

Synthesis of new DOPO derivatives and investigation of their synergistic effect with APP-PEI on the flame retardancy of epoxy composite

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Supporting Information

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Compound FR1

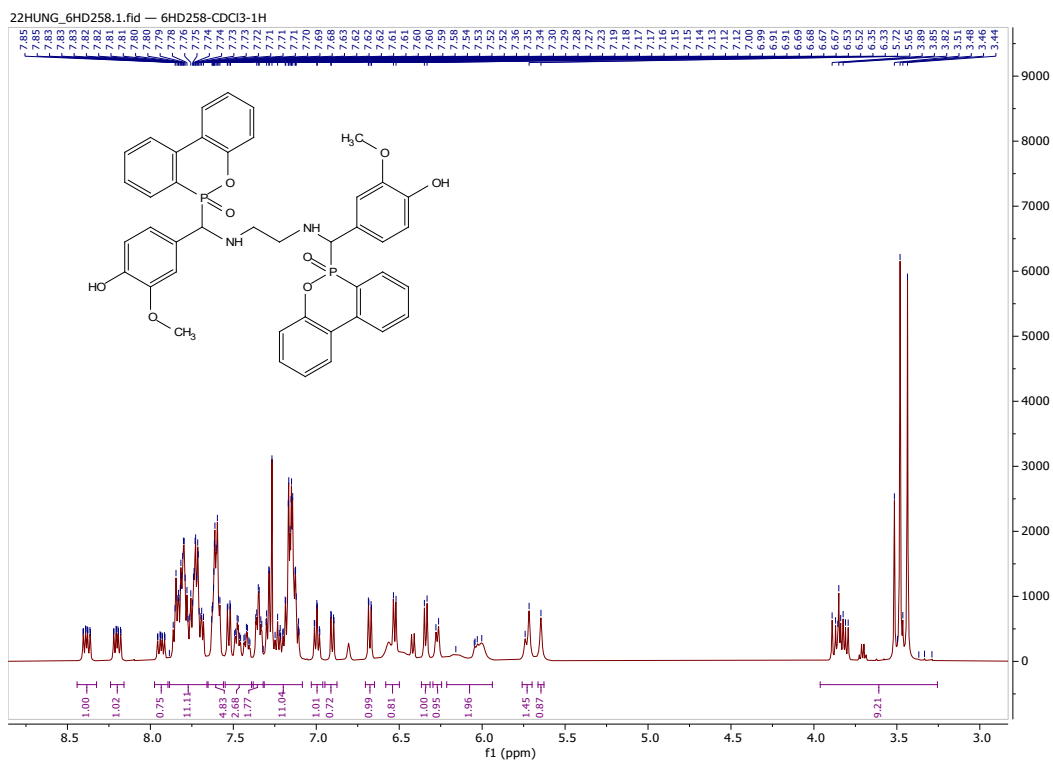


Figure 1: ^1H NMR spectroscopy of compound FR1

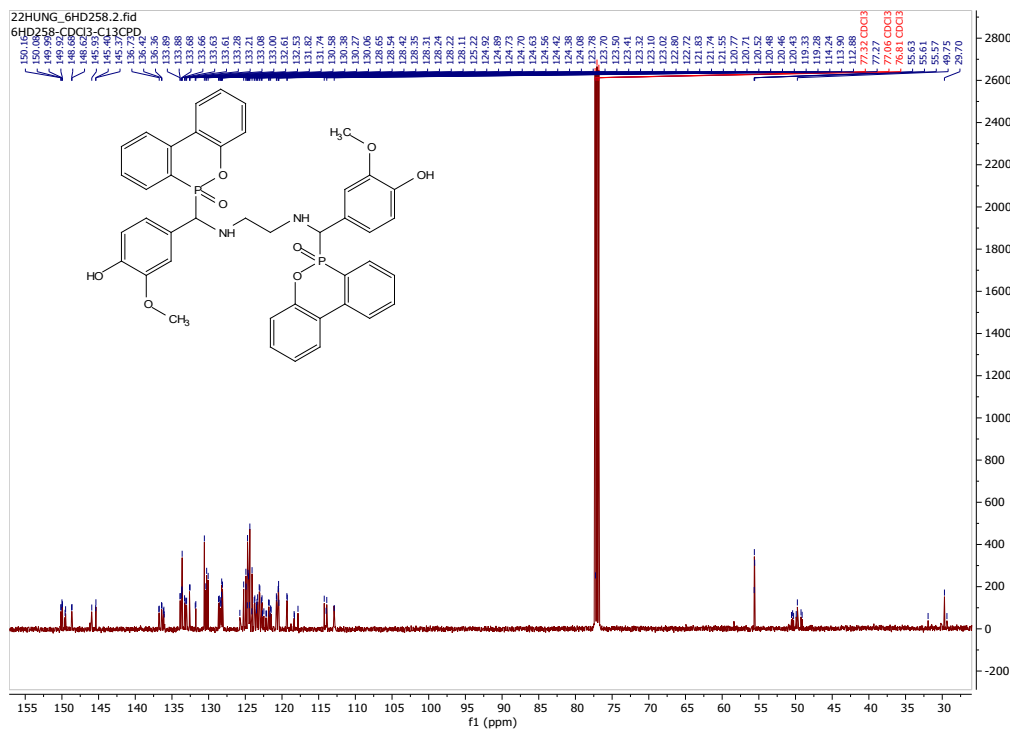


Figure 2: ^{13}C NMR spectroscopy of compound FR1

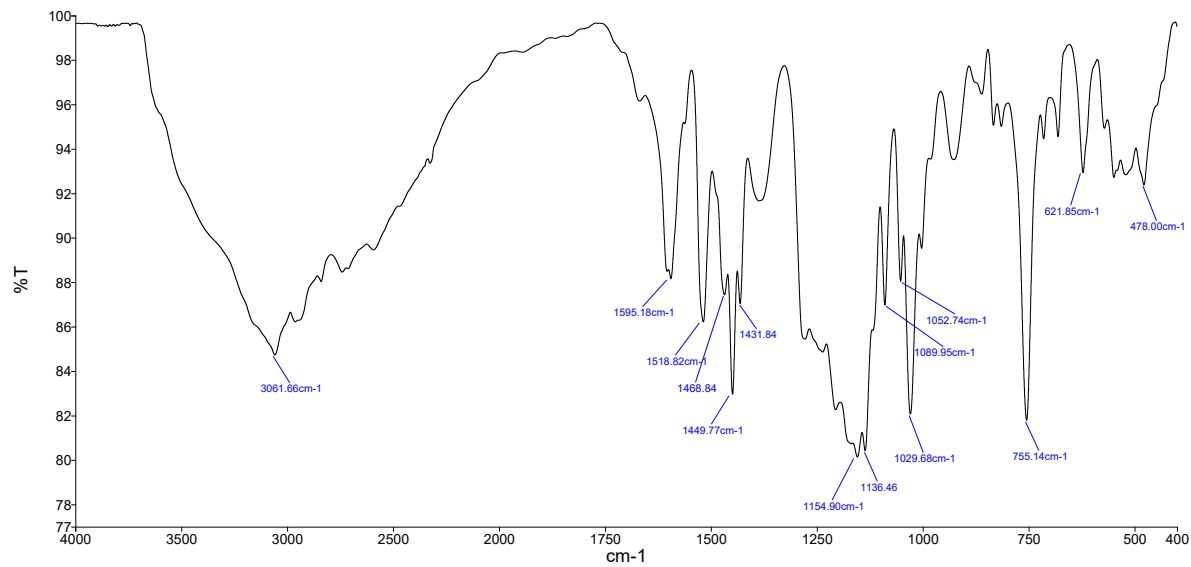


Figure 3: FT-IR spectroscopy of compound **FR1**

Compound FR2

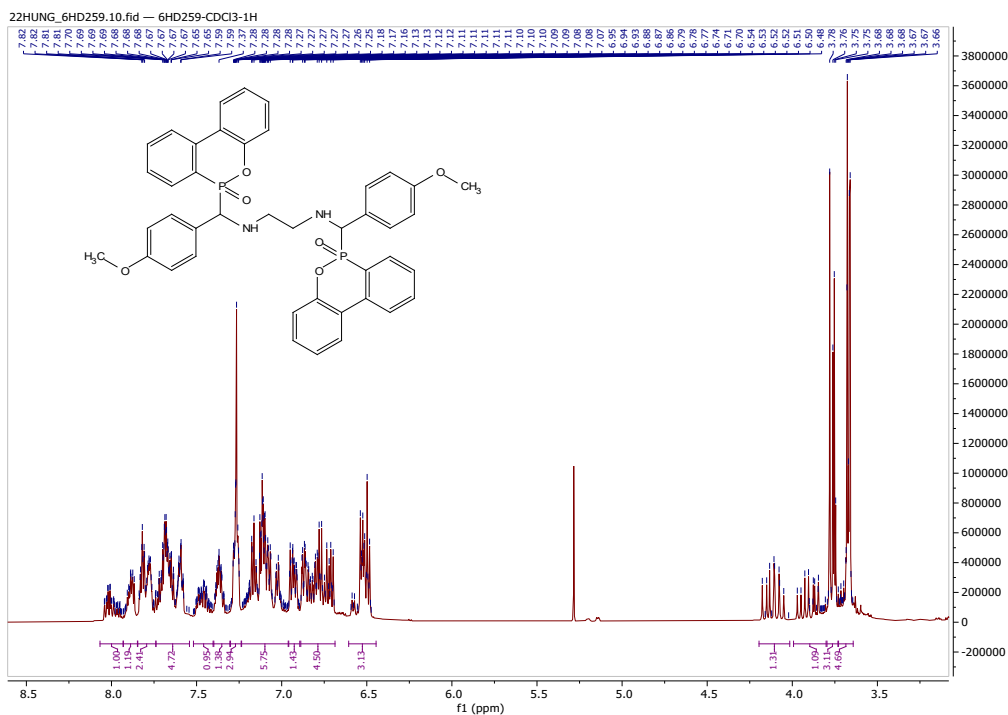


Figure 4: ¹H NMR spectroscopy of compound **FR2**

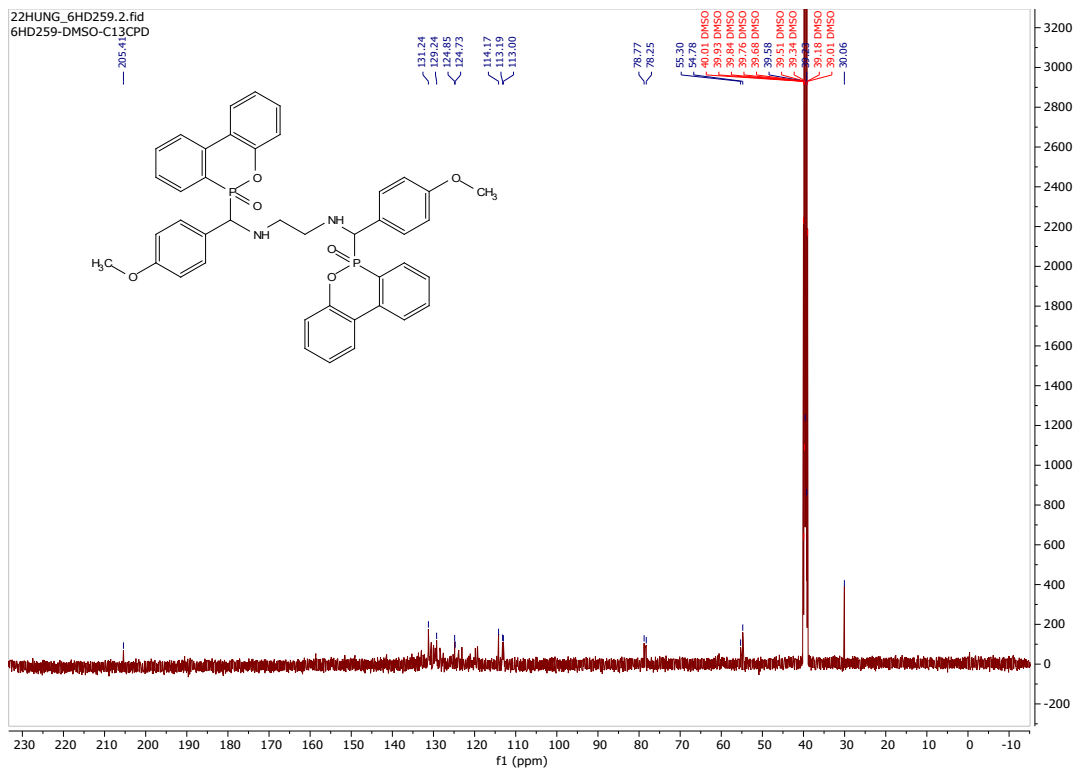


Figure 5: ^{13}C NMR spectroscopy of compound **FR2**

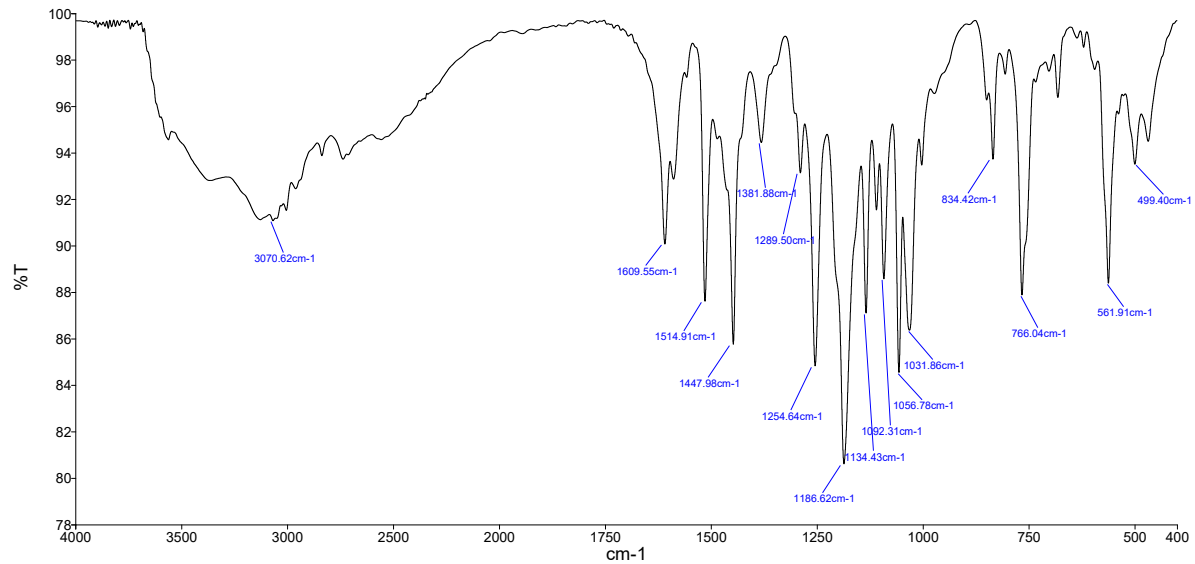


Figure 6: FT-IR spectroscopy of compound **FR2**

Compound FR3

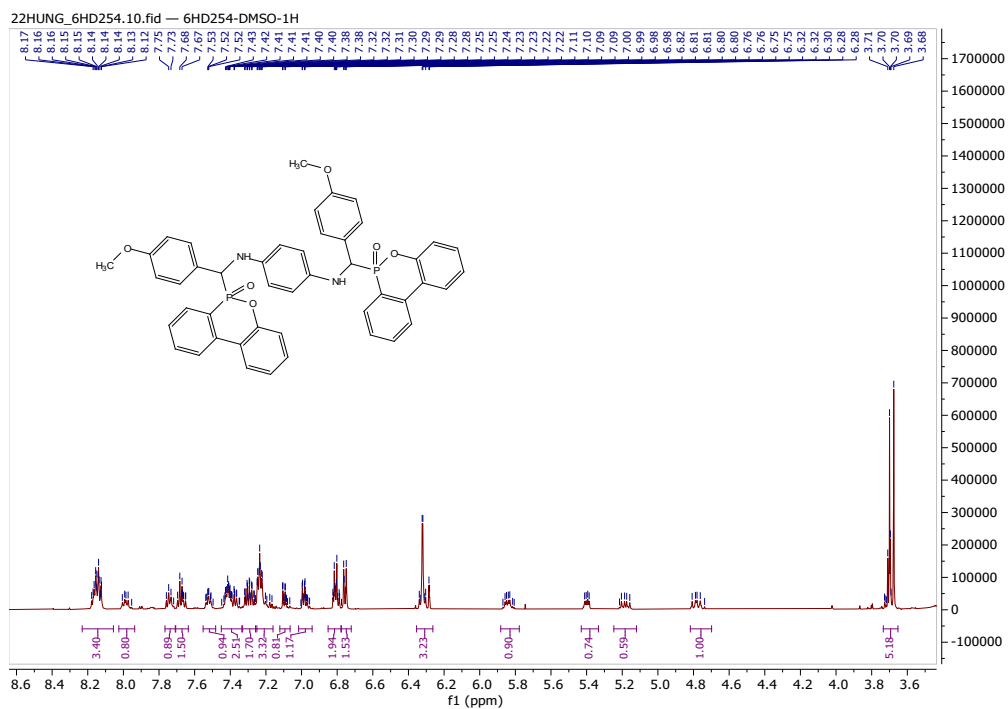


Figure 7: ^1H NMR spectroscopy of compound FR3

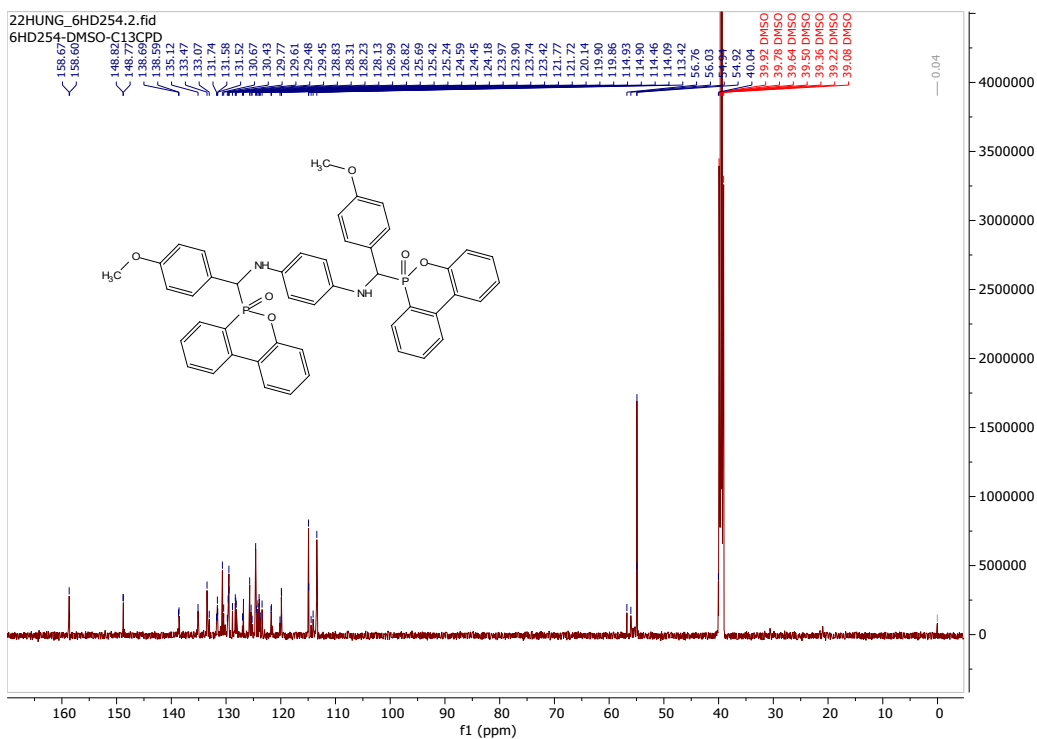


Figure 8: ^{13}C NMR spectroscopy of compound FR3

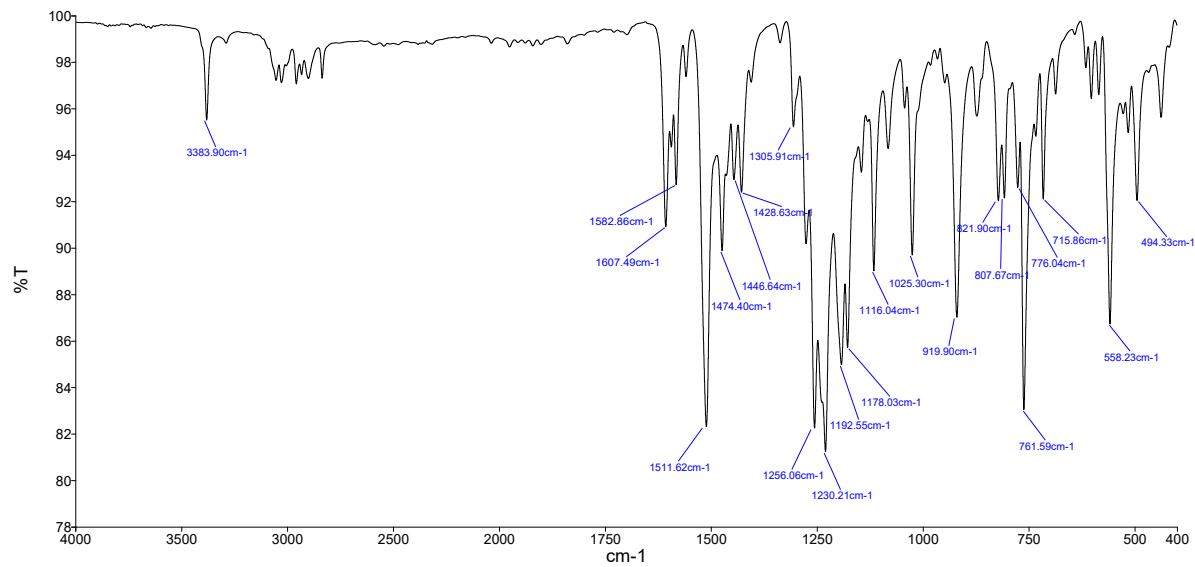


Figure 9: FT-IR spectroscopy of compound **FR3**

Compound FR4

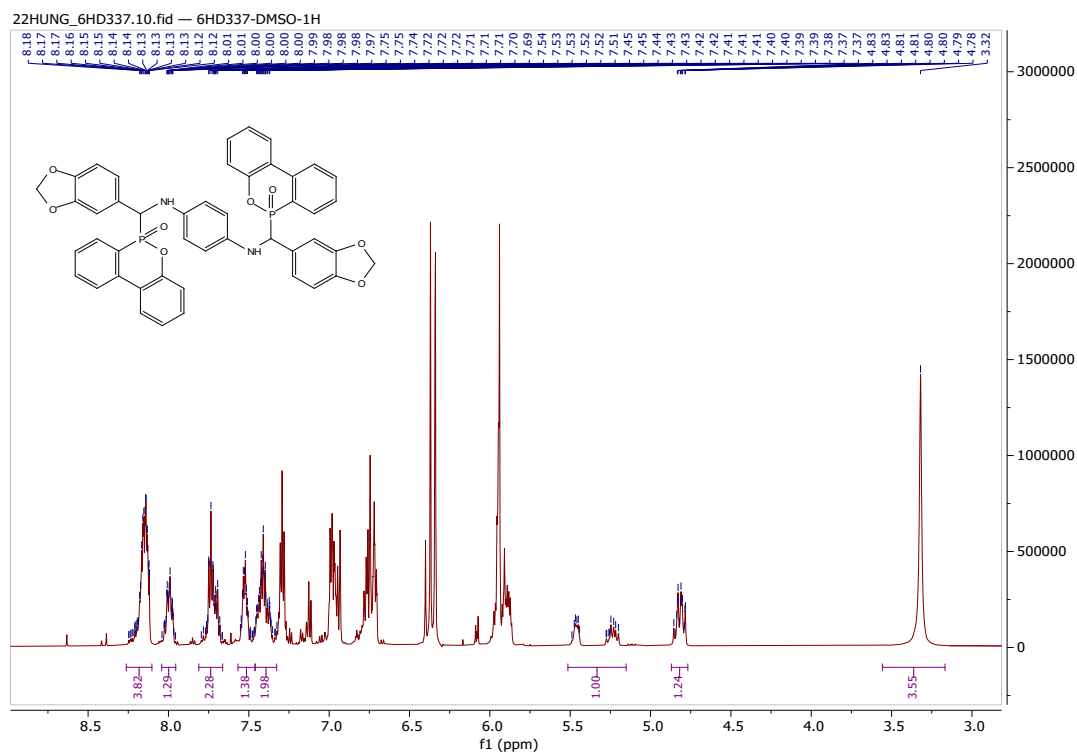


Figure 10: ¹H NMR spectroscopy of compound **FR4**

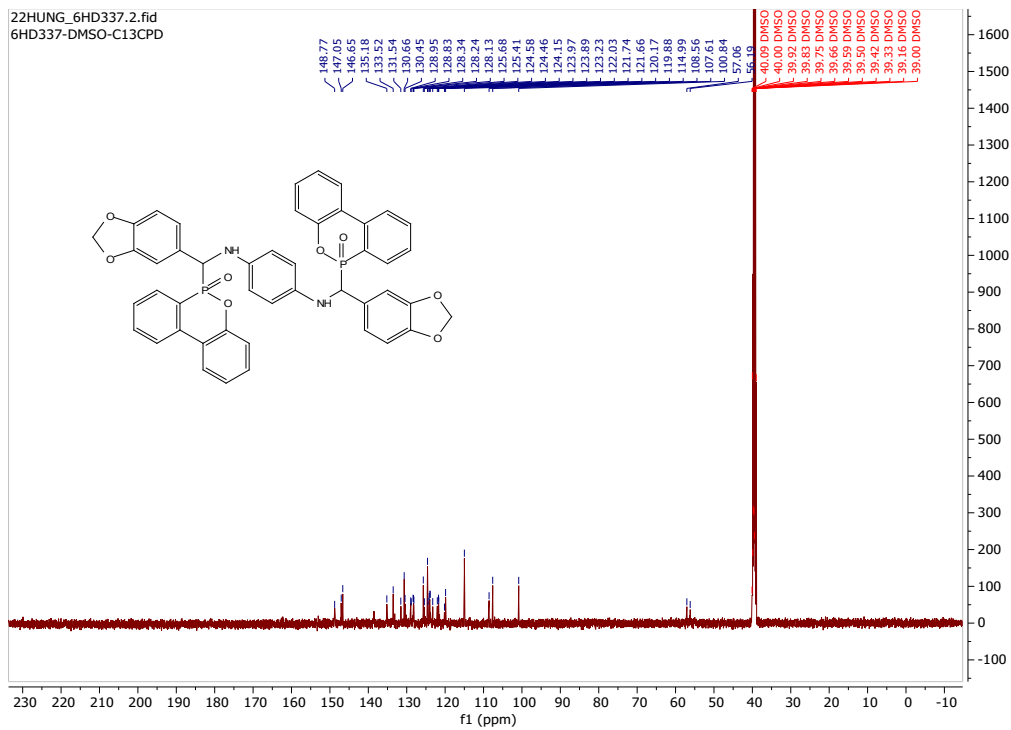


Figure 11: ^{13}C NMR spectroscopy of compound **FR4**

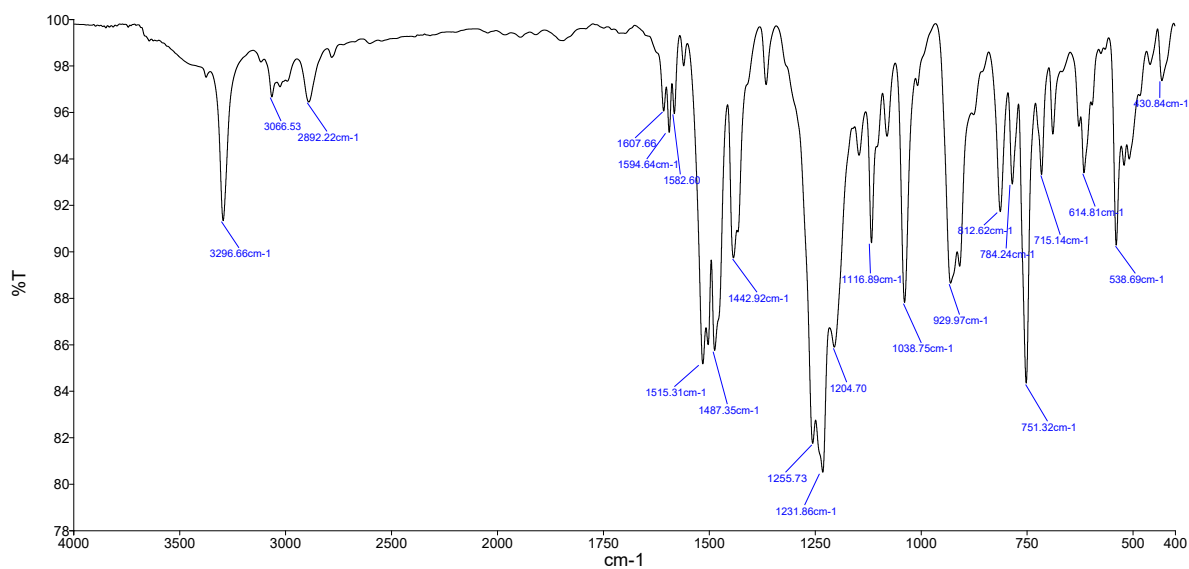


Figure 12: FT-IR spectroscopy of compound **FR4**

Compound FR5

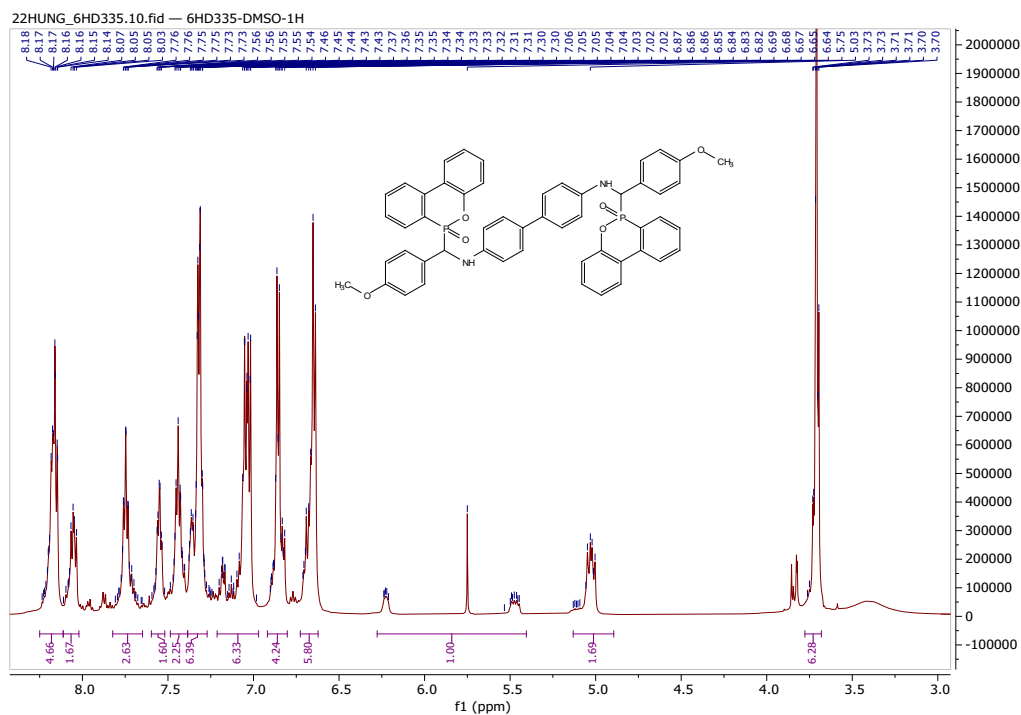


Figure 13: ^1H NMR spectroscopy of compound **FR5**

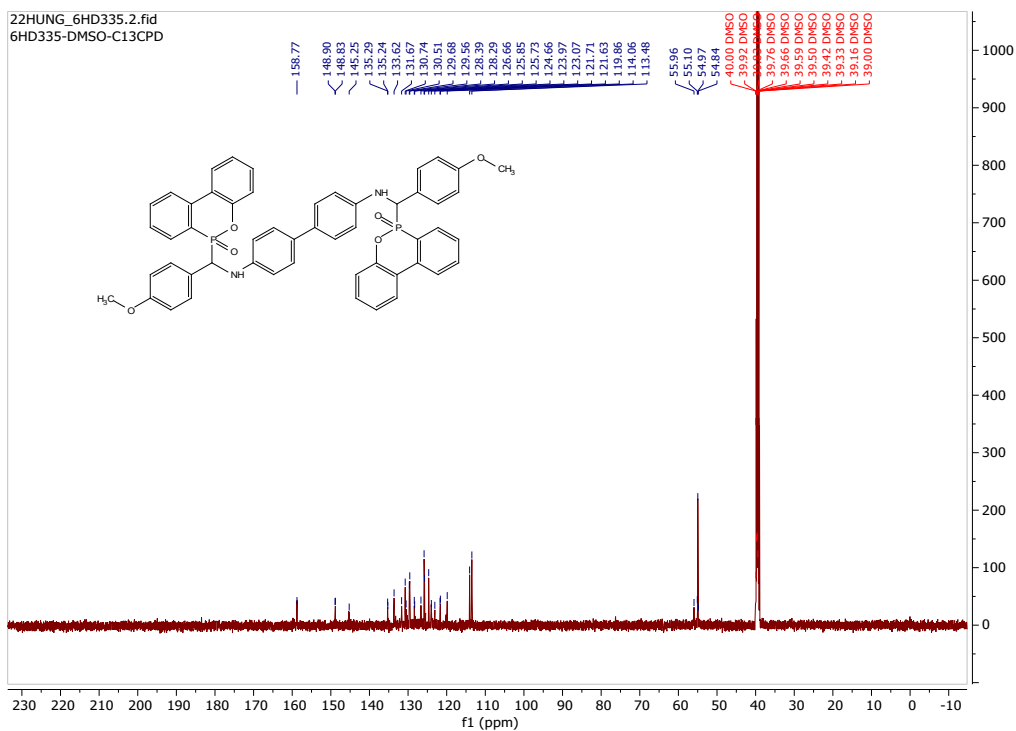


Figure 14: ^{13}C NMR spectroscopy of compound **FR5**

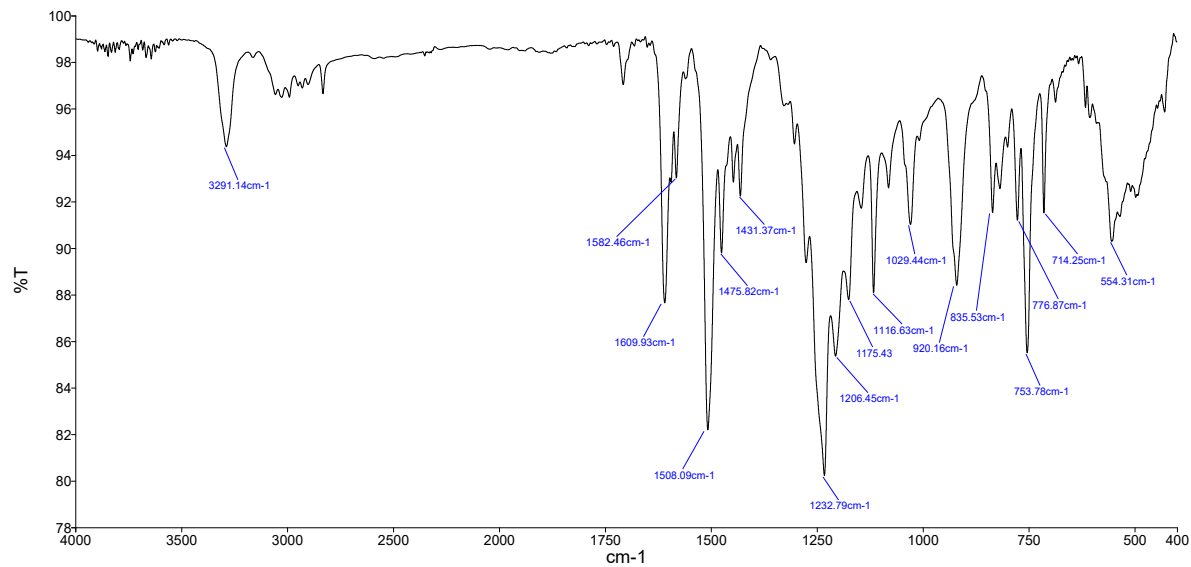


Figure 15: FT-IR spectroscopy of compound **FR5**

Compound FR6

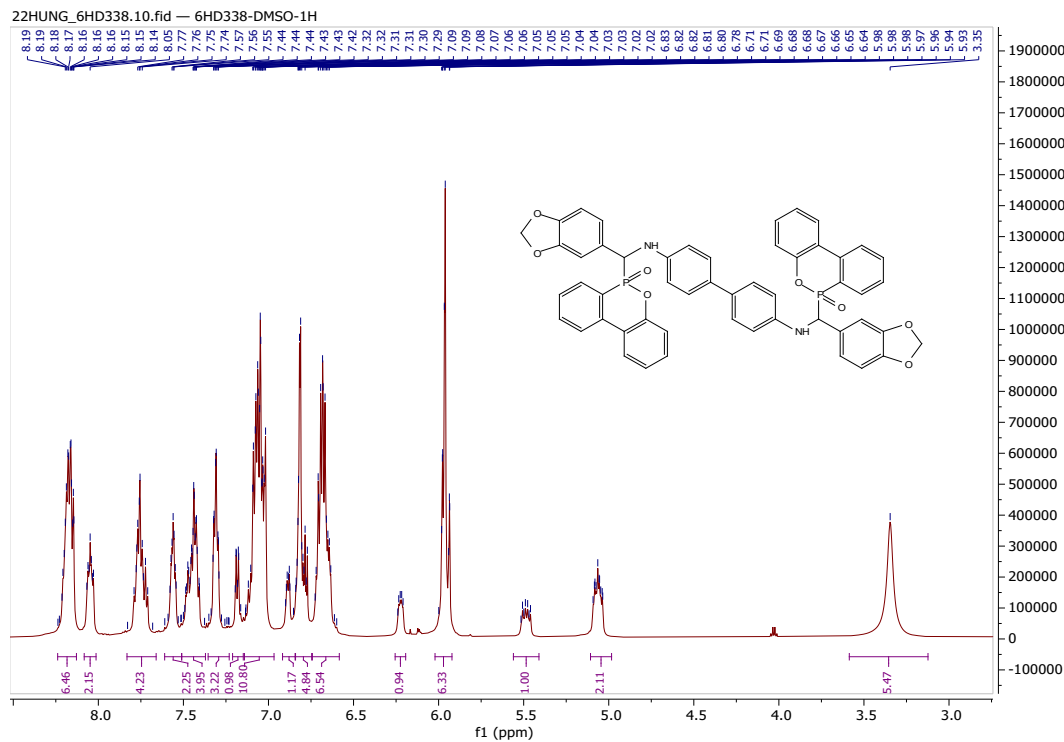


Figure 16: ¹H NMR spectroscopy of compound **FR6**

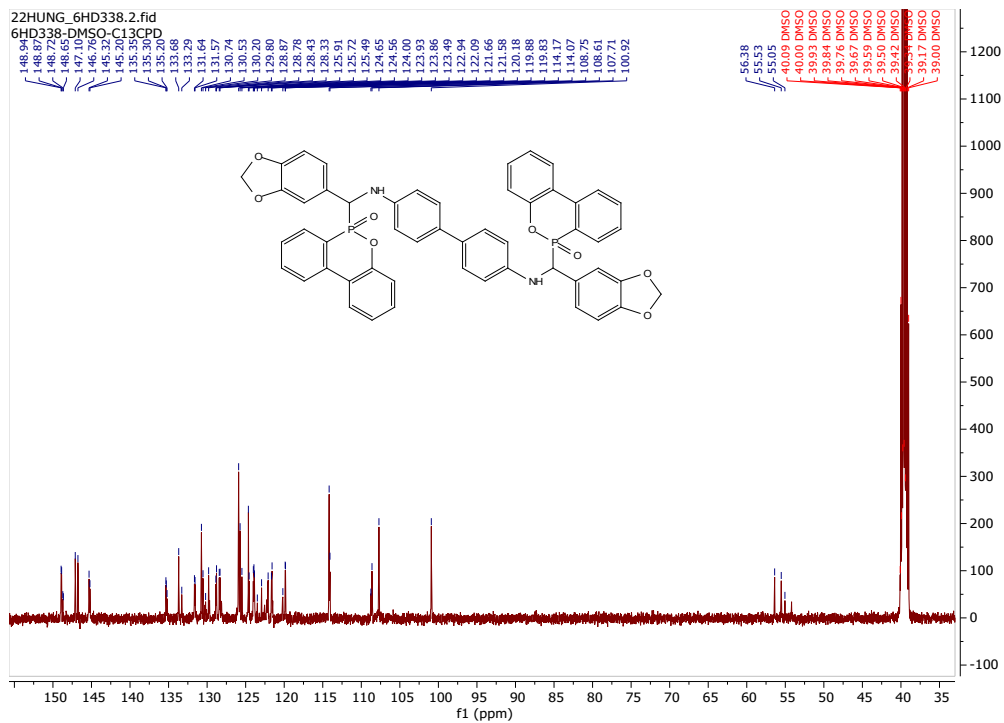


Figure 17: ^{13}C NMR spectroscopy of compound **FR6**

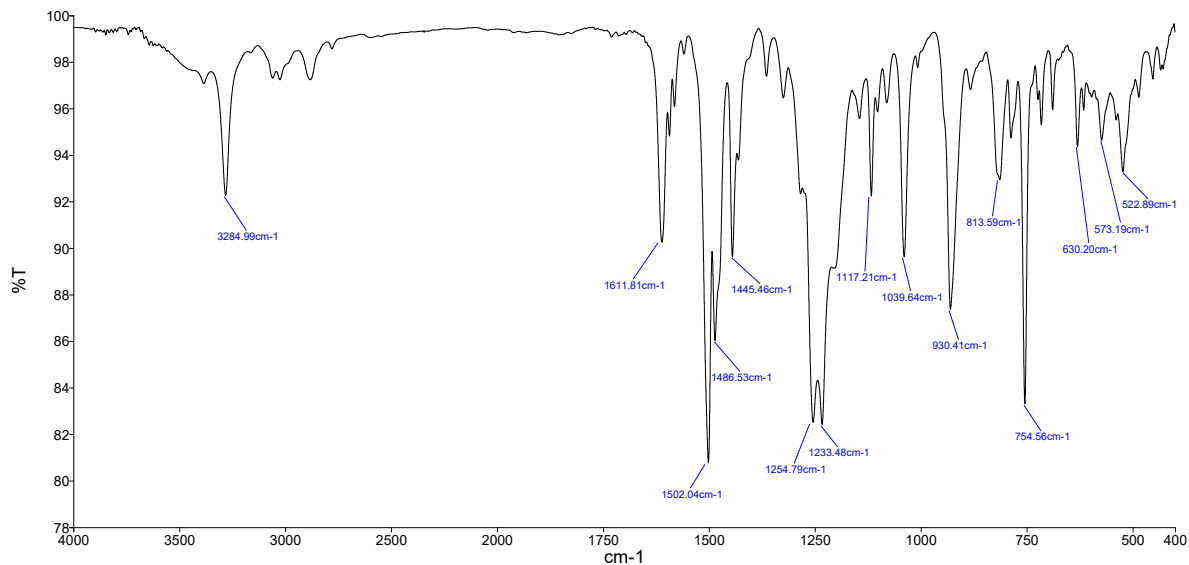


Figure 18: FT-IR spectroscopy of compound **FR6**

Compound FR7

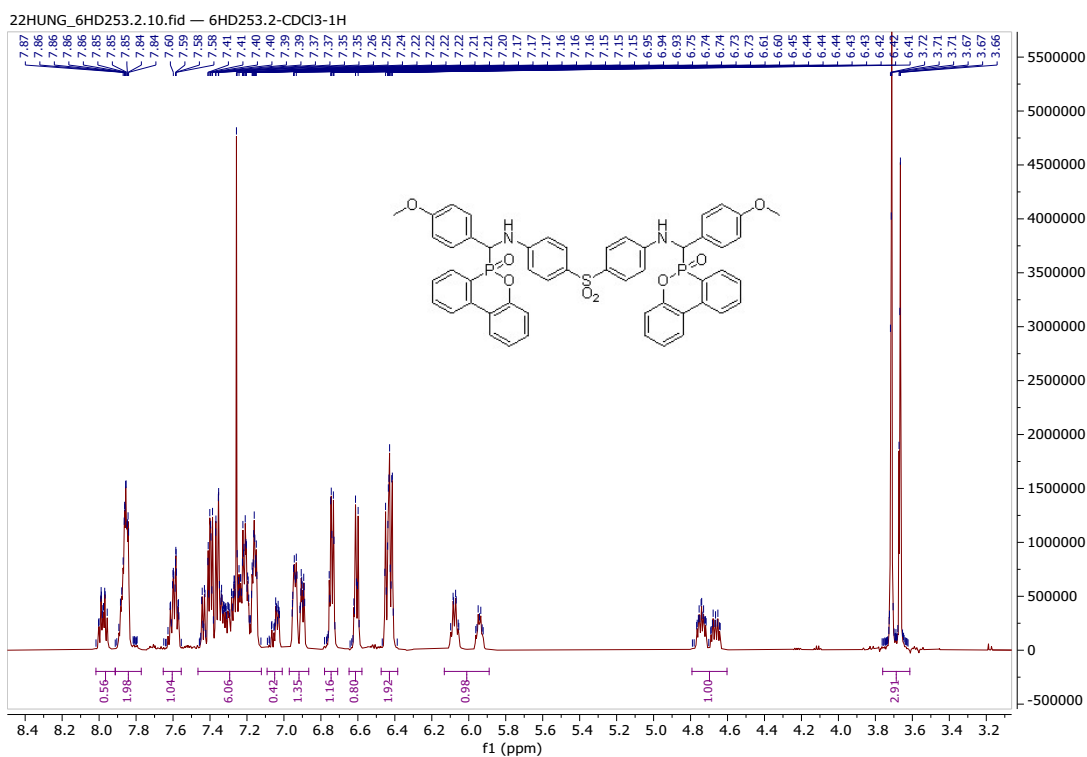


Figure 19: ¹H NMR spectroscopy of compound FR7

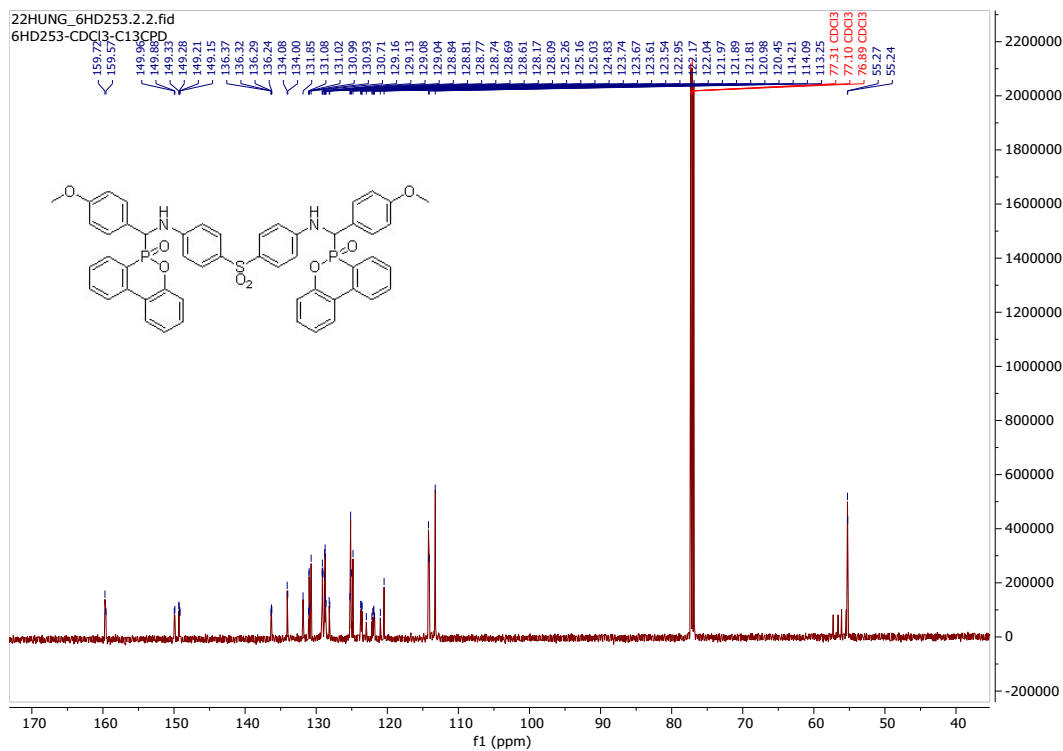


Figure 20: ¹³C NMR spectroscopy of compound FR7

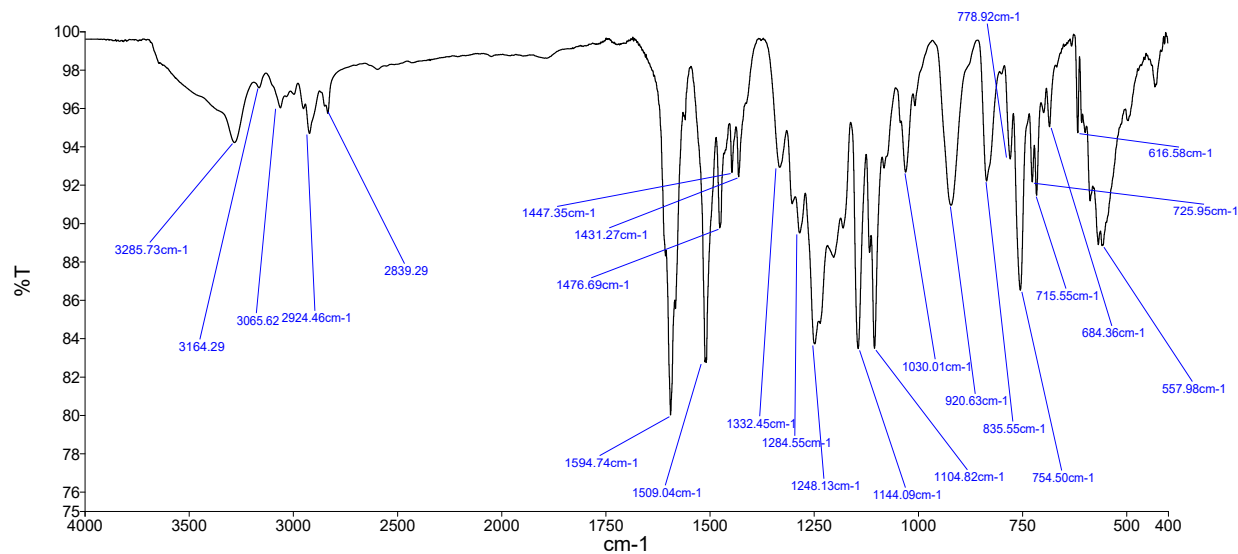


Figure 21: FT-IR spectroscopy of compound **FR7**

Compound FR8

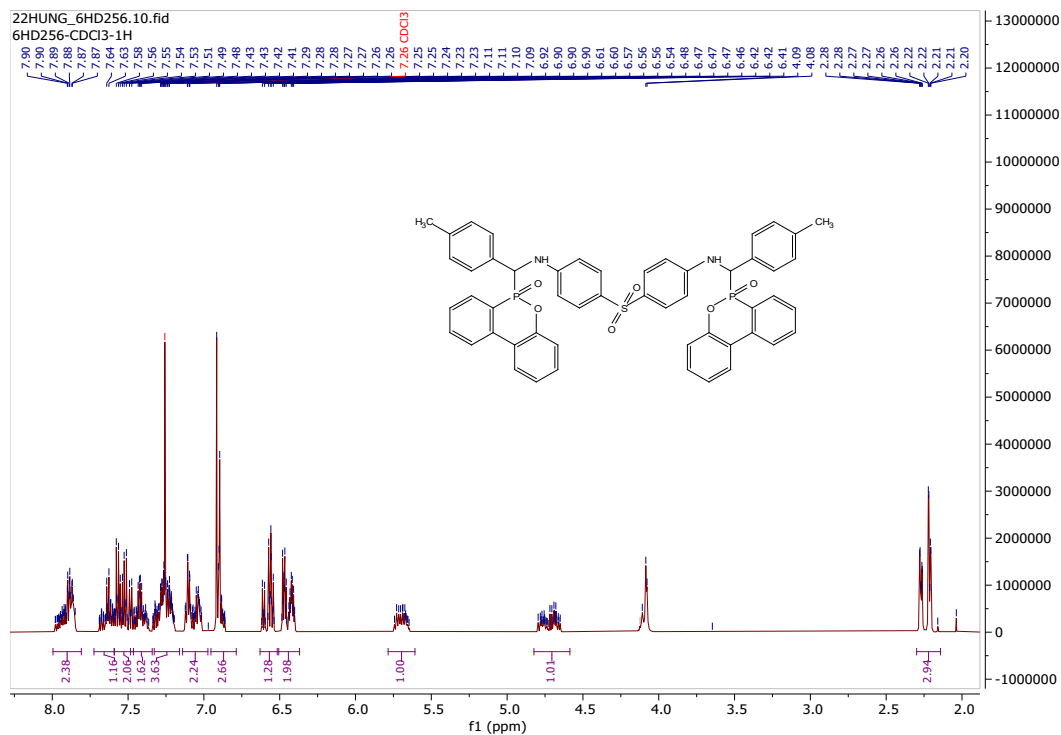


Figure 22: ¹H NMR spectroscopy of compound **FR8**

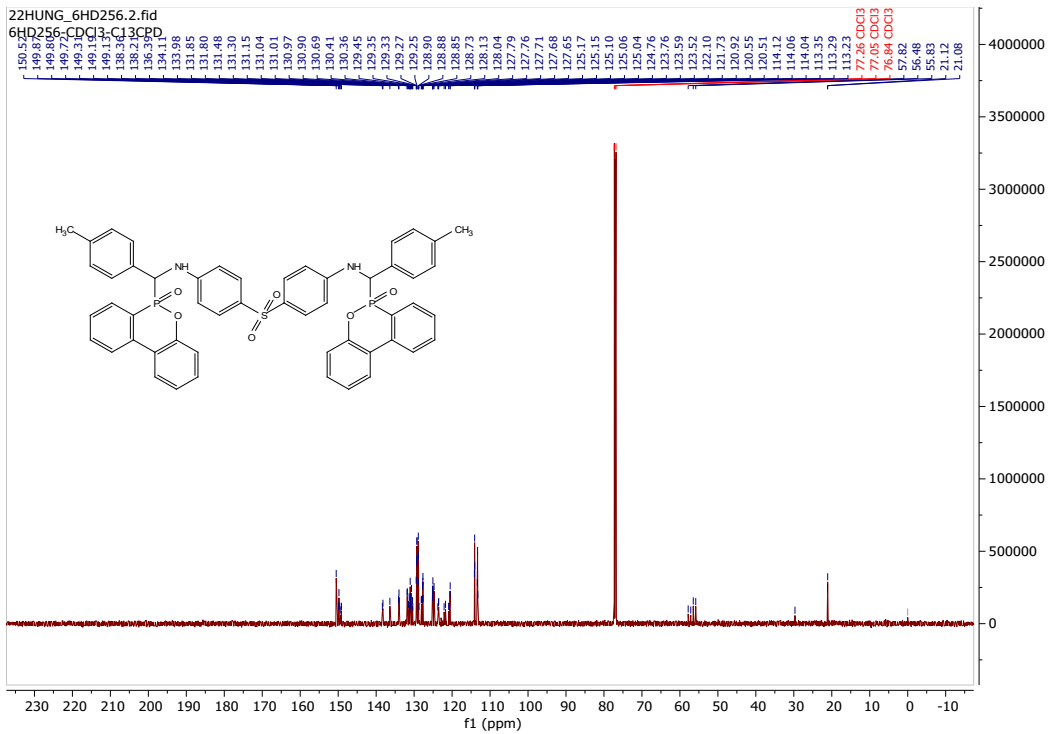


Figure 23: ^{13}C NMR spectroscopy of compound **FR8**

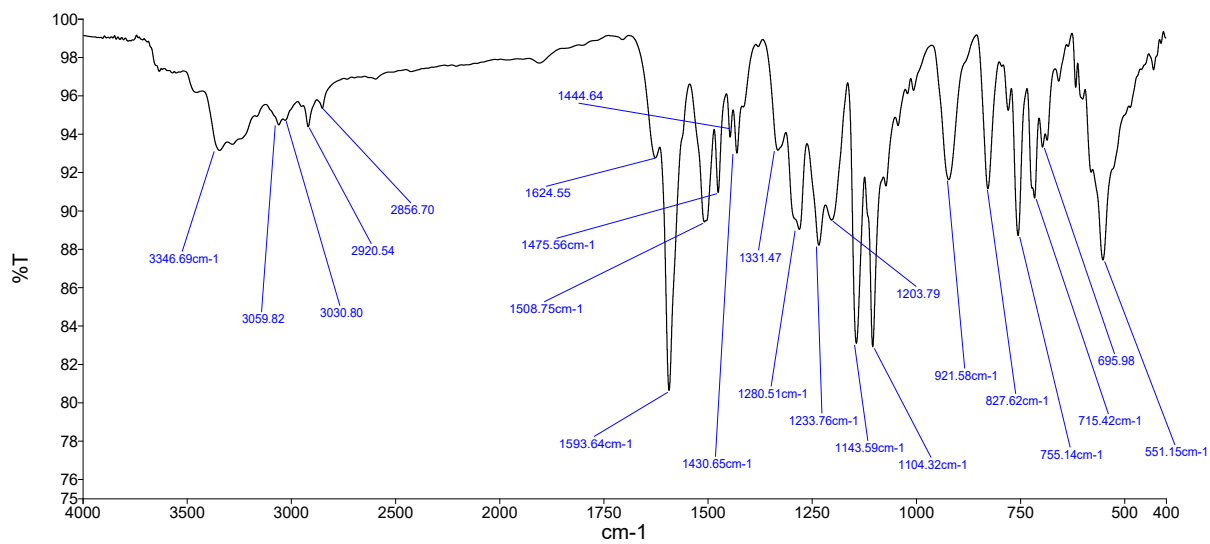


Figure 24: FT-IR spectroscopy of compound **FR8**

Compound FR9

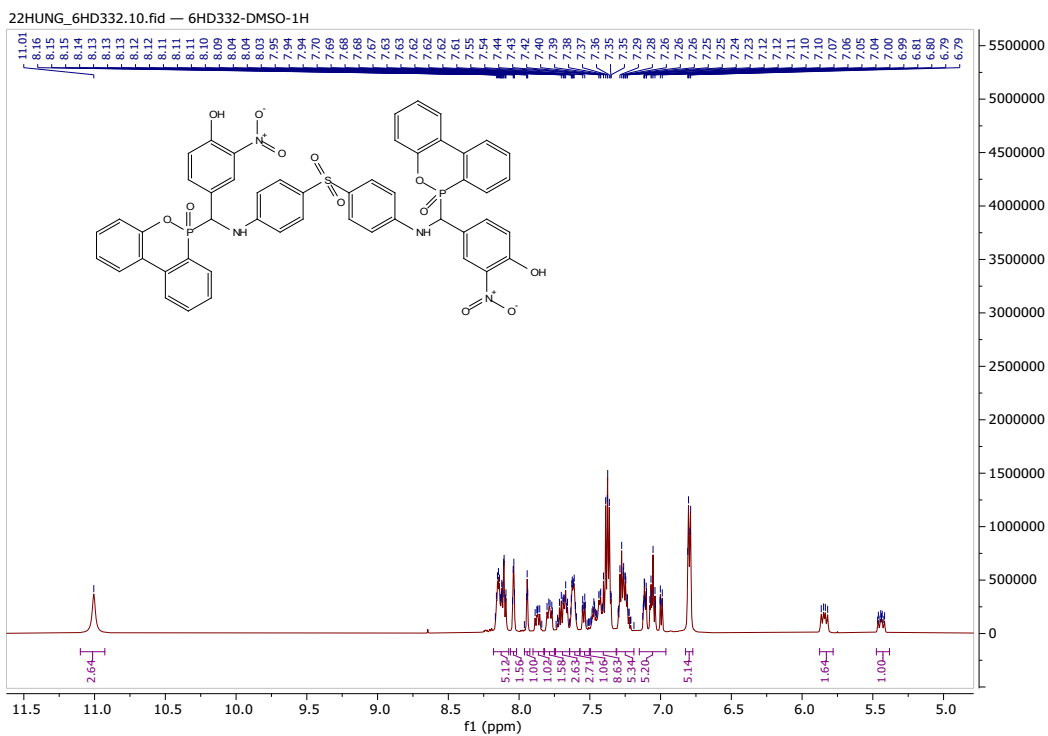


Figure 25: ^1H NMR spectroscopy of compound FR9

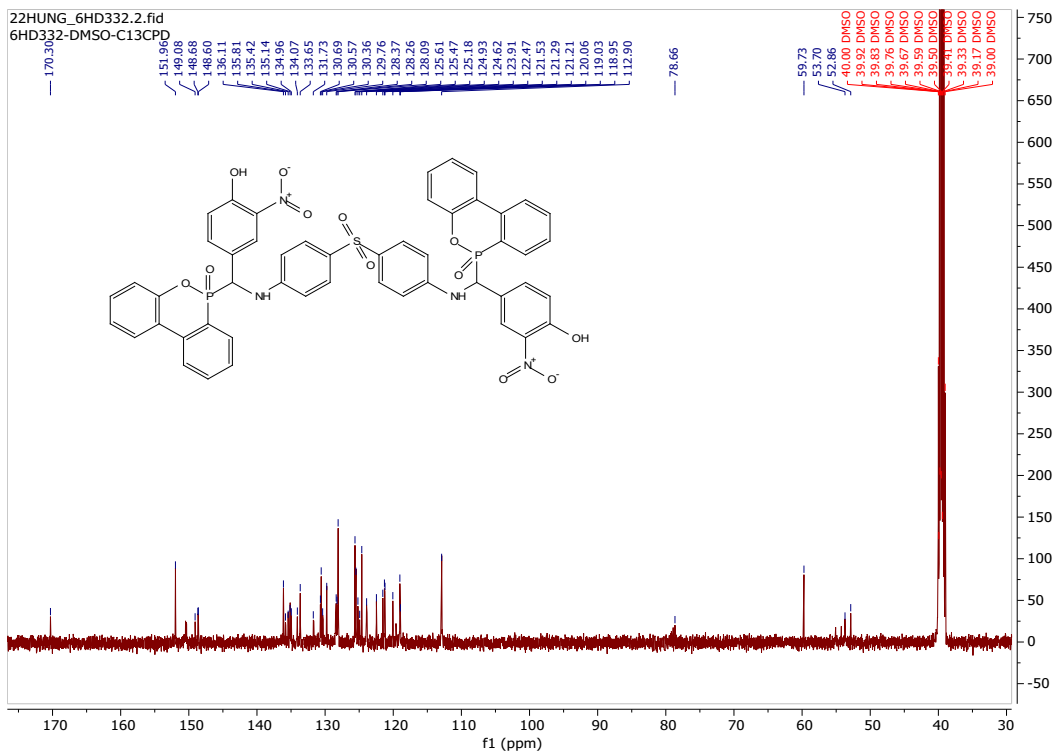


Figure 26: ^{13}C NMR spectroscopy of compound FR9

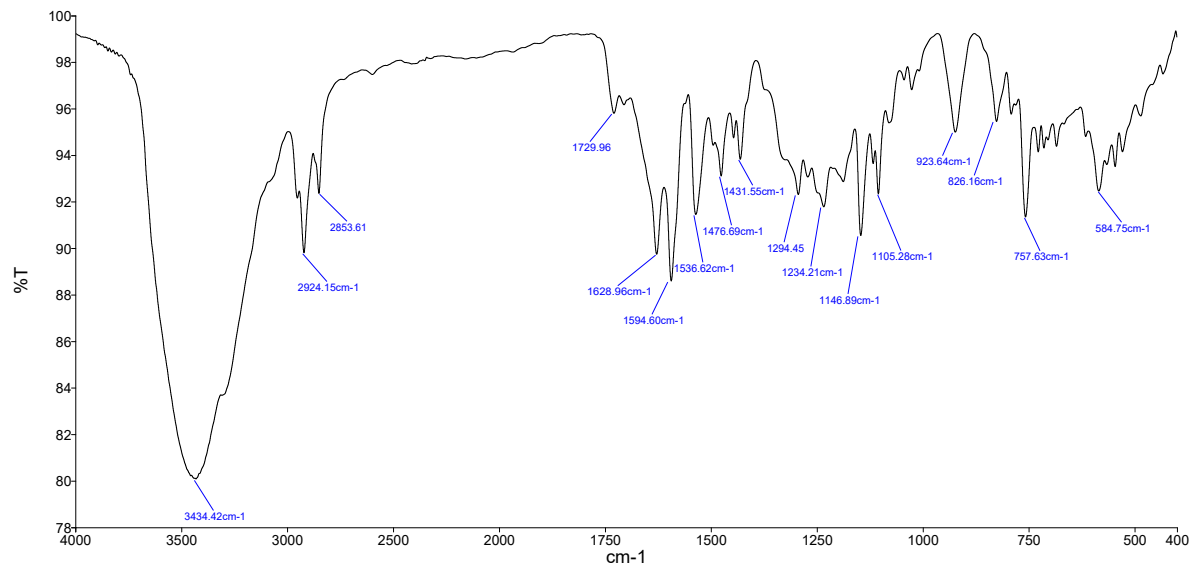


Figure 27: FT-IR spectroscopy of compound **FR9**

Compound **FR10**

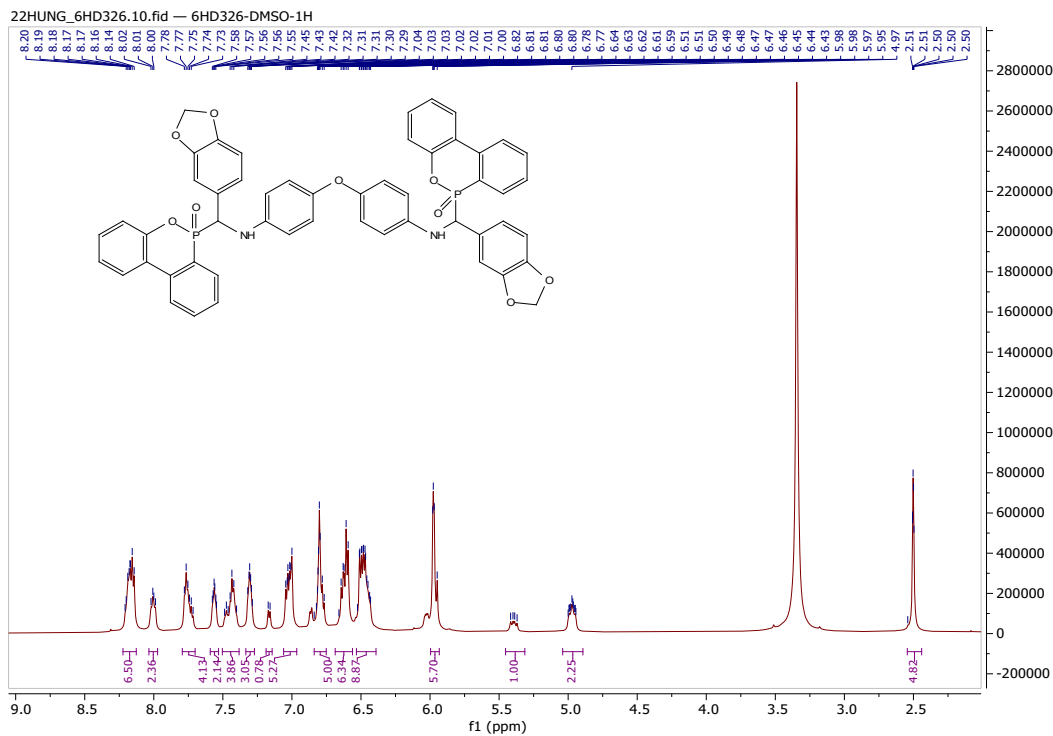


Figure 28: ¹H NMR spectroscopy of compound **FR10**

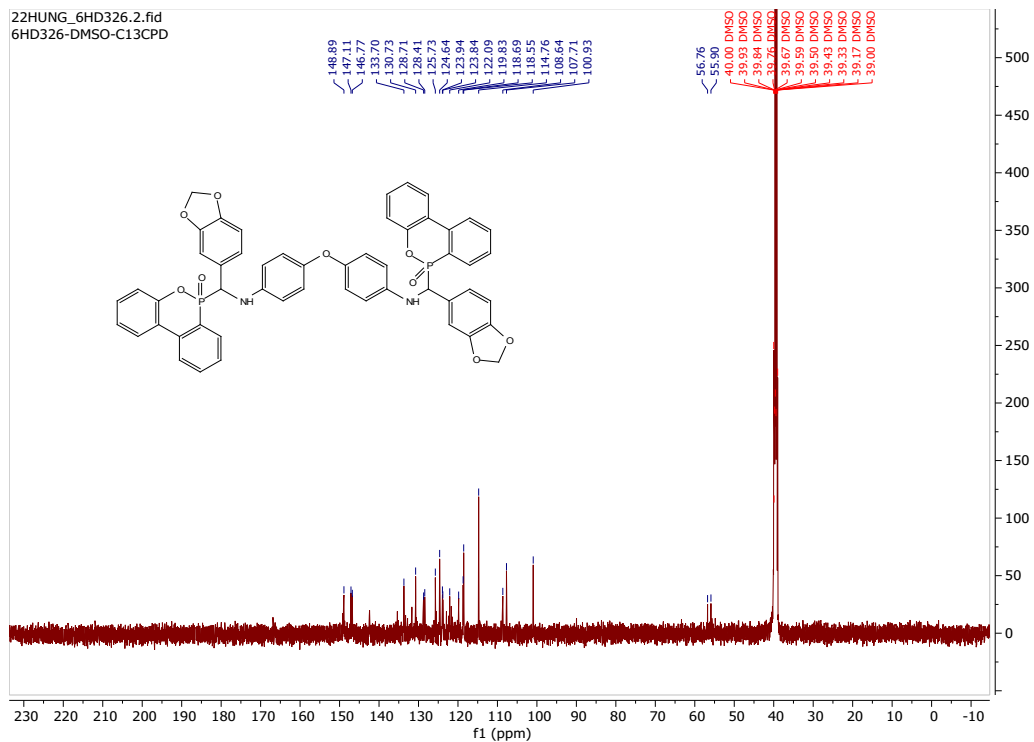


Figure 29: ^{13}C NMR spectroscopy of compound **FR10**

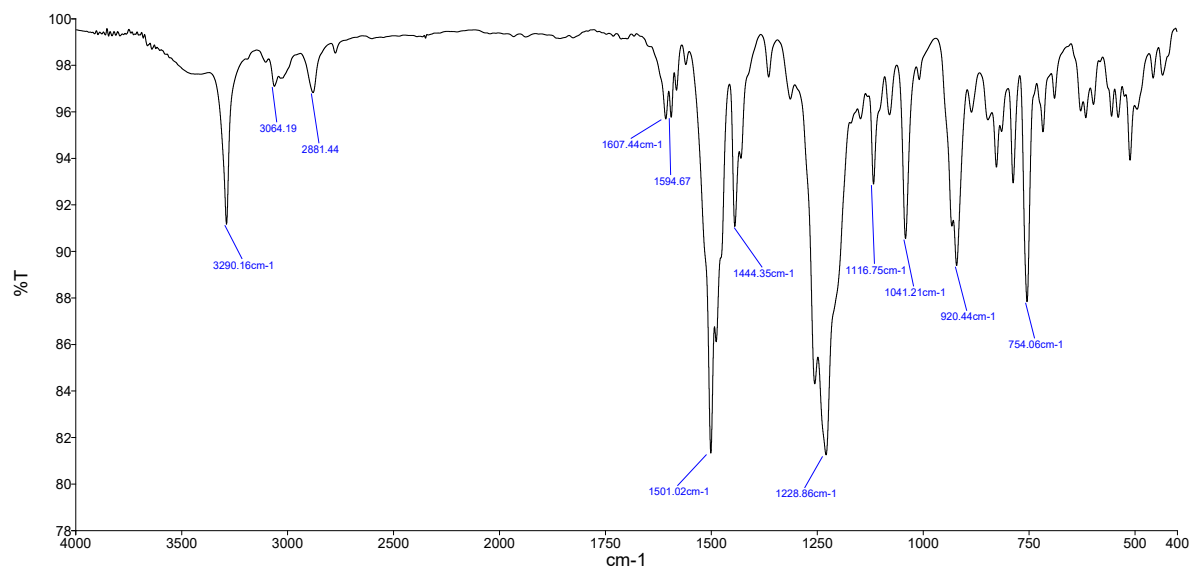


Figure 30: FT-IR spectroscopy of compound **FR10**

Compound FR11

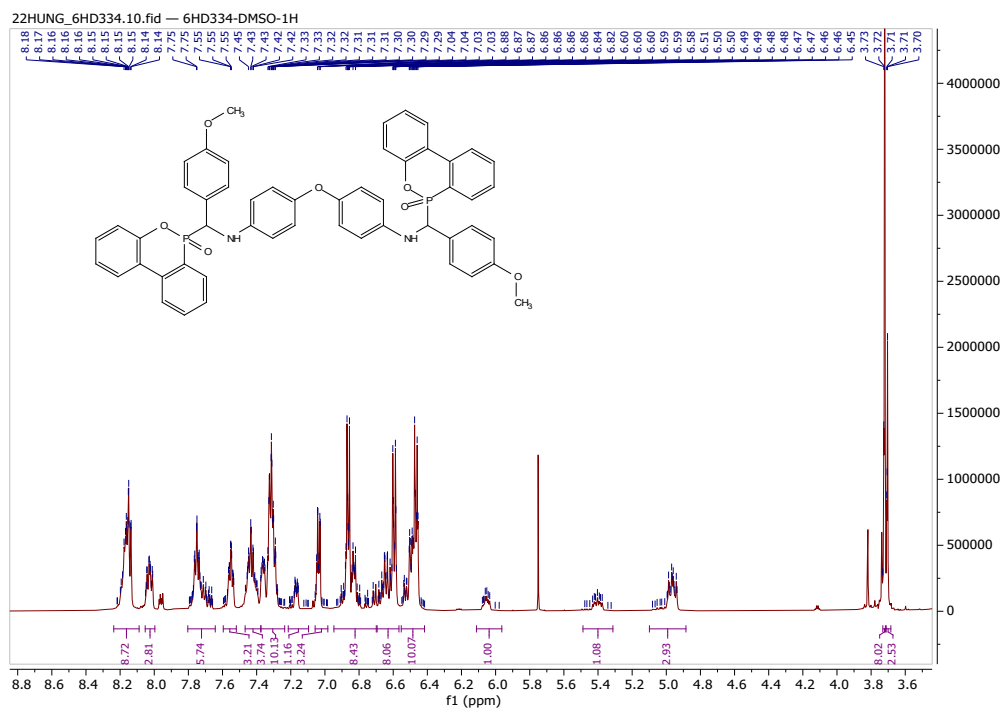


Figure 31: ¹H NMR spectroscopy of compound FR11

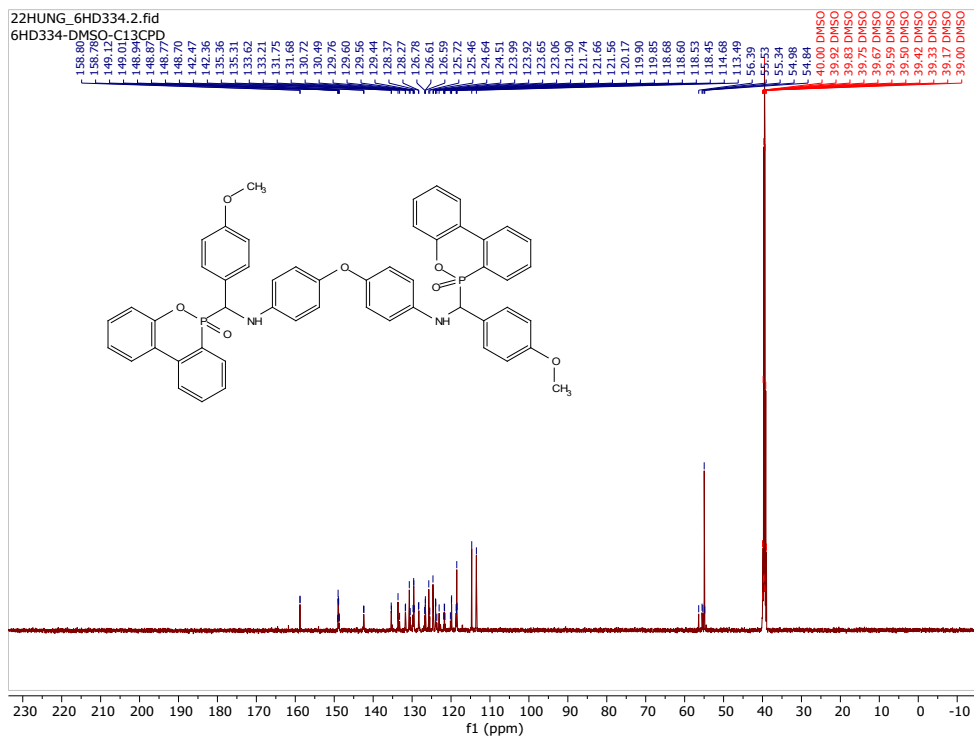


Figure 32: ¹³C NMR spectroscopy of compound FR11

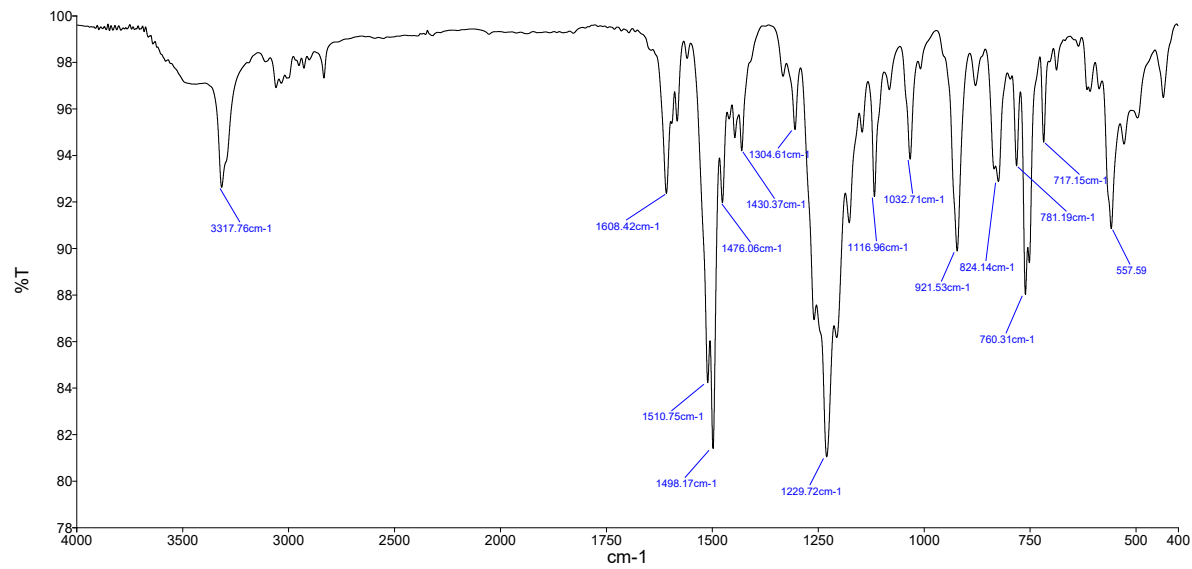


Figure 33: FT-IR spectroscopy of compound **FR11**

Compound **FR12**

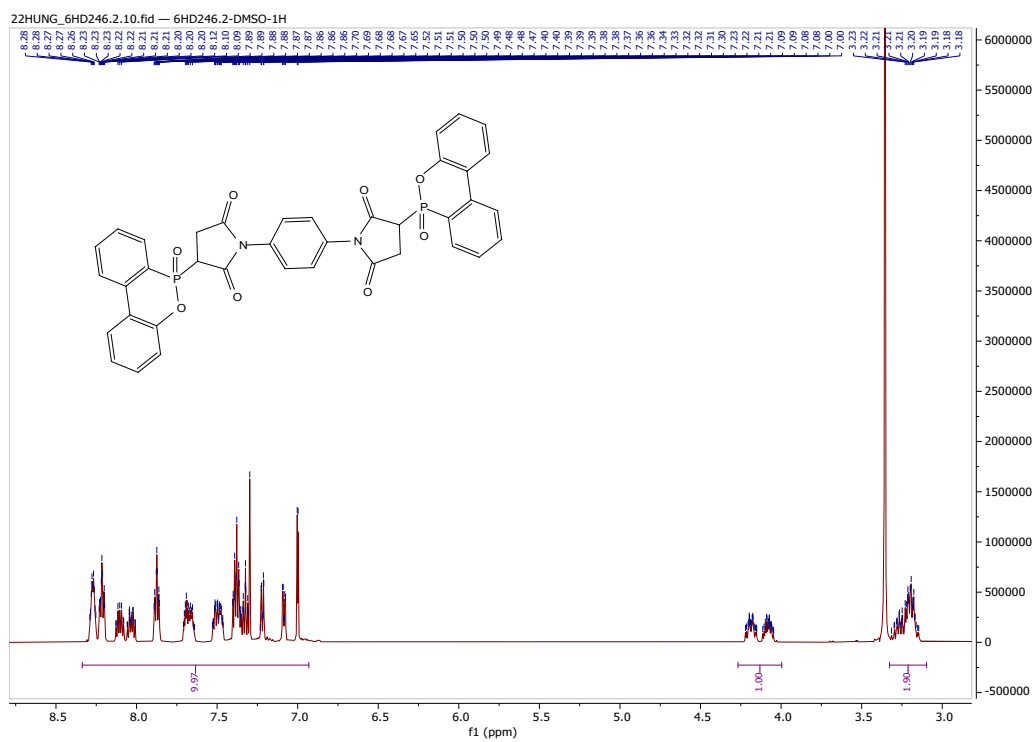


Figure 34: ^1H NMR spectroscopy of compound **FR12**

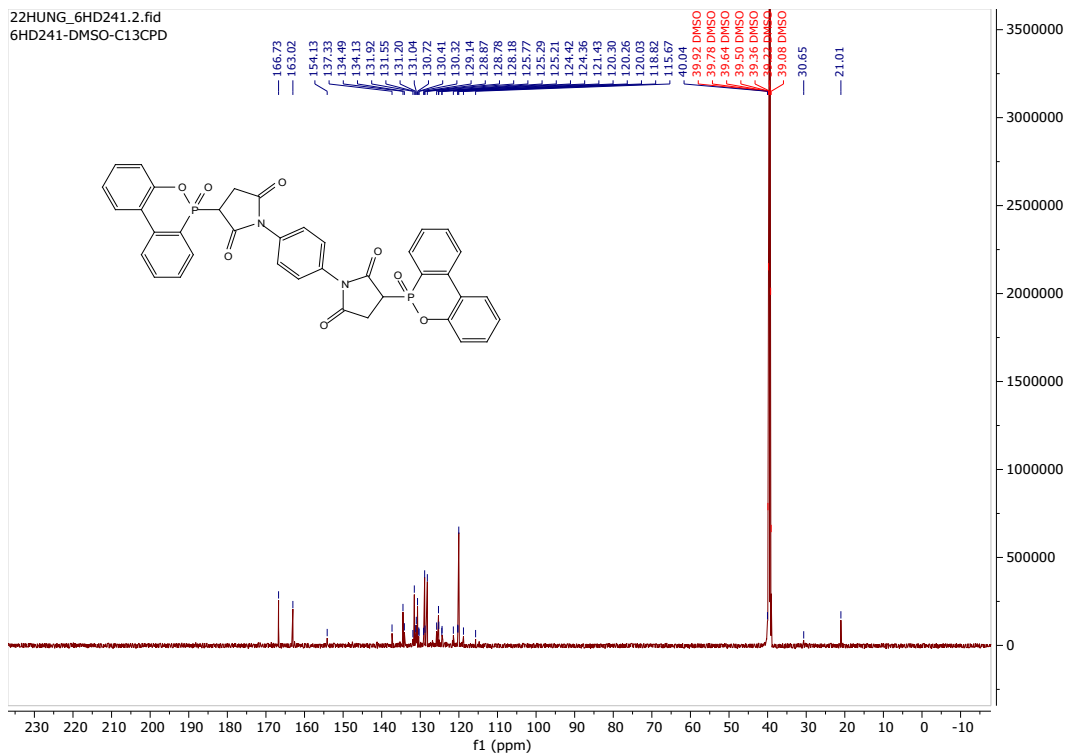


Figure 35: ^{13}C NMR spectroscopy of compound **FR12**

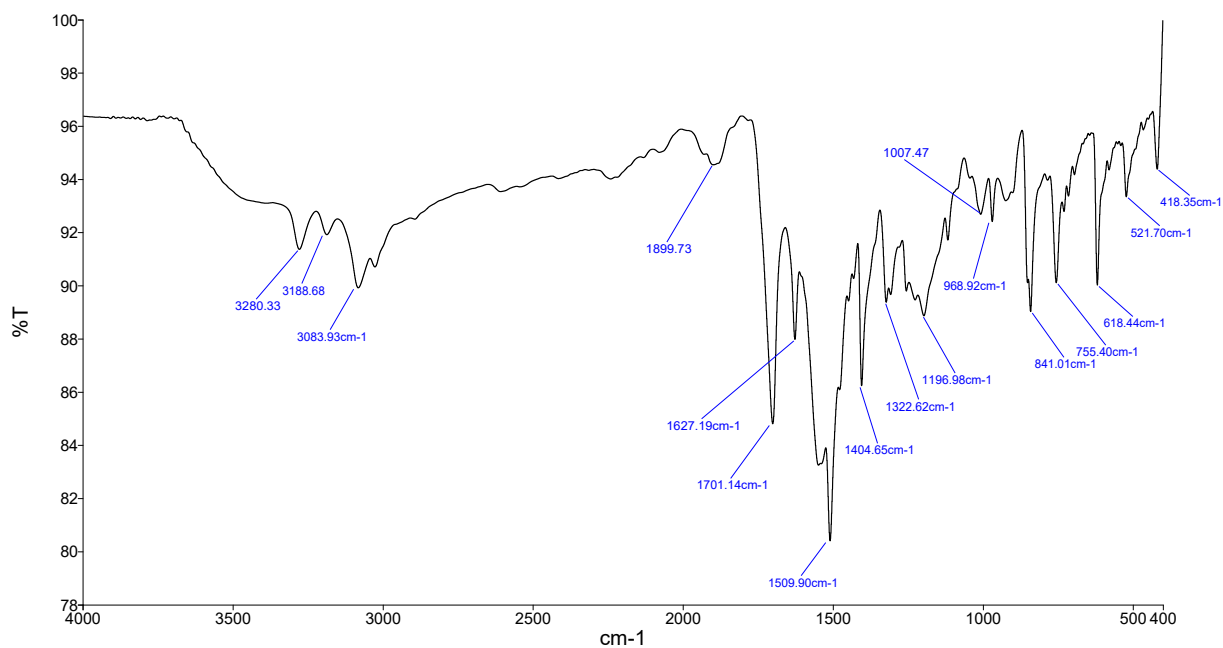


Figure 36: FT-IR spectroscopy of compound **FR12**

Compound FR13

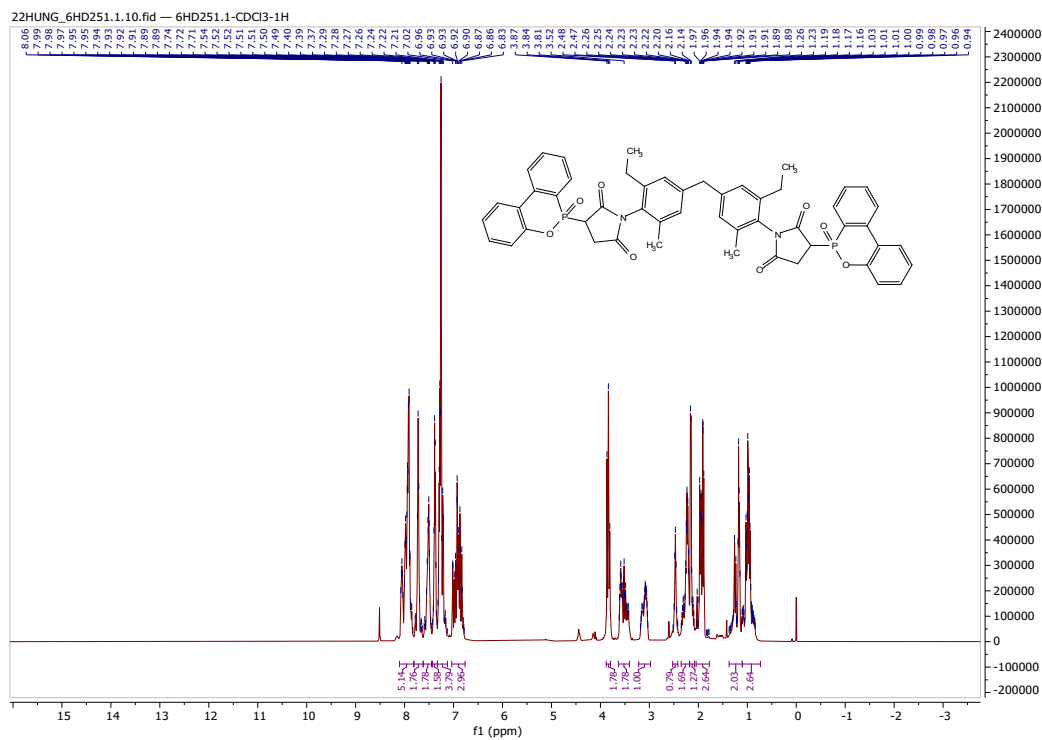


Figure 37: ^1H NMR spectroscopy of compound FR13

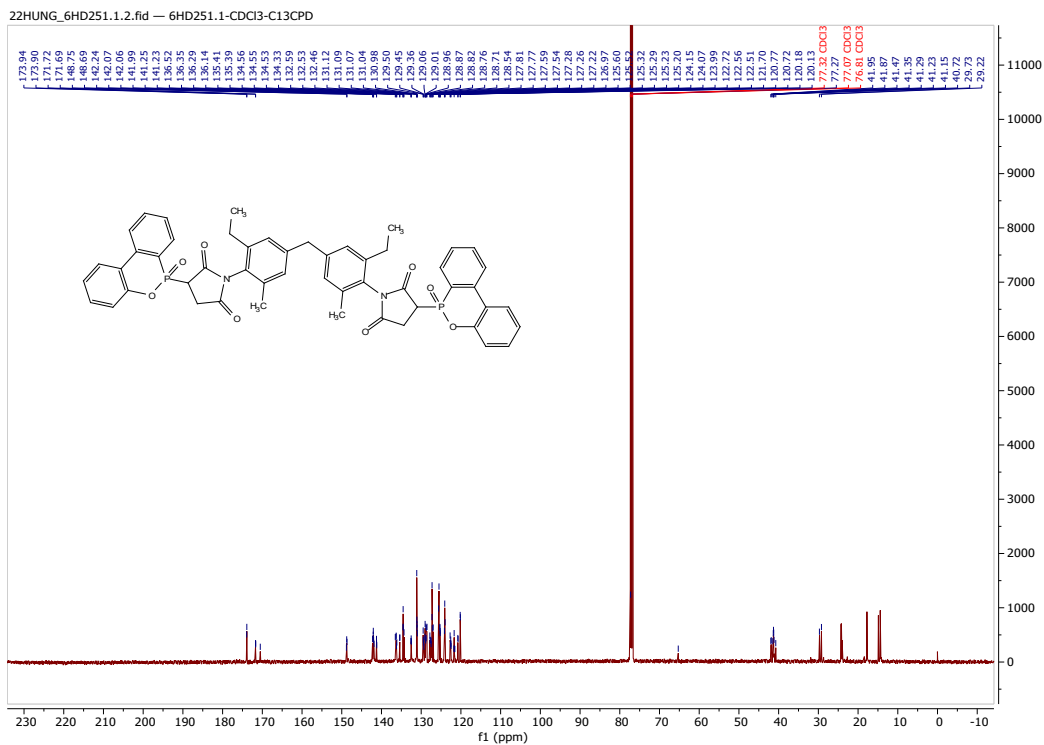


Figure 38: ^{13}C NMR spectroscopy of compound FR13

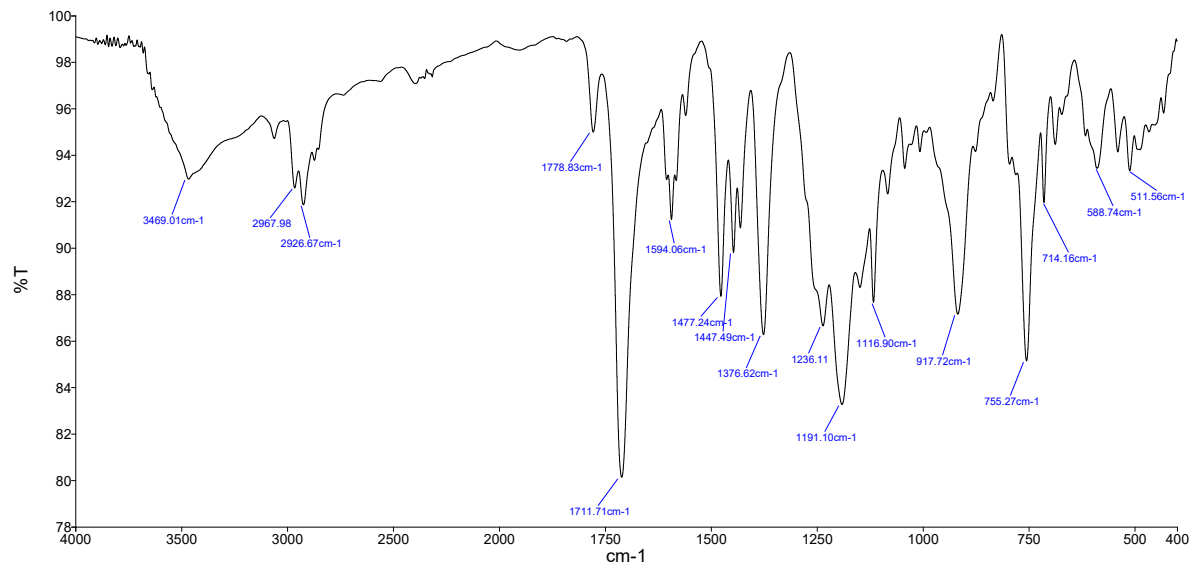


Figure 39: FT-IR spectroscopy of compound **FR13**

Compound FR14

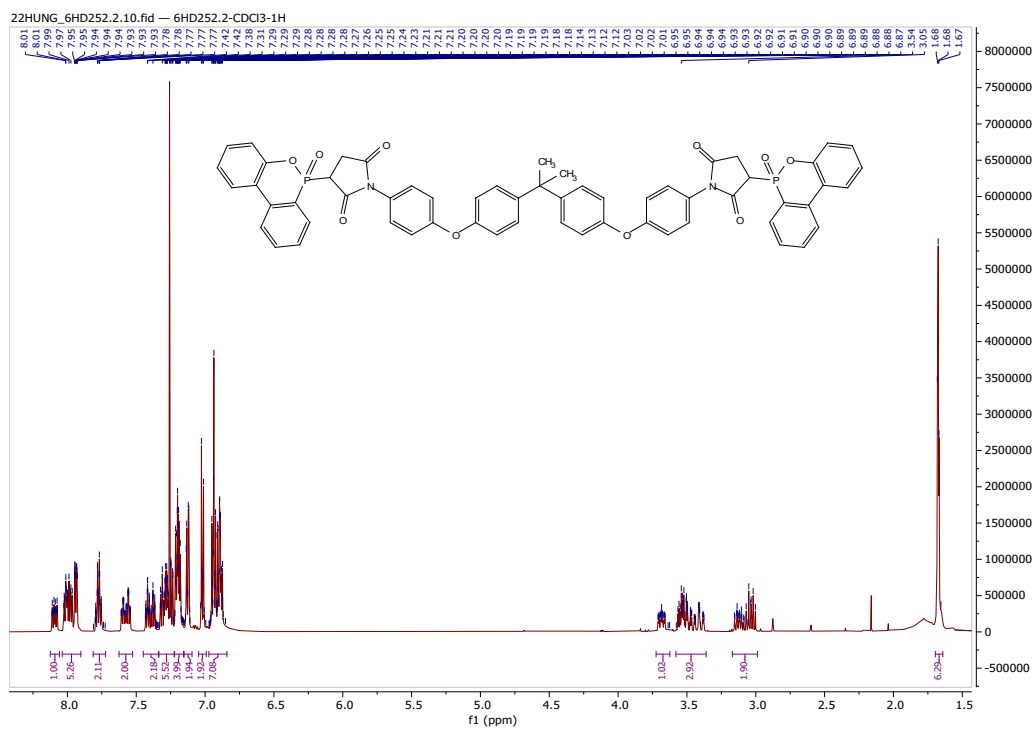


Figure 40: ¹H NMR spectroscopy of compound **FR14**

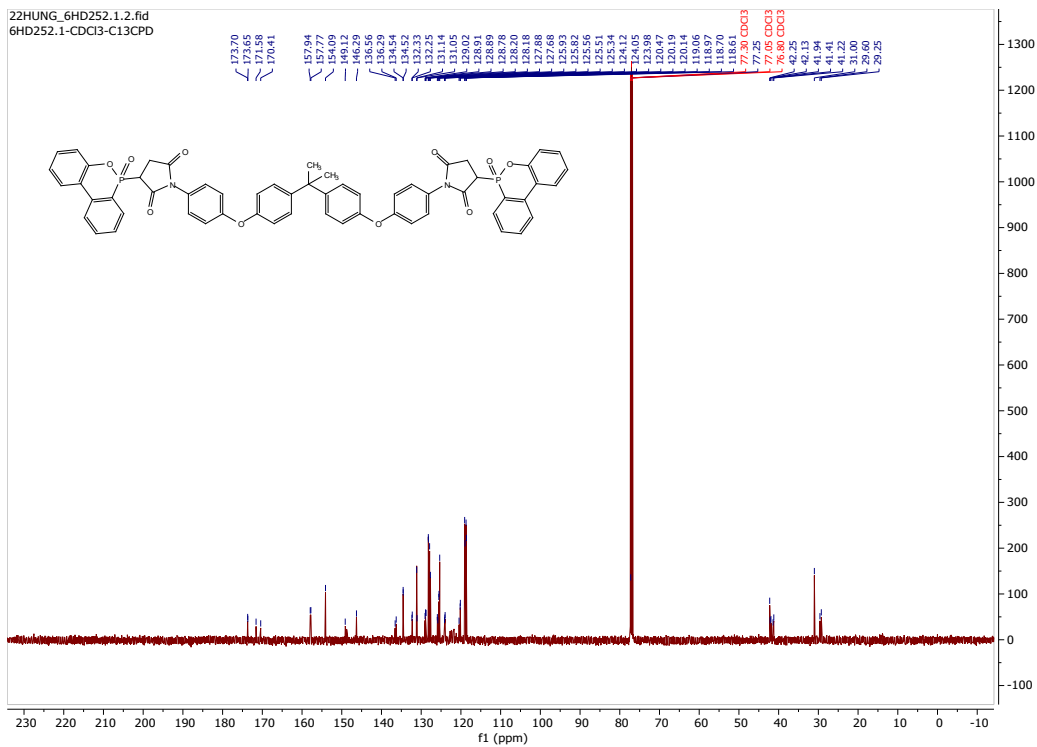


Figure 41: ^{13}C NMR spectroscopy of compound FR14

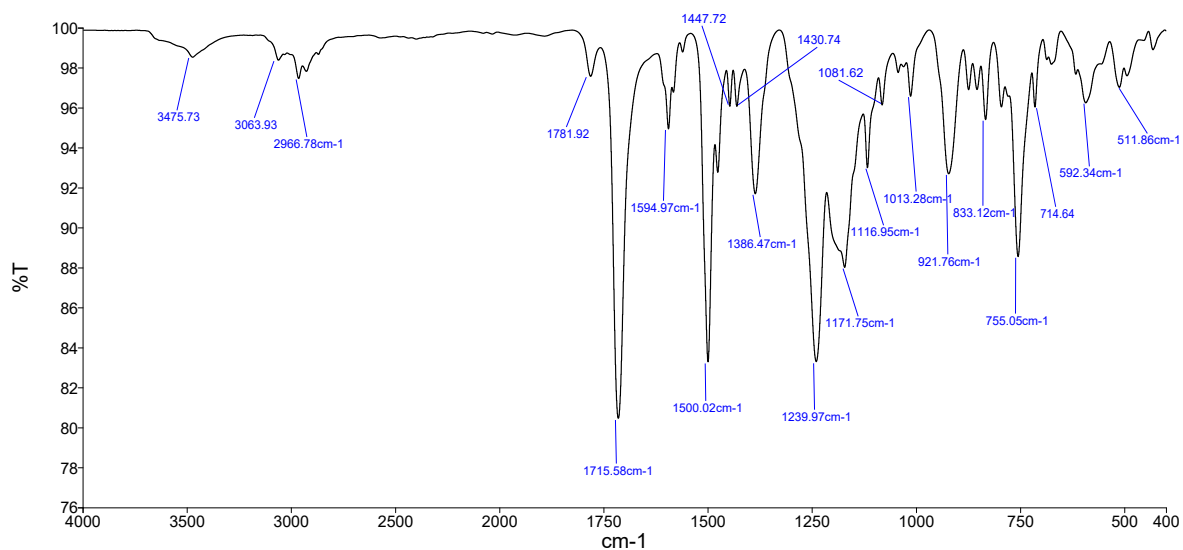


Figure 42: FT-IR spectroscopy of compound FR14

Compound FR15

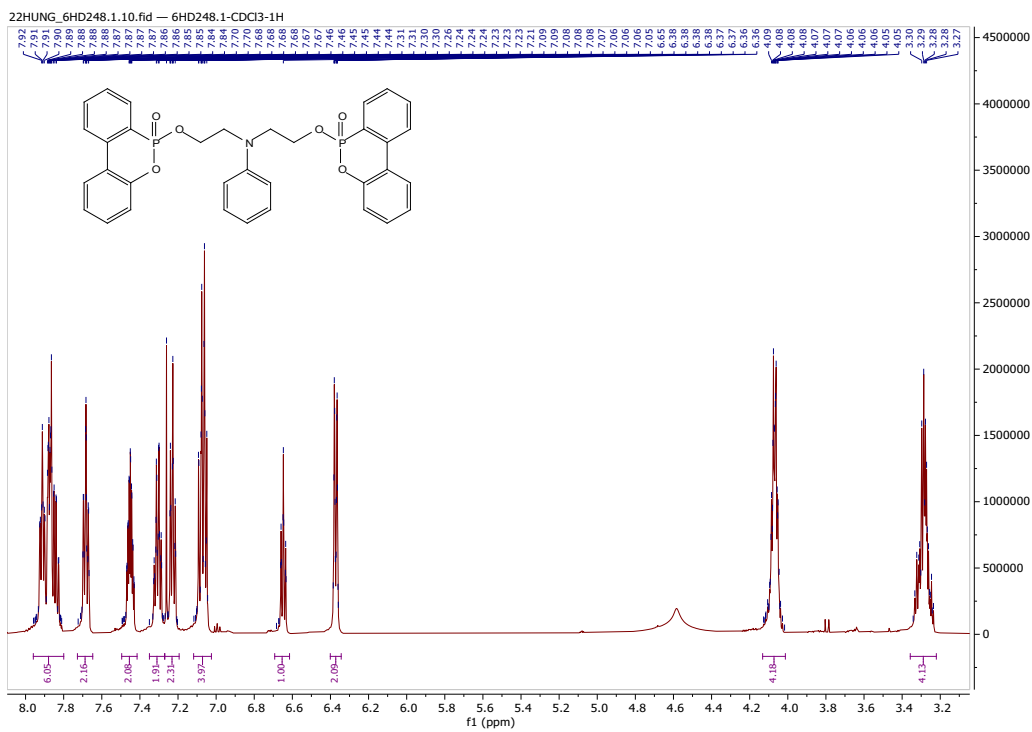


Figure 43: ¹H NMR spectroscopy of compound FR15

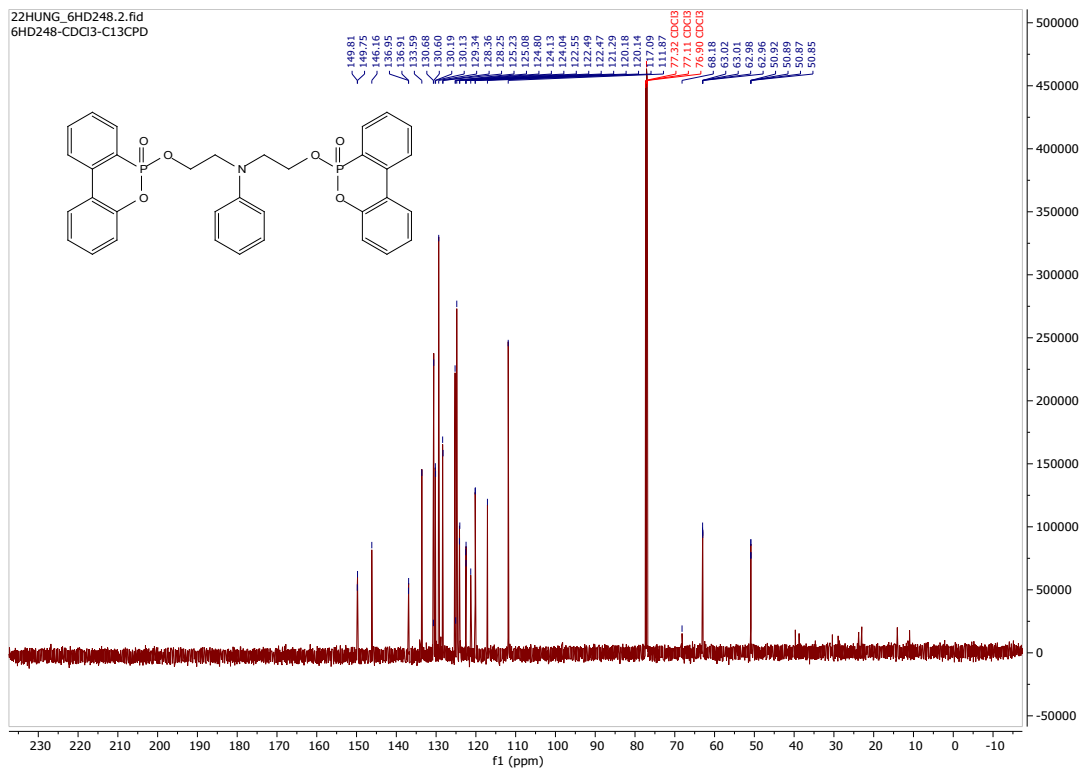


Figure 44: ¹³C NMR spectroscopy of compound FR15

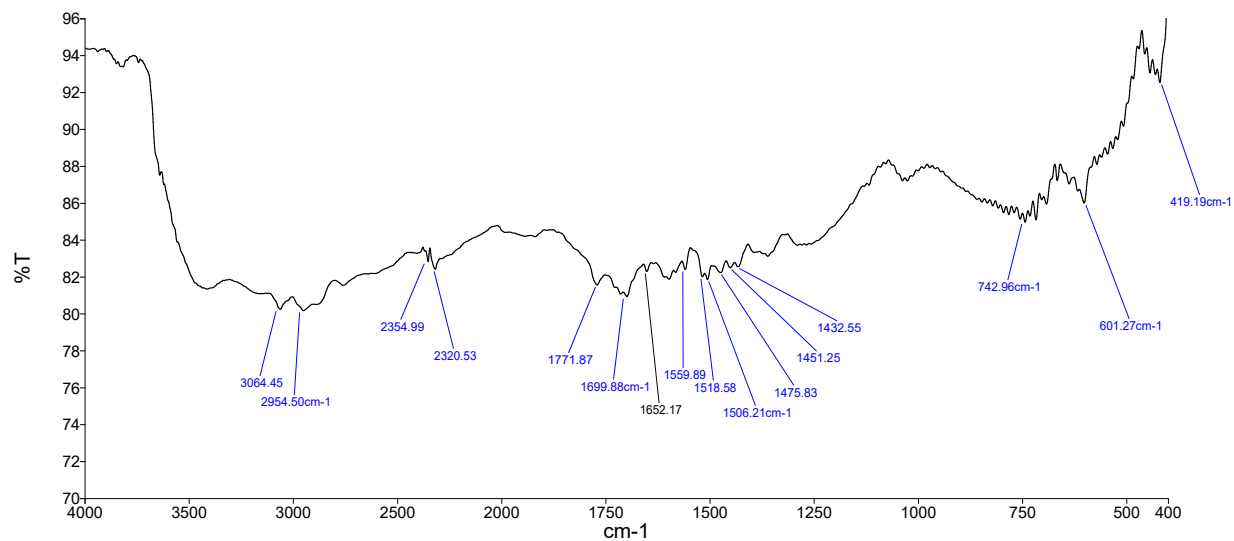


Figure 45: FT-IR spectroscopy of compound **FR15**

Compound FR16

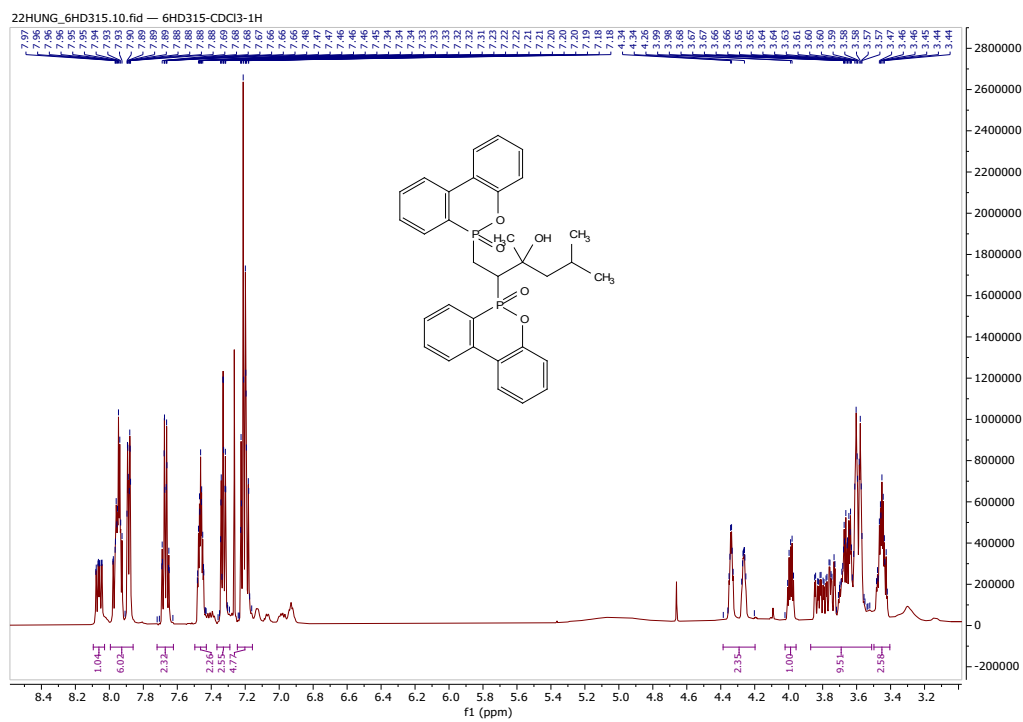


Figure 46: ¹H NMR spectroscopy of compound **FR16**

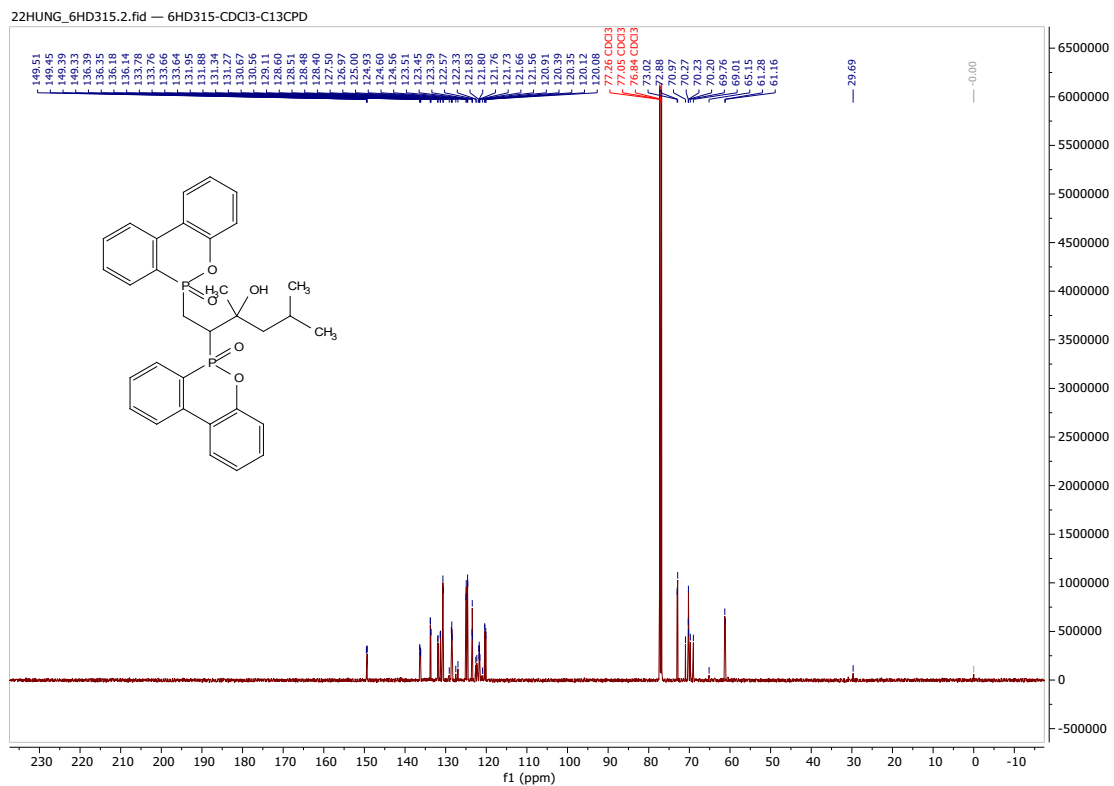


Figure 47: ^{13}C NMR spectroscopy of compound **FR16**

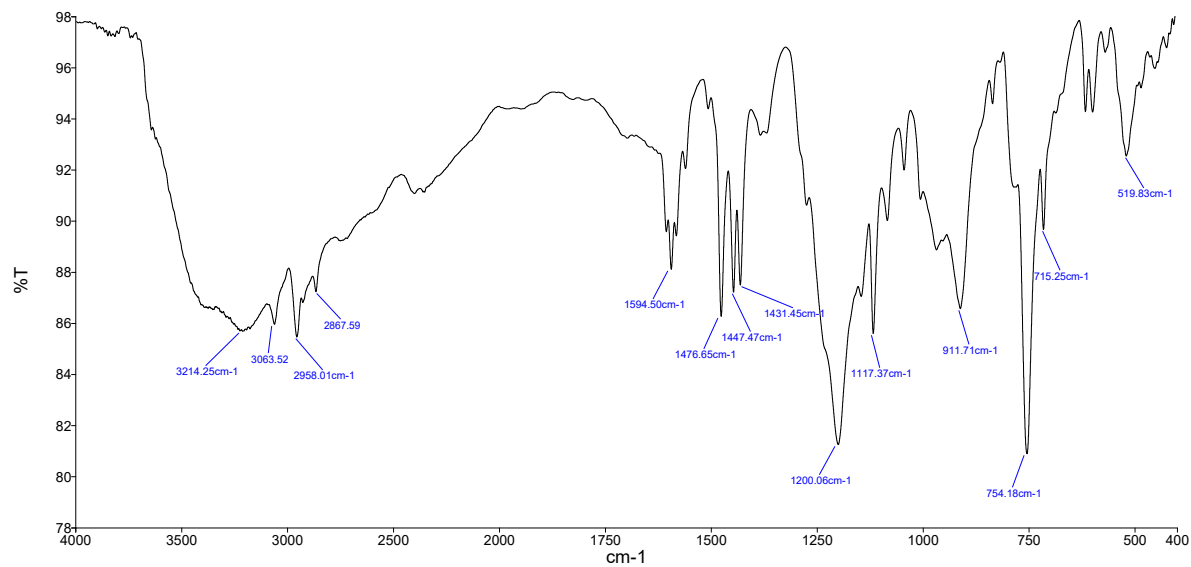


Figure 48: FT-IR spectroscopy of compound **FR16**

APP-PEI

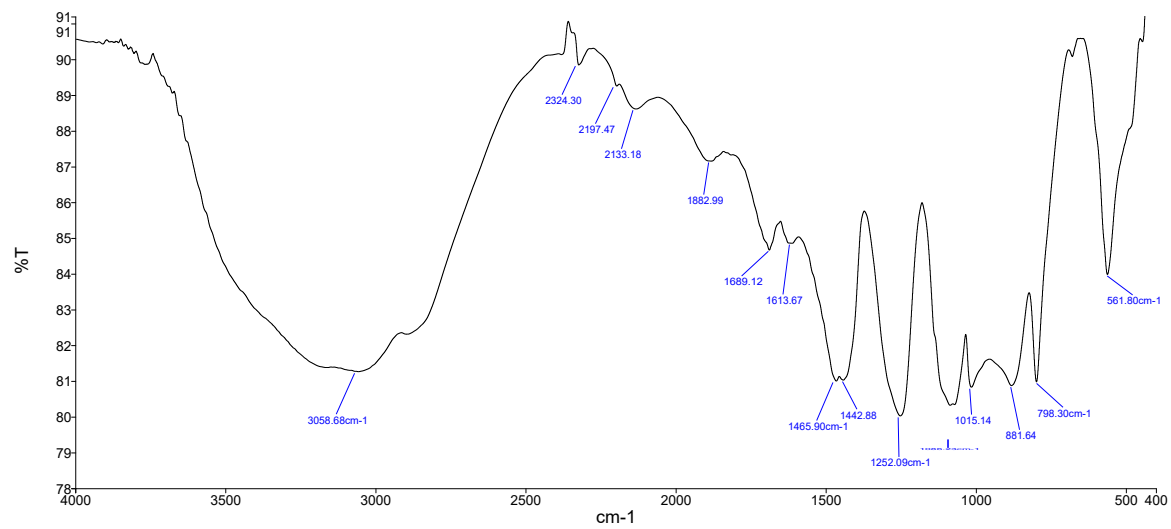


Figure 49: FT-IR spectroscopy of APP-PEI