Supporting Information

Regioselective Hydrochlorination of Unactivated Alkenes through Combined Acid System

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1. General

$^1$H and $^{13}$C NMR spectra were recorded at 400 MHz and 101 MHz using CDCl$_3$ as a solvent. The chemical shifts are reported in $\delta$ (ppm) values ($^1$H and $^{13}$C NMR relative to CHCl$_3$, $\delta$ 7.26 ppm for $^1$H NMR and $\delta$ 77.0 ppm for $^{13}$C NMR and CFCl$_3$ ($\delta$ 0 ppm for $^{19}$F NMR), multiplicities are indicated by s (singlet), d (doublet), t (triplet), q (quartet), p (pentet), h (hextet), m (multiplet) and br (broad). Coupling constants ($J$), are reported in Hertz (Hz). All reagents and solvents were employed without further purification. The products were purified using a commercial flash chromatography system. TLC was developed on silica gel 60 F254 aluminum sheets. All reagents were purchased from Sigma-Aldrich or Alfa Aesar and used as received without any further purification. HCl/DMPU (43% w/w) was prepared following our reported work.\[1\]

2. General procedures

2.1 General procedure for hydrochlorination of alkenes with combined acid system

HCl/DMPU (43% w/w, 8 equiv) was added to a solution of alkene 1 (0.2 mmol) in AcOH (0.5 ml), the mixture was stirred at room temperature for designated time. Then the reaction mixture was diluted with Et$_2$O (1 ml), sequentially washed with water (1 ml), NaHCO$_3$ aqueous solution (2 x 1 ml) and brine (1 ml). The organic layer was dried over Na$_2$SO$_4$ and concentrated to dryness. The residue was purified by flash chromatography on silica gel (hexanes/ethyl acetate) to obtain pure product 2.

2.2 Additive-based screening for heterocycles

HCl/DMPU (43% w/w, 8 equiv) and heterocycle additives (0.2 mmol, 1 equiv) were added to a solution of styrene 1a (0.2 mmol) in AcOH (0.5 ml), the mixture was stirred at room temperature for 6 h. Then internal standard CH$_2$Br$_2$ (0.2 mmol, 1 equiv) was added into the reaction mixture. Both reaction yield and additive remaining were determined through analysis of crude $^1$H NMR.

2.3 Comparison of efficiency with different HCl sources

HCl sources (8 equiv) was added to a solution of styrene 1a (0.4 mmol) in AcOH (1 ml), the mixture was stirred at room temperature for 5 h. The reaction yield was monitored at 20 min, 40 min, 1 h, 1.5 h, 2 h, 3 h and 5 h through analysis of crude $^1$H NMR.

2.4 Study of the effect of chloride concentration

Four parallel reactions with styrene 1a (0.4 mmol), HCl/DMPU (43% w/w, 2 equiv) in AcOH (1 ml) were set up, then 0, 1, 2 and 4 equivalents of LiCl was added respectively, the reaction mixtures were stirred at room temperature for 5 h. The reaction yields were monitored at 20 min, 40 min, 1 h, 1.5 h, 2 h, 3 h and 5 h through analysis of crude $^1$H NMR.

2.5 Mechanism study of hydrochlorination of styrene
A) KIE study for hydrochlorination of styrene

Two parallel reactions with styrene 1a (0.4 mmol), HCl/DMPU (43% w/w, 2 equiv) in AcOH (1 ml) and AcOD (1 ml) were set up, then the reaction mixtures were stirred at room temperature for 5 h. The reaction yields were monitored at 20 min, 40 min, 1 h, 1.5 h, 2 h, 3 h and 5 h through analysis of crude 1H NMR. The reaction rates were showed in Scheme S1.

![Reaction rates in AcOH and AcOD.](image)

**Scheme S1.** Reaction rates in AcOH and AcOD.

B) Mechanism study for step 1: acetylation of styrene

Four parallel reactions were set up: (1) styrene 1a (0.4 mmol), TfOH (2 equiv) in AcOH (1 ml); (2) styrene 1a (0.4 mmol), Ga(OTf)₃ (2 equiv) in AcOH (1 ml); (3) styrene 1a (0.4 mmol), Ga(OTf)₃ (2 equiv) in AcOD (1 ml); (4) styrene 1a (0.4 mmol) in AcOH (1 ml). Then the reaction mixtures were stirred at room temperature for 5 h. The reaction yields were monitored at 20 min, 40 min, 1 h, 1.5 h, 2 h, 3 h and 5 h through analysis of crude 1H NMR. The reaction rates of reaction (2) and (3) were showed in Scheme S2.
**Scheme S2.** Reaction rates of reaction (2) and (3).

**C) Mechanism study for step 2: chlorination**

Five parallel reactions with 1-phenylethyl acetate (0.4 mmol), HCl/DMPU (2 equiv) in solvents: (1) AcOH (1 ml); (2) AcOD (1 ml); (3) DCM (1 ml); (4) Tol (1 ml); (5) DMF were set up. Then the reaction mixtures were stirred at room temperature for 5 h. The reaction yields were monitored at 20 min, 40 min, 1 h, 1.5 h, 2 h, 3 h and 5 h through analysis of crude $^1$H NMR. The reaction rates of reaction (1) and (2) were showed in Scheme S3.

**Scheme S3.** Reaction rates of reaction (1) and (2).

**2.6 Gram-scale synthesis of 2a**

HCl/DMPU (43% w/w, 8 equiv) was added to a solution of styrene 1a (1.04g, 10 mmol) in AcOH (25 ml), the mixture was stirred at room temperature for 6 h. Then the reaction mixture was diluted with $\text{Et}_2\text{O}$ (25 ml), sequentially washed with water (25 ml), $\text{NaHCO}_3$ aqueous solution (2 × 25 ml) and brine (25 ml). The organic layer was dried over $\text{Na}_2\text{SO}_4$ and concentrated to dryness. The residue was purified by flash chromatography on silica gel to obtain pure product 2a with 90% yield.
3. Characterization of product 2

(1-chloroethyl)benzene (2a)[2]

\[
\begin{array}{c}
\text{Cl} \\
\text{C} \\
\end{array}
\]

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.43 – 7.25 (m, 5H), 5.09 (q, \(J = 6.8\) Hz, 1H), 1.85 (d, \(J = 6.8\) Hz, 3H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 142.78, 141.69, 128.60, 128.22, 126.47, 58.76, 26.50. Colorless oil (24.4 mg).

1-(1-chloroethyl)-2-methylbenzene (2b)[3]

\[
\begin{array}{c}
\text{Cl} \\
\text{C} \\
\text{CH}_3 \\
\end{array}
\]

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.53 (d, \(J = 7.5\) Hz, 1H), 7.25 – 7.15 (m, 3H), 5.35 (q, \(J = 6.7\) Hz, 1H), 2.42 (s, 3H), 1.87 (d, \(J = 6.8\) Hz, 3H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 140.42, 135.22, 130.55, 128.14, 156.50, 125.69, 55.00, 25.16, 18.99. Colorless oil (28.0 mg).

1-(1-chloroethyl)-3-methylbenzene (2c)[3]

\[
\begin{array}{c}
\text{Cl} \\
\text{C} \\
\text{CH}_3 \\
\end{array}
\]

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.27 – 7.21 (m, 3H), 7.12 (d, \(J = 7.1\) Hz, 1H), 5.07 (q, \(J = 6.8\) Hz, 1H), 2.37 (s, 3H), 1.84 (d, \(J = 6.8\) Hz, 3H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 142.71, 138.33, 129.02, 128.52, 127.19, 123.51, 58.91, 26.48, 21.41. Colorless oil (29.5 mg).

1-(1-chloroethyl)-4-methylbenzene (2d)[4]

\[
\begin{array}{c}
\text{Cl} \\
\text{C} \\
\text{CH}_3 \\
\end{array}
\]

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.31 (d, \(J = 7.8\) Hz, 2H), 7.16 (d, \(J = 7.8\) Hz, 2H), 5.08 (q, \(J = 6.9\) Hz, 1H), 2.34 (s, 3H), 1.84 (d, \(J = 6.8\) Hz, 3H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 139.87, 138.10, 129.27, 126.39, 58.81, 26.43, 21.13. Colorless oil (27.7 mg).

1-(tert-butyl)-4-(1-chloroethyl)benzene (2e)[5]
$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.42 – 7.30 (m, 4H), 5.10 (q, $J = 6.8$ Hz, 1H), 1.85 (d, $J = 6.8$ Hz, 3H), 1.31 (s, 9H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 151.27, 139.74, 126.18, 125.54, 58.74, 34.58, 31.28, 26.36. Colorless oil (33.8 mg).

1-(1-chloroethyl)-3-methoxybenzene (2f)$^6$

![Molecular structure of 1-(1-chloroethyl)-3-methoxybenzene](image)

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.27 (d, $J = 8.2$ Hz, 1H), 7.02 – 6.95 (m, 2H), 6.84 (d, $J = 8.2$ Hz, 1H), 5.06 (q, $J = 6.8$ Hz, 1H), 3.82 (s, 3H), 1.84 (d, $J = 6.8$ Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 159.70, 144.32, 129.64, 118.75, 113.62, 112.23, 58.64, 55.26, 26.50. Colorless oil (32.4 mg).

1-(1-chloroethyl)-2-methoxybenzene (2g)$^7$

![Molecular structure of 1-(1-chloroethyl)-2-methoxybenzene](image)

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.33 (d, $J = 7.5$ Hz, 1H), 7.24 (t, $J = 7.8$ Hz, 1H), 6.96 (t, $J = 7.4$ Hz, 1H), 6.87 (d, $J = 8.2$ Hz, 1H), 5.09 (d, $J = 6.3$ Hz, 1H), 3.85 (s, 2H), 1.50 (d, $J = 6.5$ Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 156.51, 133.35, 128.28, 126.07, 120.76, 110.38, 66.53, 55.23, 22.81. Colorless oil (30.7 mg).

1-(1-chloroethyl)-4-fluorobenzene (2h)$^3$

![Molecular structure of 1-(1-chloroethyl)-4-fluorobenzene](image)

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.43 – 7.37 (m, 2H), 7.05 – 7.01 (m, 2H), 5.08 (q, $J = 6.8$ Hz, 1H), 1.83 (d, $J = 6.8$ Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 162.36 (d, $J = 246.0$ Hz), 138.69, 128.25 (d, $J = 9.0$ Hz), 115.47 (d, $J = 21.0$ Hz), 57.92, 26.56. Colorless oil (29.5 mg).

1-chloro-4-(1-chloroethyl)benzene (2i)$^4$

![Molecular structure of 1-chloro-4-(1-chloroethyl)benzene](image)

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.41 – 7.26 (m, 4H), 5.05 (q, $J = 6.8$ Hz, 1H), 1.82 (d, $J = 6.8$ Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 141.29, 133.95, 128.77, 127.89. Colorless oil (32.9 mg).

1-(1-chloroethyl)-4-(trifluoromethyl)benzene (2j)$^8$

![Molecular structure of 1-(1-chloroethyl)-4-(trifluoromethyl)benzene](image)
1H NMR (400 MHz, CDCl₃) δ 7.61 (d, J = 8.2 Hz, 2H), 7.53 (d, J = 8.1 Hz, 2H), 5.10 (q, J = 6.9 Hz, 1H), 1.84 (d, J = 6.8 Hz, 3H). 13C NMR (100 MHz, CDCl₃) δ 146.56, 130.18 (m), 126.89, 125.65 (d, J = 3.0 Hz), 57.47, 26.45. Colorless oil (32.5 mg).

(1-chloropropyl)benzene (2k)[9]

1H NMR (400 MHz, CDCl₃) δ 7.39 – 7.28 (m, 5H), 4.79 (t, J = 8.0 Hz, 1H), 2.22 – 1.99 (m, 2H), 1.00 (t, J = 8.0 Hz, 3H). 13C NMR (100 MHz, CDCl₃) δ 141.75, 128.54, 128.14, 126.95, 65.46, 33.20, 11.69. Colorless oil (22.6 mg).

2-chlorooctane (2m)[10]

1H NMR (400 MHz, CDCl₃) δ 4.02 (q, J = 6.6 Hz, 1H), 1.73 – 1.66 (m, 2H), 1.56 – 1.28 (m, 11H), 0.89 – 0.86 (m, 3H). 13C NMR (100 MHz, CDCl₃) δ 58.88, 40.36, 31.67, 28.76, 26.59, 25.31, 22.54, 14.00. Colorless oil (19.33 mg).

2-chlorotridecane (2n)[11]

1H NMR (400 MHz, CDCl₃) δ 4.02 (q, J = 6.7 Hz, 1H), 1.70 (td, J = 5.7, 3.0 Hz, 2H), 1.55 – 1.17 (m, 21H), 0.93 – 0.78 (m, 3H). 13C NMR (100 MHz, CDCl₃) δ 58.95, 40.37, 31.89, 29.61, 29.55, 29.48, 29.32, 29.11, 26.65, 26.51, 25.33, 22.67, 14.09. Colorless oil (31.1 mg).

(2-chloropropyl)benzene (2o)[12]

1H NMR (400 MHz, CDCl₃) δ 7.39 – 7.15 (m, 5H), 4.24 – 4.19 (m, 1H), 3.02 (ddd, J = 50.8, 13.8, 6.8 Hz, 2H), 1.50 (d, J = 6.5 Hz, 3H). 13C NMR (100 MHz, CDCl₃) δ 137.94, 129.31, 128.38, 126.76, 58.50, 46.66, 24.64. Colorless oil (24.4 mg).

1-(2-chloropropyl)-4-methylbenzene (2p)[13]
$^1$H NMR (400 MHz, CDCl$_3$) δ 7.11 (m, 4H), 4.24 – 4.16 (m, 1H), 2.99 (dd, $J$ = 50.7, 13.8, 6.9 Hz, 2H), 2.33 (s, 3H), 1.50 (d, $J$ = 6.5 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 136.33, 134.90, 129.19, 129.08, 58.70, 46.26, 24.62, 21.06. Colorless oil (27.3 mg).

1-(2-chloropropyl)-4-fluorobenzene (2q)$^{[13]}$

\[\text{F} \quad \text{Cl} \quad \text{CF} \]

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.25 – 6.97 (m, 4H), 4.21 – 4.13 (m, 1H), 3.12 – 2.83 (m, 2H), 1.50 (d, $J$ = 6.5 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 161.8 (d, $J$ = 244.0 Hz), 133.60, 130.79 (d, $J$ = 7.0 Hz), 115.19 (d, $J$ = 21.0 Hz), 58.44, 45.69, 24.61. Colorless oil (24.9 mg).

1-(2-chloropropyl)-4-methoxybenzene (2r)$^{[14]}$

\[\text{O} \quad \text{Cl} \]

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.11 (d, $J$ = 8.1 Hz, 2H), 6.84 (d, $J$ = 7.8 Hz, 2H), 4.20 – 4.12 (m, 1H), 3.78 (s, 3H), 2.95 (ddd, $J$ = 49.0, 13.9, 6.8 Hz, 2H), 1.48 (d, $J$ = 6.5 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 158.42, 130.30, 130.04, 113.76, 58.84, 55.21, 45.77, 24.52. Colorless oil (28.1 mg).

4-(2-chloropropyl)-1,2-dimethoxybenzene (2s)

\[\text{O} \quad \text{O} \quad \text{Cl} \]

$^1$H NMR (400 MHz, CDCl$_3$) δ 6.82 – 6.70 (m, 3H), 4.24 – 4.11 (m, 1H), 3.87 (s, 3H), 3.86 (s, 3H), 3.07 – 2.79 (m, 2H), 1.50 (d, $J$ = 8.0 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 148.79, 147.91, 130.55, 121.39, 112.59, 111.14, 58.70, 55.86, 46.27, 24.60, 24.55. HRMS(CI) calcd. for [C$_{11}$H$_{16}$ClO$_2$] ([M+H]) 215.0839; found 215.0828. Colorless oil (32.6 mg).

(3-chlorobutyl)(phenyl)sulfane (2t)

\[\text{S} \quad \text{Cl} \quad \text{Cl} \quad \text{S} \]

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.36 – 7.19 (m, 5H), 4.23 – 4.17 (m, 1H), 3.19 – 2.98 (m, 2H), 2.03 – 1.97 (m, 2H), 1.52 (d, $J$ = 8.0 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 138.85, 129.32, 128.95, 126.13, 57.05, 39.48, 30.72, 25.24. Colorless oil (30.1 mg). HRMS(CI) calcd. for [C$_{10}$H$_{12}$ClS] ([M-H]) 199.0348; found 199.0338. Colorless oil (110.6 mg).

((3-chlorobutyl)sulfonyl)benzene (2u)$^{[15]}$

\[\text{O} \quad \text{S} \quad \text{O} \quad \text{Cl} \]

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.36 – 7.04 (m, 5H), 4.23 – 4.17 (m, 1H), 3.19 – 2.98 (m, 2H), 2.03 – 1.97 (m, 2H), 1.52 (d, $J$ = 8.0 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 138.85, 129.32, 128.95, 126.13, 57.05, 39.48, 30.72, 25.24. Colorless oil (30.1 mg). HRMS(CI) calcd. for [C$_{10}$H$_{12}$ClS] ([M-H]) 199.0348; found 199.0338. Colorless oil (110.6 mg).
\[\text{H NMR (400 MHz, CDCl}_3\delta \text{ 7.92 – 7.90 (m, 2H), 7.69 – 7.65 (m, 1H), 7.60 – 7.56 (m, 2H), 4.13 – 4.05 (m, 1H), 3.38 – 3.18 (m, 2H), 2.27 – 1.98 (m, 2H), 1.51 (d, } J = 8.0 \text{ Hz, 3H).}\]

\[\text{13C NMR (100 MHz, CDCl}_3\delta \text{ 138.99, 133.87, 129.39, 127.95, 56.18, 53.66, 32.88, 25.18.}\]

Colorless oil (39.6 mg).

\[2-(3\text{-chlorobutyl})\text{isoindoline-1,3-dione (2v)}^{[16]}\]

\[\begin{align*}
N & \text{O} \\
\text{Cl} & \text{O}
\end{align*}\]

\[\text{H NMR (400 MHz, CDCl}_3\delta \text{ 7.83 – 7.68 (m, 4H), 7.69 – 7.65 (m, 1H), 7.60 – 7.56 (m, 2H), 4.06 – 4.01 (m, 1H), 3.91 – 3.77 (m, 2H), 2.13 – 2.01 (m, 2H), 1.54 (d, } J = 8.0 \text{ Hz, 3H).}\]

\[\text{13C NMR (100 MHz, CDCl}_3\delta \text{ 168.17, 133.96, 132.03, 123.24, 55.54, 38.63, 35.64, 25.27.}\]

Colorless oil (39.5 mg).

\[4-(3\text{-chlorobutoxy})\text{benzonitrile (2x)}\]

\[\begin{align*}
\text{N} & \text{C} \\
\text{Cl} & \text{O}
\end{align*}\]

\[\text{H NMR (400 MHz, CDCl}_3\delta \text{ 7.58 (d, } J = 8.0 \text{ Hz, 2H), 6.94 (d, } J = 8.0 \text{ Hz, 2H), 4.31 – 4.12 (m, 3H), 2.28 – 2.06 (m, 2H), 1.60 (d, } J = 8.0 \text{ Hz, 3H).}\]

\[\text{13C NMR (100 MHz, CDCl}_3\delta \text{ 161.96, 133.99, 119.09, 115.17, 65.24, 54.72, 39.38, 25.50. HRMS(Cl) calcd. for [C}_{11}\text{H}_{13}\text{ClNO} ([M+H]) 210.0686; found 210.0679. White solid (26.0 mg).}\]

\[1-(3\text{-chlorobutoxy})-4\text{-nitrobenzene (2y)}\]

\[\begin{align*}
\text{O} & \text{N} \\
\text{Cl} & \text{O}
\end{align*}\]

\[\text{H NMR (400 MHz, CDCl}_3\delta \text{ 8.19 (d, } J = 8.0 \text{ Hz, 2H), 6.95 (d, } J = 8.0 \text{ Hz, 2H), 4.33 – 4.17 (m, 3H), 2.31 – 2.08 (m, 2H), 1.61 (d, } J = 8.0 \text{ Hz, 3H).}\]

\[\text{13C NMR (100 MHz, CDCl}_3\delta \text{ 163.71, 141.60, 125.90, 114.42, 65.70, 54.70, 39.35, 25.51. HRMS(Cl) calcd. for [C}_{10}\text{H}_{13}\text{ClNO}_3 ([M+H]) 230.0584; found 230.0576. Colorless oil (41.3 mg).}\]

\[4-(3\text{-chlorobutoxy})\text{benzaldehyde (2z)}\]

\[\begin{align*}
\text{O} & \text{H} \\
\text{Cl} & \text{O}
\end{align*}\]

\[\text{H NMR (400 MHz, CDCl}_3\delta \text{ 9.88 (s, 1H), 7.83 (d, } J = 8.0 \text{ Hz, 2H), 7.00 (d, } J = 8.0 \text{ Hz, 2H), 4.32 – 4.17 (m, 3H), 2.29 – 2.08 (m, 2H), 1.61 (d, } J = 8.0 \text{ Hz, 3H).}\]

\[\text{13C NMR (100 MHz, CDCl}_3\delta \text{ 190.69, 163.72, 131.96, 130.09, 114.75, 65.23, 54.81, 39.48, 25.50. HRMS(Cl) calcd. for [C}_{11}\text{H}_{14}\text{ClO}_2 ([M+H]) 213.0682; found 213.0673. Colorless oil (29.8 mg).}\]

\[4\text{-chlorooctane (2a')}[17]\]

\[\text{Cl} \quad \text{Cl}\]
H NMR (400 MHz, CDCl₃) δ 3.93 – 3.87 (m, 1H), 1.73 – 1.20 (m, 10H), 0.94 – 0.83 (m, 6H). ¹³C NMR (100 MHz, CDCl₃) δ 63.94, 40.57, 38.22, 28.62, 22.25, 19.67, 13.92, 13.55. Colorless oil (21.4 mg).

chlorocyclooctane (2b')[¹⁸]

1H NMR (400 MHz, CDCl₃) δ 4.25 – 4.18 (m, 1H), 2.13 – 1.93 (m, 4H), 1.77 – 1.72 (m, 2H), 1.58 – 1.50 (m, 8H). ¹³C NMR (100 MHz, CDCl₃) δ 63.54, 35.13, 27.37, 24.89, 23.54. Colorless oil (24.4 mg).

1-chloro-1-methylcyclohexane (2c')[¹⁹]

1H NMR (400 MHz, CDCl₃) δ 1.94 – 1.85 (m, 2H), 1.76 – 1.50 (m, 10H). ¹³C NMR (100 MHz, CDCl₃) δ 72.43, 41.55, 33.46, 25.18, 22.62. Colorless oil (23.1 mg).
4. Copies of NMR spectra of product 2

![NMR Spectra of Product 2](image-url)
References