Chemoselective synthesis of $N$-aryl-enaminones and 3-aryloxyquinolines via temperature and amount of catalyst synergistic control

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General Information

All compounds were fully characterized by spectroscopic data. The NMR spectra were recorded on a Bruker DRX500 (1H: 500 MHz, 13C: 125 MHz) and DRX600 (1H: 600 MHz, 13C: 150 MHz), chemical shifts (δ) are expressed in ppm, and J values are given in Hz, and deuterated CDCl₃ was used as solvent. IR spectra were recorded on a FT-IR Thermo Nicolet Avatar 360 using KBr pellet. The reactions were monitored by thin layer chromatography (TLC) using silica gel GF₂₅₄. The melting points were determined on XT-4A melting point apparatus and are uncorrected. HRMs were performed on an Agilent LC/MS TOF instrument.

All chemicals and solvents were used as received without further purification unless otherwise stated. Column chromatography was performed on silica gel (200–300 mesh).

Compounds 2 were prepared according to the literature¹. The metal chlorides were purchased from Adamas-beta®.

General Procedure for N-aryl-enaminones 3

2-Aminoaryl ketones 1 (0.5 mmol), N,N-dimethylenaminones 2 (0.5 mmol) and p-TSA (0.5 mmol) were charged into 5 mL water, and the mixture was stirred room temperature under ultrasound-assisted for 20 min until the N,N-dimethylenaminones 2 were completely consumed. The mixture was filtered to give N-aryl-enaminone derivatives 3 in 75–98% yields.

General Procedure for 3-aryl quinolines 4

2-Aminoaryl ketones 1 (0.5 mmol), N,N-dimethylenaminones 2 (0.5 mmol) and p-TSA (1.0 mmol) were charged into 5 mL ethanol-water solution (v/v = 1:4), and the mixture was stirred at 100 °C, for 6.0 h until N,N-dimethylenaminones 2 were completely consumed. The mixture was cooled to room temperature, neutralized with a saturated solution of Na₂CO₃ to pH 8–9, and then EtOAc (30 mL × 2) were added. The organic phase was washed with water (20 mL), dried over Na₂SO₄, concentrated and purified by flash column chromatography to afford 3-aryl quinoline derivatives 4 in 73–92% yields.

General Procedure for the Quinoline N–Oxide 5³
Under vigorous magnetic stirring, 3-chloroperbenzoic acid (m-CPBA) (1.1 mmol) in CH₂Cl₂ (5 mL) was dropped into solution of 3-aroyl quinoline 4q (1.0 mmol) in CH₂Cl₂ (5 mL) at 25 °C for 2.0 h. Then saturated NaHCO₃ aqueous solution was added to the mixture to neutralize residual m-CPBA. The resulting mixture was extracted with CH₂Cl₂. The organic phase were combined and washed with brine. The organic layer was dried over anhydrous Na₂SO₄, filtered and evaporated under reduced pressure to give crude product 5 in 60% yield, which were purified by column chromatography.

**General Procedure for the benzylation of heterocyclic N-oxide 6**  
In a 25 mL tube, the corresponding heterocyclic N-oxide 5 (0.5 mmol), DCP (1.0 mmol) and toluene (2.0 mL) were added under N₂ atmosphere. The tube was sealed and the resulting solution was heated in a 110 °C oil bath with vigorous stirring for 24 h. Then the reaction mixture was cooled to room temperature. The mixture was extracted with ethyl acetate (20 mL × 3), and the combined organic layer was dried over anhydrous Na₂SO₄, filtered and the solvent was evaporated under vacuum. The residue was purified by flash chromatography to afford the product 6 in 34% yield and 3-aroyl quinoline 4q in 19% yield.
Spectroscopic Data

3-((2-acetylphenyl)amino)-1-(4-methoxyphenyl)prop-2-en-1-one (3a)

Yellow solid; mp 131–133 °C; IR (KBr): 1632, 1597, 1543, 1452, 1400, 1297, 1236, 1163, 1024, 788, 755, 613 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.60 (s, 3H, CH₃), 3.77 (s, 3H, ArOCH₃), 6.03 (d, J = 8.0 Hz, 1H, C=CH), 6.85 (d, J = 9.0 Hz, 2H, ArH), 6.94–6.97 (m, 1H, ArH), 7.25 (d, J = 8.0 Hz, 1H, ArH), 7.38–7.42 (m, 2H, ArH), 7.80 (d, J = 8.0 Hz, 1H, N–CH₃), 7.96 (d, J = 8.5 Hz, 2H, ArH), 13.69 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 55.4, 96.6, 113.5, 113.5, 114.0, 121.0, 122.4, 129.9, 129.9, 132.1, 132.2, 134.3, 140.5, 142.4, 162.5, 188.9, 200.0; HRMS (TOF ES⁺): m/z calcd for C₂₁H₁₃NO₂ [(M+H)⁺], 296.1281; found, 296.1285.

3-((2-acetylphenyl)amino)-1-(p-tolyl)prop-2-en-1-one (3b)

Yellow solid; mp 155–157 °C; IR (KBr): 1631, 1566, 1457, 1402, 1296, 1228, 1159, 1046, 970, 762, 692, 614, 525 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 2.39 (s, 3H, ArCH₃), 2.68 (s, 3H, CH₃), 6.13 (d, J = 8.3 Hz, 1H, C=CH), 7.03–7.05 (m, 1H, ArH), 7.24 (d, J = 7.9 Hz, 2H, ArH), 7.34 (d, J = 8.4 Hz, 1H, ArH), 7.48–7.52 (m, 2H, ArH), 7.88–7.89 (m, 1H, ArH), 7.95 (d, J = 8.1 Hz, 1H, N–CH₃) 13.79 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (150 MHz, CDCl₃): δ = 21.6, 28.2, 96.8, 114.0, 121.2, 122.5, 127.9, 127.9, 129.0, 129.0, 132.3, 134.4, 136.5, 140.8, 142.2, 142.3, 189.8, 200.0; HRMS (TOF ES⁺): m/z calcd for C₂₀H₁₉NO₂ [(M+H)⁺], 287.1179; found, 287.1178.

3-((2-acetylphenyl)amino)-1-phenylprop-2-en-1-one (3c)

Yellow solid; mp 96–98 °C; IR (KBr): 1632, 1583, 1551, 1453, 1365, 1293, 1229, 1075, 965, 699, 598 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.51 (s, 3H, CH₃), 5.99 (d, J = 8.5 Hz, 1H, C=CH), 6.87–6.90 (m, 1H, ArH), 7.18 (d, J = 8.5 Hz, 1H, ArH), 7.27–7.39 (m, 5H, ArH), 7.71 (d, J = 9.5 Hz, 1H, N–CH₃), 7.91 (d, J = 8.5 Hz, 1H, ArH), 13.68 (d, J = 12.5 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 96.7, 114.2, 121.4, 122.4, 127.8, 127.8, 128.3, 128.3, 131.7, 132.2, 134.4, 139.1, 141.4, 142.1, 190.0, 200.1; HRMS (TOF ES⁺): m/z calcd for C₁₇H₁₆NO₂ [(M+H)⁺], 266.1176; found, 266.1176.

3-((2-acetylphenyl)amino)-1-(4-chlorophenyl)prop-2-en-1-one (3d)
3-((2-acetylphenyl)amino)-1-(4-fluorophenyl)prop-2-en-1-one (3e)

Yellow solid; mp 132–134 °C; IR (KBr): 1636, 1603, 1548, 1454, 1399, 1356, 1295, 1222, 1146, 1025, 788, 746, 611 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.70 (s, 3H, CH₃), 6.10 (d, J = 8.0 Hz, 1H, C=CH), 7.06–7.13 (m, 3H, ArH), 7.36 (d, J = 8.5 Hz, 1H, ArH), 7.51–7.57 (m, 2H, ArH), 7.91 (d, J = 8.5 Hz, 1H, N–CH), 8.06–8.08 (m, 2H, ArH), 13.81 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 96.3, 114.1, 115.2 (d, J = 21.3 Hz), 115.2 (d, J = 21.3 Hz), 121.5, 122.6, 130.1 (d, J = 8.8 Hz), 130.1 (d, J = 8.8 Hz), 132.3, 134.4, 135.5 (d, J = 1.3 Hz), 141.4, 142.1, 165.0 (d, J = 251.3 Hz), 188.5, 200.1; HRMS (TOF ES⁺): m/z calcd for C₁₇H₁₅FNO₂ [(M+H)⁺], 284.1081; found, 284.1086.

3-((2-acetylphenyl)amino)-1-(4-(trifluoromethyl)phenyl)prop-2-en-1-one (3f)

Yellow solid; mp 132–134 °C; IR (KBr): 1636, 1541, 1453, 1396, 1322, 1226, 1166, 1120, 1072, 763, 617, 531 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.72 (s, 3H, CH₃), 6.14 (d, J = 8.0 Hz, 1H, C=CH), 7.11–7.14 (m, 1H, ArH), 7.40 (d, J = 8.5 Hz, 1H, ArH), 7.53–7.57 (m, 1H, ArH), 7.59–7.63 (m, 1H, ArH), 7.72 (d, J = 8.0 Hz, 2H, ArH), 7.94 (d, J = 7.5 Hz, 1H, N–CH) 8.15 (d, J = 8.5 Hz, 2H, ArH), 13.89 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 96.3, 114.3, 121.9, 122.8 (d, J = 6.25 Hz), 125.3, 125.3, 128.0, 128.0, 132.3, 133.0 (d, J = 32.5 Hz), 134.5, 141.9, 142.1, 142.2, 188.5, 200.2; HRMS (TOF ES⁺): m/z calcd for C₁₈H₁₃F₃NO₂ [(M+H)⁺], 334.1049; found, 334.1050.
Yellow solid; mp 165–167 °C; IR (KBr): 1639, 1536, 1451, 1396, 1346, 1283, 1216, 1144, 752, 617, 528 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.73 (s, 3H, CH₃), 6.15 (d, J = 8.5 Hz, 1H, C=CH), 7.15–7.18 (m, 1H, ArH), 7.42 (d, J = 8.5 Hz, 1H, ArH), 7.56–7.59 (m, 1H, ArH), 7.63–7.68 (m, 1H, ArH), 7.96 (d, J = 8.0 Hz, 1H, N–CH), 8.19 (d, J = 8.5 Hz, 2H, ArH), 8.30 (d, J = 8.5 Hz, 2H, ArH), 13.94 (d, J = 12.5 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 96.3, 114.5, 122.3, 122.9, 123.6, 128.6, 128.6, 132.3, 134.5, 141.7, 142.9, 144.2, 149.5, 187.5, 200.3; HRMS (TOF ES⁺): m/z calcd for C₁₇H₁₅N₂O₄ [(M+H)⁺], 311.1026; found, 311.1031.

1-([1,1'-biphenyl]-4-yl)-3-((2-acetylphenyl)amino)prop-2-en-1-one (3h)

Yellow solid; mp 165–167 °C; IR (KBr): 1630, 1568, 1450, 1354, 1287, 1232, 1159, 1032, 1005, 959, 802, 754, 690, 516 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.68 (s, 3H, CH₃), 6.17 (d, J = 8.5 Hz, 1H, C=CH), 7.03–7.06 (m, 1H, ArH), 7.34–7.39 (m, 2H, ArH), 7.43–7.54 (m, 4H, ArH), 7.62–7.70 (m, 4H, ArH), 7.89 (d, J = 7.5 Hz, 1H, N–CH), 8.12 (d, J = 8.0 Hz, 2H, ArH), 13.84 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 96.8, 114.1, 121.3, 122.6, 127.0, 127.3, 127.3, 128.0, 128.4, 128.9, 128.9, 132.3, 134.4, 137.9, 140.3, 141.1, 142.3, 144.3, 189.5, 200.0; HRMS (TOF ES⁺): m/z calcd for C₂₃H₂₆N₂O₅ [(M+H)⁺], 342.1489; found, 342.1492.

3-((2-acetylphenyl)amino)-1-(naphthalen-2-yl)prop-2-en-1-one (3i)

Yellow solid; mp 130–132 °C; IR (KBr): 1624, 1545, 1456, 1281, 1247, 1181, 1123, 1020, 794, 757, 611, 527 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.71 (s, 3H, CH₃), 6.31 (d, J = 8.5 Hz, 1H, C=CH), 7.05–7.08 (m, 1H, ArH), 7.37 (d, J = 8.5 Hz, 1H, ArH), 7.50–7.60 (m, 4H, ArH), 7.87–7.91 (m, 3H, ArH), 7.97 (d, J = 7.5 Hz, 1H, N–CH), 8.19 (d, J = 7.5 Hz, 1H, ArH), 8.57 (s, 1H, ArH), 13.91 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 96.9, 114.1, 121.3, 122.6, 124.5, 126.3, 127.6, 127.8, 128.0, 128.6, 129.4, 132.2, 132.8, 134.4, 135.1, 136.5, 141.2, 142.2, 189.8, 200.0; HRMS (TOF ES⁺): m/z calcd for C₂₁H₁₈N₂O₂ [(M+H)⁺], 316.1332; found, 316.1332.

3-((2-acetylphenyl)amino)-1-(thiophen-2-yl)prop-2-en-1-one (3j)
3-((2-acetylphenyl)amino)-1-(pyridin-4-yl)prop-2-en-1-one (3k)

Yellow solid; mp 134–136 °C; IR (KBr): 1634, 1601, 1549, 1507, 1454, 1395, 1294, 1222, 1133, 791, 616 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.70 (s, 3H, CH₃), 6.10 (d, J = 8.5 Hz, 1H, C=CH), 7.11–7.13 (m, 1H, ArH), 7.39 (d, J = 8.0 Hz, 1H, ArH), 7.53–7.56 (m, 1H, ArH), 7.60–7.64 (m, 1H, ArH), 7.82–7.83 (m, 2H, ArH), 7.93 (d, J = 8.0 Hz, 1H, N–CH), 8.74–8.76 (m, 2H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 95.9, 114.4, 121.1, 121.1, 122.2, 122.9, 132.3, 134.5, 141.7, 142.9, 145.4, 150.5, 150.5, 188.0, 200.2; HRMS (TOF ES⁺): m/z calcd for C₁₆H₁₃N₂O₃ [(M+H)⁺], 267.1128; found, 267.1132.

1-((2-acetylphenyl)amino)-5-phenylpenta-1,4-dien-3-one (3l)

Yellow solid; mp 141–143 °C; IR (KBr): 1652, 1608, 1545, 1502, 1449, 1287, 1242, 1159, 1108, 973, 755, 698, 603 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.67 (s, 3H, CH₃), 5.62 (d, J = 8.0 Hz, 1H, C=CH), 6.81 (d, J = 15.5 Hz, 1H, C=CH), 7.03–7.06 (m, 1H, ArH), 7.32–7.39 (m, 4H, ArH), 7.41–7.45 (m, 1H, ArH), 7.48–7.51 (m, 1H, ArH), 7.56 (d, J = 7.0 Hz, 2H, ArH), 7.78 (d, J = 16.0 Hz, 1H, C=CH), 7.88 (d, J = 8.0 Hz, 1H, N–CH), 13.79 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 28.2, 101.2, 114.0, 121.3, 122.6, 127.4, 128.1, 128.1, 128.8, 128.8, 129.6, 132.2, 134.3, 135.6, 140.6, 140.7, 142.1, 188.4, 199.8; HRMS (TOF ES⁺): m/z calcd for C₁₉H₁₈N₂O₃ [(M+H)⁺], 292.1332; found, 292.1333.

3-((2-benzoylphenyl)amino)-1-(4-methoxyphenyl)prop-2-en-1-one (3m)
Yellow solid; mp 199–201 °C; IR (KBr): 1632, 1594, 1546, 1453, 1395, 1238, 1164, 785, 698, 626, 526 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 3.87 (s, 3H, ArOCH₃), 6.14 (d, J = 8.0 Hz, 1H, C=CH), 6.95 (d, J = 8.5 Hz, 2H, ArH), 7.03–7.06 (m, 1H, ArH), 7.41 (d, J = 8.5 Hz, 1H, N–CH), 7.46–7.50 (m, 2H, ArH), 7.52–7.61 (m, 4H, ArH), 7.82 (d, J = 8.0 Hz, 2H, ArH), 8.04 (d, J = 9.0 Hz, 2H, ArH), 13.37 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 55.4, 96.2, 127.8, 133.7, 197.0; HRMS (TOF ES⁺): HRMS (TOF ES⁺): m/z calcld for C₂₂H₂₀NO₃[(M+H)⁺], 358.1438; found, 358.1442.

3-((2-benzoylphenyl)amino)-1-(p-tolyl)prop-2-en-1-one (3n)

Yellow solid; mp 163–165 °C; IR (KBr): 1627, 1499, 1450, 1395, 1317, 1238, 1141, 1088, 1049, 987, 775, 696, 624, 529 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 2.39 (s, 3H, ArCH₃), 6.13 (d, J = 8.2 Hz, 1H, C=CH), 7.01–7.04 (m, 1H, ArH), 7.22–7.26 (m, 2H, ArH), 7.40 (d, J = 8.3 Hz, 1H, ArH), 7.44–7.47 (m, 2H, ArH), 7.56–7.68 (m, 4H, ArH+N–CH), 7.80 (d, J = 7.1 Hz, 2H, ArH), 7.93 (d, J = 8.2 Hz, 2H, ArH), 13.41 (d, J = 12.5 Hz, 1H, NH); ¹³C NMR (150 MHz, CDCl₃): δ = 21.5, 96.4, 114.9, 121.0, 124.0, 127.9, 127.9, 128.1, 128.1, 129.1, 130.1, 130.2, 132.2, 133.6, 133.8, 136.5, 138.6, 142.0, 142.1, 142.5, 190.1, 197.0; HRMS (TOF ES⁺): m/z calcld for C₂₂H₂₀NO₂[(M+H)⁺], 342.1489; found, 342.1488.

3-((2-benzoylphenyl)amino)-1-phenylprop-2-en-1-one (3o)

Yellow solid; mp 116–118 °C; IR (KBr): 1632, 1582, 1546, 1448, 1276, 1229, 1160, 1016, 927, 745, 696, 630, 525 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 6.15 (d, J = 8.2 Hz, 1H, C=CH), 7.02–7.05 (m, 1H, ArH), 7.40–7.51 (m, 6H, ArH), 7.52–7.58 (m, 4H, ArH+N–CH), 7.80 (d, J = 8.2 Hz, 2H, ArH), 8.02 (d, J = 7.6 Hz, 2H, ArH), 13.39 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (150 MHz, CDCl₃): δ = 96.4, 115.1, 121.2, 124.1, 127.8, 127.8, 128.1, 128.1, 128.3, 128.4, 130.2, 130.2, 131.6, 132.3, 133.7, 133.8, 138.6, 139.1, 142.4, 190.4, 197.0; HRMS (TOF ES⁺): m/z calcld for C₂₂H₁₄NO₂[(M+H)⁺], 328.1332; found, 328.1335.

3-((2-benzoylphenyl)amino)-1-(4-chlorophenyl)prop-2-en-1-one (3p)

Yellow solid; mp 191–193 °C; IR (KBr): 1626, 1581, 1539, 1451, 1395, 1273, 1233, 1155, 1094, 774, 695, 629, 529 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 6.07 (d, J = 8.5 Hz, 1H, C=CH), 7.03–7.06 (m, 1H, ArH), 7.38–7.40 (m, 3H, ArH), 7.41–7.52 (m, 2H, ArH), 7.53–7.59 (m, 4H,
ArH+N−CH), 7.79 (d, J = 8.5 Hz, 2H, ArH), 7.95 (d, J = 8.5 Hz, 2H, ArH), 13.38 (d, J = 12.0 Hz, 1H, NH); 13C NMR (125 MHz, CDCl3): δ = 95.9, 115.2, 121.4, 124.2, 128.1, 128.1, 128.5, 128.5, 129.1, 129.1, 130.2, 130.2, 132.3, 133.7, 133.8, 137.5, 137.8, 138.5, 142.2, 142.8, 188.9, 197.1; HRMS (TOF ES⁻): m/z calcd for C22H17ClNO2 [(M+H)⁺], 362.0942; found, 362.0947.

3-((2-benzoylphenyl)amino)-1-(2-chlorophenyl)prop-2-en-1-one (3q)

Yellow solid; mp 146–148 °C; IR (KBr): 1634, 1557, 1506, 1444, 1396, 1265, 1223, 1144, 1081, 1017, 754, 626, 530 cm⁻¹; 1H NMR (600 MHz, CDCl3): δ = 5.89 (d, J = 8.0 Hz, 1H, C=CH), 7.05–7.08 (m, 1H, ArH), 7.27–7.33 (m, 2H, ArH), 7.36–7.38 (m, 1H, ArH), 7.41 (d, J = 8.3 Hz, 1H, ArH), 7.44–7.50 (m, 3H, ArH), 7.53–7.62 (m, 4H, ArH), 7.79–7.80 (m, 2H, ArH+ N−CH), 13.20 (d, J = 12.2 Hz, 1H, NH); 13C NMR (150 MHz, CDCl3): δ = 100.6, 115.3, 121.5, 124.4, 126.7, 128.2, 128.2, 130.0, 130.1, 130.2, 130.2, 130.8, 131.0, 132.4, 133.6, 133.6, 138.4, 140.5, 142.1, 191.6, 196.8; HRMS (TOF ES⁻): m/z calcd for C22H17ClNO2 [(M+H)⁺], 362.0942; found, 362.0955.

3-((2-benzoylphenyl)amino)-1-(4-nitrophenyl)prop-2-en-1-one (3r)

Yellow solid; mp 200–202 °C; IR (KBr): 1634, 1546, 1453, 1398, 1345, 1274, 1223, 1155, 1090, 1043, 801, 749, 701, 631 cm⁻¹; 1H NMR (500 MHz, CDCl3): δ = 6.13 (d, J = 8.5 Hz, 1H, C=CH), 7.10–7.13 (m, 1H, ArH), 7.44–7.52 (m, 3H, ArH), 7.57–7.66 (m, 4H, ArH+ N−CH), 7.81 (d, J = 7.5 Hz, 2H, ArH), 8.14 (d, J = 8.5 Hz, 2H, ArH), 8.27 (d, J = 8.0 Hz, 2H, ArH), 13.47 (d, J = 12.5 Hz, 1H, NH); 13C NMR (125 MHz, CDCl3): δ = 95.9, 115.5, 122.1, 123.6, 123.6, 124.5, 128.2, 128.2, 128.6, 130.3, 130.4, 132.5, 133.8, 133.8, 138.4, 141.8, 144.1, 144.2, 149.5, 187.8, 197.1; HRMS (TOF ES⁻): m/z calcd for C22H17N2O4 [(M+H)⁺], 373.1183; found, 373.1187.

1-([(1,1'-biphenyl)-4-yl]-3-((2-benzoylphenyl)amino)prop-2-en-1-one (3s)

Yellow solid; mp 212–214 °C; IR (KBr): 1629, 1568, 1499, 1395, 1313, 1233, 1147, 925, 752, 696, 626, 528 cm⁻¹; 1H NMR (600 MHz, CDCl3): δ = 6.19 (d, J = 8.2 Hz, 1H, C=CH), 7.03–7.05 (m, 1H, ArH), 7.35–7.38 (m, 1H, ArH), 7.40–7.47 (m, 5H, ArH), 7.52–7.60 (m, 4H, ArH), 7.62–7.67 (m, 4H, ArH+ N−CH), 7.81 (d, J = 8.4 Hz, 2H, ArH), 8.10 (d, J = 8.4 Hz, 2H, ArH), 13.42 (d, J = 12.2 Hz, 1H, NH); 13C NMR (150 MHz, CDCl3): δ = 96.4, 115.1, 121.2, 124.1, 127.0, 127.0, 127.2, 127.2, 127.9, 128.1, 128.1, 128.3, 128.3, 128.9, 128.9, 130.3, 130.3, 132.3,
133.7, 133.8, 137.9, 138.6, 140.3, 142.3, 142.4, 144.3, 189.8, 197.1; HRMS (TOF ES⁺): m/z calcd for C₂₈H₂₂NO₂ [(M+H)⁺], 404.1645; found, 404.1647.

3-((2-benzyolphenyl)amino)-1-(thiophen-2-yl)prop-2-en-1-one (3t)

Yellow solid; mp 128–130 °C; IR (KBr): 1620, 1550, 1508, 1450, 1402, 1277, 1237, 1161, 965, 929, 766, 759, 707, 526 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 5.98 (d, J = 8.0 Hz, 1H, C=CH), 7.00–7.03 (m, 1H, ArH), 7.07–7.09 (m, 1H, ArH), 7.37 (d, J = 8.0 Hz, 1H, N=CH), 7.43–7.49 (m, 3H, ArH), 7.50–7.59 (m, 4H, ArH+N–CH), 7.69 (d, J = 3.5 Hz, 1H, ArH), 7.78 (d, J = 8.0 Hz, 2H, ArH), 13.17 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 96.7, 114.9, 121.1, 124.0, 127.8, 128.1, 128.5, 130.2, 130.2, 131.7, 132.3, 133.7, 133.8, 138.6, 141.9, 142.3, 146.2, 183.1, 197.0; HRMS (TOF ES⁺): m/z calcd for C₂₀H₁₆NO₃ [(M+H)⁺], 334.0896; found, 334.0900.

3-((2-benzyolphenyl)amino)-1-(pyridin-4-yl)prop-2-en-1-one (3u)

Yellow solid; mp 161–163 °C; IR (KBr): 1633, 1569, 1505, 1455, 1399, 1292, 1245, 1159, 1044, 985, 928, 878, 759, 697, 632 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 6.10 (d, J = 8.5 Hz, 1H, C=CH), 7.09–7.12 (m, 1H, ArH), 7.43–7.48 (m, 3H, ArH), 7.55–7.65 (m, 4H, ArH), 7.80–7.81 (m, 4H, ArH+N–CH), 8.74 (d, J = 5.0 Hz, 2H, ArH), 13.46 (d, J = 12.5 Hz, 1H, NH); ¹³C NMR (125 MHz, CDCl₃): δ = 95.6, 115.5, 121.1, 122.0, 124.5, 128.2, 128.3, 130.3, 130.3, 132.5, 133.7, 133.8, 138.4, 141.8, 144.1, 145.4, 150.5, 150.5, 188.4, 197.1; HRMS (TOF ES⁺): m/z calcd for C₂₁H₁₇N₂O₂ [(M+H)⁺], 329.1285; found, 329.1290.

3-((2-(4-fluorobenzoyl)phenyl)amino)-1-phenylprop-2-en-1-one (3v)

Yellow solid; mp 152–154 °C; IR (KBr): 1638, 1563, 1445, 1405, 1228, 1148, 1091, 1048, 1009, 924, 941, 756, 677, 605 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 6.17 (d, J = 8.2 Hz, 1H, C=CH), 7.06–7.09 (m, 1H, ArH), 7.15–7.18 (m, 2H, ArH), 7.42–7.46 (m, 3H, ArH), 7.49–7.52 (m, 1H, ArH), 7.53–7.52 (m, 3H, ArH), 7.85–7.88 (m, 2H, ArH+N–CH), 8.04 (d, J = 7.4 Hz, 2H, ArH), 13.31 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (150 MHz, CDCl₃): δ = 96.4, 115.2, 115.3 (d, J = 21.0 Hz), 115.3 (d, J = 21.0 Hz), 121.3, 124.0, 127.7, 127.7, 128.3, 131.6, 132.8 (d, J = 9.0 Hz), 132.8 (d, J = 9.0 Hz), 133.3, 133.7, 134.8 (d, J = 3.0 Hz), 139.1, 142.3, 142.4, 165.3 (d, J = 253.5 Hz), 190.5, 195.4; HRMS (TOF ES⁺): m/z calcd for C₂₂H₁₇FNO₂ [(M+H)⁺], 346.1238; found, 346.1239.
3-((4-chloro-2-(2-chlorobenzoyl)phenyl)amino)-1-phenylprop-2-en-1-one (3w)

Yellow solid; mp 135–137 °C; IR (KBr): 1633, 1552, 1451, 1401, 1297, 1228, 1149, 940, 805, 749, 628 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 6.23 (d, J = 8.3 Hz, 1H, C=CH), 7.33 (d, J = 2.5 Hz, 1H, ArH), 7.37–7.40 (m, 2H, ArH), 7.42–7.45 (m, 5H, ArH), 7.47–7.56 (m, 3H, ArH), 8.03–8.04 (m, 2H, ArH+N–CH), 13.75 (d, J = 12.0 Hz, 1H, NH); ¹³C NMR (150 MHz, CDCl₃): δ = 79.7, 115.8, 123.2, 126.3, 126.9, 127.8, 127.8, 128.4, 128.4, 129.4, 130.1, 131.3, 131.5, 131.9, 133.8, 134.8, 138.9, 140.8, 141.6, 190.4, 195.4; HRMS (TOF ES⁺): m/z calcd for C₂₂H₁₆ClNO₂⁺ [(M+H)⁺], 396.0553; found, 396.0555.

(4-methoxyphenyl)(4-methylquinolin-3-yl)methanone (4a)

Yellow solid; mp 99–101 °C; IR (KBr): 1641, 1596, 1499, 1450, 1398, 1313, 1253, 1157, 926, 797, 705, 626 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.58 (s, 3H, ArCH₃), 3.81 (s, 3H, ArOCH₃), 6.87–6.89 (m, 2H, ArH), 7.57–7.59 (m, 1H, ArH), 7.72–7.76 (m, 3H, ArH), 8.04 (d, J = 8.0 Hz, 1H, ArH), 8.09 (d, J = 8.0 Hz, 1H, ArH), 8.73 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 15.8, 55.6, 114.8, 114.8, 124.4, 127.3, 127.7, 130.2, 130.2, 130.5, 132.4, 132.6, 132.6, 143.0, 147.9, 148.5, 164.3, 195.5; HRMS (TOF ES⁺): m/z calcd for C₁₆H₁₆NO₂⁺ [(M+H)⁺], 278.1176; found, 278.1179.

(4-methylquinolin-3-yl)(p-tolyl)methanone (4b)

Yellow solid; mp 128–130 °C; IR (KBr): 1655, 1596, 1499, 1409, 1374, 1314, 1242, 1169, 1121, 1077, 923, 752, 480 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.46 (s, 3H, ArCH₃), 2.68 (s, 3H, ArCH₃), 7.29–7.31 (m, 2H, ArH), 7.68–7.69 (m, 1H, ArH), 7.77 (d, J = 8.0 Hz, 2H, ArH), 7.80–7.82 (m, 1H, ArH), 8.14 (d, J = 8.5 Hz, 1H, ArH), 8.19 (d, J = 8.0 Hz, 1H, ArH), 8.83 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 15.9, 21.8, 124.4, 127.3, 127.7, 129.5, 129.5, 130.2, 130.3, 130.3, 132.2, 135.1, 143.2, 145.0, 148.0, 148.6, 196.6; HRMS (TOF ES⁺): m/z calcd for C₁₈H₁₆NO [(M+H)⁺], 262.1226; found, 262.1229.

(4-methylquinolin-3-yl)(phenyl)methanone (4c)

Yellow liquid; IR (KBr): 1632, 1582, 1552, 1452, 1365, 1293, 1229, 1165, 1075, 965, 923, 752, 600 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.59 (s, 3H, ArCH₃), 7.39–7.42 (m, 2H, ArH),
7.53–7.59 (m, 2H, ArH), 7.72–7.77 (m, 3H, ArH), 8.04 (d, J = 8.5 Hz, 1H, ArH), 8.09 (d, J = 8.5 Hz, 1H, ArH), 8.74 (s, 1H, ArH); 13C NMR (125 MHz, CDCl3): δ = 15.9, 124.5, 127.4, 127.6, 128.8, 128.8, 130.2, 130.2, 130.3, 130.5, 131.9, 133.9, 137.5, 143.7, 148.0, 148.6, 197.0; HRMS (TOF ES⁺): m/z calcd for C17H14NO [(M+H)⁺], 248.1070; found, 248.1073.

(4-chlorophenyl)(4-methylquinolin-3-yl)methanone (4d)

Yellow solid; mp 155–157 °C; IR (KBr): 1661, 1577, 1493, 1394, 1314, 1281, 1236, 1086, 1005, 924, 760, 619 cm⁻¹; 1H NMR (500 MHz, CDCl3): δ = 2.59 (s, 3H, ArCH₃), 7.39 (d, J = 8.0 Hz, 2H, ArH), 7.60–7.61 (m, 1H, ArH), 7.71–7.74 (m, 3H, ArH), 8.05 (d, J = 8.5 Hz, 1H, ArH), 8.10 (d, J = 8.5 Hz, 1H, ArH), 8.72 (s, 1H, ArH); 13C NMR (125 MHz, CDCl3): δ = 15.9, 124.5, 127.5, 127.6, 129.2, 129.2, 129.2, 130.3, 130.6, 131.5, 131.5, 135.9, 140.5, 143.7, 148.2, 148.4, 195.7; HRMS (TOF ES⁺): m/z calcd for C17H13ClNO [(M+H)⁺], 282.0680; found, 282.0684.

(4-fluorophenyl)(4-methylquinolin-3-yl)methanone (4e)

Yellow solid; mp 134–136 °C; IR (KBr): 1657, 1500, 1519, 1395, 1316, 1234, 1150, 928, 866, 763, 622, 326 cm⁻¹; 1H NMR (500 MHz, CDCl3): δ = 2.70 (s, 3H, ArCH₃), 7.18–7.21 (m, 2H, ArH), 7.69–7.71 (m, 1H, ArH), 7.83–7.87 (m, 1H, ArH), 7.89–7.92 (m, 2H, ArH), 8.15 (d, J = 8.5 Hz, 1H, ArH), 8.19 (d, J = 8.5 Hz, 1H, ArH), 8.82 (s, 1H, ArH); 13C NMR (125 MHz, CDCl3): δ = 15.9, 116.1 (d, J = 22.5 Hz), 116.1 (d, J = 22.5 Hz), 124.4, 127.4, 127.6, 130.4 (d, J = 28.8 Hz), 130.4 (d, J = 28.8 Hz), 131.7, 132.8, 132.9, 134.0, 143.5, 148.1, 148.4, 166.2 (d, J = 255.0 Hz), 195.4; HRMS (TOF ES⁺): m/z calcd for C17H13FNO [(M+H)⁺], 266.0976; found, 266.0978.

(4-methylquinolin-3-yl)(4-(trifluoromethyl)phenyl)methanone (4f)

Yellow solid; mp 132–134 °C; IR (KBr): 1668, 1634, 1577, 1407, 1375, 1318, 1235, 1175, 1128, 1063, 925, 848, 765 cm⁻¹; 1H NMR (600 MHz, CDCl3): δ = 2.69 (s, 3H, ArCH₃), 7.67–7.71 (m, 1H, ArH), 7.76 (d, J = 8.2 Hz, 2H, ArH), 7.82–7.85 (m, 1H, ArH), 7.96 (d, J = 8.2 Hz, 2H, ArH), 8.15 (d, J = 8.3 Hz, 1H, ArH), 8.18 (d, J = 8.4 Hz, 1H, ArH), 8.81 (s, 1H, ArH); 13C NMR (150 MHz, CDCl3): δ = 15.9, 123.5 (q, J = 30.0 Hz), 124.5, 125.8, 125.9, 127.6, 130.3, 130.3, 130.3, 130.8, 131.0, 135.0 (q, J = 33.0 Hz), 140.4, 144.2, 148.3, 148.4, 195.9; HRMS (TOF ES⁺): m/z calcd for C18H13F₃NO [(M+H)⁺], 316.0944; found, 316.0949.

(4-methylquinolin-3-yl)(4-nitrophenyl)methanone (4g)
Yellow solid; mp 186–188 °C; IR (KBr): 1668, 1594, 1519, 1394, 1340, 1232, 1167, 927, 831, 764, 716 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.63 (s, 3H, ArCH₃), 7.61–7.65 (m, 1H, ArH), 7.76–7.80 (m, 1H, ArH), 7.94 (d, J = 8.5 Hz, 2H, ArH), 8.08–8.12 (m, 2H, ArH), 8.27 (d, J = 8.5 Hz, 2H, ArH), 8.73 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 16.1, 124.0, 124.0, 124.0, 124.6, 127.5, 127.7, 130.4, 130.5, 131.0, 131.0, 131.1, 142.2, 144.7, 148.4, 150.6, 195.2; HRMS (TOF ES⁺): m/z calcd for C₁₂H₁₃N₂O₃ [(M+H)⁺], 293.0921; found, 293.0923.

[1,1'-biphenyl]-4-yl(4-methylquinolin-3-yl)methanone (4h)

Yellow solid; mp 115–117 °C; IR (KBr): 1655, 1594, 1498, 1449, 1384, 1314, 1280, 1243, 1175, 919, 857, 749, 693 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 2.70 (s, 3H, ArCH₃), 7.41–7.43 (m, 1H, ArH), 7.46–7.49 (m, 2H, ArH), 7.63–7.65 (m, 2H, ArH), 7.67–7.68 (m, 1H, ArH), 7.70–7.72 (m, 2H, ArH), 7.81–7.82 (m, 1H, ArH), 7.92 (d, J = 8.5 Hz, 2H, ArH), 8.14–8.19 (m, 2H, ArH), 8.86 (s, 1H, ArH); ¹³C NMR (150 MHz, CDCl₃): δ = 15.9, 124.4, 127.4, 127.4, 127.4, 127.5, 127.7, 128.5, 129.0, 129.0, 130.3, 130.4, 130.8, 130.8, 132.1, 136.2, 139.7, 143.5, 146.6, 148.1, 148.6, 196.5; HRMS (TOF ES⁺): m/z calcd for C₂₃H₁₉NO [(M+H)⁺], 324.1383; found, 324.1388.

(4-methylquinolin-3-yl)(naphthalen-2-yl)methanone (4i)

Yellow solid; mp 86–88 °C; IR (KBr): 1630, 1581, 1502, 1449, 1398, 1274, 1230, 1160, 1025, 929, 699, 631 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 2.67 (s, 3H, ArCH₃), 7.45–7.46 (m, 1H, ArH), 7.54–7.56 (m, 1H, ArH), 7.65–7.67 (m, 1H, ArH), 7.76 (d, J = 8.2 Hz, 1H, ArH), 7.81–7.83 (m, 2H, ArH), 7.88 (d, J = 8.6 Hz, 1H, ArH), 7.96 (d, J = 8.6 Hz, 1H, ArH), 8.09–8.12 (m, 2H, ArH), 8.29 (d, J = 8.3 Hz, 1H, ArH), 8.84 (s, 1H, ArH); ¹³C NMR (150 MHz, CDCl₃): δ = 16.3, 124.5, 124.7, 127.2, 127.9, 128.0, 128.2, 128.6, 129.1, 129.3, 129.8, 131.6, 132.3, 132.4, 133.2, 134.5, 136.0, 145.8, 146.6, 147.0, 195.9; HRMS (TOF ES⁺): m/z calcd for C₂₅H₁₈NO [(M+H)⁺], 298.1226; found, 298.1230.

(4-methylquinolin-3-yl)(thiophen-2-yl)methanone (4j)

Yellow solid; mp 102–104 °C; IR (KBr): 1660, 1586, 1498, 1402, 1375, 1315, 1285, 1235, 1153, 924, 860, 759, 632 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 2.77 (s, 3H, ArCH₃), 7.16–7.18 (m, 1H, ArH), 7.46 (d, J = 3.5 Hz, 1H, ArH), 7.68–7.70 (m, 1H, ArH), 7.82–7.85 (m, 2H, ArH), 8.16 (d, J = 8.5 Hz, 1H, ArH), 8.19 (d, J = 8.5 Hz, 1H, ArH), 8.95 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 15.7, 124.5, 127.4, 127.7, 128.5, 130.2, 130.5, 132.0, 135.9, 135.9, 143.5, 143.9, 148.1, 148.1, 188.7; HRMS (TOF ES⁺): m/z calcd for C₁₅H₁₂NOS [(M+H)⁺], 254.0634; found,
254.0638.

(4-methylquinolin-3-yl)(pyridin-4-yl)methanone (4k)

Yellow solid; mp 138–140 °C; IR (KBr): 1670, 1566, 1497, 1396, 1314, 1283, 1234, 1171, 937, 759, 695 cm\(^{-1}\); \(^1\)H NMR (600 MHz, CDCl\(_3\)): \(\delta = 2.61\) (s, 3H, ArCH\(_3\)), 7.54 (d, \(J = 5.8\) Hz, 2H, ArH), 7.57–7.60 (m, 1H, ArH), 7.72–7.75 (m, 1H, ArH), 8.05 (d, \(J = 8.4\) Hz, 1H, ArH), 8.07 (d, \(J = 8.4\) Hz, 1H, ArH), 8.71 (s, 1H, ArH), 8.75 (d, \(J = 5.5\) Hz, 2H, ArH); \(^{13}\)C NMR (150 MHz, CDCl\(_3\)): \(\delta = 16.0, 122.7, 122.7, 124.6, 127.5, 127.7, 130.1, 130.2, 131.1, 143.6, 145.0, 148.3, 148.5, 151.0, 151.0, 195.9; HRMS (TOF ES\(^{+}\)): \(m/z\) calcd for C\(_{16}\)H\(_{13}\)N\(_2\)O [(M+H\(^{+}\)]\(^{\ominus}\), 249.1022; found, 249.1022.

1-(4-methylquinolin-3-yl)-3-phenylprop-2-en-1-one (4l)

Yellow liquid; IR (KBr): 1640, 1599, 1574, 1499, 1447, 1374, 1329, 1239, 1201, 1171, 1114, 988, 863, 763, 721, 690 cm\(^{-1}\); \(^1\)H NMR (500 MHz, CDCl\(_3\)): \(\delta = 2.78\) (s, 3H, ArCH\(_3\)), 7.19 (d, \(J = 16.0\) Hz, 1H, CH), 7.40–7.43 (m, 3H, ArH), 7.45 (d, \(J = 16.0\) Hz, 1H, CH), 7.55–7.57 (m, 2H, ArH), 7.65–7.67 (m, 1H, ArH), 7.78–7.80 (m, 1H, ArH), 8.13–8.17 (m, 2H, ArH), 8.93 (s, 1H, ArH); \(^{13}\)C NMR (150 MHz, CDCl\(_3\)): \(\delta = 15.6, 124.6, 127.3, 127.3, 127.8, 128.6, 129.1, 129.1, 130.3, 130.4, 131.1, 132.4, 143.2, 143.6, 147.4, 148.1, 148.4, 195.6; HRMS (TOF ES\(^{+}\)):

(4-methoxyphenyl)(4-phenylquinolin-3-yl)methanone (4m)

Yellow solid; mp 114–116 °C; IR (KBr): 1659, 1589, 1496, 1452, 1369, 1316, 1255, 1161, 1021, 945, 843, 766, 701, 512 cm\(^{-1}\); \(^1\)H NMR (600 MHz, CDCl\(_3\)): \(\delta = 3.70\) (s, 3H, ArOCH\(_3\)), 6.67–6.69 (m, 2H, ArH), 7.21–7.23 (m, 5H, ArH), 7.42–7.45 (m, 1H, ArH), 7.54 (d, \(J = 8.7\) Hz, 2H, ArH), 7.68–7.70 (m, 2H, ArH), 8.14 (d, \(J = 8.6\) Hz, 1H, ArH), 8.87 (s, 1H, ArH); \(^{13}\)C NMR (150 MHz, CDCl\(_3\)): \(\delta = 55.5, 113.6, 113.6, 126.6, 126.7, 127.4, 128.2, 128.2, 128.5, 128.5, 129.8, 130.0, 130.0, 130.3, 132.2, 132.3, 132.3, 135.1, 146.6, 148.4, 148.7, 163.7, 195.0; HRMS (TOF ES\(^{+}\)):

(4-phenylquinolin-3-yl)(p-tolyl)methanone (4n)

S14
Yellow solid; mp 116–118 °C; IR (KBr): 1658, 1604, 1567, 1484, 1440, 1411, 1372, 1320, 1264, 1224, 1171, 1027, 943, 766, 706, 588 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 2.34 (s, 3H, ArCH₃), 7.10 (d, J = 8.6 Hz, 2H, ArH), 7.28–7.32 (m, 5H, ArH), 7.53–7.56 (m, 3H, ArH), 7.77–7.82 (m, 2H, ArH), 8.24 (d, J = 8.4 Hz, 1H, ArH), 8.97 (s, 1H, ArH); ¹³C NMR (150 MHz, CDCl₃): δ = 21.7, 126.6, 126.8, 127.4, 128.2, 128.2, 128.5, 129.0, 129.9, 130.2, 130.2, 130.2, 130.4, 132.1, 134.9, 135.0, 144.3, 146.9, 148.5, 148.8, 196.2; HRMS (TOF ES⁺): m/z calcd for C₂₃H₁₈NO [(M+H)⁺], 324.1383; found, 324.1388.

**phenyl(4-phenylquinolin-3-yl)methanone (4o)**

![Chemical Structure of phenyl(4-phenylquinolin-3-yl)methanone (4o)](image)

Yellow solid; mp 111–113 °C; IR (KBr): 1658, 1566, 1490, 1445, 1374, 1320, 1266, 1221, 1165, 1020, 943, 859, 764, 694 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 7.26–7.31 (m, 7H, ArH), 7.42–7.45 (m, 1H, ArH), 7.53–7.56 (m, 1H, ArH), 7.60–7.62 (m, 2H, ArH), 7.78–7.82 (m, 2H, ArH), 8.24 (d, J = 8.5 Hz, 1H, ArH), 9.00 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 126.5, 126.8, 127.5, 128.2, 128.2, 128.2, 128.5, 129.8, 129.8, 129.9, 130.1, 130.1, 130.5, 131.9, 133.2, 135.0, 137.4, 147.0, 148.6, 148.9, 196.8; HRMS (TOF ES⁺): m/z calcd for C₂₂H₁₈NO [(M+H)⁺], 310.1226; found, 310.1230.

**4-chlorophenyl(4-phenylquinolin-3-yl)methanone (4p)**

![Chemical Structure of 4-chlorophenyl(4-phenylquinolin-3-yl)methanone (4p)](image)

Yellow solid; mp 116–118 °C; IR (KBr): 1657, 1577, 1451, 1394, 1314, 1268, 1226, 1160, 1086, 852, 761, 700, 623 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 7.23–7.27 (m, 5H, ArH), 7.29–7.32 (m, 2H, ArH), 7.52–7.58 (m, 3H, ArH), 7.79–7.84 (m, 2H, ArH), 8.24 (d, J = 8.5 Hz, 1H, ArH); 8.99 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 126.3, 126.7, 127.6, 128.3, 128.3, 128.5, 128.5, 128.7, 129.9, 130.1, 130.1, 130.7, 131.0, 131.0, 131.4, 134.8, 135.8, 139.7, 147.0, 148.4, 149.0, 195.7; HRMS (TOF ES⁺): m/z calcd for C₂₂H₁₆ClNO [(M+H)⁺], 344.0837; found, 344.0839.

**2-chlorophenyl(4-phenylquinolin-3-yl)methanone (4q)**

![Chemical Structure of 2-chlorophenyl(4-phenylquinolin-3-yl)methanone (4q)](image)

Yellow solid; mp 107–109 °C; IR (KBr): 1662, 1586, 1568, 1488, 1436, 1359, 1302, 1221, 1061, 954, 838, 766, 749, 699, 592 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 7.02–7.05 (m, 1H, ArH), 7.11–7.18 (m, 5H, ArH), 7.22–7.24 (m, 3H, ArH), 7.48–7.52 (m, 1H, ArH), 7.65 (d, J = 8.5 Hz, 1H, ArH), 7.78–7.81 (m, 1H, ArH), 8.22 (d, J = 8.5 Hz, 1H, ArH), 9.16 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 126.4, 127.1, 127.5, 128.1, 128.1, 128.5, 128.6, 129.3, 129.5, 129.5,
129.6, 129.9, 130.1, 130.7, 131.0, 131.6, 134.9, 138.0, 147.7, 149.2, 149.7, 196.3; HRMS (TOF ES\textsuperscript{+}): \textit{m/z} calcd for C\textsubscript{22}H\textsubscript{15}CINO [(M+H\textsuperscript{+})\textsuperscript{+}], 344.0837; found, 344.0841.

**(4-nitrophenyl)(4-phenylquinolin-3-yl)methanone (4r)**

![Diagram of (4-nitrophenyl)(4-phenylquinolin-3-yl)methanone (4r)]

Yellow solid; mp 118–120 °C; IR (KBr): 1670, 1601, 1569, 1349, 1314, 1265, 948, 839, 709, 605, 555 cm\textsuperscript{-1}; \textsuperscript{1}H NMR (600 MHz, CDCl\textsubscript{3}): \(\delta = 7.24–7.29\) (m, 5H, ArH), 7.58–7.59 (m, 1H, ArH), 7.65–7.67 (m, 2H, ArH), 7.82–7.85 (m, 2H, ArH), 8.03–8.05 (m, 2H, ArH), 8.25–8.27 (m, 1H, ArH), 9.07 (s, 1H, ArH); \textsuperscript{13}C NMR (150 MHz, CDCl\textsubscript{3}): \(\delta = 123.2\), 123.2, 125.9, 126.7, 127.9, 128.5, 128.9, 130.0, 130.2, 130.3, 130.3, 130.7, 131.1, 134.6, 142.3, 147.4, 148.5, 149.3, 149.8, 195.7; HRMS (TOF ES\textsuperscript{+}): \textit{m/z} calcd for C\textsubscript{22}H\textsubscript{15}N\textsubscript{2}O\textsubscript{3} [(M+H\textsuperscript{+})], 355.1077; found, 355.1080.

**(1,1\textsuperscript{'-biphenyl]-4-yl(4-phenylquinolin-3-yl)methanone (4s)**

![Diagram of [1,1\textsuperscript{'-biphenyl]-4-yl(4-phenylquinolin-3-yl)methanone (4s)]

Yellow solid; mp 171–173 °C; IR (KBr): 1660, 1601, 1560, 1485, 1442, 1404, 1380, 1294, 1231, 1169, 1031, 1001, 849, 770, 750, 699, 547 cm\textsuperscript{-1}; \textsuperscript{1}H NMR (600 MHz, CDCl\textsubscript{3}): \(\delta = 7.27–7.33\) (m, 4H, ArH), 7.36–7.39 (m, 1H, ArH), 7.42–7.45 (m, 2H, ArH), 7.51–7.52 (m, 2H, ArH), 7.54–7.57 (m, 2H, ArH), 7.69–7.71 (m, 3H, ArH), 7.79–7.83 (m, 2H, ArH), 8.25 (d, \(J = 8.3\) Hz, 1H, ArH), 9.03 (s, 1H, ArH); \textsuperscript{13}C NMR (150 MHz, CDCl\textsubscript{3}): \(\delta = 126.5\), 126.8, 126.9, 126.9, 127.3, 127.3, 127.5, 128.3, 128.3, 128.6, 129.0, 129.0, 129.9, 130.1, 130.1, 130.4, 130.4, 130.5, 132.0, 135.0, 136.1, 139.7, 145.9, 147.0, 148.5, 148.9, 196.3; HRMS (TOF ES\textsuperscript{+}): \textit{m/z} calcd for C\textsubscript{22}H\textsubscript{26}NO [(M+H\textsuperscript{+})], 386.1539; found, 386.1541.

**(4-phenylquinolin-3-yl)(thiophen-2-yl)methanone (4t)**

![Diagram of (4-phenylquinolin-3-yl)(thiophen-2-yl)methanone (4t)]

Yellow solid; mp 124–126 °C; IR (KBr): 1643, 1564, 1493, 1448, 1399, 1354, 1304, 1228, 1162, 1122, 1068, 935, 762 cm\textsuperscript{-1}; \textsuperscript{1}H NMR (500 MHz, CDCl\textsubscript{3}): \(\delta = 6.97–6.99\) (m, 1H, ArH), 7.28–7.29 (m, 1H, ArH), 7.33–7.39 (m, 5H, ArH), 7.53–7.57 (m, 1H, ArH), 7.60–7.62 (m, 1H, ArH), 7.79–7.82 (m, 2H, ArH), 8.23 (d, \(J = 8.5\) Hz, 1H, ArH), 9.04 (s, 1H, ArH); \textsuperscript{13}C NMR (125 MHz, CDCl\textsubscript{3}): \(\delta = 126.6\), 126.9, 127.5, 128.0, 128.3, 128.3, 128.6, 129.9, 130.1, 130.1, 130.5, 131.9, 134.9, 135.2, 135.5, 144.6, 146.8, 148.1, 148.9, 188.3; HRMS (TOF ES\textsuperscript{+}): \textit{m/z} calcd for C\textsubscript{20}H\textsubscript{14}N\textsubscript{2}S\textsubscript{2} [(M+H\textsuperscript{+})], 316.0791; found, 316.0795.
(4-phenylquinolin-3-yl)(pyridin-4-yl)methanone (4u)

Yellow solid; mp 114–116 °C; IR (KBr): 1650, 1563, 1484, 1450, 1408, 1373, 1334, 1263, 1028, 768, 699, 601 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 7.22–7.24 (m, 2H, ArH), 7.27–7.29 (m, 5H, ArH), 7.59–7.60 (m, 1H, ArH), 7.82–7.87 (m, 2H, ArH), 8.26 (d, J = 8.4 Hz, 1H, ArH), 8.55 (d, J = 4.3 Hz, 2H, ArH), 9.06 (s, 1H, ArH); ¹³C NMR (150 MHz, CDCl₃): δ = 121.9, 121.9, 126.0, 126.8, 127.9, 128.5, 129.0, 130.0, 130.3, 130.5, 130.3, 131.1, 134.6, 143.7, 147.6, 148.5, 149.4, 150.3, 196.6; HRMS (TOF ES⁺): m/z calcd for C₂₁H₁₅N₂O [(M+H)⁺], 311.1179; found, 311.1179.

(4-(4-fluorophenyl)quinolin-3-yl)(phenyl)methanone (4v)

Yellow liquid; IR (KBr): 1660, 1498, 1378, 1315, 1225, 1161, 1016, 943, 838, 767, 711, 572 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 6.89–6.92 (m, 2H, ArH), 7.15–7.18 (m, 2H, ArH), 7.20–7.23 (m, 2H, ArH), 7.36–7.39 (m, 1H, ArH), 7.46–7.49 (m, 1H, ArH), 7.52 (d, J = 7.4 Hz, 2H, ArH), 7.65 (d, J = 8.5 Hz, 1H, ArH), 7.71–7.74 (m, 1H, ArH), 8.16 (d, J = 8.5 Hz, 1H, ArH), 8.90 (d, J = 1.7 Hz, 1H, ArH); ¹³C NMR (150 MHz, CDCl₃): δ = 115.4 (d, J = 21.0 Hz), 115.4 (d, J = 21.0 Hz), 126.5, 126.5, 127.7, 128.4, 128.4, 129.7, 129.7, 130.0, 130.6, 130.9 (d, J = 3.0 Hz), 131.9 (d, J = 7.5 Hz), 131.9 (d, J = 7.5 Hz), 132.0, 133.4, 137.3, 145.9, 148.5, 148.9, 162.7 (d, J = 247.5 Hz), 196.7; HRMS (TOF ES⁺): m/z calcd for C₂₂H₁₅FNO [(M+H)⁺], 328.1132; found, 328.1133.

(6-chloro-4-(2-chlorophenyl)quinolin-3-yl)(phenyl)methanone (4w)

Yellow liquid; IR (KBr): 1662, 1609, 1482, 1437, 1400, 1357, 1314, 1231, 1130, 1076, 966, 866, 831, 710, 641 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 7.17–7.23 (m, 3H, ArH), 7.26–7.30 (m, 3H, ArH), 7.38 (d, J = 2.3 Hz, 1H, ArH), 7.41–7.44 (m, 1H, ArH), 7.59–7.61 (m, 2H, ArH), 7.66–7.68 (m, 1H, ArH), 8.11 (d, J = 9.0 Hz, 1H, ArH), 8.95 (s, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 124.4, 125.7, 126.1, 127.4, 127.4, 128.7, 128.7, 128.8, 129.4, 130.5, 130.7, 130.8, 131.6, 132.2, 132.3, 132.5, 132.9, 136.0, 143.0, 146.1, 148.0, 194.5; HRMS (TOF ES⁺): m/z calcd for C₂₂H₁₄Cl₂NO [(M+H)⁺], 378.0447; found, 378.0445.

3-(2-chlorobenzoyl)-4-phenylquinoline 1-oxide (5)
Yellow solid; mp 131–133 °C; IR (KBr): 1672, 1582, 1436, 1381, 1336, 1277, 1214, 1088, 1077, 761, 667 cm⁻¹; ¹H NMR (500 MHz, CDCl₃): δ = 7.06–7.10 (m, 1H, ArH), 7.15–7.24 (m, 5H, ArH), 7.26–7.27 (m, 3H, ArH), 7.60–7.63 (m, 1H, ArH), 7.69 (d, J = 8.5 Hz, 1H, ArH), 7.84–7.88 (m, 1H, ArH), 8.79 (s, 1H, ArH), 8.89 (d, J = 9.0 Hz, 1H, ArH); ¹³C NMR (125 MHz, CDCl₃): δ = 120.1, 126.6, 128.1, 128.3, 128.7, 129.3, 129.4, 130.0, 130.2, 130.8, 131.7, 132.0, 132.4, 132.6, 134.0, 134.7, 137.3, 137.4, 142.3, 193.5; HRMS (TOF ES⁺): m/z calcd for C₂₂H₁₅ClNO₂[(M+H)⁺], 360.0786; found, 360.0786.

2-benzyl-3-(2-chlorobenzoyl)-4-phenylquinoline 1-oxide (6)

Yellow solid; mp 130–132 °C; IR (KBr): 1726, 1671, 1635, 1593, 1555, 1452, 1374, 1327, 1291, 1226, 1030, 762, 703 cm⁻¹; ¹H NMR (600 MHz, CDCl₃): δ = 4.60 (s, 2H, CH₂), 6.91–6.94 (m, 1H, ArH), 6.99–7.01 (m, 1H, ArH), 7.09–7.23 (m, 10H, ArH), 7.46 (d, J = 7.5 Hz, 2H, ArH), 7.52–7.57 (m, 2H, ArH), 7.79–7.82 (m, 1H, ArH), 8.92 (d, J = 8.8 Hz, 1H, ArH); ¹³C NMR (150 MHz, CDCl₃): δ = 34.8, 120.3, 126.3, 126.6, 127.2, 128.0, 128.3, 128.3, 128.3, 128.5, 128.6, 129.4, 130.2, 130.2, 130.7, 131.1, 131.8, 132.9, 133.1, 134.1, 134.5, 134.6, 136.5, 136.7, 141.8, 145.5, 193.9; HRMS (TOF ES⁺): m/z calcd for C₂₀H₁₅ClNO₂ [(M+H)⁺], 450.1255; found, 450.1258.
$^1$H NMR and $^{13}$C NMR Spectra for Spectroscopic Data
Figure 1. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3a
Figure 2. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3a
Figure 3. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 3b
Figure 4. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 3b
Figure 5. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3c
Figure 6. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3c
Figure 7. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3d
Figure 8. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3d
Figure 9. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3e
Figure 10. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3e
Figure 11. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3f
Figure 12. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3f
Figure 13. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound $3g$
Figure 14. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3g
Figure 15. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3h
Figure 16. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3h
Figure 17. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3i
Figure 18. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3i
Figure 19. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3j
Figure 20. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3j
Figure 21. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3k
Figure 22. $^{13}$C NMR (125 MHz, CDCl₃) spectra of compound 3k
Figure 23. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 31
Figure 24. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3l
Figure 25. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3m
Figure 26. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3m
Figure 27. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 3n
Figure 28. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 3n
Figure 29. \(^1H\) NMR (600 MHz, CDCl\(_3\)) spectra of compound 3o
Figure 30. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 3o
Figure 31. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3p
Figure 32. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3p
Figure 33. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 3q
Figure 34. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 3q
Figure 35. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3r
Figure 36. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3r
Figure 37. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 3s
Figure 38. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 3s
Figure 39. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3t
Figure 40. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3t
Figure 41. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 3u
Figure 42. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 3u
Figure 43. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 3v
Figure 4. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 3v
Figure 45. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 3w
Figure 46. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 3w
Figure 47. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4a
Figure 48. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4a
Figure 49. "H NMR (500 MHz, CDCl₃) spectra of compound 4b
Figure 50. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4b
Figure 51. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4c
Figure 52. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4c
Figure 53. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4d
Figure 54. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4d
Figure 55. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4e
Figure 56. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4e
**Figure 57.** $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4f
Figure 58. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4f
Figure 59. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4g
Figure 60. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4g
Figure 61. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4h
Figure 62. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4h.
Figure 63. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4i
Figure 64. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4i
Figure 65. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4j
Figure 66. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4j
Figure 67. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4k
Figure 68. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4k
Figure 69. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 41
Figure 70. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4l
Figure 71. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4m
Figure 72. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4m
Figure 7.3. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4n.
\textbf{Figure 74.} $^{13}\text{C}$ NMR (150 MHz, CDCl$_3$) spectra of compound 4n
Figure 75. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4o
Figure 76. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4o
Figure 77. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4p
Figure 78. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4p
Figure 79. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4q
Figure 80. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4q
Figure 81. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4r
Figure 82. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4r
Figure 83. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4s
Figure 84. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4s.
Figure 85. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4t
Figure 86. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4t
Figure 87. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4u
Figure 88. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4u
Figure 89. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 4v
Figure 90. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 4v
Figure 91. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 4w
Figure 92. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 4w
Figure 93. $^1$H NMR (500 MHz, CDCl$_3$) spectra of compound 5
Figure 94. $^{13}$C NMR (125 MHz, CDCl$_3$) spectra of compound 5
Figure 95. $^1$H NMR (600 MHz, CDCl$_3$) spectra of compound 6
Figure 96. $^{13}$C NMR (150 MHz, CDCl$_3$) spectra of compound 6
References and Notes
