Supporting information for

Recyclable CuO-Catalyzed Synthesis of 4(3H)-Quinazolinones

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General Remarks

All glassware used was dried in an electric oven at 120 °C. All chemicals were purchased from Sigma-Aldrich, Alfa Aesar, Shanghai Aladdin Reagent Co., Ltd, and Chengdu Changzheng Chemical Co. and used as received.

All compounds were characterized by 1H NMR, 13C NMR, ESI-MS and IR spectroscopy. Copies of the 1H and 13C spectra can be found at the end of the Supporting Information. Nuclear Magnetic Resonance spectra were recorded on a Bruker Advance 300MHz or 400 MHz instrument. All 1H NMR experiments are reported in δ units, parts per million (ppm), and were measured relative to the signals for residual chloroform (7.26 ppm) or DMSO (2.50 ppm) in the deuterated solvent, unless otherwise stated. All 13C NMR spectra are reported in ppm relative to deuteron-chloroform (77.23 ppm) or DMSO-d6 (δ = 39.60 ppm), unless otherwise stated, and all were obtained with 1H decoupling. All IR spectra were taken on a Bruker Tensor-27 infrared spectrometer with an OPUS workstation. Electron-spraying ionization Mass Spectra are recorded on an Agilent 1200 series LC/MS DVL instrument. Melting points were determined on an Electrothermal melting-point apparatus. The purities of all the synthesized compounds were checked by thin-layer chromatography (TLC) using different organic solvents.
**Experimental Section**

**Typical procedure for the synthesis of 4(3H)-quinazolinones**
A mixture of anthranilamide (1.0 mmol), benzaldehyde (1.0 mmol) and CuO (0.03 mmol) in DMA (3 ml) was stirred under air in an oil bath at 120 °C for 24 hours. And then the reaction mixture was cooled to room temperature and the upper clear solution was carefully removed by a pipette. DMA (3 mL) was added to the vial, and the vial was shaken and then kept in stillness for a moment, and then the upper clear solution was removed by a pipette again. DMA (3 mL) was added to the vial again and the upper clear solution was removed again (Note: The black solid CuO in the bottom of the vial may be used as the recycling catalyst for the following synthesis of 4(3H)-quinazolinone once other reagents were added). The combined solution was condensed in vacuum to remove the solvent DMA, which was used as the solvent for the next reaction. The residual was purified by column chromatography on silica gel (gradient eluent with a mixed solution of petroleum ether and ethyl acetate) to give the pure 4(3H)-quinazolinone.

**Typical procedure for the synthesis of 4(3H)-quinazolinones with the recycling catalyst CuO**
During the workup operation of the typical procedure for the synthesis of 4(3H)-quinazolinones, the black powder CuO in the bottom of the vial was suitable for the recycling catalyst of the synthesis of 4(3H)-quinazolinone. To the vial was added anthranilamide (1.0 mmol), benzaldehyde (1.0 mmol), DMA (3 mL). The vial was stirred under air in an oil bath at 120 °C for 24 hours. After similar workup, the reaction of the first recycling of the catalyst CuO was complete. And the next time recycling reaction may be continued with the black powder CuO in the bottom of the vial.

**Scale-up procedure for the synthesis of 2-phenyl-4(3H)-quinazolinone**
A mixture of anthranilamide (20 mmol), benzaldehyde (20 mmol) and CuO (0. 6 mmol) in DMA (60 ml) was stirred under air in an oil bath at 120 °C for 24 hours. And then the reaction mixture was cooled to room temperature and filtrated to remove CuO. The filtrate was condensed in vacuum to remove the solvent DMA, which may be used for next reaction. The resulting residual was recrystallized from ethanol to give white solid 2-phenyl-4(3H)-quinazolinone 3a.
Analytical Data for Compounds 3a-3o

2-phenyl-4(3H)-quinazolinone (3a)

White solid. Mp 239-241 °C. H NMR (300 MHz, CDCl₃), δ (ppm): 11.12 (s, 1H), 8.33 (d, J = 7.52 Hz, 1H), 8.20-8.22 (m, 2H) 7.78-7.85 (m, 2H), 7.59 (t, J = 2.78 Hz, 3H) 7.51(t, J = 3.19 Hz, 1H). C NMR (75 MHz, CDCl₃), δ (ppm): 163.6, 151.6, 149.5, 134.8, 132.8, 131.6, 129.0, 128.0, 127.3, 126.8, 126.5, 120.8. ESI-MS (negative mode), m/z = 221 [M–H]. IR (KBr), ν (cm⁻¹): 2924, 1730, 1664, 1601, 1451, 1375, 1212, 1045, 942, 752, 694. Anal. calcd. (%) for C14H10N2O: C, 75.66; H, 4.54; N, 12.60. Found: C, 75.32; H, 4.41; N, 12.53.

2-(4-Methylphenyl)-4(3H)-quinazolinone (3b)

White solid. Mp 240-241 °C. H NMR (300 MHz, DMSO-d₆), δ (ppm): 12.46 (s, 1H), 8.14 (d, J = 7.95Hz, 1H), 8.09 (d, J = 8.21Hz, 2H), 7.83 (t, J = 6.87Hz, 1H), 7.72 (d, J = 7.68Hz, 1H), 7.51 (t, J = 7.02Hz, 1H), 7.35 (d, J = 8.07Hz, 2H), 2.39. C NMR (100 MHz, DMSO-d₆), δ (ppm): 167.4, 157.4, 154.0, 146.6, 139.7, 135.1, 134.4, 132.8, 132.6, 131.6, 126.1, 26.2. ESI-MS (negative mode), m/z = 235 [M–H]. IR (KBr), ν (cm⁻¹): 2921, 1657, 1599, 1445, 1300, 1149, 939, 765, 686. Anal. calcd. (%) for C15H12N2O: C, 76.25; H, 5.12; N, 11.86. Found: C, 76.12; H, 5.03; N, 11.69.

2-(3-methoxyphenyl)-4(3H)-quinazolinone (3c)

White solid. Mp 202-204 °C. H NMR (300 MHz, CDCl₃), δ (ppm): 10.75 (s, 1H), 8.31 (d, J = 8.16 Hz, 1H), 7.81-7.84 (m, 2H), 7.69-7.73 (m, 2H), 7.46-7.53 (m, 2H), 7.15 (d, J = 1.71 Hz, 1H), 3.95 (s, 3H). C NMR (100 MHz, DMSO-d₆), δ (ppm): 162.7, 159.8, 152.5, 135.0, 134.4, 130.2, 127.1, 126.3, 121.4, 120.5, 118.0, 113.0, 55.8. ESI-MS (negative mode), m/z = 251 [M–H]. IR (KBr), ν (cm⁻¹): 2987, 1786, 1679, 1584, 1375, 1218, 1043, 758, 669. Anal. calcd. (%) for C15H12N2O2: C, 71.42; H, 4.79; N, 11.10. Found: C, 71.25; H, 4.86; N, 11.18.

2-(3,5-ditertbutyl-2-hydroxyphenyl)-4(3H)-quinazolinone (3d)
White solid. Mp 287-288 °C. $^1$H NMR (300 MHz, CDCl$_3$), δ (ppm): 14.37 (s, 1H), 10.54 (s, 1H), 8.32 (d, $J$ = 7.95Hz, 1H), 7.74-7.83 (m, 2H), 7.47-7.59 (m, 2H) 7.46-7.51 (m, 1H), 1.49 (s, 9H), 1.39 (s, 9H). $^{13}$C NMR (100 MHz, DMSO-$d_6$), δ (ppm): 162.1, 158.2, 155.4, 145.9, 140.1, 137.0, 135.5, 128.2, 127.3, 126.5, 126.1, 121.0, 112.4, 35.3, 34.9, 31.8, 29.8. ESI-MS (negative mode), m/z = 349 [M–H]. IR (KBr), ν (cm$^{-1}$): 2965, 1676, 1610, 1563, 1456, 1217, 1047, 769, 667. Anal. calcd. (%) for C$_{22}$H$_{26}$N$_2$O$_2$: C, 75.40; H, 7.48; N, 7.99. Found: C, 75.22; H, 7.59; N, 7.82.

2-(4-(dimethylamino)phenyl)-4(3H)-quinazolinone (3e)

White solid. Mp 247-248 °C. $^1$H NMR (300 MHz, CDCl$_3$), δ (ppm): 9.83 (s, 1H), 8.27 (d, $J$ = 7.78Hz, 1H), 8.04 (d, $J$ = 8.92Hz, 2H), 7.85 (d, $J$ = 8.21Hz, 1H), 7.76 (dt, $J$ = 7.01Hz, 1.42Hz, 1H), 7.43 (t, $J$ = 6.93Hz, 1H), 6.79 (d, $J$ = 9.05Hz, 2H), 3.03 (s, 6H). $^{13}$C NMR (75 MHz, CDCl$_3$), δ (ppm): 163.2, 152.5, 151.6, 150.0, 134.6, 129.5, 128.4, 127.4, 126.3, 125.6, 112.0, 111.7, 40.1. ESI-MS (negative mode), m/z = 264 [M–H]. IR (KBr), ν (cm$^{-1}$): 3018, 1731, 1665, 1592, 1533, 1372, 1215, 1046, 939, 750, 667. Anal. calcd. (%) for C$_{16}$H$_{15}$N$_3$O: C, 72.43; H, 5.70; N, 15.84. Found: C, 72.51; H, 5.63; N, 15.72.

2-(4-fluorophenyl)-4(3H)-quinazolinone (3f)

White solid. Mp 288-289 °C. $^1$H NMR (300 MHz, DMSO-$d_6$), δ (ppm): 12.57 (s, 1H), 8.23-8.27 (m, 2H), 8.15 (d, $J$ = 7.92 Hz, 1H), 7.84 (t, $J$ = 6.84 Hz, 1H), 7.53 (t, $J$ = 7.03 Hz, 1H), 7.39 (t, $J$ = 8.85 Hz, 2H). $^{13}$C NMR (100 MHz, DMSO-$d_6$), δ (ppm): 167.4, 156.6, 153.8, 139.8, 135.6, 134.4, 132.6, 131.8, 131.0, 126.1, 120.9, 120.7. ESI-MS (negative mode), m/z = 239 [M–H]. IR (KBr), ν (cm$^{-1}$): 2920, 1660, 1603, 1483, 1346, 1232, 1149, 1076, 939, 763, 684. Anal. calcd. (%) for C$_{14}$H$_9$FN$_2$O: C, 69.99; H, 3.78; N, 11.66. Found: C, 69.87; H, 3.89; N, 11.48.

2-(4-chlorophenyl)-4(3H)-quinazolinone (3g)
White solid. Mp 298-299 °C. $^1$H NMR (300 MHz, DMSO-$d_6$), δ (ppm): 12.61 (s, 1H), 8.20 (d, J = 8.55Hz, 2H), 8.15 (d, J = 7.92Hz, 1H), 7.85 (t, J = 7.10Hz, 1H), 7.74 (d, J = 8.16Hz, 1H), 7.63 (d, J = 8.55Hz, 2H), 7.53 (t, J = 7.37Hz, 1H). $^{13}$C NMR (100 MHz, DMSO-$d_6$), δ (ppm): 162.6, 151.8, 148.9, 136.7, 135.1, 132.0, 130.0, 129.1, 127.9, 127.2, 126.3, 121.4. ESI-MS (negative mode), m/z = 255 [M–H]$.^-$ IR (KBr), ν (cm$^{-1}$): 2922, 1671, 1598, 1476, 1344, 1280, 1121, 1093, 982, 760, 683. Anal. calcd. (%) for C$_{14}$H$_9$ClN$_2$O: C, 65.51; H, 3.53; N, 10.91. Found: C, 65.63; H, 3.64; N, 10.78.

2-(4-bromophenyl)-4(3H)-quinazolinone (3h)

White solid. Mp 298-300 °C. $^1$H NMR (300 MHz, DMSO-$d_6$), δ (ppm): 12.60 (s, 1H), 8.14 (t, J = 7.41Hz, 3H), 7.85 (t, J = 7.02Hz, 1H), 7.76 (t, J = 7.56Hz, 3H), 7.54 (t, J = 7.56Hz, 1H). $^{13}$C NMR (100 MHz, DMSO-$d_6$), δ (ppm): 162.6, 151.9, 148.9, 135.1, 132.3, 132.0, 130.2, 127.9, 127.2, 126.3, 125.7, 121.4. ESI-MS (negative mode), m/z = 299 [M (79Br) –H]$,^-$, 301 [M (81Br) –H]. IR (KBr), ν (cm$^{-1}$): 2986, 1732, 1375, 1216, 1047, 756, 668. Anal. calcd. (%) for C$_{14}$H$_9$BrN$_2$O: C, 55.84; H, 3.01; N, 9.30. Found: C, 55.92; H, 3.16; N, 9.23.

2-(3-bromophenyl)-4(3H)-quinazolinone (3i)

White solid. Mp 271-272 °C. $^1$H NMR (300 MHz, DMSO-$d_6$), δ (ppm): 12.62 (s, 1H), 8.38 (s, 1H), 8.10-8.20 (m, 2H), 7.78-7.88 (m, 2H), 7.66-7.75 (m, 1H), 7.57-7.45 (m, 2H). $^{13}$C NMR (100 MHz, DMSO-$d_6$), δ (ppm): 162.5, 151.3, 135.4, 135.2, 134.5, 131.2, 131.2, 130.8, 128.1, 127.4, 127.3, 126.3, 122.4, 121.6. ESI-MS (negative mode), m/z = 299 [M (79Br) –H]$,^-$, 301 [M (81Br) –H]. IR (KBr), ν (cm$^{-1}$): 2923, 1678, 1607, 1471, 1309, 1152, 952, 794, 677. Anal. calcd. (%) for C$_{14}$H$_9$BrN$_2$O: C, 55.84; H, 3.01; N, 9.30. Found: C, 55.90; H, 3.21; N, 9.22.

2-(2-bromophenyl)-4(3H)-quinazolinone (3j)
White solid. Mp 159-160 °C. $^1$H NMR (300 MHz, CDCl$_3$), δ (ppm): 9.54 (s, 1H), 8.32 (d, $J = 7.87$ Hz, 1H), 7.83 (d, $J = 2.23$Hz, 2H), 7.71-7.77 (m, 2H), 7.48-7.57 (m, 2H), 7.41 (dt, $J = 7.87$Hz, 1.08Hz, 1H). $^{13}$C NMR (75 MHz, CDCl$_3$), δ (ppm): 162.2, 151.9, 148.8, 134.8, 133.7, 132.0, 131.2, 127.97, 127.94, 127.3, 126.4, 121.0, 120.8. ESI-MS (negative mode), m/z = 299 [M (79Br –H)], 301 [M (81Br –H)]. IR (KBr), ν (cm$^{-1}$): 3015, 1673, 1606, 1472, 1304, 1216, 1145, 1046, 945, 755, 666. Anal. calcd. (%) for C14H9BrN2O: C, 55.84; H, 3.01; N, 9.30. Found: C, 55.97; H, 3.25; N, 9.17.

2-furyl-4(3H)-quinazolinone (3k)

White solid.

$^1$H NMR (300 MHz, CDCl$_3$), δ (ppm): 10.85 (s, 1H), 8.30 (d, $J = 7.75$Hz, 1H), 7.77 (d, $J = 5.36$Hz, 2H), 7.66 (s, 1H), 7.45-7.50 (m, 2H), 6.65-6.67 (m, 1H). $^{13}$C NMR (75 MHz, CDCl$_3$), δ (ppm): 162.8, 149.2, 146.2, 145.5, 143.5, 134.9, 127.7, 126.6, 120.9, 114.0, 112.8, 14.1. ESI-MS (negative mode), m/z = 211 [M–H]. IR (CHCl$_3$), ν (cm$^{-1}$): 2986, 1667, 1603, 1552, 1502, 1459, 1344, 1315, 1242, 1217, 1173, 1030, 965, 750, 666. Anal. calcd. (%) for C12H8N2O2: C, 67.92; H, 3.80; N, 13.20. Found: C, 67.99; H, 3.96; N, 13.12.

2-pentylquinazolin-4(3H)-one (3l)

White solid. Mp 152-154 °C. $^1$H NMR (300 MHz, DMSO-$d_6$), δ (ppm): 12.15 (s, 1H), 8.07 (d, $J = 7.89$ Hz, 1H), 7.72-7.78 (m, 1H), 7.58 (d, $J = 8.10$ Hz, 1H), 7.41-7.46 (m, 1H), 2.49-2.60 (m, 2H), 1.67-1.72 (m, 2H), 1.29 (d, $J = 7.14$ Hz, 4H), 0.85 (d, $J = 6.66$ Hz, 3H). $^{13}$C NMR (75 MHz, DMSO-$d_6$), δ (ppm): 162.0, 157.7, 149.0, 134.4, 126.8, 126.0, 125.8, 120.8. IR (KBr), ν (cm$^{-1}$): 3846, 3696, 3121, 2925, 1845, 1675, 1614, 1564, 1470, 1380, 1324, 1254, 1027, 976, 737, 647. Anal. calcd. (%) for C13H16N2O: C, 72.19; H, 7.46; N, 12.95. Found: C, 72.12; H, 7.58; N, 12.82.

2-phenyl-3-propyl-4(3H)-quinazolinone (3m)

White solid. Mp 98-100 °C. $^1$H NMR (400 MHz, DMSO-$d_6$), δ (ppm): 8.19-8.22 (m, 1H), 7.83 (t, $J = 7.60$Hz, 1H), 7.62-7.68 (m, 3H), 7.55-7.58 (m, 4H), 3.84 (t, $J = 7.60$Hz, 2H), 1.49-1.54 (m, 2H), 0.63-0.67 (m, 3H). $^{13}$C NMR (100 MHz, DMSO-$d_6$), δ (ppm): 161.6, 156.5, 147.3, 135.9, 134.8,
130.0, 129.7, 128.9, 128.8, 128.4, 127.6, 127.4, 126.6, 120.9, 47.1, 21.7, 11.4. ESI-MS (negative mode), m/z = 263 [M–H]. IR (KBr), ν (cm⁻¹): 2983, 1677, 1604, 1461, 1360, 1249, 1073, 770, 697. Anal. calcd. (%) for C17H16N2O: C, 77.25; H, 6.10; N, 10.60. Found: C, 77.45; H, 6.32; N, 10.46.

**3-benzyl-2-phenyl-4(3H)-quinazolinone (3n)**

White solid. Mp 148-150 °C. ¹H NMR (400 MHz, DMSO-d₆), δ (ppm): 8.21-8.23 (m, 1H), 7.88 (t, J = 7.60 Hz, 1H), 7.72 (d, J = 8.00 Hz, 1H), 7.58-7.62 (m, 1H), 7.40-7.50 (m, 5H), 7.22 (d, J = 6.00 Hz, 3H), 6.92 (d, J = 6.80 Hz, 2H), 5.19 (s, 2H). ¹³C NMR (100 MHz, DMSO-d₆), δ (ppm): 161.8, 156.6, 147.4, 137.1, 135.6, 135.2, 130.1, 128.8, 128.6, 128.4, 127.8, 127.6, 127.5, 126.8, 126.7, 120.8, 48.6. ESI-MS (negative mode), m/z = 311 [M–H]. IR (KBr), ν (cm⁻¹): 3033, 1674, 1584, 1352, 1244, 949, 771, 698. Anal. calcd. (%) for C21H16N2O: C, 80.75; H, 5.16; N, 8.97. Found: C, 80.87; H, 5.28; N, 8.82.

**6-chloro-2-phenylquinazolin-4(3H)-one (3o)**

White solid, Mp. 282-284 °C. ¹H NMR (300 MHz, CDCl₃), δ (ppm): 12.75 (br, 1H), 8.17 (d, J = 6.9 Hz, 2H), 8.09 (d, J = 2.1 Hz, 1H), 7.87 (dd, J₁ = 8.7 Hz, J₂ = 2.1 Hz, 1H), 7.77 (d, J = 87 Hz, 1H), 7.53-7.63 (m, 3H). ¹³C NMR (75 MHz, CDCl₃) δ (ppm): 161.4, 152.9, 147.4, 134.7, 130.8, 129.7, 128.6, 127.8, 124.9, 122.2. IR (KBr), ν (cm⁻¹): 3724, 3565, 2983, 2351, 1681, 1605, 1577, 1482, 1305, 1158, 1122, 946, 888, 847, 770, 667. Anal. calcd. (%) for C14H9ClN2O: C, 65.51; H, 3.53; N, 10.91. Found: C, 65.57; H, 3.59; N, 10.42.
Z0-2

Current Data Parameters
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EXPNO         2
PROCNO        1

F2 - Acquisition Parameters
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F2 - Processing parameters
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