

Supporting Information

Green synthesis of dipyrromethanes in water catalyzed by SO₃H-functionalized ionic liquid

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Sangsook, Chonburi 20131, Thailand.*

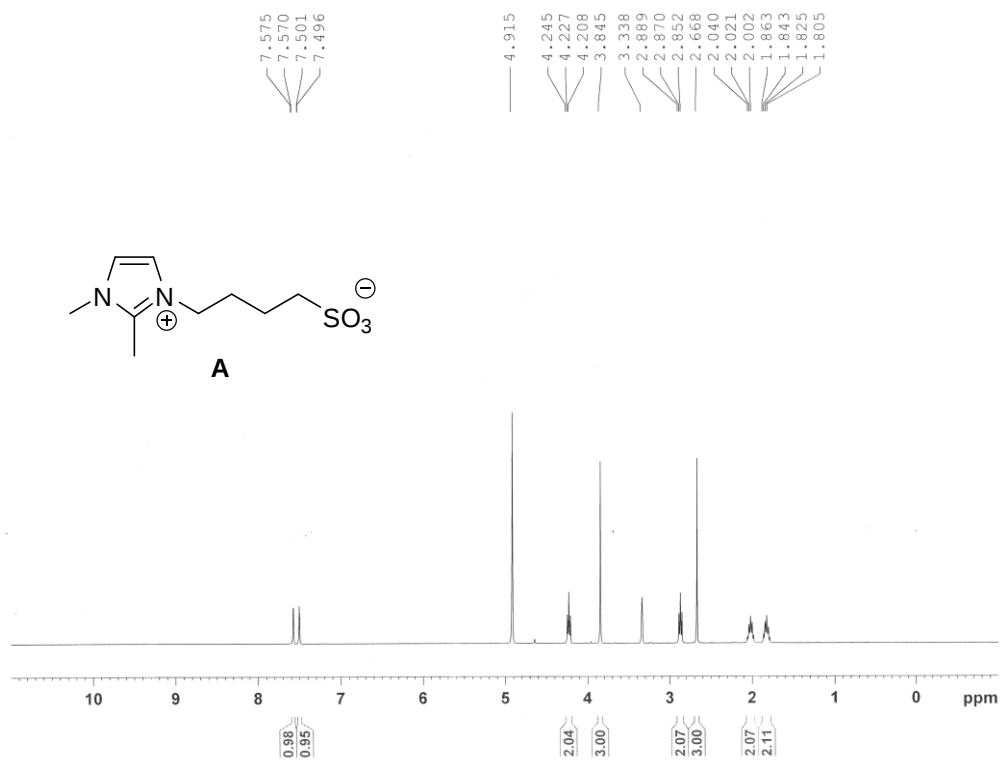
E-mail: uthaiwan@buu.ac.th, Fax: +66-3-839-3494; Tel: +66-98-026-2181

^1H and ^{13}C NMR spectra of SO_3H -functionalized ionic liquids

Compound A:

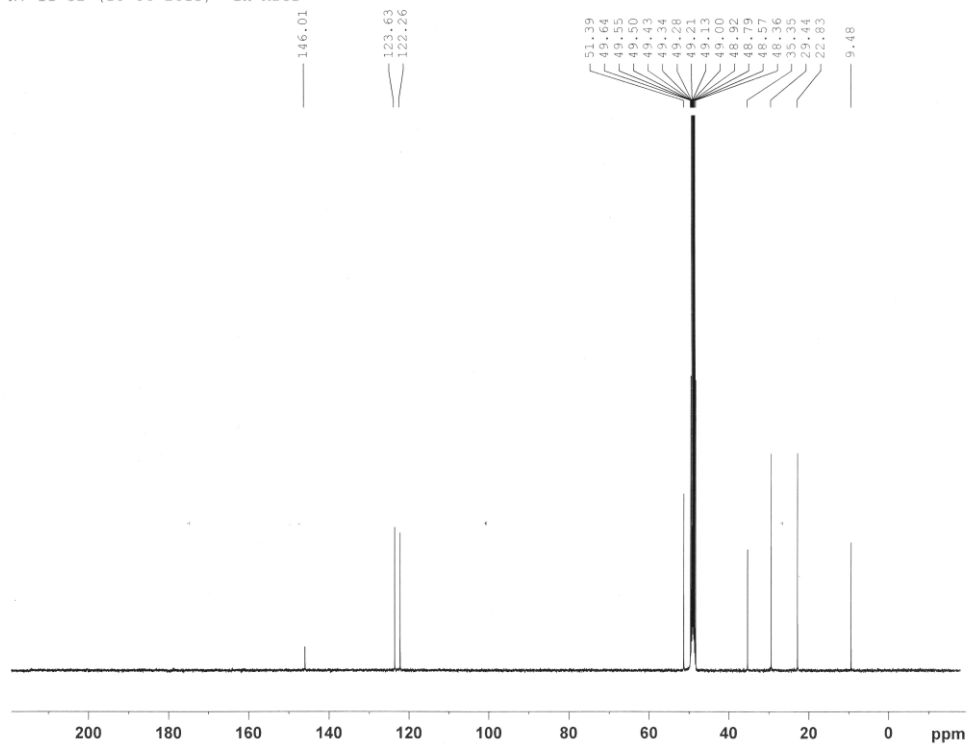
^1H -NMR (400 MHz, CD_3OD)

NV-II-32 MeOD 30-5-2013



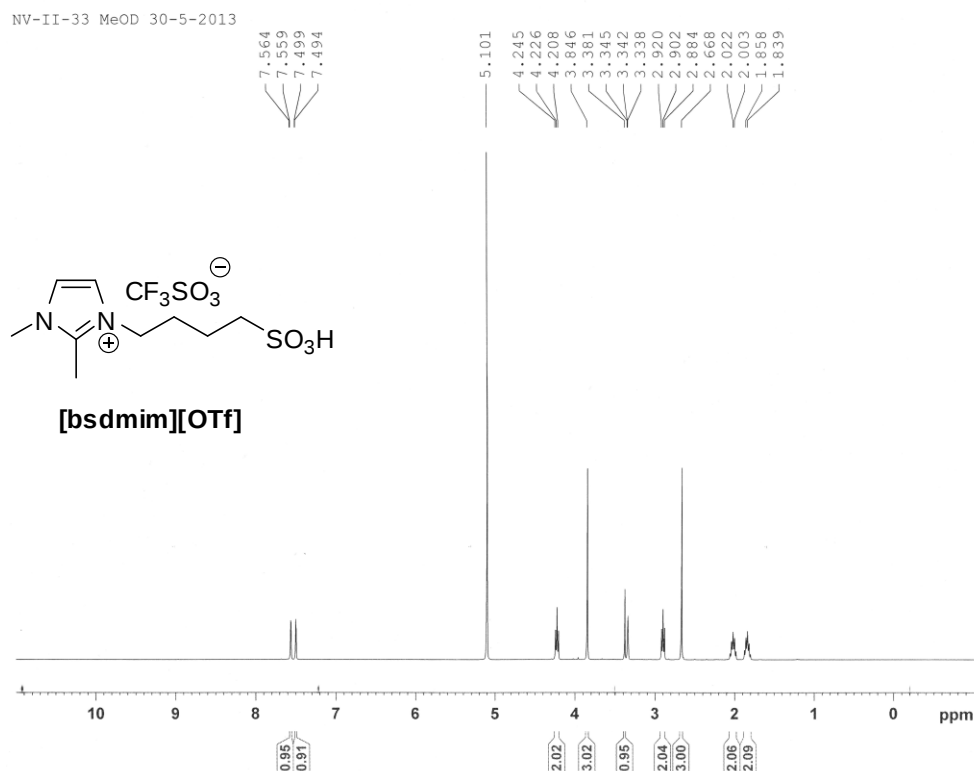
^{13}C -NMR (100 MHz, CD_3OD)

NV-II-32 (10-06-2013) in MDOD

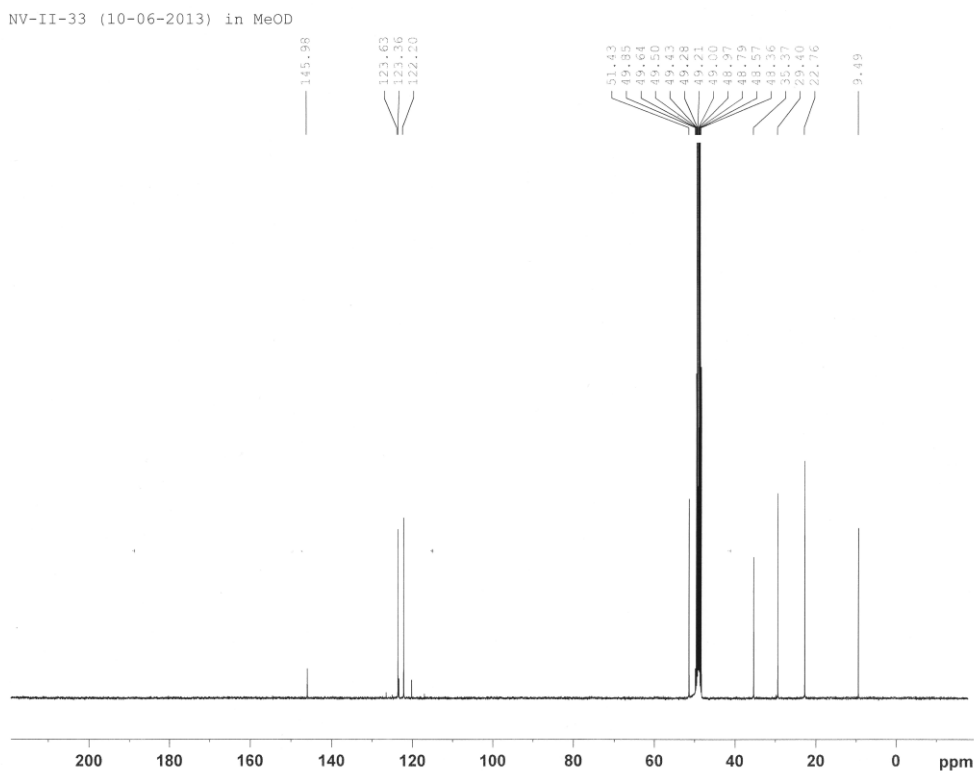


1-butylsulfonic-2,3-dimethylimidazolium trifluoromethanesulfonate (3a):

¹H-NMR (400 MHz, CD₃OD)

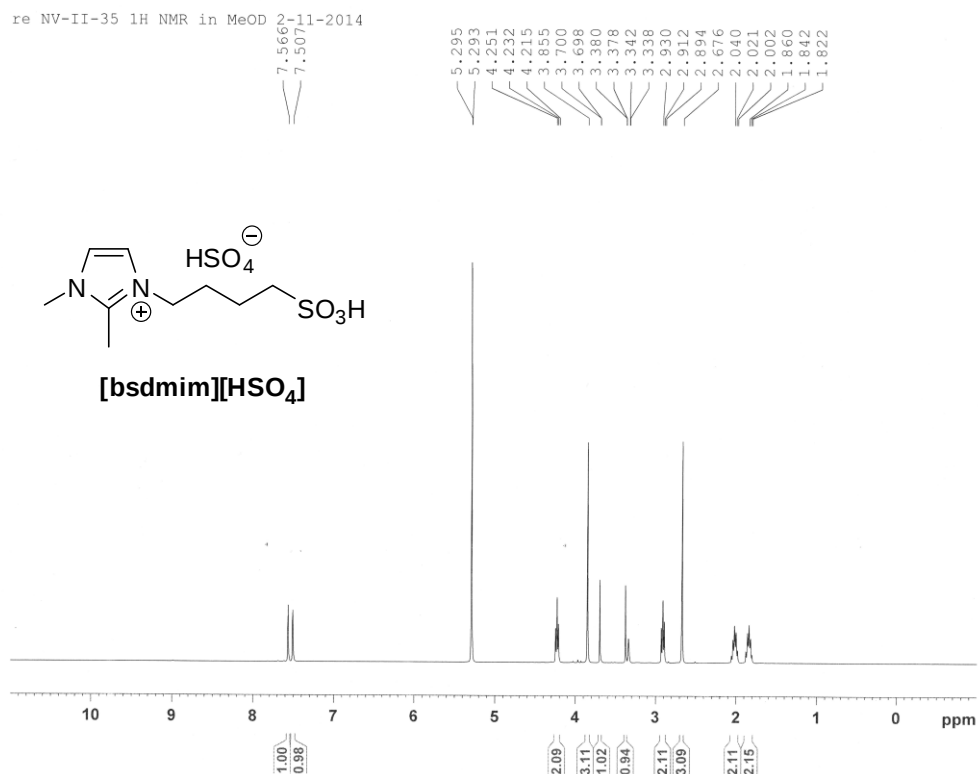


¹³C-NMR (100 MHz, CD₃OD)

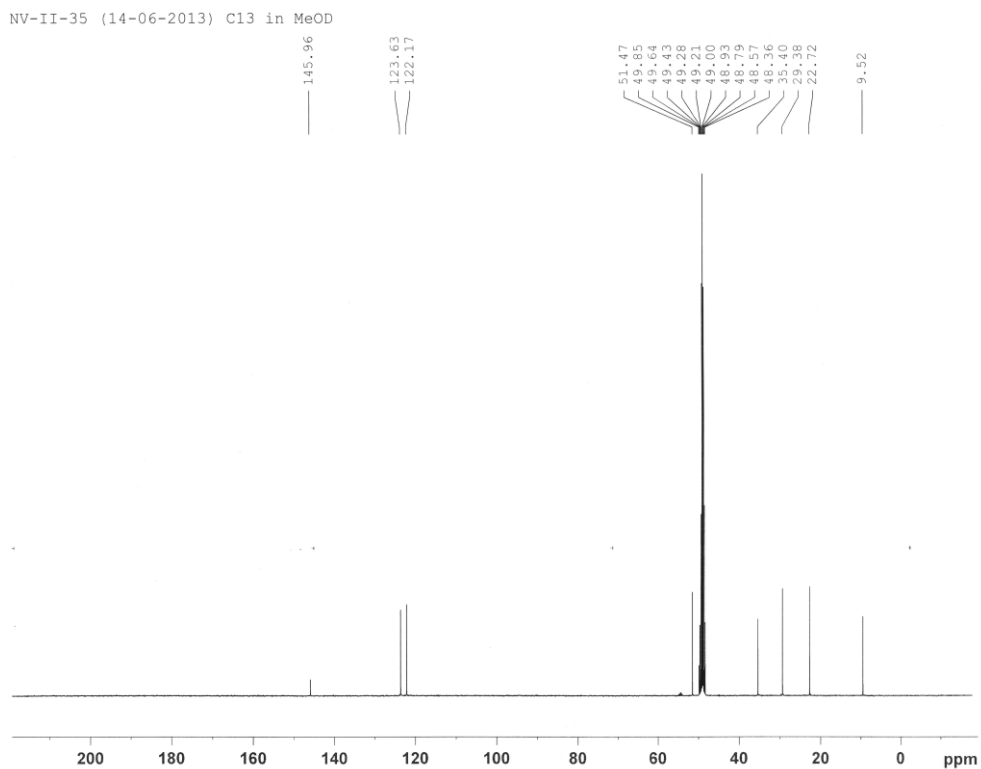


1-butylsulfonic-2,3-dimethylimidazolium hydrogen sulfate (4a):

^1H -NMR (400 MHz, CD_3OD)

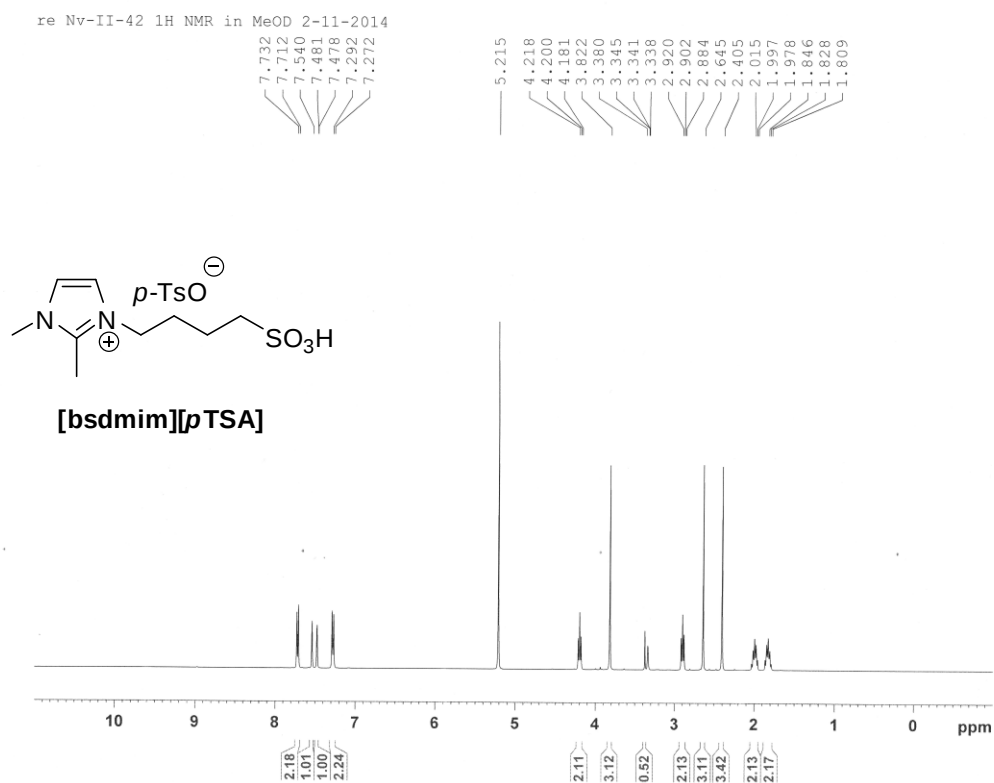


^{13}C -NMR (100 MHz, CD_3OD)

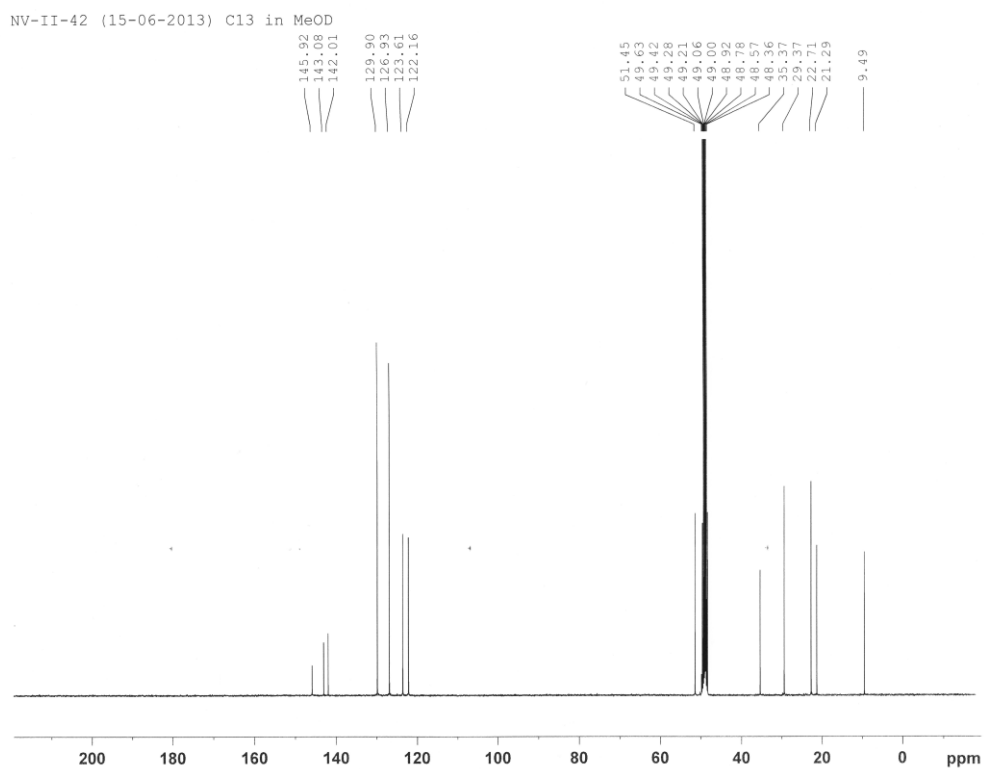


1-butylsulfonic-2,3-dimethylimidazolium toluenesulfonate (5a):

$^1\text{H-NMR}$ (400 MHz, CD_3OD)

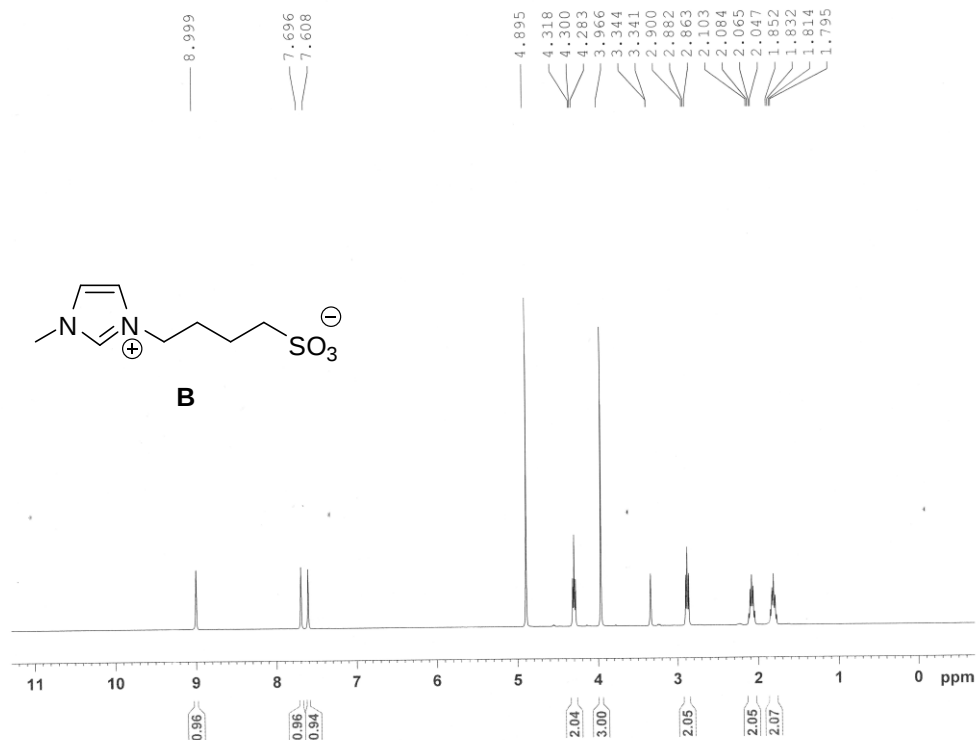


$^{13}\text{C-NMR}$ (100 MHz, CD_3OD)



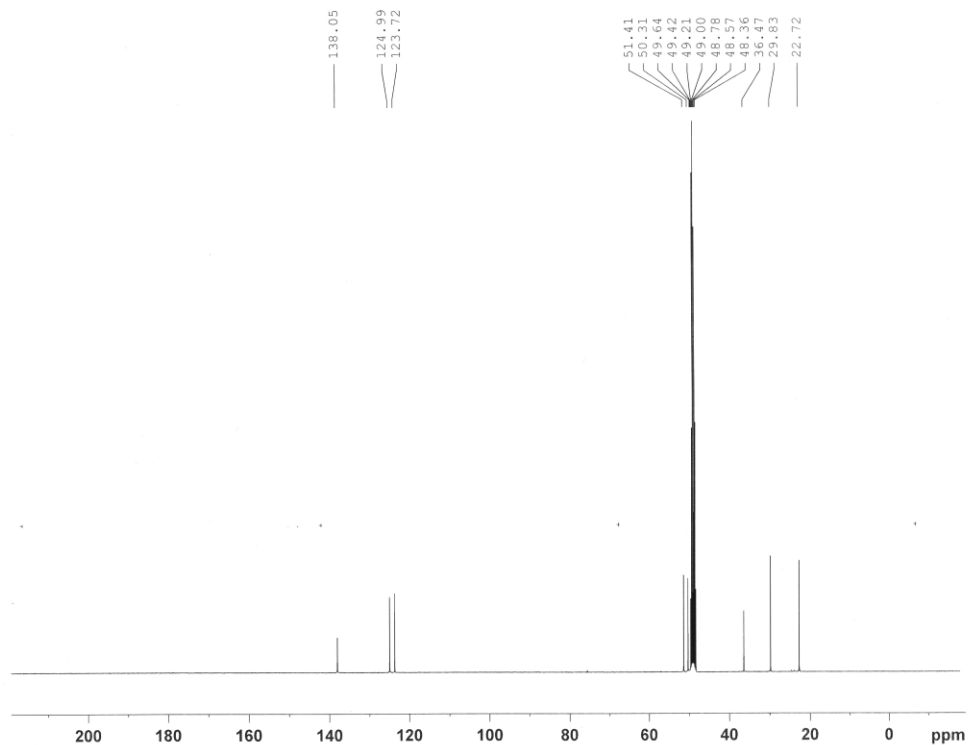
Compound B:
¹H-NMR (400 MHz, CD₃OD)

NV-II-45 10-10-56 in MeOD



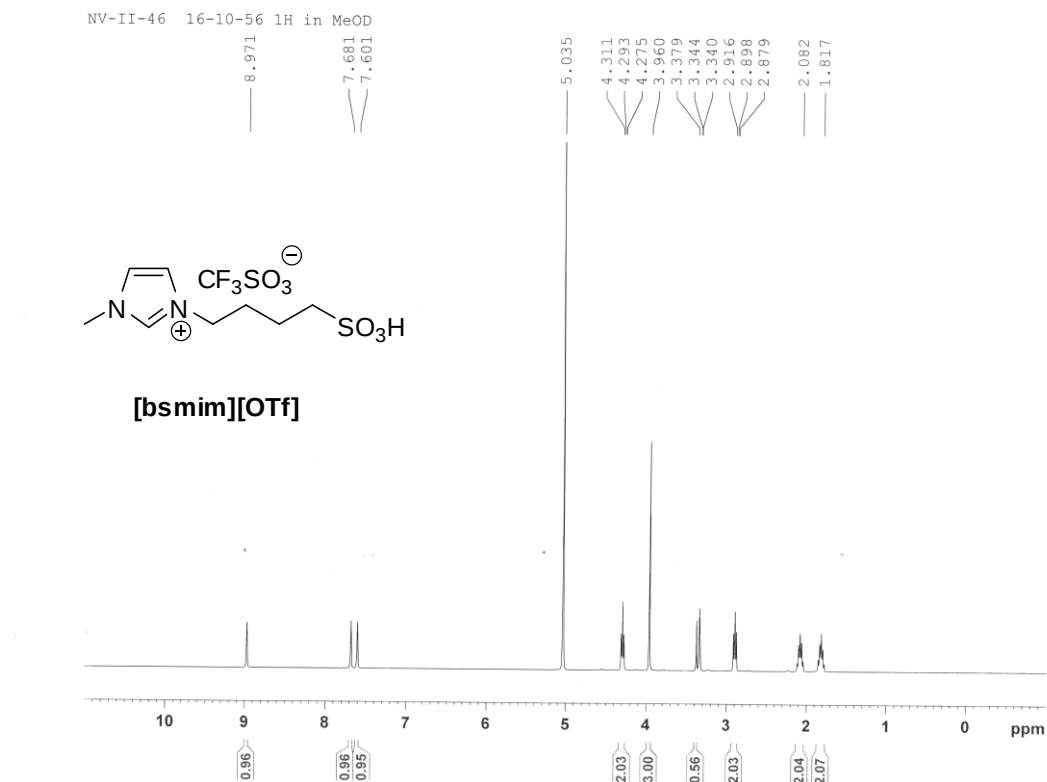
¹³C-NMR (100 MHz, CD₃OD)

NV-II-45 16-10-56 13C in MeOD

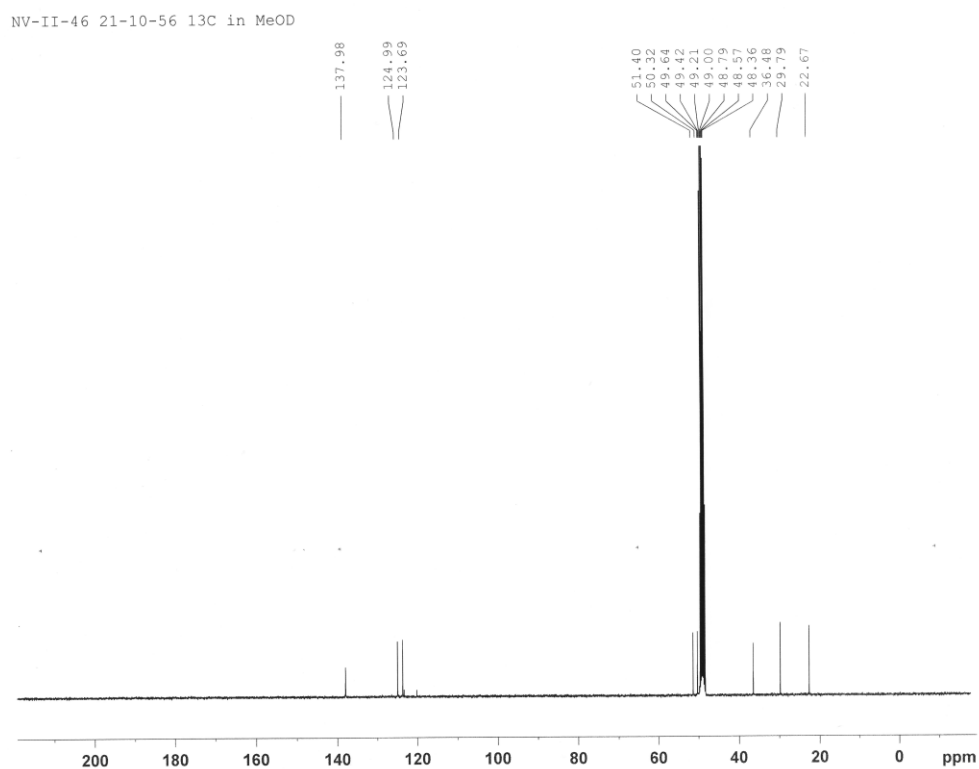


1-butylsulfonic-3-methylimidazolium trifluoromethanesulfonate (3b):

^1H -NMR (400 MHz, CD_3OD)

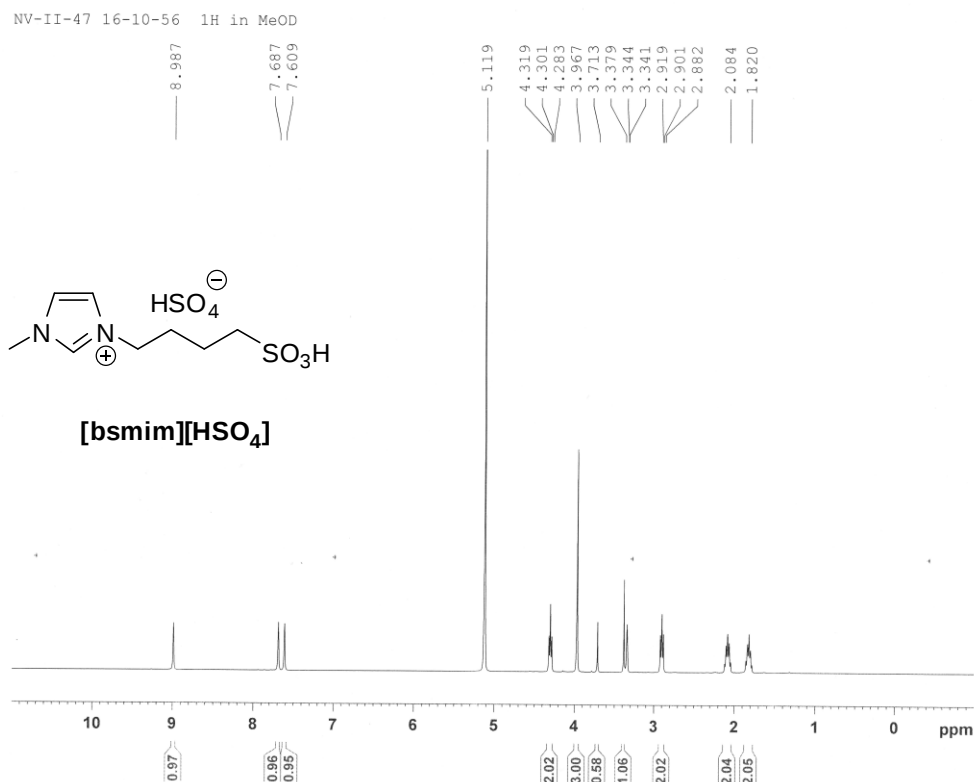


^{13}C -NMR (100 MHz, CD_3OD)

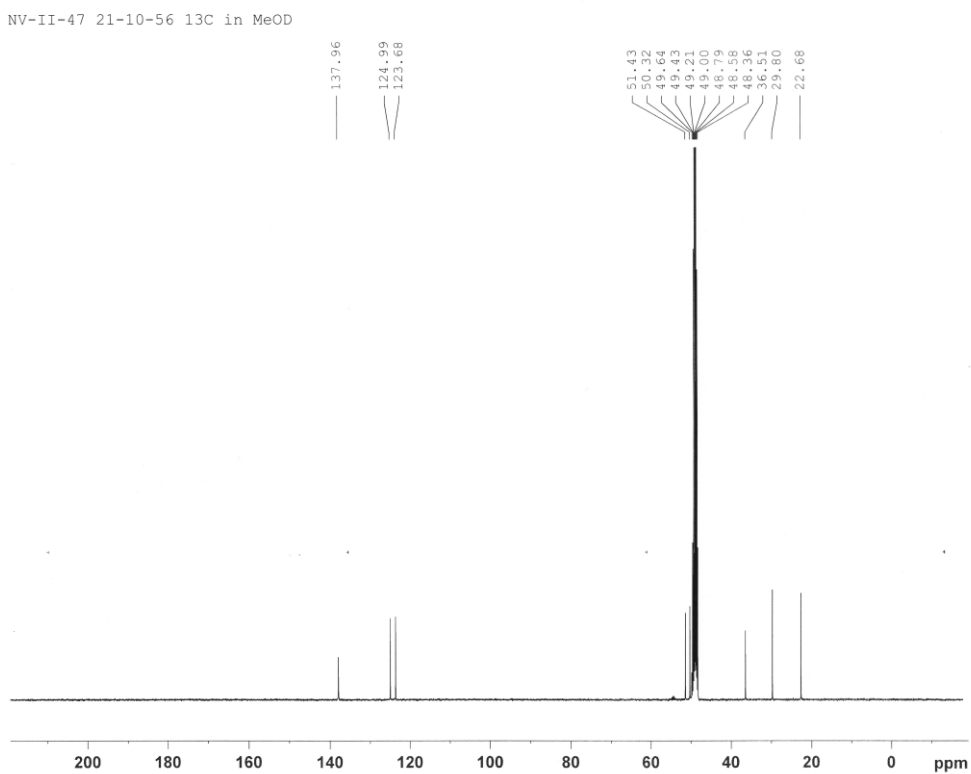


1-butylsulfonic-3-methylimidazolium hydrogen sulfate (4b):

$^1\text{H-NMR}$ (400 MHz, CD_3OD)

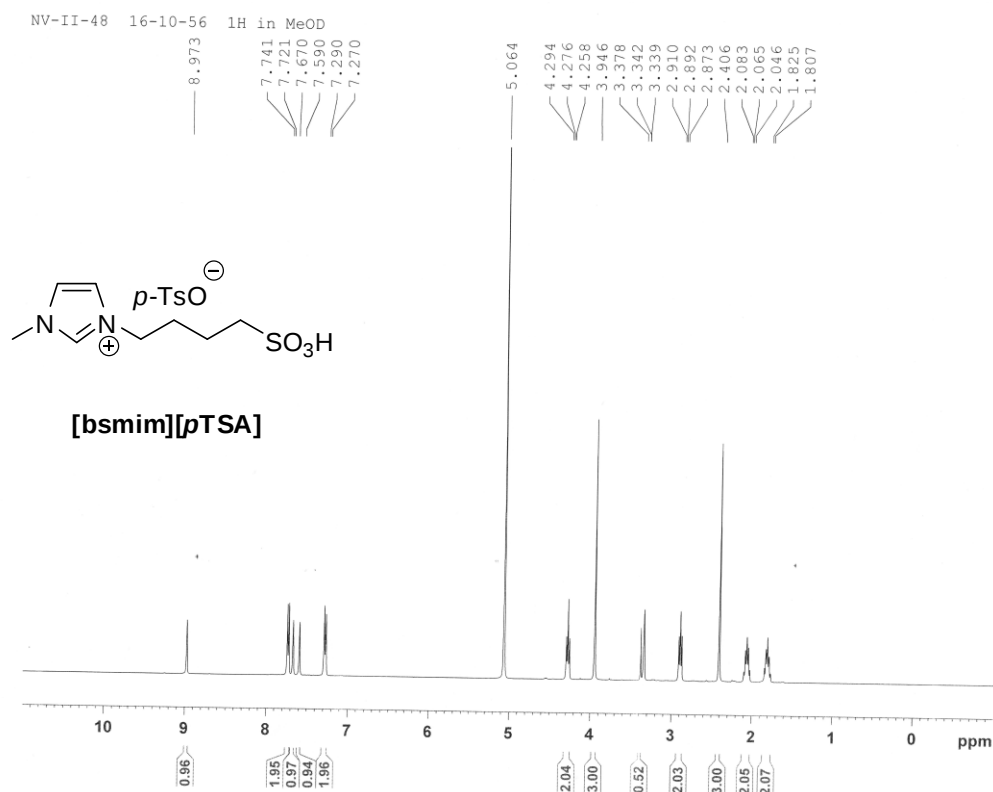


$^{13}\text{C-NMR}$ (100 MHz, CD_3OD)

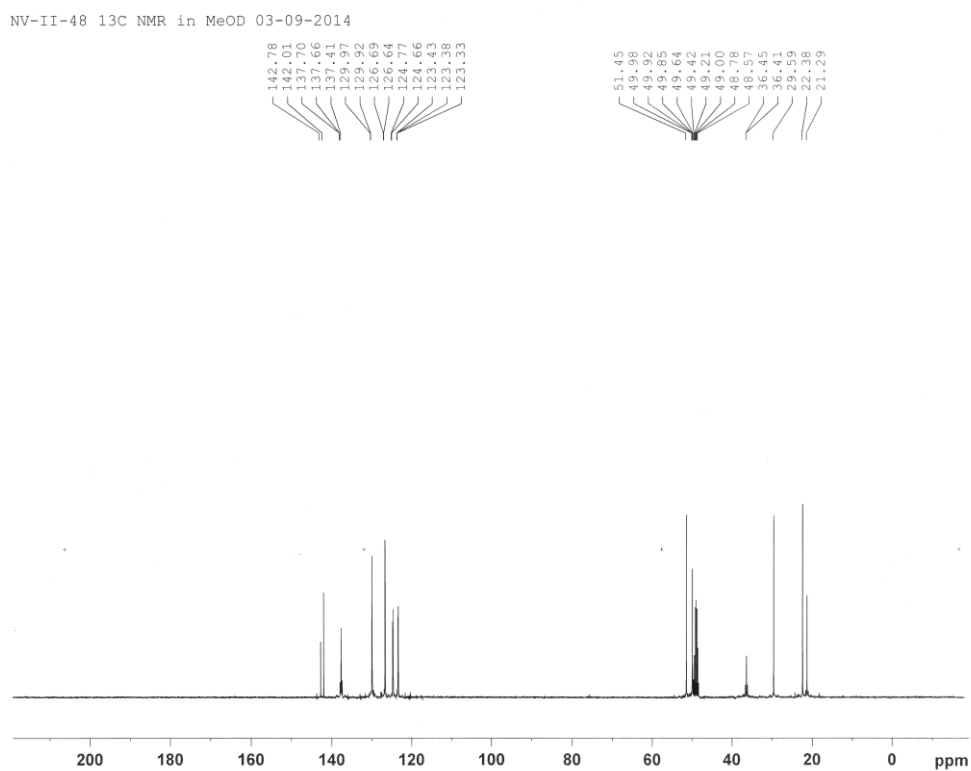


1-butylsulfonic-3-methylimidazolium toluenesulfonate (5b):

$^1\text{H-NMR}$ (400 MHz, CD_3OD)

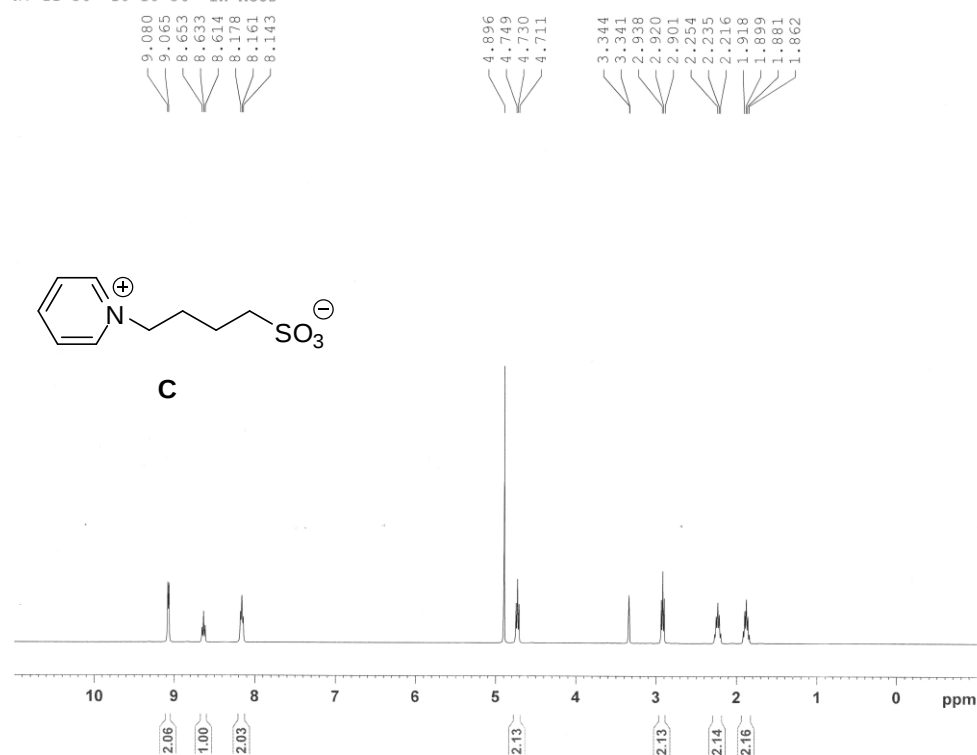


$^{13}\text{C-NMR}$ (100 MHz, CD_3OD)

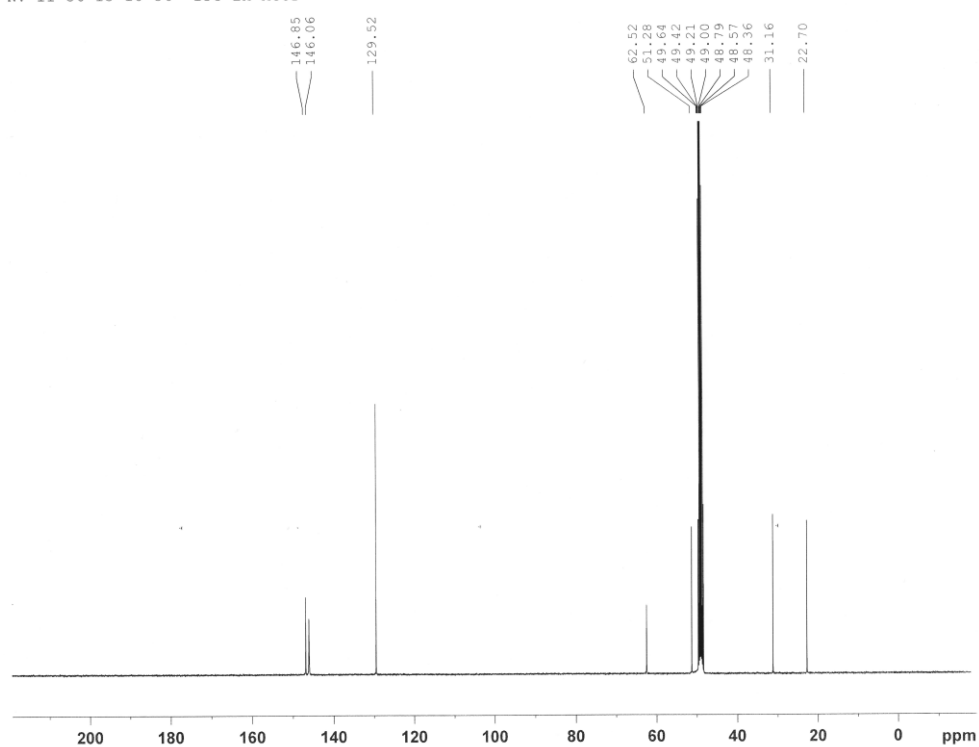


Compound C:¹H-NMR (400 MHz, CD₃OD)

NV-II-36 10-10-56 in MeOD

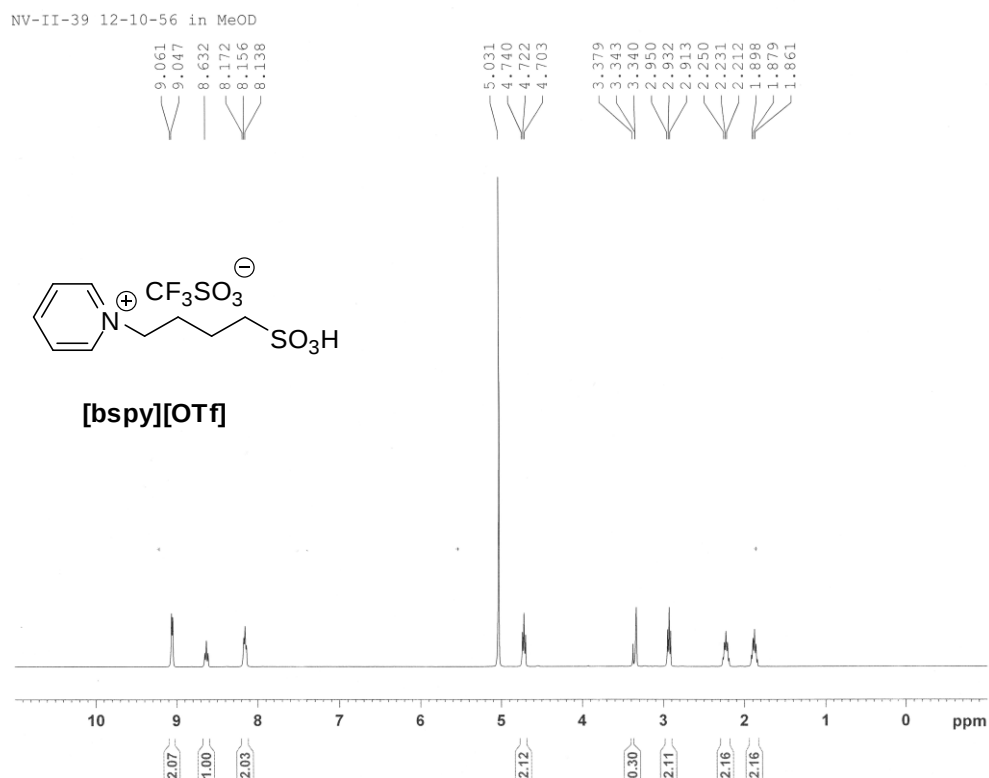
¹³C-NMR (100 MHz, CD₃OD)

NV-II-36 13-10-56 13C in MeOD

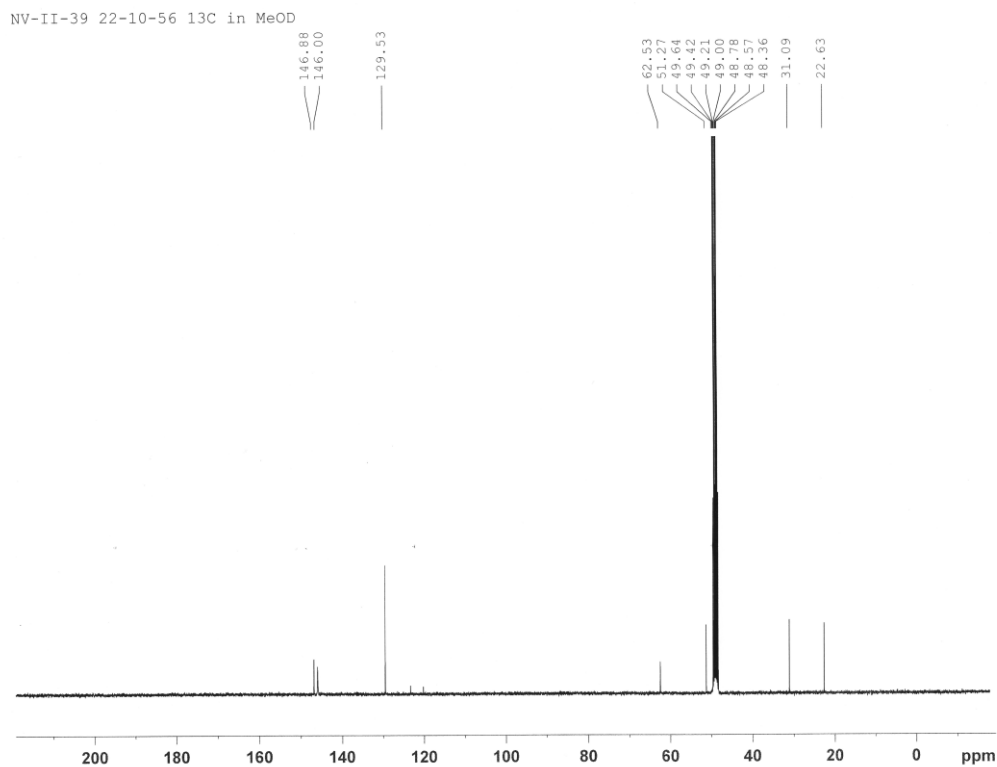


1-butylsulfonic pyridinium trifluoromethanesulfonate (3c):

$^1\text{H-NMR}$ (400 MHz, CD_3OD)

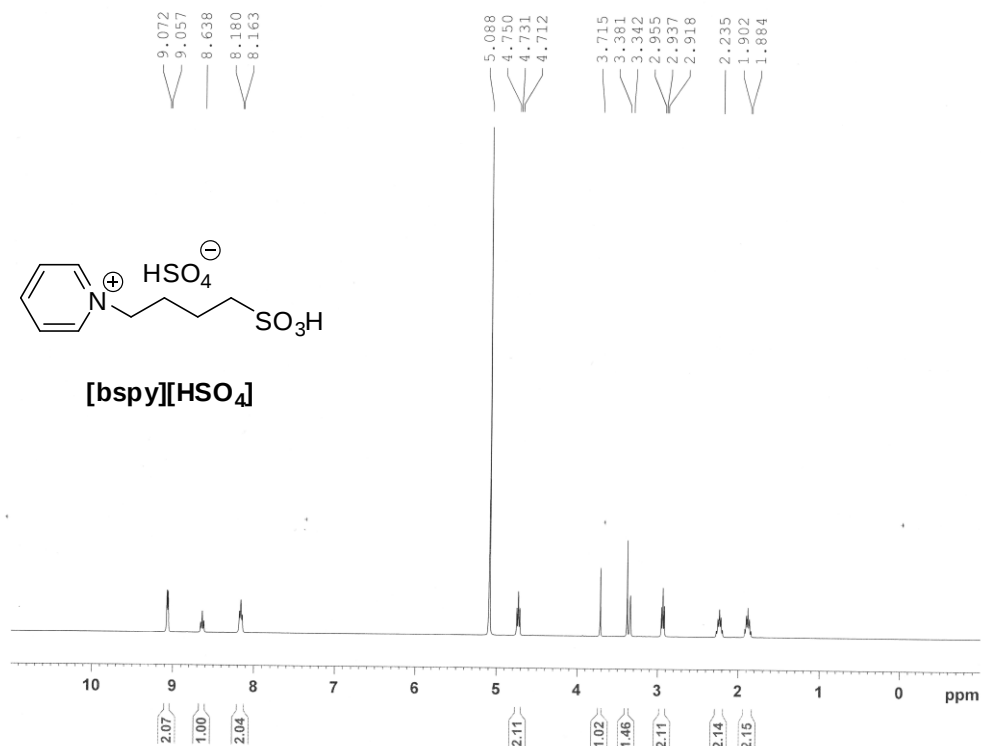


$^{13}\text{C-NMR}$ (100 MHz, CD_3OD)

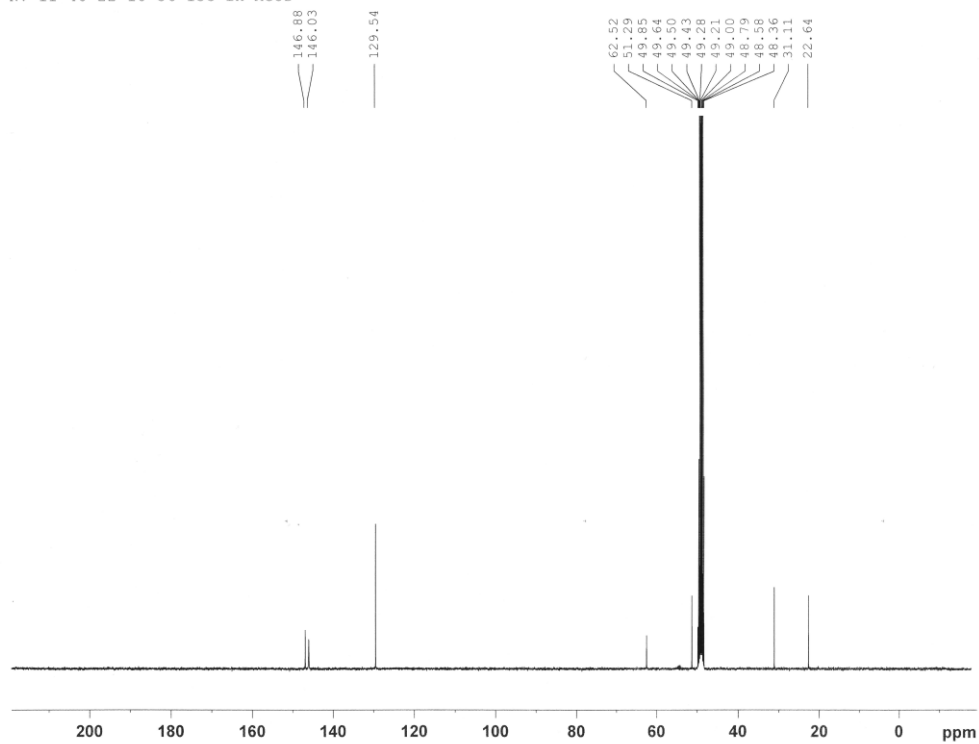


1-butylsulfonic pyridinium hydrogen sulfate (4c):**¹H-NMR (400 MHz, CD₃OD)**

NV-II-40 12-10-56 in MeOD

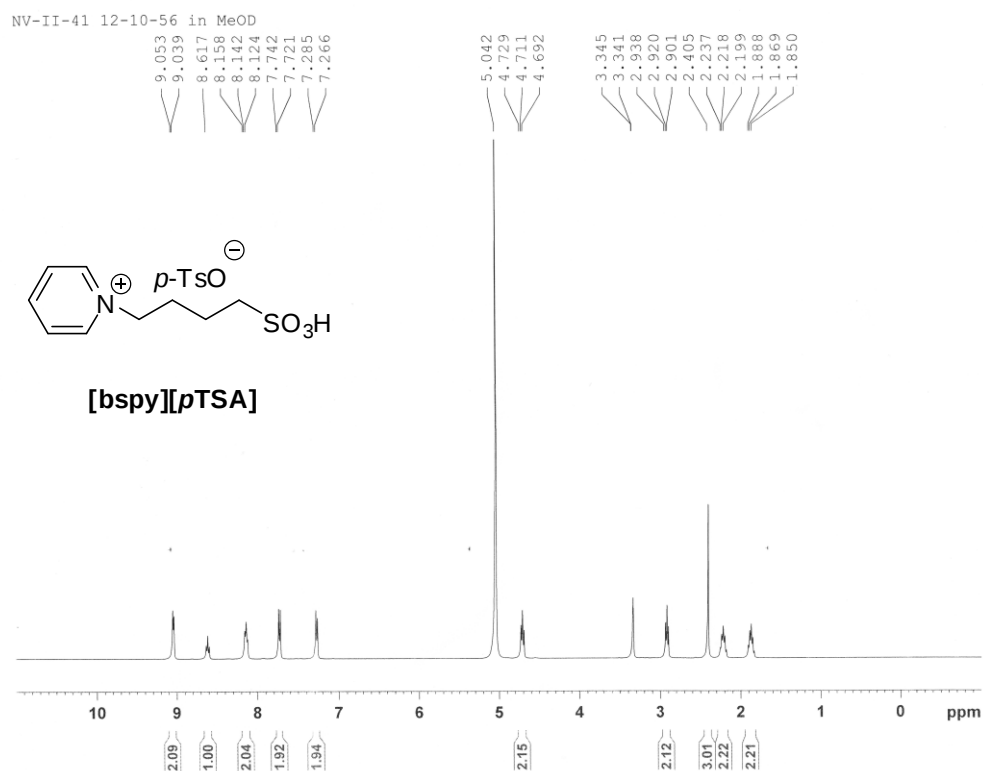
**¹³C-NMR (100 MHz, CD₃OD)**

NV-II-40 22-10-56 13C in MeOD

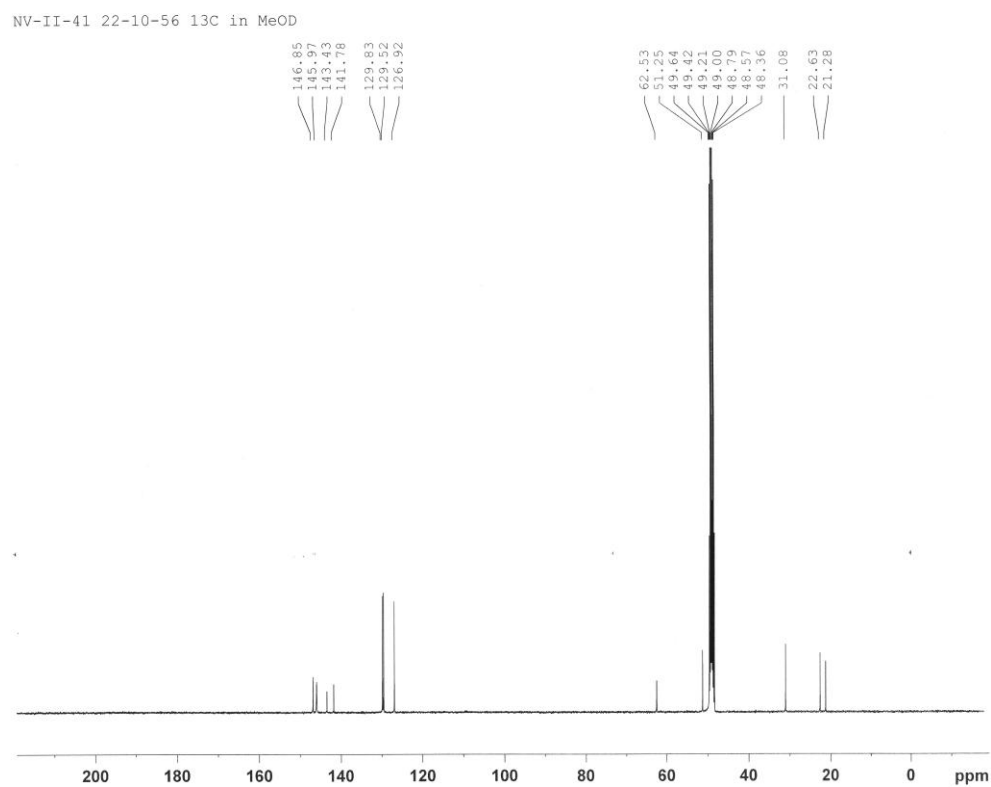


1-butylsulfonic pyridinium toluenesulfonate (5c):

$^1\text{H-NMR}$ (400 MHz, CD_3OD)



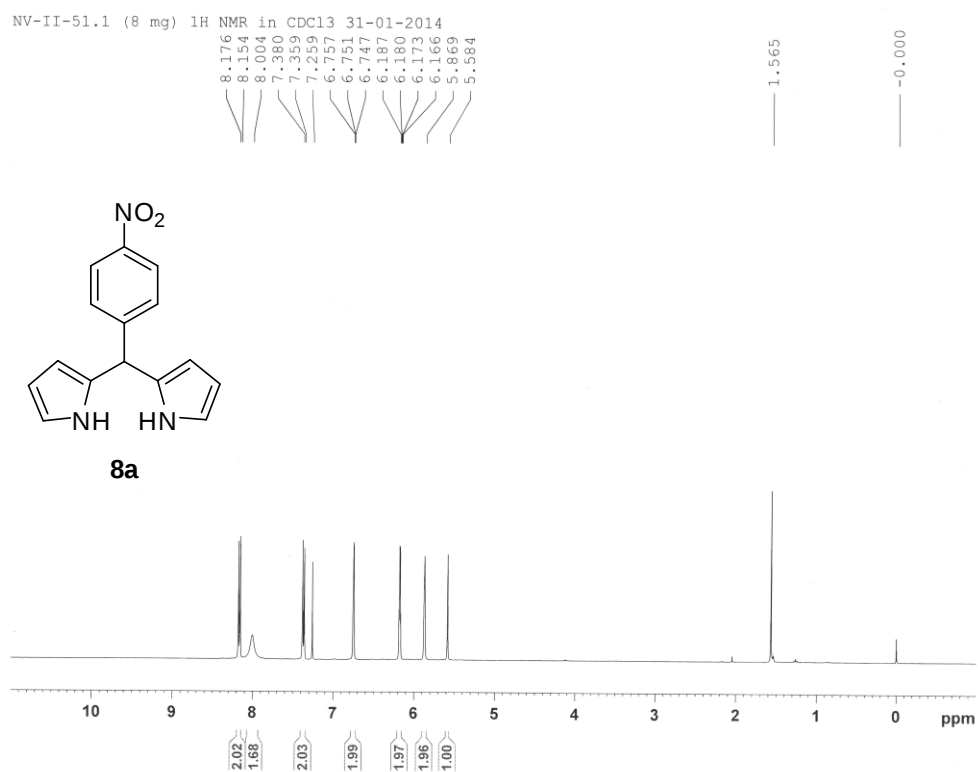
$^{13}\text{C-NMR}$ (100 MHz, CD_3OD)



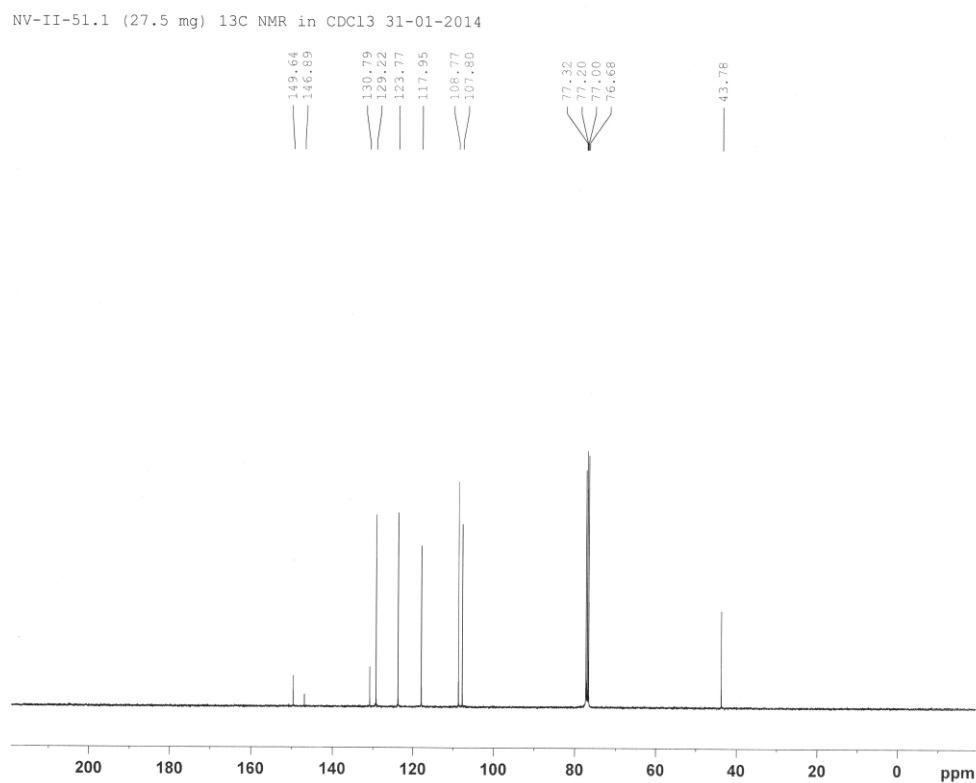
^1H and ^{13}C NMR spectra of dipyrromethane derivatives

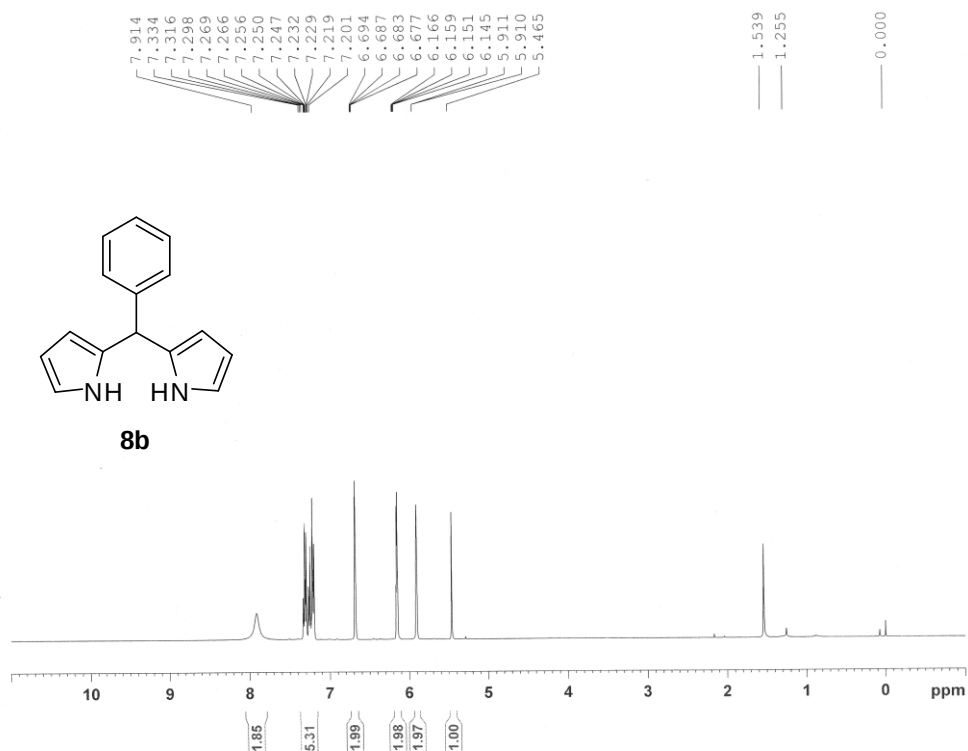
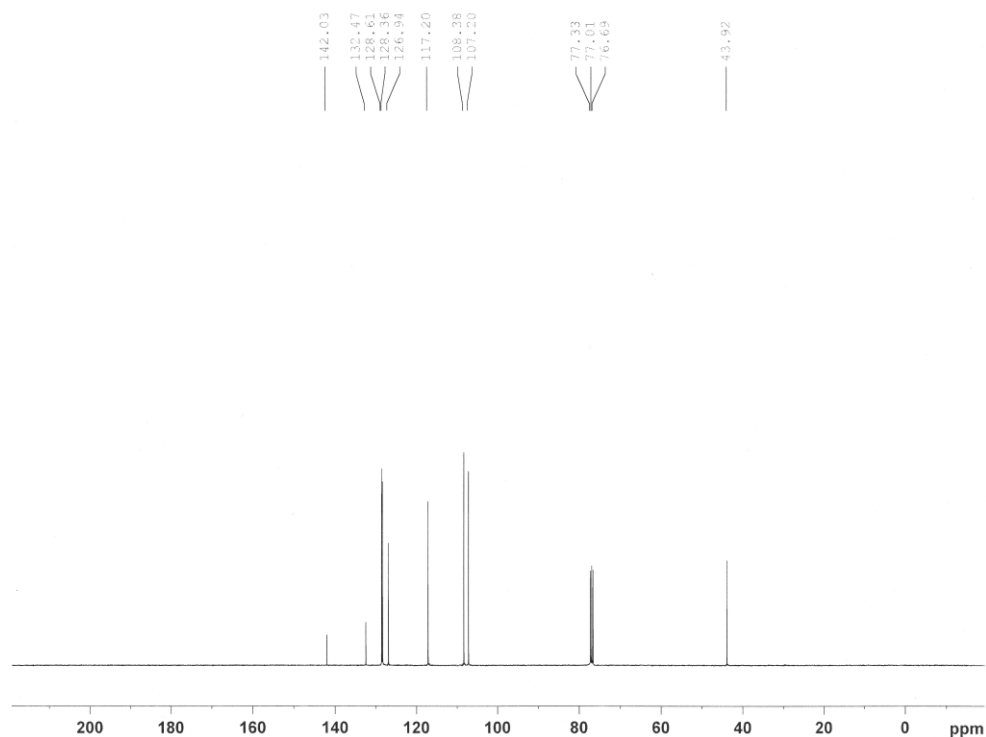
***meso*-(4-Nitrophenyl)dipyrromethane (8a):**

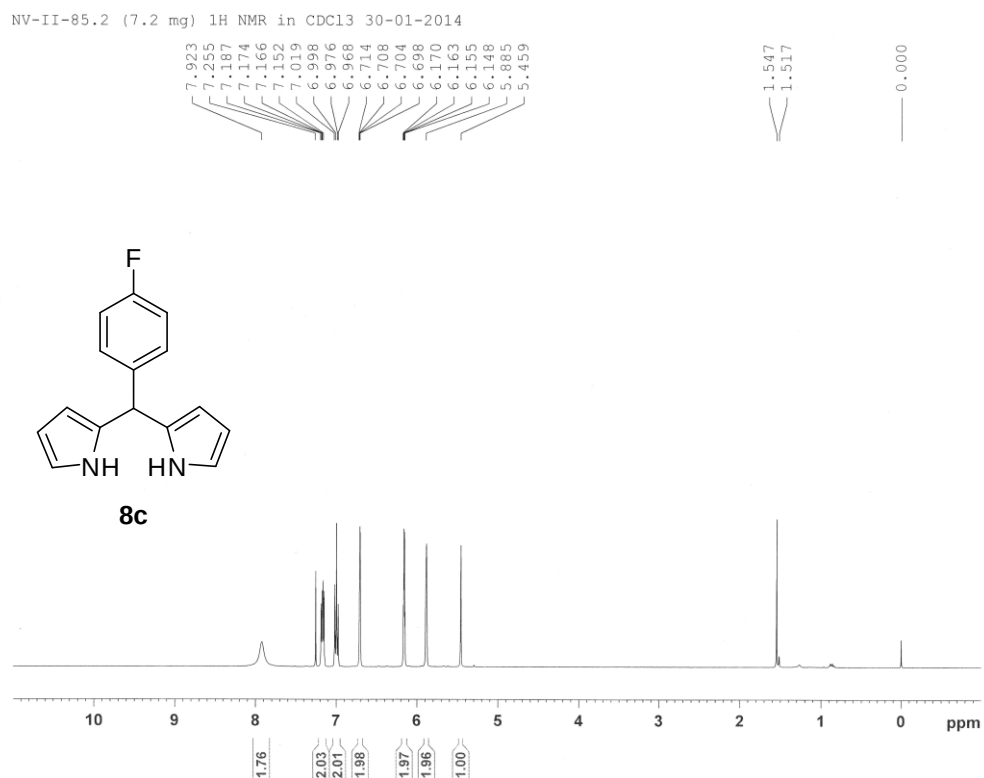
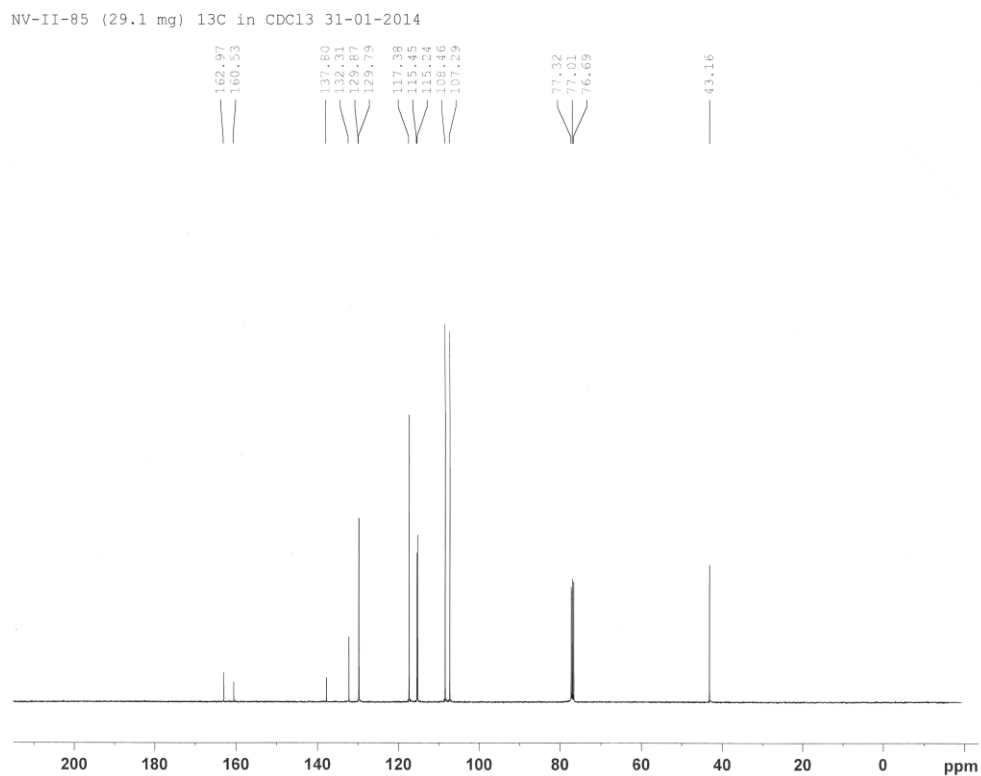
^1H -NMR (400 MHz, CDCl_3)

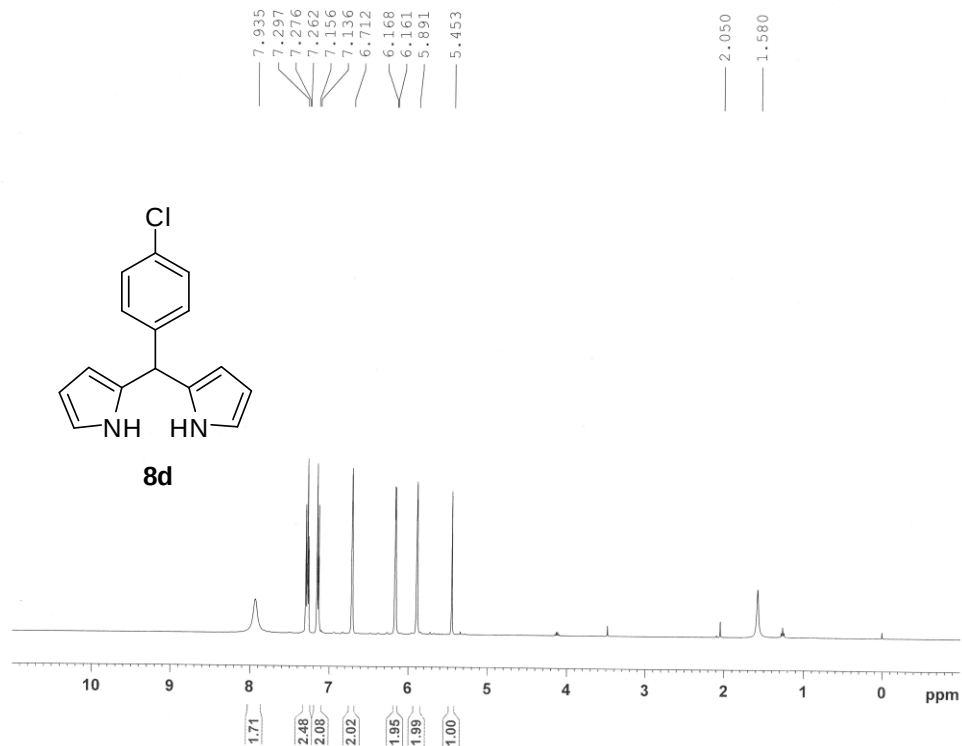
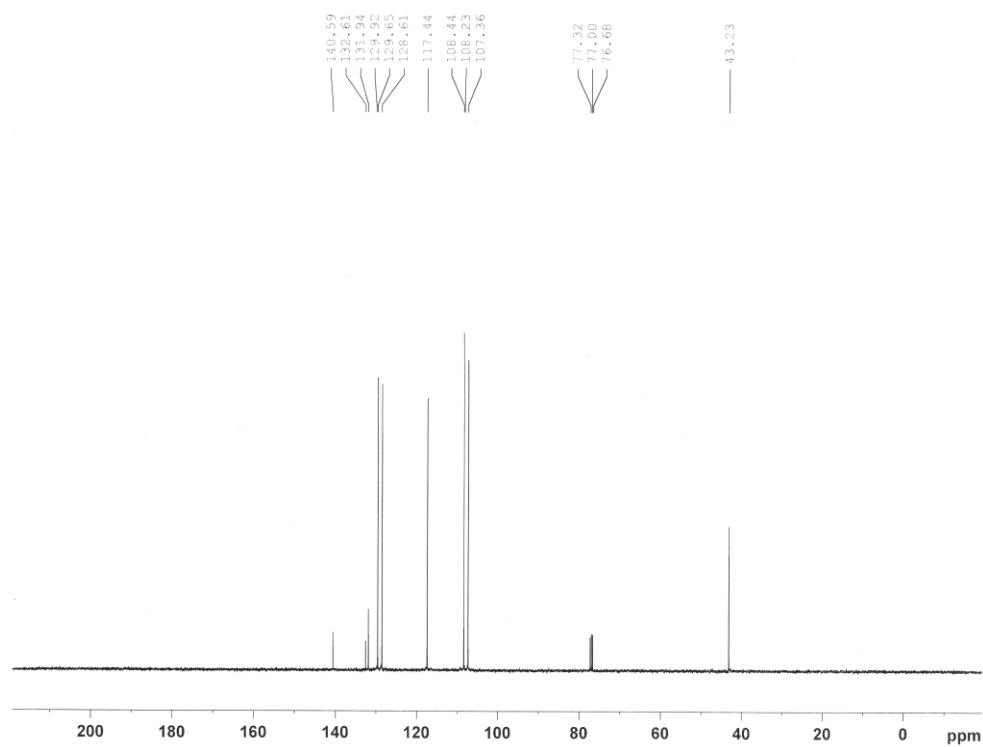


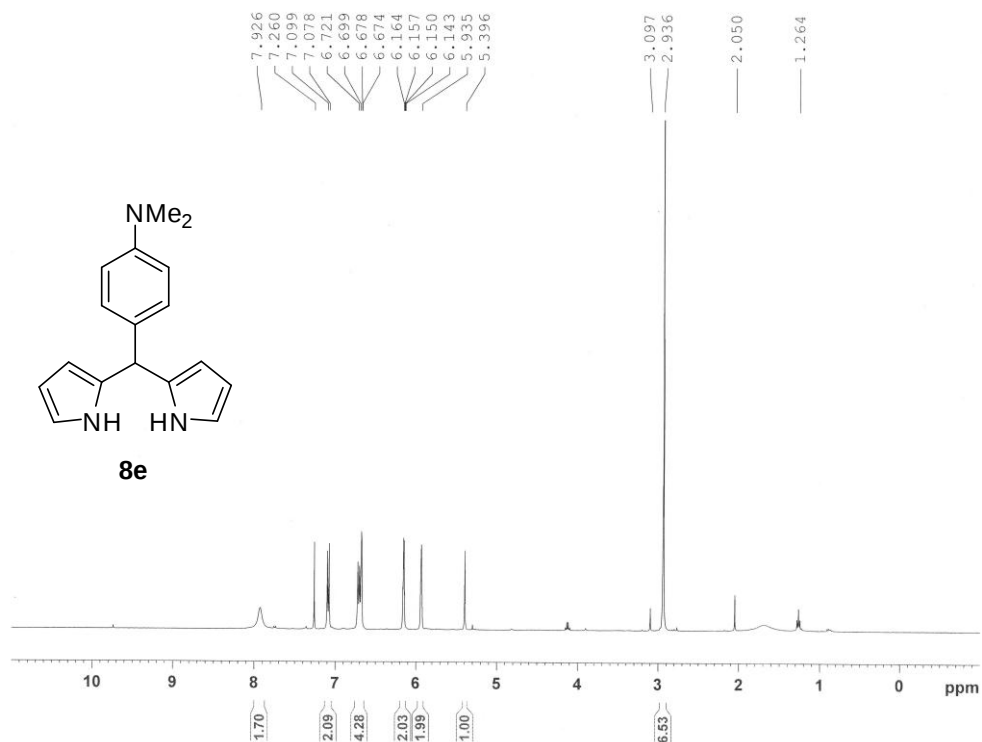
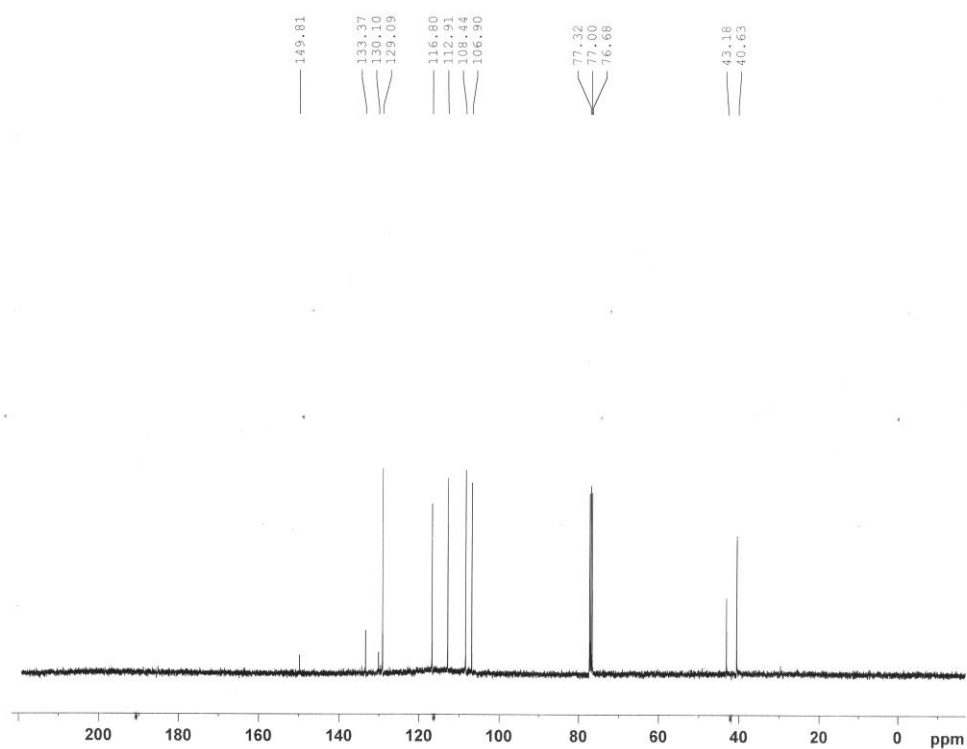
^{13}C -NMR (100 MHz, CDCl_3)

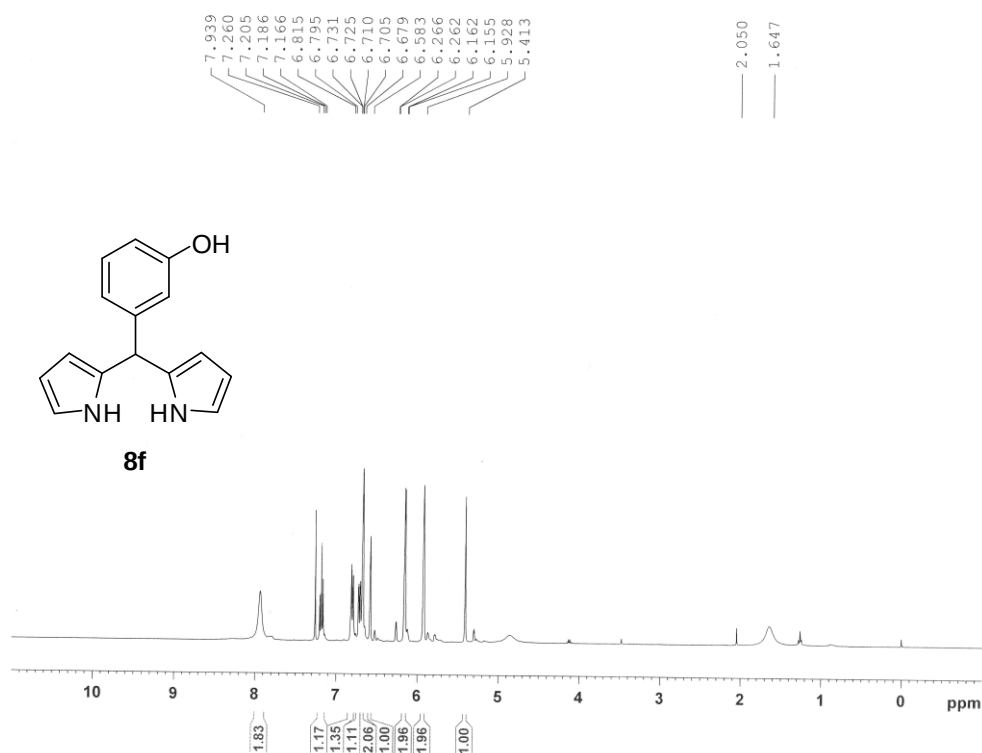
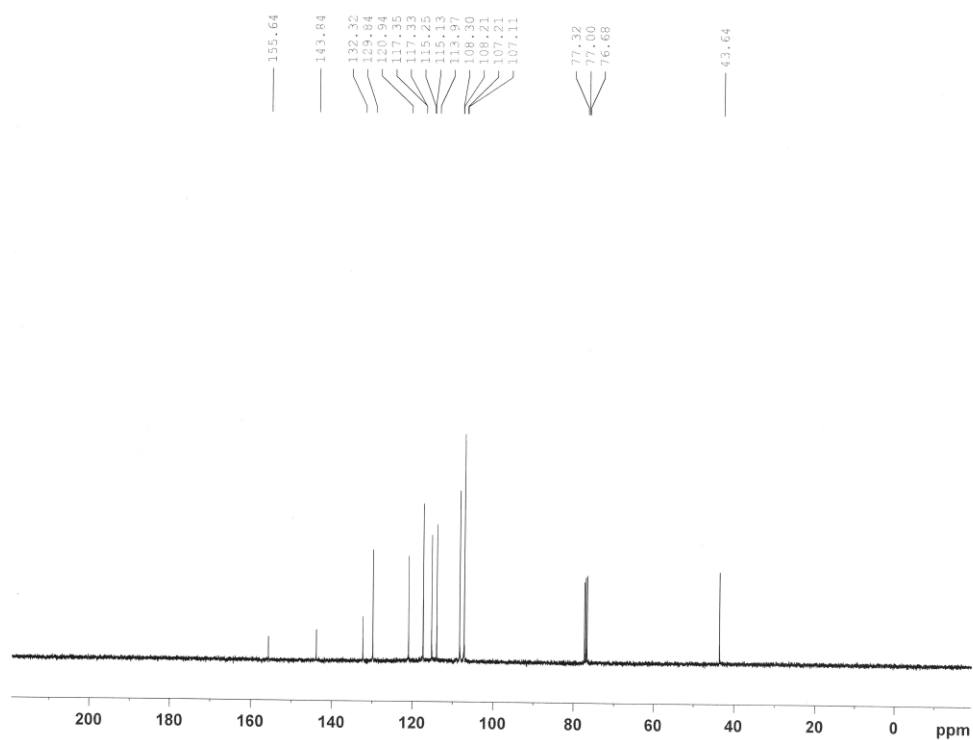


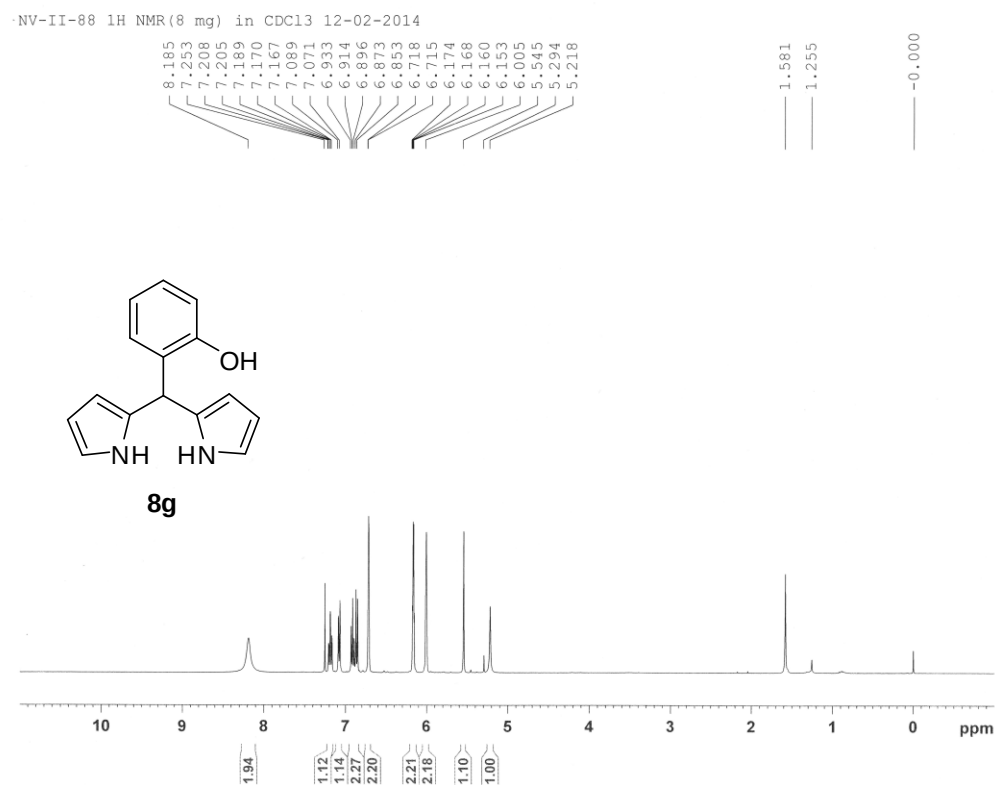
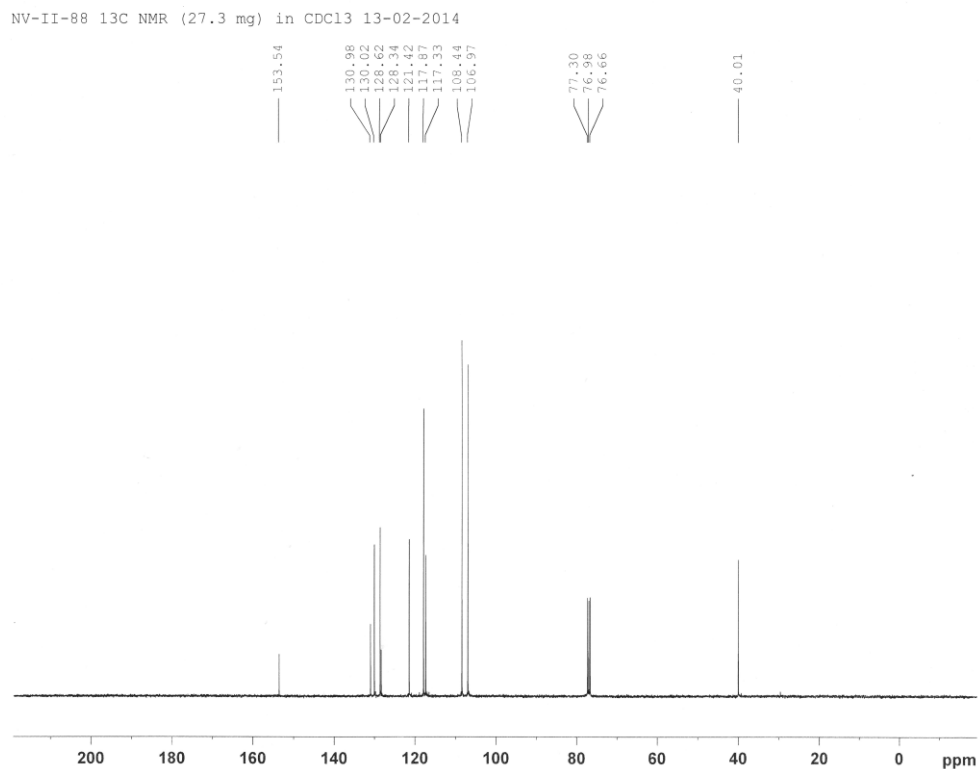
meso-(Phenyl)dipyrromethane (8b):¹H-NMR (400 MHz, CDCl₃)NV-II-87 1H-NMR 400 MHz in CDCl₃¹³C-NMR (100 MHz, CDCl₃)NV-II-87 13C NMR (29.3 mg) in CDCl₃ 13-02-2014

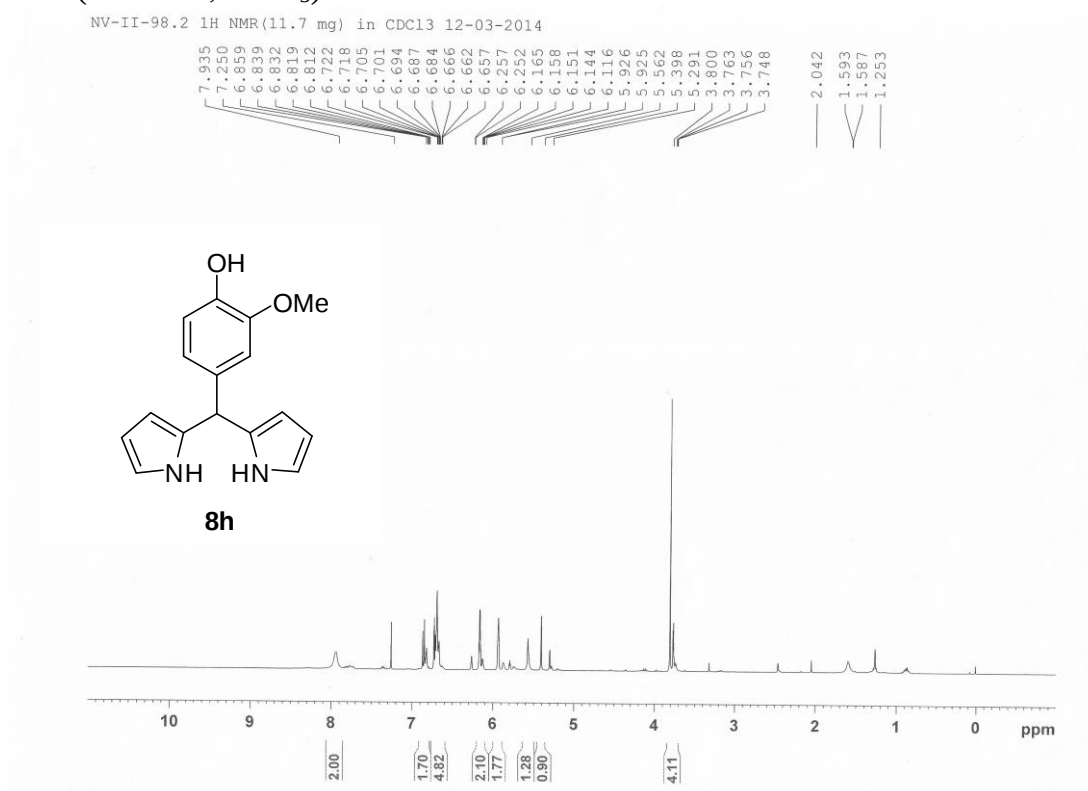
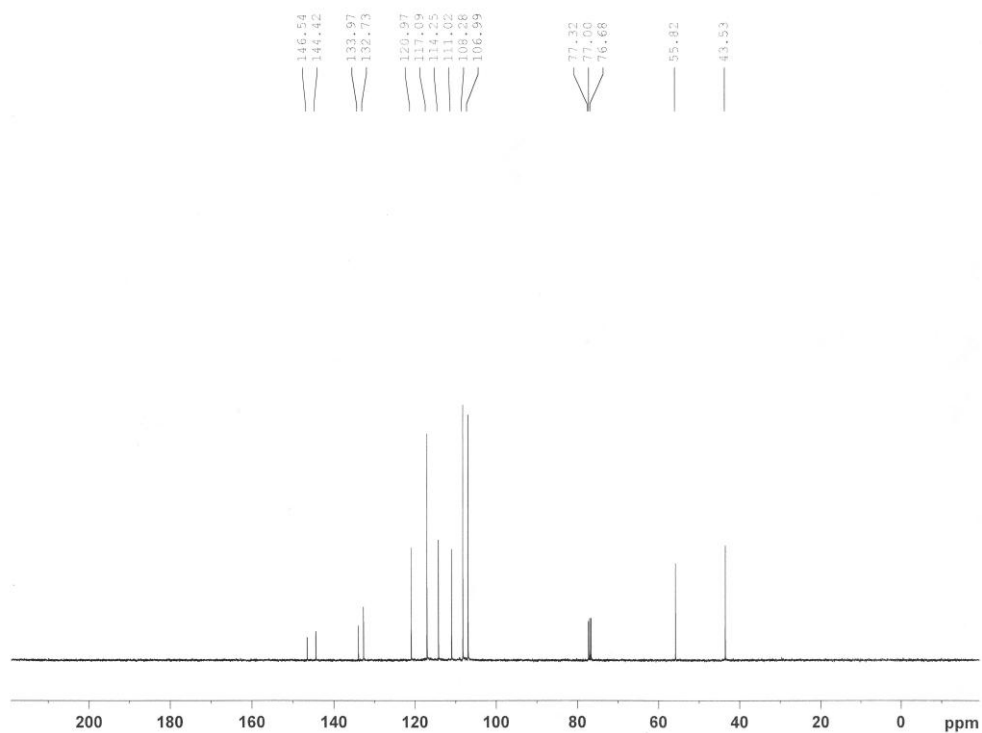
meso-(4-Fluorophenyl)dipyrromethane (8c):¹H-NMR (400 MHz, CDCl₃)¹³C-NMR (100 MHz, CDCl₃)

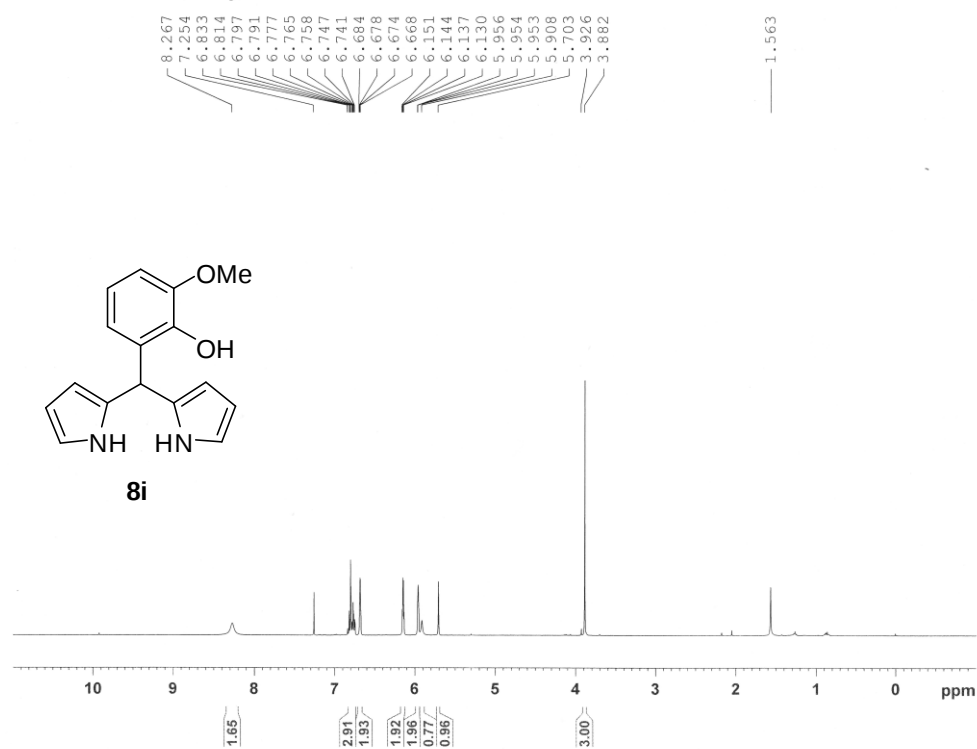
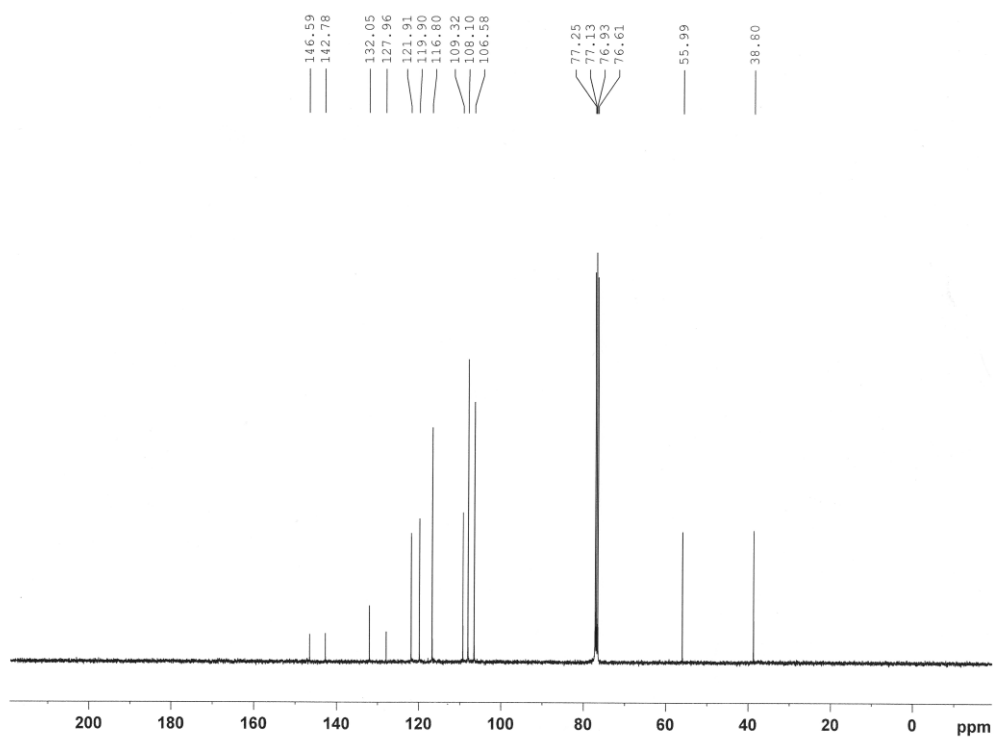
meso-(4-Chlorophenyl)dipyrromethane (8d):¹H-NMR (400 MHz, CDCl₃)NV-II-111-2 1H NMR (7.6 mg) in CDCl₃ 24-06-2014¹³C-NMR (100 MHz, CDCl₃)NV-II-111 13C NMR (85 mg) in CDCl₃ 29-08-2014

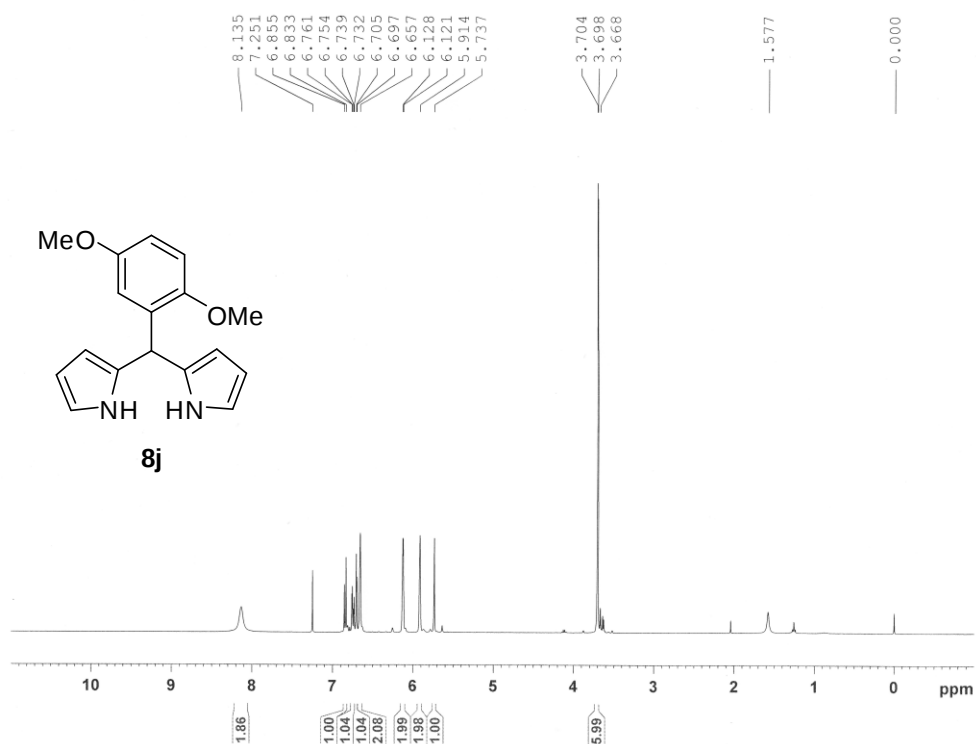
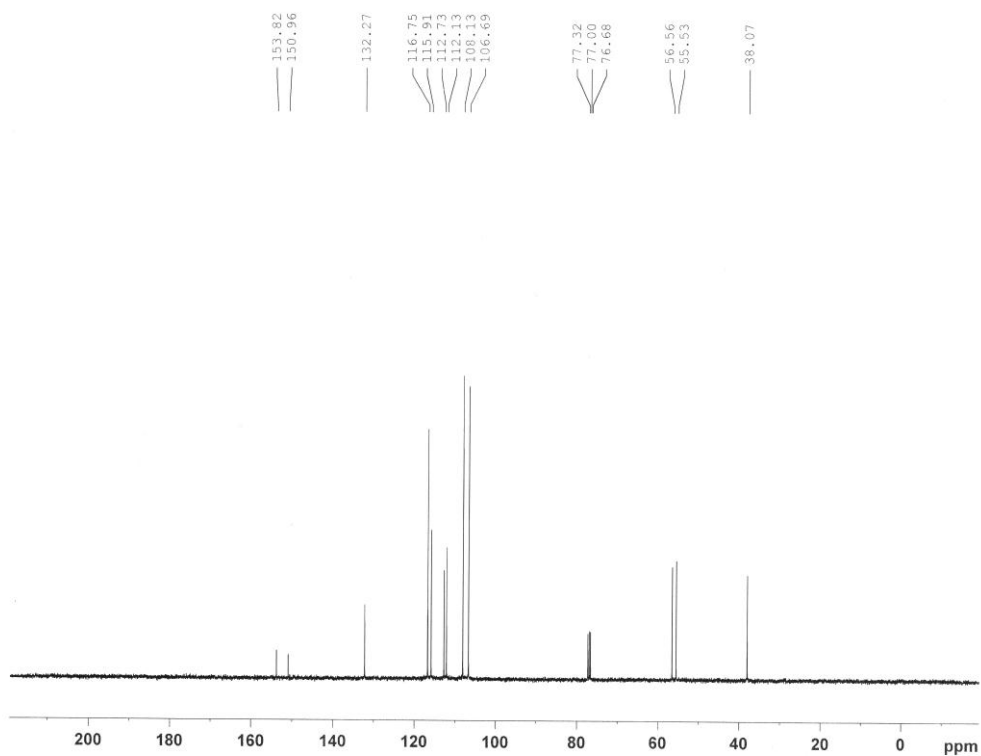
meso-4-(dimethoxyamino)phenyl dipyrromethane (8e):¹H-NMR (400 MHz, CDCl₃)NV-II-107-last 1H NMR (12 mg) in CDCl₃ 13-05-2014¹³C-NMR (100 MHz, CDCl₃)US-I-2014-2 13C NMR in CDCl₃ 20-12-2014

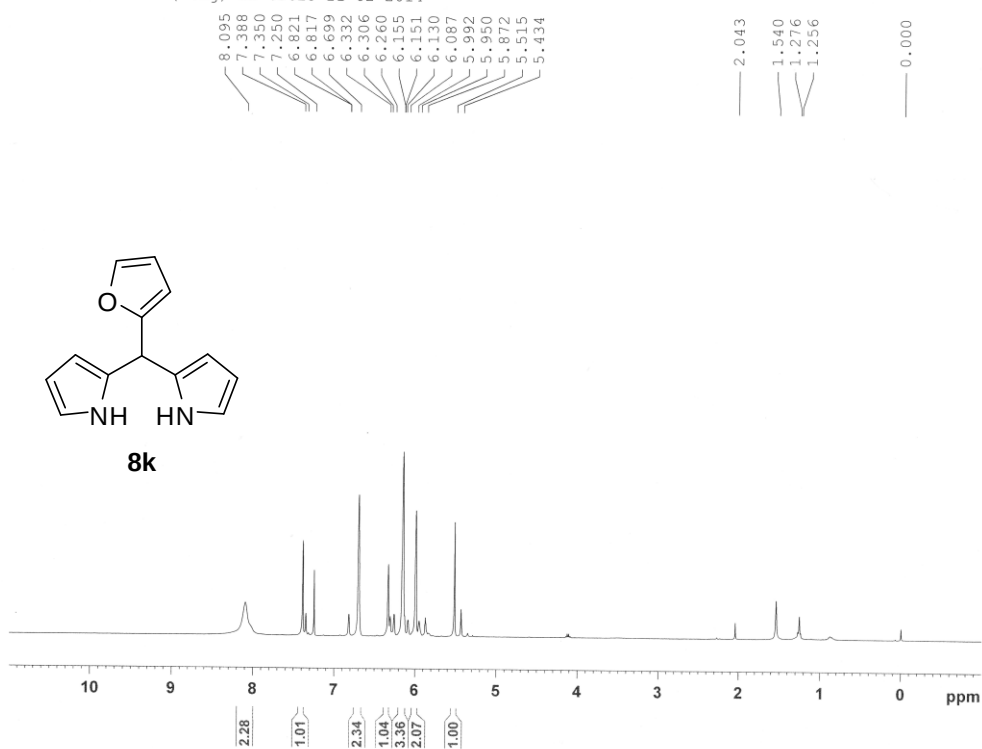
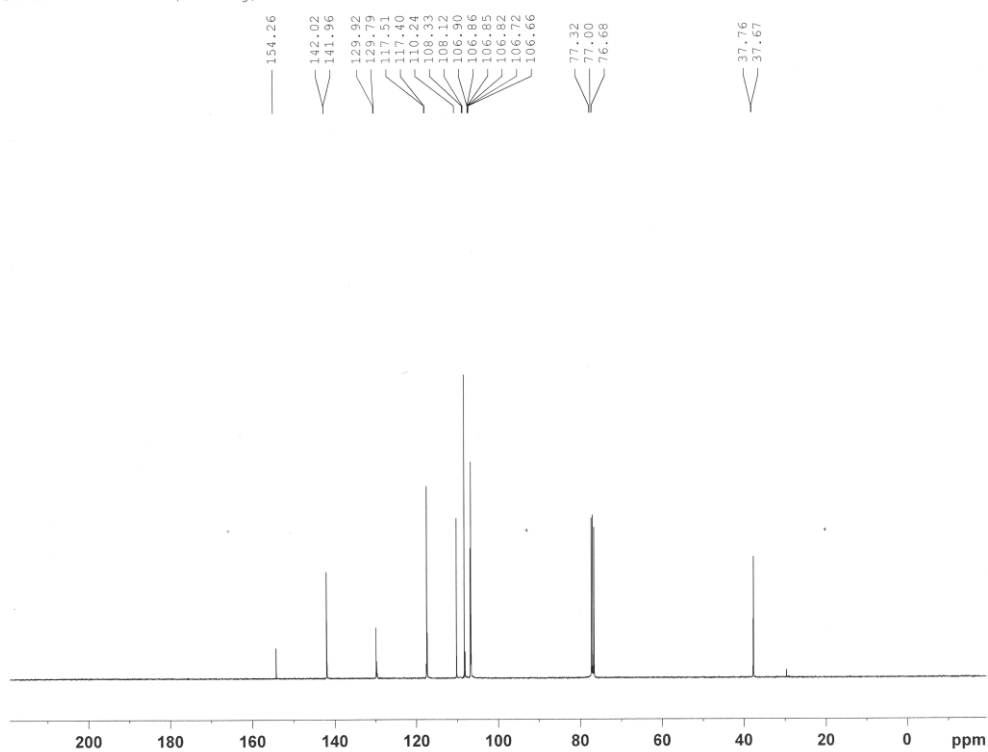
meso-(3-Hydroxyphenyl)dipyrromethane (8f):¹H-NMR (400 MHz, CDCl₃)NV-II-114-3 1H NMR in CDCl₃ 25-06-2014¹³C-NMR (100 MHz, CDCl₃)NV-II-114 13C NMR in CDCl₃ 03-09-2014

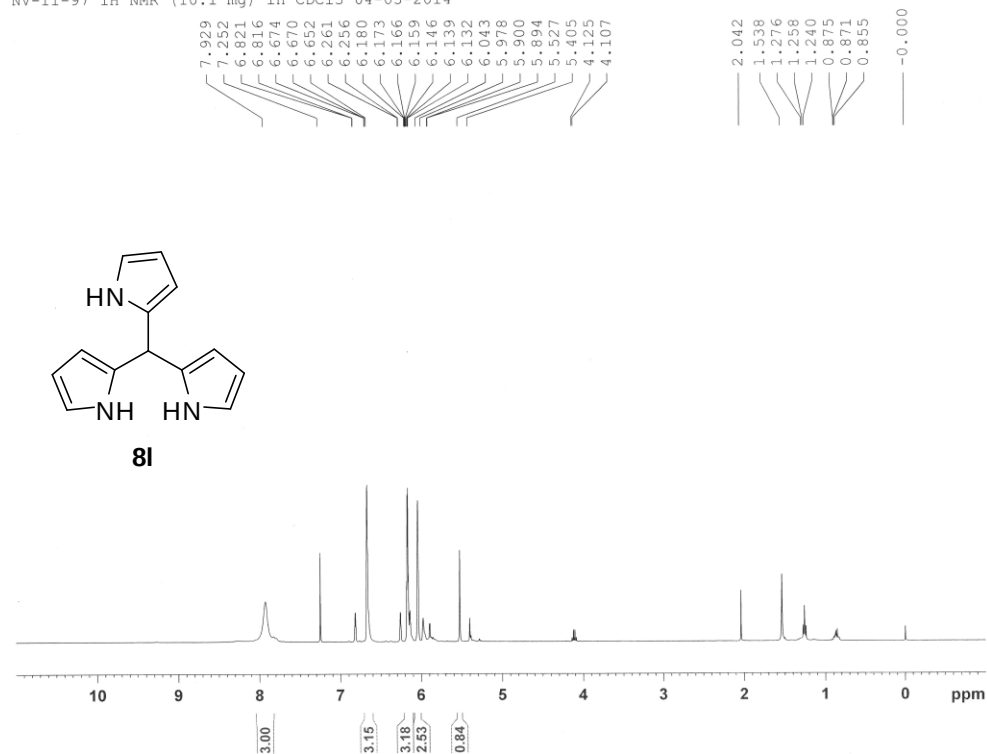
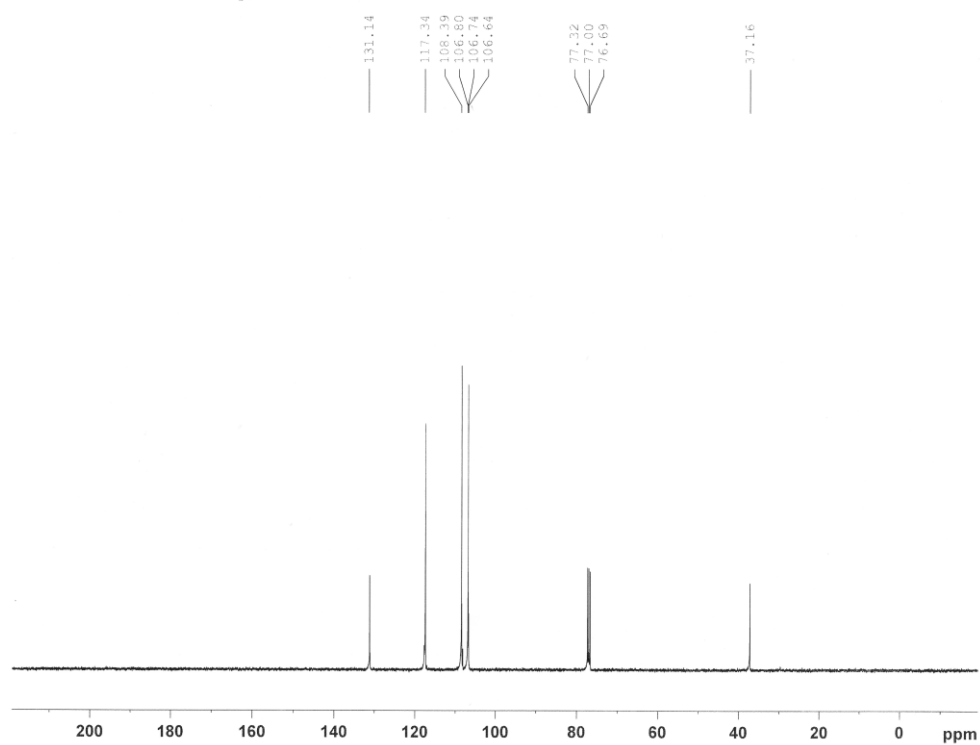
meso-(2-Hydroxyphenyl)dipyrromethane (8g):¹H-NMR (400 MHz, CDCl₃)¹³C-NMR (100 MHz, CDCl₃)

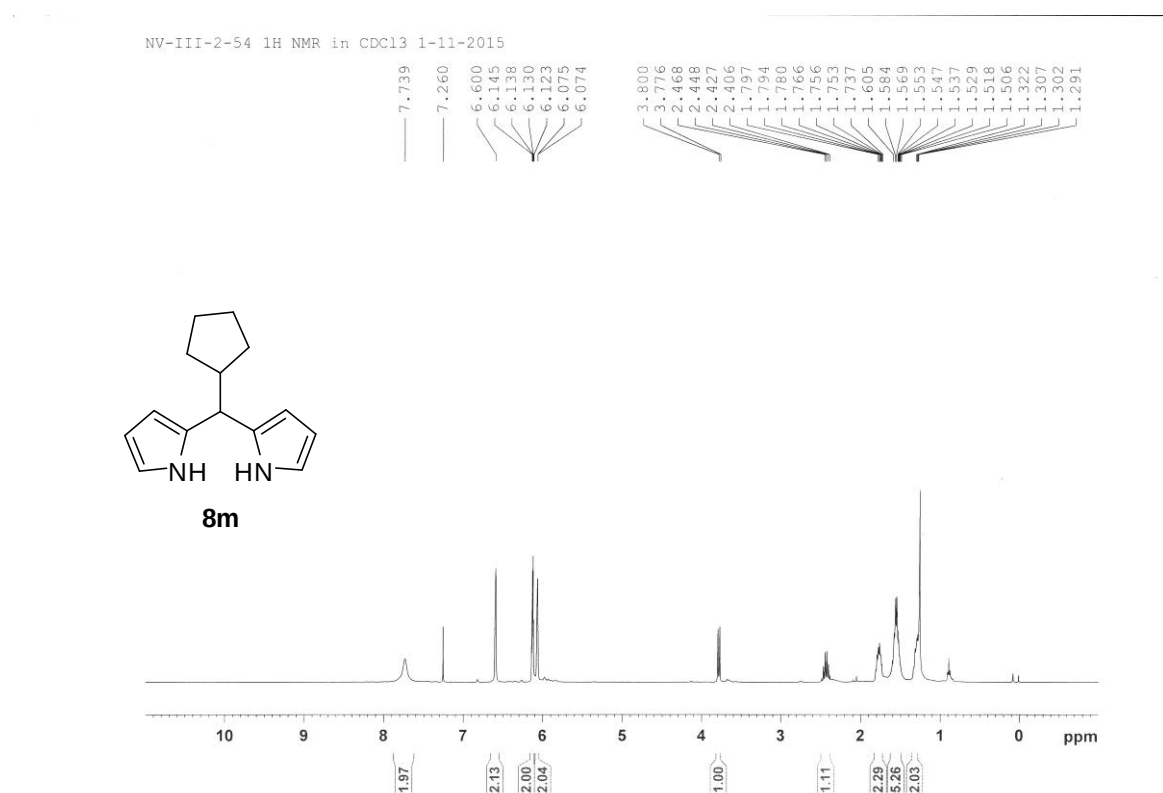
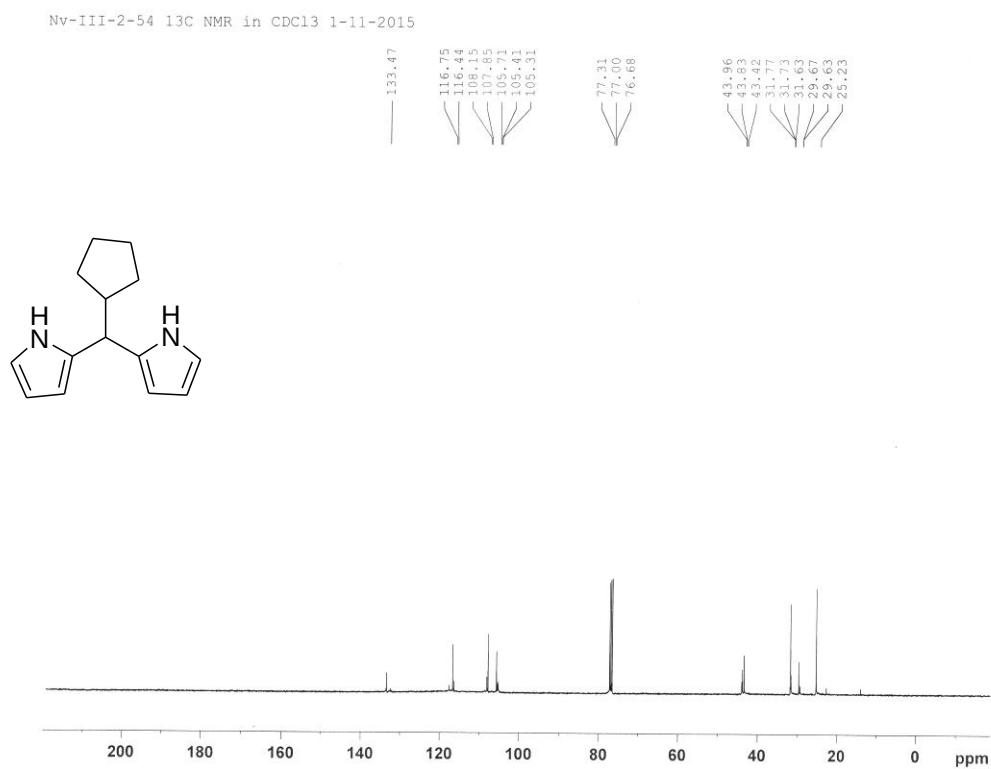
meso-(3-Methoxy-4-hydroxyphenyl)dipyrromethane (8h):¹H-NMR (400 MHz, CDCl₃)¹³C-NMR (100 MHz, CDCl₃)NV-II-116 13C NMR (60.4mg) in CDCl₃ 03-09-2014

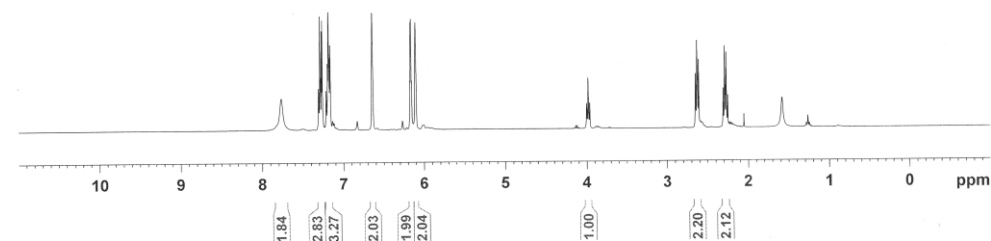
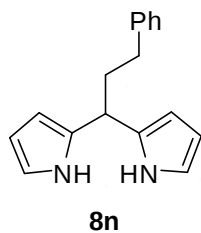
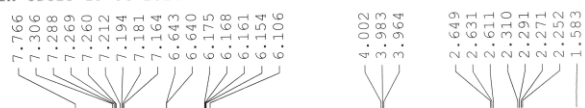
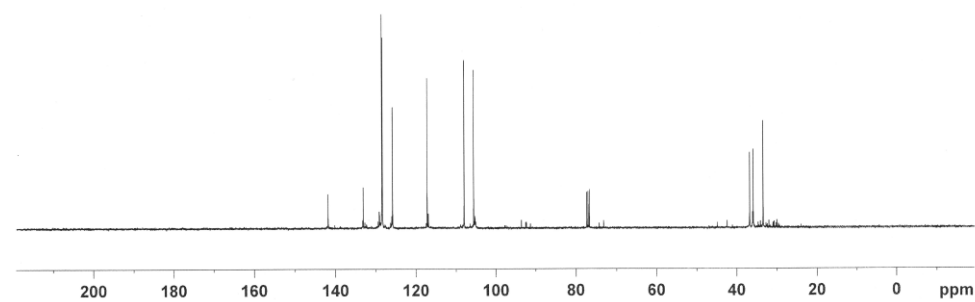
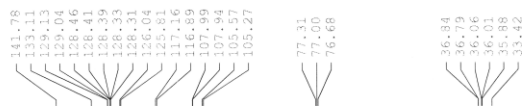
meso-(2-Hydroxy-3-methoxy)dipyrromethane (8i):**¹H-NMR (400 MHz, CDCl₃)**NV-II-109 1H NMR (9.2mg) in CDCl₃ 15-05-2014**¹³C-NMR (100 MHz, CDCl₃)**NV-II-109 13C NMR (9.2mg) in CDCl₃ 15-05-2014

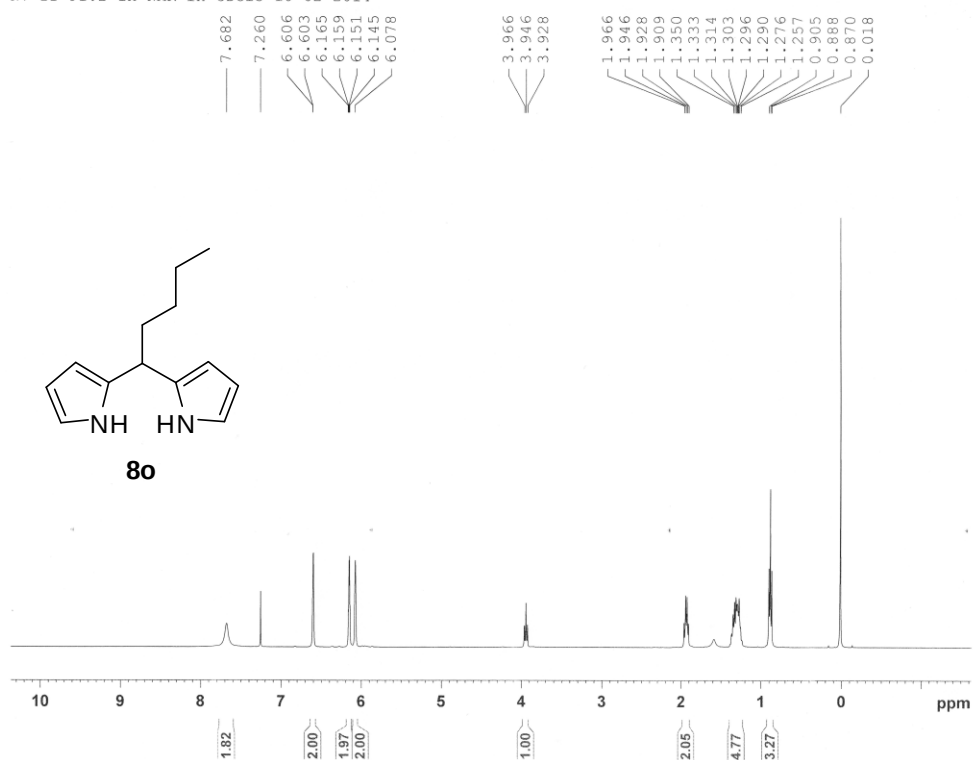
meso-(2,5-dimethoxyphenyl)dipyrromethane (8j):¹H-NMR (400 MHz, CDCl₃)NV-II-113-2 1H NMR(11.1mg) in CDCl₃ 18-08-2014¹³C-NMR (100 MHz, CDCl₃)NV-II-113 13C NMR(76mg) in CDCl₃ 29-08-2014

meso-(Furan-2-yl)dipyrromethane (8k):**¹H-NMR (400 MHz, CDCl₃)**NV-II-93 ¹H NMR (10mg) in CDCl₃ 21-02-2014**¹³C-NMR (100 MHz, CDCl₃)**NV-II-93 ¹³C NMR (26.7 mg) in CDCl₃ 05-03-2014

Tripyrromethane (8l):¹H-NMR (400 MHz, CDCl₃)NV-II-97 1H NMR (10.1 mg) in CDCl₃ 04-03-2014¹³C-NMR (100 MHz, CDCl₃)NV-II-97 13C NMR (28.3mg) in CDCl₃ 12-03-2014

meso-(Cyclopentyl)dipyrromethane (8m):¹H-NMR (400 MHz, CDCl₃)¹³C-NMR (100 MHz, CDCl₃)

meso-(3-Phenylpropyl)dipyrromethane (8n):¹H-NMR (400 MHz, CDCl₃)NV-II-115-2 1H NMR in CDCl₃ 19-06-2014¹³C-NMR (100 MHz, CDCl₃)NV-II-99 13C NMR in CDCl₃ 03-09-2014

meso-(Butyl)dipyrromethane (8o):¹H-NMR (400 MHz, CDCl₃)NV-II-91.2 1H NMR in CDCl₃ 18-02-2014¹³C-NMR (100 MHz, CDCl₃)NV-II-94 13C NMR (30.6 mg) in CDCl₃ 26-02-2014