Silver Triflate and N-Heterocyclic Carbene Co-Catalyzed Reaction of N'-{(2-Alkynylbenzylidene)hydrazide, Methanol with α,β-Unsaturated Aldehyde

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Supporting Information

1. General experimental methods (S2)
2. General experimental procedure and characterization data (S2-S11).
3. $^1$H and $^{13}$C NMR spectra of compound 3 (S12-S45).
4. X-ray ORTEP illustration of 2-amino-1,2-dihydroisoquinoline 3m (S46).
General experimental methods:
All reactions were performed in reaction tubes under nitrogen atmosphere. Flash column chromatography was performed using silica gel (60-Å pore size, 32–63 µm, standard grade). Analytical thin–layer chromatography was performed using glass plates pre-coated with 0.25 mm 230–400 mesh silica gel impregnated with a fluorescent indicator (254 nm). Thin layer chromatography plates were visualized by exposure to ultraviolet light. Organic solutions were concentrated on rotary evaporators at ~20 Torr (house vacuum) at 25–35°C. Commercial reagents and solvents were used as received. Nuclear magnetic resonance (NMR) spectra are recorded in parts per million from internal tetramethylsilane on the δ scale.

General procedure for silver triflate and N-heterocyclic carbene co-catalyzed reaction of N'-(2-alkynylbenzylidene)hydrazide, methanol, with α,β-unsaturated aldehyde.

\[
\begin{align*}
R^1\text{N} & \equiv \text{CHO} \\
R^2 & \quad \text{MeOH} \\
R^3 & \\
\text{AgOTf (5 mol %)} & \\
\text{IPr⋅HCl (5 mol %)} & \\
\text{Cs}_2\text{CO}_3 (25 \text{ mol %)} & \\
\text{THF/DCE, 50 °C} & \\
\end{align*}
\]

A mixture of N’-(2-alkynylbenzylidene)hydrazide 1 (0.2 mmol) and AgOTf (5 mol %) in DCE (1.0 mL) was stirred at 50 °C for 1 hour. Subsequently, α,β-unsaturated aldehyde 2 (0.24 mmol, 1.2 equiv), IPr-HCl (5 mol %), Cs₂CO₃ (25 mol %), and THF (1.8 mL), MeOH (0.2 mL) were added, and the mixture was stirred at 50 °C for a period of time. After completion of the reaction as indicated by TLC, the solvent was removed under vacuum, and the residue obtained was purified by flash chromatography column on silica gel (eluting with PE: EA = 1:4) to provide the desired product 3.
Methyl 3-(2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-phenylpropanoate 3a

Yield: 94%; 1H NMR (400 MHz, CDCl₃): 7.41-7.27 (m, 7H), 7.18-7.10 (m, 3H), 7.04-6.96 (m, 2H), 6.90-6.82 (m, 4H), 6.45 (d, J = 7.80 Hz, 2H), 6.02 (s, 1H), 6.00-5.94 (br, 1H), 5.07 (d, J = 11.0 Hz, 1H), 3.35 (s, 3H), 3.33-3.20 (m, 1H), 2.57-2.54 (dd, 1J = 9.16 Hz, 2J = 5.48 Hz, 2H), 2.37 (s, 3H); 13C NMR (100 MHz, CDCl₃): δ 21.6, 38.4, 44.7, 51.5, 70.0, 124.9, 126.4, 126.6, 127.3, 127.5, 127.8, 128.2, 128.4, 128.7, 128.8, 128.9, 129.1, 130.4, 131.9, 134.4, 134.9, 141.4, 143.8, 172.0; HRMS calcd for C₃₂H₃₀N₂O₄S [M+Na]⁺: 561.1824, found 561.1856.

Methyl 3-(4-bromophenyl)-3-(2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)propanoate 3b

Yield: 78%; 1H NMR (400 MHz, CDCl₃): δ 7.51-7.47 (m, 2H), 7.36-7.29 (m, 2H), 7.21-7.11 (m, 5H), 6.97-6.86 (m, 6H), 6.46 (d, J = 7.32 Hz, 2H), 6.16 (s, 1H), 6.05-6.00 (br, 1H), 5.05 (d, J = 10.6 Hz, 1H), 3.37 (s, 3H), 3.23-3.17 (m, 1H), 2.57-2.51 (dd, 1J = 9.64 Hz, 2J = 4.16 Hz, 2H), 2.37 (s, 3H); 13C NMR (100 MHz, CDCl₃): δ 21.6, 38.2, 44.4, 51.6, 69.8, 120.9, 125.1, 125.1, 126.8, 127.2, 127.7, 127.9, 128.0, 128.2, 128.4, 129.1, 130.3, 130.8, 131.6, 134.2, 134.7, 140.4, 143.9, 171.7; HRMS calcd for C₃₂H₂₉BrN₂O₄S [M+Na]⁺: 639.0929, found 639.0931.
Methyl 3-(2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-p-tolylpropanoate 3c

Yield: 66%; ¹H NMR (400 MHz, CDCl₃): δ 7.33-7.27 (m, 2H), 7.22-7.18 (m, 4H), 7.16-7.11 (m, 3H), 7.06-6.83 (m, 2H), 6.51 (d, J = 7.80 Hz, 2H), 6.04 (s, 1H), 6.03-5.92 (br, 1H), 5.01 (d, J = 10.5 Hz, 1H), 3.34 (s, 3H), 3.26-3.20 (m, 1H), 2.52-2.47 (dd, J₁ = 9.64 Hz, J₂ = 4.16 Hz, 2H), 2.42 (s, 3H), 2.36 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 21.3, 21.6, 38.3, 44.1, 51.4, 70.1, 124.8, 126.3, 126.4, 127.5, 127.6, 127.7, 128.1, 128.4, 128.7, 128.9, 129.1, 129.4, 130.3, 131.9, 134.4, 134.8, 136.8, 138.2, 143.8, 172.0; HRMS calcd. for C₃₃H₃₂N₂O₄S[M+Na]⁺: 575.1980, found 575.1982.

Methyl 3-(4-methoxyphenyl)-3-(2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)propanoate 3d

Yield: 70%; ¹H NMR (400 MHz, CDCl₃): δ 7.34-7.22 (m, 4H), 7.18-7.11 (m, 3H), 7.05-6.84 (m, 8H), 6.53 (d, J = 7.32 Hz, 2H), 6.08 (s, 1H), 5.98-5.90 (br, 1H), 5.00 (d, J = 10.5 Hz, 1H), 3.87 (s, 3H), 3.35 (s, 3H), 3.26-3.20 (m, 1H), 2.52-2.47 (dd, J₁ = 10.1 Hz, J₂ = 4.12 Hz, 2H), 2.37 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 21.6, 38.4, 43.8, 51.4, 55.4, 70.1, 114.0, 124.8, 126.3, 126.4, 127.5, 127.7, 127.8, 128.1, 128.3, 128.5, 128.8, 129.1, 129.8, 130.4, 131.8, 133.1, 134.4, 134.8, 143.8, 158.7, 172.1; HRMS calcd. for C₃₃H₃₂N₂O₅S[M+Na]⁺: 591.1930, found 591.1961.
methyl 3-(2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-(pyridin-3-yl)propanoate 3e
Yield: 83%. \(^1\)H NMR (400 MHz, CDCl\(_3\)): 8.55 (d, \(J = 4.12\) Hz, 1H), 8.46 (s, 1H), 7.70 (d, \(J = 9.68\) Hz, 1H), 7.38-7.27 (m, 4H), 7.24-7.10 (m, 3H), 7.02-6.94 (m, 2H), 6.90-6.87 (m, 4H), 6.52 (d, \(J = 7.32\) Hz, 2H), 6.30-6.00 (br, 1H), 5.14 (d, \(J = 10.52\) Hz, 1H), 3.39 (s, 3H), 3.28-3.24 (m, 1H), 2.61 (d, \(J = 7.32\) Hz, 2H), 2.36 (s, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) 21.6, 38.0, 42.8, 51.6, 69.8, 123.4, 125.2, 126.4, 126.9, 127.1, 127.6, 128.0, 128.1, 128.3, 128.9, 129.1, 130.2, 130.3, 131.6, 134.3, 135.0, 136.3, 136.8, 143.8, 148.3, 150.5, 171.6; HRMS calcd. for C\(_{31}\)H\(_{29}\)N\(_3\)O\(_4\)S [M+Na]\(^+\): 562.1776, found 562.1781.

Methyl 3-(2-(4-methylphenylsulfonamido)-3-\(p\)-tolyl-1,2-dihydroisoquinolin-1-yl)-3-phenylpropanoate 3f
Yield: 66%; \(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) 7.42-7.27 (m, 7H), 7.17-7.12 (m, 2H), 6.90-6.85 (m, 4H), 6.80-6.78 (m, 2H), 6.34 (d, \(J = 6.88\) Hz, 2H), 6.02 (s, 1H), 6.00-5.94 (br, 1H), 5.04 (d, \(J = 10.5\) Hz, 1H), 3.34 (s, 3H), 3.28-3.23 (m, 1H), 2.57-2.53 (dd, \(^1J = 9.16\) Hz, \(^2J = 5.48\) Hz, 2H), 2.37 (s, 3H), 2.26 (s, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) 21.2, 21.6, 38.4, 44.7, 51.4, 69.8, 124.8, 126.2, 127.2, 127.4, 127.5, 127.7, 128.3, 128.4, 128.5, 128.7, 128.8, 128.9, 129.0, 130.4, 131.5, 132.1,
134.8, 138.2, 141.4, 143.8, 172.0; HRMS calcd. for C_{33}H_{32}N_{2}O_{4}S[M+Na]^{+}: 575.1980, found 575.1926.

Methyl 3-(4-bromophenyl)-3-(2-(4-methylphenylsulfonamido)-3-\textit{p}-tolyl-1,2-dihydroisoquinolin-1-yl)propanoate 3g
Yield: 53%; \textsuperscript{1}H NMR (400 MHz, CDCl\textsubscript{3}): δ 7.52-7.49 (m, 2H), 7.36-7.28 (m, 2H), 7.21-7.16 (m, 4H), 6.92-6.85 (m, 4H), 6.81-6.77 (m, 2H), 6.35 (d, J = 7.80 Hz, 2H), 6.11 (s, 1H), 6.10-5.99 (br, 1H), 5.03 (d, J = 11.0 Hz, 1H), 3.37 (s, 3H), 3.21-3.17 (m, 1H), 2.56-2.52 (dd, \textsuperscript{1}J = 9.64 Hz, \textsuperscript{2}J = 3.68 Hz, 2H), 2.38 (s, 3H), 2.27 (s, 3H); \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}): δ 21.3, 21.7, 38.3, 44.4, 51.6, 69.7, 120.9, 125.1, 126.6, 127.2, 127.8, 128.0, 128.5, 128.6, 129.0, 130.2, 130.8, 131.4, 131.6, 131.8, 134.7, 138.3, 140.4, 143.9, 171.8; HRMS calcd. for C_{33}H_{31}BrN_{2}O_{4}S [M+Na]^{+}: 653.1086, found 653.1072.

Methyl 3-(4-bromophenyl)-3-(3-(4-chlorophenyl)-2-(4-methylphenylsulfonamido)-1,2-dihydroisoquinolin-1-yl)propanoate 3h
Yield: 82%; \textsuperscript{1}H NMR (400 MHz, CDCl\textsubscript{3}): δ 7.51-7.47 (m, 2H), 7.36-7.29 (m, 2H), 7.22-7.15 (m, 4H), 6.96-6.85 (m, 6H), 6.41 (d, J = 8.24 Hz, 2H), 6.13 (s, 1H), 6.12-5.90 (br, 1H), 5.01 (d, J = 10.5 Hz, 1H), 3.36 (s, 3H), 3.18-3.07 (m, 1H), 2.58-2.54 (dd, \textsuperscript{1}J = 12.84 Hz, \textsuperscript{2}J = 7.36 Hz, 2H), 2.40 (s, 3H); \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}): δ
21.6, 38.4, 44.6, 51.6, 69.9, 120.9, 125.4, 127.1, 127.8, 128.1, 128.2, 128.4, 128.5, 128.7, 129.1, 129.3, 130.2, 130.8, 131.2, 131.6, 133.0, 133.9, 134.7, 140.3, 144.2, 171.7; HRMS calcd. for C₃₂H₂₈BrClN₂O₄S [M+Na]+: 673.0539, found 673.0552.

![Chemical structure](image)

Methyl 3-((6-fluoro-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-phenylpropanoate 3i

Yield: 64%; ¹H NMR (400 MHz, CDCl₃): 7.42-7.25 (m, 5H), 7.17-7.08 (m, 2H), 7.02-7.06 (m, 3H), 6.92-6.83 (m, 5H), 6.44 (d, J = 7.32 Hz, 2H), 6.05 (s, 1H), 5.85 (br, 1H), 5.07 (d, J = 10.5 Hz, 1H), 3.37 (s, 3H), 3.32-3.26 (m, 1H), 2.54-2.51 (dd, J₁ = 9.16 Hz, J₂ = 5.48 Hz, 2H), 2.37 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 21.6, 38.1, 44.7, 51.5, 69.6, 110.8 (d, J CF = 22.9 Hz), 112.9 (d, J CF = 22.9 Hz), 126.1, 127.4, 127.6, 127.8, 128.3, 128.5, 128.6, 128.7, 128.8, 129.1, 133.8, 133.9, 134.7, 141.1, 142.1, 144.0, 162.5 (d, J CF = 243.1 Hz), 171.8. HRMS calcd. for C₃₂H₂₉FN₂O₄S [M+Na]+: 579.1730, found 579.1748.

![Chemical structure](image)

Methyl 3-((4-bromophenyl)-3-((6-fluoro-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)propanoate 3j

Yield: 65%; ¹H NMR (400 MHz, CDCl₃): δ 7.52-7.48 (m, 2H), 7.20-7.09 (m, 4H), 7.04-6.97 (m, 3H), 6.94-6.85 (m, 5H), 6.45 (d, J = 7.32 Hz, 2H), 6.21 (s, 1H), 5.98-5.89 (br, 1H), 5.06 (d, J = 10.6 Hz, 1H), 3.39 (s, 3H), 3.25-3.18 (m, 1H),...
2.54-2.49 (dd, $^1J = 8.28$ Hz, $^2J = 2.32$ Hz, 2H), 2.38 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ 21.6, 37.9, 44.5, 51.6, 69.4, 111.1 (d, $^2J_{CF} = 25.8$ Hz), 113.3, (d, $^2J_{CF} = 22.9$ Hz), 121.1, 126.0, 127.3, 128.0, 128.3, 128.6, 128.8, 128.9, 129.2, 130.6, 131.7, 133.6, 133.7, 134.7, 140.1, 142.1, 144.1, 162.5 (d, $^1J_{CF} = 243.1$ Hz), 171.6; HRMS calcd. for C$_{32}$H$_{28}$BrFN$_2$O$_4$S [M+Na]$^+$: 657.0835, found 657.0873.

Methyl 3-(6-methoxy-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-phenylpropanoate 3k

Yield: 55%; $^1$H NMR (400 MHz, CDCl$_3$): $\delta$ 7.42-7.32 (m, 5H), 7.15-7.11 (m, 1H), 7.05-6.96 (m, 3H), 6.93-6.88 (m, 4H), 6.86-6.83 (m, 1H), 6.72-6.70 (m, 1H), 6.48 (d, $J = 7.80$ Hz, 2H), 6.00 (s, 1H), 6.00-5.84 (br, 1H), 5.00 (d, $J = 11.0$ Hz, 1H), 3.88 (s, 3H), 3.36 (s, 3H), 3.28-3.24 (m, 1H), 2.56-2.52 (dd, $^1J = 9.16$ Hz, $^2J = 2.72$ Hz, 2H), 2.37 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ 21.6, 38.4, 45.0, 51.5, 55.4, 69.5, 109.6, 112.1, 123.2, 127.3, 127.6, 127.8, 128.2, 128.4, 128.7, 128.8, 128.9, 129.1, 133.1, 134.4, 134.9, 141.4, 143.8, 159.3, 172.0; HRMS calcd. for C$_{33}$H$_{32}$N$_2$O$_5$S [M+Na]$^+$: 591.1930, found 591.1939.

Methyl 3-(7-chloro-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-phenylpropanoate 3l

Yield: 65%; $^1$H NMR (400 MHz, CDCl$_3$): $\delta$ 7.42-7.26 (m, 6H), 7.18-7.07 (m, 2H),
7.04-6.96 (m, 3H), 6.94-6.91 (m, 4H), 6.51 (d, \( J = 7.36 \) Hz, 2H), 6.12 (s, 1H), 5.95 (br, 1H), 4.92 (d, \( J = 10.8 \) Hz, 1H), 3.39 (s, 3H), 3.30-3.25 (m, 1H), 2.53 (d, \( J = 7.60 \) Hz, 2H), 2.39 (s, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \( \delta \) 21.4, 38.0, 44.3, 51.4, 69.5, 125.0, 126.3, 127.2, 127.3, 127.9, 128.1, 128.2, 128.3, 128.5, 129.1, 130.2, 131.7, 132.4, 134.6, 140.9, 141.4, 144.0, 171.6; HRMS calcd for C\(_{32}\)H\(_{28}\)BrClN\(_2\)O\(_4\)S [M+Na\(^+\): 673.0539, found 673.0536.

Methyl 3-(4-bromophenyl)-3-(7-chloro-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)propanoate 3m

Yield: 92%; \(^1\)H NMR (400 MHz, CDCl\(_3\)): \( \delta \) 7.49-7.46 (m, 2H), 7.30-7.28 (m, 1H), 7.18-7.09 (m, 4H), 6.96-6.91 (m, 4H), 6.51 (d, \( J = 7.36 \) Hz, 2H), 6.31 (s, 1H), 6.04-5.97 (br, 1H), 4.92 (d, \( J = 10.6 \) Hz, 1H), 3.40 (s, 3H), 3.22-3.18 (m, 1H), 2.54-2.51 (d, \( J = 7.32 \) Hz, 2H), 2.40 (s, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \( \delta \) 21.7, 37.9, 44.3, 51.6, 69.5, 121.1, 126.1, 127.1, 127.3, 127.9, 128.3, 128.5, 129.2, 130.3, 130.6, 131.7, 131.8, 133.9, 134.8, 139.9, 141.4, 144.1, 171.6; HRMS calcd for C\(_{32}\)H\(_{28}\)BrClN\(_2\)O\(_4\)S [M+Na\(^+\): 673.0539, found 673.0536.

methyl 3-(7-chloro-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-\( p \)-tolylpropanoate 3n

Yield: 75%; \(^1\)H NMR (400 MHz, CDCl\(_3\)): 7.29-7.24 (m, 1H), 7.22-7.15 (m, 5H),
7.10-7.03 (m, 3H), 6.98-6.90 (m, 5H), 6.58 (s, 1H), 6.56 (s, 1H), 6.08 (s, 1H), 5.93-5.91 (br, 1H), 4.86 (d, J = 10.56 Hz, 1H), 3.38 (s, 3H), 3.26-3.22 (m, 1H), 2.48 (d, J = 5.26 Hz, 2H), 2.42 (s, 3H), 2.40 (s, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) 21.3, 21.7, 38.1, 43.9, 51.6, 69.9, 125.8, 126.9, 127.7, 127.8, 127.9, 128.3, 128.4, 128.6, 129.3, 129.6, 130.6, 131.4, 131.6, 134.2, 134.8, 137.1, 137.8, 141.6, 144.1, 171.9; HRMS calcd. for C\(_{33}\)H\(_{31}\)ClN\(_2\)O\(_4\)S [M+Na]^+: 609.1591, found 609.1599.

Methyl 3-(7-chloro-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-(pyridin-3-yl)propanoate 3o

Yield: 77%; \(^1\)H NMR (400 MHz, CDCl\(_3\)): 8.47 (d, J = 3.68 Hz, 1H), 8.44 (d, J = 1.84 Hz, 1H), 7.62 (d, J = 7.80 Hz, 1H), 7.31-7.23 (m, 2H), 7.17-7.08 (m, 3H), 7.05-6.96 (m, 3H), 6.96-6.91 (m, 4H), 6.57 (m, 2H), 6.14-6.00 (br, 1H), 5.01 (d, J = 10.08 Hz, 1H), 3.41 (s, 3H), 3.26-3.23 (m, 1H), 2.62-2.56 (m, 2H), 2.37 (s, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) 21.6, 37.6, 42.7, 51.7, 69.5, 123.5, 126.1, 127.2, 127.4, 128.1, 128.2, 128.3, 128.6, 129.3, 129.4, 130.2, 131.6, 132.1, 134.0, 135.1, 136.3, 136.5, 141.3, 144.0, 148.4, 150.2, 171.5; HRMS calcd. for C\(_{31}\)H\(_{28}\)ClN\(_3\)O\(_4\)S [M+Na]^+: 596.1387, found 596.1398.

Methyl 3-(7-fluoro-3-(4-methoxyphenyl)-2-(4-methylphenylsulfonamido)-1,2-dihydroisoquinolin-1-yl)-3-phenylpropanoate 3p
Yield: 54%; $^1$H NMR (400 MHz, CDCl$_3$): δ 7.42-7.29 (m, 5H), 7.17-7.08 (m, 1H), 6.98-6.88 (m, 5H), 6.85-6.82 (m, 1H), 6.56-6.51 (m, 2H), 6.41-6.35 (m, 2H), 6.05-6.01 (br, 1H), 5.89-5.78 (br, 1H), 5.03 (d, $J = 11.0$ Hz, 1H), 3.76 (s, 3H), 3.36 (s, 3H), 3.31-3.24 (m, 1H), 2.58-2.48 (m, 2H), 2.38 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$): δ 21.6, 38.1, 44.5, 51.5, 55.3, 69.5, 69.6, 110.8 (d, $^2J_{CF} = 22.8$ Hz), 112.5 (d, $^2J_{CF} = 22.8$ Hz), 113.2, 125.9, 126.4, 126.7, 127.4, 128.3, 128.5, 128.6, 128.8, 129.0, 129.1, 134.1, 134.7, 141.2, 141.9, 143.9, 159.9, 162.4 (d, $^1J_{CF} = 243.1$ Hz), 171.9; HRMS calcd. for C$_{33}$H$_{31}$FN$_2$O$_5$S [M+Na]$^+$: 609.1835, found 609.1837.

![Chemical structure](image)

Methyl 3-(7-fluoro-2-(4-methylphenylsulfonamido)-3-phenyl-1,2-dihydroisoquinolin-1-yl)-3-$p$-tolylpropanoate 3q

Yield: 68%; $^1$H NMR (400 MHz, CDCl$_3$): 7.23-7.18 (m, 4H), 7.16-7.10 (m, 2H), 7.05-6.98 (m, 3H), 6.94-6.90 (m, 4H), 6.79 (dd, $^1J = 2.28$ Hz, $^2J = 8.72$ Hz, 1H), 6.51 (d, $J = 7.36$ Hz, 1H), 6.08 (s, 1H), 5.94-5.92 (br, 1H), 4.95 (d, $J = 10.96$ Hz, 1H), 3.38 (s, 3H), 3.29-3.21 (m, 1H), 2.53-2.51 (dd, $^1J = 5.48$ Hz, $^2J = 8.725.48$ Hz, 2H), 2.41 (s, 3H), 2.38 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$): δ 21.2, 21.5, 38.1, 44.0, 51.4, 69.7, 114.1 (d, $^2J = 22.9$ Hz), 114.6, (d, $^2J = 21.9$ Hz), 125.9, 126.0, 127.4, 127.7, 128.1, 128.2, 128.6, 129.0, 129.4, 132.1, 132.2, 134.2, 134.8, 136.9, 137.7, 140.3, 143.9, 161.5 (d, $^1J = 245.0$ Hz), 171.8; HRMS calcd. for C$_{33}$H$_{31}$FN$_2$O$_4$S [M+Na]$^+$: 593.1886, found 593.1897.