

# 4'-Methyl-2'-(quinolin-8-ylcarbamoyl)-biphenyl-4-carboxylic Acid Ethyl Ester

Hamad H. Al Mamari <sup>1,\*</sup>, and Anfal Al Hasani <sup>1</sup>

<sup>1</sup> Department of Chemistry, College of Science, Sultan Qaboos University, PO Box 36, Al Khoudh 123, Muscat, Sultanate of Oman

\* Correspondence: halmamari@squ.edu.om; Tel.: +968 24142472, Fax: +968 24141469

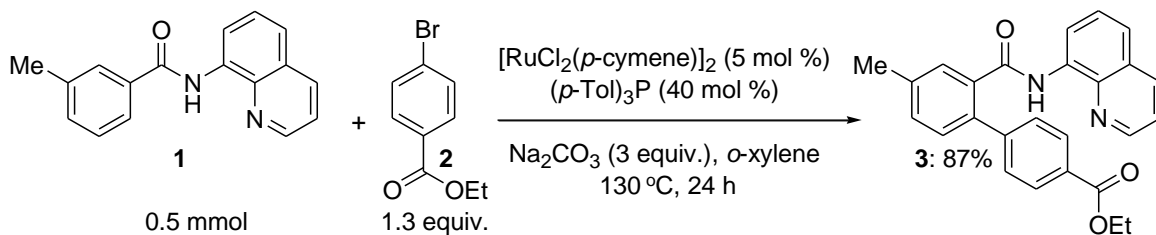
---

## *General Methods*

All chemicals, reagents and solvents were purchased from chemical companies (Sigma-Aldrich Chemie GmbH, Taufkirchen, Germany) and were used as received without prior purification. Reactions that required dry conditions were performed in an inert atmosphere with Ar gas. Syringes and needles for the transfer of reagents were oven dried and cooled in a desiccator over silica gel before use. The reaction's progress was monitored by thin-layer chromatography (TLC) on glass plates pre-coated with Merck silica gel. TLC plates were examined under UV lamplight (UVGL-58 Handheld 254/365 nm). Büchi-USA rotary evaporators were used to evaporate solvents using appropriate temperatures. Flash column chromatography was performed using silica gel (Kieselgel) (70–230) mesh as an adsorbent. The purified products were characterized using analyses NMR (<sup>1</sup>H NMR, <sup>13</sup>C NMR), IR, mass spectra and melting points. Melting points were recorded on the Gallenkamp-MPd350.bm2.5 melting point apparatus (Gallenkamp, Kent, UK). Attenuated total-reflectance IR spectra were recorded on pure samples on Agilent Technologies Cary 630 FTIR (Agilent, Santa Clara, CA, USA). <sup>1</sup>H NMR spectra were recorded in CDCl<sub>3</sub> on JEOL ECX-400 spectrometers (JEOL Ltd, Tokyo, Japan). <sup>1</sup>H NMR chemical shifts ( $\delta$ ) were assigned in part per million (ppm) downfield using an internal standard trimethylsilane (TMS) and were referenced to CDCl<sub>3</sub>,  $\delta = 7.24$ . Abbreviations s, d, t, q, quin, sept and m refer to singlet, doublet, triplet, quartet, quintet, septet and multiplet, respectively. Chemical shifts in <sup>13</sup>C spectra (175 MHz) were quoted in ppm and referenced to the central line of the CDCl<sub>3</sub> triplet,  $\delta C 77.0$ . Coupling constants (*J*) were recorded in hertz (Hz). GC-MS spectra were obtained using an Agilent mass spectrometer (Agilent, Santa Clara, CA, USA). Catalytic reactions were carried out in Schlenk tubes under a Ar atmosphere using pre-dried glassware. *o*-Xylene was distilled from CaH<sub>2</sub>, distilled and stored over 4Å molecular sieves. Ligands obtained from

chemical vendors were used as received without further purification. Elemental analysis was performed using an EuroEA Elemental Analyzer (configuration CHN (EuroVector Instruments & Software, Milano, Italy) with a calibration type of K-factor.

***4'-Methyl-2'-(quinolin-8-ylcarbamoyl)-biphenyl-4-carboxylic acid ethyl ester (3)***



3-Methyl-*N*-(quinolin-8-yl) benzamide<sup>1,2</sup> (**1**) (0.131 g, 0.499 mmol), ethyl-4-bromobenzoate (**2**) (100  $\mu$ L, 0.612 mmol), Na<sub>2</sub>CO<sub>3</sub> (0.160 g, 1.51 mmol), [RuCl<sub>2</sub>(*p*-cymene)]<sub>2</sub> (5 mol %) and P(*p*-Tol)<sub>3</sub> (60.9 mg, 0.200 mmol, 40 mol %) were added to *o*-xylene (3 mL) in an oven-dried Schlenk tube under Ar atmosphere. The reaction mixture was stirred for 24 h at 130 °C. The reaction was quenched with saturated NH<sub>4</sub>Cl (5 mL). The mixture was extracted with CH<sub>2</sub>Cl<sub>2</sub> (3  $\times$  10 mL). The combined organic extracts were dried over anhydrous MgSO<sub>4</sub> and filtered. Concentration under reduced pressure gave a crude product which was purified by flash chromatography (SiO<sub>2</sub>) using hexane: EtOAc (4:1) to give the C-H arylation product (**3**) as a white solid; R<sub>f</sub>= 0.4 (hexane: EtOAc (1:1)); mp=176-177 °C. <sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz)  $\delta$  (ppm) 9.66 (s, 1H), 8.74 (dd, *J* = 7.2, 1.8 Hz, 1H), 8.60 (dd, *J* = 4.2, 1.6 Hz, 1H), 8.08 (dd, *J* = 8.3, 1.6 Hz, 1H), 7.89 (d, *J* = 8.6 Hz, 2H), 7.66 (dd, *J* = 12.0, 6.9 Hz, 1H), 7.59 (d, *J* = 8.6 Hz, 2H), 7.56-7.30 (m, 5H), 4.25 (q, *J* = 7.1 Hz, 2H), 2.53 (s, 3H), 1.29 (t, *J* = 7.1 Hz, 3H). <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz)  $\delta$  (ppm) = 168.0, 166.5, 148.2, 145.1, 138.7, 136.8, 136.3, 136.1, 134.2, 132.2, 132.1, 130.2, 129.6, 129.4, 129.3, 128.8, 128.7, 128.5, 127.9, 127.6, 127.4, 122.0, 121.6, 60.9, 19.9, 14.4. IR (neat) (cm<sup>-1</sup>): 3325, 2925, 2850, 1725, 1676, 1600, 1525, 1487, 1275. MS (ESI) *m/z* (relative intensity): 410 (50), 365 (10), 267 (15), 221 (7), 195 (100), 165 (47), 144 (15), 89 (6), 55 (3). Elemental analysis, calculated: C (76.08), H (5.40), N (6.82), found: C (75.70), H (5.71), N (6.76).

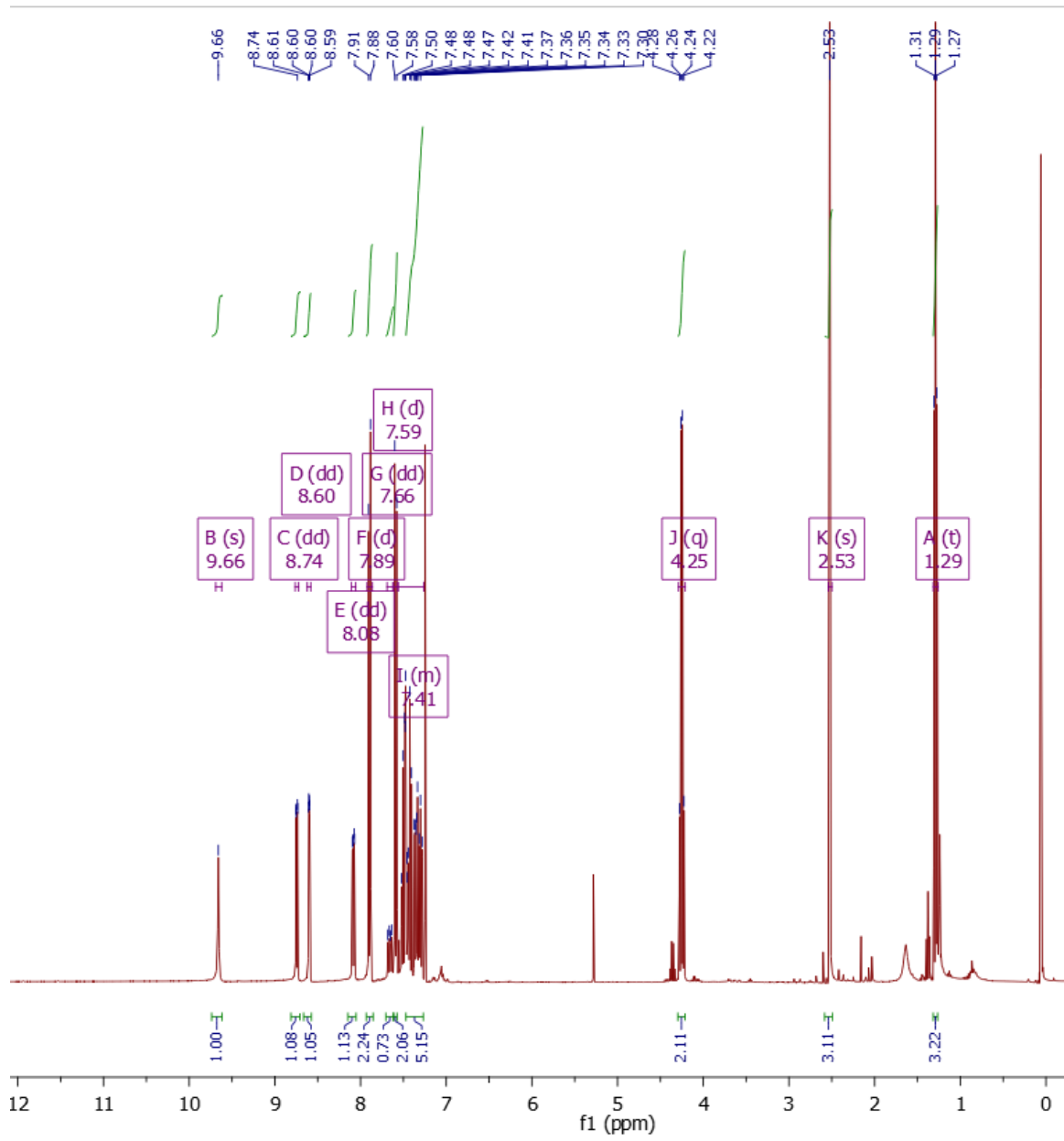
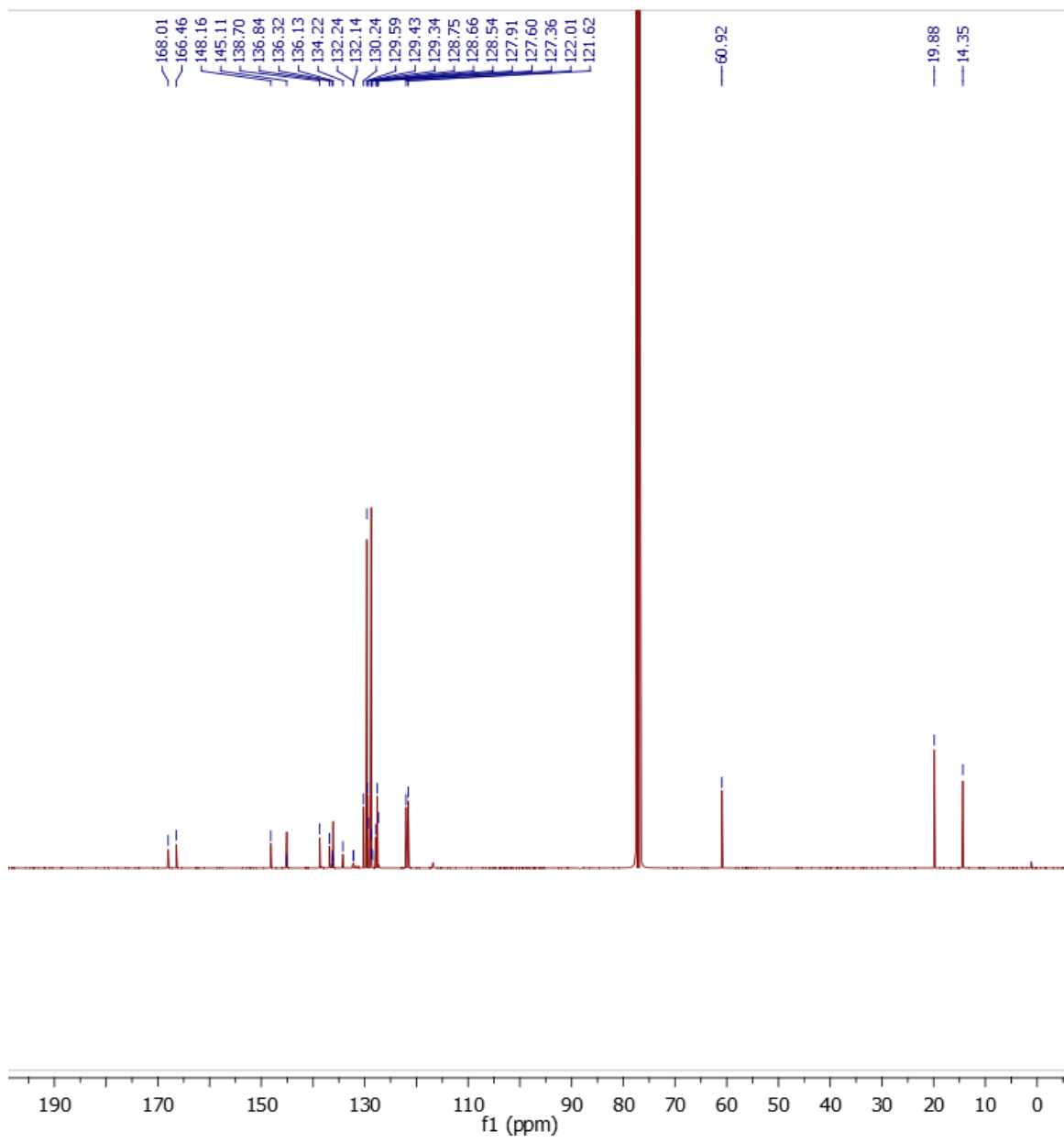


Figure S1.  $^1\text{H}$  NMR of the title compound.



**Figure S2.**  $^{13}\text{C}$  NMR of the title compound.

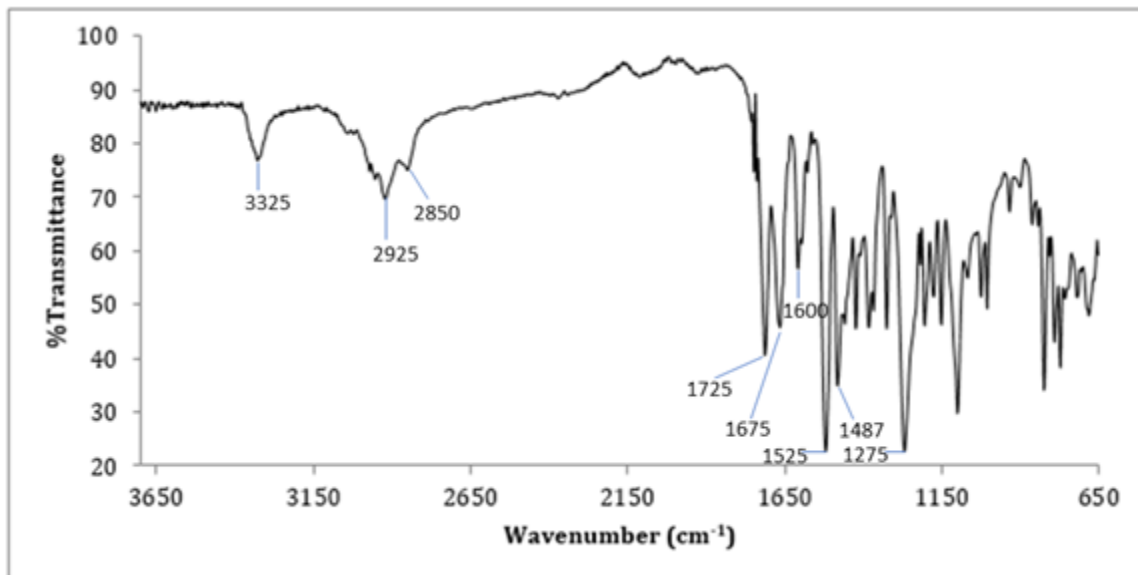


Figure S3. IR of the title compound.

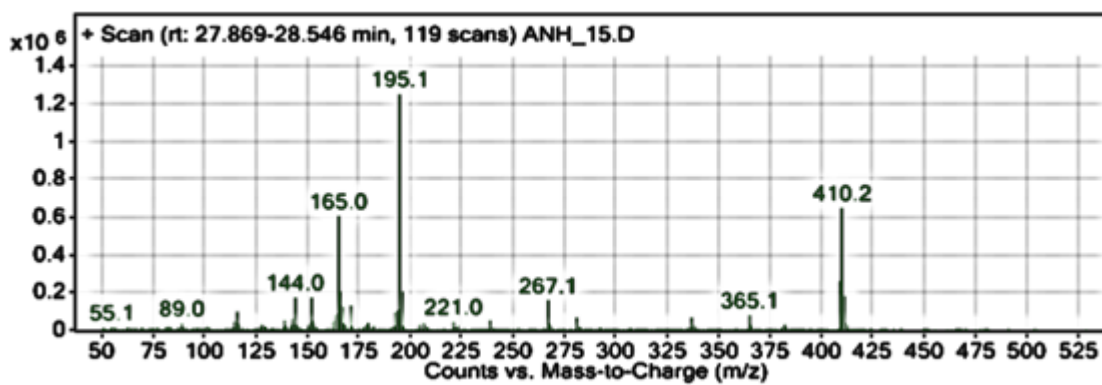


Figure S4. GC-MS of the title compound.

1. Aihara, Y.; Chatani, N. Ruthenium-catalyzed direct arylation of C–H bonds in aromatic amides containing a bidentate directing group: significant electronic effects on arylation. *Chem. Sci.*, **2013**, *4*, 664-670.
2. Shibata, K.; Yamaguchi, T.; Chatani, N. Rhodium-Catalyzed Alkylation of C–H Bonds in Aromatic Amides with Styrenes *via* Bidentate–Chelation Assistance. *Org. Lett.* **2015**, *17*, 14, 3584-3587.