Supporting Information
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Pd/PTABS: An Efficient Catalytic System For The Aminocarbonylation Of Nucleosides

Supporting file

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General:

All the reactions were performed under a nitrogen atmosphere using stainless steel autoclave in well ventilated fuming hood. 5’-DMT-5-IdU were purchased from Sapala Organics Pvt. Ltd. The completely dried N,N-dimethylformamide (DMF, 99.8%, extra dry, stored over molecular sieves) was purchased from Acros organics was used as received for all air or moisture sensitive reactions. $^1$H NMR (500 MHz) and $^{13}$C NMR (126 MHz) spectra were recorded either on Agilent 500 MHz spectrometer. Chemical shifts δ are given in ppm and the solvent residual peak (CDCl$_3$: $^1$H, δ = 7.27; $^{13}$C, δ = 77.0 and DMSO-d$_6$: $^1$H, δ = 2.50; $^{13}$C, δ = 40) was used as an internal standard. Peak multiplicities are specified as followed: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet; br, broad. APCI-MS (m/z) spectra were recorded on an Advion MS. Mechenary-Nagel silica gel 60 F254 plates were used for thin layer chromatography (TLC), and detection was achieved by UV light. Column chromatography was performed on silica gel 60 (40-63 μm) or Acros Organics silica gel 60 (35-70 μm). The silica made neutral by treating it with triethylamine. “ElementarVario MICRO cube” was used for the experimental determination of elemental configurations of final pure products.

Unless mentioned otherwise, all materials and solvents were commercially obtained and used without further purification and all the experiments were performed under nitrogen atmosphere. The high pressure reactions handled in autoclave and in fuming hood and in an autoclave. $^1$H NMR, $^{13}$C NMR were recorded at 500 MHz, 126 MHz respectively on aAgilent 500 MHz instrument. “ElementarVario MICRO cube” was used for the experimental determination of elemental configurations of final pure products. HPLC analyses were obtained using an Agilent 1260 Infinity HPLC instrument. Separation was achieved using DAICEL CHIRALPAK AD-H column with 1 mL/min. flow rate and using Hexane:IPA (80:20). Optical rotations were measured on a Rudolph made polarimeter AUTOPOL IV at 20 °C.
Caution: Carbon Monoxide (CO) is an odorless, colorless and highly toxic gas. The reactions should be carried out in efficient fume hoods with CO detectors by trained chemists only.

General Procedures

1.0 mmol (656mg) of 5'-O-DMT-2'-deoxyuridine (5'-O-DMT-5'-IdU, 1a), 2.0 mmol of the corresponding amine, 2 mol% of Pd(OAc)$_2$, 4 mol% of PTABS ligand, 10 mmol triethylamine and 10 mL N$_2$ purged DMF was taken in the 100 mL stainless steel autoclave reaction flask at room temperature. Then autoclave was closed and flushed with nitrogen gas and then pressurized with CO gas (40 psi). Reaction mixture stirred with mechanical stirrer (500 rpm), heated at 60 °C for 24 hours. After that, the reaction was cooled to room temperature and CO was de-pressurized carefully in fume hood by passing in KMnO$_4$ solution. The reaction mass was diluted in cold water and was subsequently extracted with ethyl acetate (25ml x 3). The organic layer was dried over Na$_2$SO$_4$ and concentrated in-vacuo. Slurry was prepared using silica and the product was isolated by using column chromatography on 60-120 neutralized silica by using (97.5:2.0:0.5 CHCl$_3$: MeOH: Et$_3$N) eluent system.
**Substrate Scope:**

**N-benzyl-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3a):**

White solid; Yield: 544 mg (82%).

$^1$H NMR (500 MHz, DMSO-d$_6$) $\delta$ 9.05 (t, $J = 6.6$ Hz, 1H), 8.43 (s, 1H), 7.35 – 7.09 (m, 15H), 6.83 (d, $J = 8.7$ Hz, 4H), 6.03 (ddd, $J = 6.9$, 4.0, 1.8 Hz, 1H), 5.33 – 5.26 (m, 1H), 4.46 – 4.40 (m, 2H), 4.09 – 4.02 (m, 1H), 3.89 (s, 1H), 3.67 (d, $J = 1.7$ Hz, 6H), 3.16 – 3.12 (m, 2H), 2.24 – 2.13 (m, 2H).

$^{13}$C NMR (126 MHz, DMSO-d$_6$) $\delta$ 163.6, 161.9, 158.4, 149.8, 146.0, 145.2, 139.6, 135.7, 130.1, 130.0, 128.7, 128.2, 127.6, 127.3, 127.0, 113.6, 105.5, 86.4, 86.3, 86.1, 70.7, 64.0, 55.3, 46.1, 42.5.

Anal. Calcd for C$_{38}$H$_{37}$N$_3$O$_8$: C, 68.77; H, 5.62; N, 6.33; Found: C, 68.59; H, 5.52; N, 6.33.

**N-(naphthalen-1-ylmethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3b):**

Off-white solid; Yield: 534 mg (75%).

$^1$H NMR (500 MHz, DMSO-d$_6$) $\delta$ 9.14 – 9.08 (m, 1H), 8.50 (dd, $J = 4.7$, 2.0 Hz, 1H), 8.11 – 8.05 (m, 1H), 7.96 – 7.90 (m, 1H), 7.87 – 7.81 (m, 1H), 7.56 – 7.47 (m, 2H), 7.47 – 7.41 (m, 2H), 7.41
- 7.34 (m, 2H), 7.34 – 7.19 (m, 7H), 7.19 – 7.12 (m, 1H), 6.90 – 6.81 (m, 4H), 6.08 – 6.03 (m, 1H), 5.40 – 5.26 (m, 1H), 4.98 – 4.90 (m, 2H), 4.11 – 4.06 (m, 1H), 3.95 – 3.91 (m, 1H), 3.69 – 3.64 (m, 6H), 3.19 – 3.16 (m, 2H), 2.31 – 2.24 (m, 1H), 2.23 – 2.16 (m, 1H).

^13^C NMR (126 MHz, DMSO-d6), 163.7 (s), 161.7 (s), 158.4 (s), 158.4 (s), 149.8 (s), 146.1 (s), 145.3 (s), 135.8 (s), 135.7 (s), 134.7 (s), 133.7 (s), 131.1 (s), 130.2 (s), 130.1 (s), 129.0 (s), 128.2 (s), 128.1 (s), 128.0 (s), 126.8 (s), 126.3 (s), 125.9 (s), 123.7 (s), 113.6 (s), 105.3 (s), 105.3 (s), 105.3 (s), 86.5 (s), 86.3 (s), 86.1 (s), 70.8 (s), 64.0 (s), 55.4 (s), 55.3 (s), 46.1 (s).

Anal. Calcd for C_{42}H_{39}N_{3}O_{8}: C, 70.67; H, 5.51; N, 5.89; Found: C, 70.67; H, 5.31; N, 5.63.

**N-(4-fluorobenzyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3c):**

![Structure](image)

White solid; Yield: 544 mg (80%).

^1H NMR (500 MHz, DMSO-d6) δ 11.97 (s, 1H), 9.07 (d, J = 5.5 Hz, 1H), 8.45 (d, J = 2.4 Hz, 1H), 7.39 – 7.04 (m, 13H), 6.90 – 6.79 (m, 4H), 6.05 (t, J = 5.9 Hz, 1H), 5.38 – 5.34 (m, 1H), 4.41 (d, J = 13.2 Hz, 2H), 4.07 (d, J = 5.3 Hz, 1H), 3.94 – 3.89 (m, 1H), 3.75 – 3.62 (m, 6H), 3.14 (dd, J = 9.3, 8.1 Hz, 2H), 2.27 (dd, J = 15.2, 4.0 Hz, 1H), 2.23 – 2.17 (m, 1H).

^13^C NMR (126 MHz, DMSO-d6) δ 163.3 (s), 161.7 (s), 161.4 (d, J = 243.1 Hz), 158.2 (s), 149.6 (s), 145.8 (s), 145.0 (s), 135.6 (s), 135.5 (s), 129.9 (s), 129.8 (s), 129.5 (d, J = 8.1 Hz), 127.9 (d, J = 21.4 Hz), 126.8 (s), 115.31 (s), 115.1 (s), 113.4 (s), 105.3 (s), 86.2 (s), 86.1 (s), 85.9 (s), 70.6 (s), 63.8 (s), 55.1 (s), 41.6 (s).

^19^F NMR (471 MHz, DMSO-d6) -116.0 δ.

Anal. Calcd for C_{38}H_{36}FN_{3}O_{8}: C, 66.95; H, 5.32; N, 6.16; Found: C, 66.75; H, 5.22; N, 6.10.

**N-(4-Methoxybenzyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3d):**
Off-white solid; Yield: 568 mg (82%).

$^1$H NMR (500 MHz, DMSO-d$_6$) $\delta$ 8.99 (d, $J = 6.0$ Hz, 1H), 8.47 (s, 1H), 7.35 (d, $J = 7.7$ Hz, 2H), 7.28 - 7.15 (m, 10H), 6.85 (t, $J = 8.5$ Hz, 6H), 6.06 (t, $J = 6.4$ Hz, 1H), 5.35 (d, $J = 4.6$ Hz, 1H), 4.41 - 4.35 (m, 2H), 4.08 (dt, $J = 9.1$, 4.5 Hz, 1H), 3.92 (dd, $J = 8.7$, 4.4 Hz, 1H), 3.70 (s, 9H), 3.17 (d, $J = 4.4$ Hz, 2H), 2.28 - 2.18 (m, 2H).

$^{13}$C NMR (126 MHz, DMSO-d$_6$) $\delta$ 163.6 (s), 162.7 (s), 161.7 (s), 158.7 (s), 158.4 (s), 149.8 (s), 146.0 (s), 145.3 (s), 135.8 (s), 135.7 (s), 131.5 (s), 130. (s), 129.1 (s), 128.2 (s), 127.0 (s), 114.2 (s), 113.6 (s), 105.5 (s), 86.4 (s), 86.3 (s), 86.1 (s), 70.7 (s), 64.0 (s), 55.4 (s), 42.0 (s), 36.2 (s).

Anal. Calcd for C$_{39}$H$_{39}$N$_3$O$_9$: C, 67.52; H, 5.67; N, 6.06; Found: C, 67.41; H, 5.52; N, 5.98.

**N-phenethyl amine-5-carboxamide-5′-O-DMT-2′-deoxyuridine (3e):**

White solid; Yield: 582 mg (86%).

$^1$H NMR (500 MHz, DMSO-d$_6$) $\delta$ 11.93 (s, 1H), 8.72 (t, $J = 5.7$ Hz, 1H), 8.44 (s, 1H), 7.35 (d, $J = 7.4$ Hz, 2H), 7.27 (d, $J = 7.9$ Hz, 3H), 7.26 - 7.16 (m, 9H), 6.87 (d, $J = 8.4$ Hz, 4H), 6.05 (t, $J = 6.4$ Hz, 1H), 5.35 (d, $J = 4.6$ Hz, 1H), 4.08 (td, $J = 8.9$, 4.4 Hz, 1H), 3.91 (dd, $J = 8.8$, 4.4 Hz, 1H), 3.70 (d, $J = 1.1$ Hz, 6H), 3.50 - 3.44 (m, 2H), 3.20 - 3.14 (m, 2H), 2.76 (t, $J = 7.2$ Hz, 2H), 2.28 - 2.24 (m, 1H), 2.20 (dd, $J = 13.4$, 6.7 Hz, 1H)
$^{13}$C NMR (126 MHz, dmsO) δ 163.5 (s), 161.7 (s), 158.4 (s), 149.8 (s), 145.8 (s), 145.3 (s), 139.6 (s), 135.9 (s), 135.7 (s), 130.1 (s), 129.0 (s), 128.8 (s), 128.2 (s), 127.0 (s), 126.6 (s), 113.6 (s), 105.5 (s), 86.3 (s), 86.2 (s), 86.1 (s), 70.7 (s), 63.9 (s), 55.3 (s), 40.6 (s), 35.6 (s).

Anal. Calcd for C$_{39}$H$_{39}$N$_{3}$O$_{8}$: C, 69.11; H, 5.80; N, 6.20; Found: C, 69.19; H, 5.63; N, 6.03.

N-(3,4-dimethoxyphenethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3f):

![Structure of 3f]

White solid; Yield: 589 mg (80%).

$^1$H NMR (500 MHz, DMSO-d$_6$) δ 8.71 (t, $J = 5.6$ Hz, 1H), 8.44 (s, 1H), 7.35 (d, $J = 7.4$ Hz, 2H), 7.29 – 7.21 (m, 6H), 7.18 (t, $J = 7.3$ Hz, 1H), 6.87 (d, $J = 8.1$ Hz, 4H), 6.83 (d, $J = 8.2$ Hz, 1H), 6.81 (d, $J = 1.8$ Hz, 1H), 6.71 (dd, $J = 8.1$, 1.8 Hz, 1H), 6.05 (t, $J = 6.4$ Hz, 1H), 5.35 (s, 1H), 4.08 (s, 1H), 3.93 – 3.90 (m, 1H), 3.71 (t, $J = 3.4$ Hz, 6H), 3.69 (d, $J = 2.1$ Hz, 6H), 3.18 – 3.15 (m, 2H), 2.69 (t, $J = 7.0$ Hz, 2H), 2.64 (dd, $J = 14.2$, 7.1 Hz, 2H), 2.28 – 2.24 (m, 1H), 2.20 (dd, $J = 13.3$, 6.6 Hz, 1H).

$^{13}$C NMR (126 MHz, DMSO-d$_6$) δ 163.5 (s), 161.7 (s), 158.4 (s), 149.8 (s), 149.0 (s), 147.6 (s), 145.8 (s), 145.2 (s), 135.9 (s), 132.1 (s), 130.2 (s), 128.2 (s), 127.0 (s), 120.8 (s), 113.6 (s), 112.9 (s), 112.3 (s), 105.6 (s), 86.3 (s), 86.2 (s), 86.1 (s), 70.7 (s), 63.9 (s), 55.9 (s), 55.7 (s), 55.4 (s), 46.1 (s), 40.8 (s), 35.2 (s), 11.0 (s).

Anal. Calcd for C$_{41}$H$_{43}$N$_{3}$O$_{10}$: C, 66.75; H, 5.87; N, 5.70; Found: C, 66.63; H, 5.63; N, 5.53.
N-(3,3-diphenylpropyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3g):

White solid; Yield: 650 mg (85%).

$^1$H NMR (400 MHz, DMSO-d6) $\delta$ 8.69 (s, 1H), 8.39 (s, 1H), 7.45 – 6.99 (m, 20H), 6.89 – 6.78 (m, 4H), 6.07 – 6.02 (m, 1H), 5.39 – 5.31 (m, 1H), 4.10 – 4.05 (m, 1H), 3.95 – 3.89 (m, 2H), 3.64 (s, 6H), 3.14 (d, $J$ = 3.2 Hz, 2H), 2.98 – 2.90 (m, 4H), 2.24 – 2.19 (m, 2H).

$^{13}$C NMR (101 MHz, DMSO-d6) $\delta$ 163.6 (s), 161.7 (s), 158.4 (s), 149.8 (s), 145.7 (s), 145.2 (s), 144.9 (d), 135.8 (d), 130.1 (d), 128.8 (s), 128.0 (d), 127.0 (s), 126.5 (s), 113.6 (s), 105.6 (s), 86.3 (s), 86.2 (s), 86.1 (s), 70.8 (s), 63.9 (s), 55.3 (s), 48.6 (s), 40.4 (s), 37.8 (s), 34.9 (s).

Anal. Calcd for C$_{46}$H$_{45}$N$_3$O$_8$: C, 71.95; H, 5.91; N, 5.47; Found: C, 71.73; H, 5.86; N, 5.37.

N-[(R)-1-phenylethyl]-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3h):

Off-white solid; Yield: 568 mg (84%).

$^1$H NMR (500 MHz, DMSO-d6) $\delta$ 9.11 (d, $J$ = 7.8 Hz, 1H), 8.39 (s, 1H), 7.42 – 7.27 (m, 7H), 7.26 – 7.20 (m, 7H), 7.15 (dd, $J$ = 10.4, 4.2 Hz, 1H), 6.87 – 6.82 (m, 4H), 6.07 (t, $J$ = 6.4 Hz, 1H), 5.44 – 5.30 (m, 1H), 5.07 (dd, $J$ = 14.4, 7.1 Hz, 1H), 4.08 (dd, $J$ = 10.6, 4.4 Hz, 1H), 3.91 (dd, $J$ = 9.3, 4.3 Hz, 1H), 3.69 (s, 6H), 3.18 – 3.11 (m, 2H), 2.25 (ddd, $J$ = 13.5, 6.3, 4.4 Hz, 1H), 2.18 (dt, $J$ = 13.4, 6.5 Hz, 1H), 1.43 (d, $J$ = 6.9 Hz, 3H).
\[^{13}\text{C}\] NMR (126 MHz, DMSO-d6) \(\delta\) 163.9 (s), 161.0 (s), 158.4 (s), 149.9 (s), 145.9 (s), 145.3 (s), 144.4 (s), 135.9 (s), 135.7 (s), 130.2 (s), 128.8 (s), 128.2 (s), 127.3 (s), 127.0 (s), 126.2 (s), 113.6 (s), 105.4 (s), 86.3 (s), 86.2, 86.1 (s), 70.7 (s), 64.0 (s), 55.3 (s), 48.4 (s), 22.9 (s).

\(^\alpha\)D\(_{20}\) = +8.088 (conc. 1.0 mM in MeOH)

Chiral HPLC analysis: Chiralpak AD-H (80:20 hexane:IPA, flow rate 1 mL/min\(^{-1}\), 250 nm, 25 °C) tR : 19.68 min. (100% ee).

Anal. Calcd for C\(_{39}\)H\(_{39}\)N\(_3\)O\(_8\): C, 69.11; H, 5.80; N, 6.20; Found: C, 69.01; H, 5.80; N, 6.10.

**N-(furan-2-ylmethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3i):**

![Image of molecule 3i]

White solid; Yield: 522 mg (80%).

\(^1\text{H} \) NMR (400 MHz, DMSO-d6) \(\delta\) 11.94 (s, 1H), 8.98 – 8.93 (m, 1H), 8.43 (s, 1H), 7.54 (s, 1H), 7.33 (d, \(J\) = 7.4 Hz, 2H), 7.28 – 7.19 (m, 6H), 7.18 – 7.14 (m, 1H), 6.90 – 6.80 (m, 4H), 6.38 – 6.33 (m, 1H), 6.22 (t, \(J\) = 4.5 Hz, 1H), 6.04 (q, \(J\) = 5.8 Hz, 1H), 5.30 (q, \(J\) = 6.1 Hz, 1H), 4.48 – 4.41 (m, 2H), 4.08 (td, \(J\) = 6.3, 4.0 Hz, 1H), 3.93 – 3.87 (m, 1H), 3.69 (s, 6H), 3.20 – 3.10 (m, 2H), 2.26 – 2.14 (m, 2H).

\(^{13}\text{C} \) NMR (126 MHz, DMSO-d6) \(\delta\) 163.6 (s), 161.7 (s), 158.4 (s), 152.3 (s), 149.8 (s), 146.1 (s), 145.3 (s), 142.7 (s), 135.8 (s), 130.2 (s), 128.2 (s), 128.0 (s), 127.0 (s), 113.6 (s), 110.9 (s), 107.4 (s), 105.2 (s), 86.4 (s), 86.2 (s), 86.1 (s), 70.7 (s), 64.0 (s), 55.4 (s), 55.3 (s), 35.8 (s).

Anal. Calcd for C\(_{36}\)H\(_{35}\)N\(_3\)O\(_9\): C, 66.15; H, 5.40; N, 6.43; Found: C, 65.95; H, 5.26; N, 6.33.

**N-(pyridin-3-ylmethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3j):**
White solid; Yield: 530 mg (80%).

\(^1\)H NMR (500 MHz, DMSO-d6) \(\delta\) 11.98 (s, 1H), 9.15 (t, \(J = 6.1\) Hz, 1H), 8.51 (d, \(J = 1.7\) Hz, 1H), 8.46 (s, 1H), 8.43 (dd, \(J = 4.7, 1.3\) Hz, 1H), 7.65 (d, \(J = 7.8\) Hz, 1H), 7.34 (d, \(J = 7.5\) Hz, 2H), 7.29 (dd, \(J = 7.8, 4.8\) Hz, 1H), 7.27 – 7.21 (m, 6H), 7.16 (t, \(J = 7.3\) Hz, 1H), 6.86 (s, 2H), 6.84 (s, 2H), 6.06 (t, \(J = 6.4\) Hz, 1H), 5.35 (d, \(J = 4.4\) Hz, 1H), 4.51 – 4.45 (m, 2H), 4.08 (dt, \(J = 8.4, 4.2\) Hz, 1H), 3.79 (q, \(J = 4.4\) Hz, 1H), 3.69 (d, \(J = 2.4\) Hz, 6H), 3.16 (d, \(J = 4.6\) Hz, 2H), 2.27 (ddd, \(J = 10.4, 6.3, 4.4\) Hz, 1H), 2.23 – 2.17 (m, 1H).

\(^{13}\)C NMR (126 MHz, DMSO-d6) \(\delta\) 163.5 (s), 162.1 (s), 158.4 (s), 149.8 (s), 149.2 (s), 148.4 (s), 146.1 (s), 145.2 (s), 135.8 (s), 135.7 (s), 135.6 (s), 135.3 (s), 130.12 (s), 128.2 (s), 127.0 (s), 123.9 (s), 113.6 (s), 105.4 (s), 86.4 (s), 86.3 (s), 86.1 (s), 70.8 (s), 64.0 (s), 55.4 (s), 46.0 (s), 15.6 (s), 9.0 (s).

Anal. Calcd for C\(_{37}\)H\(_{36}\)N\(_4\)O\(_8\): C, 66.86; H, 5.46; N, 8.43; Found: C, 66.65; H, 5.29; N, 8.12.

\textbf{N-(thiophen-2-ylmethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3k):}

Off-white solid; Yield: 521 mg (78%).

\(^1\)H NMR (400 MHz, DMSO-d6) \(\delta\) 9.11 – 9.04 (m, 1H), 8.45 (s, 1H), 7.38 – 7.31 (m, 3H), 7.28 – 7.14 (m, 8H), 7.00 – 6.89 (m, 2H), 6.85 (d, \(J = 8.7\) Hz, 4H), 6.04 (t, \(J = 6.1\) Hz, 1H), 5.35 – 5.28
(m, 1H), 4.59 (t, J = 7.6 Hz, 2H), 4.12 – 4.04 (m, 1H), 3.95 – 3.86 (m, 1H), 3.69 (s, 6H), 3.23 – 3.10 (m, 2H), 2.29 – 2.09 (m, 2H).

$^{13}$C NMR (101 MHz, DMSO- d6) δ 163.5 (s), 161.7 (s), 158.4 (s), 149.7 (s), 146.1 (s), 145.2 (s), 142.3 (s), 135.9 (s), 130.2 (s), 128.2 (s), 128.1 (s), 127.1 (s), 127.0 (s), 126.1 (s), 125.6 (s), 113.6 (s), 105.3 (s), 86.6 (s), 86.3 (s), 85.1 (s), 70.7 (s), 64.0 (s), 55.4 (s), 46.1 (s), 37.5 (s).

Anal. Calcd for: C_{36}H_{35}N_{3}O_{8}S: C, 64.56; H, 5.27; N, 6.27; S, 4.79; Found: C, 64.43; H, 5.37; N, 6.17; S, 4.58;

N-(2-(thiophen-2-yl)ethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3l):

Off-white solid; Yield: 560 mg (82%).

$^1$H NMR (500 MHz, DMSO-d6) δ 11.93 (s, 1H), 8.81 (t, J = 5.9 Hz, 1H), 8.44 (s, 1H), 7.36 – 7.33 (m, 2H), 7.31 (dd, J = 5.1, 1.2 Hz, 1H), 7.29 – 7.21 (m, 6H), 7.20 – 7.16 (m, 1H), 6.92 (dd, J = 5.1, 3.4 Hz, 1H), 6.86 (dd, J = 6.6, 1.8 Hz, 5H), 6.05 (t, J = 6.4 Hz, 1H), 5.34 (d, J = 6.6 Hz, 1H), 4.07 (dq, J = 6.4, 4.4 Hz, 1H), 3.91 (t, J = 4.5 Hz, 1H), 3.70 (s, 6H), 3.52 – 3.46 (m, 2H), 3.16 (d, J = 4.5 Hz, 2H), 2.98 (t, J = 7.0 Hz, 2H), 2.28 – 2.23 (m, 1H), 2.20 (dd, J = 13.5, 6.7 Hz, 1H).

$^{13}$C NMR (126 MHz, DMSO-d6) δ 163.4 (s), 161.8 (s), 158.4 (s), 149.8 (s), 145.9 (s), 145.3 (s), 141.7 (s), 135.9 (s), 130.2 (s), 128.2 (s), 128.0 (s), 127.4 (s), 127.0 (s), 125.6 (s), 124.5 (s), 113.6 (s), 105.5 (s), 86.4(s), 86.2 (s) – 86.1 (s), 70.7 (s), 64.0 (s), 55.3 (s), 40.7 (s), 36.2 (s), 29.7 (s).

Anal. Calcd for: C, 64.99; H, 5.45; N, 6.15; S, 4.69; Found: C, 64.78; H, 5.32; N, 6.10; S, 4.51.

N-(2-(1H-imidazol-5-yl)ethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3m):
Off-white solid; Yield: 520 mg (78%).

$^1$H NMR (500 MHz, DMSO-d6) δ 11.60 (d, $J = 0.6$ Hz, 1H), 7.74 (s, 1H), 7.35 (d, $J = 7.3$ Hz, 2H), 7.31 – 7.16 (m, 8H), 6.86 (d, $J = 8.0$ Hz, 4H), 6.12 (t, $J = 5.9$ Hz, 1H), 5.36 (s, 1H), 4.27 (s, 1H), 3.90 (s, 1H), 3.71 (s, 6H), 3.23 – 3.19 (m, 1H), 3.06 (d, $J = 8.0$ Hz, 1H), 2.73 (d, $J = 9.8$ Hz, 6H), 2.22 (s, 2H).

$^{13}$C NMR (126 MHz, DMSO-d6) δ 164.0 (s), 160.6 (s), 158.4 (s), 150.2 (s), 145.1 (s), 140.3 (s), 136.0 (s), 135.7 (s), 130.0 (s), 128.3 (s), 128.0 (s), 127.1 (s), 127.0 (s), 113.6 (s), 112.5 (s), 86.2 (s), 86.1 (s) 85.3 (s), 70.9 (s), 64.1 (s), 55.4 (s), 46.1 (s), 38.2 (s), 34.9 (s), 9.0 (s).

Anal. Calcd for: C$_{36}$H$_{37}$N$_5$O$_8$: C, 64.76; H, 5.59; N, 10.49; Found: C, 64.64; H, 5.45; N, 10.52.

N-(2-morphinoethyl)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3n):

White solid; Yield: 535 mg (78%).

$^1$H NMR (500 MHz, DMSO-d6) δ 11.99 – 11.88 (m, 1H), 8.86 (t, $J = 5.3$ Hz, 1H), 8.43 (s, 1H), 7.34 (dd, $J = 8.4$, 1.0 Hz, 2H), 7.24 (ddd, $J = 10.8$, 8.7, 4.8 Hz, 6H), 7.20 – 7.16 (m, 1H), 6.86 (dd, $J = 8.9$, 1.4 Hz, 4H), 6.06 (t, $J = 6.4$ Hz, 1H), 5.36 (d, $J = 4.5$ Hz, 1H), 4.08 (dt, $J = 8.9$, 4.3 Hz, 1H), 3.91 (dd, $J = 8.6$, 4.4 Hz, 1H), 3.71 (d, $J = 1.1$ Hz, 6H), 3.54 (s, 4H), 3.18 – 3.13 (m, 2H), 2.52 – 2.46 (m, 2H), 2.46 – 2.29 (m, 6H), 2.29 – 2.24 (m, 1H), 2.22 – 2.16 (m, 1H).

$^{13}$C NMR (126 MHz, DMSO-d6) δ 163.4 (s), 161.69 (s), 158.4 (s), 149.8 (s), 145.7 (s), 145.2 (s), 135.9 (s), 130.0 (s), 128.2 (s), 128.0 (s), 127.0 (s), 113.6 (s), 105.6 (s), 86.3 (s), 86.2 (s), 86.1 (s), 70.7 (s), 66.5 (s), 63.9 (s), 57.1 (s), 55.4 (s), 53.4 (s), 45.9 (s), 35.8 (s).
Anal. Calcd for C$_{37}$H$_{42}$N$_4$O$_9$: C, 64.71; H, 6.16; N, 8.16; Found: C, 64.56; H, 6.12; N, 8.02.

N-cyclhexyl amine-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3o):

![Chemical structure of 3o]

Off-white solid; Yield: 457 mg (69%).

$^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 11.95 – 11.88 (m, 1H), 8.66 (ddd, $J$ = 5.7, 5.2, 2.1 Hz, 1H), 8.40 (s, 1H), 7.38 – 7.29 (m, 2H), 7.29 – 7.14 (m, 7H), 6.90 – 6.79 (m, 4H), 6.07 – 6.02 (m, 1H), 5.31 (d, $J$ = 3.6 Hz, 1H), 4.11 – 4.04 (m, 1H), 3.89 (ddd, $J$ = 5.5, 2.9, 2.1 Hz, 1H), 3.70 (s, 6H), 3.18 – 3.10 (m, 2H), 2.25 – 2.12 (m, 2H), 1.81 – 1.72 (m, 2H), 1.61 (dd, $J$ = 12.2, 5.1 Hz, 2H), 1.52 – 1.46 (m, 1H), 1.36 – 1.12 (m, 6H).

$^{13}$C NMR (101 MHz, DMSO-d$_6$) $\delta$ 163.7 (s), 160.7 (s), 158.4 (s), 149.8 (s), 145.7 (s), 145.3 (s), 135.9 (d, $J$ = 19.6 Hz), 130.2 (s), 128.2 (s), 127.0 (s), 113.6 (s), 105.7 (s), 86.3 (s), 86.2 (2), 86.1 (s), 70.7 (s), 64.0 (s), 55.4 (s), 47.4 (s), 36.2 (s), 32.6 (s), 25.5 (s), 24.5 (s).

Anal. Calcd for C$_{38}$H$_{37}$N$_3$O$_8$: C, 68.77; H, 5.62; N, 6.33; Found: C, 68.58; H, 5.52; N, 6.38.

N-cyclopentyl amine-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3p):

![Chemical structure of 3p]

Off-white solid; Yield: 435 mg (68%).
\[ \text{H NMR (400 MHz, DMSO-d6)} \delta 11.98 – 11.86 (m, 1H), 8.69 – 8.62 (m, 1H), 8.39 (s, 1H), 7.37 – 7.30 (m, 2H), 7.29 – 7.12 (m, 7H), 6.90 – 6.79 (m, 4H), 6.08 – 6.02 (m, 1H), 5.35 – 5.29 (m, 1H), 4.15 – 4.04 (m, 2H), 3.93 – 3.87 (m, 1H), 3.70 (s, 6H), 3.19 – 3.10 (m, 2H), 2.27 – 2.15 (m, 2H), 1.90 – 1.79 (m, 2H), 1.58 (ddd, J = 21.2, 13.8, 8.1 Hz, 4H), 1.43 – 1.33 (m, 2H).

\[ \text{13C NMR (101 MHz, DMSO-d6)} \delta 163.7 (s), 161.1 (s), 158.4 (s), 149.8 (s), 145.6 (s), 145.2 (s), 135.9 (s), 130.1 (s), 128.24 (s), 127.0 (s), 113.6 (s), 105.6 (s), 86.3 (s), 86.2 (s), 85.1 (s), 70.7 (s), 64.0 (s), 55.4 (s), 50.7 (s), 33.1 (s), 33.0 (s), 23.7 (s).

Anal. Calcd for C\textsubscript{36}H\textsubscript{39}N\textsubscript{3}O\textsubscript{8}: C, 67.38; H, 6.13; N, 6.55; Found: C, 67.16; H, 6.05; N, 6.27.

\[ \text{N-adamantyl amine-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3q):} \]

\[ \text{3q} \]

Off-white solid; Yield: 530 mg (75%).

\[ \text{H NMR (500 MHz, DMSO-d6)} \delta 11.91 (s, 1H), 8.56 (s, 1H), 8.39 (d, J = 3.0 Hz, 1H), 7.35 (d, J = 7.9 Hz, 2H), 7.31 – 7.20 (m, 6H), 7.20 – 7.16 (m, 1H), 6.87 (d, J = 8.8 Hz, 4H), 6.05 (t, J = 6.4 Hz, 1H), 5.35 – 5.31 (m, 1H), 4.11 – 4.05 (m, 1H), 3.93 – 3.88 (m, 1H), 3.71 (d, J = 2.6 Hz, 6H), 3.17 (d, J = 4.1 Hz, 2H), 2.29 – 2.23 (m, 1H), 2.21 – 2.15 (m, 1H), 1.95 (dd, J = 3.7, 11.4 Hz, 9H), 1.65 – 1.55 (m, 6H).

\[ \text{13C NMR (126 MHz, DMSO-d6)} \delta 163.8 (s), 160.4 (s), 158.4 (s), 149.8 (s), 145.5 (s), 145.2 (s), 135.7 (s), 130.1 (s), 128.2 (s), 128.0 (s), 127.0 (s), 113.6 (s), 106.1 (s), 86.2 (s), 86.2 (s), 86.1 (s), 70.7 (s), 64.0 (s), 55.3 (s), 51.1 (s), 42.4 (s), 41.6 (s), 36.5 (s), 36.3 (s), 29.3 (s), 29.2 (s).

Anal. Calcd for C\textsubscript{41}H\textsubscript{45}N\textsubscript{3}O\textsubscript{8}: C, 69.57; H, 6.41; N, 5.94; Found: C, 69.53; H, 6.27; N, 5.69.

\[ \text{N-n-decyl amine-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3r):} \]
Off-white solid; Yield: 541 mg (76%).

$^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 11.89 (ddd, $J = 11.4, 8.7, 4.2$ Hz, 1H), 8.63 (s, 1H), 8.40 (s, 1H), 7.31 (d, $J = 7.1$ Hz, 2H), 7.25 − 7.13 (m, 6H), 6.82 (d, $J = 8.4$ Hz, 4H), 6.06 − 6.00 (m, 1H), 5.32 (d, $J = 3.5$ Hz, 1H), 4.11 − 4.03 (m, 1H), 3.89 (d, $J = 3.4$ Hz, 1H), 3.67 (s, 6H), 3.17 (dd, $J = 11.9, 7.2$ Hz, 4H), 2.23 (s, 1H), 2.16 (d, $J = 6.3$ Hz, 1H), 1.40 (d, $J = 3.8$ Hz, 2H), 1.17 (s, 18H).

$^{13}$C NMR (101 MHz, DMSO-d$_6$) $\delta$ 163.6 (s), 161.6 (s), 158.4 (s), 149.8 (s), 145.6 (s), 145.2 (s), 135.9 (s), 135.7 (s), 130.1 (s), 128.2 (s), 126.9 (s), 113.6 (s), 105.7 (s), 86.3 (s), 86.2 (s), 86.1 (s), 70.7 (s), 63.9 (s), 55.3 (s), 38.8 (s), 31.7 (s), 29.5 (s), 29.4 (s), 29.3 (s), 29.1 (s), 26.8 (s), 22.5 (s), 14.3 (s).

Anal. Calcd for C$_{41}$H$_{51}$N$_3$O$_8$: C, 68.98; H, 7.20; N, 5.89; Found: C, 68.78; H, 7.01; N, 5.71.

**N-oleyl amine 5-carboxamide-5'-O-DMT-2'-deoxyuridine (3s):**

Off-white solid; Yield: 675 mg (82%).

$^1$H NMR (500 MHz, DMSO-d$_6$) $\delta$ 11.94 (s, 1H), 8.66 (t, $J = 5.6$ Hz, 1H), 8.43 (s, 1H), 7.34 (d, $J = 7.9$ Hz, 2H), 7.21 (ddd, $J = 30.6, 14.0, 7.3$ Hz, 7H), 6.89 − 6.81 (m, 4H), 6.06 (t, $J = 6.4$ Hz, 1H), 5.35 − 5.24 (m, 3H), 4.08 (dt, $J = 8.5, 4.2$ Hz, 1H), 3.91 (dd, $J = 8.5, 4.3$ Hz, 1H), 3.70 (s, 6H), 3.21 (dd, $J = 12.7, 6.4$ Hz, 2H), 3.16 (d, $J = 4.1$ Hz, 2H), 2.29 − 2.22 (m, 1H), 2.22 − 2.14 (m, 1H), 2.00 − 1.85 (m, 4H), 1.42 (d, $J = 5.7$ Hz, 2H), 1.20 (s, 22H), 0.81 (t, $J = 5.7$ Hz, 3H).

$^{13}$C NMR (126 MHz, DMSO-d$_6$) $\delta$ 163.6 (s), 161.6 (s), 158.4 (s), 149.8 (s), 145.7 (s), 145.2 (s), 135.9 (s), 135.7 (s), 130.2, 130.0 (s), 128.0 (s), 127.0 (s), 113.6 (s), 105.7 (s), 86.3 (s), 86.2 (s), 86.1 (s), 70.7 (s), 63.9 (s), 55.3 (s), 38.8 (s), 32.3 (s), 31.7 (s), 29.5 (s), 29.2(s), 29.1(s), 29.0 (s), 27.0 (s), 26.8 (s), 22.5 (s), 14.3 (s).
N-(Piperidine)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3t):

White solid; Yield: 461 mg (72%).

$^1$H NMR (500 MHz, DMSO-d$_6$) δ 11.58 (s, 1H), 7.66 (s, 1H), 7.34 (d, $J$ = 7.4 Hz, 2H), 7.28 (t, $J$ = 7.7 Hz, 2H), 7.24 – 7.18 (m, 5H), 6.87 (d, $J$ = 8.3 Hz, 4H), 6.11 (t, $J$ = 6.7 Hz, 1H), 5.33 (t, $J$ = 4.6 Hz, 1H), 4.22 (dt, $J$ = 9.1, 4.6 Hz, 1H), 3.90 – 3.87 (m, 1H), 3.72 (d, $J$ = 0.5 Hz, 6H), 3.49 – 3.35 (m, 2H), 3.28 – 3.06 (m, 5H), 1.51 – 1.24 (m, 7H).

$^{13}$C NMR (126 MHz, dmoso) δ 162.3 (s), 160.7 (s), 158.4 (s), 150.2 (s), 145.1 (s), 139.7 (s), 136.0 (s), 130.0 (s), 128.3 (s), 128.0 (s), 127.0 (s), 113.6 (s), 112.4 (s), 86.2 (s), 86.1 (s), 85.3 (s), 79.6 (s), 70.9 (s), 64.1 (s), 55.4 (s), 47.9 (s), 42.4 (s), 26.2 (s), 25.4 (s), 24.2 (s).

Anal. Calcd for C$_{36}$H$_{39}$N$_3$O$_8$: C, 67.38; H, 6.13; N, 6.55; Found: C, 67.45; H, 6.20; N, 6.45.

N-(Pyrrolidine)-5-carboxamide-5'-O-DMT-2'-deoxyuridine (3u):

Off-white solid; Yield: 470 mg (75%).

$^1$H NMR (500 MHz DMSO-d$_6$) δ 11.62 (s, 1H), 7.76 (s, 1H), 7.34 (d, $J$ = 7.5 Hz, 2H), 7.27 (t, $J$ = 7.7 Hz, 2H), 7.21 (ddd, $J$ = 17.7, 10.7, 6.0 Hz, 5H), 6.89 – 6.83 (m, 4H), 6.11 (t, $J$ = 6.7 Hz, 1H), 5.34 (d, $J$ = 4.4 Hz, 1H), 4.24 (dt, $J$ = 9.1, 4.4 Hz, 1H), 3.91 – 3.88 (m, 1H), 3.71 (s, 6H), 3.25 – 3.15 (m, 4H), 3.09 – 3.05 (m, 2H), 2.25 – 2.19 (m, 2H), 1.70 – 1.58 (m, 4H).
\(^{13}\)C NMR (126 MHz, DMSO-d6) \(\delta\) 162.2 (s), 160.4 (s), 158.4 (s), 150.1 (s), 145.1 (s), 140.5 (s), 135.9 (s), 130.0 (s), 128.3 (s), 128.0 (s), 127.0 (s), 113.6 (s), 113.2 (s), 86.2 (s), 86.1 (s), 85.3 (s), 70.9 (s), 64.1 (s), 55.4 (s), 47.3 (s), 45.9 (s), 36.2 (s), 25.7 (s), 24.2 (s).

Anal. Calcd for C\(_{35}\)H\(_{37}\)N\(_3\)O\(_8\): C, 66.97; H, 5.94; N, 6.69; Found: C, 66.88; H, 5.87; N, 6.85.

5-(morpholine) carboxamide-5'-0-DMT-2'-deoxyuridine (3v):

![Chemical structure of 3v](image)

Off-white solid; Yield: 527 mg (82%).

\(^1\)H NMR (400 MHz, DMSO-d6) \(\delta\) 11.58 (s, 1H), 7.77 – 7.72 (m, 1H), 7.35 – 7.16 (m, 9H), 6.85 (d, \(J = 8.6\) Hz, 4H), 6.09 (dt, \(J = 11.2, 5.5\) Hz, 1H), 5.29 (dd, \(J = 8.3, 4.3\) Hz, 1H), 4.19 (dd, \(J = 10.9, 7.6\) Hz, 1H), 4.04 – 3.94 (m, 1H), 3.90 – 3.84 (m, 1H), 3.70 (s, 6H), 3.47 – 3.40 (m, 2H), 3.20 – 3.03 (m, 4H), 2.24 – 2.14 (m, 2H), 1.98 – 1.93 (m, 1H), 1.25 – 1.09 (m, 2H).

\(^{13}\)C NMR (126 MHz, DMSO-d6) \(\delta\) 162.7 (s), 160.7 (s), 158.4 (s), 150.2 (s), 145.2 (s), 140.9 (s), 135.9 (s), 130.0 (s), 128.3 (s), 128.0 (s), 127.0 (s), 113.6 (s), 113.1 (s), 111.6 (s), 86.1 (s), 85.4 (s), 70.8 (s), 66.6 (s), 64.1 (s), 55.4 (s), 47.5 (s), 42.3 (s), 21.2 (s), 14.5 (s).

Anal. Calcd for C\(_{35}\)H\(_{37}\)N\(_3\)O\(_9\): C, 65.31; H, 5.79; N, 6.53; Found: C, 65.09; H, 5.53; N, 6.43.

4-chloro-5-iodo-7H-pyrrolo[2,3-d]pyrimidine (4b):
Procedure: In a clean and dry Schlenk tube added 6-chloro-7-deaza purine (1 mmol) and 6 mL of dry DMF under the flow of nitrogen. Then, N-iodosuccinimide (1.1 mmol) was added under N_2. The reaction mass was allowed to stir at RT for 4 hours. Progress of the reaction was monitored by TLC. After the completion of reaction, the reaction mass was poured in 50 mL ice cold water containing sodium thiosulphate (0.5 mmol). The solid obtained filtered at Buchner funnel, washed with cold water several times and dried under high vacuum.

^1^H NMR (400 MHz, DMSO-d6) δ 12.90 (s, 1H), 8.55 (s, 1H), 7.89 (s, 1H).

^1^3^C NMR (126 MHz, DMSO-d6) δ 157.2 (s), 151.9 (s), 150.9 (s), 127.4 (s), 103.1 (s), 50.8 (s).

Anal. Calcd for C_6H_3ClIN_3: C, 25.79; H, 1.08; N, 15.04
Found: C, 25.75; H, 1.11; N, 15.14.

4-chloro-5-iodo-7-tosyl-7H-pyrrolo[2,3-d]pyrimidine (4c):

In a clean and dry Schlenk tube, added 4-chloro-5-iodo-7H-pyrrolo[2,3-d]pyrimidine (4b, 1 mmol) and THF (10 mL). To this solution, added NaH (1.2 mmol) under nitrogen flow. The reaction mass was cooled to 0 °C and allowed to stir the solution for 15-20 min. Then, added p-toluenesulfonyl chloride (1.2 mmol) portionwise (precaution should take that, temp not rise above 10 °C), then the reaction mass was allowed to stir at RT for 1 hr. The reaction mass extracted by using sat. NaHCO_3 solution and ethyl acetate. Collect the organic layer and add anhydrous sodium sulphate and concentrated under reduced pressure to give the product as a white solid.

White solid; Yield 255 mg (59%).

^1^H NMR (400 MHz, DMSO-d6) δ 8.78 (s, 1H), 8.32 (s, 1H), 8.05 (s, 1H), 8.03 (s, 1H), 7.46 (s, 1H), 7.44 (s, 1H), 2.35 (s, 3H).
$^{13}$C NMR (101 MHz, DMSO-d6) δ 152.9 (s), 152.8 (s), 150.4 (s), 147.2 (s), 133.8 (s), 133.0 (s), 130.8 (s), 128.53 (s), 118.8 (s), 59.4 (s), 21.6 (s).

Anal. Calcd for C$_{13}$H$_9$ClN$_3$O$_2$S: C, 36.01; H, 2.09; N, 9.69; S, 7.39; Found: C, 36.25; H, 2.22; N, 9.78; S, 7.45.

N-benzyl-4-(benzylamino)-7-tosyl-7H-pyrrolo[2,3-d]pyrimidine-5-carboxamide (4d):

![Chemical structure of 4d](image)

White solid; 409 mg (80%).

$^1$H NMR (400 MHz, DMSO-d6) δ 10.00 (dq, $J = 5.6$, 3.5 Hz, 1H), 9.42 – 9.35 (m, 1H), 8.58 (s, 1H), 8.22 (s, 1H), 7.99 (d, $J = 7.8$ Hz, 2H), 7.43 (d, $J = 7.9$ Hz, 2H), 7.37 – 7.12 (m, 10H), 4.69 (d, $J = 5.4$ Hz, 2H), 4.45 (d, $J = 4.4$ Hz, 2H), 2.33 (s, 3H).

$^{13}$C NMR (101 MHz, DMSO-d6) δ 163.8 (s), 156.9 (s), 154.6 (d), 150.3 (s), 146.7 (s), 139.5 (s), 139.1 (s), 134.1 (s), 130.6 (s), 128.8 (d), 128.4 (s), 127.9 (s), 127.6 – 127.1 (m), 124.8 (s), 114.2 (s), 102.9 (s), 43.7 (s), 43.1 (s), 21.5 (s).

Anal. Calcd for: C$_{28}$H$_{25}$N$_5$O$_3$S: C, 65.74; H, 4.93; N, 13.69; S, 6.27; Found: C, 65.72; H, 4.96; N, 13.72; S, 6.32.

**Reaction with other nucleosides:**

![Chemical structures and reaction conditions](image)

**Scheme S1:** Aminocarbonylation reaction of 5-iodo-2'-deoxycytidine (5-IdC)
Scheme S2: Aminocarbonylation reaction of 8-Bromo-2'-deoxyguanosine (8-BrdG)

Scheme S3: Aminocarbonylation reaction of 8-Bromo-2'-deoxyadenosine (8-BrdA)

Scheme S4: Aminocarbonylation reaction of 2'-deoxy-5-iodo-3',5'-O-[1,1,3,3-tetrakis(1-methylethyl)-1,3-disiloxanediy]-uridine

4-Chloro-N-(2-morpholinoethyl)benzamide (Moclebimide) (5c):
General procedure followed by employing 2 equivalent triethylamine and 2 equivalent of 2-morpholinoethan-1-amine.

White solid; Yield: 190 mg (94%).

$^1$H NMR (500 MHz, CDCl$_3$) δ 8.35 – 8.26 (m, 2H), 7.55 (t, $J = 9.7$ Hz, 1H), 7.48 – 7.41 (m, 2H), 3.74 – 3.71 (m, 4H), 3.50 – 3.46 (m, 2H), 2.58 (ddd, $J = 5.9, 5.3, 2.2$ Hz, 2H), 2.50 (s, 4H).

$^{13}$C NMR (126 MHz, CDCl$_3$) δ 186.7 (s), 161.5 (s), 141.1 (s), 132.6 (s), 128.9 (s), 66.9 (s), 56.6 (s), 53.3 (s), 35.7 (s).

**N,N-Diethylnicotinamide (Nikethamide) (6b):**

General procedure followed by employing 2 equivalent triethylamine and 2 equivalent of diethyl amine

Pale yellow oil; Yield: 163 mg (92%).

$^1$H NMR (500 MHz, DMSO-d6) δ 8.61 (dd, $J = 4.9, 1.7$ Hz, 1H), 8.56 – 8.53 (m, 1H), 7.99 – 7.76 (m, 1H), 7.44 (ddd, $J = 7.8, 4.9, 0.8$ Hz, 1H), 3.43 (d, $J = 6.6$ Hz, 2H), 3.15 (d, $J = 6.7$ Hz, 2H), 1.13 (t, $J = 6.3$ Hz, 3H), 1.03 (t, $J = 6.3$ Hz, 3H).

$^{13}$C NMR (126 MHz, DMSO-d6) δ 168.0 (s), 150.4 (s), 147.2 (s), 134.4 (s), 133.4 (s), 123.9 (s), 43.3 (s), 39.3 (s), 14.4 (s), 13.2 (s).
3u
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