

Electronic supplementary information

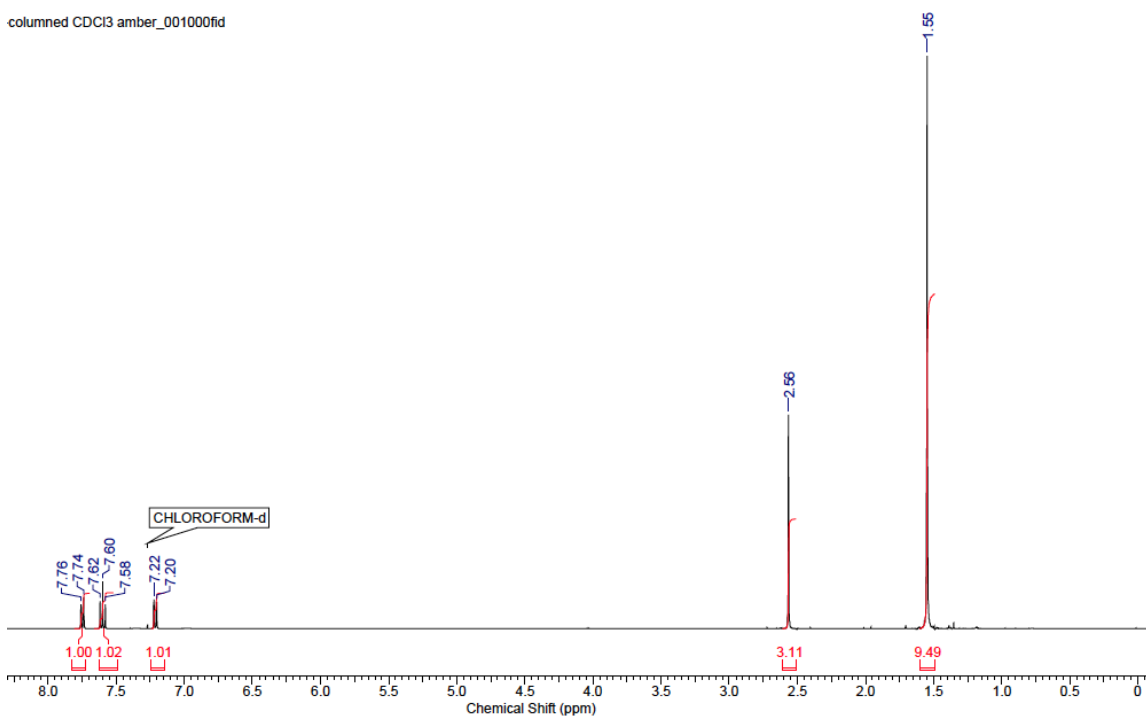
Improved Modular Synthesis of H₄octapa and H₂dedpa, and Yttrium Coordination Chemistry Towards ^{86/90}Y Radiopharmaceuticals.

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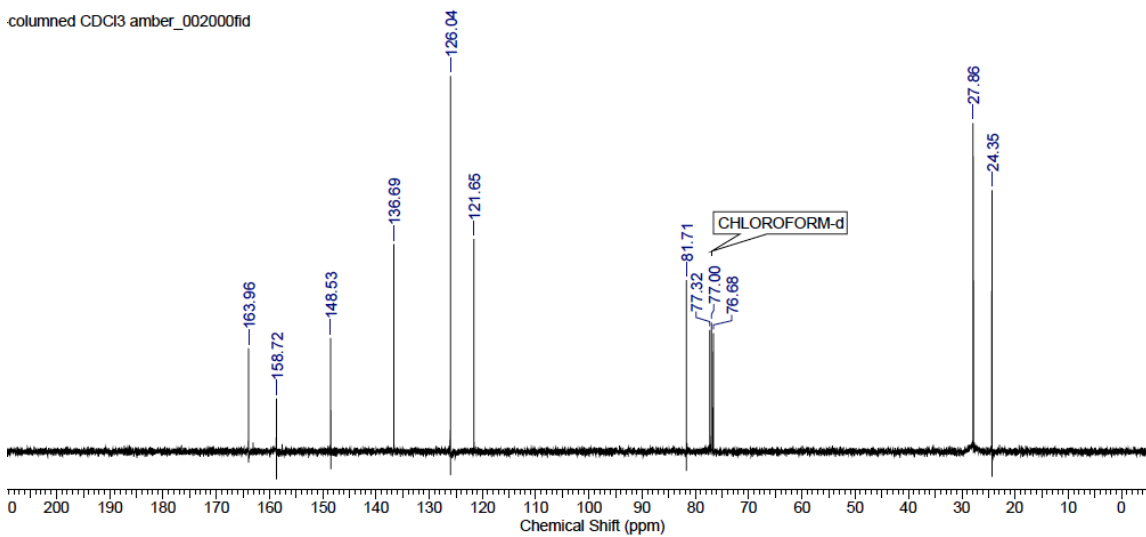
§TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia, Canada, V6T 2A3;

columned CDCl3 amber_001000fid



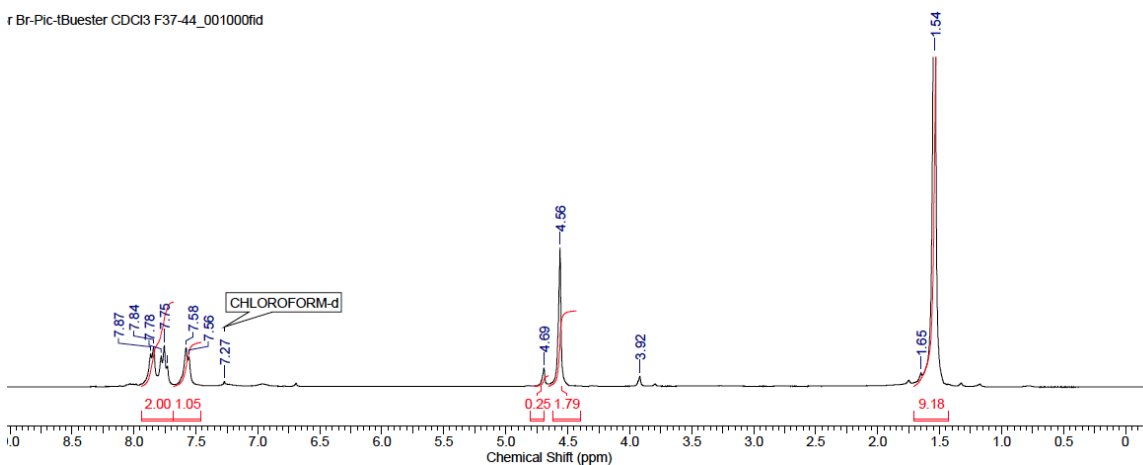
Supplementary Figure S1. ¹H NMR spectrum (400 MHz, CDCl₃, RT) of *tert*-Butyl 6-(methyl)picolinate (1).

columned CDCl3 amber_002000fid



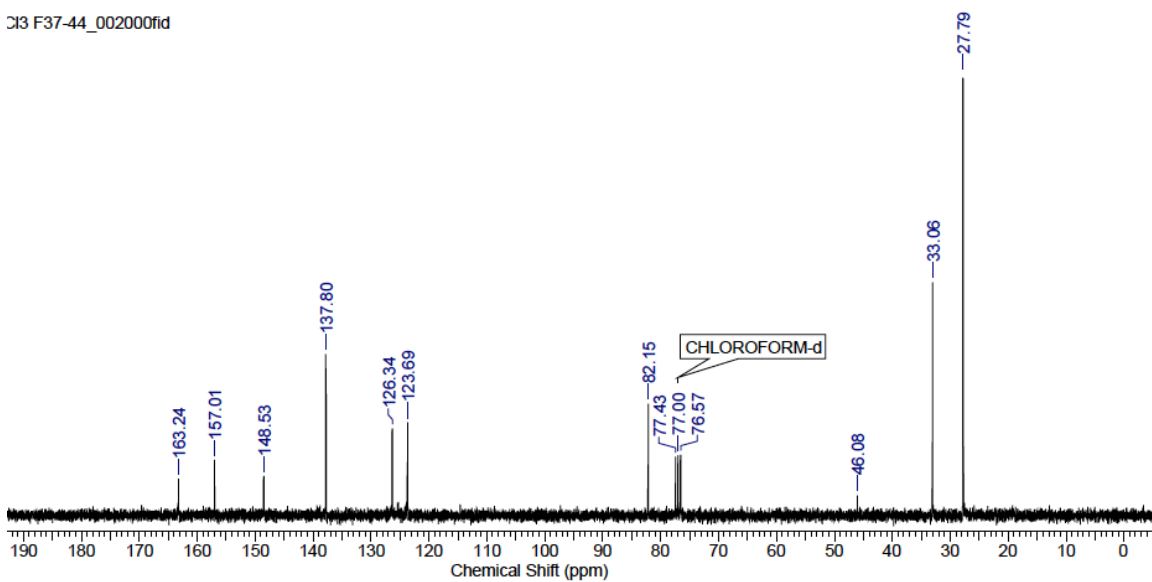
Supplementary Figure S2. ¹³C NMR spectrum (100 MHz, CDCl₃, RT) of *tert*-Butyl 6-(methyl)picolinate (1).

r Br-Pic-tBuester CDCl3 F37-44_001000fid

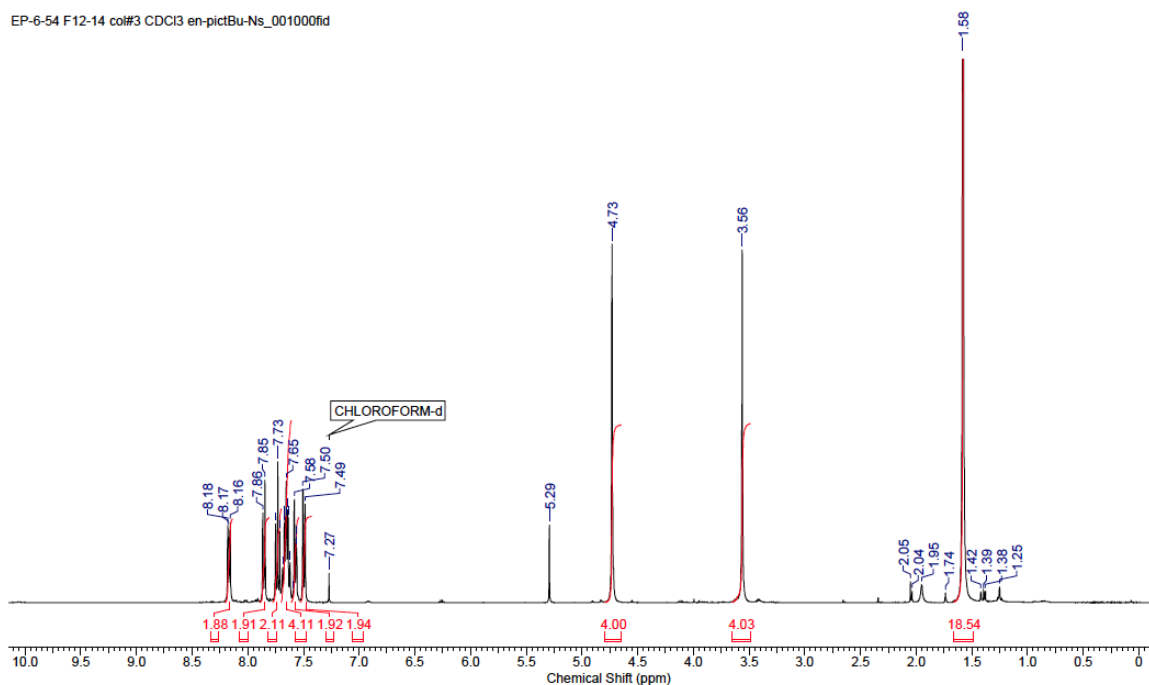


Supplementary Figure S3. ^1H NMR spectrum (300 MHz, CDCl_3 , RT) of *tert*-Butyl 6-(bromomethyl)picolinate (**2**).

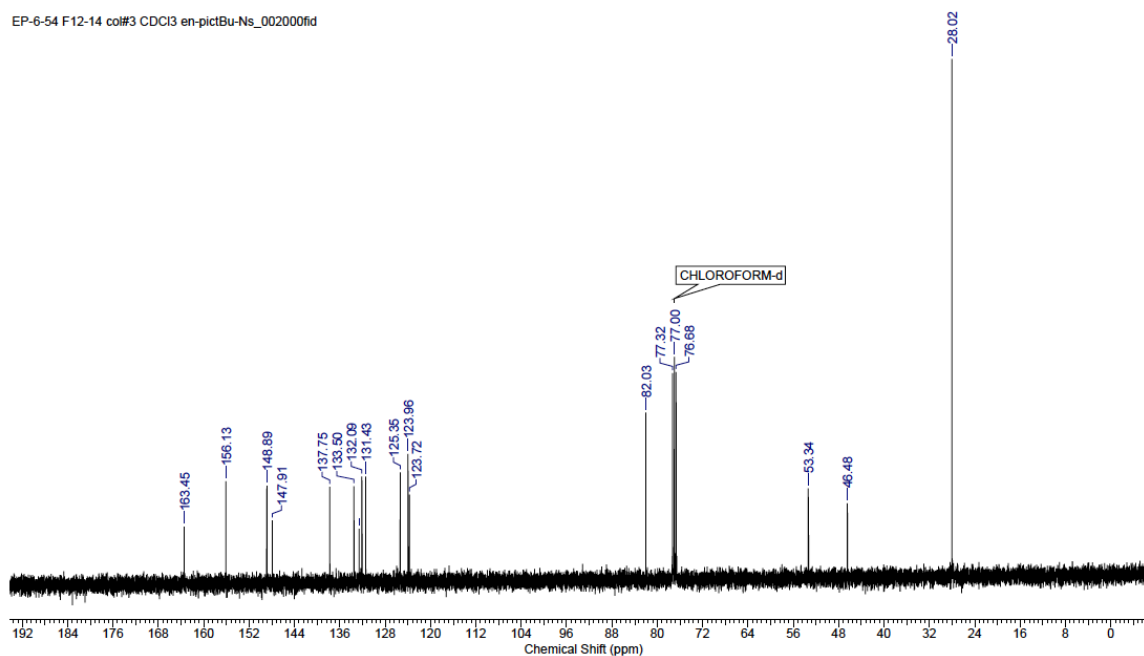
3 F37-44_002000fid



Supplementary Figure S4. ^{13}C NMR spectrum (75 MHz, CDCl_3 , RT) of *tert*-Butyl 6-(bromomethyl)picolinate (**2**).

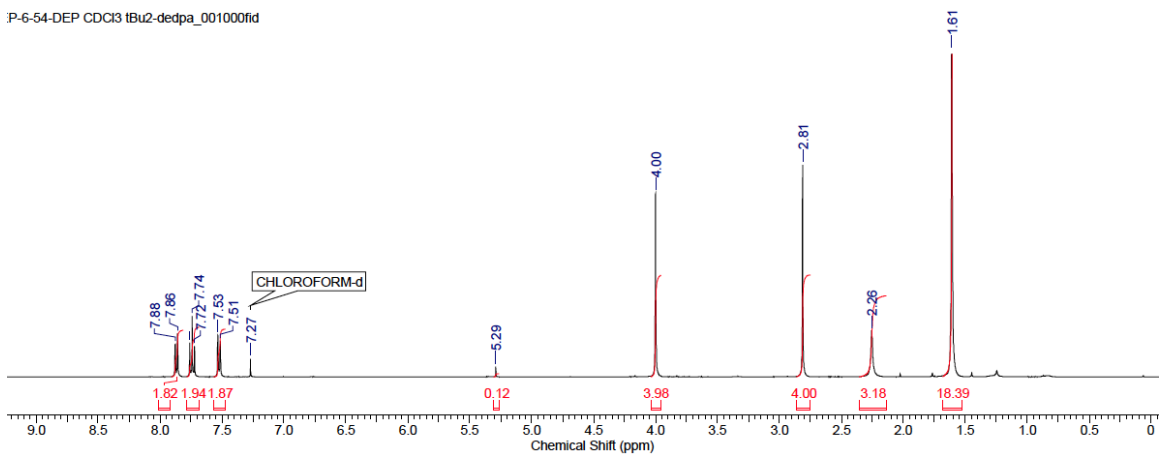


Supplementary Figure S5. ^1H NMR spectrum (400 MHz, CDCl_3 , RT) of *N,N'*-(2-Nitrobenzenesulfonamide)-*N,N'*-[6-(*tert*-butoxycarbonyl)pyridin-2-yl]methyl]-1,2-diaminoethane (**4**).



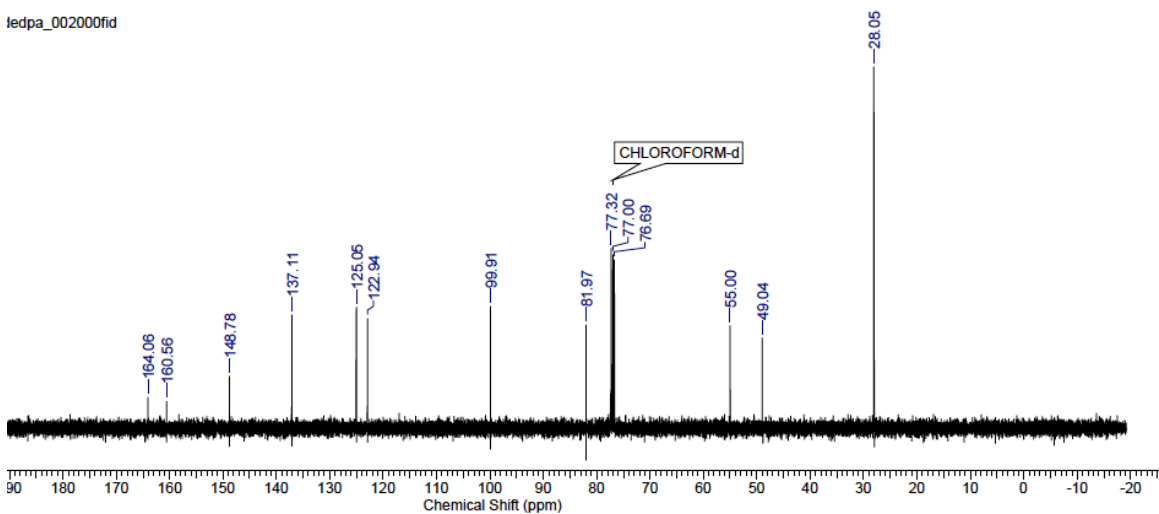
Supplementary Figure S6. ^{13}C NMR spectrum (100 MHz, CDCl_3 , RT) of *N,N'*-(2-Nitrobenzenesulfonamide)-*N,N'*-[6-(*tert*-butoxycarbonyl)pyridin-2-yl]methyl]-1,2-diaminoethane (**4**).

P-6-54-DEP CDCl3 tBu2-dedpa_001000fid



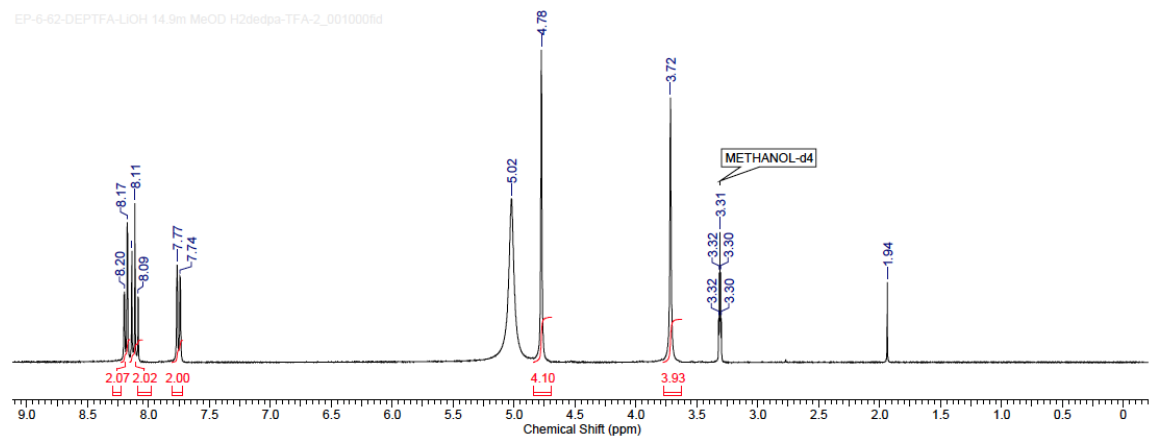
Supplementary Figure S7. ^1H NMR spectrum (400 MHz, CDCl_3 , RT) of N,N' -[6-(*tert*-Butoxycarbonyl)pyridin-2-yl]methyl-1,2-diaminoethane (5).

ledpa_002000fid

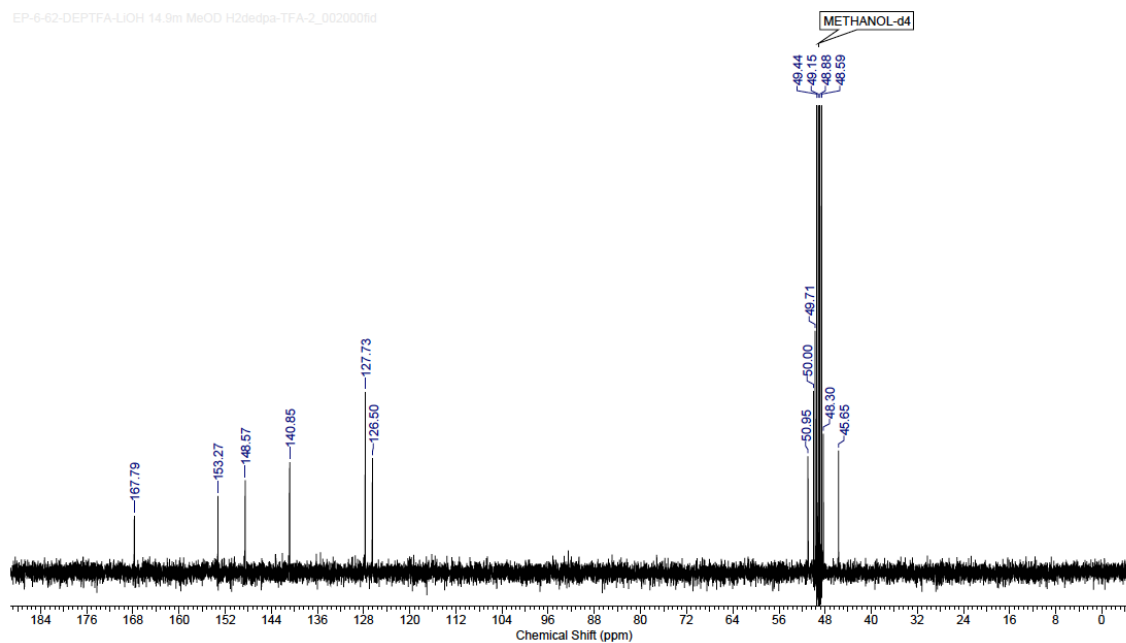


Supplementary Figure S8. ^{13}C NMR spectrum (100 MHz, CDCl_3 , RT) of N,N' -[6-(*tert*-Butoxycarbonyl)pyridin-2-yl]methyl-1,2-diaminoethane (5).

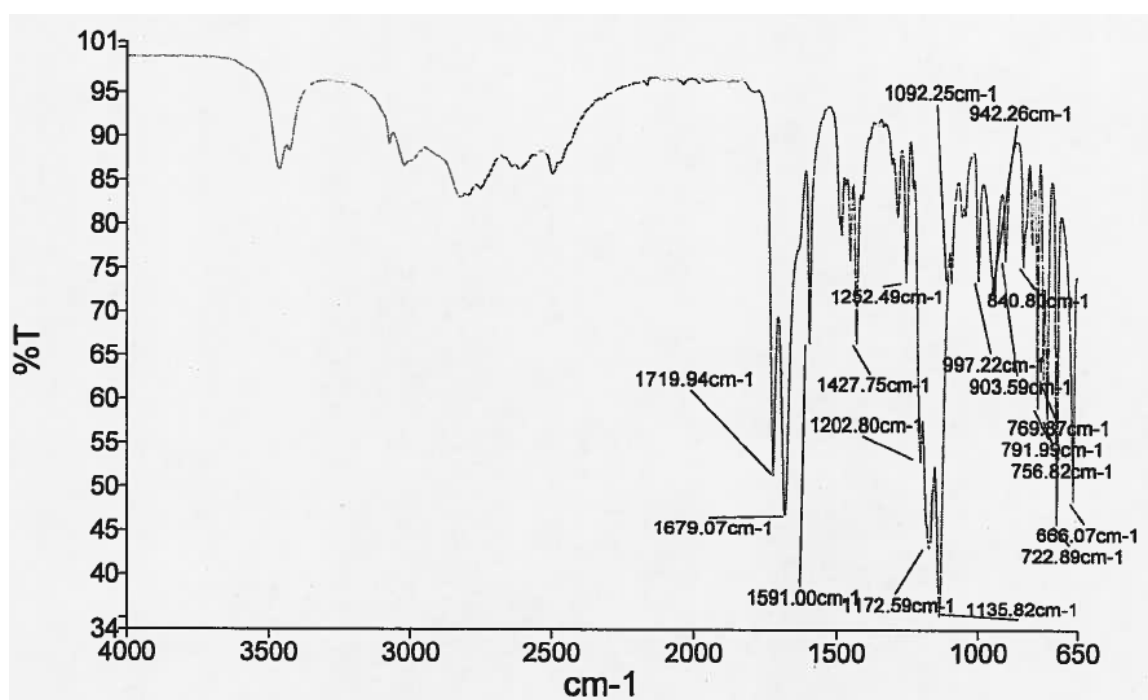
EP-6-62-DEPTFA-LiOH 14.9m MeOD H2dedpa-TFA-2_001000fid



Supplementary Figure S9. ^1H NMR spectrum (300 MHz, MeOD, RT) of H_2dedpa , N,N' -[(6-carboxylato)pyridin-2-yl]methyl-1,2-diaminoethane (6).

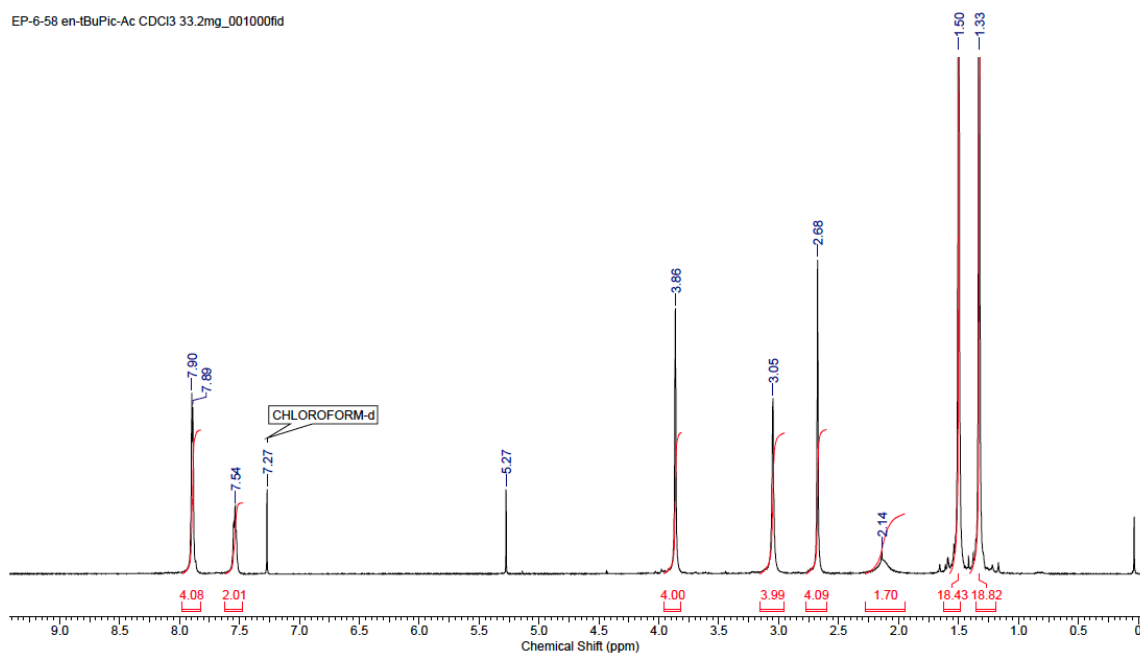


Supplementary Figure S10. ¹³C NMR spectrum (75 MHz, MeOD, RT) of H₂dedpa, *N,N'*-[(6-carboxylato)pyridin-2-yl)methyl]-1,2-diaminoethane (6).



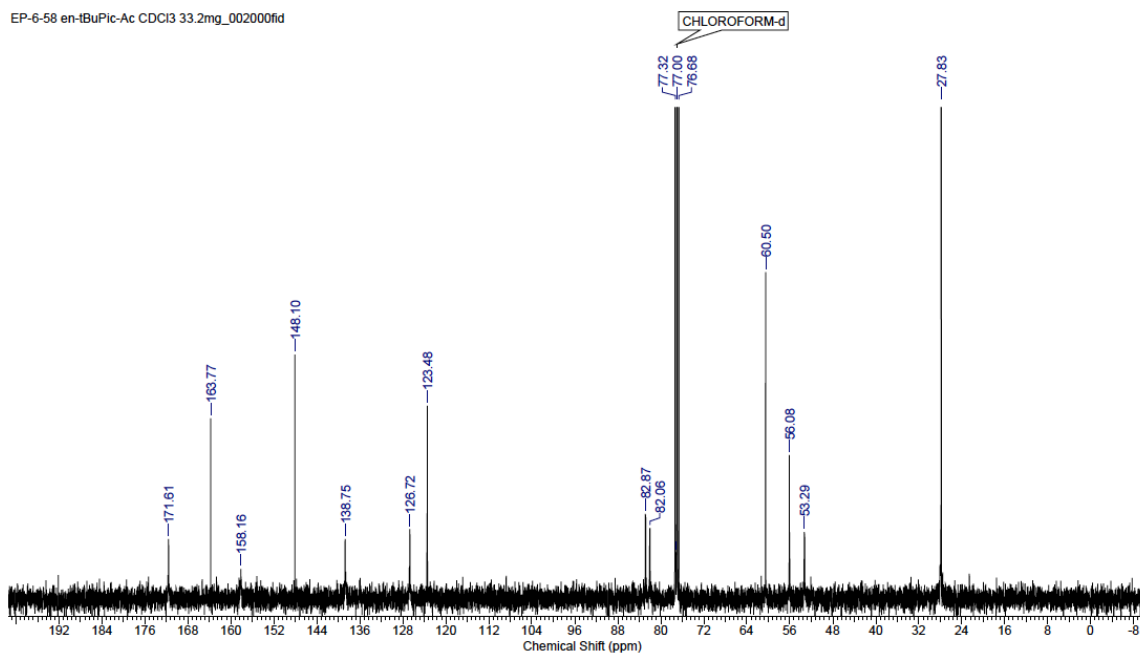
Supplementary Figure S11. ATR-IR spectrum (neat) of H₂dedpa, *N,N'*-[(6-carboxylato)pyridin-2-yl)methyl]-1,2-diaminoethane (6).

EP-6-58 en-tBuPic-Ac CDCl3 33.2mg_001000fid



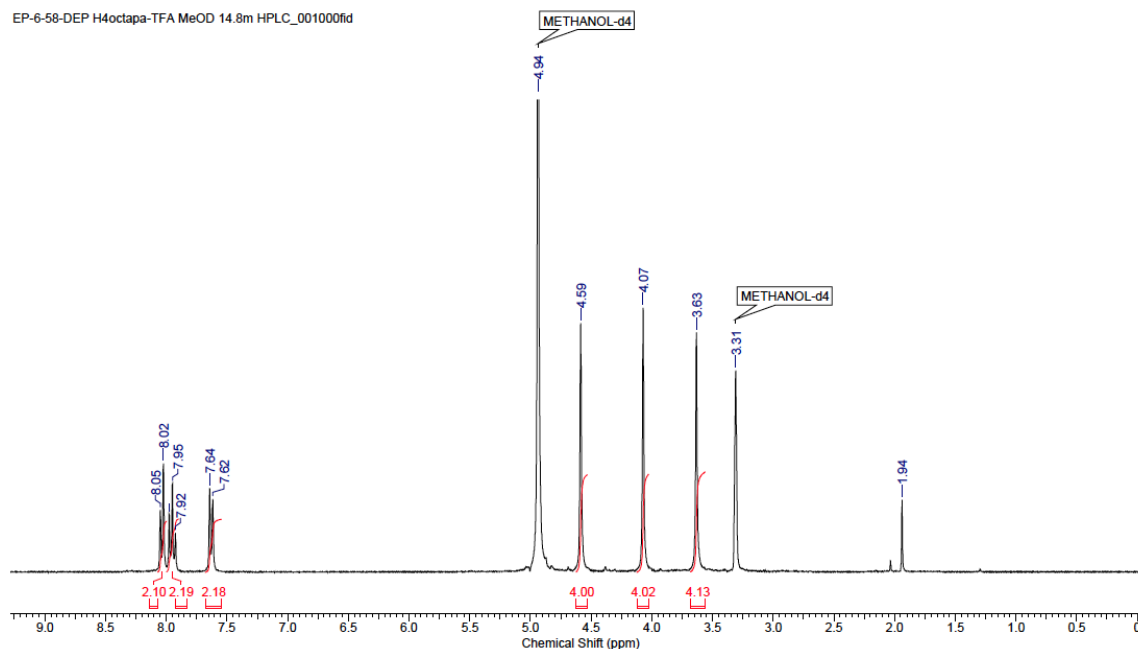
Supplementary Figure S12. ^1H NMR spectrum (400 MHz, CDCl_3 , RT) of *N,N'*-[*tert*-Butoxycarbonyl)methyl-*N,N'*-[6-(*tert*-butoxycarbonyl)pyridin-2-yl]methyl]-1,2-diaminoethane (7).

EP-6-58 en-tBuPic-Ac CDCl3 33.2mg_002000fid



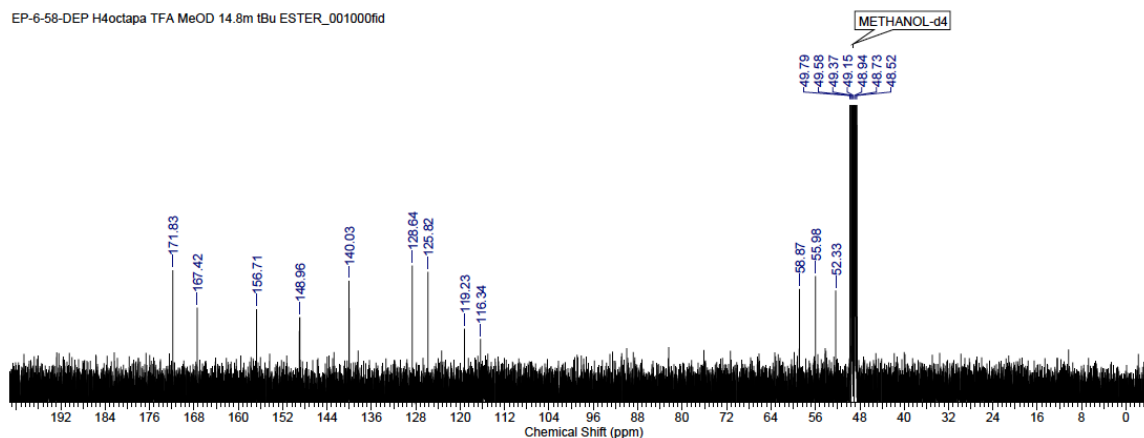
Supplementary Figure S13. ^{13}C NMR spectrum (100 MHz, CDCl_3 , RT) of *N,N'*-[*tert*-Butoxycarbonyl)methyl-*N,N'*-[6-(*tert*-butoxycarbonyl)pyridin-2-yl]methyl]-1,2-diaminoethane (7).

EP-6-58-DEP H4octapa-TFA MeOD 14.8m HPLC_001000fid

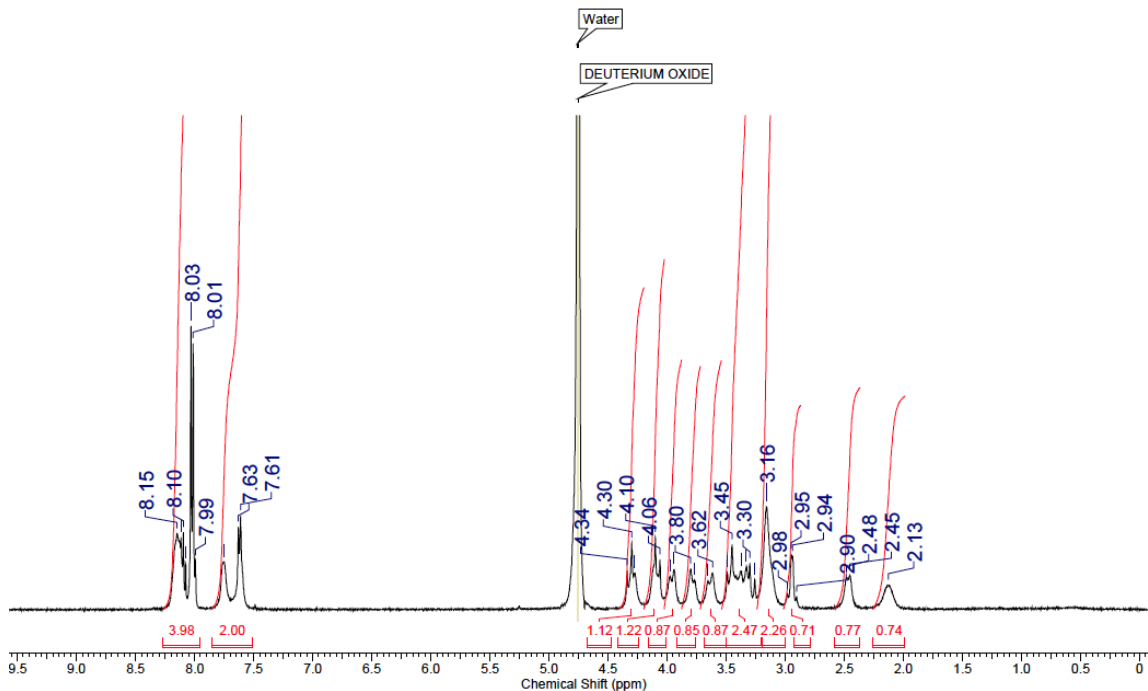


Supplementary Figure S14. ^1H NMR spectrum (300 MHz, MeOD, RT) of H_4octapa , N,N' -[(6-carboxylato)pyridin-2-yl)methyl]- N,N' -diacetic acid-1,2-diaminoethane (**8**).

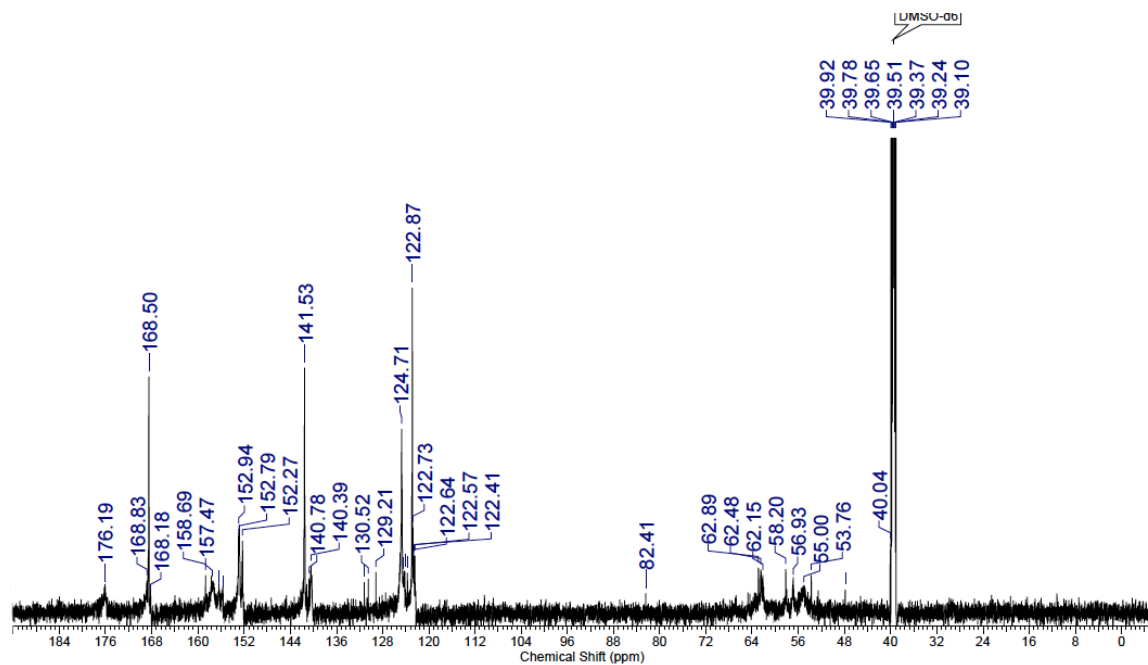
EP-6-58-DEP H4octapa TFA MeOD 14.8m tBu ESTER_001000fid



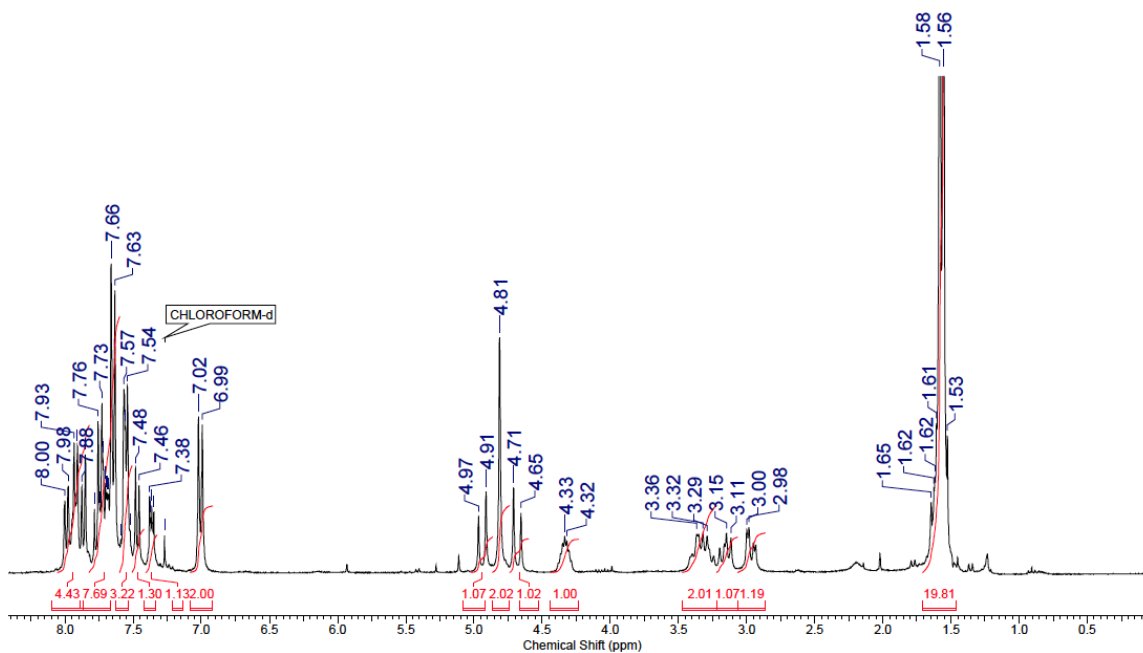
Supplementary Figure S15. ^{13}C NMR spectrum (100 MHz, MeOD, RT) of H_4octapa , N,N' -[(6-carboxylato)pyridin-2-yl)methyl]- N,N' -diacetic acid-1,2-diaminoethane (**8**).



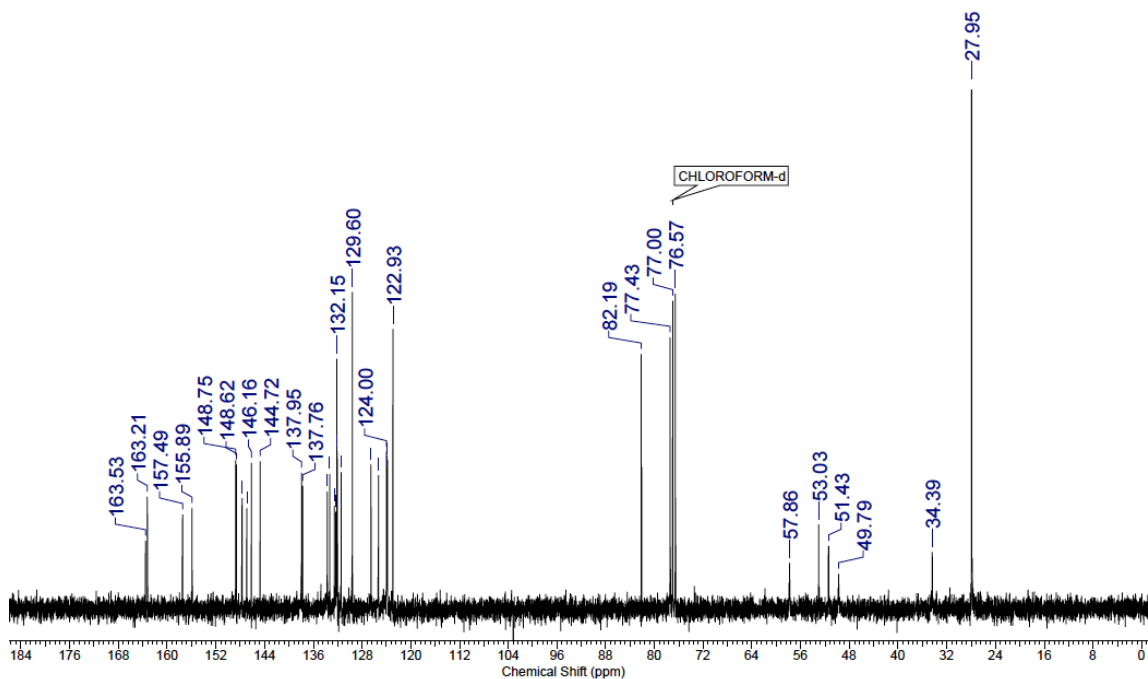
Supplementary Figure S18. ^1H NMR spectrum (400 MHz, D_2O , RT) of $[\text{Y}(\text{octapa})]^-$ (9).



Supplementary Figure S19. ^{13}C NMR spectrum (75 MHz, D_2O , RT) of $[\text{Y}(\text{octapa})]^-$ (9).

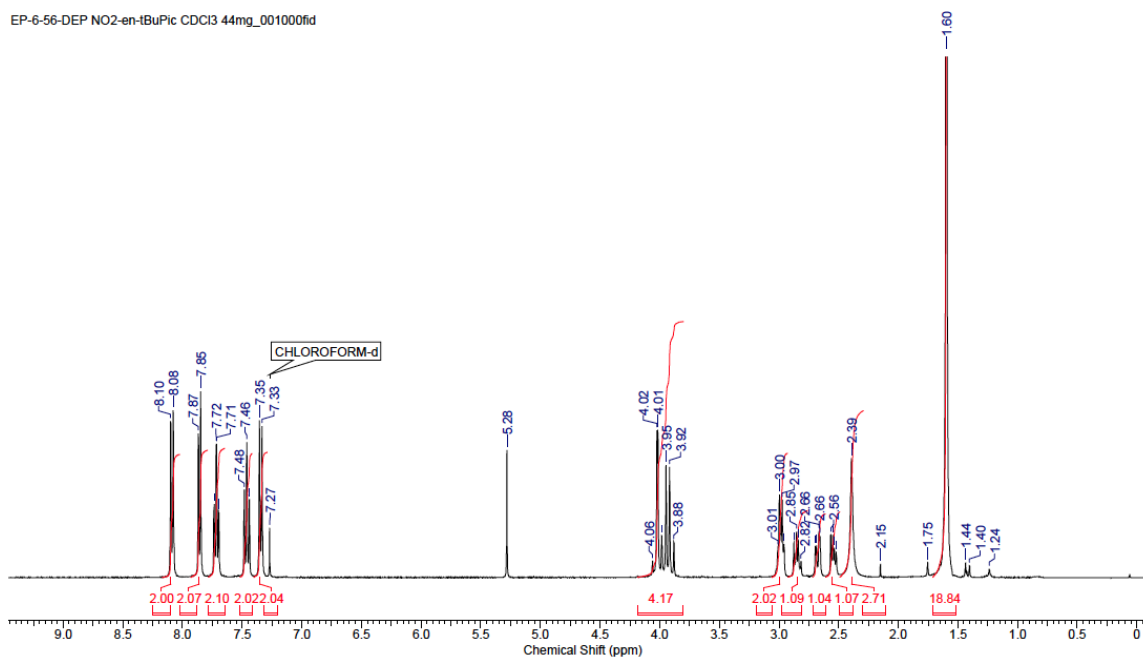


Supplementary Figure S20. ^1H NMR spectrum (300 MHz, CDCl_3 , RT) of *N,N'*-(2-Nitrobenzenesulfonamide)-*N,N'*-[6-(methoxycarbonyl)pyridin-2-yl]methyl]-1-(*p*-nitrobenzyl)-1,2-diaminoethane (**12**).



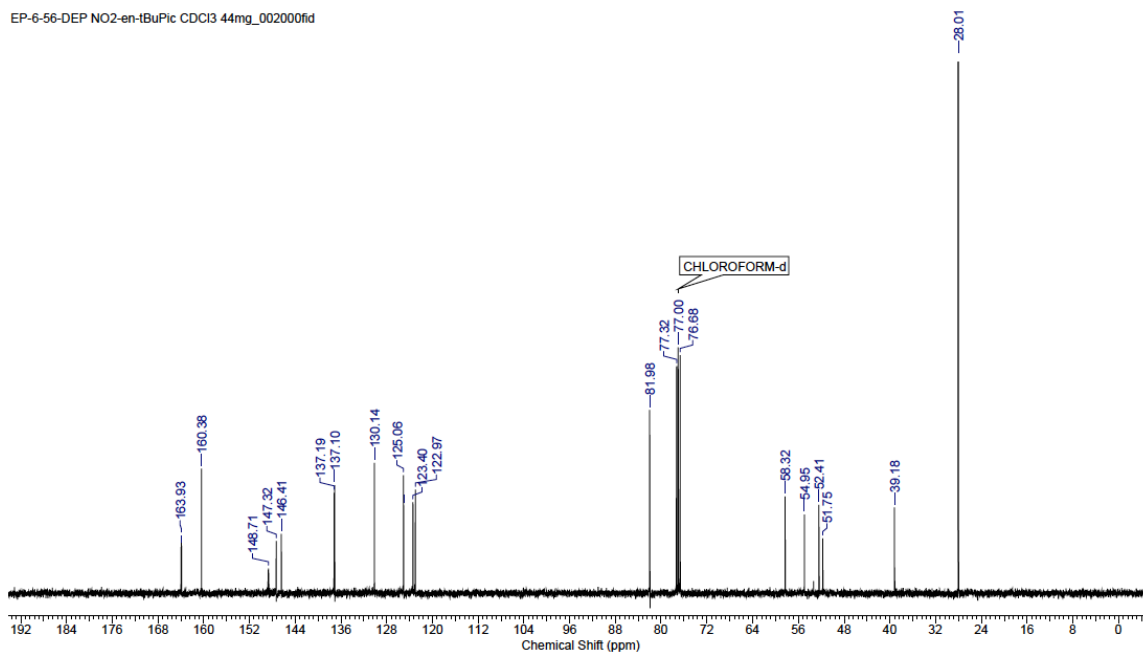
Supplementary Figure S21. ^{13}C NMR spectrum (75 MHz, CDCl_3 , RT) of *N,N'*-(2-Nitrobenzenesulfonamide)-*N,N'*-[6-(methoxycarbonyl)pyridin-2-yl]methyl]-1-(*p*-nitrobenzyl)-1,2-diaminoethane (**12**).

EP-6-56-DEP NO2-en-tBuPic CDCl3 44mg_001000fid

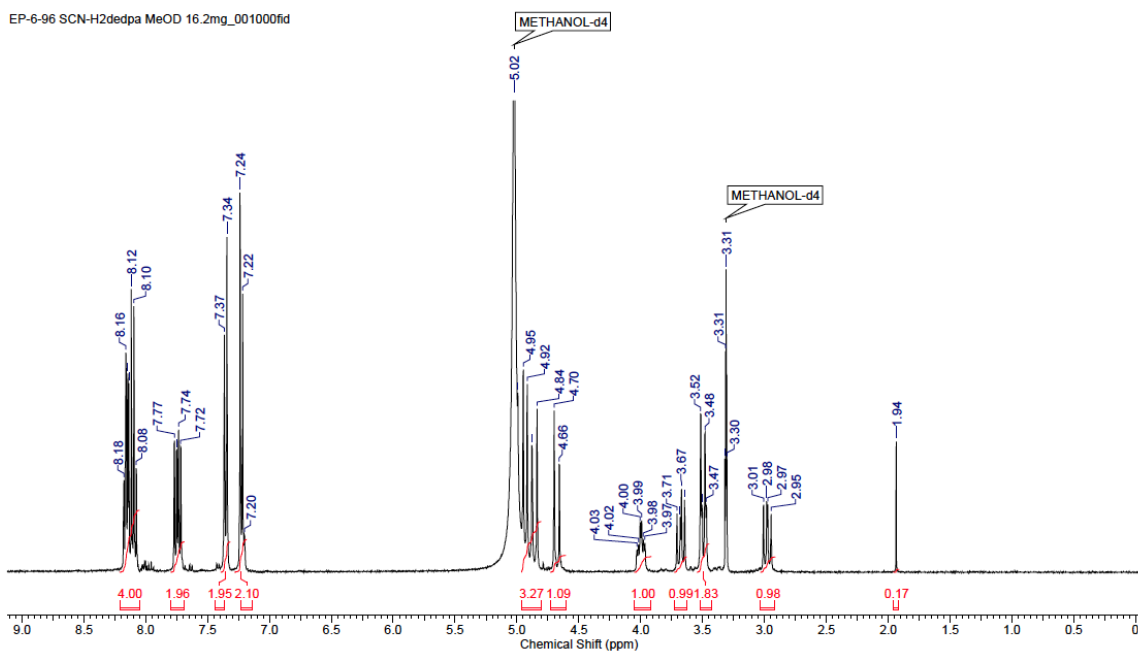


Supplementary Figure S22. ^1H NMR spectrum (400 MHz, CDCl_3 , RT) of *N,N'*-[6-(Methoxycarbonyl)pyridin-2-yl]methyl]-1-(*p*-nitrobenzyl)-1,2-diaminoethane (13).

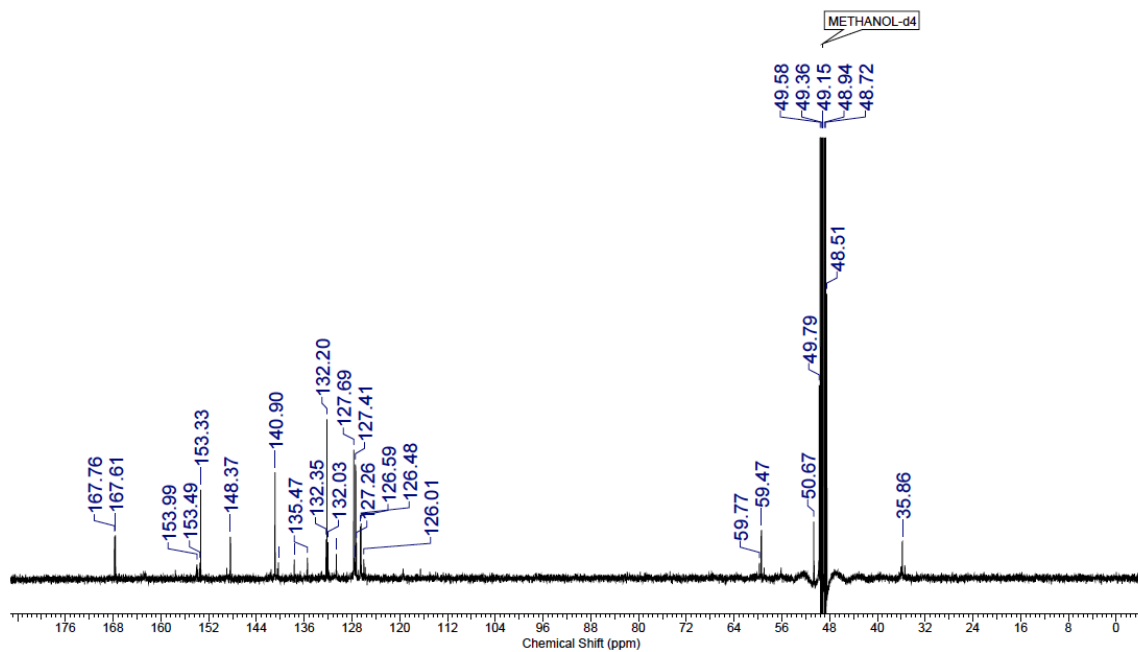
EP-6-56-DEP NO2-en-tBuPic CDCl3 44mg_002000fid



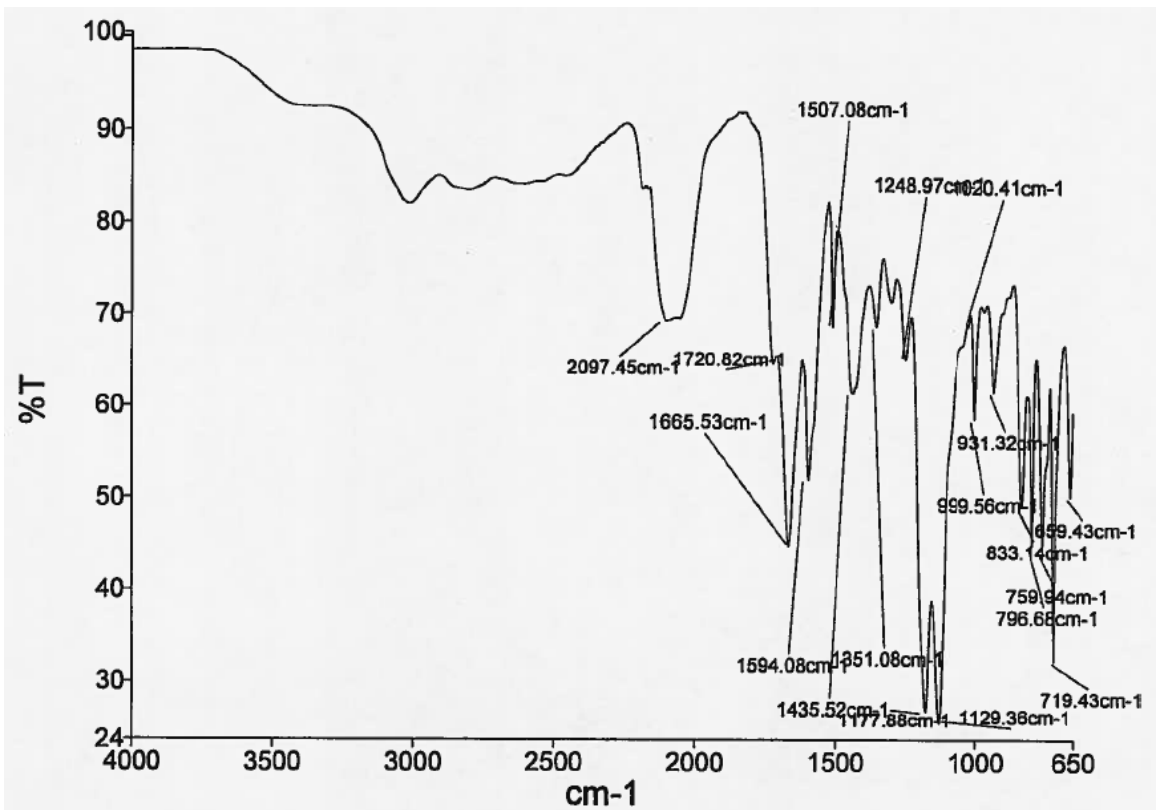
Supplementary Figure S23. ^{13}C NMR spectrum (100 MHz, CDCl_3 , RT) of *N,N'*-[6-(Methoxycarbonyl)pyridin-2-yl]methyl]-1-(*p*-nitrobenzyl)-1,2-diaminoethane (13).



Supplementary Figure S24. ^1H NMR spectrum (400 MHz, MeOD, RT) of *p*-SCN-Bn-H₂dedpa, *N,N'*-{[(6-carboxylato)pyridin-2-yl]methyl}-1-(*p*-benzylisothiocyanato)-1,2-diaminoethane (**14**).

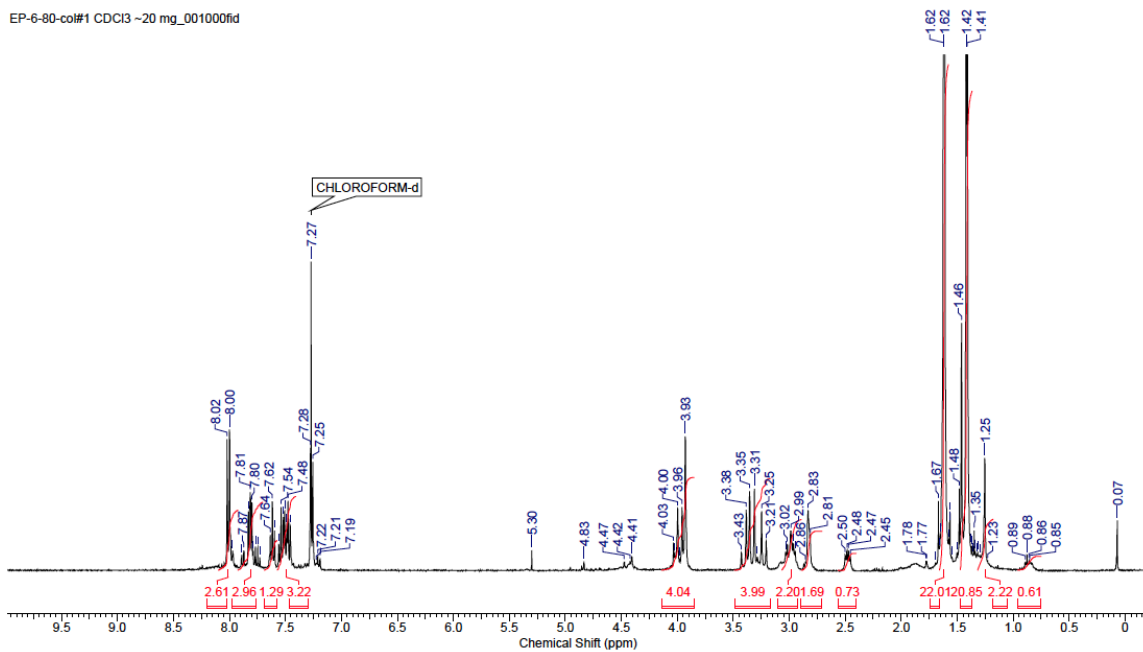


Supplementary Figure S25. ^{13}C NMR spectrum (100 MHz, MeOD, RT) of *p*-SCN-Bn-H₂dedpa, *N,N'*-{[(6-carboxylato)pyridin-2-yl]methyl}-1-(*p*-benzylisothiocyanato)-1,2-diaminoethane (**14**).



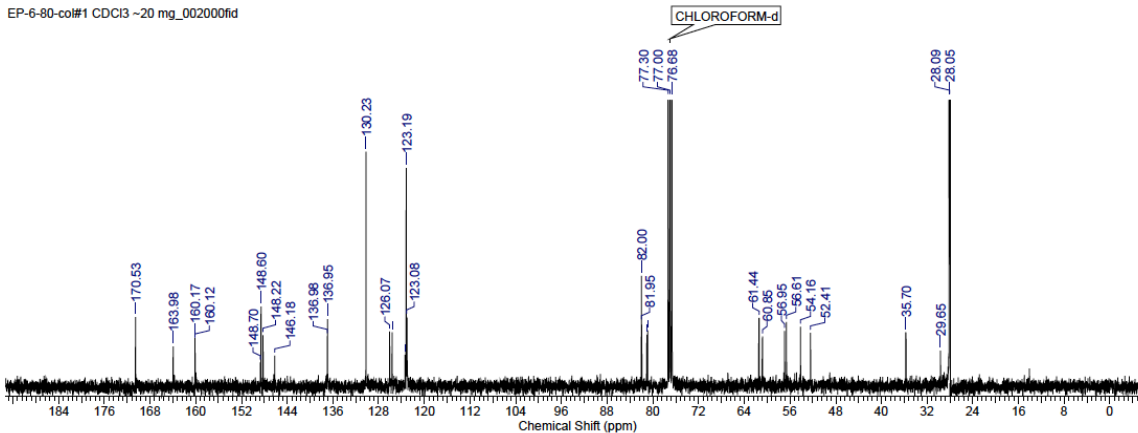
Supplementary Figure S26. ATR-IR spectrum (neat) of *p*-SCN-Bn-H₂dedpa, *N,N'*-[[[(6-carboxylato)pyridin-2-yl]methyl]-1-(*p*-benzylisothiocyanato)-1,2-diaminoethane (14).

EP-6-80-co#1 CDCl₃ ~20 mg_001000fid



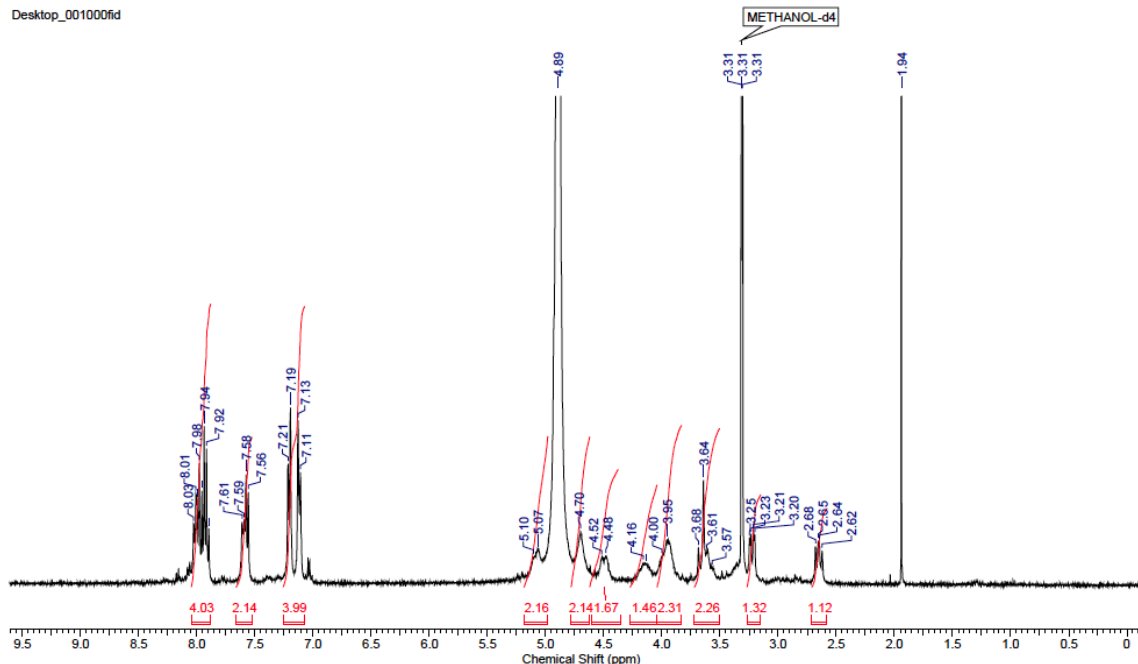
Supplementary Figure S27. ¹H NMR spectrum (400 MHz, CDCl₃, RT) of *N,N'*-[[[(*tert*-Butoxycarbonyl)methyl]-*N,N'*-[[[(6-*tert*-butoxycarbonyl)pyridin-2-yl]methyl]-1-(*p*-nitrobenzyl)-1,2-diaminoethane (15).

EP-6-80-co#1 CDCl3 ~20 mg_002000fid

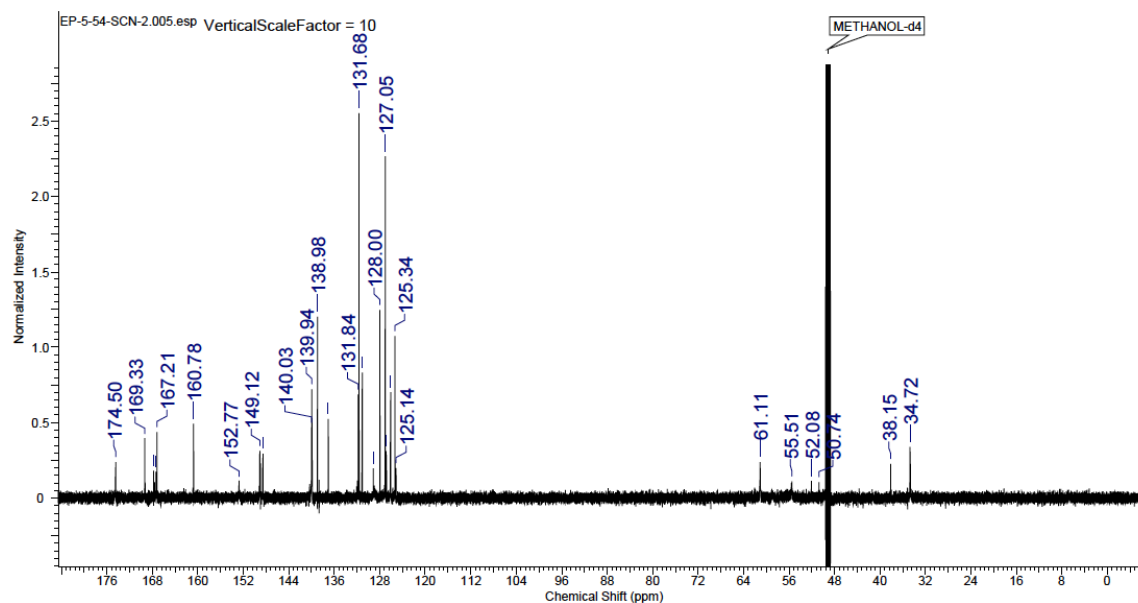


Supplementary Figure S28. ^{13}C NMR spectrum (100 MHz, CDCl_3 , RT) of *N,N'*-[*tert*-Butoxycarbonyl)methyl]-*N,N'*-{[(6-*tert*-butoxycarbonyl)pyridin-2-yl)methyl]-1-(*p*-nitrobenzyl)-1,2-diaminoethane (15).

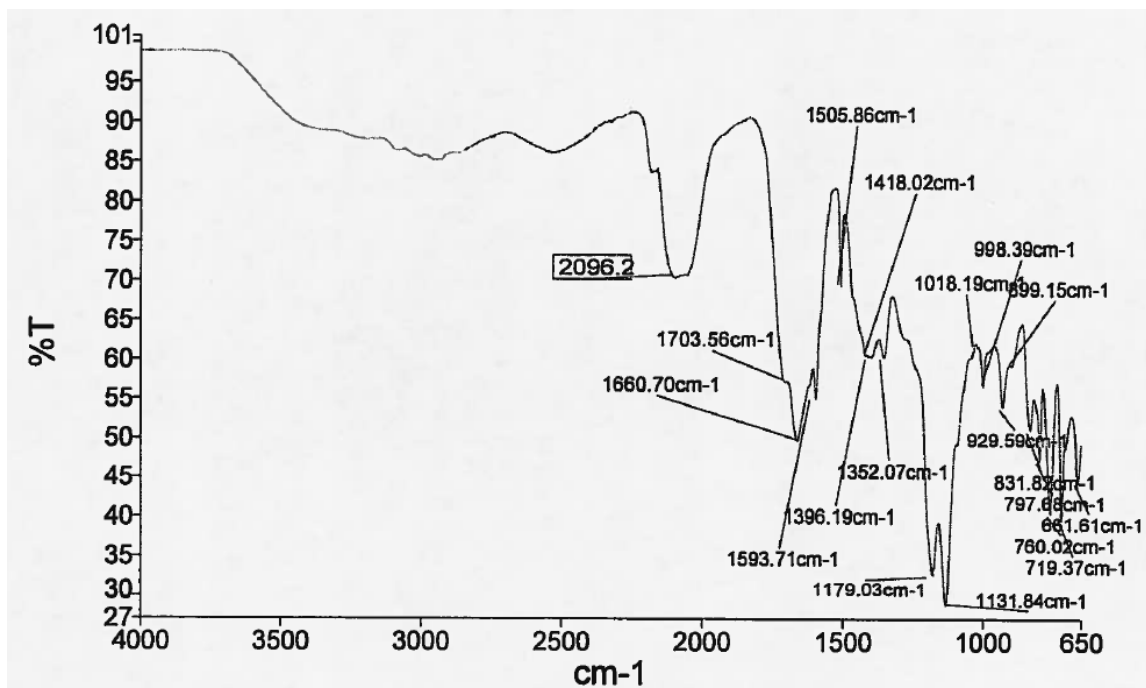
Desktop_001000fid



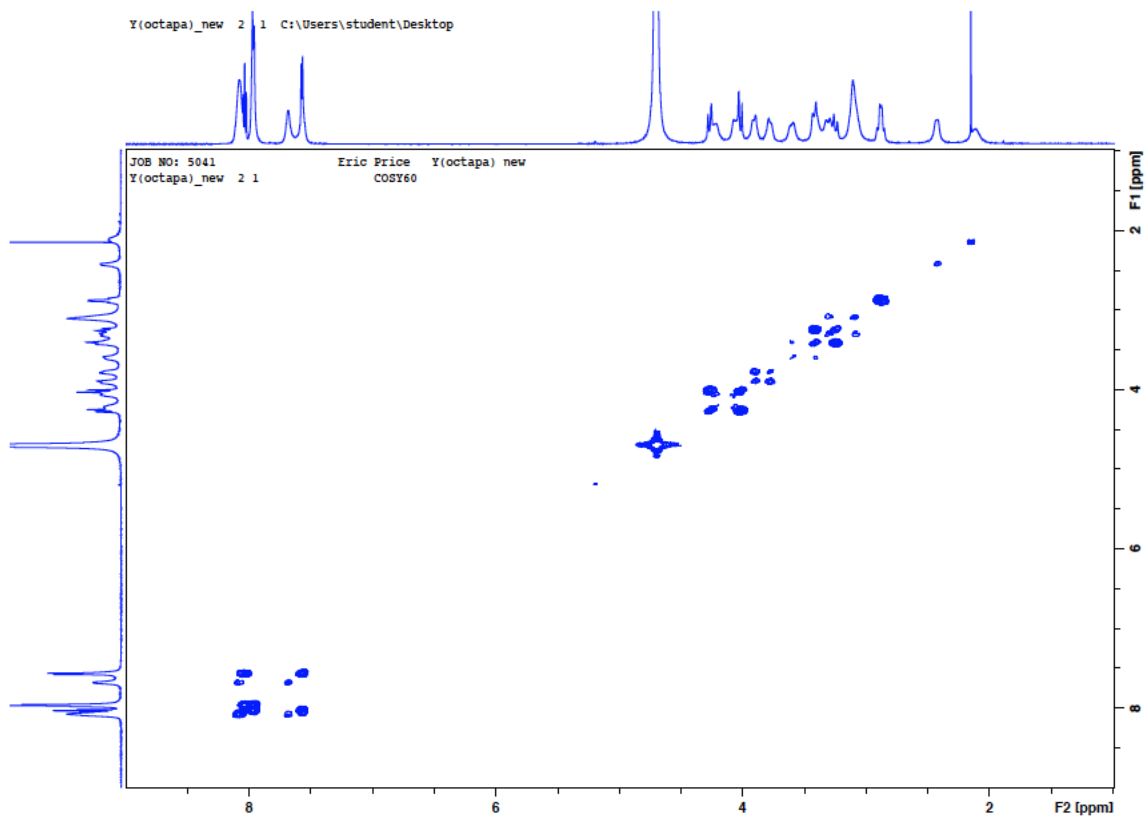
Supplementary Figure S29. ^1H NMR spectrum (400 MHz, MeOD, RT) of *p*-SCN-Bn- H_4 octapa, *N,N'*-[(Carboxylato)methyl]-*N,N'*-{[(6-carboxylato)pyridin-2-yl)methyl]-1-(*p*-benzylisothiocyanato)-1,2-diaminoethane (16).



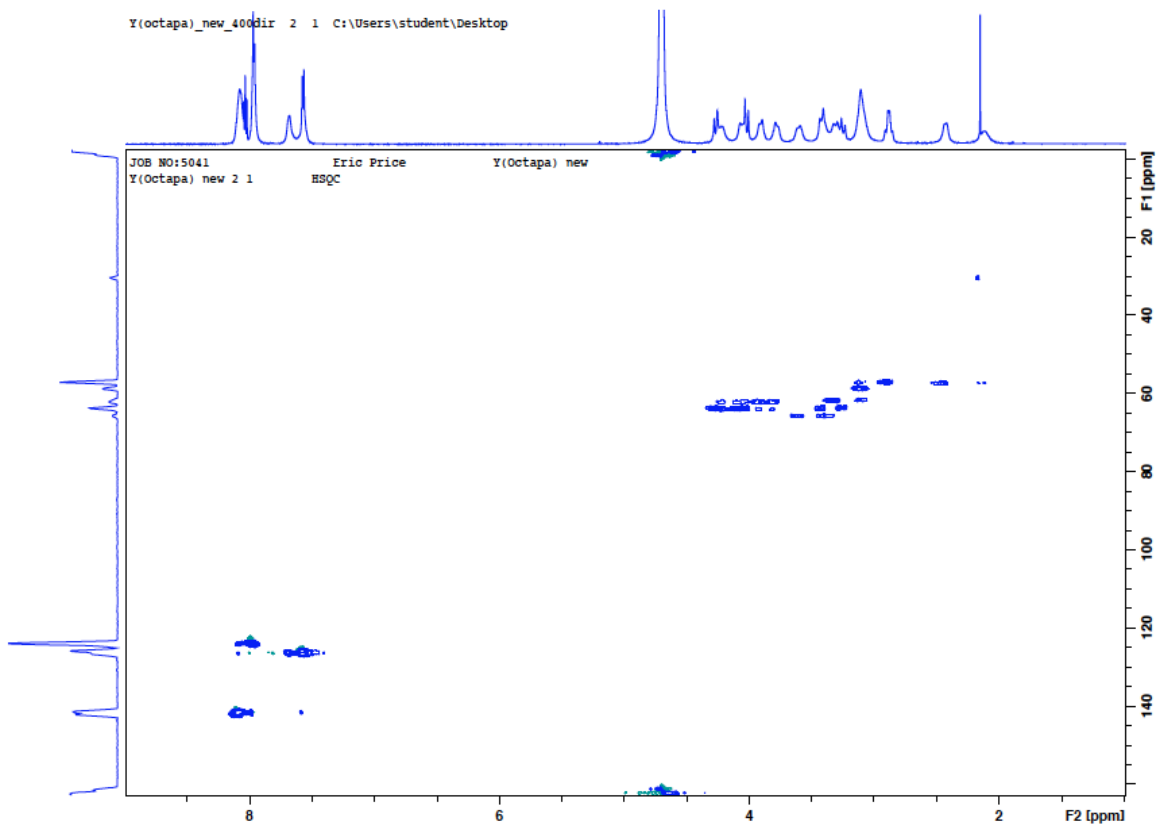
Supplementary Figure S30. ^{13}C NMR spectrum (150 MHz, MeOD, RT) of *p*-SCN-Bn- H_4 octapa, *N,N'*-[[Carboxylato)methyl]-*N,N'*-[[6-carboxylato)pyridin-2-yl)methyl]-1-(*p*-benzylisothiocyanato)-1,2-diaminoethane (**16**).



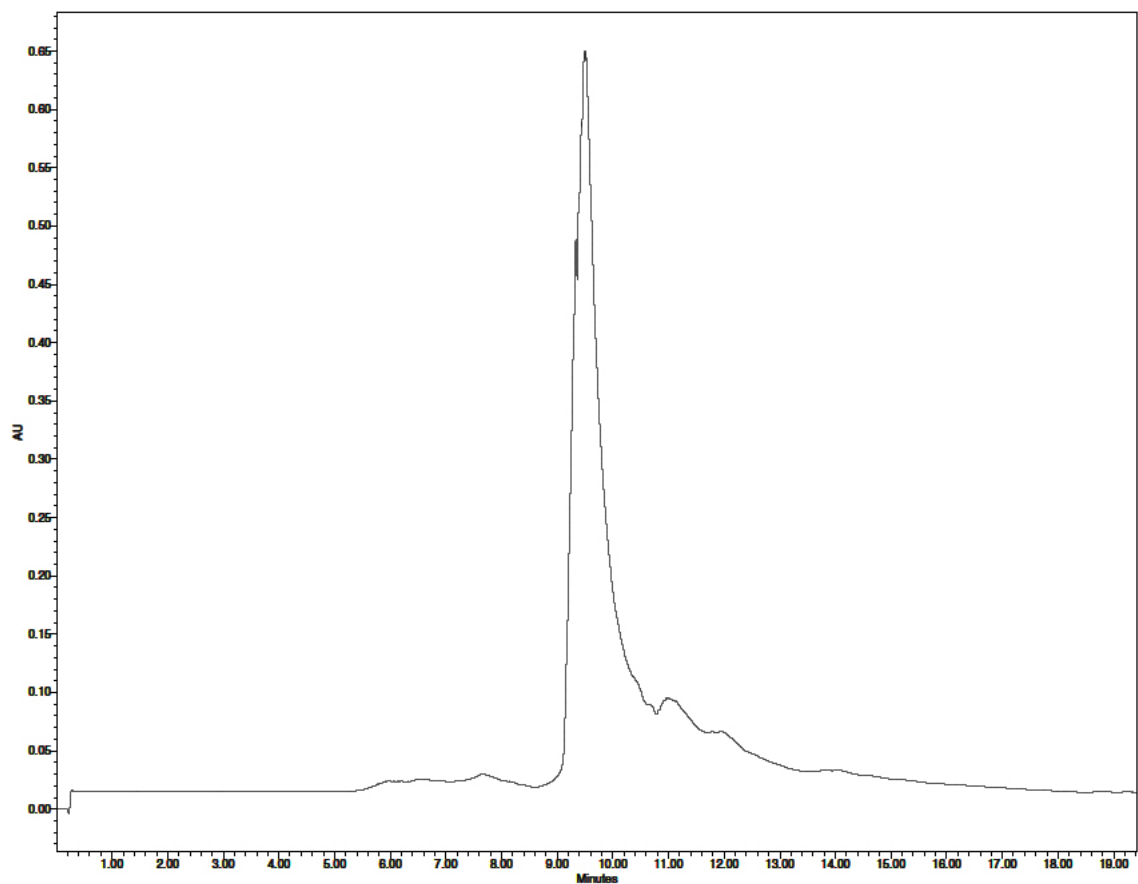
Supplementary Figure S31. ATR-IR spectrum (neat) of *p*-SCN-Bn- H_4 octapa, *N,N'*-[[Carboxylato)methyl]-*N,N'*-[[6-carboxylato)pyridin-2-yl)methyl]-1-(*p*-benzylisothiocyanato)-1,2-diaminoethane (**16**).



Supplementary Figure S32. ^1H - ^1H COSY NMR full spectrum of [Y(octapa)]- (600 MHz, D_2O , RT).



Supplementary Figure S33. ^1H - ^{13}C HSQC NMR full spectrum of $[\text{Y}(\text{octapa})]^-$ (400 MHz, 100 MHz, D_2O , RT).



Supplementary Figure S34. RP-HPLC chromatograph of [Y(octapa)], mobile phase A: deionized H₂O, B: acetonitrile, gradient 10% to 100% B over 30 minutes, product $t_R = 9.5$ min.