Supporting Information

A Highly Active and Recyclable Homogeneous NHC-Palladium Catalyst with pH- and Light-Sensitive Tags for the Suzuki–Miyaura Coupling Reactions of Aryl Halides with Arylboronic Acids

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1. General Techniques

1.1. Materials

Unless otherwise noted, all reactions were performed under an atmosphere of dry N₂ with oven-dried glassware and anhydrous solvents. Toluene, THF, hexane, and diethyl ether were distilled from sodium benzophenone under a N₂ atmosphere. CH₂Cl₂ was dried over CaCl₂, and distilled prior to use. All other solvents were dried over 4-8 Å mesh molecular sieves (Aldrich). Reactions were monitored by thin layer chromatography on 0.20 mm Anhui Liangchen silica gel plates and spots were detected with UV light. Silica gel (200-300 mesh) (from Anhui Liang Chenchem Company, Ltd.) was used for flash chromatography. The (Pd(allyl)Cl)₂¹ and nitrobenzospiropyran (SP)² were prepared according to literature method. Other chemicals or reagents were obtained from commercial sources.

1.2. Spectroscopic Procedures

NMR spectra were recorded with a Bruker Avance III 400 MHz spectrometer. UV-vis spectra were recorded with a SHIMADZU UV-2700 spectrophotometer at 20 °C. Elemental analyses were determined in house using a Perkin-Elmer 2400 CHN elemental analyzer.

1.3. Synthetic Procedures

All experiments were carried out in Synthware glass round-bottom flasks, equipped with magnetic stir bars and high vacuum Teflon valves.

2. Preparation of 1

![Diagram](image)

A 250-mL flask was charged with 3.73 mL 40% aqueous glyoxal and 50 mL methanol. Then 4-bromo-2,6-dimethyl phenylamine (13.5 g, 67 mmol) in 50 mL methanol was added dropwise at room temperature. After the mixture was stirred for 12 h at room temperature, the resulting yellow precipitate was collected by filtration and dried in vacuum.

A suspension of the resulting yellow precipitate (5.5 g, 13 mmol) in THF/methanol (40 mL/60 mL) was stirred at room temperature in a 250-mL round bottom flask equipped with a stir bar. Then sodium borohydride (7 g, 184 mmol) was slowly added. The mixture was refluxed for 1.5 h. After cooling to room temperature, saturated ammonium chloride aqueous solution (20 mL) was added.
The mixture was filtered and the filtrate was extracted with ether (3 x 20 mL), washed with water, dried over Na₂SO₄ and concentrated under vacuum to afford a pink solid. Yield: 69%. ¹H-NMR (400 MHz, CDCl₃) δ (ppm): 7.05 (s, 4H), 3.07 (s, 4H), 2.19 (s, 12H). ¹³C-NMR (100 MHz, CDCl₃) δ (ppm): 144.7, 131.7, 131.4, 114.6, 48.7, 18.3. Analytical Data. Calcd (found) for C₁₈H₂₂N₂Br₂: C, 50.73 (50.86); H, 5.20 (4.98).

3. Preparation of 2

Under a N₂ atmosphere, a 50-mL flask was charged with compound 1 (1 g, 2.3 mmol), ethyl acrylate (1.9 g, 18.8 mmol), trimethylamine (TEA) (1.9 g, 18.8 mmol), tetrakis-(triphenylphosphine)-palladium (0.27 g, 0.23 mmol) and toluene (2 mL). The mixture was heated to 100 ºC for 36 h. After cooling to room temperature, a quantity of water was added. The mixture was filtered and the filtrate was extracted with ether (3 x 20 mL), washed with water, dried over Na₂SO₄ and concentrated under vacuum to afford a yellow solid. The product was further purified by flash chromatography on a silica gel column using pentanes/ethyl acetate (3:1) as the eluent. Yield: 70%. ¹H-NMR (400 MHz, CDCl₃) δ (ppm): 7.57 (d, J = 16.0 Hz, 2H), 7.18 (s, 4H), 6.29 (d, J = 16.0 Hz, 2H), 4.23 (q, J = 7.2 Hz, 4H), 3.29 (s, 4H), 2.28 (s, 12H), 1.32 (s, 6H). ¹³C-NMR (100 MHz, CDCl₃) δ (ppm): 166.9, 147.5, 144.0, 128.6, 128.1, 127.3, 114.9, 59.7, 47.9, 18.3, 13.8. Analytical Data. Calcd (found) for C₂₉H₄₀N₂O₄: C, 72.47 (72.34); H, 8.39 (8.27).

4. Preparation of 3

A suspension of 2 (200 mg, 0.4 mmol) in 10% NaOH (8 mL) and methanol (24 mL) was refluxed in a 100-mL round bottom flask for 1.5 h. After cooling to room temperature, the pH of the mixture was adjusted to 1.0 with 1 M HCl and then extracted with CH₂Cl₂ (3 x 20 mL). The organic layer was dried over Na₂SO₄, filtered and concentrated in vacuum to give the resulting yellow solid. Yield: 90%. ¹H-NMR (400 MHz, DMSO) δ (ppm): 7.41 (d, J = 16.0 Hz, 2H), 7.23 (s, 4H), 6.26 (d, J = 16.0 Hz, 2H), 3.33 (s, 4H), 2.20 (s, 12H). ¹³C-NMR (100 MHz, DMSO) δ (ppm): 167.9, 148.7, 144.3,
129.0, 127.8, 125.9, 115.1, 47.5, 18.7. Analytical Data. Calcd (found) for C$_{24}$H$_{28}$N$_{2}$O$_{4}$: C, 70.57 (70.66); H, 6.91 (6.97).

5. Preparation of 4

DCC (N,N'-dicyclohexylcarbodiimide) (0.206 g, 1 mmol) and DMAP (4-dimethylaminopyridine) (0.25 g, 0.2 mmol) were added to a solution of 3 (0.20 g, 0.5 mmol) and (R/S)-SP (0.35 g, 1 mmol) in 5 mL anhydrous CH$_2$Cl$_2$ at 0 °C. The reaction mixture was then slowly warmed to room temperature and stirred for another 12 h at room temperature. Then the insoluble materials were filtered out and the filtrate was concentrated under vacuum. The crude product was purified by flash column chromatography on silica using CH$_2$Cl$_2$ as the eluent to give green product 4 as a solid. Yield: 60%. $^1$H-NMR (400 MHz, CDCl$_3$) δ (ppm): 8.00 (d, $J$ = 8.0 Hz, 4H), 7.51 (d, $J$ = 16.0 Hz, 2H), 7.22 (t, $J$ = 7.6 Hz, 2H), 7.11-7.08 (m, 6H), 6.92-6.88 (m, 4H), 6.71 (t, $J$ = 8.0 Hz, 4H), 6.14 (d, $J$ = 16.0 Hz, 2H), 5.88 (d, $J$ = 10.4 Hz, 2H), 4.33 (t, $J$ = 5.6 Hz, 4H), 3.62-3.55 (m, 4H), 3.30 (s, 4H), 2.29 (s, 12H), 1.28 (s, 6H), 1.17 (s, 6H). $^{13}$C-NMR (100 MHz, CDCl$_3$) δ (ppm): 166.3, 158.7, 147.7, 145.9, 144.6, 140.3, 135.0, 128.4, 127.8, 127.5, 127.1, 126.5, 125.1, 121.9, 121.0, 119.1, 117.7, 114.8, 113.6, 106.0, 105.7, 61.5, 52.6, 52.1, 47.6, 41.8, 25.1, 19.1, 18.1. Analytical Data. Calcd (found) for C$_{64}$H$_{64}$N$_{6}$O$_{10}$: C, 71.36 (73.97); H, 5.99 (6.25).

6. Preparation of 5
First 4 (220 mg, 0.2 mmol) and 2,3,4,5,6-pentafluorobenzaldehyde (78 mg, 0.4 mmol) were dissolved in 2 mL CH₂Cl₂. Then, 0.5 mL acetic acid was added and the mixture was stirred for 3 h at 30 °C. The solution was then extracted with CH₂Cl₂ (3 x 20 mL), washed with water, dried over Na₂SO₄ and concentrated under vacuum. The crude product was purified by flash chromatography on a silica gel column using pentanes/CH₂Cl₂ (1:1) as the eluent to give pure product 5 as a blue solid. Yield: 37%. ¹H-NMR (400 MHz, CD₃CN) δ (ppm): 8.04-8.02 (m, 2H), 7.96-7.90 (m, 2H), 7.41 (d, J = 3.6 Hz, 2H), 7.21-7.17 (m, 7H), 7.13 (d, J = 7.2 Hz, 2H), 7.08-7.04 (m, 2H), 6.87 (t, J = 7.2 Hz, 2H), 6.74-6.67 (m, 4H), 6.19 (dd, J = 6.0 Hz, J = 16.0 Hz, 2H), 5.97 (d, J = 10.4 Hz, 2H), 4.36-4.27 (m, 4H), 3.65-3.50 (m, 8H), 2.39 (s, 1H), 1.25 (s, 1H), 1.11 (s, 1H). ¹⁹F-NMR (376 MHz, CD₃CN) δ (ppm): -137.83 (s, 1F), -150.59 (d, J = 15 Hz, 1F), -156.85 (d, J = 19.6 Hz, 1F), -164.24 (d, J = 5.2 Hz, 1F), 164.86 (d, J = 1.8 Hz, 1F). Analytical Data. Calcd (found) for C₇₁H₆₃F₅N₆O₁₀: C, 67.93 (69.86); H, 5.06 (5.13).

7. Preparation of Catalyst 6

A suspension of (Pd(allyl)Cl)₂ (0.04 mg, 0.03 mmol) and 5 (0.022 mg, 0.06 mmol) in toluene (1 mL) was heated at 80 °C for 1.5 h under a N₂ atmosphere. After cooling to room temperature, petroleum ether was added. The mixture was filtered and the resulting solid was washed with petroleum ether. The product was dried under vacuum to give 6 as a light blue solid. Yield: 95%. ¹H-NMR (400 MHz, CDCl₃) δ (ppm): 7.99-7.97 (m, 4H), 7.61-7.48 (m, 2H), 7.28-7.19 (m, 6H), 7.09 (d, J = 7.2 Hz, 2H), 6.94-6.89 (m, 4H), 6.75-6.69 (m, 4H), 6.41 (d, J = 8.0 Hz, 1H), 6.22 (d, J = 8.0 Hz, 2H), 5.89 (d, J = 10.4 Hz, 2H), 4.38-4.23 (m, 4H), 3.88 (d, J = 7.2 Hz, 1H), 3.65-3.45 (m, 4H), 3.19-
3.13 (m, 4H), 3.03 (d, J = 12.0 Hz, 1H), 2.70 (d, J = 13.6 Hz, 1H), 2.49 (s, 12H), 1.81 (d, J = 12.0 Hz, 1H), 1.28 (s, 6H), 1.17 (s, 6H). $^{13}$C-NMR (100 MHz, CDCl$_3$) $\delta$ (ppm): 211.4, 166.7, 166.4, 159.4, 146.5, 144.3, 143.5, 141.0, 140.0, 139.8, 137.2, 135.7, 134.5, 131.1, 128.4, 127.8, 125.9, 122.7, 121.8, 121.8, 119.9, 119.1, 118.5, 118.2, 115.6, 114.4, 106.6, 106.4, 72.7, 62.6, 60.5, 52.9, 51.0, 46.0, 42.4, 29.6, 25.8, 19.8, 18.8. Analytical Data. Calcd (found) for $C_{68}H_{67}ClN_6O_{10}$Pd: C, 64.30 (64.66); H, 5.32 (5.87). High-resolution MS analysis (ESI) m/z: $[M-Cl]^+$ calcd 1233.3953, found 1233.3958.

8. Characterization of Complex 8

According to Ref (Org. Biomol. Chem. 2013, 11, 6047-6055.), the compound ME was converted to compound A and B in the presence of KOH in $i$-PrOH/H$_2$O. We characterized them by $^1$H NMR and the spectra are shown as follows. Judging from the spectra (base on the chemistry shift from 6.50 to 5.00 ppm), the products are a mixture and the ratio of A and B is 1:1. By this way, we also
characterized 8a/8b by $^1$H NMR and the products are also a mixture of 8a and 8b. The ratio of 8a and 8b is 1:4.
Partial amplification of $^1$H NMR of A and B (d$_6$-DMSO as solvent)

Partial amplification of $^1$H NMR of A and B (d$_6$-DMSO as solvent)
9. Absorption Spectrum of Complex 6, 7 and 8

Catalyst 6 (1 x 10^{-3} mmol) was dissolved in 10 mL i-PrOH–H_2O (1:1 v/v) (C=1.0 x 10^{-4} M). The
absorption spectrum of the resulting solution was then measured and the results are shown in Figure 1 (black line). Then, KOH (2 x 10^{-3} mmol) was added and the solution was shaken by hand. The absorption spectrum of the resulting solution is shown in Figure 1 (red line). Then, the pH of the above solution was adjusted to 7.0 with 1 M HCl. The absorption spectrum of that solution is shown in Figure 1 (blue line). The solution was then irradiated with light (λ > 380 nm) at room temperature for 2 min. The results are shown in Figure 1 (green line).

10. Optimization of the Reaction Conditions

A mixture of phenylboronic acid (0.25 mmol), 4-bromotoluene (0.25 mmol), and base (0.5 mmol) was dissolved in different solvent (1 mL) and heated to 30 °C. Then catalyst 6 (0.1 mol %) was added and the reaction mixture was stirred for 4-12 h. After completion of the reaction, the mixture was extracted three times with n-hexane (3 x 1 mL), dried over anhydrous Na₂SO₄, filtered and concentrated under vacuum. The products were further purified by flash chromatography on a silica gel column. The results are presented in Table S1.

Table S1 Optimizing reaction conditions for the reaction of 4-bromotoluene with phenylboronic acid.\textsuperscript{a}

<table>
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<tr>
<th>entry</th>
<th>base</th>
<th>solvent</th>
<th>time</th>
<th>yield (%)\textsuperscript{b}</th>
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<td>1</td>
<td>KOH</td>
<td>i-PrOH/ H₂O (1:1)</td>
<td>4h</td>
<td>99</td>
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<tr>
<td>2</td>
<td>KOH</td>
<td>DMF/ H₂O (1:1)</td>
<td>12h</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
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<td>THF/ H₂O (1:1)</td>
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<td>0</td>
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<tr>
<td>4</td>
<td>KOH</td>
<td>MeOH/ H₂O (1:1)</td>
<td>12h</td>
<td>60</td>
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<td>MeOH</td>
<td>12h</td>
<td>70</td>
</tr>
<tr>
<td>11</td>
<td>K₂CO₃</td>
<td>i-PrOH/ H₂O (1:1)</td>
<td>4h</td>
<td>50</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Reactions were carried out using 4-bromotoluene (0.25 mmol, 1 equiv), PhB(OH)₂ (0.25 mmol, 1 equiv), solvent (1 mL) and base (1 mmol, 2 equiv) at 30 °C. \textsuperscript{b} Isolated yields.

**Fig.S1** Homogeneous catalyst system for Suzuki-Miyaura coupling reactions of aryl halides with arylboronic acids.

### 12. General Procedure for NHC-Pd(II) Catalyzed Suzuki-Miyaura Coupling Reaction of Aryl halides with Arylboronic acids

A mixture of arylboronic acids (0.25 mmol), aryl halides (0.25 mmol), and KOH (0.5 mmol) was dissolved in $i$-PrOH/H$_2$O (0.5 mL / 0.5 mL) and heated to 30 °C. Then catalyst 6 (0.1 mol %) was added and the reaction mixture was stirred for 4 h. After completion of the reaction, the mixture was extracted three times with n-hexane (3 x 1 mL), dried over anhydrous Na$_2$SO$_4$, filtered and concentrated under vacuum. The products were further purified by flash chromatography on a silica gel column.

### 13. General Procedure for Recycling the NHC-Pd(II) Catalyst

A mixture of PhB(OH)$_2$ (0.25 mmol), 4-bromotoluene (0.25 mmol), and KOH (0.5 mmol) was dissolved in $i$-PrOH/H$_2$O (0.5 mL/ 0.5 mL) and heated to 30 °C. Then catalyst 6 (0.5 mol %) was added and the mixture was stirred. After completion of the reaction, the products were separated from the reaction mixture by adding cyclohexane (2 x 1 mL) as the extraction media. Then, the pH of the solution was adjusted to 7.0 with 1 M HCl and extracted with CH$_2$Cl$_2$ (2 x 1 mL). The CH$_2$Cl$_2$
solution was irradiated with visible light (λ > 380 nm). After the color of the purple solution disappeared, the solution was dried over magnesium sulfate, filtered and concentrated by vacuum to give the original catalyst 6, which was then used in another reaction cycle.

14. Characterization Data of the Products in Table 2 and Table 3:

4-Methyl-biphenyl (11a): \(^{1}H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm): 7.61-7.57 (m, 2H), 7.51-7.41 (m, 4H), 7.37-7.30 (m, 1H), 7.26-7.24 (m, 2H), 2.40 (s, 3H). \(^{13}C\) NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm): 141.2, 138.4, 137.0, 129.5, 128.8, 127.3, 127.2, 127.0, 21.1.

Biphenyl (11b): \(^{1}H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm): 7.70-7.68 (m, 4H), 7.55-7.51 (m, 4H), 7.45-7.42 (m, 2H); \(^{13}C\) NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm): 141.3, 128.8, 127.7, 127.2.

4-Fluoro-biphenyl (11c): \(^{1}H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm): 7.59 (d, J = 8.0 Hz, 1H), 7.55-7.52 (m, 2H), 7.46-7.41 (m, 3H), 7.34 (t, J = 7.6 Hz, 3H), 7.12 (t, J = 8.4 Hz, 2H); \(^{13}C\) NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm): 162.4 (d, J = 245.7 Hz, 1C), 140.3, 137.3, 128.8, 128.7, 128.6, 127.2, 127.0, 115.6 (d, J = 21.2 Hz, 1C).

2-Methyl-biphenyl (11d): \(^{1}H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm): 7.40-7.33 (m, 2H), 7.32-7.26 (m, 3H), 7.25-7.18 (m, 4H), 2.25 (s, 3H); \(^{13}C\) NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm): 142.0, 142.0, 135.3, 130.3, 129.8, 129.2, 128.1, 127.3, 126.8, 125.8, 20.5.

Biphenyl-4-carbaldehyde (11e): \(^{1}H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm): 10.06 (s, 1H), 7.96 (d, J = 8.4 Hz, 2H), 7.75 (d, J = 8.0 Hz, 2H), 7.66-7.63 (m, 2H), 7.51-7.40 (m, 3H); \(^{13}C\) NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm): 191.9, 147.1, 139.7, 135.2, 130.2, 129.0, 128.5, 127.6, 127.3.

2-Phenyl-pyridine (11f): \(^{1}H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm): 8.72-8.71 (m, 1H), 8.01-7.99 (m,
4-Nitro-biphenyl (11g): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 8.32-8.28 (m, 2H), 7.76-7.72 (m, 2H), 7.64-7.61 (m, 2H), 7.52-7.43 (m, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 147.6, 147.0, 138.7, 129.1, 128.9, 127.8, 127.4, 124.1

4-Methoxy-4'-methyl-biphenyl (12a): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 7.51 (d, $J = 8.8$ Hz, 2H), 7.45 (d, $J = 8.4$ Hz, 2H), 7.23 (d, $J = 7.6$ Hz, 2H), 6.97 (d, $J = 8.8$ Hz, 2H), 3.85 (s, 3H), 2.38 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 158.9, 138.0, 136.3, 133.7, 129.4, 127.9, 126.6, 114.2, 55.3, 21.0.

4-Chloro-4'-methyl-biphenyl (12b): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 7.51-7.49 (m, 2H), 7.47-7.46 (m, 2H), 7.44-7.41 (m, 2H), 7.40-7.37 (m, 2H), 2.39 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 139.6, 137.4, 137.1, 133.0, 129.6, 128.8, 128.1, 21.1.

4,4'-Dimethyl-biphenyl (12c): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 7.47 (d, $J = 8.0$ Hz, 4H) 7.23 (d, $J = 8.0$ Hz, 4H), 2.38 (s, 6H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 138.4, 136.7, 129.5, 126.9, 21.1.

2,4'-Dimethyl-biphenyl (12d): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 7.30-7.27 (m, 8H), 2.44 (s, 3H), 2.31 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 141.9, 139.1, 136.4, 135.4, 130.3, 129.9, 129.1, 128.8, 127.1, 125.8, 21.2, 20.6.

4'-Methyl-biphenyl-4-ol (12e): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 7.44 (d, $J = 8.4$ Hz, 4H), 7.22 (d, $J = 7.6$ Hz, 2H), 6.89 (d, $J = 8.4$ Hz, 2H), 4.75 (s, 1H), 2.38 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 154.8, 137.9, 136.4, 134.0, 129.4, 128.1, 126.5, 115.5, 21.0.
3-Fluoro-4'-methyl-biphenyl (12f): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 7.49-7.46 (m, 2H), 7.42-7.34 (m, 2H), 7.29-7.25 (m, 3H), 7.09-6.99 (m, 1H), 2.40 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 163.2 (d, J = 243.9 Hz), 143.4 (d, J = 7.8 Hz), 137.7, 137.3, 130.2 (d, J = 8.2 Hz), 129.6, 126.9, 122.7 (d, J = 19.8 Hz), 113.8 (t, J = 5.3 Hz), 113.7 (d, J = 4.7 Hz), 21.0.

1-Methyl-4-p-tolyl-naphthalene (12g): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 8.06 (d, J = 8.4 Hz, 1H), 7.94 (d, J = 8.4 Hz, 1H), 7.56-7.52 (m, 1H), 7.45-7.41 (m, 1H), 7.39-7.36 (m, 3H), 7.32-7.29 (m, 3H), 2.75 (s, 3H), 2.46 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 138.6, 138.1, 136.7, 133.5, 132.8, 131.8, 130.0, 128.9, 126.7, 126.5, 126.1, 125.5, 124.3, 21.2, 19.5. Analytical Data. Calcd (found) for C$_{18}$H$_{16}$: C, 93.06 (93.12); H, 6.94 (6.88).

3-p-Tolyl-furan (12h): $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm): 7.70 (s, 1H), 7.48-7.46 (m, 1H), 7.38 (d, J = 8.4 Hz, 2H), 7.18 (d, J = 8.4 Hz, 2H), 6.68 (m, 1H), 2.36 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm): 143.5, 138.1, 136.7, 129.4, 129.4, 126.8, 125.7, 108.8, 21.1.

15. NMR Spectra of Compounds
References