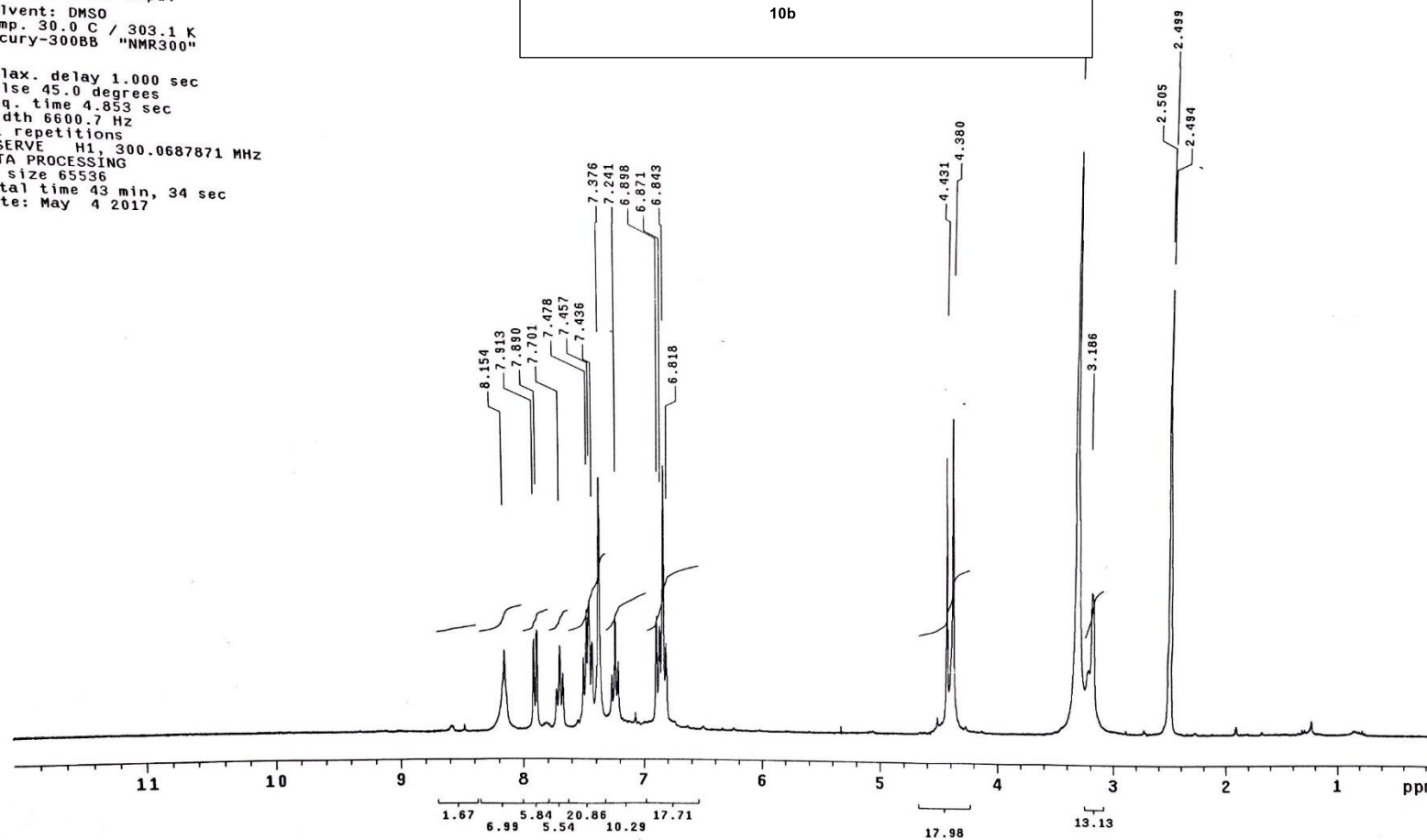
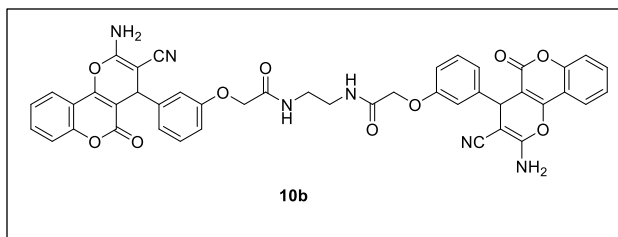
¹³C NMR of compound 10a

AhmadHelmy-A33-DMSO-1H

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File: PROTON

Pulse Sequence: s2pu1
Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
21 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
FT size 65536
Total time 43 min, 34 sec
Date: May 4 2017



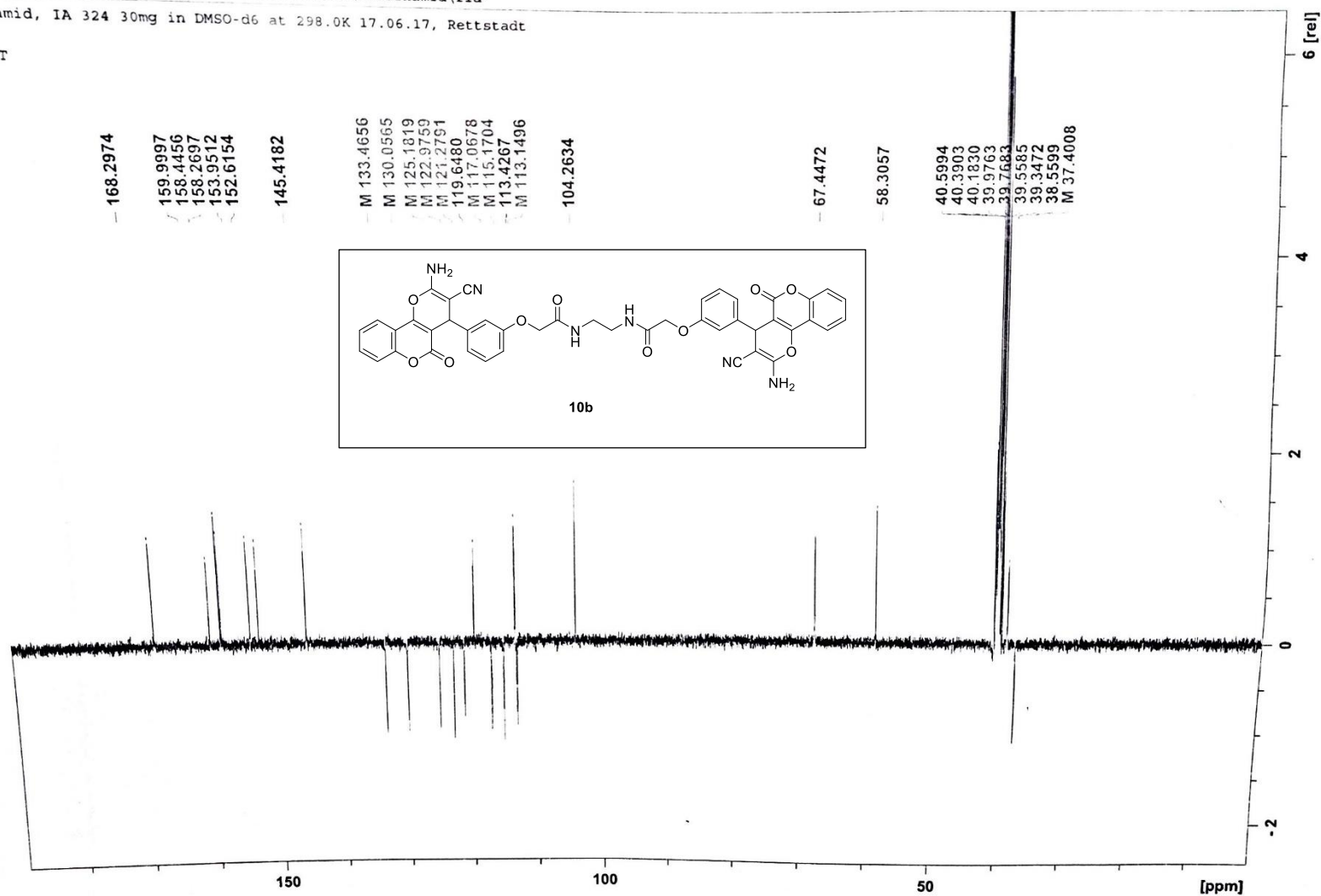
¹H NMR of compound 10b

IACC3240 10 1 "C:\Arbeitskreis Butenschön\Abdelhamid\fid"

Abdelhamid, IA 324 30mg in DMSO-d6 at 298.0K 17.06.17, Rettstadt

A33

¹³C-APT



¹³C NMR of compound 10b

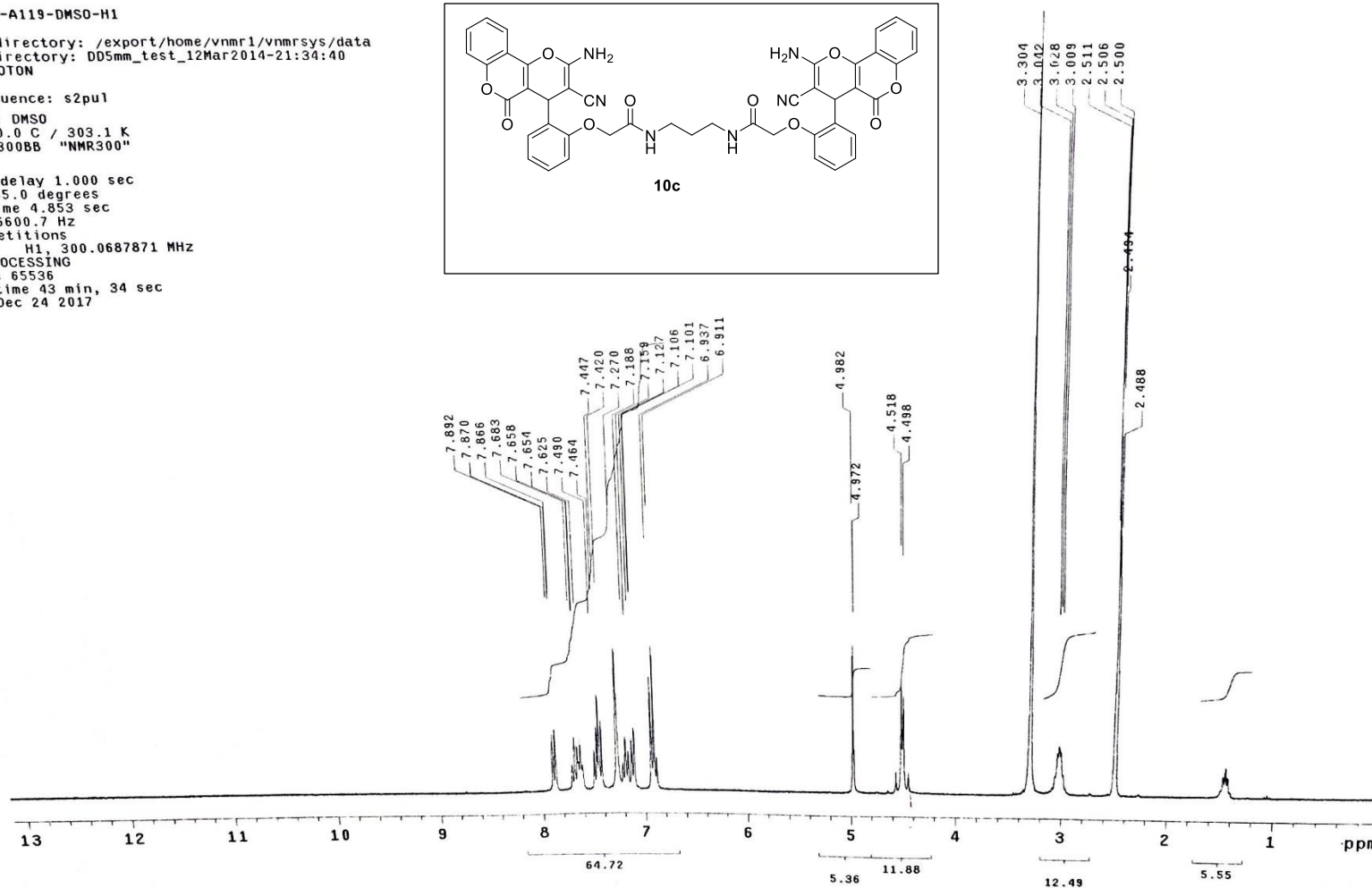
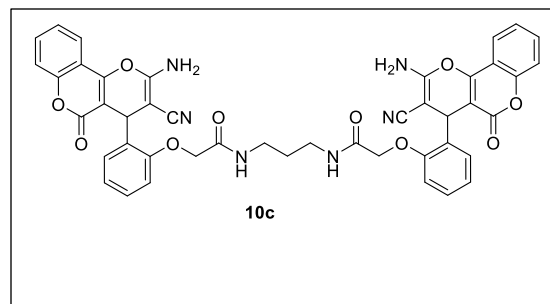
AhmedHelmy-A119-DMSO-H1

Archive directory: /export/home/vnmr1/vnmrsys/data
Sample directory: D05mm_test_12Mar2014-21:34:40
File: PROTON

Pulse Sequence: s2pul1

Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
18 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
FT size 65536
Total time 43 min, 34 sec
Date: Dec 24 2017

¹H NMR of compound 10c

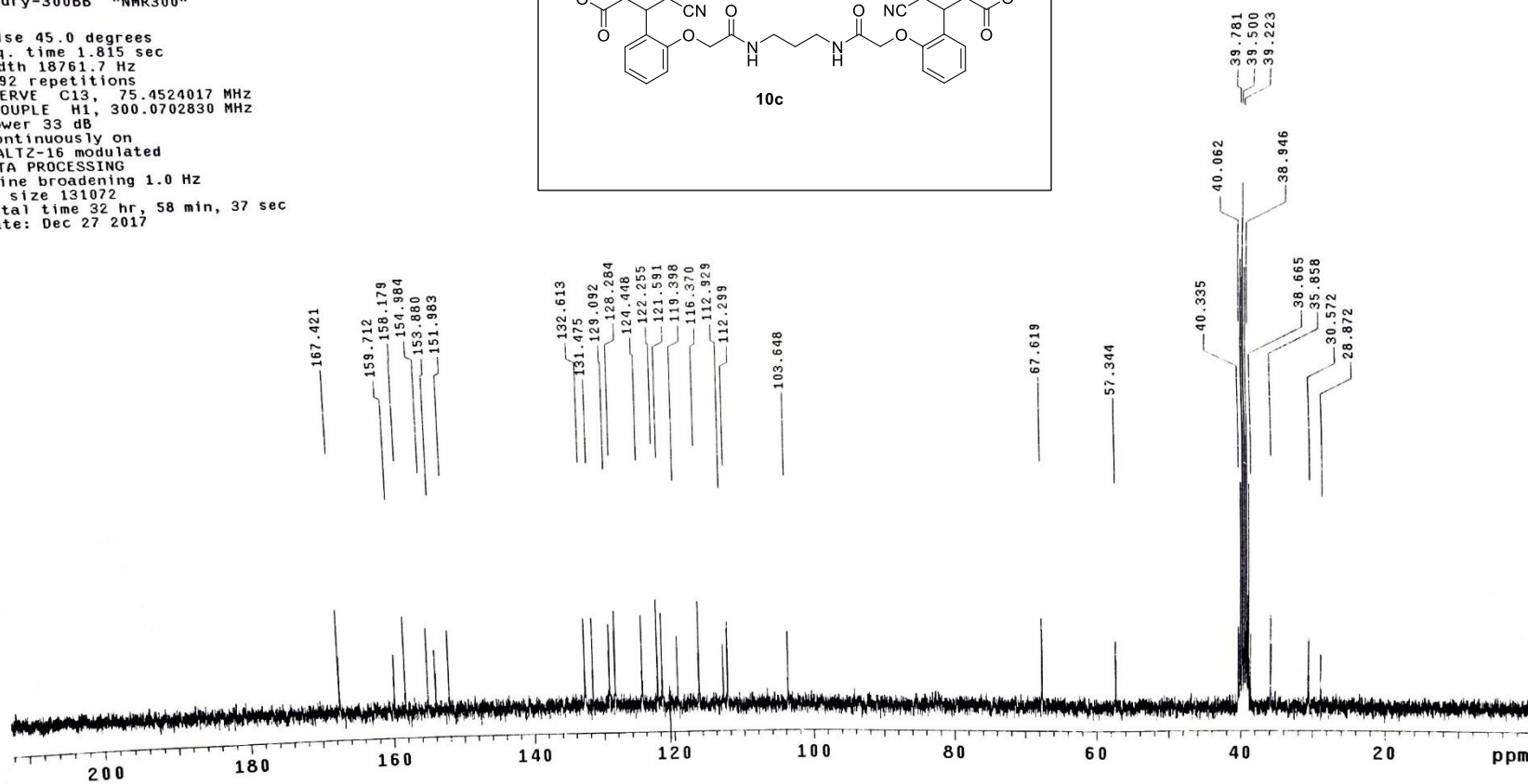
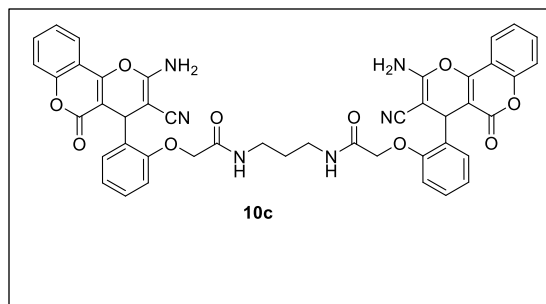
AhmedHelmy-A119-DMSO-C13

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File: PROTON

Pulse Sequence: s2pul1

Solvent: DMSO
Temp. 40.0 C / 313.1 K
Mercury-300BB "NMR300"

Pulse 45.0 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
2192 repetitions
OBSERVE C13, 75.4524017 MHz
DECOUPLE H1, 300.0702830 MHz
Power 33 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 32 hr, 58 min, 37 sec
Date: Dec 27 2017

 ^{13}C NMR of compound 10c

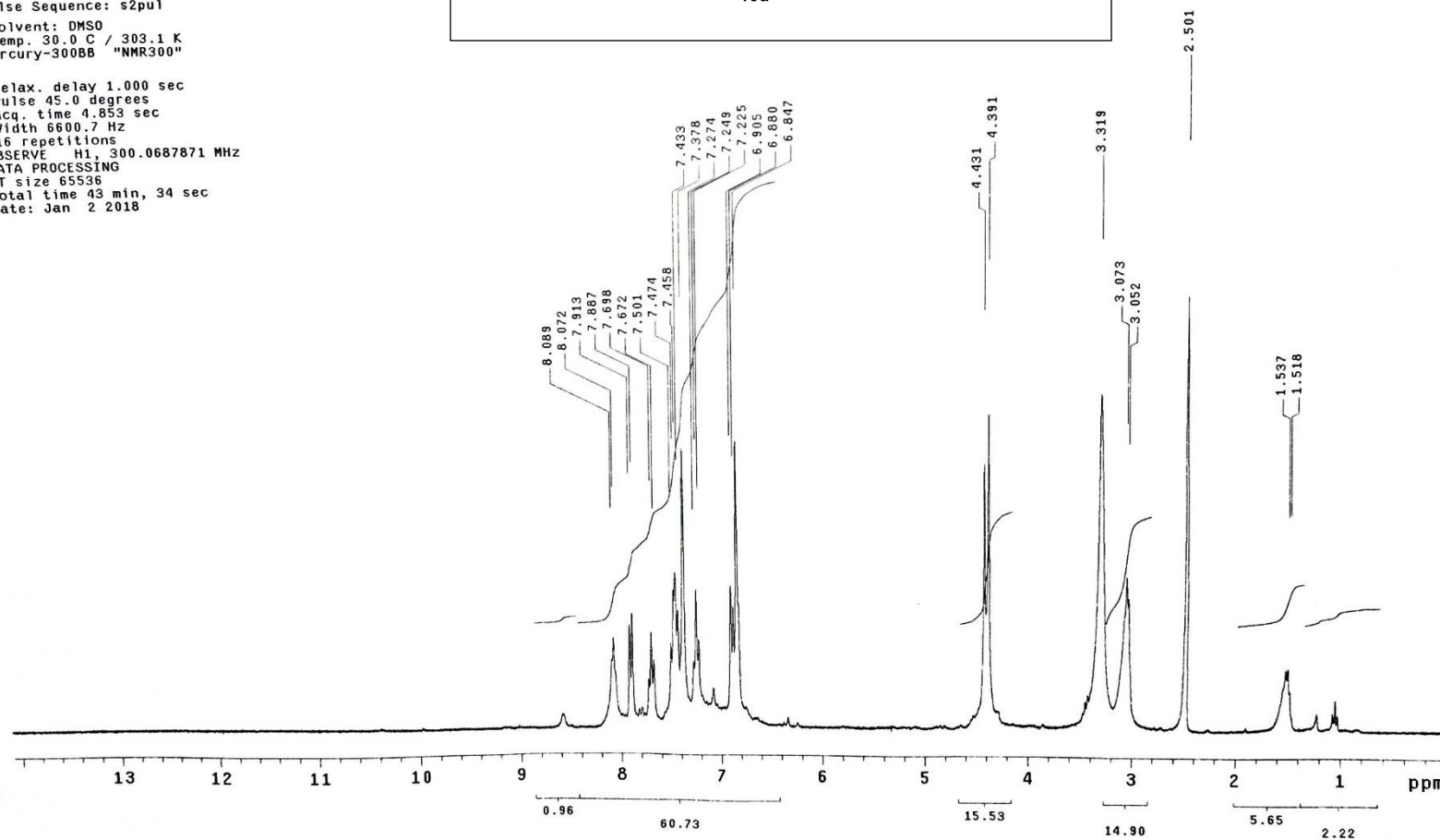
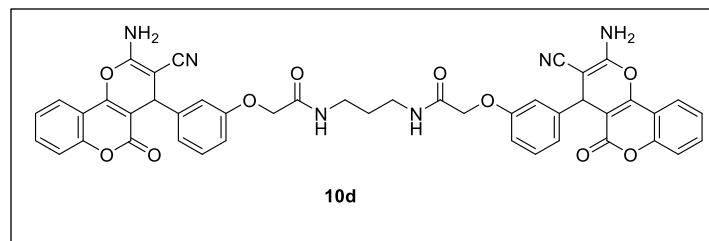
AhmedHelmy-A123-DMSO-H1

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File: PROTON

Pulse Sequence: s2pu1

Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
16 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
FT size 65536
Total time 43 min, 34 sec
Date: Jan 2 2018

¹H NMR of compound 10d

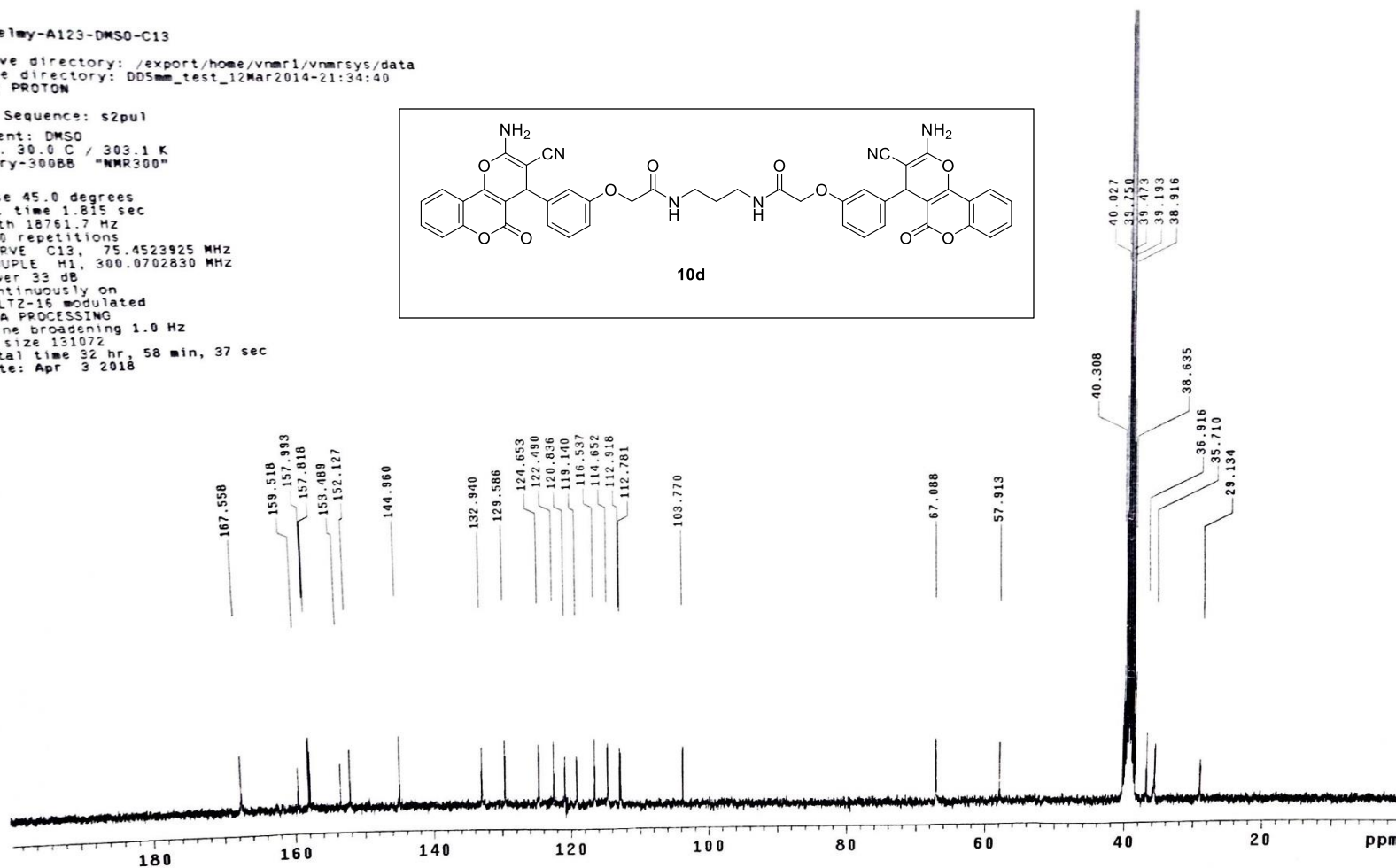
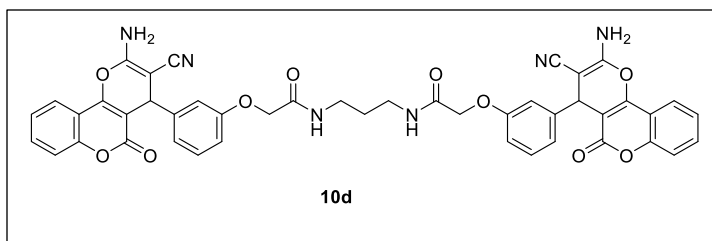
AhmedHeliwy-A123-DMSO-C13

Archive directory: /export/home/vnmr1/vnmrsys/data
Sample directory: D05mm_test_12Mar2014-21:34:40
File: PROTON

Pulse Sequence: s2pul1

Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Pulse 45.0 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
2560 repetitions
OBSERVE C13, 75.4523925 MHz
DECOUPLE H1, 300.0702830 MHz
Power 33 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 32 hr, 58 min, 37 sec
Date: Apr 3 2018

¹³C NMR of compound 10d

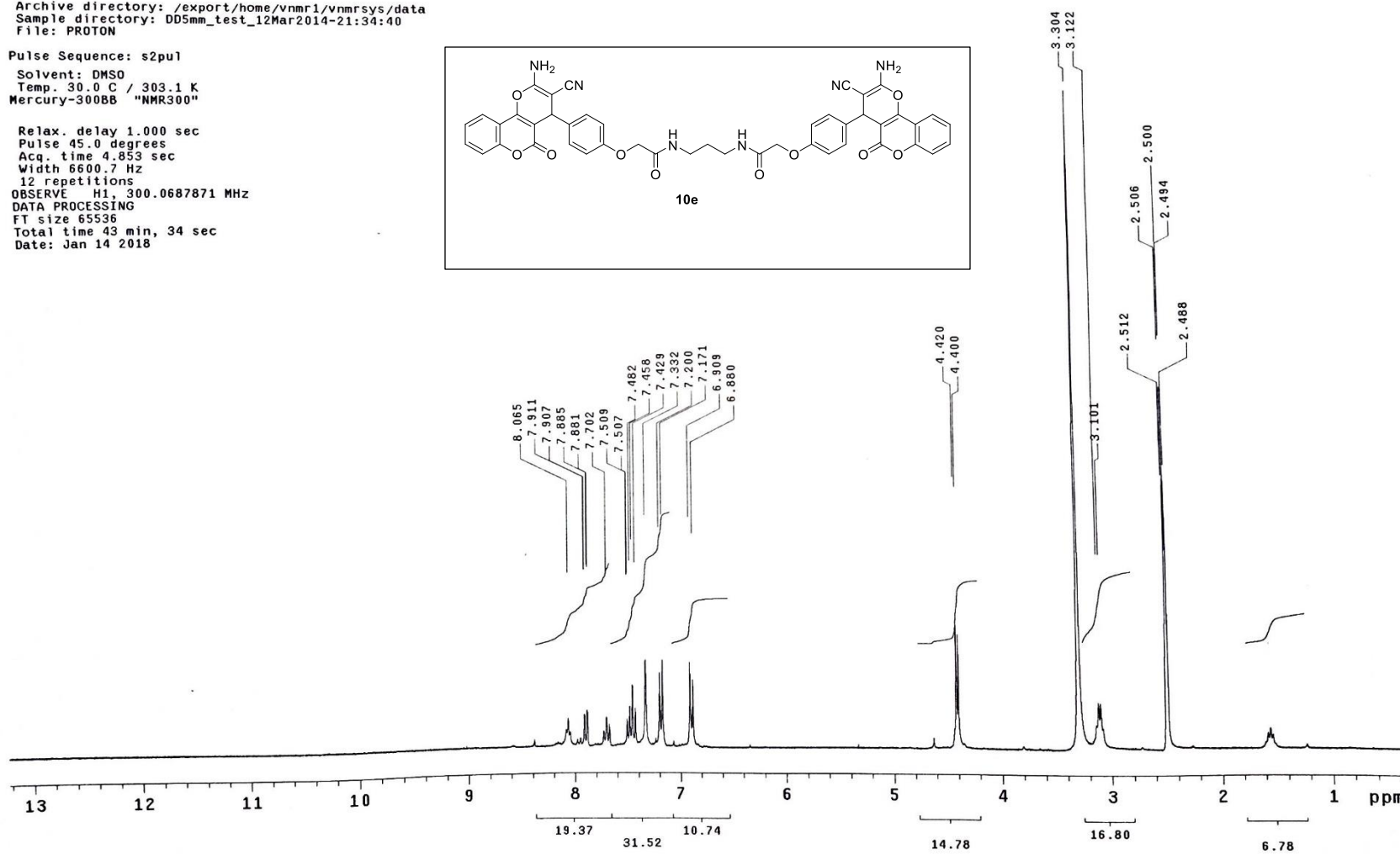
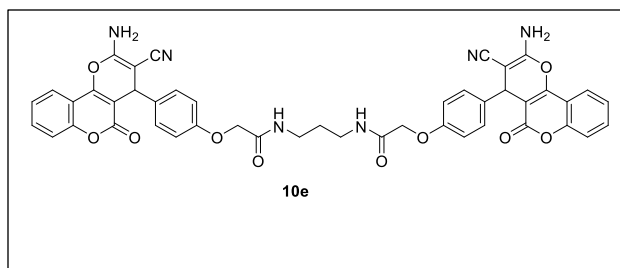
SaiedGhozlan-A126-DMSO-H1

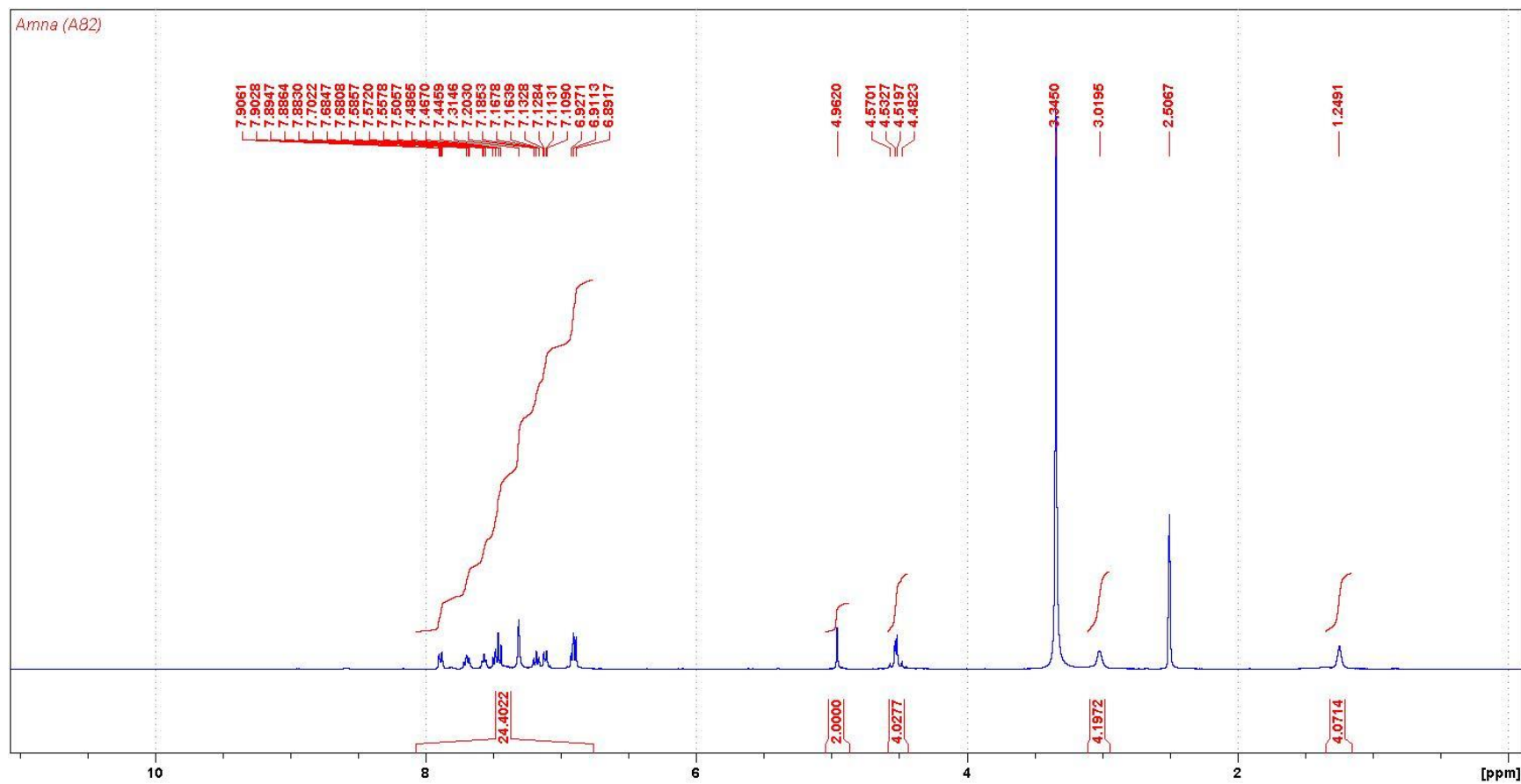
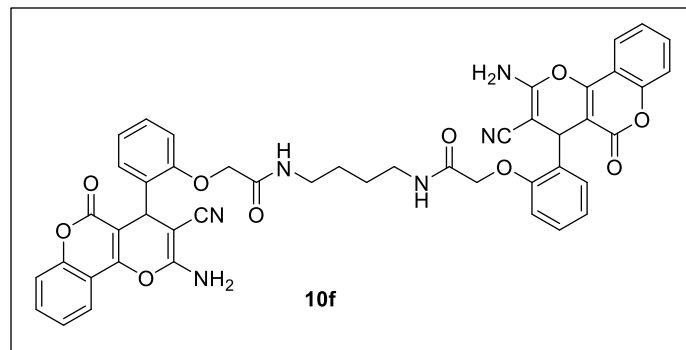
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Pulse Sequence: s2pu1

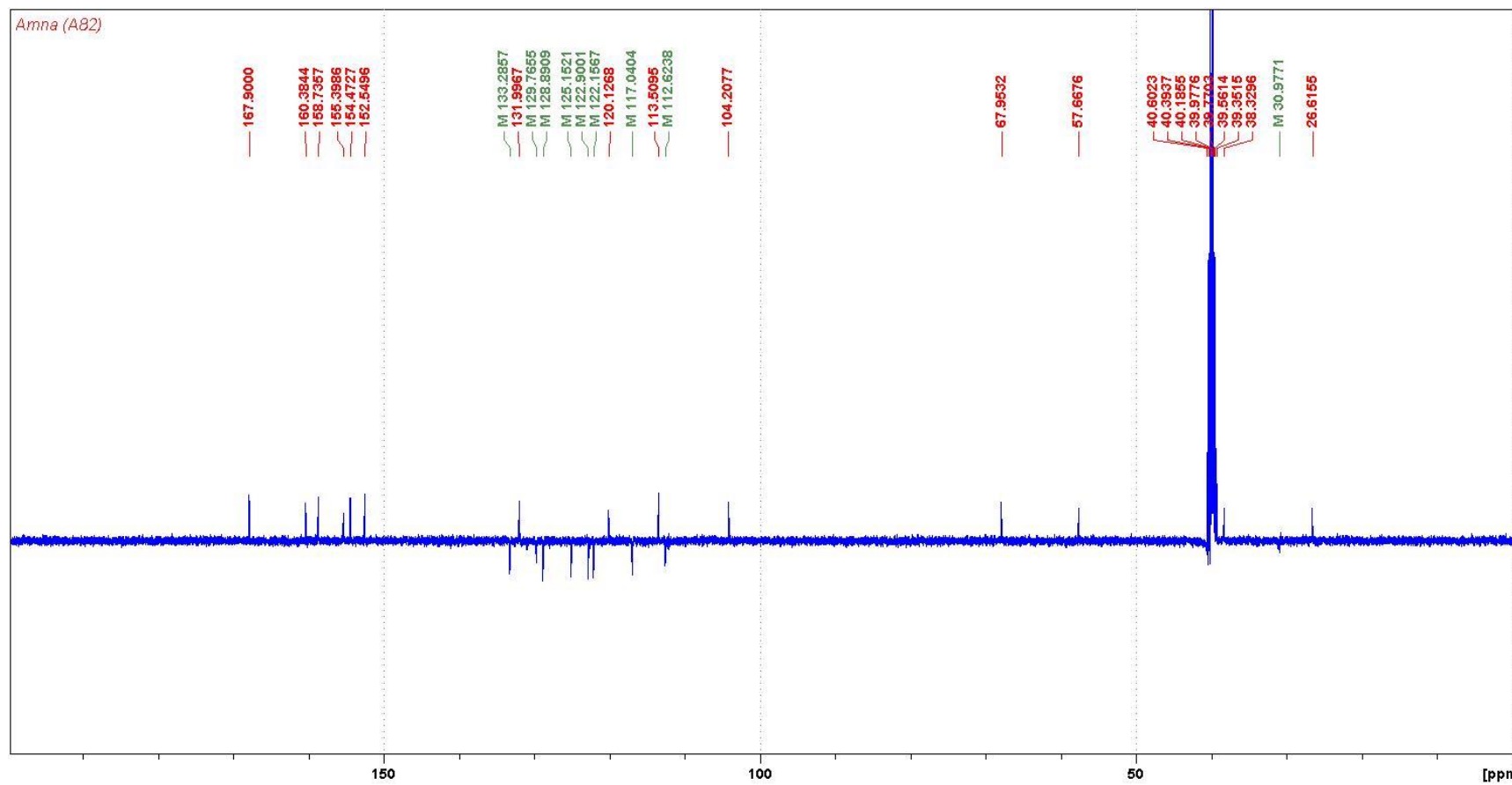
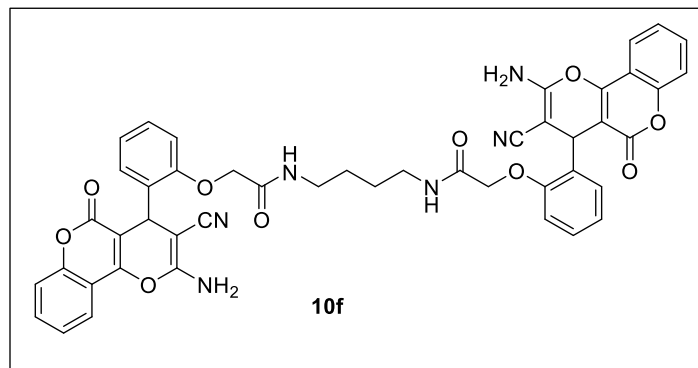
Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

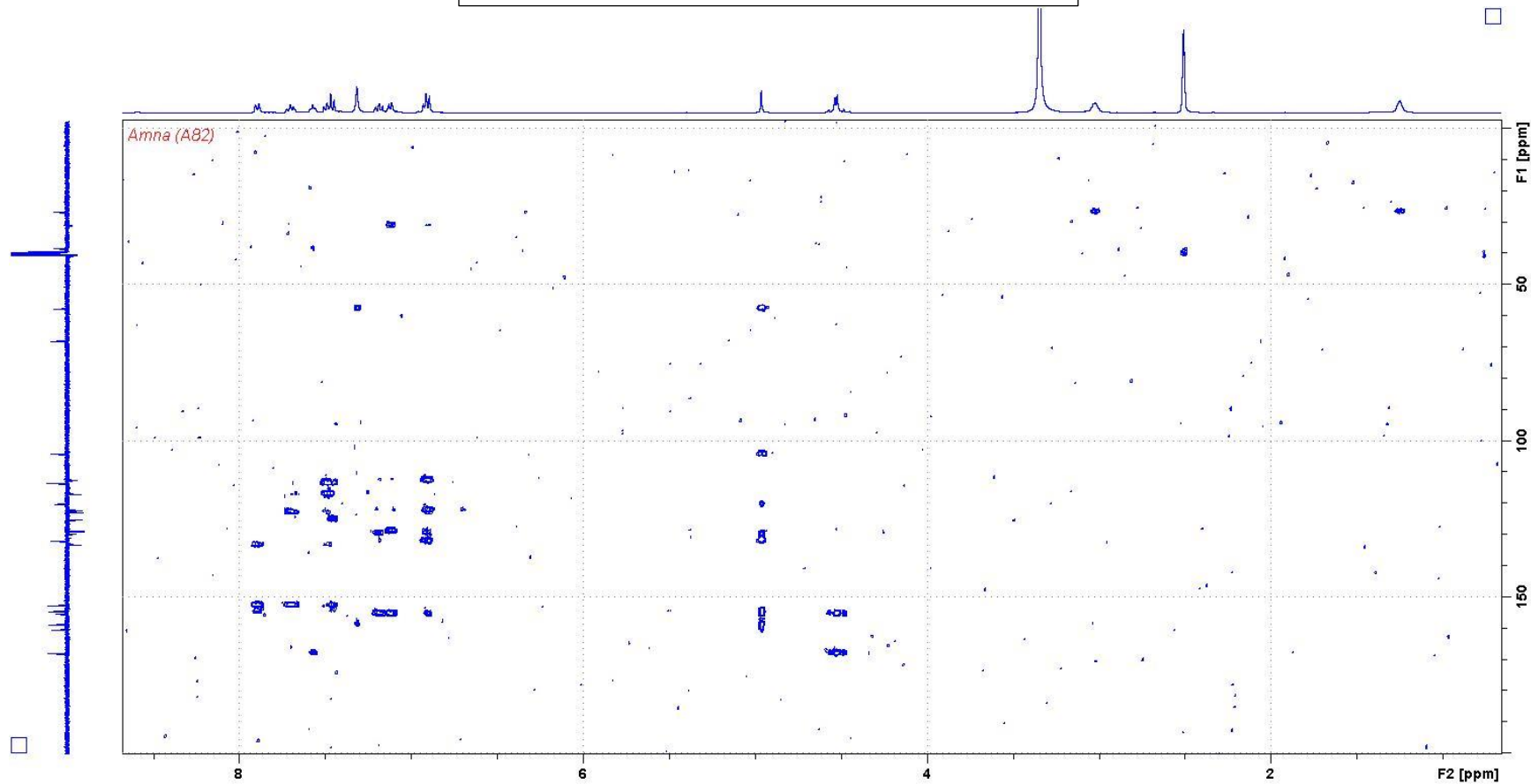
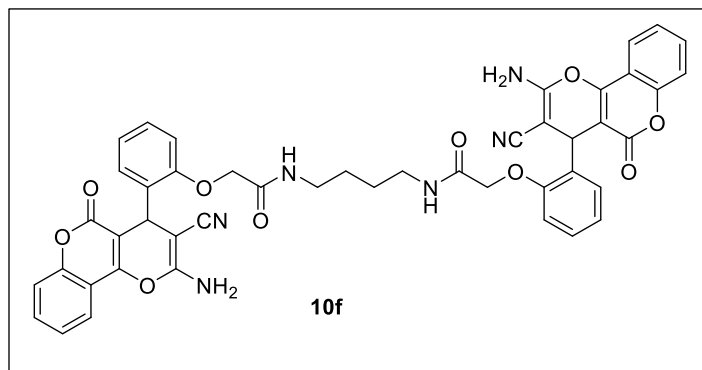
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
12 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
FT size 65536
Total time 43 min, 34 sec
Date: Jan 14 2018

¹H NMR of compound 10e



¹H NMR of compound 10f

¹³C NMR of compound **10f**



HMBC NMR of compound 10f

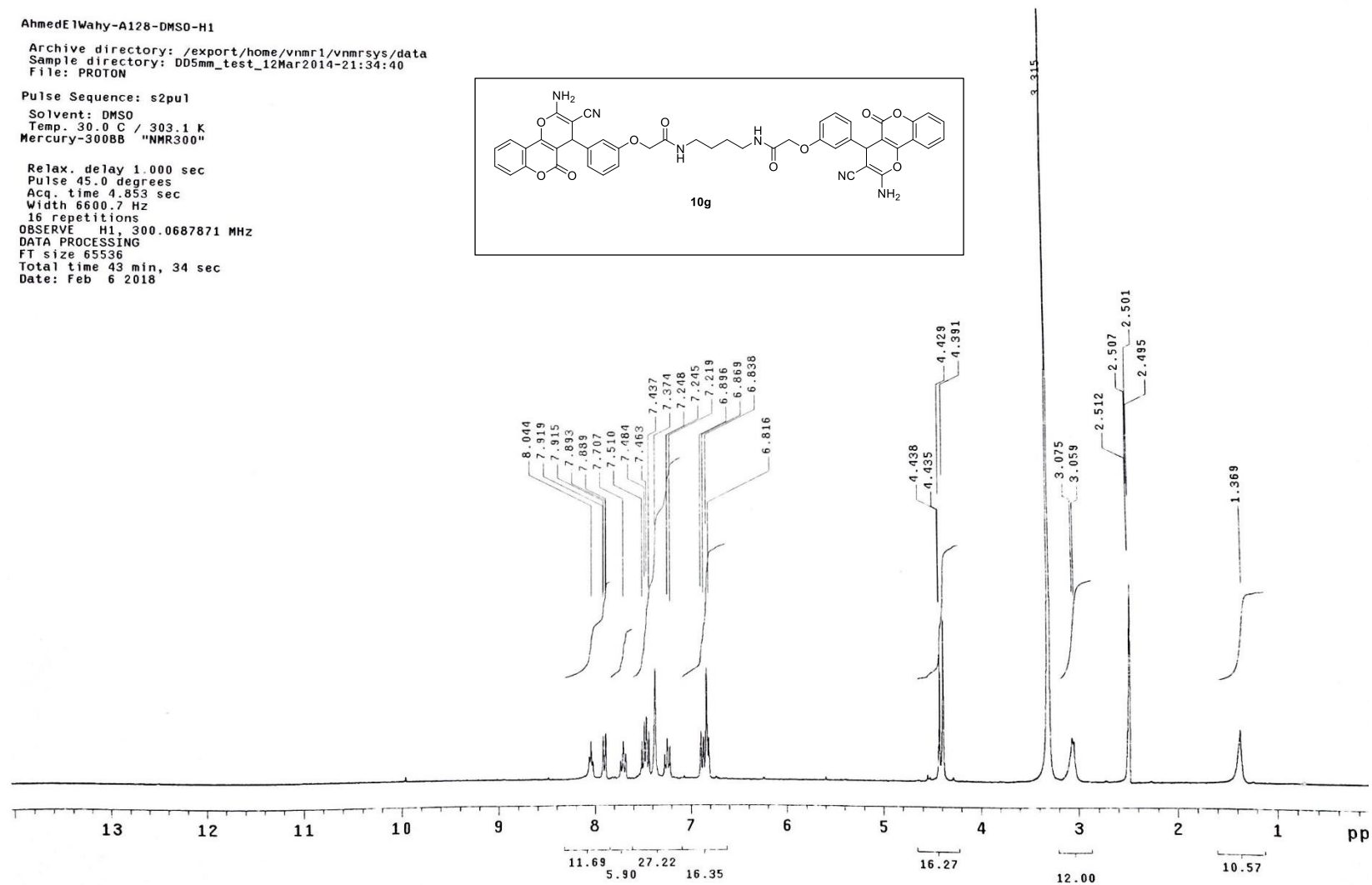
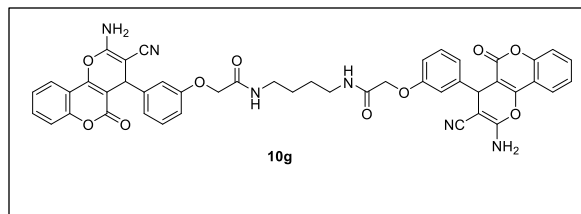
AhmedE1Wahy-A128-DMSO-H1

Archive directory: /export/home/vnmr1/vnmrsys/data
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File: PROTON

Pulse Sequence: s2pu1

Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 4.853 sec
Width 6600.7 Hz
16 repetitions
OBSERVE H1, 300.0687871 MHz
DATA PROCESSING
FT size 65536
Total time 43 min, 34 sec
Date: Feb 6 2018

¹H NMR of compound 10g

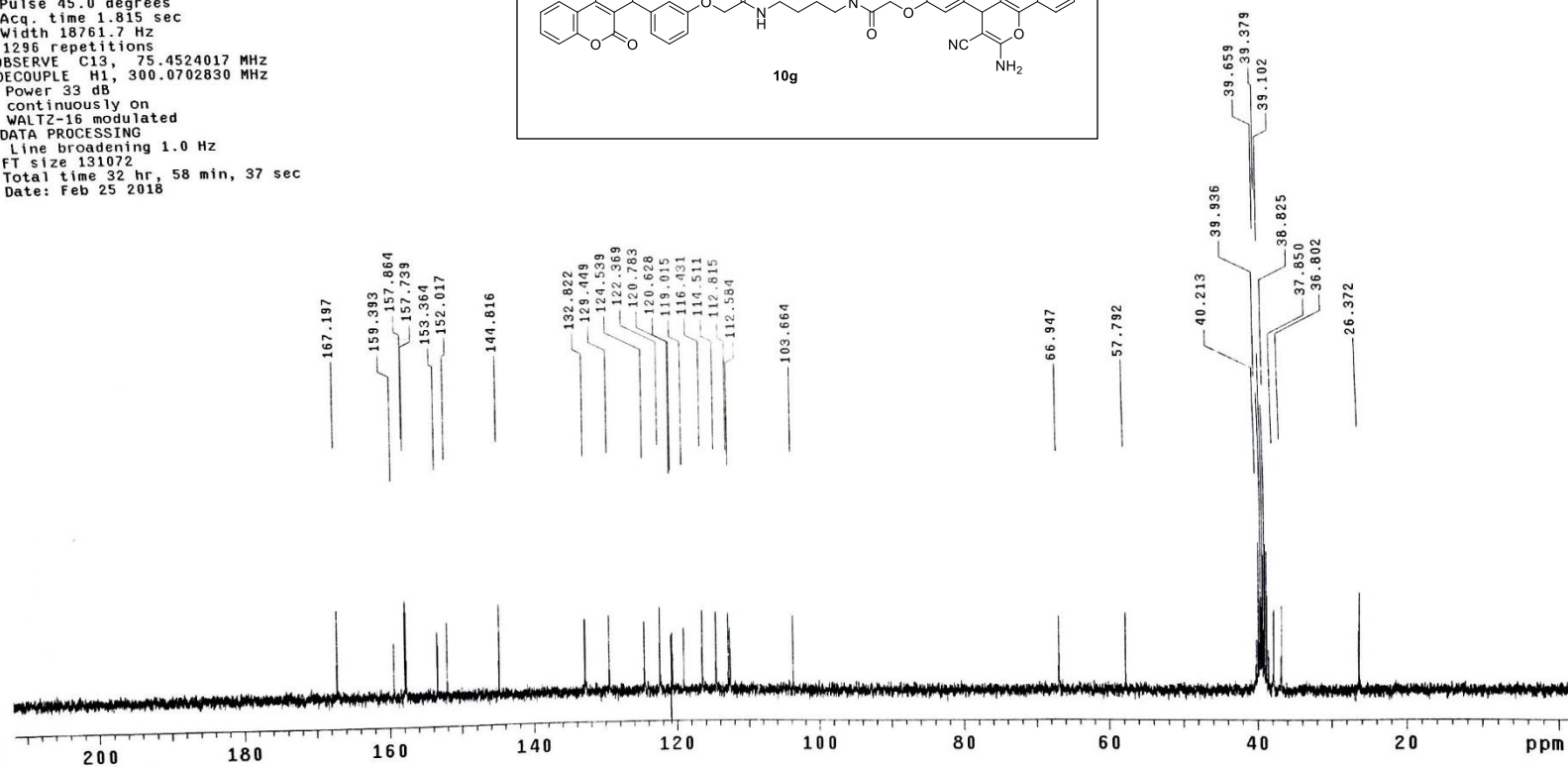
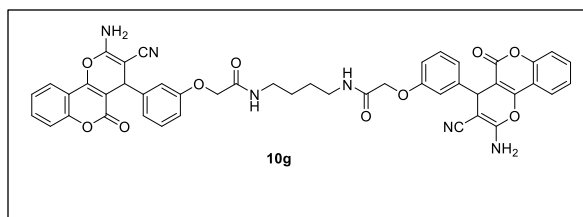
AhmedHelmy-A128-DMSO-C13

Archive directory: /export/home/vnmr1/vnmrsys/data
Sample directory: DD5mm_test_12Mar2014-21:34:40
File: PROTON

Pulse Sequence: s2pu1

Solvent: DMSO
Temp. 30.0 C / 303.1 K
Mercury-300BB "NMR300"

Pulse 45.0 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
1296 repetitions
OBSERVE C13, 75.4524017 MHz
DECOUPLE H1, 300.0702830 MHz
Power 33 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 32 hr, 58 min, 37 sec
Date: Feb 25 2018

¹³C NMR of compound 10g

AhmedHelmy-A83-DMSO-H1

Archive directory: /export/home/vnmr1/vnmrsys/data
Sample directory: DD5mm_test_12Mar2014-21:34:40
File: PROTON

Pulse Sequence: s2pu1

Solvent: DMSO

Temp. 30.0 C / 303.1 K

Mercury-300BB "NMR300"

Relax. delay 1.000 sec

Pulse 45.0 degrees

Acq. time 4.853 sec

Width 6600.7 Hz

32 repetitions

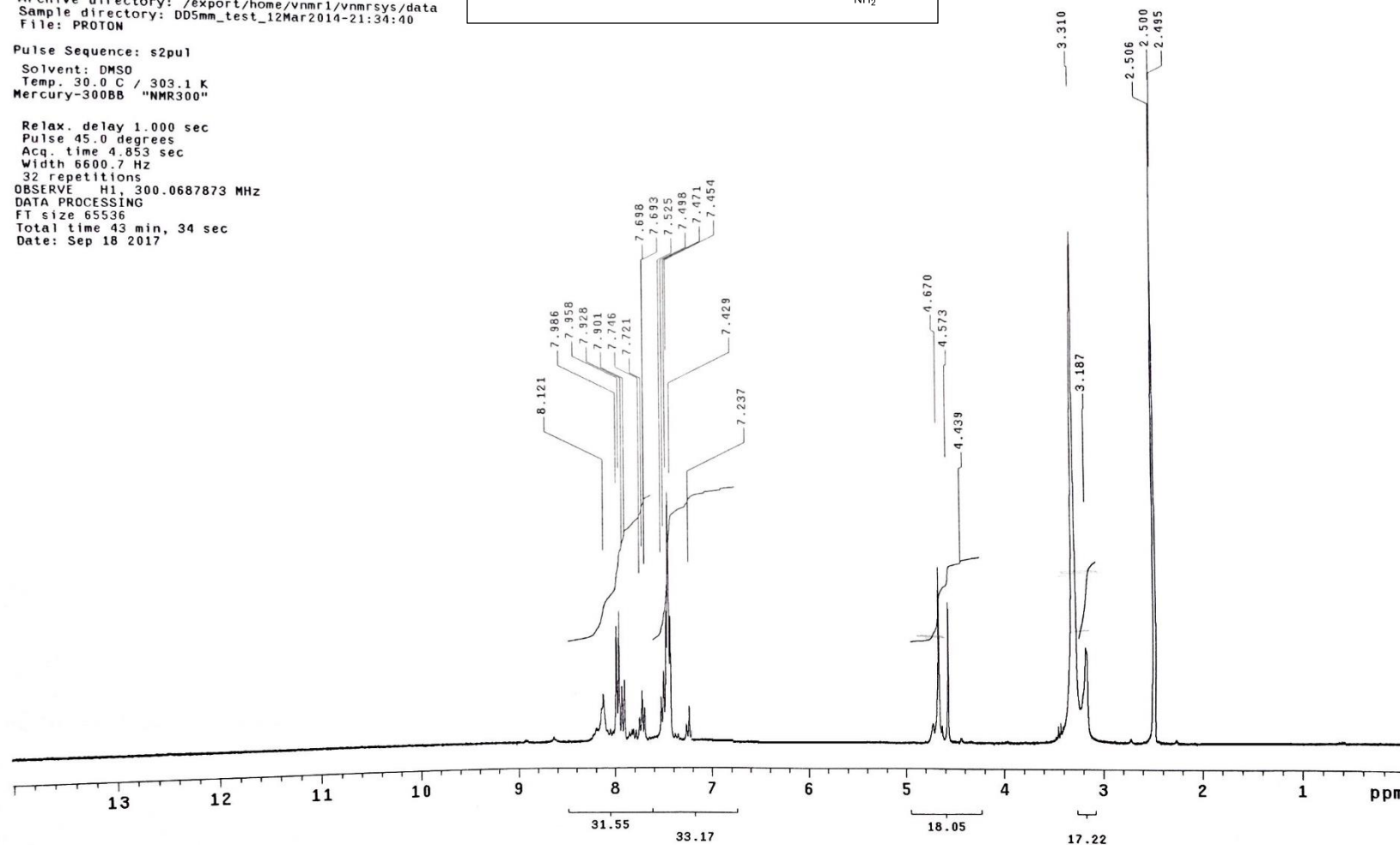
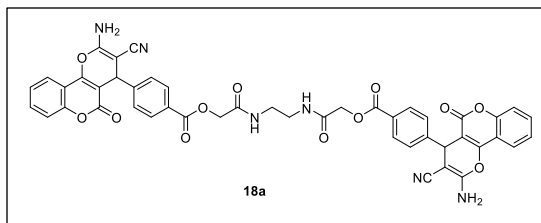
OBSERVE H1, 300.0687873 MHz

DATA PROCESSING

FT size 65536

Total time 43 min, 34 sec

Date: Sep 18 2017

¹H NMR of compound 18a

AhmedHelmy-A83-DMSO-C13

Archive directory: /export/home/vnmr1/vnmrsys/data
Sample directory: DD5mm_test_12Mar2014-21:34:40
File: PROTON

Pulse Sequence: s2pu1

Solvent: DMSO

Temp. 40.0 C / 313.1 K

Mercury-300BB "NMR300"

Pulse 45.0 degrees

Acq. time 1.815 sec

Width 18761.7 Hz

1384 repetitions

OBSERVE C13, 75.4524028 MHz

DECOUPLE H1, 300.0702830 MHz

Power 33 dB

continuously on

WALTZ-16 modulated

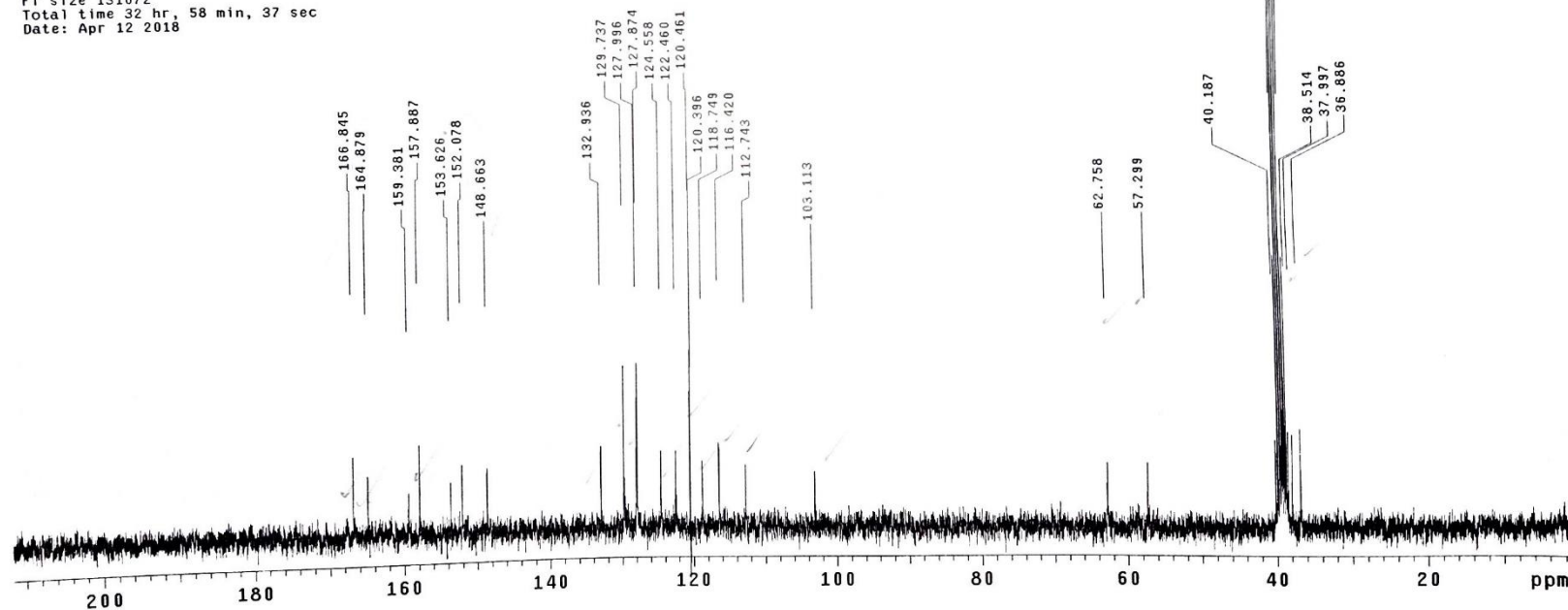
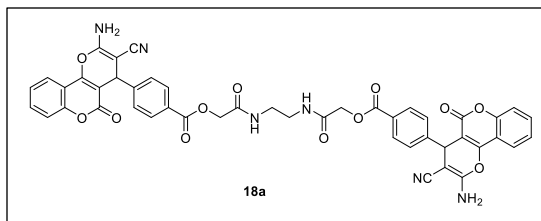
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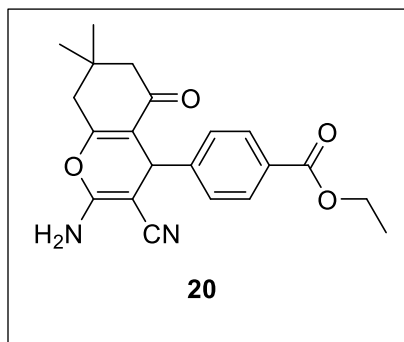
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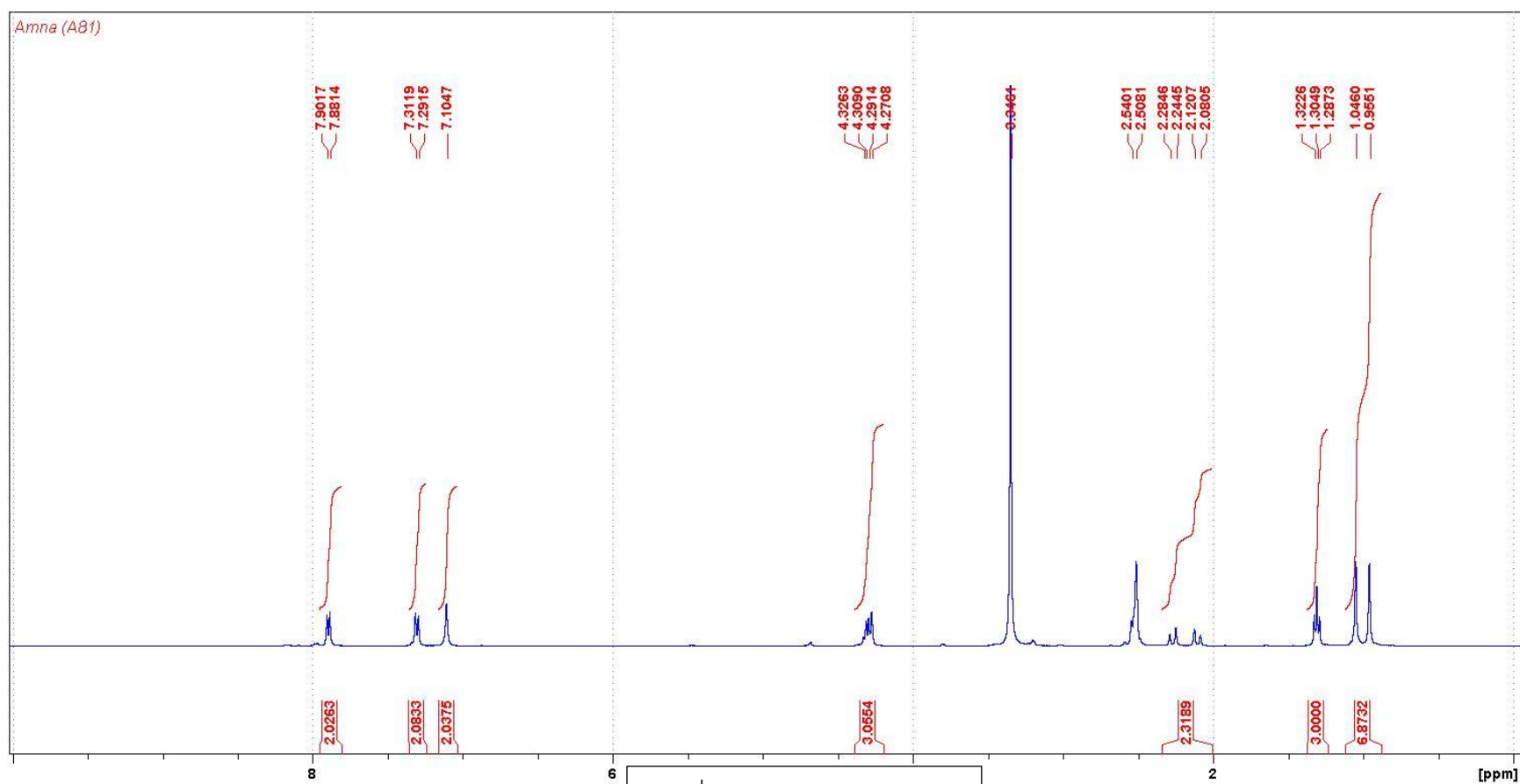
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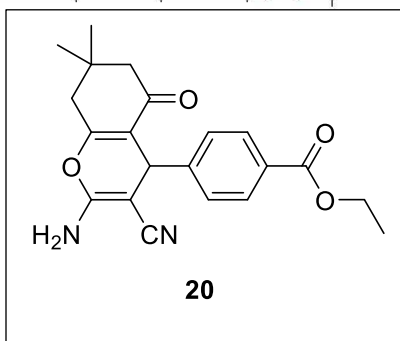
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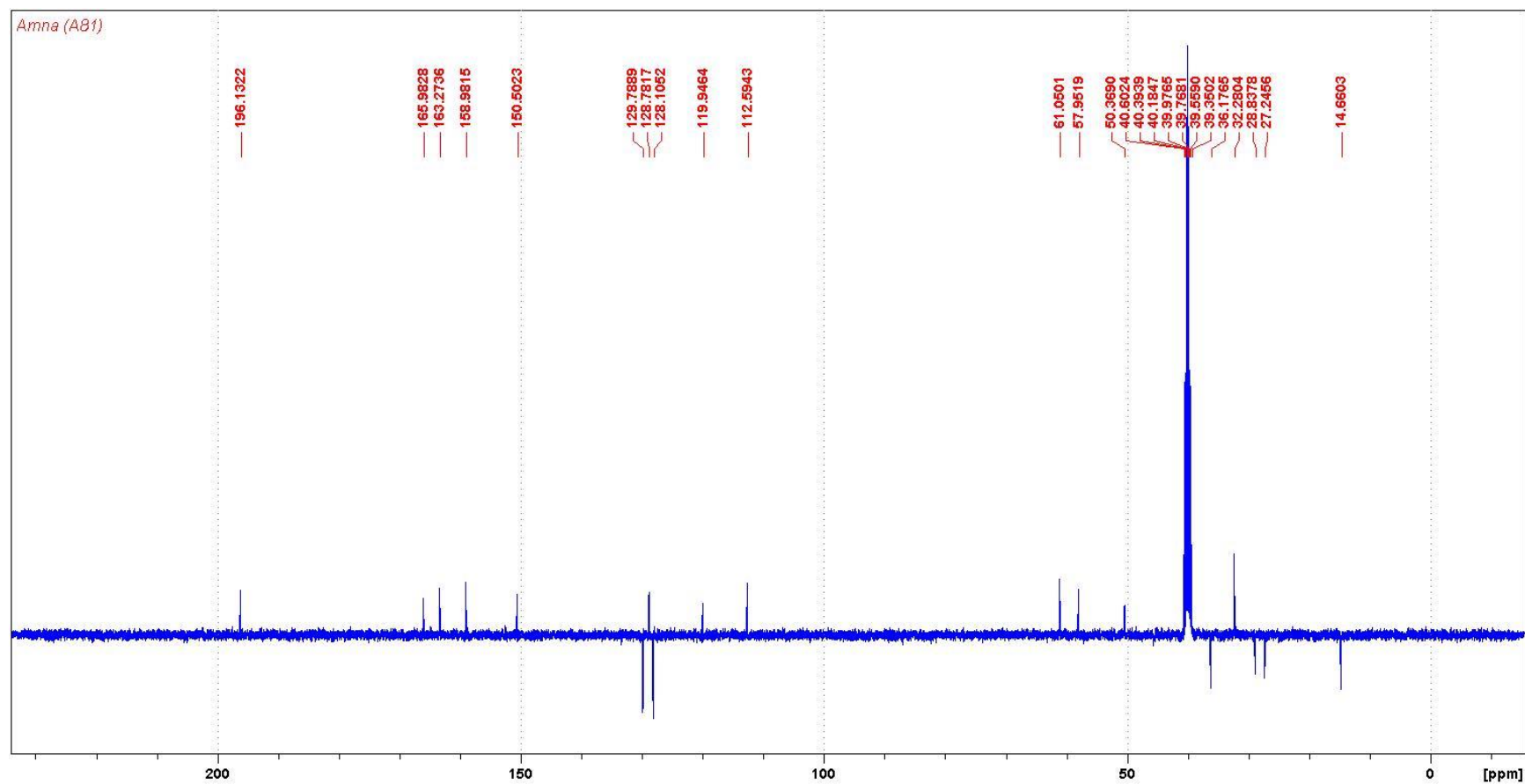
¹³C NMR of compound 18a





¹H NMR of compound 20





^{13}C NMR of compound 20