Supplementary Information:

Pd\textsuperscript{II}-Catalyzed methoxylation of C(sp\textsuperscript{3})–H bonds adjacent to benzoazoles and benzothiazoles

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Table S1: Optimization of the Reaction Conditions for the Dehydrogenative Methoxylation

<table>
<thead>
<tr>
<th>No</th>
<th>Catalyst</th>
<th>Oxidant</th>
<th>Additive (eq)</th>
<th>Solvent, 100 °C, 16 h</th>
<th>Isolated yields, 2 (%)</th>
<th>Isolated yields, 3 (%)</th>
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<td>30⁺</td>
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<td>PhI(OAc)₂</td>
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<td>PhI(OAc)₂</td>
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<td>15</td>
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<td>46⁺⁺</td>
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<td>PhI(OAc)₂</td>
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<td>DCE</td>
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<td>0</td>
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<tr>
<td>47⁺⁺</td>
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<td>PhI(OAc)₂</td>
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<td>DCE</td>
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<td>DCE</td>
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<td>49⁺⁺</td>
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<td>DCE</td>
<td>52</td>
<td>0</td>
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</table>

Reaction conditions: 1a (0.2 mmol), Pd-Cat. (10 mol%), Oxidant (0.4 mmol), additive, MeOH (2 mL), 100 °C, 16 h; Isolated yields. * (1.0 mL MeOH + 1.0 mL solvent) was used in entries 20–49. † 24 h. ‡ 90 °C. § 60 °C. ¶ 25 °C. ¶ 0.25 mL MeOH + 1.75 mL DCE. † 5 mol% Pd(OAc)₂. ‡ 1.5 equiv PhI(OAc)₂.
Table S2: Effects of varying amounts of water in the reaction outcome:

<table>
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<tr>
<th>Sr. No.</th>
<th>Amount of H$_2$O ($\mu$L)</th>
<th>2a (%)</th>
<th>2a’ (%)</th>
<th>3 (%)</th>
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<td>1</td>
<td>50</td>
<td>78</td>
<td>N.D.</td>
<td>trace</td>
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<tr>
<td>2</td>
<td>100</td>
<td>70</td>
<td>N.D.</td>
<td>trace</td>
</tr>
<tr>
<td>3</td>
<td>500</td>
<td>61</td>
<td>8</td>
<td>12</td>
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<td>4</td>
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<td>23</td>
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<tr>
<td>5$^a$</td>
<td>1000</td>
<td>–</td>
<td>28</td>
<td>37</td>
</tr>
</tbody>
</table>

Reaction conditions: 1a (0.2 mmol), Pd(OAc)$_2$ (10 mol%), Phl(OAc)$_2$ (0.4 mmol), DCE (1 mL), MeOH (1 mL), H$_2$O, 100°C, 16 h; Isolated yields. $^a$ In the absence of MeOH.

Mechanistic studies

Experiment with TEMPO:

A 20 mL Schlenk tube was charged with 2-benzylbenzo[d]oxazole 1a (31 mg, 0.15 mmol, 1 equiv), palladium(II) acetate (3 mg, 0.015 mmol, 10 mol%), iodobenzene diacetate (97 mg, 0.3 mmol, 2 equiv) and TEMPO (35 mg, 0.225 mmol, 1.5 equiv). To it, anhydrous dichloroethane (0.75 mL) and methanol (0.75 mL) were added. The tube was attached with a coil-condenser equipped with a glass stopper and chilled water circulator and the reaction mixture was stirred at 100 °C for 16 h. After cooling, the solvent was evaporated and the residue was then directly subjected to flash column chromatography on silica-gel to recover the starting material 1a (26 mg, 84%).

Experiment with BHT:

A 20 mL Schlenk tube was charged with 2-benzylbenzo[d]oxazole 1a (31 mg, 0.15 mmol, 1 equiv), palladium(II) acetate (3 mg, 0.015 mmol, 10 mol%), iodobenzene diacetate (97 mg, 0.3 mmol, 2 equiv) and BHT (50 mg, 0.225 mmol, 1.5 equiv). To it, anhydrous dichloroethane (0.75 mL) and methanol (0.75 mL) were added. The tube was attached with a coil-condenser equipped with a glass stopper and chilled water circulator and the reaction mixture was stirred at 100 °C for 16 h. After cooling, an aliquot (0.2 mL) from the reaction mixture was withdrawn and diluted with EtOAc (2 mL) and washed with water (1 mL). The organic layer was dried over Na$_2$SO$_4$, and subsequently submitted to GC-MS, which shows the formation of the BHT(OMe) adduct (m/z = 250). The rest of the solvent from the crude reaction mixture was evaporated and the residue was then directly subjected to flash column chromatography on silica-gel to recover the starting material 1a (24 mg, 76%).
GCMS spectrum of BHT (m/z = 230, R_t = 13.267 min):

![GCMS spectrum of BHT](image1)

GCMS spectrum of BHT(OMe) adduct (m/z = 250, R_t = 14.665 min):

![GCMS spectrum of BHT(OMe) adduct](image2)
Evidence against the Formation of an Acetoxyalkane Intermediate:

A reaction pathway consisting of acetoxylation of 1a and the subsequent methoxylation of the resulting compound 10 was excluded based on the following experimental results:

\[
\text{N} \quad \text{O} \quad \text{Ph}
\]

A 20 mL Schlenk tube was charged with 2-benzylbenzoxazole 1a (31 mg, 0.15 mmol, 1 equiv), palladium(II) acetate (3 mg, 0.015 mmol, 10 mol%), iodobenzene diacetate (97 mg, 0.3 mmol, 2 equiv). To it, anhydrous dichloroethane (0.75 mL) was added. The tube was attached with a coil-condenser equipped with a glass stopper and chilled water circulator and the reaction mixture was stirred at 100 ºC for 16 h. After cooling, the solvent was evaporated and the residue was then directly subjected to flash column chromatography on silica-gel to recover the starting material 1a (18 mg, 57%) accompanied by a small extent of the phenyl ring acetoxylation product 10a (7 mg, 17%).

A 20 mL Schlenk tube was charged with preformed 10 (27 mg, 0.1 mmol, 1 equiv), palladium(II) acetate (2.3 mg, 0.01 mmol, 10 mol%), iodobenzene diacetate (64 mg, 0.2 mmol, 2 equiv). To it, anhydrous dichloroethane (0.5 mL) and methanol (0.5 mL) were added. The tube was attached with a coil-condenser equipped with a glass stopper and chilled water circulator and the reaction mixture was stirred at 100 ºC for 16 h. The reaction however led to a mixture of unreacted starting material 10 and several unwanted by-products. The desired compound 2a was not formed even in traces.
Attempted methoxylation of various benzylic substrates containing coordinating and non-coordinating functions e.g., 2-pyridyl, 1-methylbenzimidazolyl, carboxylic acid, nitrile, 8-aminoquinolinocarbonyl, 2-benzofuranyl and phenyl under the optimized reaction condition:

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]

\[
Pd(OAc)_2 (10 \text{ mol} \%) \\
Pd(OAc)_2 (2.0 \text{ eq}) \\

dce, 100 \degree C, 16 \text{ h} \\
\text{No reaction} \\
\]
Intermolecular Kinetic Isotope Effect Study:

For estimating the intermolecular kinetic isotope effect (KIE), a 1:1 mixture of 1a and the doubly deuterated substrate 1a-d2 was subjected to the standard reaction condition for 5 h and the product mixture was purified by column chromatography over silica gel. The H/D ratio of the product mixture as found by 1H NMR analysis indicated an intermolecular KIE of $k_H/k_D = 2.3$. This result implies that the cleavage of the C(sp3)-H bond is possibly involved in the rate-limiting step.

\[
\text{KIE (} k_H/k_D \text{) = 2.3}
\]

1H NMR analysis for the determination of the intermolecular Kinetic Isotope Effect:

Determination of KIE by independent parallel experiment

Two independent reactions with 1a and 1a-d2 under the optimal reaction conditions were conducted: A 20 mL Schlenk tube was charged with 1a (42 mg, 0.2 mmol, 1.00 equiv) or 1a-d2 (44 mg, 0.2 mmol, 1.00 equiv), palladium(II) acetate (4.5 mg, 0.02 mmol, 10 mol%) and iodobenzene diacetate (129 mg, 0.4 mmol, 2.00 equiv). To it, anhydrous dichloroethane (1 mL) and methanol (1 mL) were added sequentially. The tube was attached with a coil-condenser equipped with a glass stopper and chilled water circulator. The reaction mixture was stirred at 100 °C for the required time as indicated in the following table. An aliquot of 0.1 mL was withdrawn periodically and passed through a small bed of silica-gel and the product formation was monitored by GC analysis (Figure S1). Comparison of the two individual reactions indicated a kinetic isotope effect of 2.2.
Figure S1: Independent parallel experiments with 1a and 1a-d$_2$ as monitored by GC analysis.
General Methods. NMR spectra were recorded on Jeol Resonance ECZ 600R spectrometer (600 MHz for $^1$H NMR, 151 MHz for $^{13}$C NMR, 564 MHz for $^{19}$F) and Bruker AvanceII 500 spectrometer (500 MHz for $^1$H NMR, 121 MHz for $^{13}$C NMR). Chemical shifts were reported in ppm on the δ scale relative to Me$_4$Si (δ = 0.00 for $^1$H-NMR) and CDCl$_3$ (δ = 77.160 for $^{13}$C-NMR). Multiplicities are indicated as: br (broad), s (singlet), d (doublet), t (triplet), q (quartet), or m (multiplet). Coupling constants (J) are reported in Hertz (Hz). Infrared (IR) spectra were recorded on Perkin Elmer Spectrum GX FT-IR system. HRMS (SI) spectra were recorded on a Micromass Q-Tof microTM instrument. GCMS spectral data were acquired on a Shimadzu GC-2010 Plus coupled with GCMS-TQ8040 instrument. All low temperature reactions were performed in a Siskin Profichill RFC-90 immersion cooler instrument. For thin-layer chromatography (TLC) analysis throughout this work, Macherey-Nagel pre-coated TLC plates (silica gel 60 F254 0.25 mm) were used. Solvents e.g. DMF, DMSO, Toluene, THF, Dioxan and DCM were dried by standard drying techniques. All other solvents and commercially available compounds were used without further purification.

Preparation of Substrates:

Substrates 1a, 1b, 1d–1o, and 4a, 4b, 4f–4h, 4j–4p were prepared by reported methods. Substrates 1c, 4c–4e and 4i were prepared as follows:

Preparation of Compound 1c:

A mixture of 1e (158.5 mg, 0.55 mmol), benzeneboronic acid (80 mg, 0.66 mmol, 1.2 equiv), Pd(dppf)$_2$Cl$_2$ (25 mg, 0.031 mmol) and potassium acetate (230 mg, 1.66 mmol) was dissolved in anhydrous 1,4-dioxane (10 mL) and heated at 90 °C under nitrogen atmosphere for 10 h. After cooling to room temperature, the mixture was poured into water (20 mL) and extracted with dichloromethane. The combined organic layers were dried over anhydrous Na$_2$SO$_4$ and concentrated under vacuum. The crude product was purified by column chromatography using hexane/diethyl ether (9:1) as the eluent to afford pure product 1e (133 mg, yield: 85%) as a yellow solid. R$_f$ = 0.6 (Hexane:Et$_2$O = 4:1). mp = 91 °C. IR (KBr): ν = 3144, 1612, 1402, 1141, 749 cm$^{-1}$. $^1$H NMR (600 MHz, CDCl$_3$) δ 7.69–7.70 (m, 1H), 7.56–7.57 (m, 4H), 7.40–7.48 (m, 5H), 7.28–7.34 (m, 3H), 4.31 (s, 2H) ppm. $^{13}$C NMR (151 MHz, CDCl$_3$) δ 165.27, 151.20, 141.49, 140.81, 140.46, 133.90, 129.56 (2C), 129.22 (2C), 127.72 (2C), 127.45, 127.20 (2C), 124.87, 124.35, 119.98, 110.61, 35.04 ppm. HRMS (ESI): m/z calcd. for C$_{20}$H$_{16}$NO [M + H]$^+$, 286.1232; found, 286.1252.
Preparation of Compound 4c:

4-Hydroxyphenylacetic acid (1.52 g, 10 mmol, 1 equiv), benzyl bromide (1.88 g, 11 mmol, 1.1 equiv), KOH (1.4 g, 25 mmol, 2.5 equiv), and NaI (29.98 mg, 0.2 mmol, 0.02 equiv) were dissolved in absolute EtOH (78.4 mL) and refluxed for 20 h. The solution was allowed to stand at r.t. and then treated with 3 N aq HCl (45 mL). The precipitate was filtered, washed with H₂O (30 mL), and dried under vacuum to give the compound 4c as a colorless powder. Yield = 1.5 g, 60%. Rᶠ = 0.50 (hexane-EtOAc, 1:1).

To a solution of A (606 mg, 2.5 mmol, 1 equiv) in dry CH₂Cl₂ (9.6 mL) at 0 °C under N₂ was added dropwise oxalyl chloride (3.75 mmol, 1.5 equiv) followed by a catalytic amount of dry DMF (3 drops). The reaction mixture was stirred at room temperature until the reaction was complete (typically 3 h). The volatiles were evaporated under reduced pressure and the resulting crude acid chloride was used directly for the next step without further purification.

To the resulting residue (B), anhydrous dioxane (5 mL), 2-amino thiophenol (313 mg, 2.5 mmol, 1 equiv) and CH₃SO₃H (0.5 mL) were added successively. The resultant mixture was stirred at 100 ºC for 2 h (TLC). After completion of the reaction, dioxane was removed and the residue was diluted with EtOAc (10 mL), followed by saturatedaq. NaHCO₃ (5 mL). The organic layer was separated and the aqueous layer was extracted with EtOAc (3×5 mL). The combined EtOAc extracts were washed with H₂O (3×5 mL), dried (Na₂SO₄), and concentrated under reduced pressure to afford the crude product which was purified by column chromatography to furnish the compound 4c (497 mg, 60%). Rᶠ = 0.5 (Hexane-EtOAc = 4:1). mp 99 ºC. IR (KBr): ν = 3133, 1639, 1402, 1246, 754 cm⁻¹. ¹H NMR (600 MHz, CDCl₃) δ 7.98 (d, J = 8.4 Hz, 1H), 7.78 (d, J = 7.8 Hz, 1H), 7.42 – 7.45 (m, 3H), 7.38 (t, J = 7.2 Hz, 2H), 7.28 – 7.34 (m, 4H), 6.96 (d, J = 7.8, 2H), 5.05 (s, 2H), 4.37 (s, 2H) ppm. ¹³C NMR (151 MHz, CDCl₃) δ 172.03, 158.26, 153.45, 137.05, 135.80, 130.42 (2C), 129.73, 128.73 (2C), 128.13, 127.62 (2C), 126.07, 124.89, 122.88, 121.65, 115.32 (2C), 70.18, 39.93 ppm. HRMS (ESI): m/z calcd. for C₂₁H₁₇NOSNa [M + Na]+, 354.0929; found, 354.0951.

Preparation of Compound 4d:

A solution of C (1.93 g, 8 mmol) and concentrated sulfuric acid (3 drops) in acetic anhydride (8.17 g, 7.6 mL, 10 equiv) at room temperature were stirred for 30 minute. The reaction mixture was poured in water (14.2 mL) and extracted with DCM (3 × 15 mL). The combined organic extracts were successively washed with a saturated aqueous solution of Na₂CO₃ (2 × 15 mL), brine (20 mL), dried (MgSO₄), filtered and concentrated under reduced pressure to obtain a yellow oil which was purified by column chromatography to afford 4d as a dark yellow solid (2.04 g, 90% yield). Rᶠ = 0.5 (Hexane:EtOAc = 4:1). mp = 45 °C. IR (KBr): ν = 3122, 1639,
1402, 1197, 760 cm\(^{-1}\). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta\) 7.99 (d, \(J = 8.4\) Hz, 1H), 7.79 (d, \(J = 8.4\) Hz, 1H), 7.45 (t, \(J = 7.8\) Hz, 1H), 7.32–7.38 (m, 3H), 7.07 (d, \(J = 8.4\) Hz, 2H), 4.42 (s, 2H), 2.28 (s, 3H) ppm. \(^13\)C NMR (151 MHz, CDCl\(_3\)) \(\delta\) 170.67, 169.49, 153.36, 149.99, 135.74, 134.81, 130.25 (2C), 126.13, 125.01, 122.90, 122.05 (2C), 121.66, 40.00, 21.23 ppm. HRMS (ESI): \(m/z\) calcd. for C\(_{16}\)H\(_{13}\)NO\(_2\)SNa [M + Na]\(^+\), 306.0565; found, 306.0647.

Preparation of Compound 4e:

\[
\begin{array}{c}
\text{O} \\
\text{OH} \\
\text{OH} \\
\text{MsCl (1.5 eq)} \\
\text{H}_2\text{O, 33% aq NaOH} \\
\text{O} \\
\text{OH} \\
\text{OMs} \\
\text{(COCl)}_2 (1.5 eq) \\
\text{DCM, DMF (cat.)} \\
\text{r.t., 5 h} \\
\text{O} \\
\text{OMs} \\
\text{4e} \\
\text{MsOH} \\
\text{NH}_2 \text{SH (1 eq)} \\
\text{1,4-dioxane, 100 °C, 2 h} \\
\text{D} \\
\end{array}
\]

A 25 mL R.B. flask was charged with 0.6 mL of water and 1.2 mL of 33% aq. sodium hydroxide solution. The solution was cooled to 0–5°C and 4-hydroxyphenylacetic acid (1.22 g, 8 mmol) was slowly added with stirring. The temperature was increased up to 30°C. The solution was then cooled to 0°C to 15°C. To the cooled solution, 0.83 mL of methanesulfonyl chloride was slowly added. Here, the pH of the reaction solution was maintained between 11–11.5 by the addition of dilute NaOH (prepared from 3.7 ml of water and 1.5 ml of sodium hydroxide). After the complete addition of methanesulfonyl chloride, it was stirred as long as pH 11–11.5 to prevent addition of sodium hydroxide solution. Then a further 0.25 mL of methanesulfonyl chloride was slowly added to this under cooling and the pH value was kept constant at 11–11.5 by the addition of dilute NaOH solution as described above. After completing the addition of the methanesulfonyl chloride, it was stirred so long at pH 11–11.5 until the pH value remained constant without addition of sodium hydroxide solution. To the resulting reaction mixture, a solution of 2.7 mL of water and 0.75 mL of glacial acetic acid was slowly added to precipitate the product. It was filtered and thoroughly washed with water. The crude product D obtained after drying at 50 °C under vacuum was used directly in the next step. Yield = 1.47 g, 80%.

To a solution of D (576 mg, 2.5 mmol, 1 equiv) in dry CH\(_2\)Cl\(_2\) (9.6 mL) at 0 °C under N\(_2\) was added dropwise oxalyl chloride (3.75 mmol, 1.5 equiv) and a catalytic amount of dry DMF (3 drops). The reaction mixture was stirred at room temperature until the reaction was complete (typically 3 h). The volatiles were evaporated under reduced pressure and the resulting crude acid chloride was used directly for the next step without further purification.

To the resulting residue (E), anhydrous dioxane (5 mL), 2-aminothiophenol (313 mg, 2.5 mmol, 1 equiv) and CH\(_3\)SO\(_3\)H (0.5 mL) were added successively. The resultant mixture was stirred at 100 °C for 2 h (TLC). The resultant mixture was stirred at 100 °C for 2 h (TLC). After completion of the reaction, dioxane was removed and the residue was diluted with Et\(_2\)OAc (10 mL), followed by saturated aq. NaHCO\(_3\) (5 mL). The organic layer was separated and the aqueous layer was extracted with Et\(_2\)OAc (3×5 mL). The combined Et\(_2\)OAc extracts were washed with H\(_2\)O (3×5 mL), dried (Na\(_2\)SO\(_4\)), and concentrated under reduced pressure to afford the crude product which was purified by column chromatography to furnish the compound 4e. Yield = 559 mg, 70%. R\(_f\) = 0.5 (Hexane:Et\(_2\)OAc = 4:1). mp = 80 °C. IR (KBr): \(\nu\) = 3144, 1639, 1409, 1152, 807 cm\(^{-1}\). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta\) 8.0 (d, \(J = 8.4\) Hz, 1H), 7.81 (d, \(J = 8.4\) Hz, 1H), 7.47 (t, \(J = 7.8\) Hz, 1H), 7.42 (d, \(J = 7.8\) Hz, 2H), 7.36 (t, \(J = 7.8\) Hz, 1H), 7.26–7.27 (m, 2H), 4.45 (s, 2H), 3.13 (s, 3H) ppm. \(^13\)C NMR (151 MHz, CDCl\(_3\)) \(\delta\) 169.88, 153.34, 148.50, 136.68, 135.66, 130.84 (2C), 126.26, 125.18, 122.98, 122.51 (2C), 121.70, 39.88, 37.48 ppm. HRMS (ESI): \(m/z\) calcd. for C\(_{15}\)H\(_{14}\)NO\(_3\)S\(_2\)[M + H]\(^+\), 320.0415; found, 320.0438.
Preparation of Compound 4i:

A 50 mL R.B. flask was charged with a mixture of 1e (456 mg, 1.5 mmol), Pd(OAc)$_2$ (7 mg, 2 mol%) and PPh$_3$ (16 mg, 0.06 mmol) in DMF (3 mL) under nitrogen atmosphere. To it, butyl acrylate (385 mg, 2 equiv) and N,N-diisopropyl ethyl amine (481 mg, 2.5 equiv) were added and the whole mixture was heated at 100 °C for 36 h. After cooling to room temperature, it was acidified with 1N HCl and extracted with ethyl acetate. The organic layer was washed with 1N HCl and then water, combined organic layers were dried with anhydrous Na$_2$SO$_4$ and concentrated in vacuum. The crude product was purified by column chromatography to give 4i as a brown solid.

Yield = 422 mg, 80%. R$_f$ = 0.5 (Hexane:EtOAc = 4:1). mp = 68 ºC. IR (KBr): $\nu$ = 3144, 1628, 1402, 1163, 760 cm$^{-1}$.

$^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 8.00 (d, $J$ = 8.4 Hz, 1H), 7.80 (d, $J$ = 7.8 Hz, 1H), 7.66 (d, $J$ = 16.2 Hz, 1H), 7.44 – 7.51 (m, 3H), 7.33 – 7.39 (m, 3H), 6.43 (d, $J$ = 16.2 Hz, 1H), 4.45 (s, 2H), 4.20 (t, $J$ = 7.2 Hz, 2H), 1.66 – 1.71 (m, 2H), 1.41 – 1.45 (m, 2H), 0.96 (t, $J$ = 7.8 Hz, 3H) ppm.

$^{13}$C NMR (151 MHz, CDCl$_3$) $\delta$ 170.24, 167.21, 153.38, 144.10, 139.50, 135.75, 133.76, 129.81 (2C), 128.68 (2C), 126.22, 125.12, 122.99, 121.70, 118.54, 64.61, 40.49, 39.20, 19.34, 13.89 ppm. HRMS (ESI): m/z calcd. for C$_{21}$H$_{21}$NO$_2$SNa [M + Na]$^+$, 374.1191; found, 374.1159.

General Procedure A. Dehydrogenative methoxylation of 2-alkyl-2-benzoxazoles (1) or 2-alkyl-2-benzthiazoles (4) with methanol:

A 20 mL Schlenk tube was charged with 2-alkyl-2-benzoxazoles (1) or 2-alkyl-2-benzthiazoles (4) (0.2 mmol, 1.00 equiv), palladium(II) acetate (4.5 mg, 0.02 mmol, 10 mol%) and iodobenzene diacetate (129 mg, 0.4 mmol, 2.00 equiv). To it, anhydrous dichloroethane (1 mL) and methanol (1 mL) were added sequentially. The tube was attached with a coil-condenser equipped with a glass stopper and chilled water circulator. The reaction mixture was stirred at 100 ºC for the required time (TLC). After completion, the solvent was evaporated from the reaction mixture and the residue was then directly subjected to flash column chromatography on silica-gel to provide the corresponding methoxy-functionalized benzoxazole/benzothiazole-derivatives (2 or 5).

Characterization of methoxy-functionalized benzoxazoles (2a–2n).

2-(methoxy(phenyl)methyl)benzo[d]oxazole (2a) was prepared according to the general procedure A using 2-benzylbenzo[d]oxazole 1a (42 mg, 0.2 mmol) as the starting material. Thick yellow liquid (39 mg, 82%). R$_f$ = 0.5 (Hexane:EtOAc = 4:1). mp = 68 ºC. IR (neat): $\nu$ = 2928, 1589, 1490, 1258, 754 cm$^{-1}$. $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 7.72–7.74 (m, 1H), 7.56 (d, $J$ = 7.8 Hz, 2H), 7.47–7.49 (m, 1H), 7.38 (t, $J$ = 7.8 Hz, 2H), 7.28 –7.33 (m, 3H), 5.57 (s, 1H), 3.50 (s, 3H) ppm. $^{13}$C NMR (151 MHz, CDCl$_3$) $\delta$ 164.48, 150.98, 140.82, 136.88, 128.98, 128.82 (2C), 127.20 (2C), 125.38, 124.55, 111.00, 79.51, 57.78 ppm. HRMS (ESI): m/z calcd. for C$_{15}$H$_{14}$NO$_2$ [M + H]$^+$, 240.1025; found, 240.1032.

2-(methoxy(4-methoxyphenyl)methyl)benzo[d]oxazole (2b) was prepared according to the general procedure A using 2-(4-methoxybenzyl)benzo[d]oxazole 1b (48 mg, 0.2 mmol) as the starting material. Colorless liquid (39 mg, 73%). R$_f$ = 0.3 (Hexane:EtOAc = 4:1). IR (neat): $\nu$ = 3133, 1645, 1103, 605 cm$^{-1}$. $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 7.72–7.74 (m, 1H), 7.48–7.51 (m, 3H), 7.31–7.33 (m, 2H), 6.91–6.93 (m, 2H), 5.52 (s, 1H), 3.80 (s, 3H), 3.49 (s, 3H) ppm. $^{13}$C NMR (151 MHz, CDCl$_3$) $\delta$ 164.48, 150.98, 140.82, 136.88, 128.98, 128.82 (2C), 127.20 (2C), 125.38, 124.55, 111.00, 79.51, 57.78 ppm. HRMS (ESI): m/z calcd. for C$_{16}$H$_{15}$NO$_3$Na [M + Na]$^+$, 292.0950; found, 292.0947.
2-((1,1′-biphenyl)-4-yl(methoxy)methyl)benzo[d]oxazole (2c) was prepared according to the general procedure A using 2-((1,1′-biphenyl)-4-ylmethyl)benzo[d]oxazole 1e (57 mg, 0.2 mmol) as the starting material. Yellow solid (47 mg, 75%). mp = 79 ºC. Rf = 0.3 (Hexane:EtO = 9:1). IR (KBr): ν = 3128, 1639, 1402, 1091, 743 cm⁻¹. ¹H NMR (600 MHz, CDCl₃) δ 7.74–7.76 (m, 1H), 7.61–7.64 (m, 4H), 7.56–7.57 (m, 2H), 7.51–7.53 (m, 1H), 7.42 (t, J = 7.2, 2H), 7.32–7.35 (m, 3H), 5.62 (s, 1H), 5.35 (s, 3H) ppm. ¹³C NMR (151 MHz, CDCl₃) δ 164.50, 151.05, 141.94, 140.88, 140.69, 135.87, 128.93 (2C), 127.79 (2C), 127.67(2C), 127.64, 127.28 (2C), 125.48, 124.64, 120.53, 111.08, 79.33, 57.89 ppm. HRMS (ESI): m/z calcd. for C₁₉H₁₇NO₂Na [M + Na]⁺, 338.1157; found, 338.1164.

2-((4-fluorophenyl)(methoxy)methyl)benzo[d]oxazole (2d) was prepared according to the general procedure A using 2-(4-fluorobenzyl)benzo[d]oxazole 1d (45 mg, 0.2 mmol) as the starting material. Thick yellow liquid (40 mg, 78%). Rf = 0.5 (Hexane:EtO = 8:5:1.5). IR (neat): ν = 2928, 1230, 1097, 826, 749 cm⁻¹. ¹H NMR (600 MHz, CDCl₃) δ 7.73–7.74 (m, 1H), 7.50–7.55 (m, 3H), 7.33–7.34 (m, 2H), 7.08 (t, J = 9.0, 2H), 5.56 (s, 1H), 3.51 (s, 3H) ppm. ¹³C NMR (151 MHz, CDCl₃) δ 164.28, 163.08 (d, J = 21.6 Hz, 2C), 163.09, 151.07, 148.24, 143.98, 140.65, 128.90 (2C), 128.38 (d, J = 8.4 Hz, 2C), 125.57, 124.70, 120.56, 115.88 (d, J = 21.6 Hz, 2C), 111.06, 78.84, 57.83 ppm. ¹⁹F NMR (564 MHz, CDCl₃) δ – 7.30 (m, 2H), 6.24 (s, 1H), 3.59 (s, 3H) ppm. IR (KBr): ν = 3144, 1634, 1402, 1109, 611 cm⁻¹. ¹H NMR (600 MHz, CDCl₃) δ 8.30 (d, J = 8.4 Hz, 1H), 7.84 – 7.87 (m, 3H), 7.73 – 7.74 (m, 2H), 7.51–7.53 (m, 1H), 7.35–7.37 (m, 2H), 5.69 (s, 1H), 3.57 (s, 3H) ppm. ¹³C NMR (151 MHz, CDCl₃) δ 164.37, 151.01, 140.75, 135.97, 132.05 (2C), 128.94 (2C), 125.62, 124.72, 123.06, 120.56, 111.06, 78.83, 57.90 ppm. HRMS (ESI): m/z calcd. for C₁₃H₁₂FNO₂ [M + H]⁺, 258.0930; found, 258.0934.

2-((4-bromophenyl)(methoxy)methyl)benzo[d]oxazole (2e) was prepared according to the general procedure A using 2-((4-bromophenyl)methoxy)methyl)benzo[d]oxazole 1c (57 mg, 0.2 mmol) as the starting material. Light yellow solid (32 mg, 55%). Rf = 0.4 (Hexane:EtO = 4:1). mp = 108 ºC. IR (KBr): ν = 3144, 1634, 1402, 1109, 611 cm⁻¹. ¹H NMR (600 MHz, CDCl₃) δ 8.25–8.26 (m, 2H), 7.75 (d, J = 8.4 Hz, 3H), 7.51–7.53 (m, 1H), 7.35–7.37 (m, 2H), 5.69 (s, 1H), 3.57 (s, 3H) ppm. ¹³C NMR (151 MHz, CDCl₃) δ 163.09, 151.07, 148.24, 143.98, 140.65, 128.00 (2C), 125.96, 124.95, 124.09 (2C), 120.69, 111.15, 78.42, 58.24 ppm. HRMS (ESI): m/z calcd. for C₁₃H₁₃BrNO₂ [M + H]⁺, 285.0875; found, 285.0876.

2-(methoxy(naphthalen-1-yl)methyl)benzo[d]oxazole (2g) was prepared according to the general procedure A using 2-((naphthalen-1-yl)methoxy)methyl)benzo[d]oxazole 1g (52 mg, 0.2 mmol) as the starting material. Light yellow solid (32 mg, 55%). Rf = 0.4 (Hexane:EtO = 8:5:1.5). mp = 54 ºC. IR (KBr): ν = 3128, 1634, 1402, 1108, 627 cm⁻¹. ¹H NMR (600 MHz, CDCl₃) δ 8.30 (d, J = 9.0 Hz, 1H), 7.84 – 7.87 (m, 3H), 7.73 – 7.74 (m, 1H), 7.43 – 7.55 (m, 4H), 7.27 – 7.30 (m, 2H), 6.24 (s, 1H), 3.59 (s, 3H) ppm. ¹³C NMR (151 MHz, CDCl₃) δ 164.42, 150.94, 140.91, 134.00, 132.36, 130.88, 129.70, 128.94, 126.79, 125.99, 125.94, 125.51, 125.37, 124.55, 123.60, 120.51, 111.03, 77.64, 57.98 ppm. HRMS (ESI): m/z calcd. for C₁₀H₁₀NO₂ [M + H]⁺, 290.1181; found, 290.1179.
2-(methoxy(o-tolyl)methyl)benzo[d]oxazole (2h) was prepared according to the general procedure A using 2-(2-methylbenzyl)benzo[d]oxazole 1h (45 mg, 0.2 mmol) as the starting material. Brown liquid (33 mg, 65%). \(R_f = 0.5 \text{ (Hexane:Et}_2\text{O = 8.5:1.5). IR (neat): } \nu = 3105, 1645, 1402, 1086, 737 \text{ cm}^{-1}\). \(^1\text{H NMR (600 MHz, CDCl}_3\) \(\delta 7.73 – 7.74 \text{ (m, 1H), 7.64 (d, } \text{J = 7.8 Hz, 1H), 7.48 – 7.50 \text{ (m, 1H), 7.23 – 7.32 \text{ (m, 4H), 7.17 – 7.20 \text{ (m, 1H), 5.77 (s, 1H), 3.52 (s, 3H), 2.43 (s, 3H) ppm.} \text{HRMS (ESI): } m/z \text{ calcd. for C}_{13}\text{H}_{16}\text{NO}_2\text{Na [M + Na]}^{+}, 276.1000; \text{found, 276.1009.} \)

2-((2-chlorophenyl)(methoxy)phenyl)methyl)benzo[d]oxazole (2i) was prepared according to the general procedure A using 2-(2-chlorobenzyl)benzo[d]oxazole 1l (49 mg, 0.2 mmol) as the starting material. Thick colourless liquid (40 mg, 73%). \(R_f = 0.6 \text{ (Hexane:Et}_2\text{O = 9:1). IR (neat): } \nu = 3133, 1634, 1402, 1246, 832 \text{ cm}^{-1}\). \(^1\text{H NMR (600 MHz, CDCl}_3\) \(\delta 7.73 – 7.74 \text{ (m, 1H), 7.49 – 7.51 (m, 1H), 7.34 – 7.37 (m, 2H), 7.27 – 7.33 (m, 3H, 7.14 – 7.15 (m, 1H), 5.54 (s, 1H), 3.51 (s, 3H ppm.} \text{HRMS (ESI): } m/z \text{ calcd. for C}_{13}\text{H}_{16}\text{NO}_2\text{Na [M + Na]}^{+}, 274.0635; \text{found, 274.0626.} \)

2-(methoxy(tolyl)methyl)benzo[d]oxazole (2j) was prepared according to the general procedure A using 2-(3-methylbenzyl)benzo[d]oxazole 1n (45 mg, 0.2 mmol) as the starting material. Light yellow liquid (23 mg, 47%). \(R_f = 0.6 \text{ (Hexane:Et}_2\text{O = 8.5:1.5). IR (neat): } \nu = 3133, 1645, 1451, 1097, 749 \text{ cm}^{-1}\). \(^1\text{H NMR (600 MHz, CDCl}_3\) \(\delta 7.71 (s, 1H), 7.54 (d, \text{J = 8.4 Hz, 1H), 7.49 – 7.51 (d, } \text{J = 7.2 Hz, 2H), 7.51 (s, 1H), 7.33 – 7.39 (m, 4H), 7.12 (d, } \text{J = 8.4 Hz, 1H), 5.55 (s, 1H), 3.50 (s, 3H), 2.44 (s, 3H) ppm.} \text{HRMS (ESI): } m/z \text{ calcd. for C}_{13}\text{H}_{16}\text{NO}_2\text{Na [M + Na]}^{+}, 296.0549; \text{found, 296.0549.} \)

5-chloro-2-(methoxy(phenyl)methyl)benzo[d]oxazole (2m) was prepared according to the general procedure A using 2-benzyl-5-chlorobenzo[d]oxazole 1p (49 mg, 0.2 mmol) as starting material. Colourless liquid (36 mg, 66%). \(R_f = 0.4 \text{ (Hexane:Et}_2\text{O = 9:1). IR (neat): } \nu = 2928, 1573, 1456, 1252, 1097, 705 \text{ cm}^{-1}\). \(^1\text{H NMR (600 MHz, CDCl}_3\) \(\delta 7.71 (s, 1H), 7.54 (d, \text{J = 7.2 Hz, 2H), 7.39 – 7.42 (m, 3H), 7.36 – 7.37 (m, 1H), 7.29 – 7.30 (m, 1H), 5.55 (s, 1H), 3.51 (s, 3H) ppm.} \text{HRMS (ESI): } m/z \text{ calcd. for C}_{13}\text{H}_{12}\text{ClNO}_2\text{S [M + H]}^{+}, 296.0454; \text{found, 296.0520.} \)

For C_{13}H_{12}CINO_2Na [M + Na]^+, 296.0454; found, 296.0520.
2-(methoxy(phenyl)methyl)-6-methylbenzo[d]oxazole (2n) was prepared according to the general procedure A using 2-benzyl-6-methylbenzo[d]oxazole 1n (45 mg, 0.2 mmol) as the starting material. Yellow liquid (36 mg, 71%). \( R_f = 0.4 \) (Hexane:EtOAc = 9:1). IR (neat): \( \nu = 2928, 1744, 1451, 1224, 1091, 809 \text{ cm}^{-1} \). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \( \delta \) 7.59 (d, \( J = 8.4 \text{ Hz}, 1H \)), 7.55 (d, \( J = 7.2 \text{ Hz}, 2H \)), 7.38 (t, \( J = 7.8 \text{ Hz}, 2H \)), 7.32–7.34 (m, 1H), 7.30 (s, 1H), 7.13 (d, \( J = 8.4 \text{ Hz}, 1H \)), 5.55 (s, 1H), 3.50 (s, 3H), 2.45 (s, 3H) ppm. \(^{13}\)C NMR (151 MHz, CDCl\(_3\)) \( \delta \) 163.96, 151.34, 138.67, 137.05, 135.89, 128.89, 128.85 (2C), 127.31 (2C), 125.81, 119.80, 111.18, 79.55, 57.79, 21.86 ppm. HRMS (ESI): \( m/z \) calcd. for \( C_{19}H_{13}NO_2Na \ [M + Na]^+ \), 276.1000; found, 276.1112.

2-(methoxy(phenyl)methyl)benzo[d]thiazole (5a) was prepared according to the general procedure A using 2-benzyl-phenylbenzo[d]thiazole 4a (45 mg, 0.2 mmol) as starting material. Thick yellow liquid (43 mg, 84%). \( R_f = 0.5 \) (Hexane:EtOAc = 9:1). IR (neat): \( \nu = 2928, 1744, 1366, 1224, 1025, 760 \text{ cm}^{-1} \). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \( \delta \) 7.30 (s, 1H), 7.13 (d, \( J = 7.8 \text{ Hz}, 1H \)), 7.09–7.11 (m, 2H), 5.67 (s, 1H), 3.53 (s, 3H), 2.28 (s, 3H) ppm.

2-(methoxy(4-methoxyphenyl)methyl)benzo[d]thiazole (5b) was prepared according to the general procedure A using 2-(4-methoxybenzyl)phenylbenzo[d]thiazole 4b (51 mg, 0.2 mmol) as starting material. Colourless solid (38 mg, 67%). \( R_f = 0.3 \) (Hexane:EtOAc = 4:1). IR (KBr): \( \nu = 3139, 1634, 1402, 1080, 837 \text{ cm}^{-1} \). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \( \delta \) 7.99 (d, \( J = 8.4 \text{ Hz}, 1H \)), 7.86 (d, \( J = 7.8 \text{ Hz}, 1H \)), 7.52 (d, \( J = 7.8 \text{ Hz}, 2H \)), 7.44 (t, \( J = 7.8 \text{ Hz}, 1H \)), 7.35–7.38 (m, 3H), 7.30–7.34 (m, 1H), 5.67 (s, 1H), 3.53 (s, 3H), 3.50 (s, 3H) ppm. \(^{13}\)C NMR (151 MHz, CDCl\(_3\)) \( \delta \) 174.03, 159.12, 153.22, 136.95, 135.23, 131.52, 128.73 (2C), 128.54 (2C), 127.31 (2C), 126.07, 125.21, 123.36, 121.91, 83.68, 57.80 ppm. HRMS (ESI): \( m/z \) calcd. for \( C_{21}H_{15}NO_3S \ [M + H]^+ \), 362.1215; found, 362.1216.

2-((4-benzylbenzoyl)oxy)(methyl)phenyl methanesulfonate (5d) was prepared according to the general procedure A using 4-benzyl(phenyl)methanesulfonate 4d (57 mg, 0.2 mmol) as the starting material. Yellow solid (40 mg, 64%). \( R_f = 0.4 \) (Hexane:EtOAc = 4:1). mp = 82 °C. IR (KBr): \( \nu = 3099, 1756, 1634, 1402, 1192, 760 \text{ cm}^{-1} \). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \( \delta \) 7.98 (d, \( J = 8.4 \text{ Hz}, 1H \)), 7.84 (d, \( J = 7.8 \text{ Hz}, 1H \)), 7.39 – 7.43 (m, 5H), 7.30–7.37 (m, 4H), 6.97 (d, \( J = 8.4 \text{ Hz}, 2H \)), 5.61 (s, 1H), 5.03 (s, 2H), 3.49 (s, 3H) ppm. \(^{13}\)C NMR (151 MHz, CDCl\(_3\)) \( \delta \) 173.04, 159.12, 153.12, 153.23, 153.15, 135.25, 128.73 (2C), 128.54 (2C), 128.14, 127.60 (2C), 126.05, 125.17, 123.34, 121.91, 115.17 (2C), 83.29, 70.17, 57.64 ppm. HRMS (ESI): \( m/z \) calcd. for \( C_{22}H_{20}NO_3S \ [M + Na]^+ \), 322.1024; found, 322.1028.
2-((4-fluorophenyl)(methoxy)methyl)benzo[d]thiazole (5f) was prepared according to the general procedure A using 2-(4-fluorobenzyl)benzo[d]thiazole 4f (49 mg, 0.2 mmol) as the starting material. Light yellow liquid (40 mg, 74%). Rf = 0.5 (Hexane:EtO = 8:5.1). IR (neat): ν = 2928, 1600, 1506, 1224, 1091, 766 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 7.99 (d, J = 7.8 Hz, 1H), 7.87 (d, J = 7.8 Hz, 1H), 7.44 – 7.50 (m, 3H), 7.37 (t, J = 7.8 Hz, 1H), 7.04 – 7.07 (m, 2H), 5.65 (s, 1H), 3.52 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 173.50, 162.87 (d, J_C,F = 247.34 Hz), 153.15, 135.19, 134.96 (d, J_C,F = 2.72 Hz), 128.88 (d, J_C,F = 8.46 Hz, 2C), 126.17, 125.33, 123.37, 121.96, 115.80 (d, J_C,F = 21.74 Hz, 2C), 82.98, 57.81 ppm. HRMS (ESI): m/z calcd. for C₁₄H₁₂NO₂S₂ [M + H]⁺, 350.0521; found, 350.0511.

2-((4-bromophenyl)(methoxy)methyl)benzo[d]thiazole (5g) was prepared according to the general procedure A using 2-(4-bromobenzyl)benzo[d]thiazole 4g (61 mg, 0.2 mmol) as the starting material. Colorless liquid (46 mg, 69%). Rf = 0.5 (Hexane: EtO = 9:1). IR (neat): ν = 2928, 1645, 1468, 1163, 1048, 826 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 7.99 (d, J = 8.4 Hz, 1H), 7.87 (d, J = 8.4 Hz, 1H), 7.44 – 7.51 (m, 3H), 7.36 – 7.41 (m, 3H), 5.62 (s, 1H), 3.52 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 173.09, 153.15, 138.18, 135.20, 132.00 (2C), 128.74 (2C), 126.19, 125.38, 123.40, 122.70, 121.97, 83.00, 57.88 ppm. HRMS (ESI): m/z calcd. for C₁₄H₁₂NO₂Br [M + H]⁺, 333.9901; found, 333.9900.

2-(methoxy(4-nitrophenyl)methyl)benzo[d]thiazole (5h) was prepared according to the general procedure A using 2-(4-nitrobenzyl)benzo[d]thiazole 4h (54 mg, 0.2 mmol) as the starting material. Thick yellow liquid (46 mg, 75%). Rf = 0.3 (Hexane:EtO = 8:5:1). IR (neat): ν = 2928, 1517, 1346, 1091, 760 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 8.22 – 8.24 (m, 2H), 8.00 (d, J = 8.4 Hz, 1H), 7.88 (d, J = 7.8 Hz, 1H), 7.73 (d, J = 9.0 Hz, 2H), 7.47 – 7.49 (m, 1H), 7.38 – 7.41 (m, 1H), 5.77 (s, 1H), 3.58 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 172.08, 153.11, 148.00, 146.16, 135.20, 127.76 (2C), 126.39, 125.65, 124.05 (2C), 123.49, 122.05, 82.64, 58.24 ppm. HRMS (ESI): m/z calcd. for C₁₄H₁₂N₂O₂S [M + H]⁺, 301.0647; found, 301.0653.

Butyl-3-((benzo[d]thiazol-2-yl(methoxy)methyl)phenyl)acrylate (5i) was prepared according to the general procedure A using butyl-3-(4-(benzo[d]thiazol-2-ylmethyl)phenyl)acrylate 4i (70 mg, 0.2 mmol) as the starting material. Colourless liquid (42 mg, 55%). Rf = 0.5 (Hexane:EtO = 3:2). IR (neat): ν = 2956, 1711, 1456, 1313, 1169, 760 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 7.99 (d, J = 7.8 Hz, 1H), 7.85 (d, J = 7.8 Hz, 1H), 7.65 (d, J = 16.2 Hz, 1H), 7.52 – 7.55 (m, 4H), 7.44 (t, J = 7.8 Hz, 1H), 7.35 (t, J = 7.8 Hz, 1H), 6.43 (d, J = 15.6 Hz, 1H), 5.68 (s, 1H), 4.20 (t, J = 6.6 Hz, 2H), 3.53 (s, 3H), 1.65 – 1.70 (m, 2H), 1.40 – 1.44 (m, 2H), 0.95 (t, J = 7.8 Hz, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 173.08, 167.05, 153.12, 143.94, 141.15, 135.18, 134.75, 128.47 (2C), 127.49 (2C), 126.11, 125.29, 123.34, 124.91, 118.85, 83.20, 64.55, 57.86, 30.84, 19.28, 13.84 ppm. HRMS (ESI): m/z calcd. for C₁₃H₁₄NO₂S [M + H]⁺, 382.1477; found, 382.1496.

2-((2-chlorophenyl)(methoxy)methyl)benzo[d]thiazole (5j) was prepared according to the general procedure A using 2-(2-chlorobenzyl)benzo[d]thiazole 4j (52 mg, 0.2 mmol) as the starting material. Colourless liquid (41 mg, 81%). Rf = 0.5 (Hexane:EtO = 9:1). IR (neat): ν = 2928, 1672, 1440, 1091, 760 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 8.03 (d, J = 7.8 Hz, 1H), 7.86 (d, J = 7.8 Hz, 1H), 7.60 – 7.61 (m, 1H), 7.45 (t, J = 7.8 Hz, 1H), 7.40 – 7.41 (m, 1H), 7.37 (t, J = 7.8 Hz, 1H), 7.27 – 7.33 (m, 2H), 6.14 (s, 1H), 3.55 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 171.77, 153.30, 136.89, 135.29, 133.88, 129.89, 129.86, 128.62, 127.46, 126.13, 125.33, 123.64, 121.83, 79.60, 57.99 ppm. HRMS (ESI): m/z calcd. for C₁₅H₁₃ClNO₂S [M + H]⁺, 290.0406; found, 290.0407.
2-(methoxy(o-tolyl)methyl)benzo[d]thiazole (5k) was prepared according to the general procedure A using 2-(2-methylbenzyl)benzo[d]thiazole 4k (48 mg, 0.2 mmol) as the starting material. 5k was obtained as an inseparable mixture with 4k after passing the crude reaction mixture through a small bed of silica gel. Thick colourless liquid (51 mg, 59% 5k + 41% 4k) based on 1H NMR analysis. Rf = 0.5 (Hexane:EtOAc = 9:1). IR (neat): ν = 2928, 1606, 1451, 1313, 1086, 737 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 7.99 (d, J = 8.4 Hz, 2H), 7.83 (d, J = 7.8 Hz, 1H), 7.75 (d, J = 8.4 Hz, 1H), 7.56 (d, J = 7.2 Hz, 1H), 7.42 – 7.43 (m, 2H), 7.30 – 7.35 (m, 3H), 7.16 – 7.25 (m, 6H), 5.85 (s, 1H), 4.43 (s, 2H), 3.52 (s, 3H), 2.43 (s, 3H), 2.33 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 173.21, 171.80, 153.42, 153.16, 137.42, 137.13, 136.53, 135.78, 135.66, 135.45, 130.91, 130.84, 130.30, 128.56, 127.96, 126.78, 126.57, 126.48, 126.06, 126.02, 125.21, 124.86, 123.43, 122.83, 121.86, 121.64, 80.86, 57.73, 38.66, 19.81, 19.67 ppm. HRMS (ESI): m/z calcld. for C₁₆H₁₂NOSNa [M + Na]+, 270.0953; found, 270.0962.

2-(methoxymethyl)methyl)benzo[d]thiazole (5l) was prepared according to the general procedure A using 2-(3-methylbenzyl)benzo[d]thiazole 4l (48 mg, 0.2 mmol) as the starting material. Thick yellow liquid (44 mg, 81%). Rf = 0.6 (Hexane:EtOAc = 8.5:1.5). IR (neat): ν = 2928, 1512, 1451, 1091, 760 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 7.99 (d, J = 8.4 Hz, 1H), 7.84 (d, J = 7.8 Hz, 1H), 7.43 (t, J = 7.8 Hz, 1H), 7.22 – 7.25 (m, 2H), 7.11 (d, J = 7.2 Hz, 1H), 5.63 (s, 1H), 3.51 (s, 3H), 2.34 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 173.81, 153.16, 138.97, 138.55, 136.30, 129.41, 128.72, 127.69, 126.00, 125.03, 124.17, 123.31, 121.86, 83.71, 57.73, 21.55 ppm. HRMS (ESI): m/z calcld. for C₁₆H₁₄NOSNa [M – H]⁻, 268.0796; found, 268.0795.

2-(methoxy(thiophen-3-ylmethyl)benzo[d]thiazole (5m) was prepared according to the general procedure A using 2-(thiophen-3-ylmethyl)benzo[d]thiazole 4m (46 mg, 0.2 mmol) as the starting material. Thick brown liquid (26 mg, 50%). Rf = 0.4 (Hexane:EtOAc = 8.5:1.5). IR (neat): ν = 2928, 1717, 1435, 1169, 1091, 760 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 8.01 (d, J = 8.4 Hz, 2H), 7.88 (d, J = 7.8 Hz, 1H), 7.46 (t, J = 7.8, 1H), 7.42 (s, 1H), 7.38 (t, J = 7.8 Hz, 1H), 7.31 (s, 1H), 7.15 (d, J = 4.8 Hz, 1H), 5.77 (s, 1H), 5.33 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 173.18, 153.13, 140.15, 135.28, 126.66, 126.18, 126.14, 125.34, 123.41, 123.40, 121.98, 80.03, 57.83 ppm. HRMS (ESI): m/z calcld. for C₁₆H₁₂NOSNa [M + Na]+, 284.0180; found, 284.0303.

5-chloro-2-(methoxy(o-tolyl)methyl)benzo[d]thiazole (4m) was prepared according to the general procedure A using 2-benzyl-5-chlorobenzo[d]thiazole 4n (52 mg, 0.2 mmol) as the starting material. Golden yellow solid (39 mg, 67%). Rf = 0.5 (Hexane:EtOAc = 9:1). mp = 86 °C. IR (KBr): ν = 2928, 1612, 1435, 1070, 798 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 7.96 (s, 1H), 7.75 (d, J = 8.4 Hz, 1H), 7.50 (d, J = 7.2 Hz, 2H), 7.38 (t, J = 7.2 Hz, 2H), 7.31 – 7.33 (m, 2H), 6.54 (s, 1H), 3.52 (s, 3H) ppm. 13C NMR (151 MHz, CDCl₃) δ 175.84, 154.09, 138.77, 133.51, 132.08, 128.91 (2C), 127.8, 127.10 (2C), 125.70, 123.19, 122.61, 83.54, 57.80 ppm. HRMS (ESI): m/z calcld. for C₁₆H₁₂NOSNa [M + Na]+, 312.0226; found, 312.0224.

2-(1-methoxethyl)benzo[d]thiazole (5o) was prepared according to the general procedure A using 2-ethylbenzo[d]thiazole 4o (65 mg, 0.4 mmol) as the starting material. Thick yellow liquid (22 mg, 28%). Rf = 0.5 (Hexane:EtOAc = 9:1). IR (neat): ν = 2928, 1650, 1451, 1263, 1091, 754 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 8.00 (d, J = 7.8 Hz, 1H), 7.91 (d, J = 8.4 Hz, 1H), 7.48 (t, J = 7.8 Hz, 1H), 7.39 (t, J = 7.8 Hz, 1H), 4.75 – 4.78 (m, 1H), 3.46 (s, 3H), 1.64 ppm. 13C NMR (151 MHz, CDCl₃) δ 175.86, 153.20, 135.07, 126.08, 125.19, 123.11, 122.04, 78.05, 57.70, 22.41 ppm. HRMS (ESI): m/z calcld. for C₁₆H₁₄NOSNa [M – H]⁻, 312.0640; found, 312.0637.

2-(benz[d]thiazol-2-yl)-2,2-dimethoxyacetanilide (5p) was prepared according to the general procedure A using 2-(benz[d]thiazol-2-yl)acetanilide 4p (35 mg, 0.2 mmol) as the starting material. Colourless liquid (42 mg, 90%). Rf = 0.5 (Hexane:EtOAc = 4:1). IR (neat): ν = 2950, 1639, 1445, 1246, 799 cm⁻¹. 1H NMR (600 MHz, CDCl₃) δ 8.18 (d, J = 8.4 Hz, 1H), 7.95 (d, J = 8.4 Hz, 1H), 7.56 (t, J = 7.2 Hz, 1H), 7.49 (t, J = 7.2 Hz, 1H), 3.57 (s, 6H) ppm. 13C NMR (151
MHz, CDCl$_3$) $\delta$ 164.17, 152.71, 135.50, 126.88, 126.70, 124.64, 122.03, 113.88, 96.88, 52.72 (2C) ppm. HRMS (ESI): m/z calcd. for C$_{11}$H$_{11}$N$_2$O$_2$S [M + H]$^+$, 235.0541; found, 235.0555.

Representative procedure for the removal of benzoxazole protection from 2c:

A 25 mL R.B. flask was charged with 2c (57 mg, 0.18 mmol, 1.0 equiv), ZnCl$_2$ (49 mg, 0.36 mmol, 2.0 equiv), 14% HCl (1.5 mL) and EtOH (1.5 mL). The reaction mixture was stirred at 100 ºC using a coil-condenser for 24 h. After completion, the resulting mixture was diluted with DCM (5 mL) and extracted with saturated aqueous NaHCO$_3$ solution (3 x 15 mL). The combined aqueous layer was acidified with concentrated HCl and then extracted with DCM (3 x 15 mL). The combined organic layers were dried over anhydrous Na$_2$SO$_4$ and concentrated in vacuum to give the crude carboxylic acid 8, which was further purified by column chromatography over silica-gel. Brown solid (31 mg, 71%). mp = 120 ºC. R$_f$ = 0.5 (DCM:MeOH = 9.5:0.5). IR (KBr): $\tilde{\nu}$ = 3128, 1639, 1402, 1114, 622 cm$^{-1}$. $^1$H NMR (600 MHz, DMSO-$d_6$) $\delta$ 7.64 (t, $J$ = 8.4 Hz, 4H), 7.45 – 7.49 (m, 4H), 7.35 – 7.38 (m, 1H), 4.73 (s, 1H), 3.57 (s, 3H) ppm. $^{13}$C NMR (151 MHz, DMSO-$d_6$) $\delta$ 172.03, 139.86, 139.76, 137.10, 131.03, 128.95 (3C), 127.97, 127.48, 126.67 (2C), 126.48, 66.37, 56.38 ppm. HRMS (ESI): m/z calcd. for C$_{15}$H$_{14}$O$_3$Na [M + Na]$^+$, 265.0841; found, 265.0824.

Synthesis of N-methylated azolium triflate 9 from 5a:

Compound 9 was prepared using a reported protocol described by Mayr et al.$^3$ Under nitrogen atmosphere, a 25 mL rb was charged with 5a (153 mg, 0.6 mmol, 1 eq.) in anhydrous Et$_2$O (5 mL). To it, was added MeOTf (148 mg, 0.9 mmol, 1.5 eq.) via syringe and the reaction mixture was allowed to stir for 16 h at room temperature. The solvent was then decanted and the residue was washed with cooled Et$_2$O (3 x 5 mL) and hexane (3 x 5 mL) and dried under vacuum to afford a colorless powder (229 mg, 91%). The characterization data are in agreement with that of the reported compound.$^3$ $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 8.14 (d, $J$ = 7.8 Hz, 1H), 8.04 (d, $J$ = 9.0, 1H), 7.79 – 7.83 (m, 1H), 7.72 – 7.74 (m, 1H), 7.52 (m, 2H), 7.47 (s, 3H), 6.39 (s, 1H), 4.15 (s, 3H), 3.54 (s, 3H) ppm. $^{13}$C NMR (151 MHz, DMSO-$d_6$) $\delta$ 172.03, 139.86, 139.76, 137.10, 131.03, 128.95 (3C), 127.97, 127.48, 126.67 (2C), 126.48, 66.37, 56.38 ppm. HRMS (ESI): m/z calcd. for [C$_{16}$H$_{16}$NOS]$^+$ is 270.0947; found, 270.1260.

References:


$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
\(^1\text{H NMR (600 MHz, CDCl}_3\):}
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl₃):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![Chemical Structure](image)

(f1 (ppm))
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

\[ \text{Diagram showing \text{1k}} \]
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):

![NMR spectrum diagram]
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}\text{C} \text{ NMR (151 MHz, } \text{CDCl}_3):$
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1\text{H NMR (}600\text{ MHz, CDCl}_3):$
$^{13}$C NMR (151 MHz, CDCl₃):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
\(^{13}\)C NMR (151 MHz, CDCl\(_3\)):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$)
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![NMR Spectrum Image]
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
NMR spectra of all products

$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^{19}$F NMR (564 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![Carbon-13 NMR spectrum]

**Peak Assignments:**

- 144.3 ppm (O-CH$_3$)
- 140.9 ppm (C=O)
- 128.8 ppm (Ar-C)
- 126.8 ppm (Ar-C)
- 126.0 ppm (Ar-C)
- 125.5 ppm (Ar-C)
- 124.9 ppm (Ar-C)
- 124.8 ppm (Ar-C)
- 124.0 ppm (Ar-C)
- 123.2 ppm (Ar-C)
- 121.0 ppm (Ar-C)
- 118.2 ppm (Ar-C)
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![$^{13}$C NMR spectrum](image)
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![NMR Spectrogram]
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^{1}H$ NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![NMR spectrum image]
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![C NMR spectrum](image.png)
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^{19}$F NMR (564 MHz, CDCl$_3$):

\[ \text{Diagram of chemical structure} \]
$^1$H NMR (600 MHz, CDCl$_3$):

![NMR Spectrum](image)
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl₃):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):

![NMR spectrum diagram]
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):
$^1$H NMR (600 MHz, DMSO-d$_6$):
$\text{C NMR (151 MHz, DMSO-}d_6$:}
$^1$H NMR (600 MHz, CDCl$_3$):
$^{13}$C NMR (151 MHz, CDCl$_3$):