SUPPLEMENTARY MATERIAL TO

Synthesis, spectral studies and in vitro antimicrobial activity of some new Di/Triorganotin(IV) complexes of Schiff bases derived from 2-benzoyl pyridine

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SPECTRAL DATA OF SYNTHESIZED LIGANDS AND ORGANOTIN COMPLEXES, AND NMR, MASS SPECTRA OF COMPLEXES (Bu_2SnClL_2 & Bu_3SnClL_4)

(E)-2-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazide (H_1L_1):

$C_{19}H_{14}N_4O_3$, M.pt: 125 °C, Light brown color, Yield: 79 %. IR (KBr) ν: 1605 (C=N), 3310 (N-H), 1671 (C=O), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 13.75 (*s*, 1H, NH, H-8), 8.82(*d*, 1H, J = 8Hz, H-1pyd.ring), 8.16 (*d*, 1H, *J* = 4), 8.02 (*d*, 1H *J* = 4), 7.82-7.71 (*m*, 2H), 7.65-7.57 (*m*, 2H), 7.46-7.22 (*m*, 7H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 163.98 (C=O), 158.66 (C=N), 152.13, 147.53, 149.31, 146.69, 143.84, 141.50, 138.74, 137.23, 134.73, 133.21, 130.08, 129.81, 129.74 128.80, 123.76 (Ar-C), ESI-MS (*m/z*): Calculated for $[C_{19}H_{14}N_4O_3 + H]^+$ 346.11, observed 346.08. Combustion analysis for $C_{19}H_{14}N_4O_3$: Calculated. C 65.89, H 4.07, N 16.18, O 13.86; found C 65.60, H 3.98, N 16.08, O 13.62.

(E)-4-nitro-N'-(phenyl(pyridin-2-yl)methylene) benzohydrazide (H_1L_2):

$C_{19}H_{14}N_4O_3$, M.pt: 152 °C, White color, Yield: 82 %. IR (KBr) ν: 1611 (C=N), 3190 (N-H), 1682 (C=O), cm^{-1}. ^1H NMR (DMSO-d_6, 400 MHz, δ): 14.83 (*s*, 1H, NH, H-8), 9.00 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.41 (*d*, 2H, *J* = 4), 8.13-8.04 (*m*, 3H), 7.55-7.41 (*m*, 7H) , 7.66-7.63(*m*, 2H, Ar-H), 7.41-7.32. ^{13}C NMR (DMSO-d_6, 100 MHz, δ): 162.16 (C=O), 153.49 (C=N), 150.10,

149.87, 149.62, 139.30, 138.34, 137.46, 131.24, 129.76, 127.33, 125.15, 124.19, 122.11, 120.57(Ar-C). ESI-MS (*m/z*): Calculated for $[C_{19}H_{14}N_4O_3 + H]^+$ 346.11, observed 346.07. Combustion analysis for $C_{19}H_{14}N_4O_3$: Calculated. C 65.89, H 4.07, N 16.18, O 13.86 ; found C 65.78, H 3.98, N 16.09, O 13.66.

(E)-4-methyl-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazide (H_1L_3):

$C_{20}H_{17}N_3O$, M.pt: 296 °C, white color, Yield: 78%. IR (KBr) ν: 1608 (C=N), 3292 (N-H), 1675 (C=O) cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, *δ*): 13.78 (*s*, 1H, NH, H-8), 8.71(*d*, 1H, *J* = 4, H-1pyd.ring), 8.23 (*d*, 1H, *J* = 8), 7.68-7.65 (*m*, 2H, Ar-H), 7.63 (*d*, 2H, *J* = 8), 7.52-7.41- (*m*, 5H, Ar-H), 7.23 (*d*, 2H, *J* = 8), 2.15 (*s*, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz, *δ*): 163.19 (C=O), 152.46 (C=N), 150.13, 149.84, 148.50, 147.34, 139.58, 137.23, 129.7, 139.24, 137.23, 129.76, 125.72, 124.26, 120.56 (Ar-C), 23.67 (CH_3). ESI-MS (*m/z*): Calculated for $[C_{20}H_{17}N_3O + H]^+$ 315.37, observed 315.14. Combustion analysis for $C_{20}H_{17}N_3O$: Calculated. C 76.17, H 5.43, N 13.32, O 5.07; found C 76.05, H 5.21, N 13.09, O 4.99.

(E)-4-chloro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazide (H_1L_4):

$C_{19}H_{14}ClN_3O$, M.pt: 170 °C,White color, Yield: 78%.. IR (KBr) ν: 1603 (C=N), 3305 (N-H), 1686 (C=O) cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 15.20 (*s*, 1H, NH, H-8), 8.82 (*d*, 1H, *J* = 4, H-1pyd.ring), 7.95 (*d*, 2H, *J* = 8), 7.88-7.84 (*m*, 1H, Ar-H), 7.52-7.28 (*m*, 9H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 163.38 (C=O), 153.11 (C=N), 148.30, 147.83, 138.19, 137.72, 137.63, 132.27, 129.48, 129.20, 129.04, 128.99, 128.43, 126.98, 124.40 (Ar-C). ESI-MS (*m/z*): Calculated for $[C_{19}H_{14}ClN_3O + H]^+$ 335.79, observed 335.08. Combustion analysis for $C_{19}H_{14}ClN_3O$: Calculated. C 67.96, H 4.20, Cl 10.56, N 12.51, O 4.76 ; found C 67.82, H 4.09, Cl 10.31, N 12.45, O 4.56.

(1E,N'Z)-chlorodiphenylstannyl-2-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Ph_2SnL_1Cl):

$C_{31}H_{23}ClN_4O_3Sn$ M.pt: 213 °C, yellow color, Yield: 78%. IR (KBr) ν: 1591 (C=N), 447 (Sn-N) , 552 (Sn-O), 731 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, *δ*): 9.23 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.89-8.23 (*m*, 4H, Ar-H), 7.95-7.23 (*m*, 18H, Ar-H). ^{13}C ($CDCl_3$, 100 MHz, *δ*): 163.75 (C=O), 148.75 (C=N), 148.92, 145.74, 143.52, 131.42, 137.94, 137.35, 137.16, 131.22, 129.77, 129.58,

129.17, 128.98, 128.42, 127.79, 126.83, 125.89, 123.29, (Ar-C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): –343.76. ESI-MS (*m/z*): Calculated for $[C_{31}H_{23}ClN_4O_3Sn + H]^+$ 653.70, observed 654.61. Combustion analysis for $C_{31}H_{23}ClN_4O_3Sn$: Calculated. C 56.96, H 3.55,Cl 5.42, N 8.57, O 7.34, Sn 18.16; found C 56.67, H 3.23,Cl 5.31, N 8.34, O 7.22, Sn, 18.04.

(1E,N'Z)-dibutylchlorostannyl-2-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Bu_2SnL_1Cl):

$C_{27}H_{31}ClN_4O_3Sn$, M.pt: 203 °C, Light brown, Yield: 73%. IR (KBr) ν: 1582 (C=N), 432 (Sn-N), 557 (Sn-O), 689 (Sn-C), cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz, δ): 9.12 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.93- 8.61 (*m*, 3H), 8.34 (*d*, 1H), 7.92-7.67 (*m*, 3H), 7.61-7.54 (*m*, 5H), 1.73-1.67 (*m*, 4H, $4CH_2$, Bu), 1.48-1.41 (*m*, 4H, CH_2, Bu), 1.38-1.32 (*m*, 4H, CH_2, Bu), 0.70 (*t*, *J* = 8, 6H, CH_3, Bu). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 164.01 (C=O), 149.15 (C=N), 148.24, 141.25, 137.56, 133.43, 134.87, 134.27, 133.47, 131.71, 129.63, 129.52, 129.03, 129.00, 128.57, 126.32, 123.29 (Ar-C), 34.32, 28.81, 25.82, 13.57 (Aliphatic proton). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): –297.11. ESI-MS (*m/z*): Calculated for $[C_{31}H_{23}ClN_4O_3Sn + H]^+$ 613.72, observed (614.72). Combustion analysis for $C_{27}H_{31}ClN_4O_3Sn$: Calculated. C 52.84, H 5.09, Cl 5.78, N 9.13, O 7.82, Sn 19.34; found C 52.91, H 4.98, Cl 5.49, N 8.95, O 7.67, Sn 19.01.

(1E,N'Z)-chlorodimethylstannyl-2-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Me_2SnL_1Cl):

$C_{21}H_{19}ClN_4O_3Sn$, M.pt: 219°C, Yellow, Yield: 71%. IR (KBr) ν: 1576 (C=N), 435 (Sn-N), 553 (Sn-O), 692 (Sn-C), cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz, δ): 8.92 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.51 (*d*, 1H), 8.31-8.28 (*m*, 3H, Ar-H), 7.68-7.31 (*m*, 8H, Ar-H), 1.32 (*s*, 6H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 161.34 (C=O), 149.28 (C=N), 153.94, 149.13, 137.96, 132.76, 130.51, 129.63, 129.19, 128.84, 128.61, 128.58, 127.87, 126.75, 124.81, 124.25, 122.34, (Ar-C), 21.1(CH_3-C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): –219.89. ESI-MS (*m/z*): Calculated for $[C_{21}H_{19}ClN_4O_3Sn + H]^+$ 529.50, observed 530.71. Combustion analysis for $C_{21}H_{19}ClN_4O_3Sn$: Calculated. C 47.63, H 3.62, Cl 6.69, N 10.58, O 9.06, Sn 22.42; found C 47.48, H 3.43, Cl 6.43, N 10.21, O 8.87, Sn 22.76.

(1E,N'Z)-triphenylstannyl-2-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Ph_3SnL_1):

$C_{37}H_{28}N_4O_3Sn$, M.pt: 234 °C, Yellow, Yield: 62%. IR (KBr) ν: 1579 (C=N), 437 (Sn-N), 557 (Sn-O), 703 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 9.03 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.82-8.63 (*m*, 4H, *J* = 8), 7.68-7.33 (*m*, 23 H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 162.48 (C=O), 149.87 (C=N), 152.76, 137.65, 137.14, 137.00, 136.78, 135.34, 134.91, 134.83, 131.72, 130.54, 130.12, 129.40, 129.37, 128.53, 128.34 (Ar-C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -437.89. ESI-MS (*m/z*): Calculated for $[C_{37}H_{28}N_4O_3Sn + H]^+$ 695.35, observed 696.84. Combustion analysis for $C_{37}H_{28}N_4O_3Sn$: Calculated. C 63.89, H 4.01, N 8.03, O 6.88, Sn 17.05, found C 63.91, H 4.06, N 8.06, O 6.90, Sn 17.07.

(1E,N'Z)-tributylstannyl-2-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate(Bu_3SnL_1):

$C_{31}H_{40}N_4O_3Sn$, M.pt: 204 °C, Dark brown, Yield: 75%. IR (KBr) ν: 1582 (C=N), 453 (Sn-N), 554 (Sn-O), 617 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 9.18 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.28 (*d*, 1H, *J* = 8 Hz), 7.94-7.91 (*m*, 2H), 7.87 (*t*, 1H, *J* = 8), 7.60-7.56 (*m*, 3H) 7.38-7.32 (*m*, 5H, Ar-H), 1.49 (*t*, 6H,-CH_2, Bu), 1.41-1.21 (*m*, 12H -CH_2, Bu), δ = 0.94 (*t*, 9H, CH_3, J=8 Hz, Bu). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 163.81 (C=O), 148.41 (C=N), 148.20, 145.21, 131.98, 131.73, 130.72, 130.24, 129.89, 129.58, 128.81, 128.73, 124.77, 124.63, 124.41, 125.32, 123.70, (Ar-C), 12.54, 22.17, 27.88, 42.67 (Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -290.72. ESI-MS (*m/z*): Calculated for $[C_{31}H_{40}N_4O_3Sn + H]^+$ 635.38, observed 636.84. Combustion analysis for $C_{31}H_{40}N_4O_3Sn$: Calculated. C 58.60, H 6.35, N 8.82, O 7.55, Sn 18.68; found C 58.71, H 6.18, N 8.54, O 7.34, Sn 18.42.

(1E,N'Z)-trimethylstannyl-2-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Me_3SnL_1):

$C_{22}H_{22}N_4O_3Sn$, M.pt: 198°C, Yellow, Yield: 69%. IR (KBr) ν: 1581 (C=N), (N-H), (C=O) disappeared, 457 (Sn-N), 564 (Sn-O), 696 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 8.96 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.57-8.32 (*m*, 4H, Ar-H), 7.84-7.35 (*m*, 8H, Ar-H), 1.03 (*s*, 9H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 167.62 (C=O), 149.78 (C=N), 151.72, 141.34, 133.18, 130.65, 129.96, 129.74, 129.86, 129.80, 129.78, 129.64, 129.59, 129.47, 128.48, 128.39, 125.29, (Ar-C), 14.54, (Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -236.84. ESI-MS (*m/z*): Calculated for $[C_{22}H_{22}N_4O_3Sn + H]^+$ 509.15, observed 510.56. Combustion analysis for $C_{22}H_{22}N_4O_3Sn$:

Calculated. C 51.88, H 4.03, N 10.97, O 9.41, Sn 23.30; found C 51.90, H 4.36, N 11.00, O 9.43, Sn 23.32.

(1E,N'Z)-chlorodiphenylstannyl-4-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Ph_2SnClL_2):

$C_{31}H_{23}ClN_4O_3Sn$, M.pt: 211°C, Yellow, Yield: 71%. IR (KBr) ν: 1592 (C=N), 449 (Sn-N), 561 (Sn-O), 668 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, *δ*): 9.25 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.92-8.15 (*m*, 5H, Ar-H), 7.91-7.89 (*d*, 2H, *J* = 8), 7.34-7.17 (*m*, 15 H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 167.40 (C=O), 149.37 (C=N), 148.27, 142.78, 137.91, 131.74, 130.78, 129.73, 129.36, 129.13, 129.07, 128.29, 128.37, 127.57, 127.02 (Ar-C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, *δ*): -331.45. ESI-MS (*m/z*): Calculated for $[C_{31}H_{23}ClN_4O_3Sn + H]^+$ 653.70, observed 654.78. Combustion analysis for $C_{31}H_{23}ClN_4O_3Sn$: Calculated. C 56.96, H 3.55,Cl 5.42, N 8.57, O 7.34, Sn 18.16; found C 56.73, H 3.27, Cl 5.34, N 8.13, O 7.09, Sn 18.03.

(1E,N'Z)-dibutylchlorostannyl-4-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Bu_2SnClL_2):

$C_{27}H_{31}ClN_4O_3Sn$, M.pt: 215 °C, Yellow, Yield: 68%. IR (KBr) ν: 1588 (C=N), 433 (Sn-N), 566 (Sn-O), 675 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, *δ*): 9.54 (*d*, 1H, *J* = 4 H-1pyd.ring), 8.26-8.18 (*m*, 5H, Ar-H), 7.70-7.53 (*m*, 7H, Ar-H), 1.75-1.68 (*m*, 4H, -CH_2 Bu), 1.46-1.38 (*m*, 4H -CH_2 Bu), 1.24-1.15 (m, 4H, -CH_2, Bu), 0.73 (*t*, 6H, *J* = 8, CH_3, Bu). ^{13}C NMR ($CDCl_3$, 100 MHz, *δ*): 162.74 (C=O), 149.57 (C=N), 140.48, 139.75, 130.48, 129.82, 129.51, 129.47, 128.68, 128.49, 126.66, 126.25, 124.79, 123.99, 123.19, (Ar-C), 45.84, 27.65, 26.01, 25.37, (Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149MHz, *δ*): -274.11. ESI-MS (*m/z*): Calculated for $[C_{27}H_{31}ClN_4O_3Sn + H]^+$ 613.72, observed 614.59. Combustion analysis for $C_{27}H_{31}ClN_4O_3Sn$: Calculated. C 52.84, H 5.09,Cl 5.78, N 9.13, O 7.82, Sn 19.34; found C 52.58, H 4.85,Cl 5.43, N 9.01, O 7.65, Sn 19.08.

(1E,N'Z)-chlorodimethylstannyl-4-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Me_2SnClL_2):

$C_{21}H_{19}ClN_4O_3Sn$, M.pt: 238 °C, Yellow, Yield: 61%. IR (KBr) ν: 1590 (C=N), 451 (Sn-N), 553 (Sn-O), 621 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz, δ): 8.86 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.40 (*d*, 2H, *J* = 8), 8.17 (*d*, 2H *J* = 8), 7.89 (*t*, 1H, *J* = 8), 7.66-7.64 (*m*, 2H, Ar-H), 7.52-7.38 (*m*, 5H, Ar-H), 1.67 (*s*, 6H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 162.34 (C=O), 149.83 (C=N), 153.04, 149.83, 149.26, 147.80, 137.90, 129.49, 129.43, 128.71, 128.51, 127.27, 124.65, 124.01, 122.50, (Ar-C), 10.49 (CH_3). ^{119}Sn NMR ($CDCl_3$, 149M Hz, δ): -213.67. ESI-MS (*m/z*): Calculated for $[C_{21}H_{19}ClN_4O_3Sn + H]^+$ 529.56, observed 530.56. Combustion analysis for $C_{21}H_{19}ClN_4O_3Sn$: Calculated. C 47.63, H 3.62,Cl 6.69, N 10.58, O 9.06, Sn 22.42; found C 47.34, H 3.37, Cl 6.38, N 10.29, O 8.89, Sn 22.13.

1E,N'Z)-triphenylstannyl-4-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate((Ph_3SnL_2):

$C_{37}H_{28}N_4O_3Sn$, M.pt: 243 °C, Yellow, Yield: 72%. IR (KBr) ν: 1578 (C=N), 456 (Sn-N), 561 (Sn-O), 708 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 8.85 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.40 (*d*, 2H, *J* = 8), 8.17 (*d*, 2H, *J* = 8), 7.89(*t*, 1H, *J* = 8), 7.38-7.82 (*m*, 22H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 160.81 (C=O), 149.93 (C=N), 152.47, 137.69, 137.34, 137.10, 136.48, 135.89, 134.73, 134.51, 131.47, 130.58, 130.23, 129.41, 129.38, 129.27, 128.86 (Ar-C). ^{119}Sn NMR ($CDCl_3$, 400 Hz, δ): -453.62. ESI-MS (*m/z*): Calculated for $[C_{37}H_{28}N_4O_3Sn + H]^+$ 695.35, observed 696.78. Combustion analysis for $C_{37}H_{28}N_4O_3Sn$: Calculated. C 63.91, H 4.06, N 8.08, O 6.90, Sn 17.07; found C 63.71, H 3.97, N 7.99, O 6.71, Sn 17.05.

(1E,N'Z)-tributylstannyl-4-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Bu_3SnL_2):

$C_{31}H_{40}N_4O_3Sn$, M.pt: 211°C, Light yellow, Yield- 73%. IR (KBr) ν: 1589 (C=N), 439 (Sn-N), 558 (Sn-O), 643 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 9.13 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.74 (*d*, 2H, *J* = 8), 8.37 (*d*, 2H, *J* = 8), 7.93 (*t*, 1H, *J* = 8), 7.65(*m*, 2H, Ar-H), 7.52-7.38(*m*, 5H, Ar-H), 1.51-1.26 (*m*, 18H,-CH_2, Bu), 0.91(*t*, 9H, CH_3 Bu, *J*=8 Hz). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 163.04 (C=O), 149.50 (C=N), 149.26, 147.80, 139.4, 137.29, 131.53, 130.71, 130.64, 129.43, 128.71, 128.51, 127.31, 124.65, 124.01, (Ar-C), 16.96, 21.15, 26.28, 43.67(Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -272.48. ESI-MS (*m/z*): Calculated for $[C_{31}H_{40}N_4O_3Sn + H]^+$

635.38, observed 636.71. Combustion analysis for $C_{31}H_{40}N_4O_3Sn$: Calculated. C 58.60, H 6.35, N 8.82, O 7.55, Sn 18.68; found C 58.27, H 6.19, N 8.57, O 7.24, Sn 18.43.

(1E,N'Z)-trimethylstannyl-4-nitro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Me_3SnL_2):

$C_{22}H_{22}N_4O_3Sn$, M.pt: 189 °C Yellow, Yield: 79%. IR (KBr) ν: 1591 (C=N), 438 (Sn-N), 567 (Sn-O), 683 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, *δ*): 9.12 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.89-8.83 (*m*, 3H, Ar-H), 8.62 (*d*, 2H, *J* = 8), 7.95 (*d*, 2H, *J = 8*), 7.45-7.32 (*m*, 5H, Ar-H), 0.97 (s, 9H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, *δ*): 166.97 (C=O), 149.81 (C=N), 150.72, 141.47, 134.27, 130.74, 130.61, 129.84, 129.67, 129.53, 129.46, 128.40, 128.41, 127.75, 125.39, (Ar-C), 15.39(CH_3). ^{119}Sn NMR ($CDCl_3$, 149 MHz, *δ*): -203.35. ESI-MS (*m/z*): Calculated for $[C_{22}H_{22}N_4O_3Sn + H]^+$ 509.15, observed 510.25. Combustion analysis for $C_{22}H_{22}N_4O_3Sn$: Calculated. C 51.90, H 4.36, N 11.00, O 9.43, Sn 23.32; found C 51.76, H 4.03, N 10.82, O 9.32, Sn 23.08.

(1E,N'Z)-chlorodiphenylstannyl-4-methyl-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Ph_2SnClL_3):

$C_{32}H_{26}ClN_3OSn$, M.pt: 133°C, Dark Yellow, Yield: 71%. IR (KBr) ν: 1575 (C=N), 445 (Sn-N), 549 (Sn-O), 701 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, *δ*): 9.05 (*d*, 1H, *J* = 4, H-1pyd.ring) , 8.62-8.35 (*m*, 3H, Pyrd ring), 7.57 (*d*, 2H, *J* = 8), 7.38-7.23 (*m*, 15 H, Ar-H), 6.94 (*d*, 2H, *J* = 8), 2.15 (*s*, 3H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, *δ*): 168.79 (C=O), 149.29 (C=N), 143.78, 140.24, 139.92, 130.29, 130.77, 130.34, 129.08, 129.31, 129.45, 129.27, 128.37, 128.29, 125.97, 125.12, 124.06, (Ar-C), 21.57(CH_3). ^{119}Sn NMR ($CDCl_3$, 149 MHz, *δ*): -367.41. ESI-MS (*m/z*): Calculated for $[C_{32}H_{26}ClN_3OSn + H]^+$ 622.73, observed 622.73. Combustion analysis for $C_{32}H_{26}ClN_3OSn$: Calculated. C 61.72, H 4.21, Cl 5.69, N 6.75, O 2.57, Sn 19.06; found C 61.54, H 3.98, Cl 5.69, N 6.54, O 2.39, Sn 18.84.

(1E,N'Z)-dibutylchlorostannyl-4-methyl-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Bu_2SnClL_3):

$C_{28}H_{34}ClN_3OSn$, M.pt: 142°C, Dark Yellow, Yield: 74%. IR (KBr) ν: 1578 (C=N), 436 (Sn-N), 547 (Sn-O), 612 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, *δ*): 9.48 (*d*, 1H, *J* = 4, H-1pyd.ring),

8.02-7.98 (*m*, 3H, Pyrd ring), 7.66-7.55 (*m*, 7H, Ar-H), 7.18 (*d*, 2H, *J* = 8), 2.39 (*s*, 3H, CH_3), 1.73-1.66 (*m*, 4H,-CH_2, Bu), 1.48-1.35 (*m*, 4H -CH_2, Bu), 1.22-1.17 (*m*, 4H,-CH_2, Bu), 0.73 (*t*, 6H, CH_3, Bu, *J* = 8). ^{13}C NMR ($CDCl_3$, 100MHz, *δ*): 173.91 (C=O), 149.24 (C=N), 149.42, 142.37, 140.22, 131.19, 130.77, 130.10, 129.77, 129.61, 129.54, 129.07, 128.79, 128.57, 125.97, (Ar-C), 34.81, 27.24, 25.95 21.86, 20.89(Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, *δ*): -270.75. ESI-MS (*m/z*): Calculated for $[C_{28}H_{34}\ ClN_3OSn + H]^+$ 582.75, observed 583.95. Combustion analysis for $C_{28}H_{34}\,ClN_3OSn$: Calculated. C 57.71, H 5.88, Cl 6.08, N 7.21, O 2.75, Sn 20.37; found C 57.59, H 5.65, Cl 5.81, N 6.94, O 2.49, Sn 20.03.

(1E,N'Z)-chlorodimethylstannyl-4-methyl-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate ($\mathbf{Me_2SnClL_3}$**):**

$C_{22}H_{22}\,ClN_3OSn$, M.pt: 120°C, Yellow, Yield: 68%. IR (KBr) ν: 1573 (C=N), 434 (Sn-N), 523 (Sn-O), 623 (Sn-C) cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz, *δ*): 9.28 (*d*, 1H, *J* = 4, H-1pyd.ring), 7.63 (*d*, 2H, *J* = 4), 7.41-7.37 (*m*, 8H, Ar-H), 7.13 (*d*, 2H, *J* = 8), 2.03 (*s*, 3H, CH_3), 1.07 (*s*, 6H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, *δ*): 162.23 (C=O), 148.79 (C=N), 141.37, 140.42, 138.83, 131.97, 131.62, 130.83, 130.05, 129.38, 129.29, 128.36, 128.17, 128.07, 127.67(Ar-C), 31.81, 20.09(Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, *δ*): -228.23. ESI-MS (*m/z*): Calculated for $[C_{22}H_{22}\,ClN_3OSn + H]^+$ 498.95, observed 499.76. Combustion analysis for $C_{22}H_{22}ClN_3OSn$: Calculated. C 53.00, H 4.45, Cl 7.11, N 8.43, O 3.21, Sn 23.81; found C 52.73, H 4.18; Cl 6.89, N 8.01, O 3.08, Sn 23.66.

(1E,N'Z)-triphenylstannyl-4-methyl-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate ($\mathbf{Ph_3SnL_3}$**):**

$C_{38}H_{31}N_3OSn$, M.pt: 198 °C, Yellow, Yield: 62%. IR (KBr) ν: 1585 (C=N), 451 (Sn-N), 556 (Sn-O), 678 (Sn-C), cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz, *δ*): 8.96 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.47-8.21 (*m*, 3H), 7.89-7.37 (*m*, 24H, Ar-H), 1.96 (s, 3H CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, *δ*): 161.92 (C=O), 149.36 (C=N), 152.78, 137.79, 137.48, 137.67, 136.28, 135.56, 134.72, 134.53, 131.49, 130.11, 130.07, 129.67, 129.58, 129.11, 128.75, (Ar-C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, *δ*): -452.38. ESI-MS (*m/z*): Calculated for $[C_{38}H_{31}N_3OSn + H]^+$ 664.38, observed 665.21. Combustion analysis for $C_{38}H_{31}N_3OSn$: Calculated. C 68.70, H 4.70, N 6.32, O 2.41, Sn 17.87; found C 68.67, H 4.66; N 6.29, O 2.39, Sn 17.85.

(1E,N'Z)-tributylstannyl-4-methyl-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Bu_3SnL_3):

$C_{32}H_{43}N_3OSn$, M.pt: 178 °C, Pale Yellow, Yield: 68%. IR (KBr) ν: 1572 (C=N), 457 (Sn-N), 543 (Sn-O), 679 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 8.85 (*d*, 1H, *J* = 4, H-1pyd.ring), 7.91 (*d*, 2H, *J* = 8), 7.87 (*t*, 1H, *J* = 8), 7.69-7.60 (*m*, 5H, Ar-H), 7.33 (*d*, 2H, *J* = 8), 2.45 (*s*, 3H, CH_3), 1.57-1.41 (*m*, 12H-CH_2), 1.34 -1.28 (*m*, 6H, -CH_2), 0.92 (*t*, 9H, CH_3, *J* = 8). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 168.77 (C=O), 149.78 (C=N), 149.75 141.62, 140.59, 131.83, 130.51, 130.10, 129.61, 129.37, 129.31, 129.12, 128.59, 128.27, 125.92, (Ar-C), 45.67, 25.17, 20.35, 21.78, 14.69, (Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -273.29. ESI-MS (*m/z*): Calculated for $[C_{32}H_{43}N_3OSn + H]^+$ 604.41, observed 605.47. Combustion analysis for $C_{32}H_{43}N_3OSn$: Calculated. C 63.59, H 7.17, N 6.95, O 2.65, Sn 19.64; found C 63.37, H 6.98; N 6.87, O 2.32, Sn 19.23.

(1E,N'Z)-trimethylstannyl 4-methyl-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Me_3SnL_3):

$C_{23}H_{25}N_3OSn$, M.pt: 168 °C, Yellow, Yield: 69%. IR (KBr) ν: 1578 (C=N), 451 (Sn-N), 547 (Sn-O), 682 (Sn-C) cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 8.97 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.89-8.83 (*m*, 3H), 8.62 (*d*, 2H, *J* = 8), 7.95 (*d*, 2H, *J* = 8), 7.45-7.32 (*m*, 5H, Ar-H), 0.97 (*s*, 9H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 170.93 (C=O), 149.78 (C=N), 150.68, 140.87, 135.87, 131.74, 130.72, 129.84, 129.68, 129.51, 129.46, 128.39, 128.16, 127.87, 125.49, (Ar-C), 41.62, 15.23, (Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -210.83. ESI-MS (*m/z*): Calculated for $[C_{23}H_{25}N_3OSn + H]^+$ 478.17, observed 479.39. Combustion analysis for $C_{23}H_{25}N_3OSn$: Calculated. C 57.77, H 5.27, N 8.79, O 3.35, Sn 24.83; found C 57.75, H 5.24, N 8.76, O 3.32, Sn 24.79.

(1E,N'Z)-chlorodiphenylstannyl-4-chloro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Ph_2SnClL_4):

$C_{31}H_{23}Cl_2N_3OSn$, M.pt: 122°C, Yellow, Yield: 73%. IR (KBr) ν: 1592 (C=N), 459 (Sn-N), 561 (Sn-O), 701 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 9.28 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.57-8.28 (*m*, 3H, Pyrd ring), 7.63 (*d*, 2H, *J* = 8), 7.57 (*d*, 2H, *J* = 8), 7.36-7.21 (*m*, 15H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 167.89 (C=O), 148.70 (C=N), 142.58, 140.24, 138.36, 131.83,

130.92, 130.45, 129.31, 129.03, 129.56, 129.27, 128.89, 127.76, 125.97, (Ar-C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -376.12. ESI-MS (*m/z*): Calculated for $[C_{31}H_{23}Cl_2N_3OSn + H]^+$ 643.15, observed 644.95. Combustion analysis for $C_{31}H_{23}Cl_2N_3OSn$: Calculated. C 57.89, H 3.60, N 6.53, O 2.49,Cl 11.02, Sn 18.46; found C 57.64, H 3.53, N 6.27, O 2.15,Cl 10.87, Sn 18.12.

(1E,N'Z)-dibutylchlorostannyl-4-chloro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Bu_2SnClL_4) :

$C_{27}H_{31}Cl_2N_3OSn$, M.pt: 169°C, Yellow, Yield: 72%, IR (KBr) *ν*: 1579 (C=N), 433 (Sn-N), 556 (Sn-O), 693(Sn-C), cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz, δ): 9.51 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.23-8.16 (*m*, 5H, Ar-H), 7.71-7.54 (*m*, 5H, Ar-H), 7.50 (*d*, 2H, *J* = 8), 1.53-1.48 (*m*, 4H,-CH_2), 1.38-1.33 (*m*, 4H-CH_2), 1.21-1.13 (*m*, 4H, -CH_2), 0.72 (*t*, 6H, CH_3, *J* = 8). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 170.91 (C=O), 149.30 (C=N), 141.37, 140.12, 130.35, 131.91, 130.11, 129.64, 129.41, 128.80, 128.33, 127.85, 127.08, 126.15, 125.76, (Ar-C), 13.51, 25.54, 25.98, 35.43, (Aliphatic C). ^{119}Sn NMR ($CDCl_3$, 149 MHz, δ): -289.17. ESI-MS (*m/z*): Calculated for $[C_{27}H_{31}Cl_2N_3OSn + H]^+$ 603.17, observed 604.78. Combustion analysis for $C_{27}H_{31}Cl_2N_3OSn$: Calculated. C 53.76, H 5.18, N 6.97, O 2.65,Cl 11.76, Sn 19.68; found C 53.59, H 4.97, N 6.73, O 2.47,Cl 11.64, Sn 19.56.

(1E,N'Z)-chlorodimethylstannyl-4-chloro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate ((Me_2SnClL_4):

$C_{21}H_{19}Cl_2N_3OSn$, M.pt: 137°C, Yellow, Yield: 69%. IR (KBr) *ν*: 1593 (C=N), 431(Sn-N), 534(Sn-O), 632(Sn-C), cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz, δ): 9.33 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.03 (*d*, 2H, *J* = 8), 7.54-7.41 (*m*, 8H, Ar-H), 7.33 (*d*, 2H, *J* = 8), 1.12 (*s*, 6H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 168.56 (C=O), 148.63 (C=N), 148.57, 139.80, 137.81, 131.80, 130.19, 129.59, 129.43, 129.07, 128.41, 128.22, 126.42, 125.81, (Ar-C), 26.08 (CH_3). ^{119}Sn NMR ($CDCl_3$, 149MHz, δ): -208.18. ESI-MS (*m/z*): Calculated for $[C_{21}H_{19}Cl_2N_3OSn + H]^+$ 519.01, observed 520.71. Combustion analysis for $C_{21}H_{19}Cl_2N_3OSn$: Calculated. C 48.60, H 3.69, N 8.10, O 3.08, Cl 13.66, Sn 22.87; found C 48.37, H 3.47, N 7.97, O 2.95, Cl 13.34, Sn 22.53.

(1E,N'Z)-triphenylstannyl 4-chloro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate (Ph_3SnL_4):

$C_{37}H_{28}ClN_3OSn$, M.pt: 207°C, Yellow, Yield: 67%, IR (KBr) ν: 1603 (C=N), 446 (Sn-N), 548 (Sn-O), 673 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 9.01 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.54-8.37 (*m*, 3H), 7.92-7.48 (*m*, 24H). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 167.91 (C=O), 149.78 (C=N), 152.91, 137.59, 137.42, 137.69, 136.33, 135.76, 134.65, 134.52, 131.53, 130.15, 130.08, 129.48, 129.32, 129.03, (Ar-C). ^{119}Sn NMR ($CDCl_3$, 149MHz, δ): -468.18. ESI-MS (m/z): Calculated for $[C_{37}H_{28}ClN_3OSn + H]^+$ 684.80, observed 685.87. Combustion analysis for $C_{37}H_{28}ClN_3OSn$: Calculated. C 64.89, H 4.12, N 6.14, O 2.34, Cl 5.18, Sn 17.33; found C 64.69, H 4.01, N 5.97, O 2.10, Cl 5.02, Sn 17.01.

(1E,N'Z)-tributylstanny-4-chloro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate(Bu_3SnL_4):

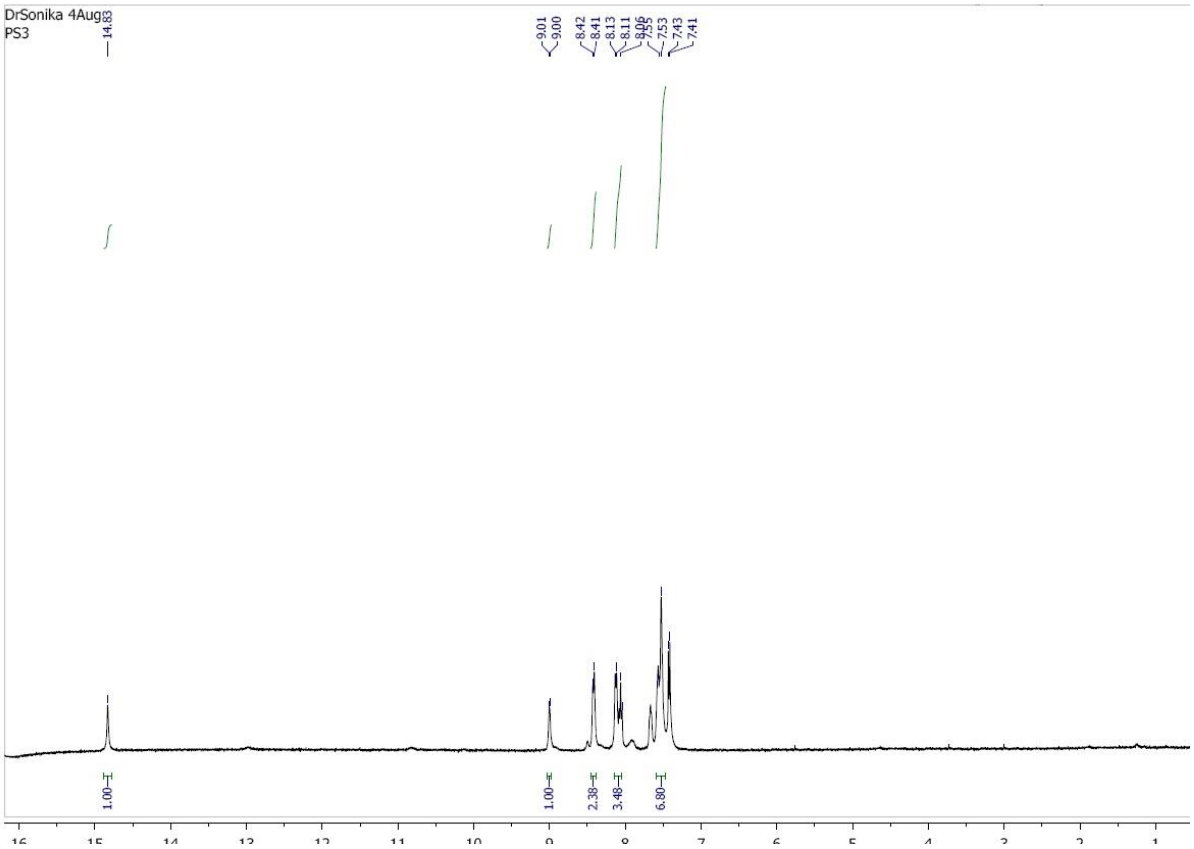
$C_{31}H_{40}ClN_3OSn$, M.pt: 191°C, Yellow, Yield: 71%. IR (KBr) ν: 1592 (C=N), 447 (Sn-N), 551 (Sn-O), 631 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 9.41(*d*, 1H, *J* = 4, H-1pyd.ring), 8.26-8.19 (*m*, 4H, Ar-H), 8.03 (*t*, 1H, *J* = 8), 7.69-7.52 (*m*, 7H, Ar-H), 1.81-1.05 (*m*, 18H,-CH_2), 0.73(*t*, 9H, CH_3, *J* = 8). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 164.04(C=O), 149.66(C=N), 148.90, 148.49, 140.19, 139.15, 130.79, 130.58, 129.83, 129.61, 128.65, 128.53, 127.00, 126.45, 123.22, (Ar-C), 50.87, 31.26, 25.96, 16.65, (Aliphatic-C). ^{119}Sn NMR ($CDCl_3$, 149MHz, δ): -252.95. ESI-MS (*m/z*): Calculated for $[C_{31}H_{40}ClN_3OSn + H]^+$ 624.83, observed 625.97. Combustion analysis for $C_{31}H_{40}ClN_3OSn$: Calculated. C 59.59, H 6.45, N 6.73, O 2.56, Cl 5.67, Sn 19.00; found C 59.32, H 6.21, N 6.58, O 2.38, Cl 5.43, Sn 18.86.

(1E,N'Z)-trimethylstannyl-4-chloro-N'-(phenyl(pyridin-2-yl)methylene)benzohydrazonate(Me_3SnL_4):

$C_{22}H_{22}ClN_3OSn$, M.pt: 181°C, Yellow, Yield: 74%. IR (KBr) ν: 1597 (C=N), 452 (Sn-N), 559 (Sn-O), 656 (Sn-C), cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz, δ): 8.98 (*d*, 1H, *J* = 4, H-1pyd.ring), 8.83-8.74(*m*, 3H), 8.68 (*d*, 2H, *J* = 8), 7.93 (*d*, 2H, *J* = 8), 7.57-7.39 (*m*, 5H, Ar-H), 1.32 (*s*, 9H, CH_3). ^{13}C NMR ($CDCl_3$, 100 MHz, δ): 170.92 (C=O), 149.56 (C=N), 150.06, 140.57, 135.86, 131.72, 130.46, 129.78, 129.62, 129.50, 129.41, 128.98, 128.26, 127.94, 125.45, (Ar-C), 16.38 (CH_3). ^{119}Sn NMR ($CDCl_3$, 149MHz, δ): -215.766. ESI-MS (*m/z*): Calculated for $[C_{22}H_{22}ClN_3OSn + H]^+$ 498.59, observed 499.87. Combustion analysis for $C_{22}H_{22}ClN_3OSn$: Calculated. C 53.00, H

311 4.45, N 8.43, O 3.21, Cl 7.11, Sn 23.81; found . C 52.98, H 4.43, N 8.39, O 3.19, Cl 7.08, Sn
312 23.77.

313



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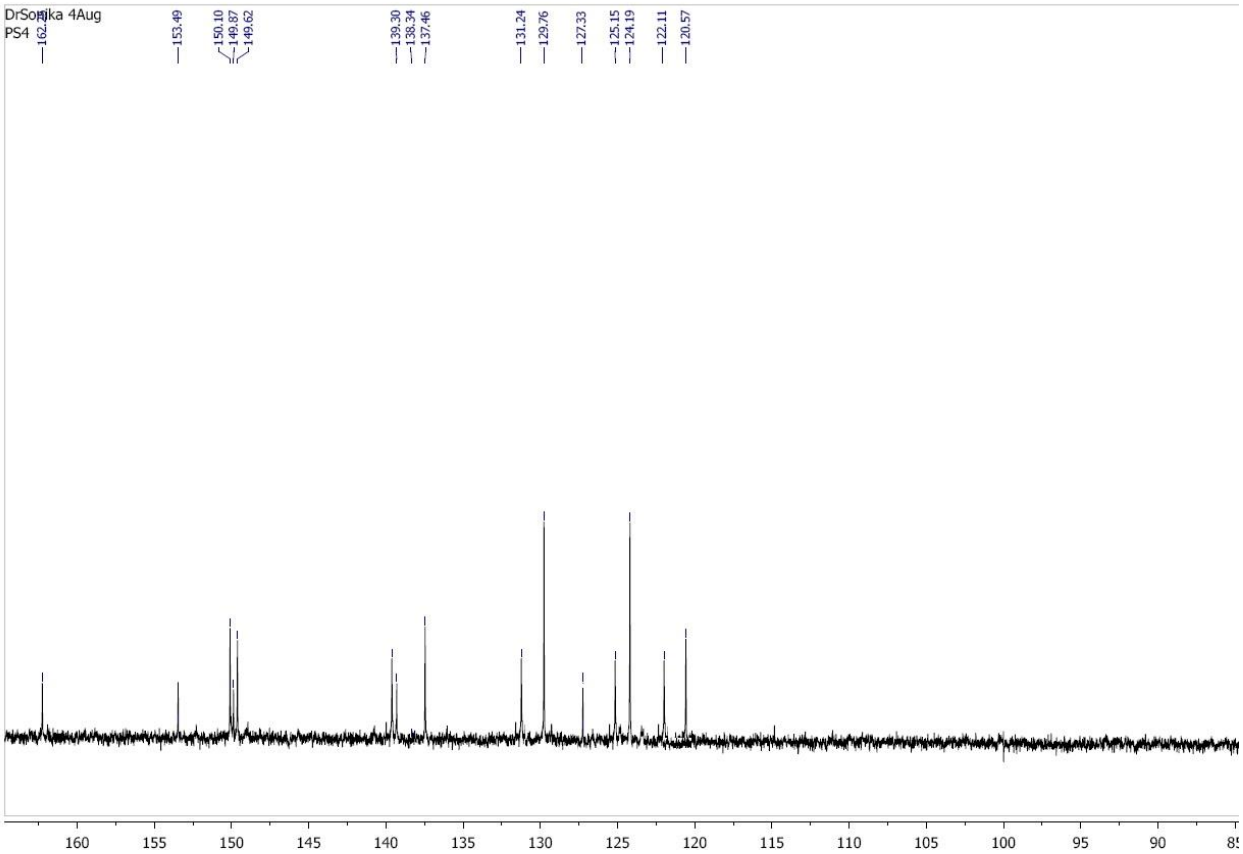
315 Fig S1 ^{1}H NMR of H_1L_2



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317 Fig S2 ^{13}C NMR of H_1L_2

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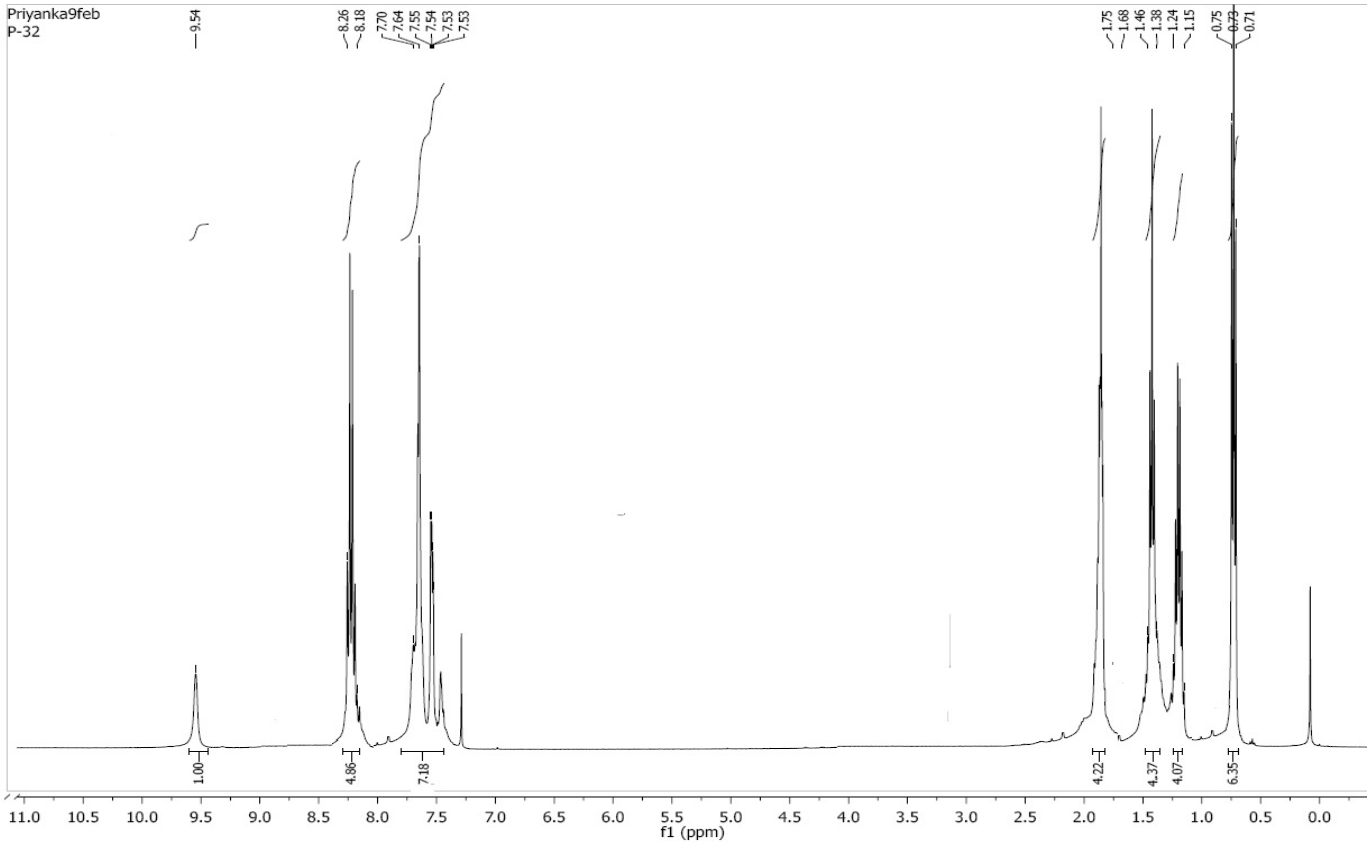

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321 Fig S3 ^{1}H NMR of Bu_2SnClL_2

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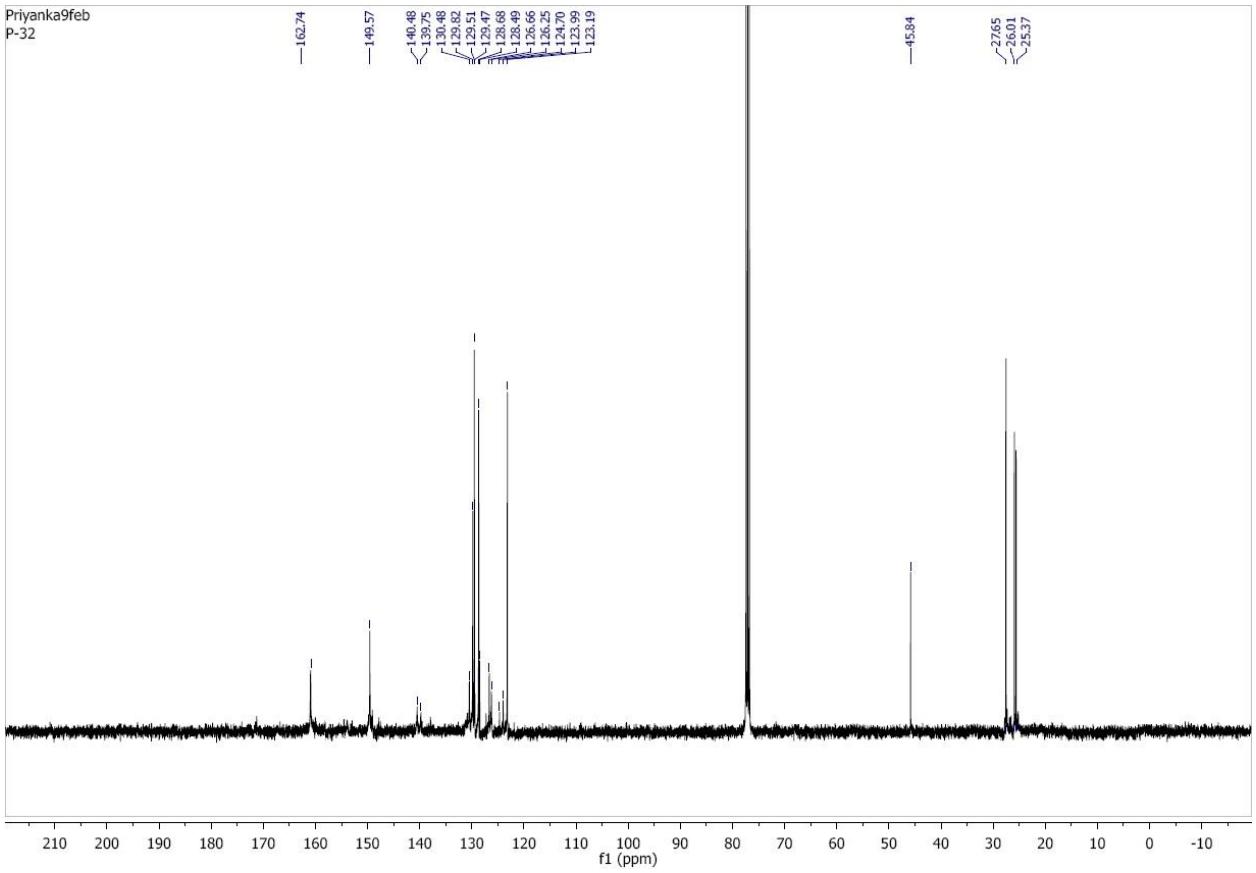

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324 Fig S4 ^{13}C NMR of Bu_2SnClL_2

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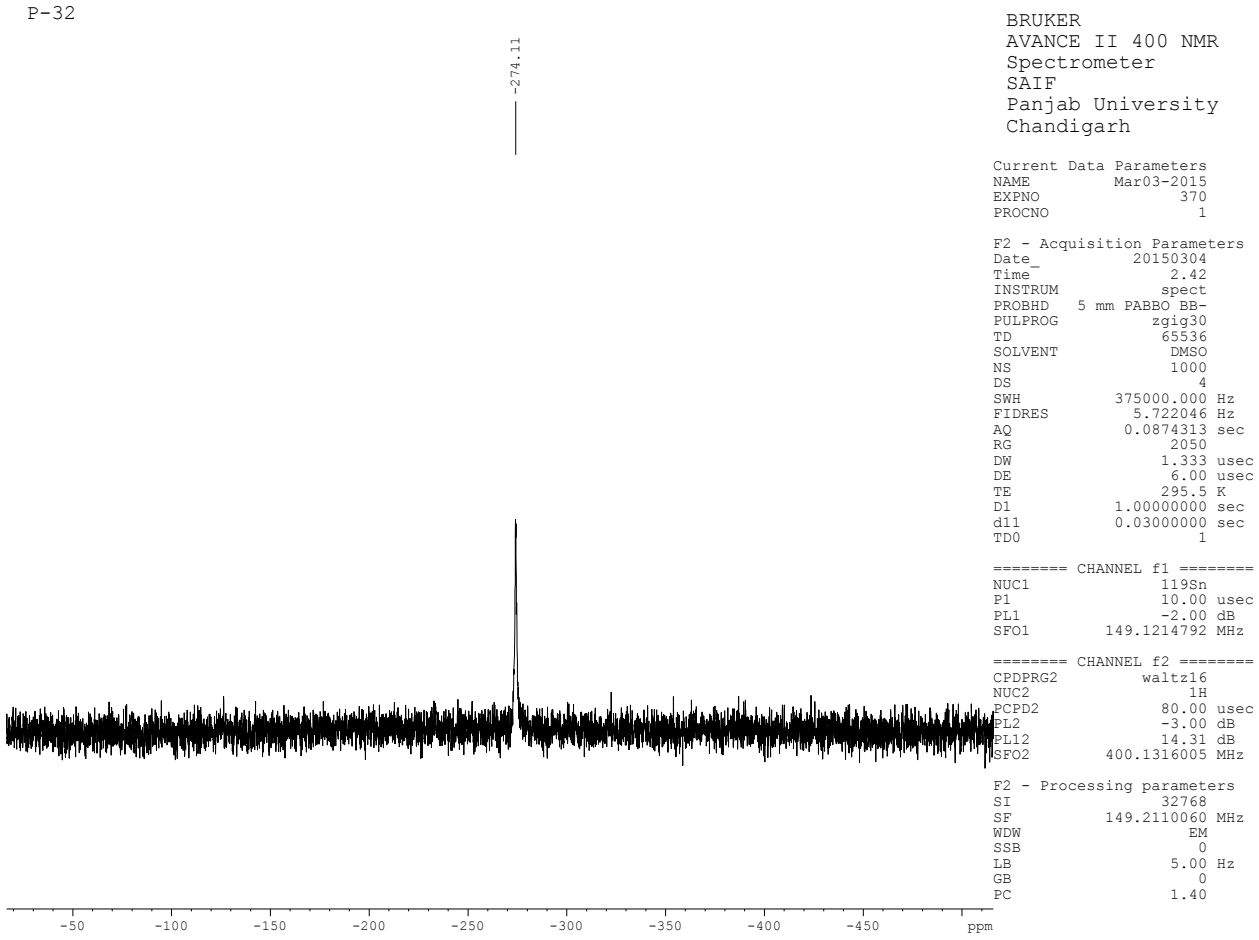
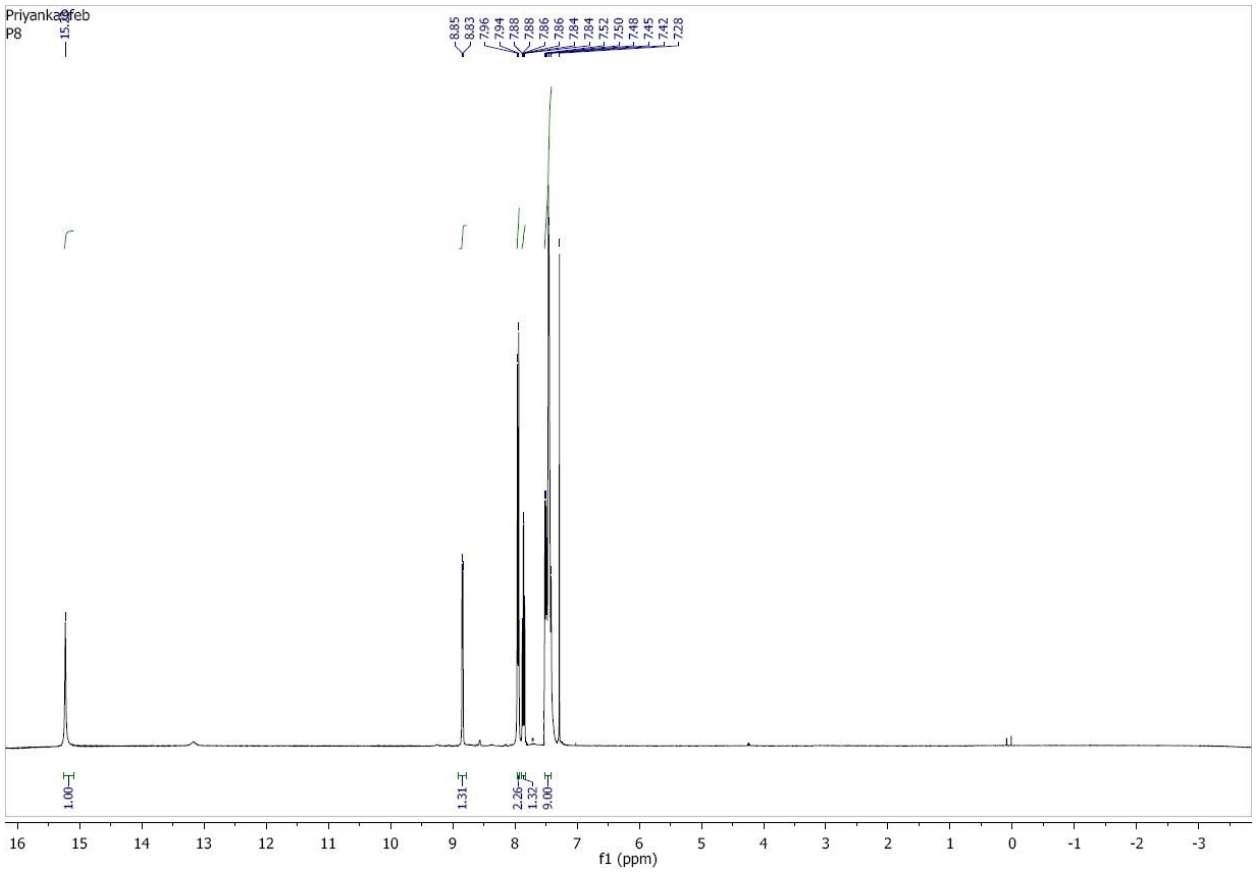


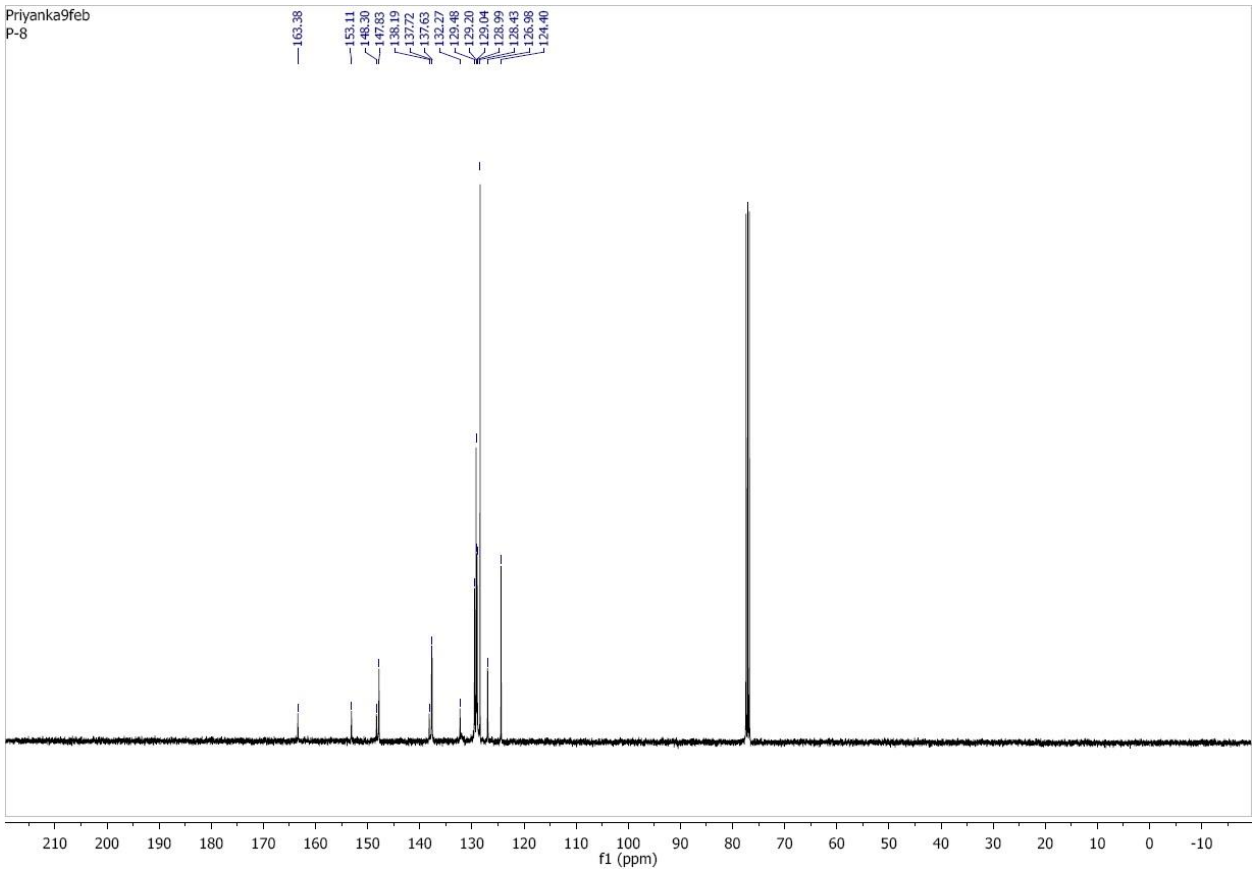
326 avtar_saifpu@yahoo.co.in

327 Fig S5 ^{119}Sn NMR of Bu_2SnClL_2

328 

329 Fig S6 ^{1}HNMR of H_1L_4

330



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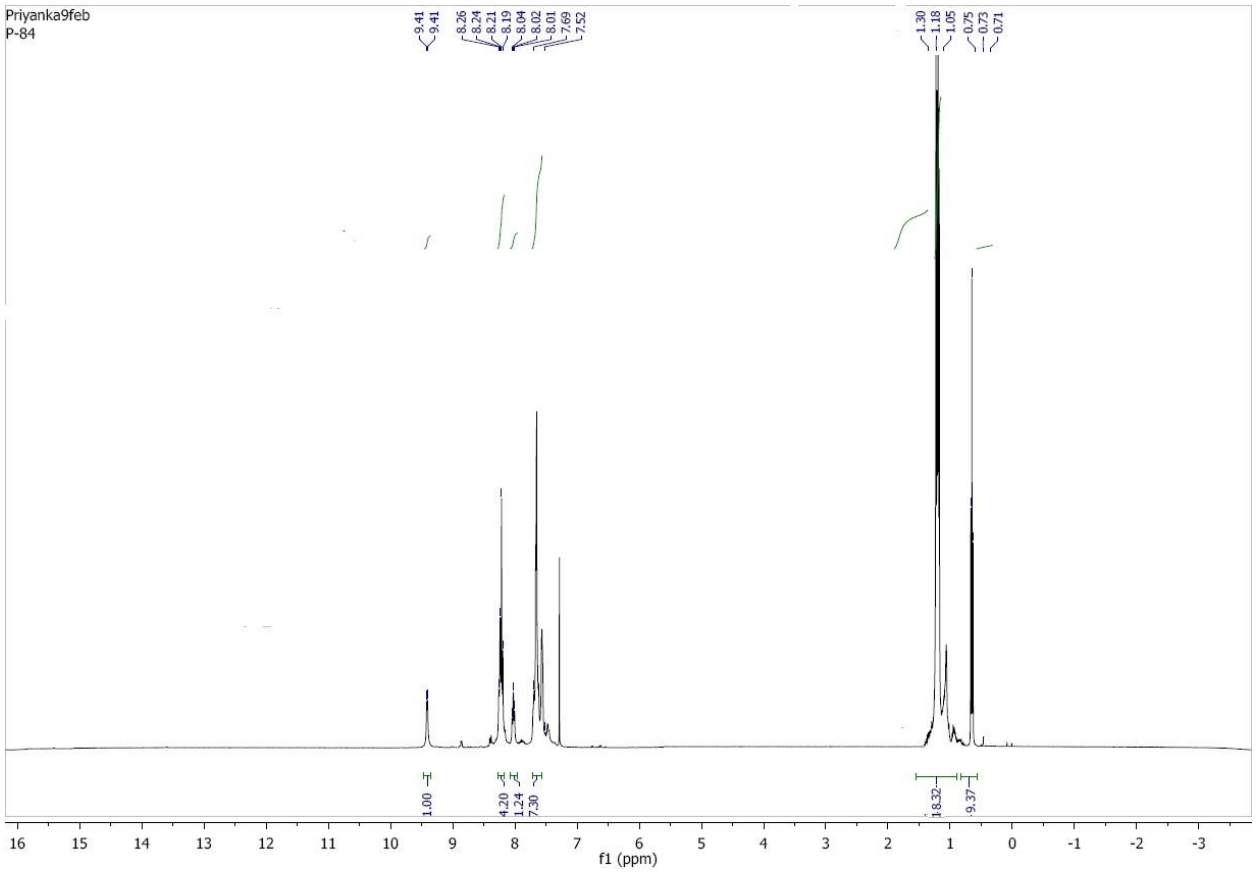
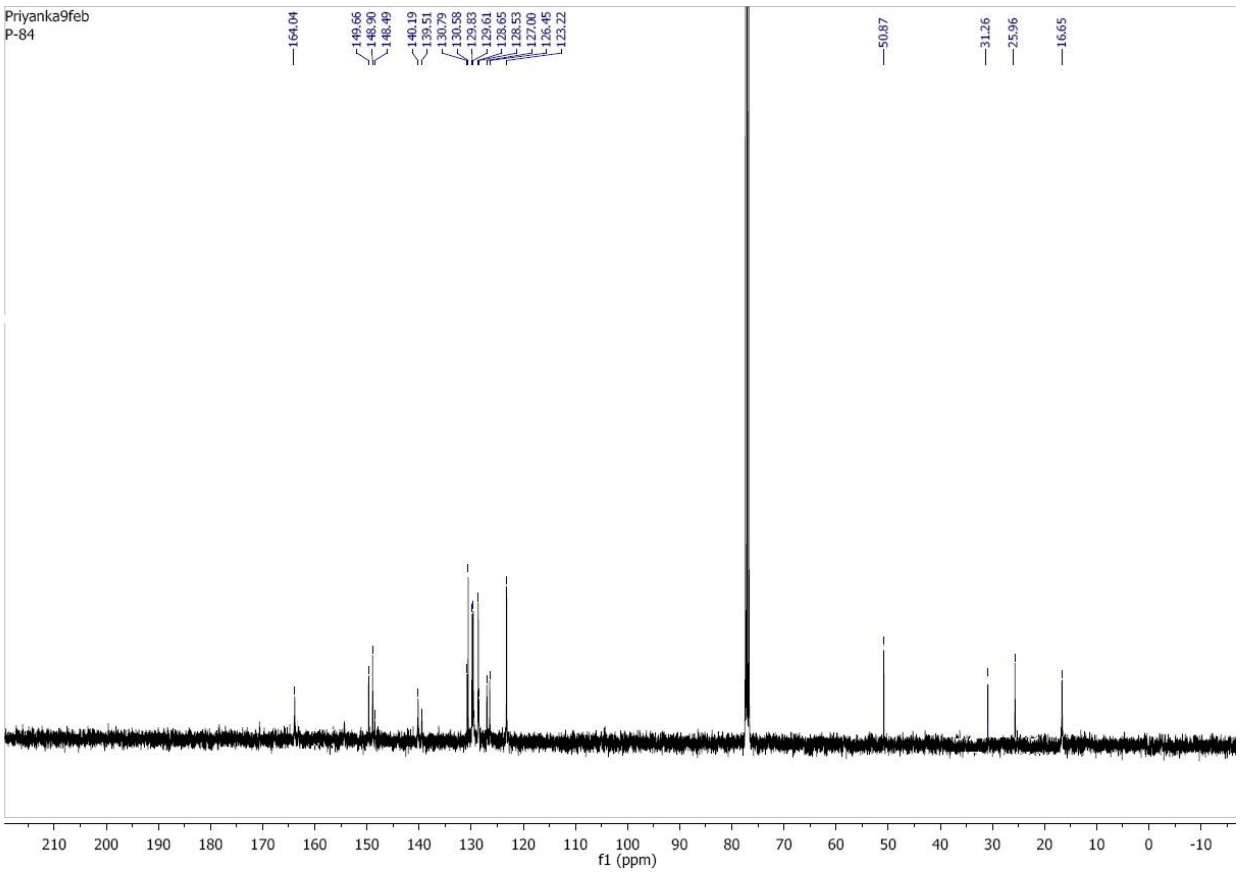
332 Fig S7 ^{13}CNMR of H_1L_4



333

334 Fig S8 ^{1}HNMR of Bu_3SnL_4

335



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337 Fig S9 ^{13}C NMR of Bu_3SnL_4

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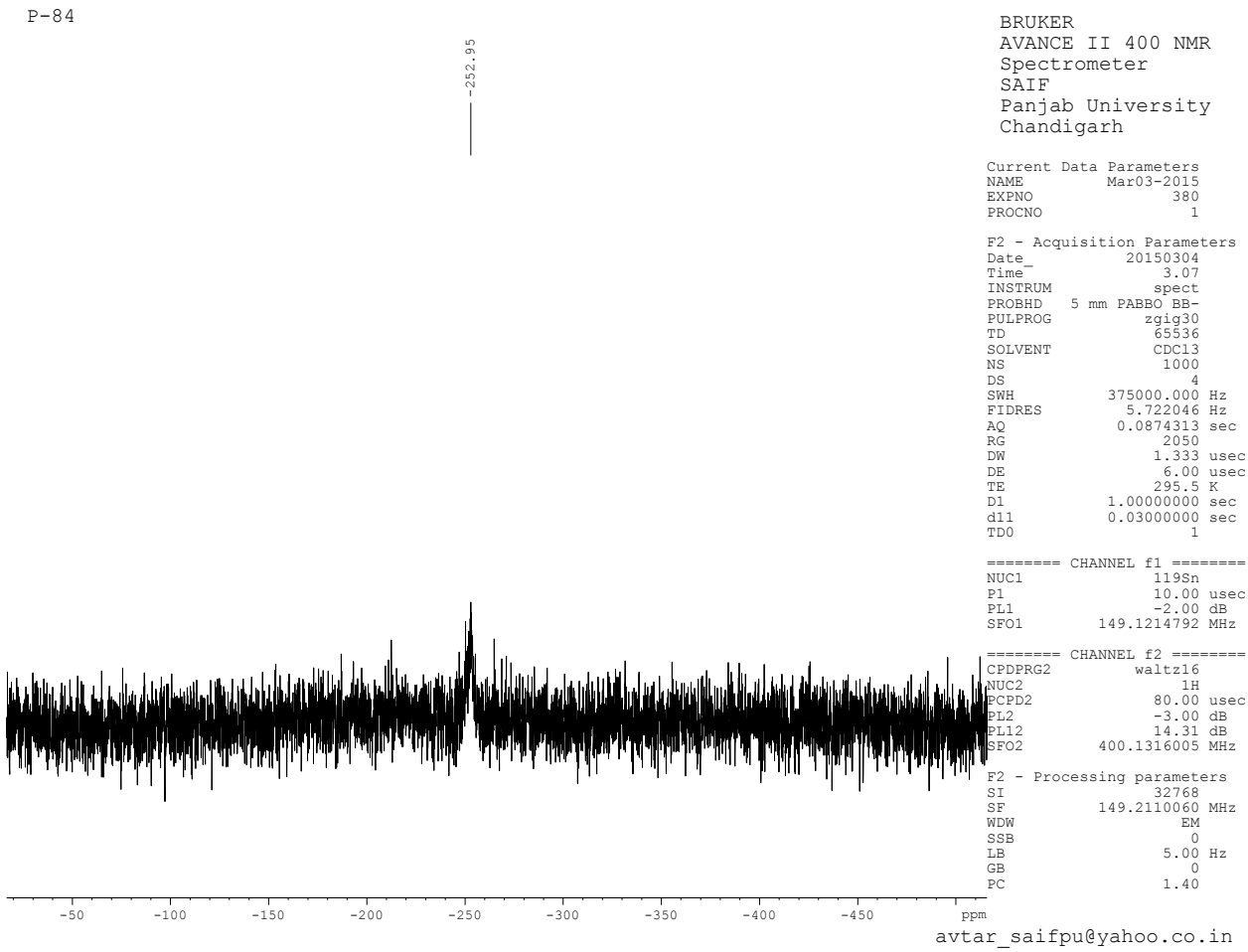
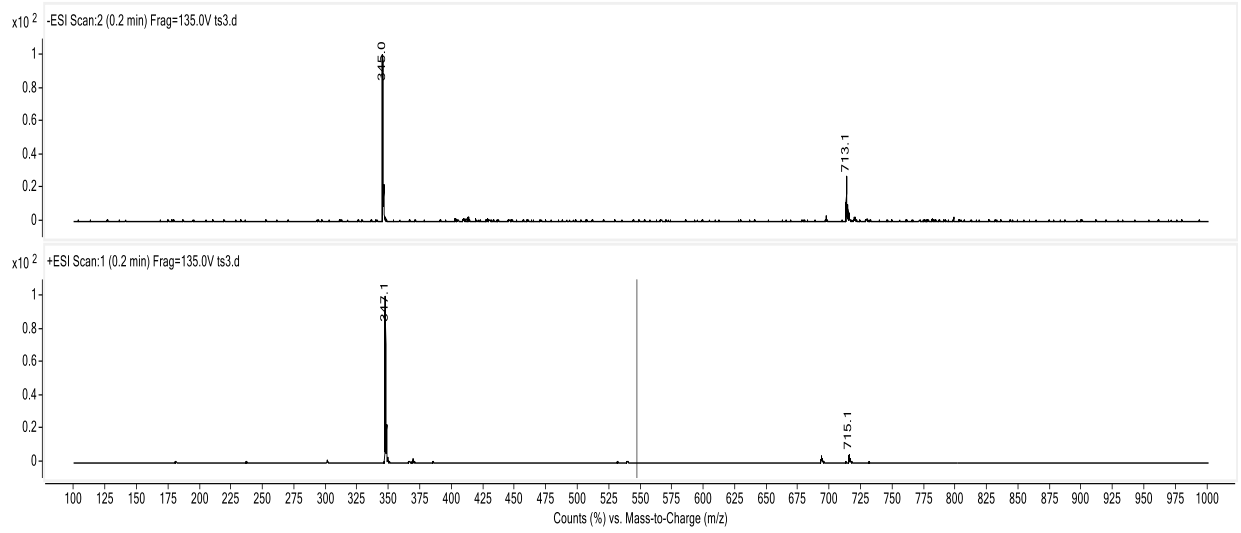


339

340 Fig S10 ^{119}Sn NMR of Bu_3SnL_4

341



342

343 Fig S11 Mass spectra of H_1L_1

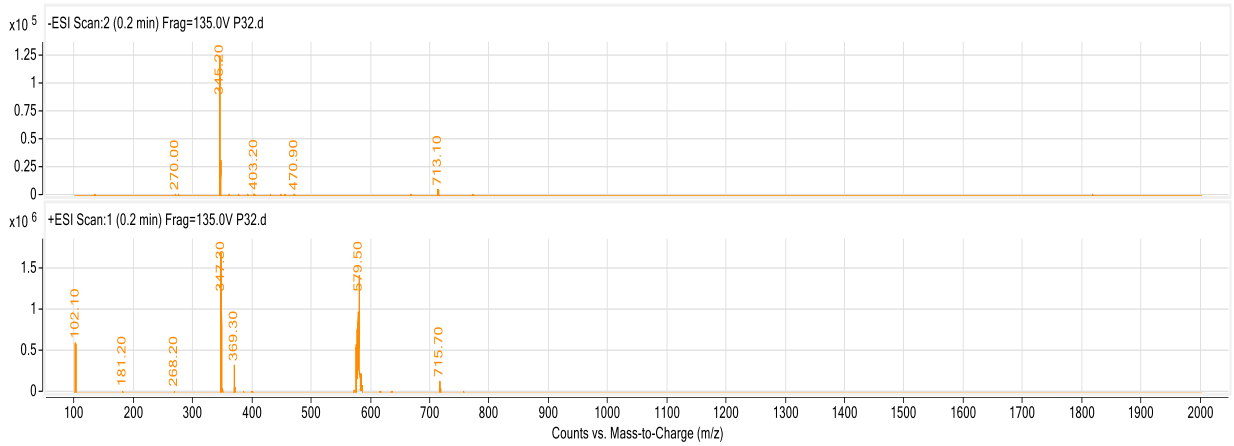


Fig S12 Mass spectra of Bu_2SnClL_2