*Supporting Information*

*for*

A Simple and Efficient Catalyst for Suzuki Reaction based on Ultra-low Palladium Chloride Supported on ZnO Nanowires

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**Experimental Section:**

**General.** 1H and 13C NMR spectra were recorded on a AVANCE AV 400MHz (6-440Hz) spectrometers. The chemical shifts were reported in parts per million (*δ*) relative to internal standard TMS (0.03%) for CDCl3. The peak patterns are indicated as follows: s, singlet; d, doublet; dd, doublet of doublet; t, triplet; m, multiplet; q, quartet. The coupling constants, *J*, are reported in Hertz (Hz). CDCl3 was used as an NMR solvent. GC analysis was carried out on a GC-2010 Pro (FID). The model of the scanning electron microscope is Gemini SEM500, Resolution: 0.6nm@15KV; 1.1nm@1KV; 1.4nm@500V. Accelerating voltage: 0.02~30KV. Gain:12-2000000X. Beam current: 3pA-20nA. Electron gun: thermal field emission Schottky electron gun, beam stability due to 0.2%/h. The model of the transmission electron microscope (TEM) is Hitachi H7650. Accelerating voltage:120KV, Resolution: 0.204 nm (Lattice image), Gain:200-600000X, Sample tilt: ±20°, Image is tilted ±90°.

**Preparation procedure for ZnO nanowires:** Zinc chloride (0.2 g), sodium dodecyl sulfate (SDS, 1.5 g) and sodium carbonate (20 g) were dissolved in 40 mL deionized water, and stirred for 30 min. Then the solution was transferred into a 50 mL Teflon-lined autoclave and kept at 140℃ for 12 h. After cooled to the room temperature, the precipitate was collected by filtration, rinsed with deionized water and absolute ethanol for three times, and finally dried at 80℃ for 12 h under vacuum, to give the desired ZnO nanowires.

**Preparation procedure for PdCl2/ZnO*NWs* catalyst:** PdCl2/ZnO*NWs* catalyst was prepared by adsorption method: Firstly, take 1.8 mg of palladium chloride and dissolve it in a small amount of concentrated hydrochloric acid, and then dilute it to a 20 mL solution. Secondly, weigh 0.1 g of zinc oxide nanowires and disperse them in 1 mL of water. Then add 2 mL of the above prepared palladium chloride solvent and stir at room temperature for 3 hours. The precipitate was separated by centrifugation, washed three times with water and ethanol separately, and dried under vacuum to give the desired PdCl2/ZnO*NWs* catalyst.

**General procedure for the Suzuki-Miyaura reaction:** a mixture of aryl halide (0.25 mmol), arylboronic acid (0.375 mmol), PdCl2/ZnO*NWs* (1.0 mg, 76 mol ppm Pd species), and Na2CO3 (0.5 mmol) in EtOH/H2O (1.0 mL/1.0mL) were stirred at 80 ℃ for 12 h (24 h for aryl bromides). After completion of the reaction, the reaction mixture was cooled to room temperature, the mixture was extracted with ethyl acetate (3 mL x3). The combined organic phases were concentrated in vacuo and the crude products were purified by column chromatography (hexane/AcOEt) to give the corresponding products.

**Spectral data for all compounds**



**1,1'-biphenyl (3a).** Isolated by column chromatography (hexane/AcOEt = 20: 1, Rf = 0.8). The title compound was obtained as white solid (99%). 1H NMR (ppm) *δ* 7.66-7.64 (m, 4H), 7.49 (t, 4H, *J* = 7.2 Hz), 7.41-7.38 (m, 2H); 13C NMR (ppm) *δ* 141.2, 128.7, 127.2, 127.1.



**4-Methoxy-1,1'-biphenyl (3b).** Isolated by column chromatography (hexane/AcOEt = 5: 1, Rf = 0.6). The title compound was obtained as white solid (99%).1H NMR (ppm) *δ* 7.65 (dq, 4 H, *J* = 8.4 Hz, *J* = 8.4 Hz), 7.59 (dd, 1 H, *J* = 193.2 Hz, *J* = 193.2 Hz), 7.53 (dd, 2 H, *J* = 6.8 Hz, *J* = 6.8 Hz), 7.00 (dd, 2 H, *J* = 6.8 Hz, *J* = 6.8 Hz), 3.86 (s, 3 H); 13C NMR (ppm) *δ* 159.1, 140.8, 133.7, 128.7, 128.1, 126.7, 126.6, 114.2, 55.3.



**4-Chloro-1,1'-biphenyl (3c).** Isolated by column chromatography (hexane/AcOEt = 20: 1, Rf = 0.7). The title compound was obtained as light-yellow powder (99%).1H NMR (ppm) *δ* 7.54 (q, 4 H, *J* = 6 Hz), 7.48-7.36 (m, 5 H); 13C NMR (ppm) *δ* 134.0, 139.6, 133.4, 128.9, 128.8, 128.4, 127.6, 127.0.



**1-([1,1'-Biphenyl]-4-yl)ethan-1-one** **(3d)**. Isolated by column chromatography (hexane/AcOEt = 15: 1, Rf = 0.7). The title compound was obtained as white solid (99%). 1H NMR (ppm) *δ* 8.04 (d, 2 H, *J* = 8.4 Hz), 7.65 (dd, 4 H, *J* = 23.2 Hz, *J* = 22 Hz), 7.50-7.39 (m,3 H), 2.64 (s, 3 H);13C NMR (ppm) *δ* 197.6, 145.7, 139.8, 135.8, 128.9, 128.8, 128.2, 127.2, 127.2, 26.6.



**4,4'-Dimethyl-1,1'-biphenyl (3e).** Isolated by column chromatography (hexane/AcOEt = 5: 1, Rf = 0.5). The title compound was obtained as light-yellow solid (82%).1H NMR (ppm) *δ* 7.46 (d, 4H, *J* = 8 Hz), 7.2 (d, 4H, *J* = 8 Hz), 2.36 (s, 6H); 13C NMR (ppm) *δ* 138.3, 136.6, 129.4, 126.8, 21.0.



**1-(4'-Methyl-[1,1'-biphenyl]-4-yl)ethan-1-one (3f)**.Isolated by column chromatography (hexane/AcOEt = 25: 1, Rf = 0.7). The title compound was obtained as white powder (99%). 1H NMR (ppm) *δ* 8.02 (d, 2 H, *J* = 8 Hz), 7.67 (d, 2 H, *J* = 8 Hz), 7.54 (d, 2 H, *J* = 12 Hz), 7.28 (d, 2 H, *J* = 8 Hz), 2.64 (s, 3 H), 2.42 (s, 3 H); 13C NMR (ppm) *δ* 197.8, 145.7, 138.2, 136.9, 135.5, 129.7, 128.9, 127.1, 126.9, 29.7, 26.7, 21.2.



**4'-Methoxy-[1,1'-biphenyl]-4-Chloro (3g)**.Isolated by column chromatography (hexane/AcOEt = 2: 1, Rf = 0.7). The title compound was obtained as white powder (86%). 1H NMR (ppm) *δ* 7.52-7.46 (m, 4 H), 7.39 (dt, 2 H, *J* = 4.8 Hz, *J* = 4.8 Hz), 6.99 (dt, 2 H, *J* = 5.2 Hz, *J* = 5.2 Hz), 3.86 (s, 3 H); 13C NMR (ppm) *δ* 159.3, 139.2, 132.6, 132.5, 128.8, 128.0, 127.9,114.3, 55.3.

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**4'-Acetyl-(1,1'-biphenyl)-4-carbonitrile (3h).** Isolated by column chromatography (hexane/AcOEt = 2: 1, Rf = 0.6). The title compound was obtained as white solid (93%). 1H NMR (ppm) *δ* 8.06 (d, 2H, *J* = 8.4 Hz), 7.76-7.67 (m, 6H,), 2.64 (s, 3H); 13C NMR (ppm) *δ* 197.5, 144.2, 143.5, 136.8, 132.7, 129.1, 127.9, 127.4, 118.6, 111.8, 26.7.

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**1-(4'-Chloro-[1,1'-biphenyl]-4-yl)ethan-1-one (3i)**.Isolated by column chromatography (hexane/AcOEt = 2: 1, Rf = 0.6). The title compound was obtained as light yellow powder (99%). 1H NMR (ppm) *δ* 8.03 (dt, 2 H, *J* = 3.6 Hz, *J* = 4 Hz), 7.64 (dt, 2 H, *J* = 3.6 Hz, *J* = 4 Hz), 7.55 (dt, 2 H, *J* = 4.4 Hz, *J* = 4.4 Hz), 7.43 (dt, 2 H, *J* = 4.4 Hz, *J* = 4.4 Hz), 2.64 (s, 3 H); 13C NMR (ppm) *δ* 197.6, 144.4, 138.3, 136.1, 134.4, 129.1, 129.0, 128.5, 127.0, 26.6.

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**4,4'-Dimethoxy-1,1'-biphenyl (3j).** Isolated by column chromatography (hexane/AcOEt = 2: 1, Rf = 0.6). The title compound was obtained as white powder (99%).1H NMR (ppm) δ 7.48 (dt, 4H, J = 8.8 Hz, J = 1.6 Hz), 6.60 (dt, 4H, J = 8.8 Hz, J = 1.4 Hz), 3.85 (s, 6 H); 13C NMR (ppm) δ 158.7, 133.5, 127.7, 114.1, 55.3.

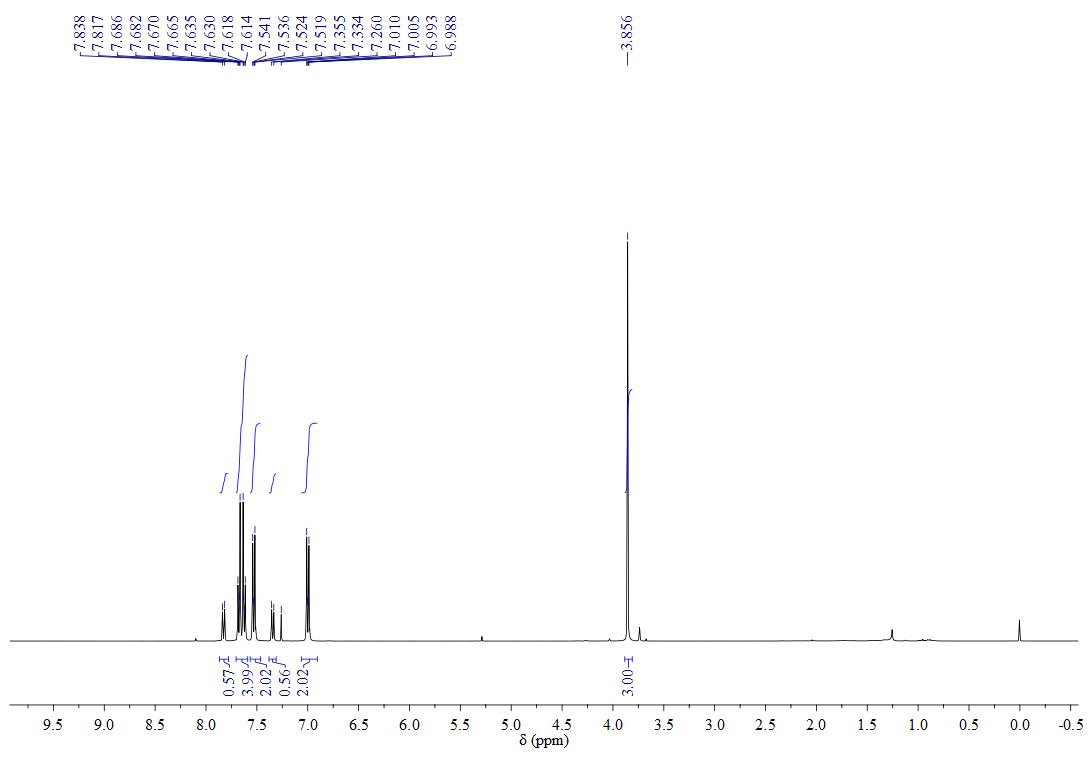


**4'-Methylester-(1,1'-biphenyl)-4-Methoxy (3k).** Isolated by column chromatography (hexane/AcOEt = 2: 1, Rf = 0.7). The title compound was obtained as white powder (87%). 1H NMR (ppm) *δ* 7.81 (d, 4H, *J* = 8.8 Hz), 7.65 (d, 4H, *J* = 8.8 Hz), 2.56 (s, 6H); 13C NMR (ppm) *δ* 197.23, 137.84, 136.28, 129.66, 101.05, 26.43.

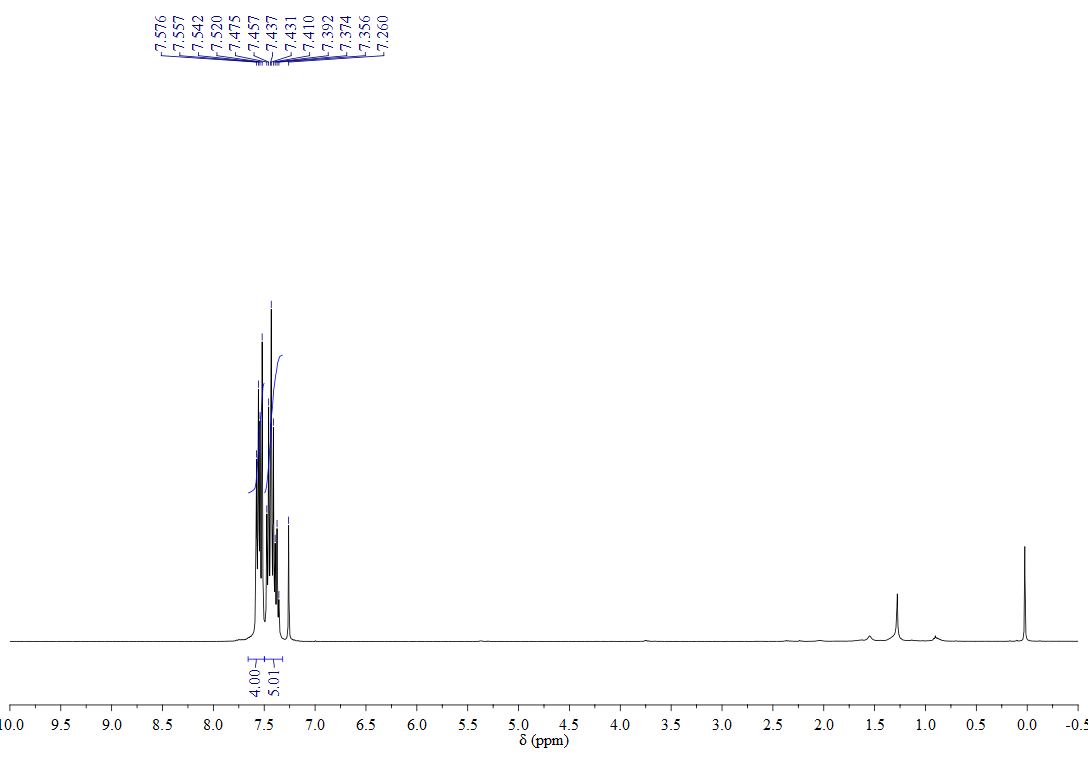
**1H and 13C NMR spectra for all compounds**

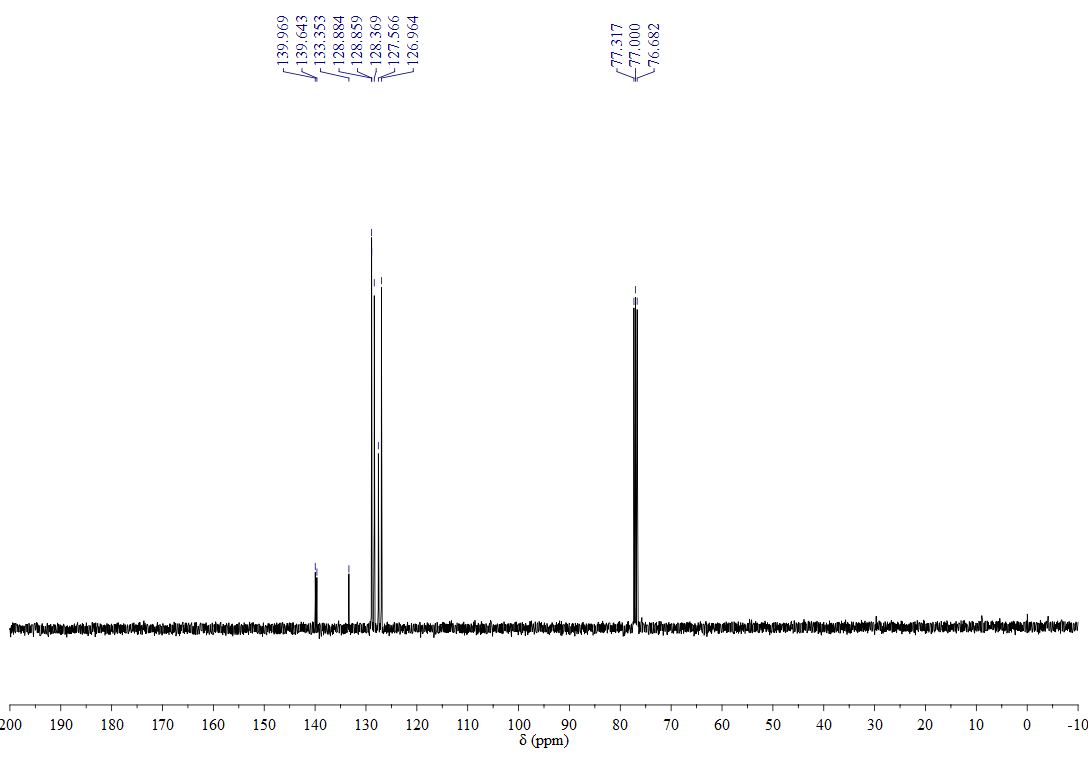


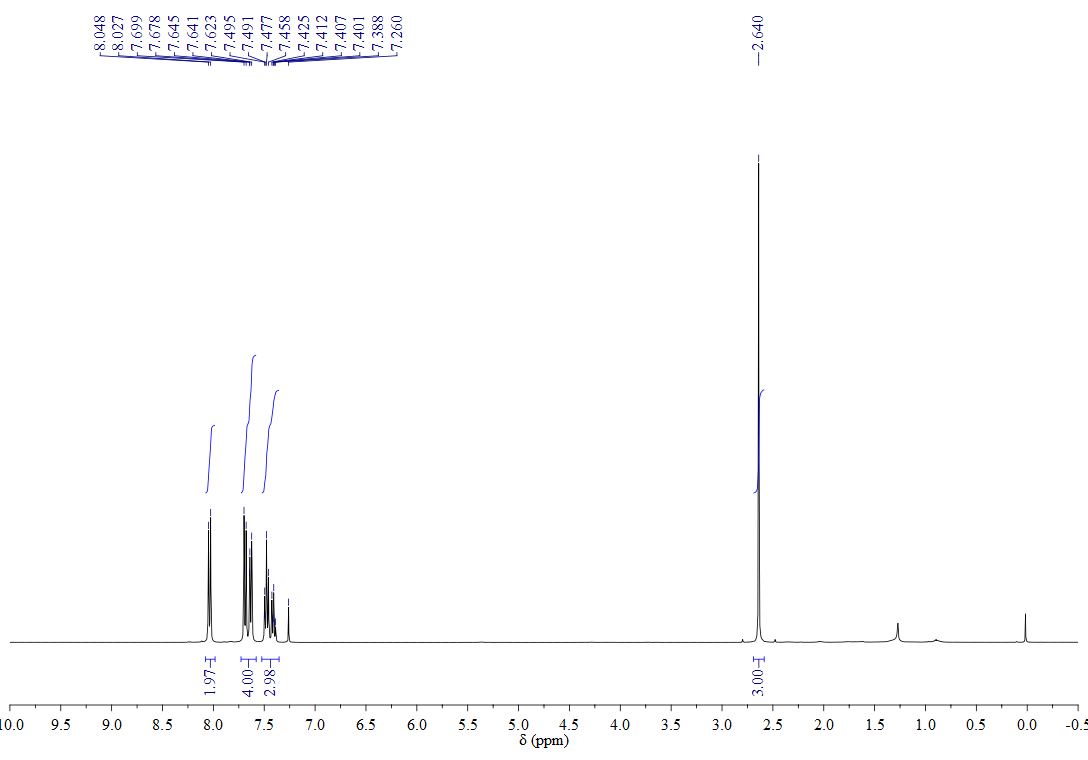




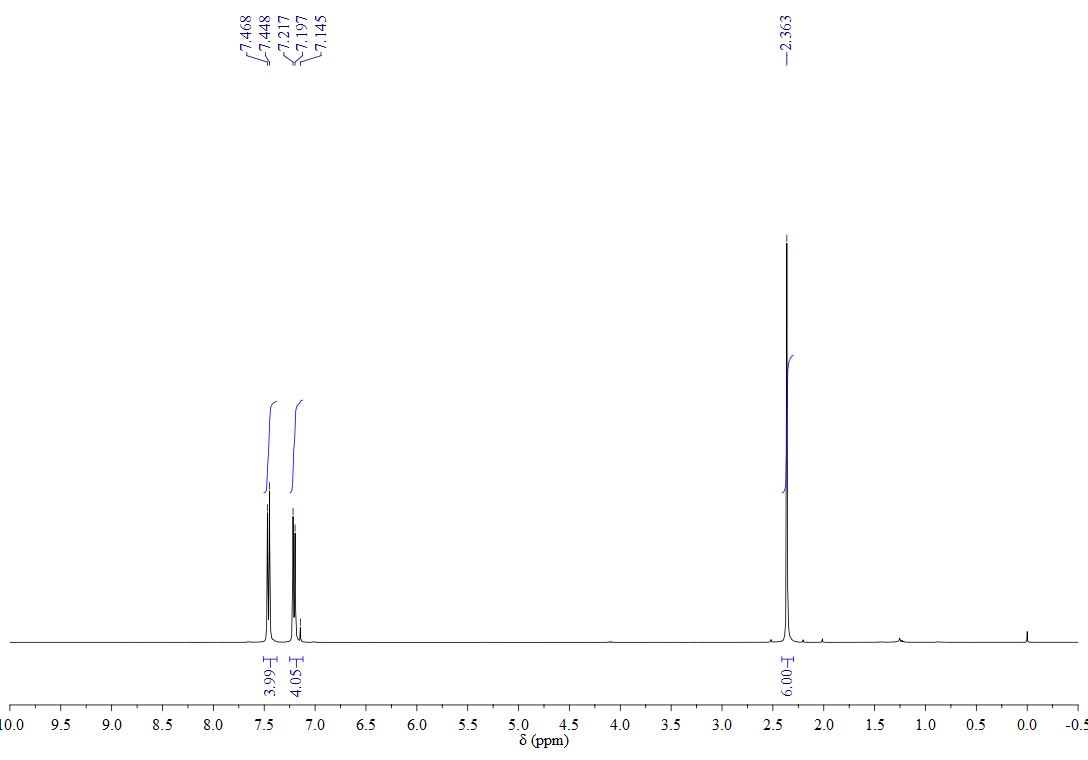




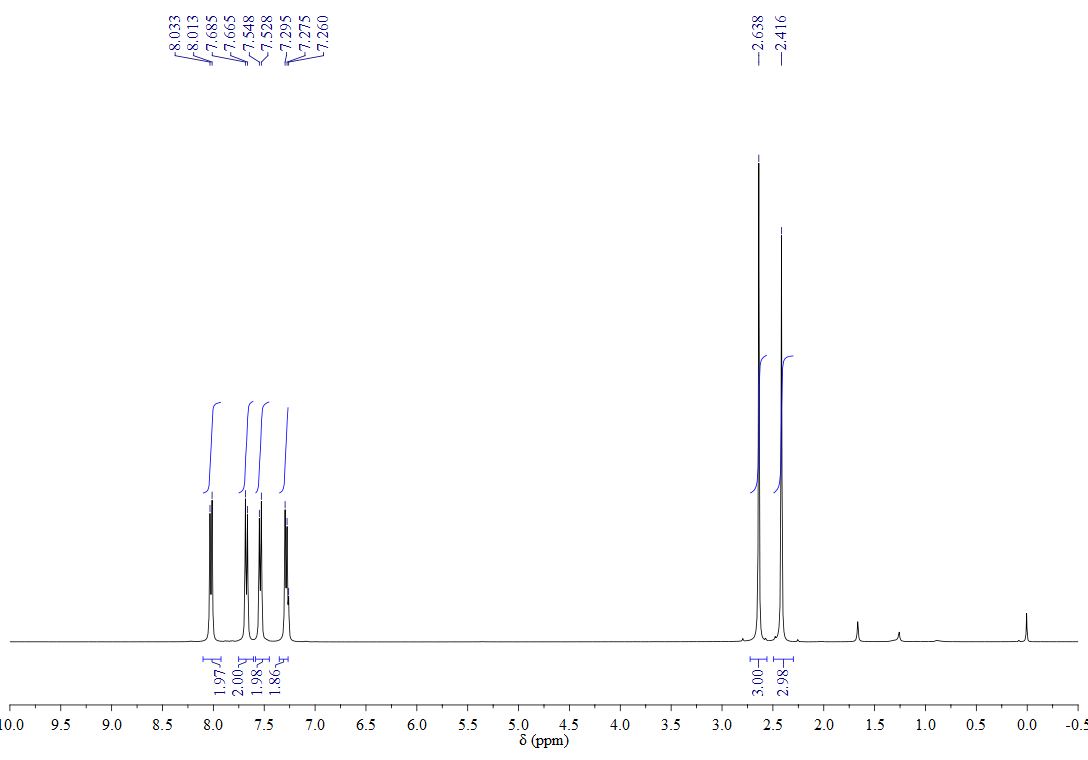




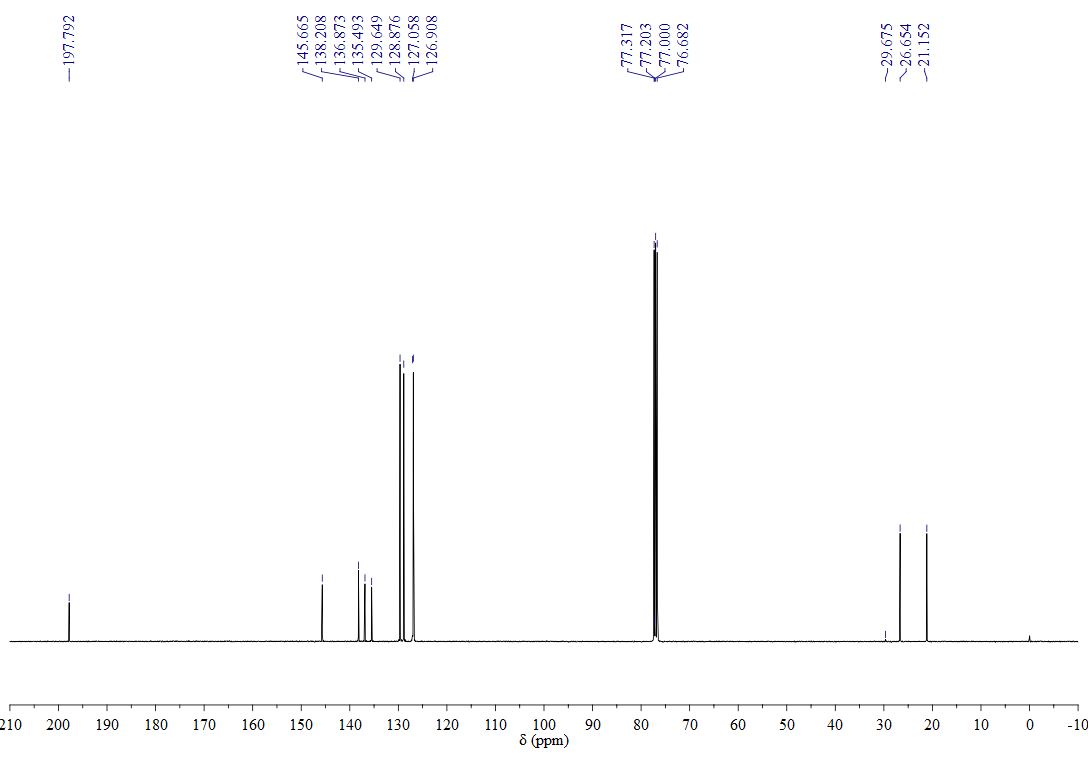


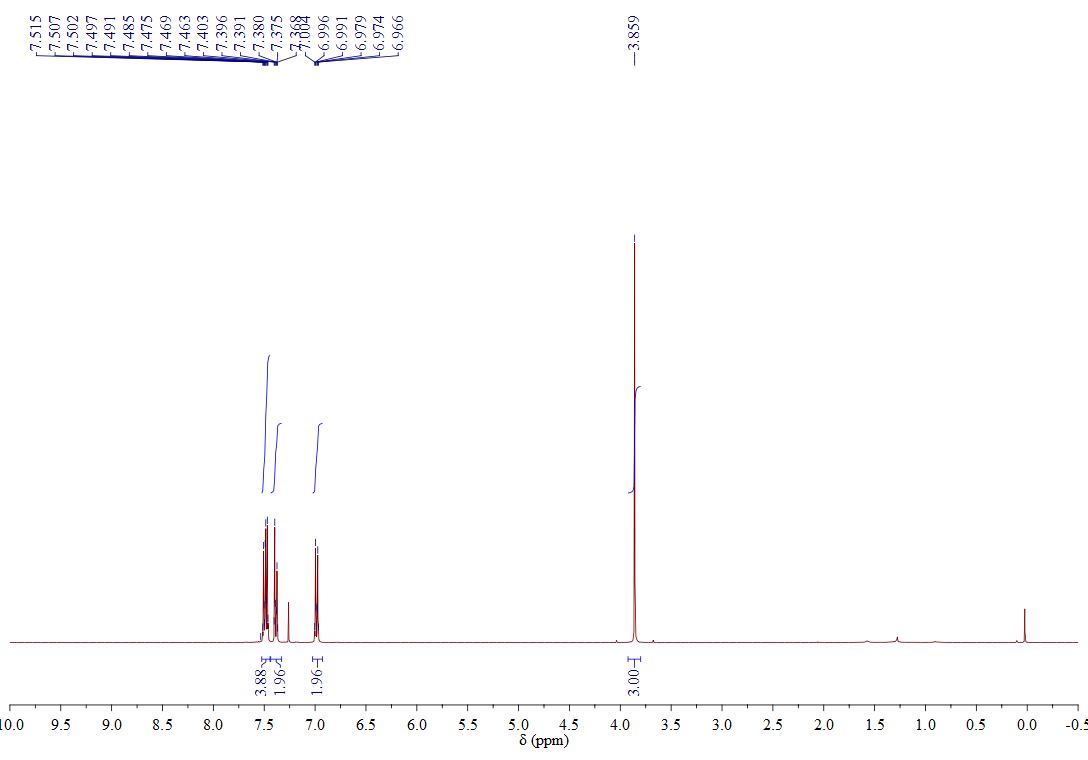




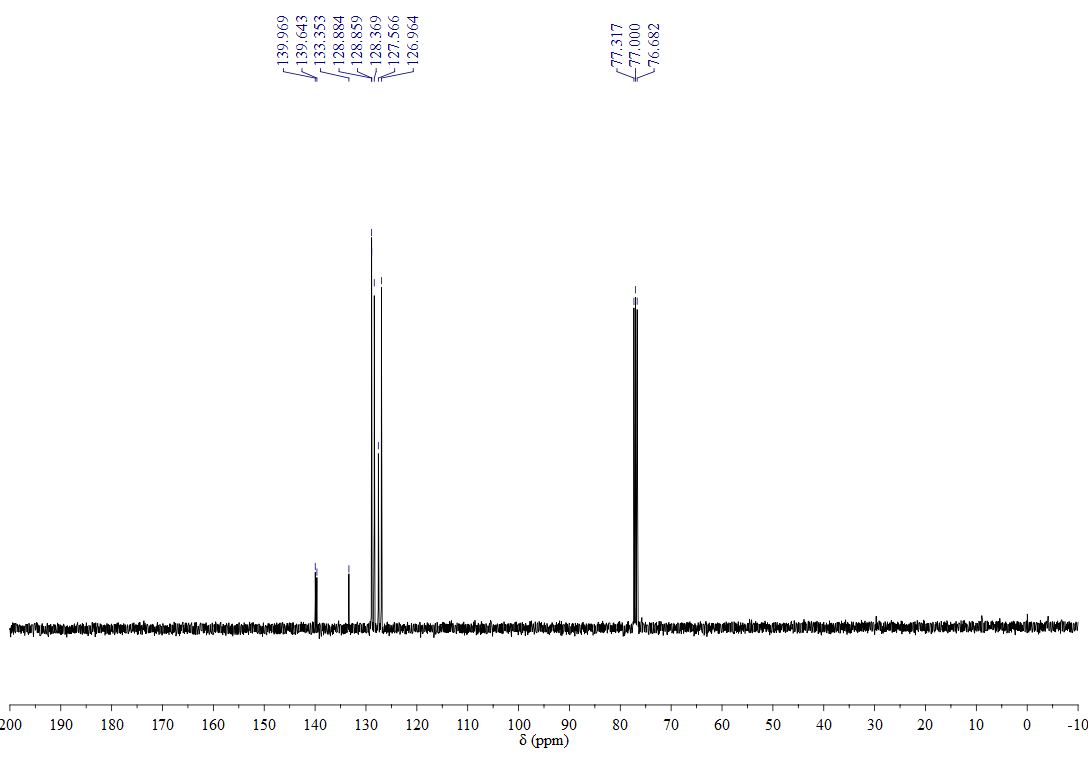


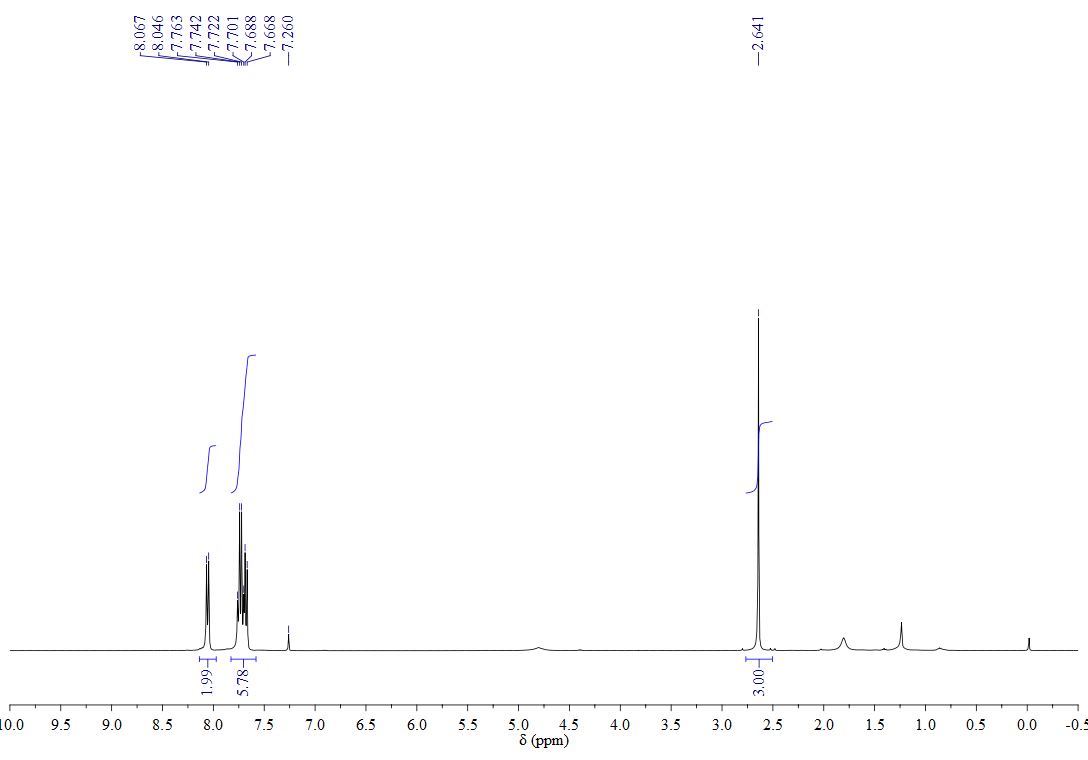






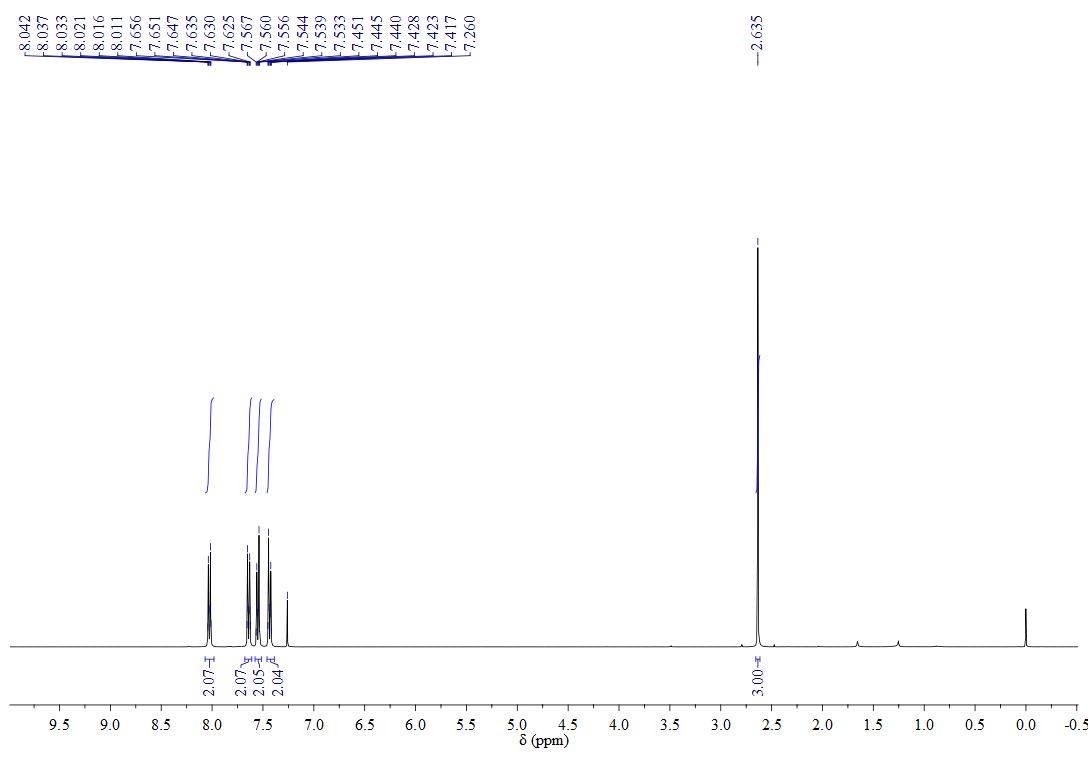




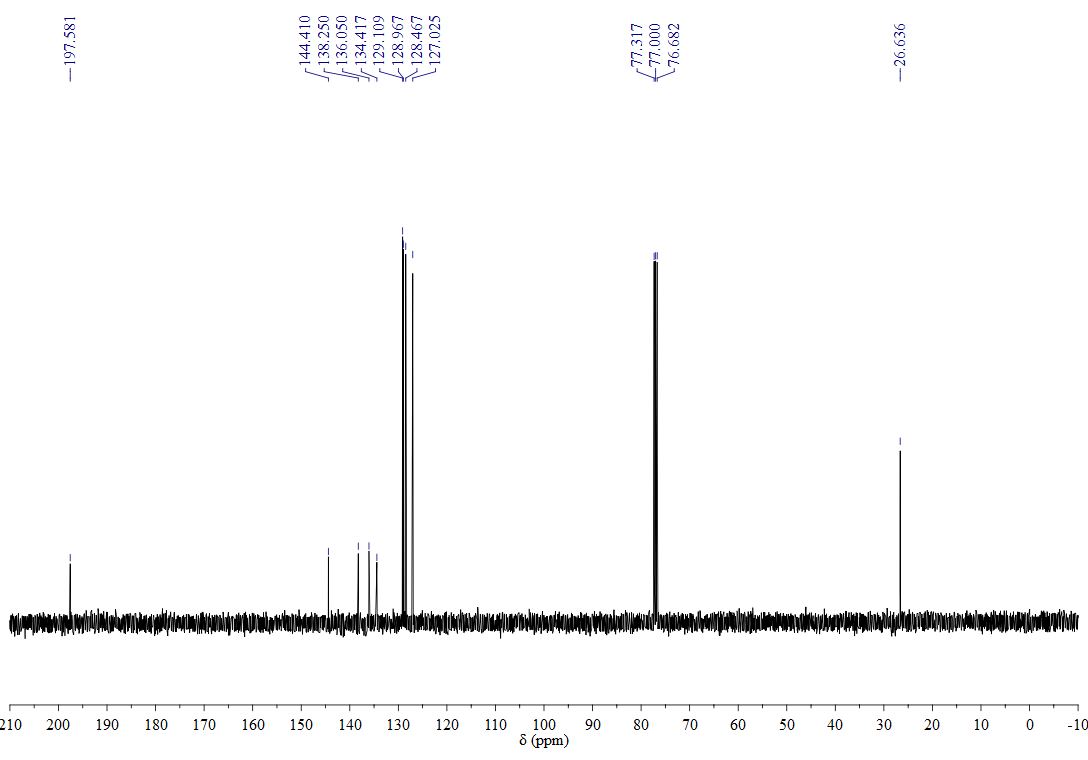


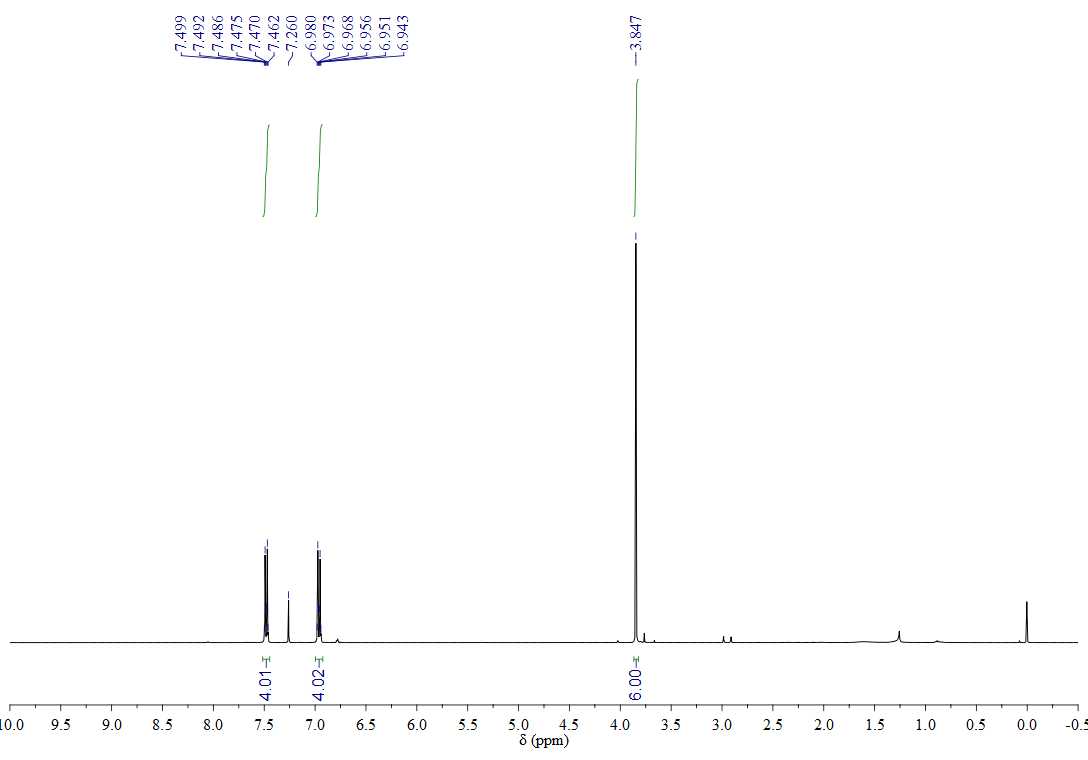










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