*Electronic Supplementary Information (ESI)*

Controllable preparation of magnetic carbon nanocomposites by pyrolysis of organometallic precursors, similar molecular structure but very different morphology, composition and properties

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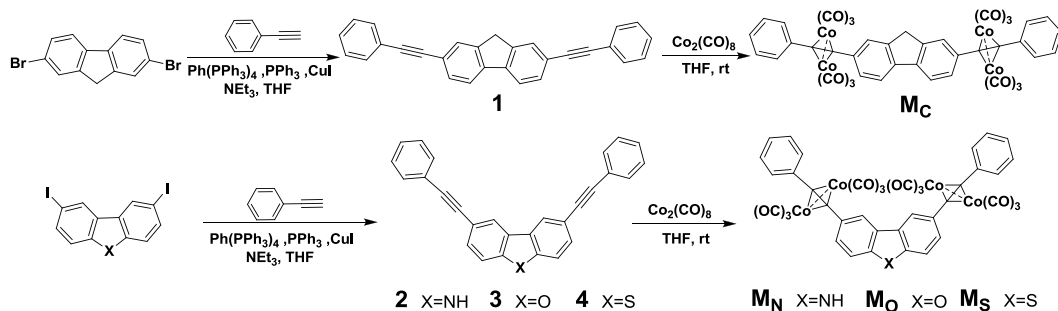
Scheme S1. Synthetic pathway of organometallic precursors M_C, M_N, M_O and M_S.
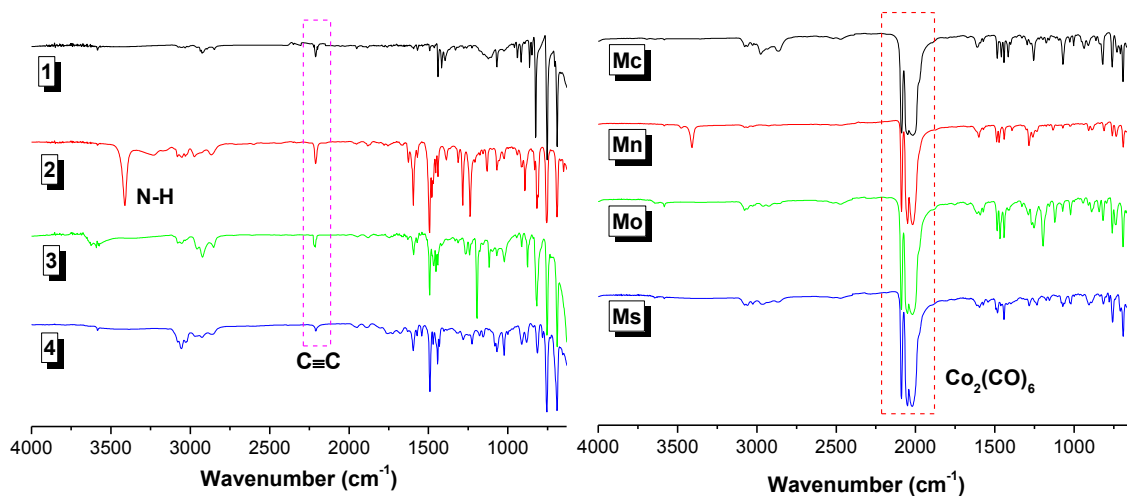

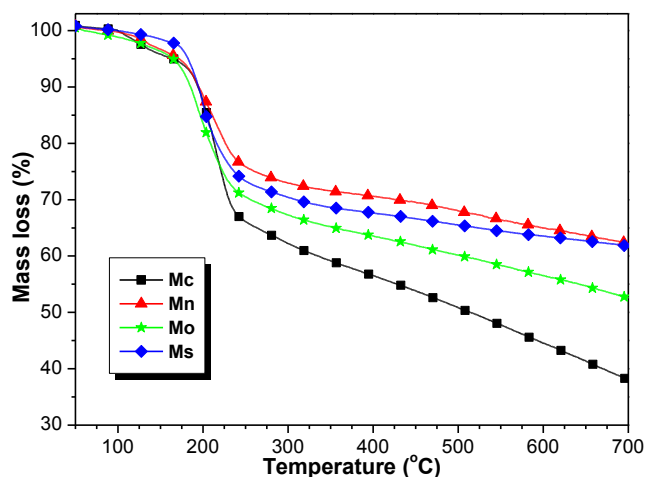**Figure S1.** IR spectra of compounds **1-4** and organometallic precursors M_C-M_S.

Figure S2. TGA thermograms of organometallic precursors M_C, M_N, M_O and M_S measured under nitrogen at a heating rate of 10 ^{o}C min^{-1}.
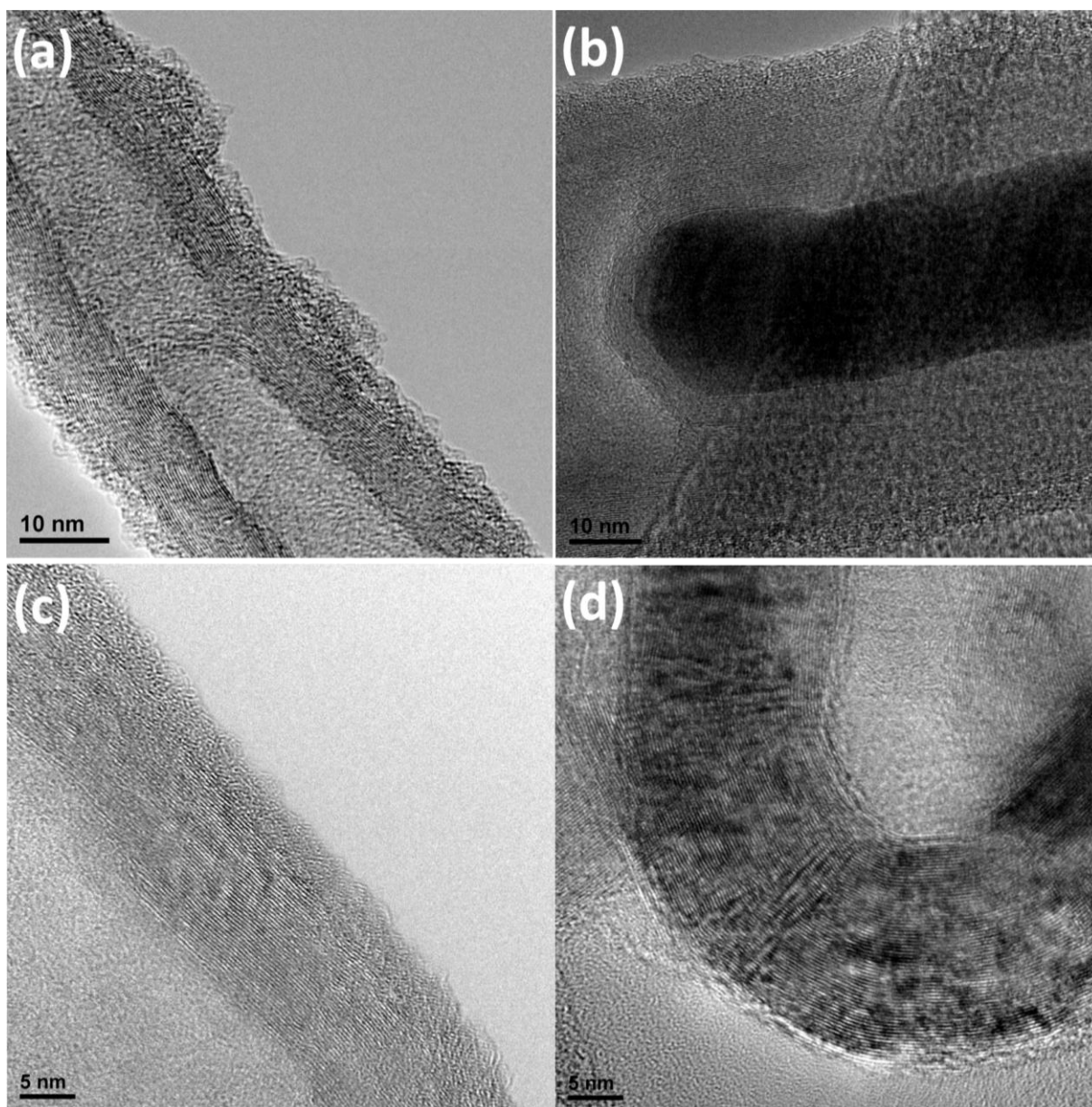
Figure S3. HRTEM images of the CNTs obtained through pyrolysis of M_C (a, b) and M_N (c, d).
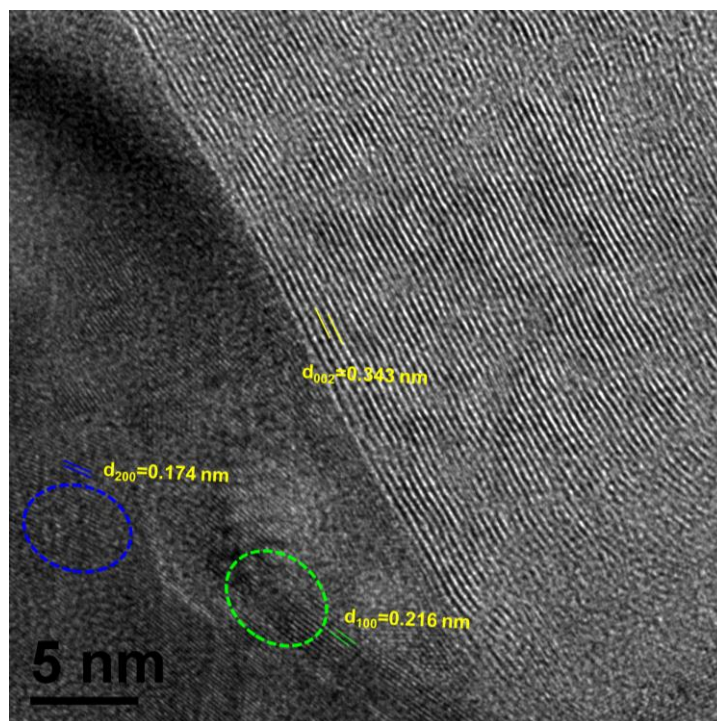
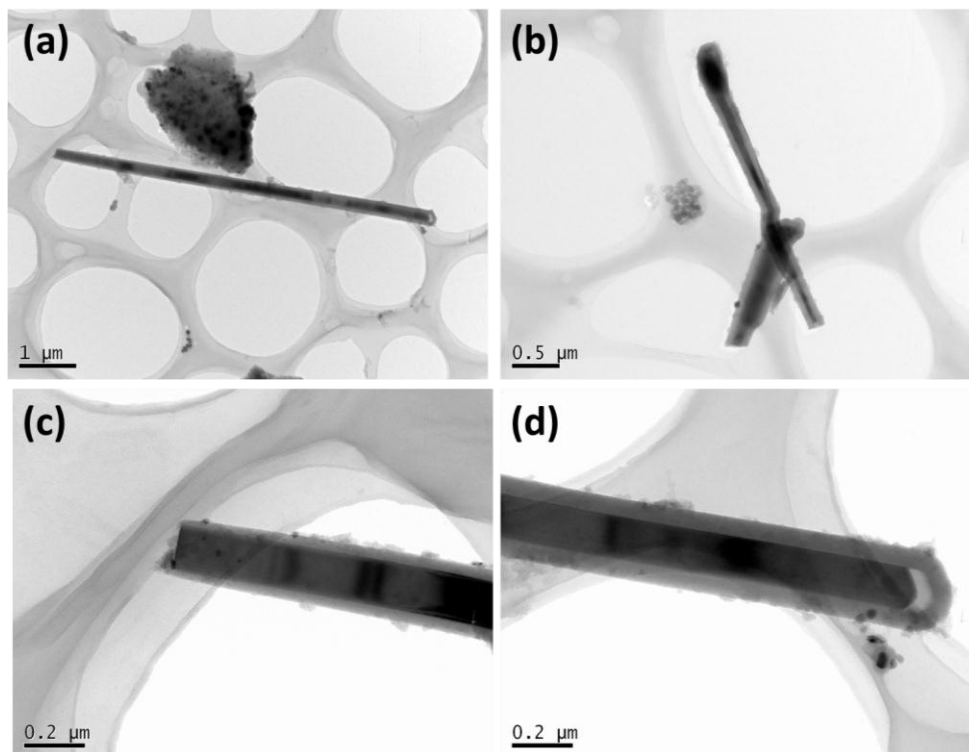**Figure S4.** HRTEM images of the nanoparticles obtained through pyrolysis of M_O.

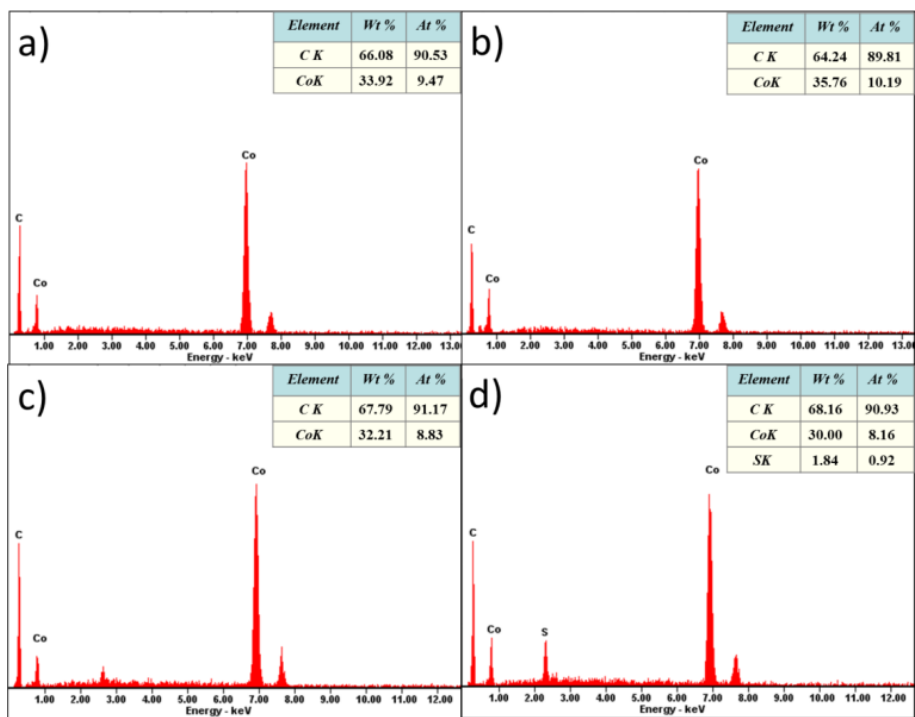**Figure S5.** TEM images of the cobalt core/carbon sheath nanocable obtained through pyrolysis of M_S.

Figure S6. SEM-EDX spectra of the materials obtained from pyrolysis of M_C-S (a), M_N-S (b), M_O-S (c) and M_S-S (d).

Experimental Section

General procedure for the synthesis of compounds 1-4: A mixture of 2,7-Dibromofluorene or 3,6-Diiodocarbazole or 2,8-Diiododibenzofuran or 2,8-Diiododibenzothiophene (1.00 equiv), CuI (20% equiv), triphenylphosphine (PPh$_3$) (10% equiv), tetrakis (triphenylphosphine) palladium (Pd(PPh$_3$)$_4$) (5 mol%) and THF/triethylamine (2:1 in volume), was charged with argon, and then phenylacetylene (3.00 equiv) was added dropwise by syringe. The reaction was stirred at 50-80 ^{o}C for 12 h. After cooled to room temperature, the mixture was filtered. The filtrate was evaporated to remove the solvent. The crude product was purified by column chromatography.

Compound **1**: White powder (1.22 g, 75%). ^{1}H NMR (300 MHz, CDCl$_3$) δ (ppm): 7.75 (m, 4H, ArH), 7.57 (m, 6H, ArH), 7.36 (m, 6H, ArH), 3.94 (s, 2H, -CH$_2$-). MS (EI), *m/z* [M$^+$]: 366.2, calcd: 366.1.

Compound **2**: White powder (1.43 g, 78%). ^{1}H NMR (300 MHz, CDCl$_3$) δ (ppm): 8.27 (s, 2H, ArH), 8.24 (s, 1H, N-H), 7.64 (s, 2H, ArH), 7.59 (d, J = 9 Hz, 4H, ArH), 7.40 (m, 8H, ArH). MS (EI), *m/z* [M$^+$]: 367.1, calcd: 367.1.

Compound **3**: White-off powder (0.58 g, 55%). ^{1}H NMR (300 MHz, CDCl$_3$) δ (ppm): 8.13 (s, 2H, ArH), 7.68 (d, J = 8.4 Hz, 2H, ArH), 7.57 (m, 6H, ArH), 7.38 (m, 6H, ArH). MS (EI), *m/z* [M$^+$]: 368.2, calcd: 368.1.

Compound **4**: White-off powder (0.62 g, 60%). ^{1}H NMR (300 MHz, CDCl$_3$) δ (ppm): 8.36 (s, 2H, ArH), 7.85 (d, J = 8.1 Hz, 2H, ArH), 7.60 (m, 6H, ArH), 7.37 (m, 6H, ArH). MS (EI), *m/z* [M$^+$]: 384.2, calcd: 384.1.

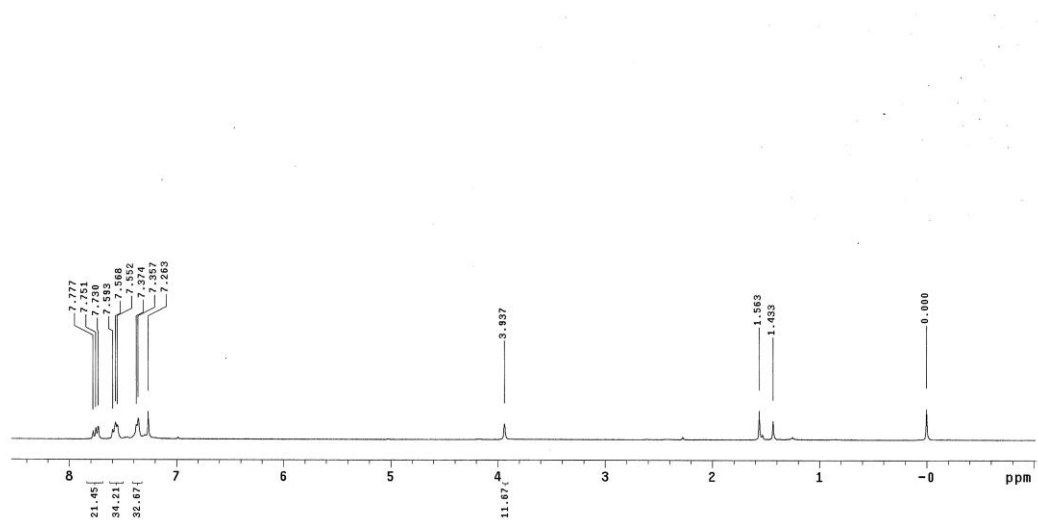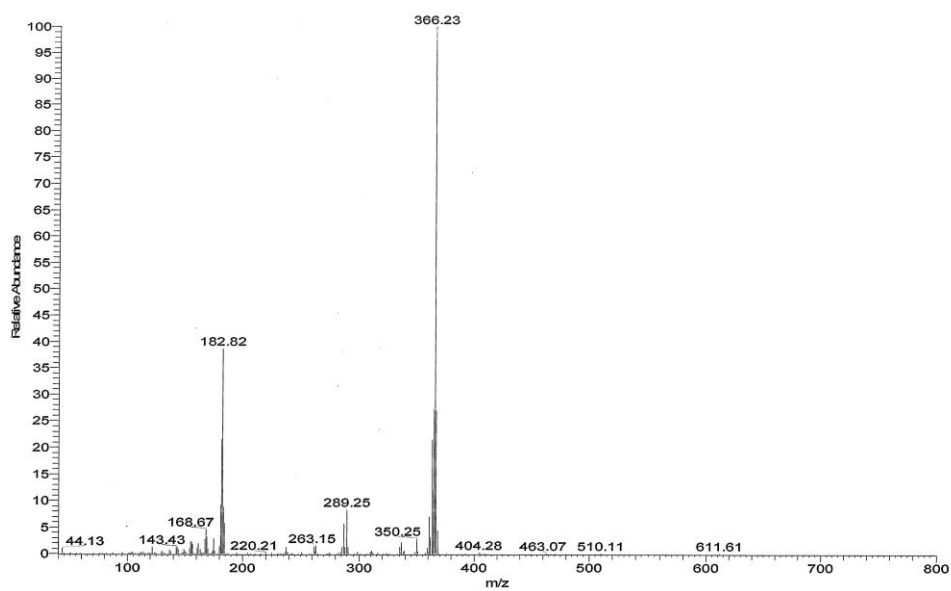**Figure S7.** ^{1}H NMR spectrum of **1** in CDCl$_3$.
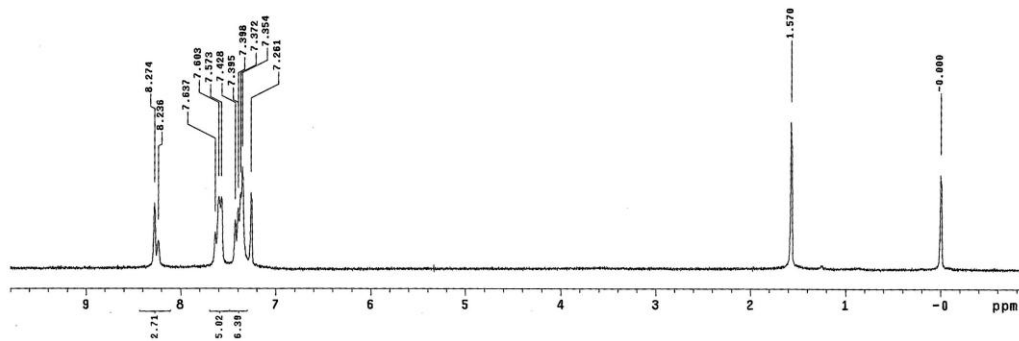

Figure S8. MS (EI) spectrum of **1**.

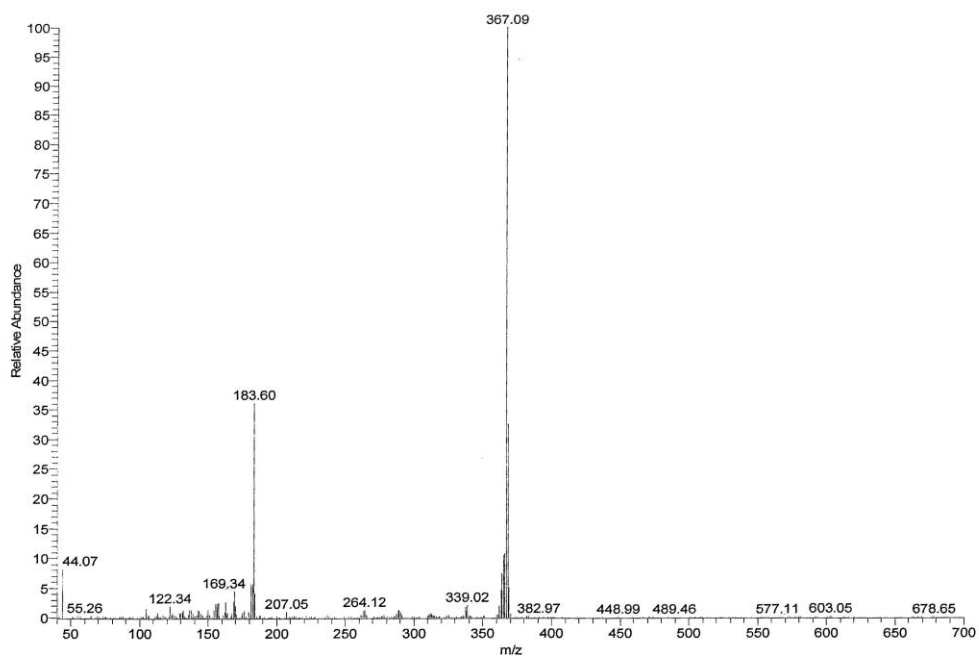**Figure S9.** ^{1}H NMR spectrum of **2** in CDCl$_3$.
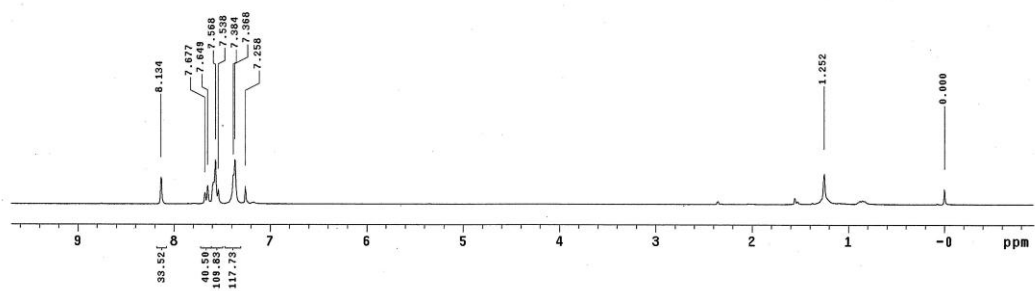

Figure S10. MS (EI) spectrum of **2**.

Figure S11. ^{1}H NMR spectrum of **3** in CDCl$_3$.
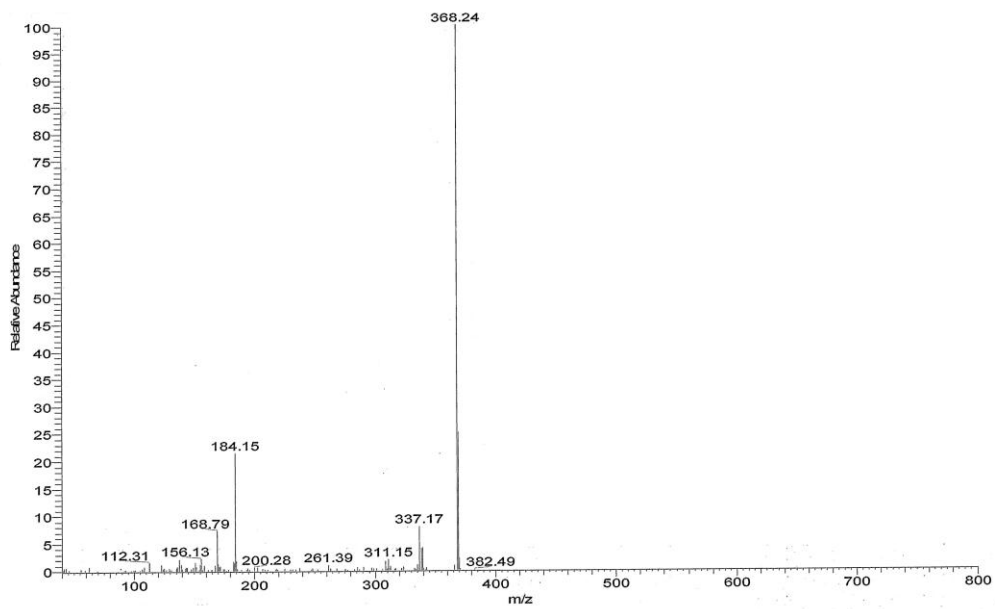

Figure S12. MS (EI) spectrum of **3**.
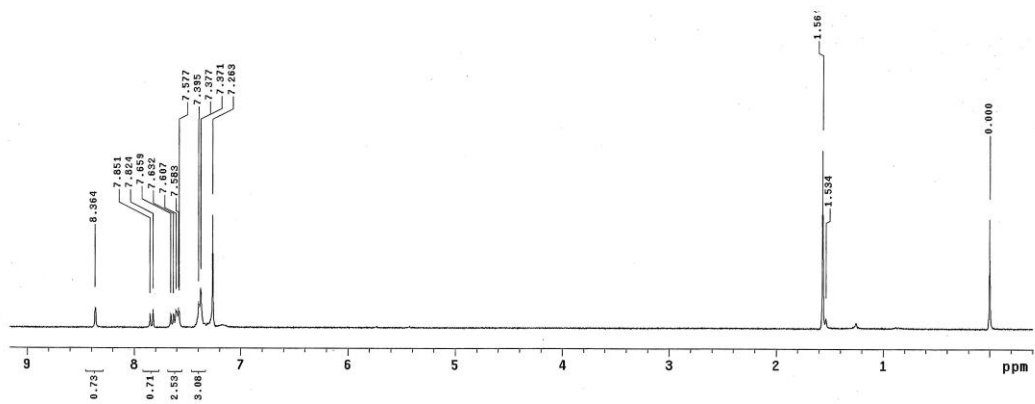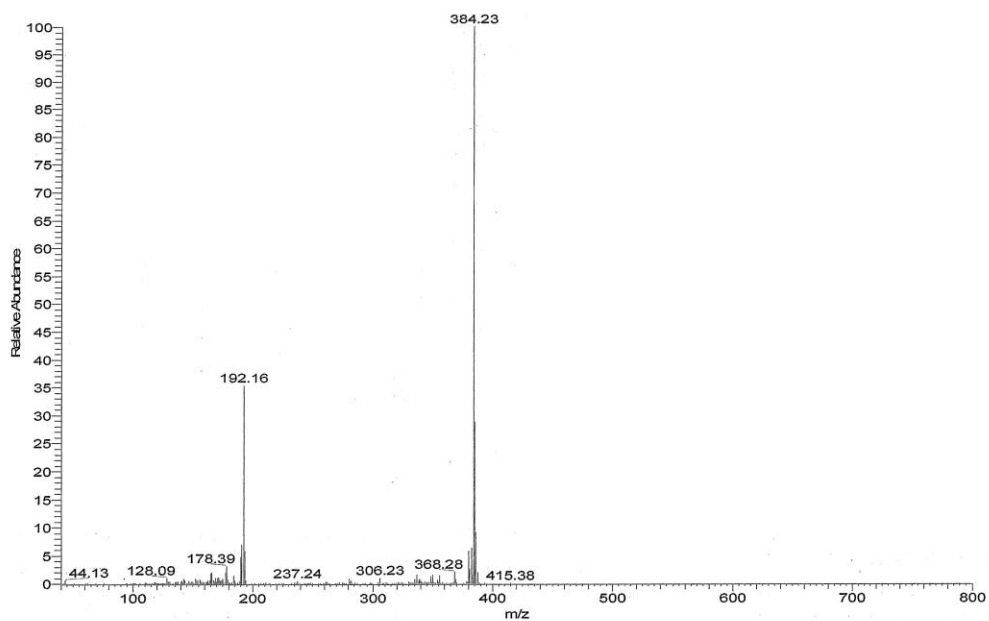
Figure S13. ^{1}H NMR spectrum of **4** in CDCl$_3$.

Figure S14. MS (EI) spectrum of **4**.
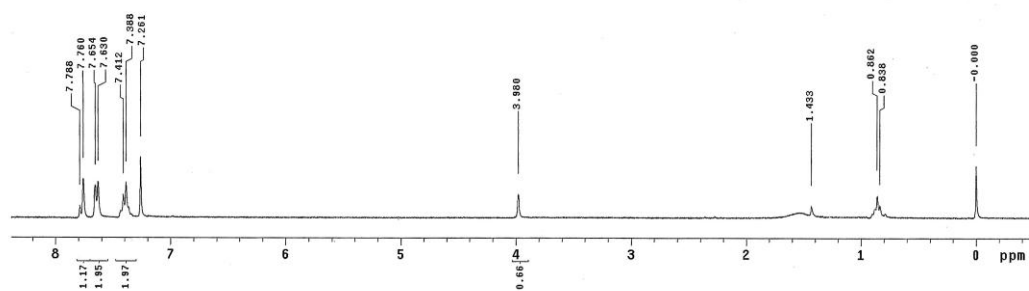
Figure S15. ^{1}H NMR spectrum of $\mathbf{M_C}$ in CDCl$_3$.
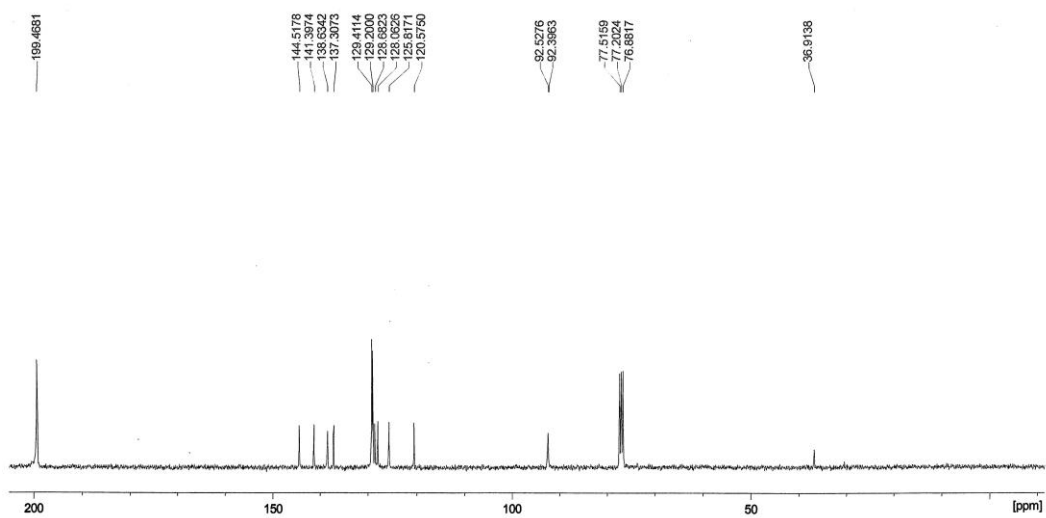
Figure S16. ^{13}C NMR spectrum of $\mathbf{M_C}$ in CDCl$_3$.

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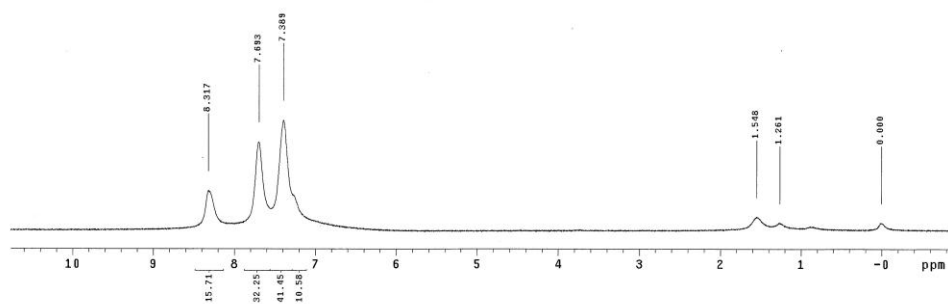
Figure S17. ^{1}H NMR spectrum of $\mathbf{M_N}$ in CDCl$_3$.
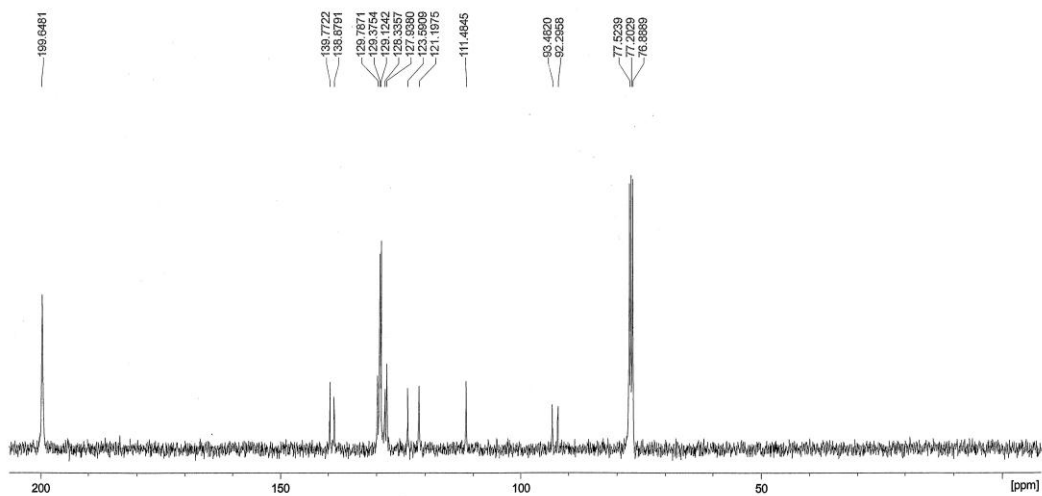
Figure S18. ^{13}C NMR spectrum of $\mathbf{M_N}$ in CDCl$_3$.
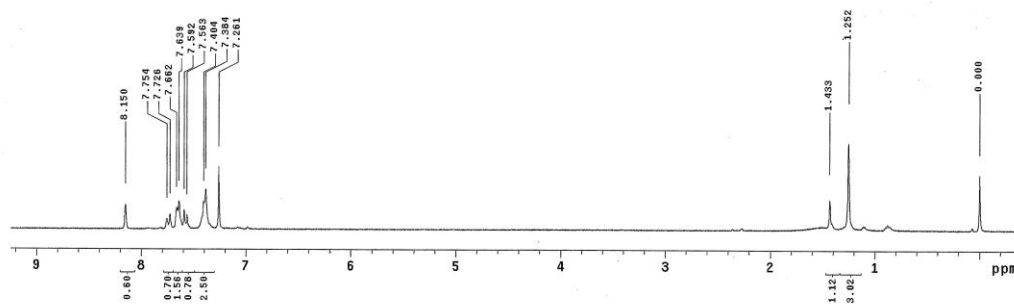
Figure S19. ^{1}H NMR spectrum of **M$_O$** in CDCl$_3$.
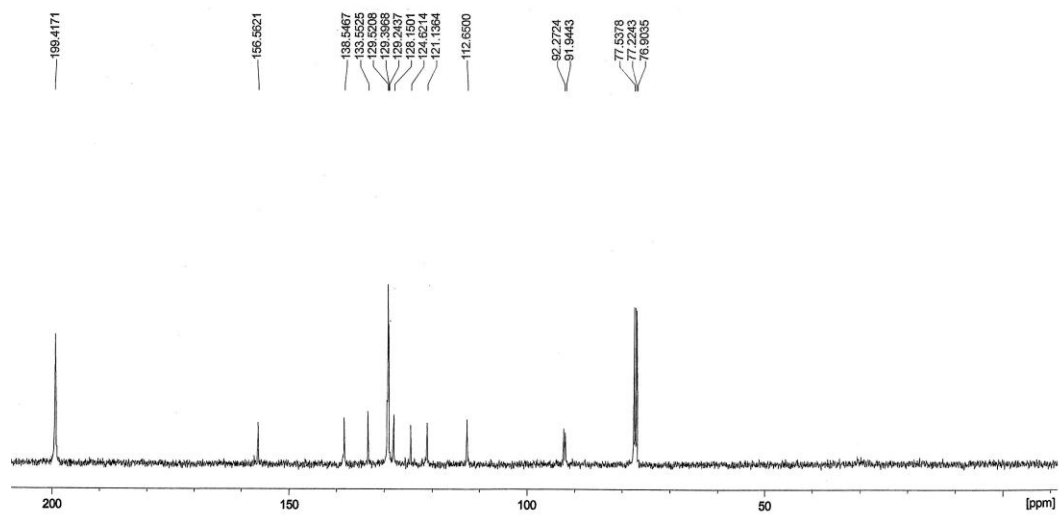
Figure S20. ^{13}C NMR spectrum of **M$_O$** in CDCl$_3$.
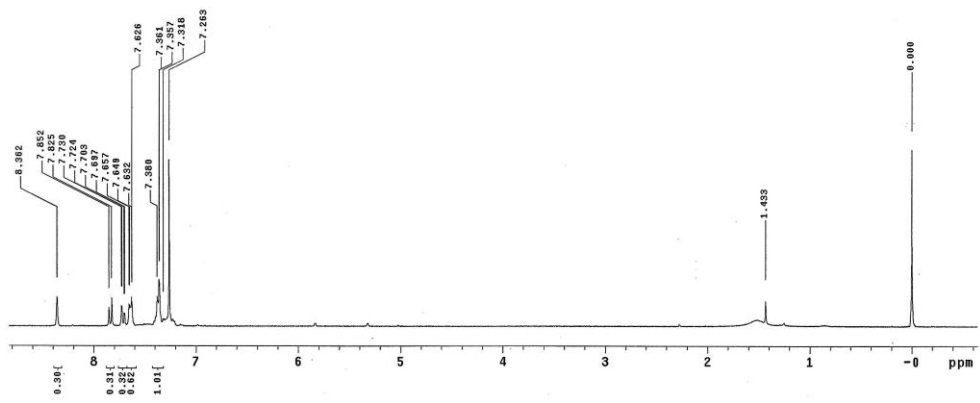
Figure S21. ^{1}H NMR spectrum of $\mathbf{M_S}$ in CDCl$_3$.
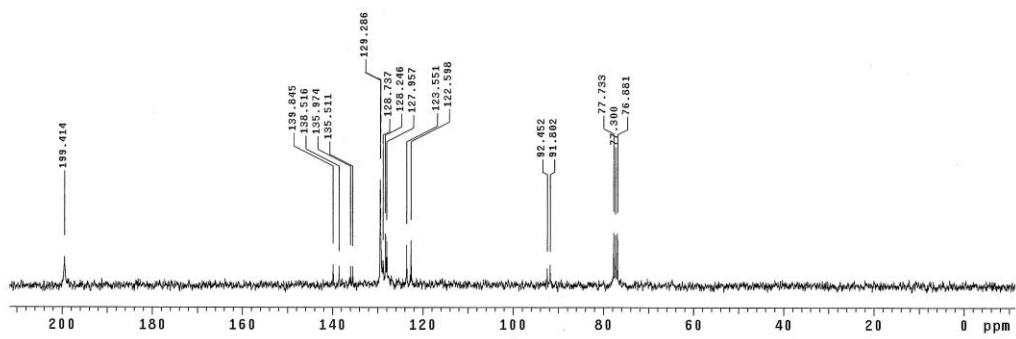
Figure S22. ^{13}C NMR spectrum of $\mathbf{M_S}$ in CDCl$_3$.