Supporting Information

Highly efficient syntheses of [methyl-\textsuperscript{11}C]thymidine and its analogue 4’-[methyl-\textsuperscript{11}C]thiothymidine as nucleoside PET probes for cancer cell proliferation by Pd\textsuperscript{0}-mediated rapid C-\textsuperscript{11}C methylation

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1. General Information

2. a) HPLC chart for co-injection of 1 (retention time: 10.5 min), b) HPLC chart for co-injection of 4 (retention time: 12.0 min), c) HPLC chart for co-injection of [\textsuperscript{11}C]1 (retention time: 6.8 min), d) HPLC chart for co-injection of [\textsuperscript{11}C]4 (retention time: 7.4 min).
3. a) HPLC chart after the rapid $[^{11}\text{C}]$C-methylation of $[^{11}\text{C}]\text{CH}_3\text{I}$ and 6, giving $[^{11}\text{C}]\text{I}$ (retention time: 12.5 min), and b) HPLC chart after purification of $[^{11}\text{C}]\text{I}$

4. a) HPLC chart after the rapid $[^{11}\text{C}]$C-methylation of $[^{11}\text{C}]\text{CH}_3\text{I}$ and 5, giving $[^{11}\text{C}]\text{4}$ (retention time: 12.5 min), and b) HPLC chart after purification of $[^{11}\text{C}]\text{4}$
1. General information

Instrument: Shimadzu HPLC system with a system controller (SCL-10AVP), a degasser (DGU-12A), a liquid chromatograph (LC-10AT and LC-10ATVP), a column oven (CTO-10AVP), an UV-vis detector (SPD-10A), and software (CLASS-VP); column, SHIM-PACK CLC-ODS (6.0 mm I.D. × 250 mm, SHIMADZU); mobil phase, CH$_3$CN:100 mM NaH$_2$PO$_4$ containing 200 mM NaClO$_4$ (pH 2) (6:94, v/v); flow rate, 1.0 mL min$^{-1}$; detection, UV 260 nm; column temperature, 40 °C; retention time, thymidine (1), 10.7 min.

Instrument: JASCO HPLC system with a chromatography interface (LC-Net II/ADC), a quaternary HPLC pump (PU-2089Plus), a diode array detector (MD-2010Plus), a column oven (CO-2065Plus), a recycling valve unit (RV-2080-02), and software (chrom NAV chromatography data system); column, SHIM-PACK CLC-ODS (6.0 mm I.D. × 150 mm, SHIMADZU); mobil phase, CH$_3$CN:100 mM NaH$_2$PO$_4$ containing 200 mM NaClO$_4$ (pH 2) (6:94, v/v); flow rate, 1.0 mL min$^{-1}$; detection, UV 260 nm; column temperature, 40 °C; retention time, 4’-thiothymidine (4), 12.0 min; 2’-deoxy-4’-thiouridine (8), 6.8 min.

Shimadzu HPLC system with a system controller (CBM-20A), an online degasser (DHU-20A$_3$), a solvent delivery unit (LC-20AD), a column oven (CTO-20AC), a photodiode array detector (SPD-20A), and software (LC solution) and an Aloka radioanalyzer (RLC-700).
Preparative HPLC conditions: semi-preparative column, Gemini 5 C18 (21.2 mm I.D. × 250 mm, Phenomenex); mobile phase, CH$_3$CN:100 mM NH$_4$HCO$_3$ (pH 7.8) (4:96, v/v); flow rate, 9.9 mL min$^{-1}$; detection, UV 265 nm; retention time of [methyl-$^{11}$C]thymidine, 12.5 min; mobile phase, CH$_3$CN:100 mM NH$_4$HCO$_3$ (pH 7.8) (7:93, v/v); flow rate, 9.9 mL min$^{-1}$; detection, UV 270 nm; retention time of 4′-[methyl-$^{11}$C]thiothymidine, 12.5 min.

Analytical HPLC conditions for determination of purity: column, Luna 5 C18 (4.6 mm I.D. × 150 mm, Phenomenex); mobile phase, CH$_3$CN:100 mM NH$_4$HCO$_3$ (pH 7.8) (4:97, v/v); flow rate, 1.0 mL min$^{-1}$; detection, UV 265 nm; retention time of [methyl-$^{11}$C]thymidine, 6.9 min; mobile phase, CH$_3$CN:100 mM NH$_4$HCO$_3$ (pH 7.8) (8:93, v/v); flow rate, 1.0 mL min$^{-1}$; detection, UV 270 nm; retention time of 4′-[methyl-$^{11}$C]thiothymidine, 7.5 min.

2. a) HPLC chart for co-injection of 1 (retention time: 10.5 min)
b) HPLC chart for co-injection of 4 (retention time: 12.0 min)

![HPLC chart for co-injection of 4](image)

3. a) HPLC chart after the rapid $^{[11}C\text{]C}$-methylation of $^{[11}C\text{]CH}_3I$ and 6, giving $^{[11}C\text{]}1$ (retention time: 12.5 min), and b) HPLC chart after purification of $^{[11}C\text{]}1$. 

c) HPLC chart for co-injection of $^{[11}C\text{]}1$ (retention time: 6.8 min)

![HPLC chart for co-injection of $^{[11}C\text{]}1$](image)

d) HPLC chart for co-injection of $^{[11}C\text{]}4$ (retention time: 7.4 min)

![HPLC chart for co-injection of $^{[11}C\text{]}4$](image)
3. a) HPLC chart after the rapid $[^{11}\text{C}]\text{C}$-methylation of $[^{11}\text{C}]\text{CH}_3\text{I}$ and 5, giving $[^{11}\text{C}]4$ (retention time: 12.5 min), and b) HPLC chart after purification of $[^{11}\text{C}]4$.