

Supplementary Materials: Lipase-Catalyzed Synthesis of Indolyl 4H-Chromenes via a Multicomponent Reaction in Ionic Liquid

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Table S1. Ionic liquids and the abbreviations.

Entry	Ionic liquid	Abbreviation
1	1-butyl-3-methylimidazolium trifluoromethanesulfonate	[BMIM][OTf]
2	1-butyl-3-methylimidazolium bis[(trifluoromethyl)sulfonyl]imide	[BMIM]N(Tf) ₂
3	1-butyl-3-methylimidazolium hexafluorophosphate	[BMIM][PF ₆]
4	1-Butyl-3-methylimidazolium acetate	[BMIM][Ac]
5	1-Butyl-3-methylimidazolium nitrate	[BMIM][NO ₃]
6	1-Butyl-3-methylimidazolium tetrafluoroborate	[BMIM][BF ₄]
7	1-Ethyl-3-methylimidazolium Tetrafluoroborate	[EMIM][BF ₄]
8	1-Hexyl-3-methylimidazolium tetrafluoroborate	[HMIM][BF ₄]

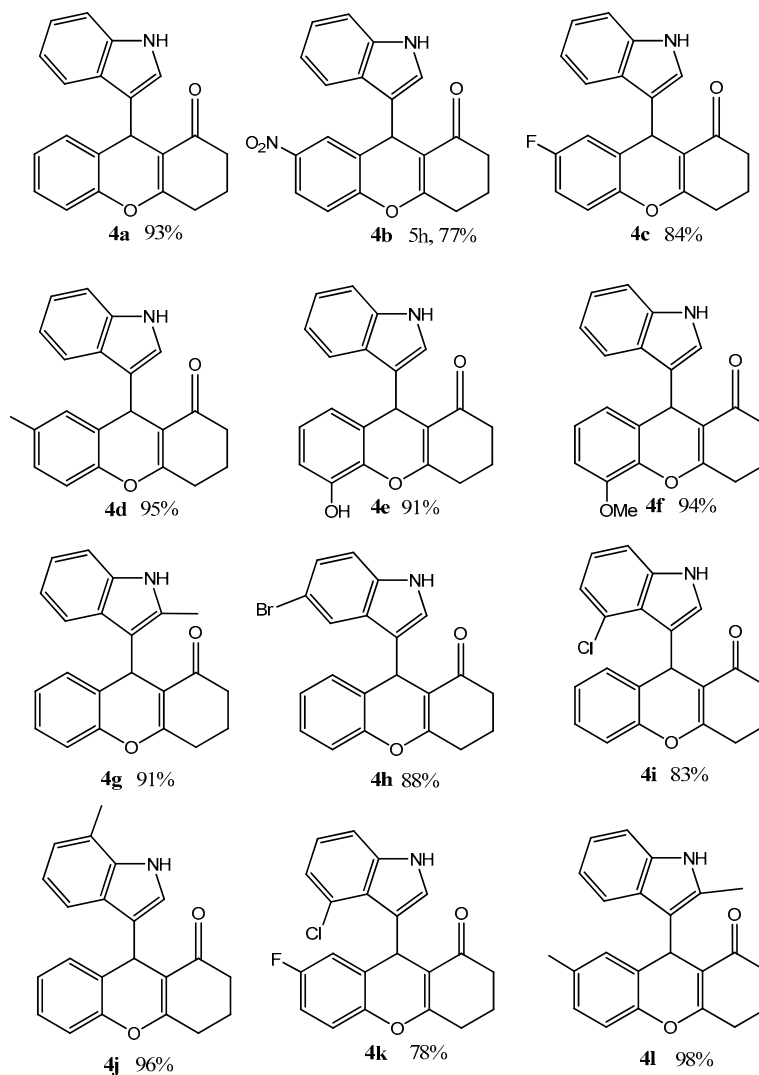


Figure S1. Data of products.

4a

¹H-NMR (500 MHz, DMSO-d₆) δ : 10.82 (s, 1H), 7.48 (d, *J* = 6.5 Hz, 1H), 7.27-7.31 (m, 2H), 7.13-7.20 (m, 3H), 6.99-7.04 (m, 2H), 6.91 (t, *J* = 6.5 Hz, 1H), 5.22 (s, 1H), 2.68-2.80 (m, 2H), 2.25-2.34 (m, 2H), 1.86-2.02 (m, 2H).

4b

¹H-NMR (500 MHz, DMSO-d₆) δ : 10.94 (s, 1H), 8.21 (d, *J* = 2.5 Hz, 1H), 8.05 (dd, *J* = 2.5, 9.0 Hz, 1H), 7.49 (d, *J* = 8.0 Hz, 1H), 7.42 (d, *J* = 8.0 Hz, 1H), 7.30 (d, *J* = 8.0 Hz, 1H), 7.27 (d, *J* = 2.0 Hz), 7.21 (t, *J* = 7.5 Hz, 1H), 6.95 (t, *J* = 7.5 Hz, 1H), 5.39 (s, 1H), 2.73-2.87 (m, 2H), 2.27-2.36 (m, 2H), 1.90-2.05 (m, 2H).

4c

¹H-NMR (500 MHz, DMSO-d₆) δ : 10.87 (s, 1H), 7.49 (d, *J* = 6.5 Hz, 1H), 7.30 (d, *J* = 6.5 Hz, 1H), 7.12-7.22 (m, 3H), 7.01-7.04 (m, 2H), 6.93 (t, *J* = 6.5 Hz, 1H), 5.24 (s, 1H), 2.69-2.81 (m, 2H), 2.24-2.36 (m, 2H), 1.98-2.02 (m, 1H), 1.87-1.92 (m, 1H).

4d

¹H-NMR (500 MHz, DMSO-d₆) δ: 10.81 (s, 1H), 7.42 (d, J = 7.0 Hz, 1H), 7.28 (d, J = 7.0 Hz, 1H), 7.14 (d, J = 2.0 Hz, 1H), 6.97-7.06 (m, 4H), 6.90 (t, J = 6.5 Hz, 1H), 2.70-2.78 (m, 2H), 2.22-2.35 (m, 2H), 2.15 (s, 3H) 1.97-2.01 (m, 1H), 1.82-1.88 (m, 1H).

4e

¹H-NMR (500 MHz, DMSO-d₆) δ: 10.79 (s, 1H), 9.65 (s, 1H), 7.47 (d, J = 6.5 Hz, 1H), 7.27 (d, J = 6.5 Hz, 1H), 7.10 (d, J = 2.0 Hz, 1H), 7.01 (t, J = 6.5 Hz, 1H), 6.79 (t, J = 6.5 Hz, 1H), 6.67-6.70 (m, 2H), 5.15 (s, 1H), 2.69-2.82 (m, 2H), 2.24-2.27 (m, 2H), 1.89-2.02 (m, 2H).

4f

¹H-NMR (500 MHz, DMSO-d₆) δ: 10.81 (s, 1H), 7.46 (d, J = 7.0 Hz, 1H), 7.28 (d, J = 7.0 Hz, 1H), 7.12 (d, J = 2.0 Hz, 1H), 7.00 (t, J = 6.5 Hz, 1H), 6.91-6.97 (m, 2H), 6.84-6.87 (m, 2H), 5.17 (s, 1H), 3.83 (s, 3H), 2.68-2.83 (m, 2H), 2.23-2.35 (m, 2H), 1.98-2.02 (m, 1H), 1.85-1.91 (m, 1H).

4g

¹H-NMR (500 MHz, DMSO-d₆) δ: 10.72 (s, 1H), 7.14-7.17 (m, 3H), 7.12 (d, J = 8.0 Hz, 1H), 7.06 (d, J = 8.0 Hz, 1H), 6.92-7.00 (m, 1H), 6.88 (t, J = 8.5 Hz, 1H), 6.78 (t, J = 8.0 Hz, 1H), 5.14 (s, 1H), 2.71-2.74 (m, 2H), 2.53 (s, 3H), 2.17-2.33 (m, 2H), 1.77-2.00 (m, 2H).

4h

¹H-NMR (500 MHz, DMSO-d₆) δ: 11.06 (s, 1H), 7.68 (d, J = 1.5 Hz, 1H), 7.04-7.30 (m, 7H), 5.22 (s, 1H), 2.68-2.79 (m, 2H), 2.29-2.34 (m, 2H), 1.87-2.03 (m, 2H).

4i

¹H-NMR (500 MHz, DMSO-d₆) δ: 10.76 (s, 1H), 7.28 (d, J = 7.5 Hz, 2H), 7.11-7.18 (m, 3H), 7.02 (t, J = 7.5 Hz, 1H), 6.81 (m, 2H), 5.20 (s, 1H), 2.71-2.80 (m, 2H), 2.27-2.33 (m, 2H), 1.88-2.02 (m, 2H).

4j

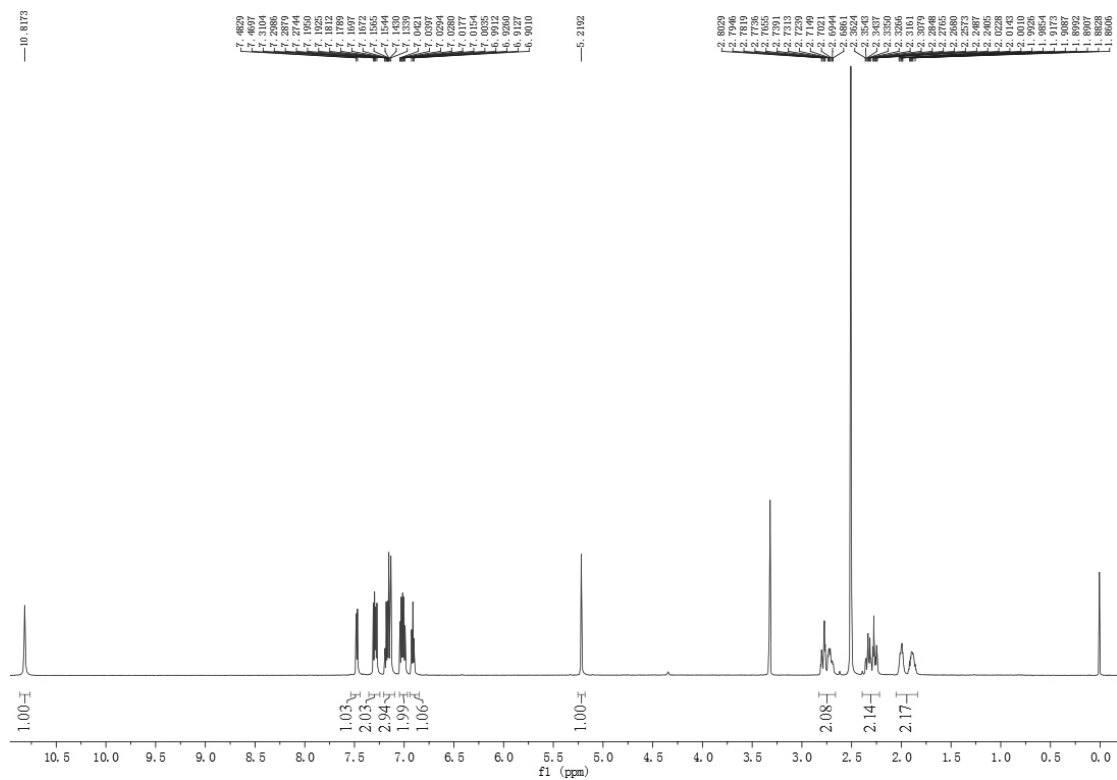
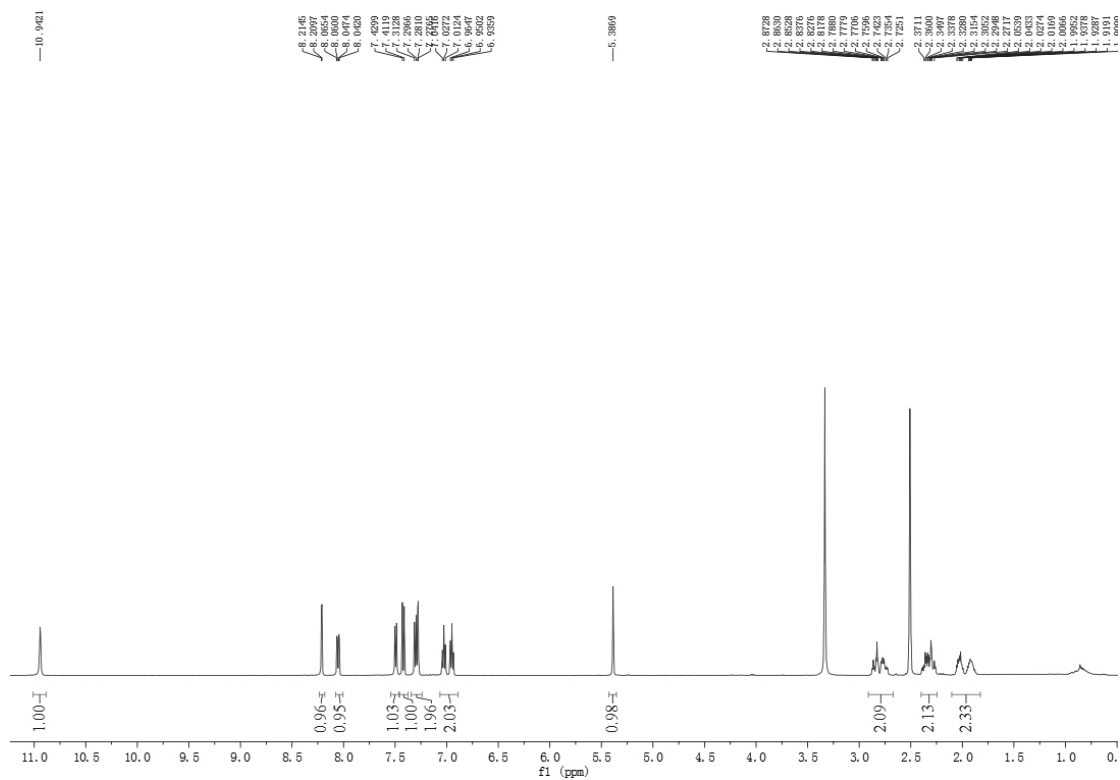
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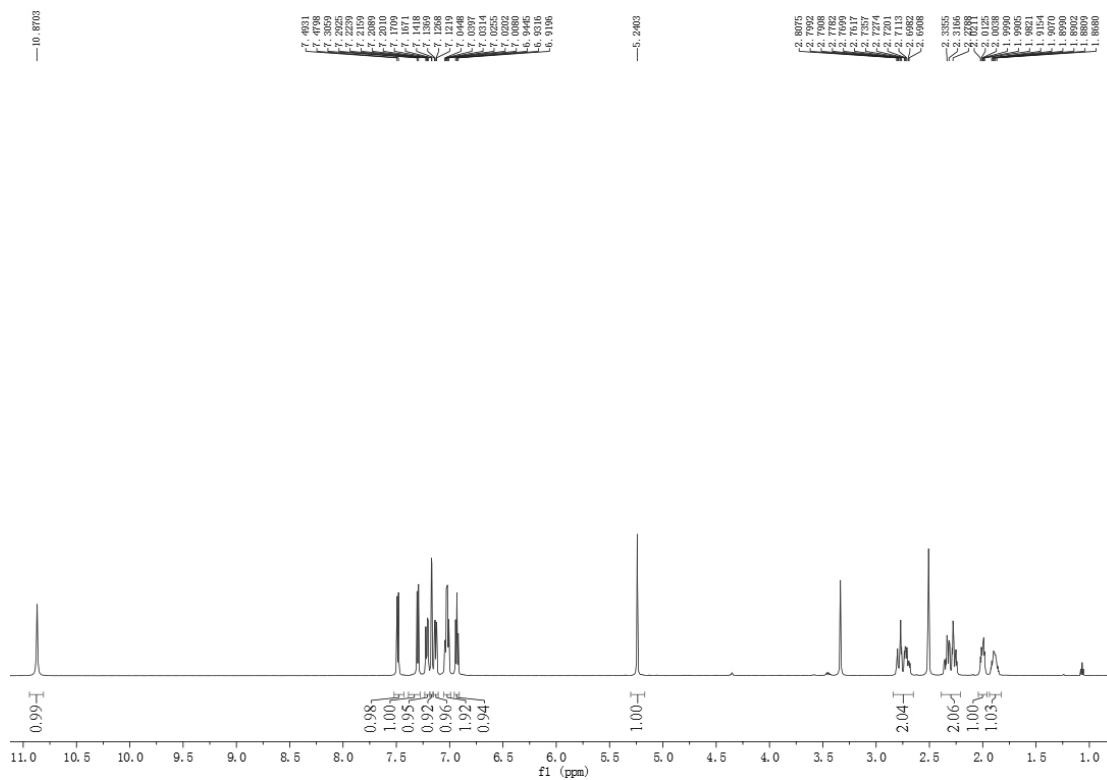
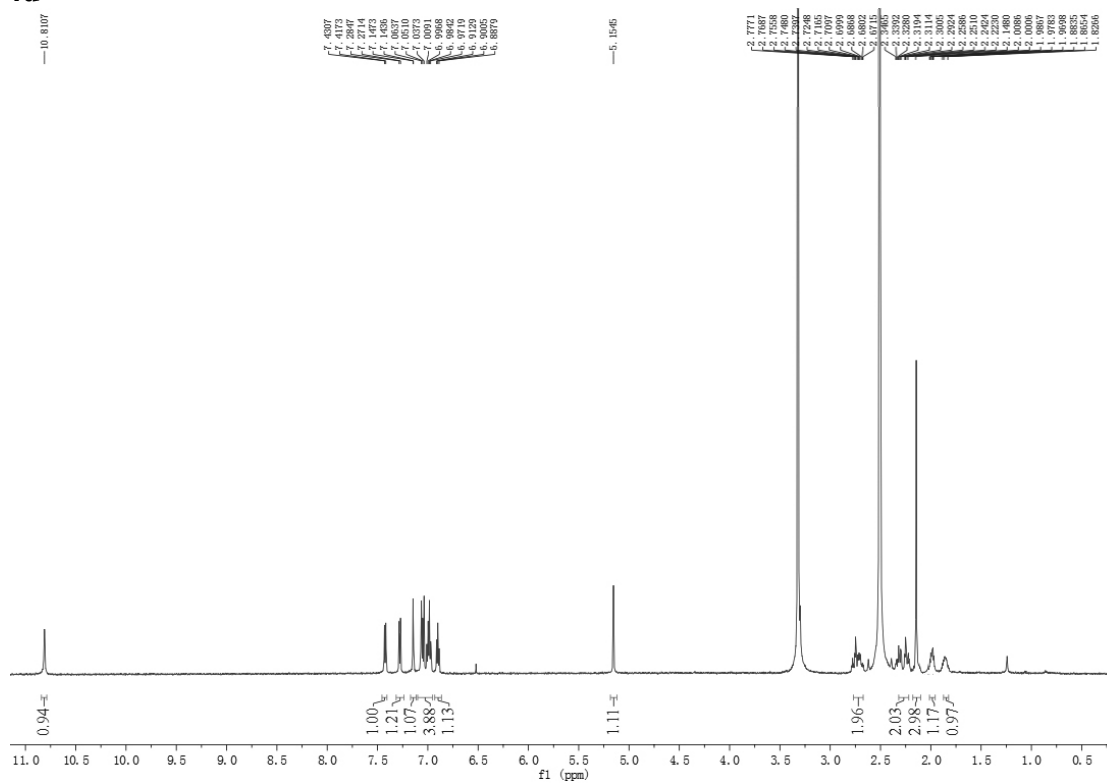
4k

¹H-NMR (500 MHz, DMSO-d₆) δ: 11.29 (s, 1H), 7.32 (d, J = 7.5 Hz, 1H), 7.00-7.21 (m, 6H), 5.82 (s, 1H), 2.67-2.83 (m, 2H), 3.30-3.33 (m, 2H), 2.02-2.04 (m, 2H).

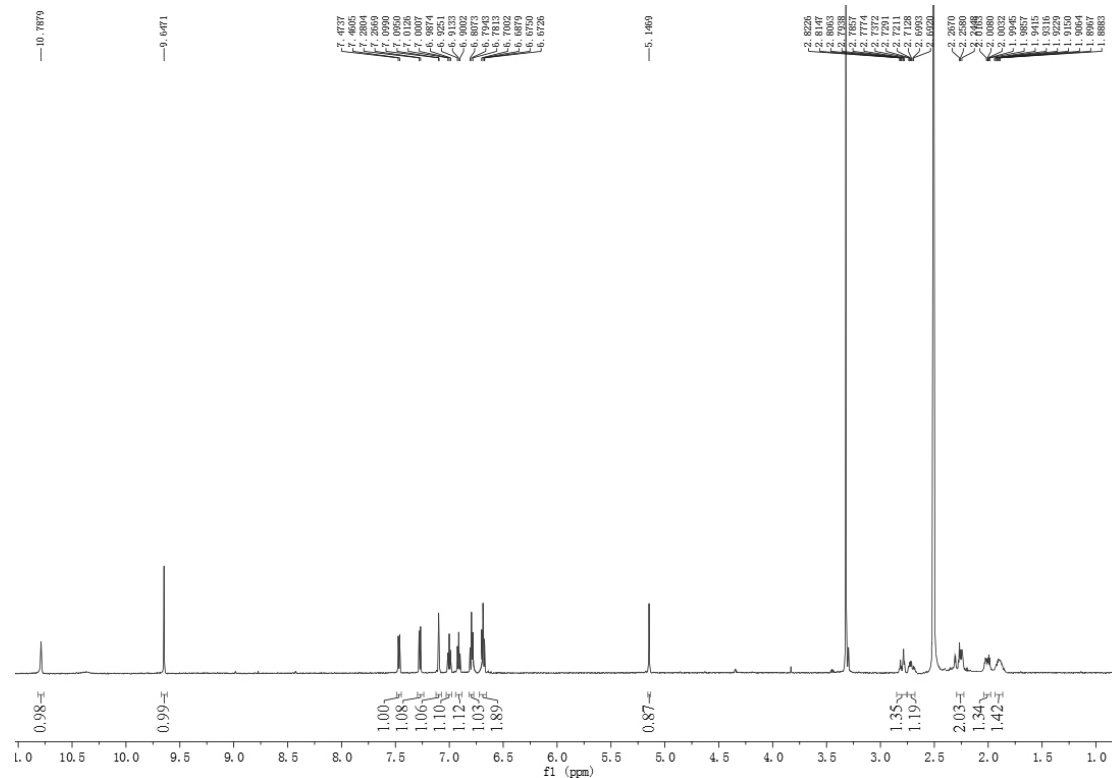
4l

¹H-NMR (500 MHz, DMSO-d₆) δ: 10.72 (s, 1H), 7.16 (d, J = 8.0 Hz, 1H), 7.10 (d, J = 7.5 Hz, 1H), 7.04 (d, J = 8.5 Hz, 1H), 6.96 (d, J = 8.0 Hz, 1H), 6.88 (t, J = 7.5 Hz, 1H), 6.84 (s, 1H), 6.78 (t, J = 7.5 Hz, 1H), 5.09 (s, 1H), 2.66-2.74 (m, 2H), 2.53 (s, 3H), 2.12-2.28 (m, 2H), 1.75-1.97 (m, 2H).

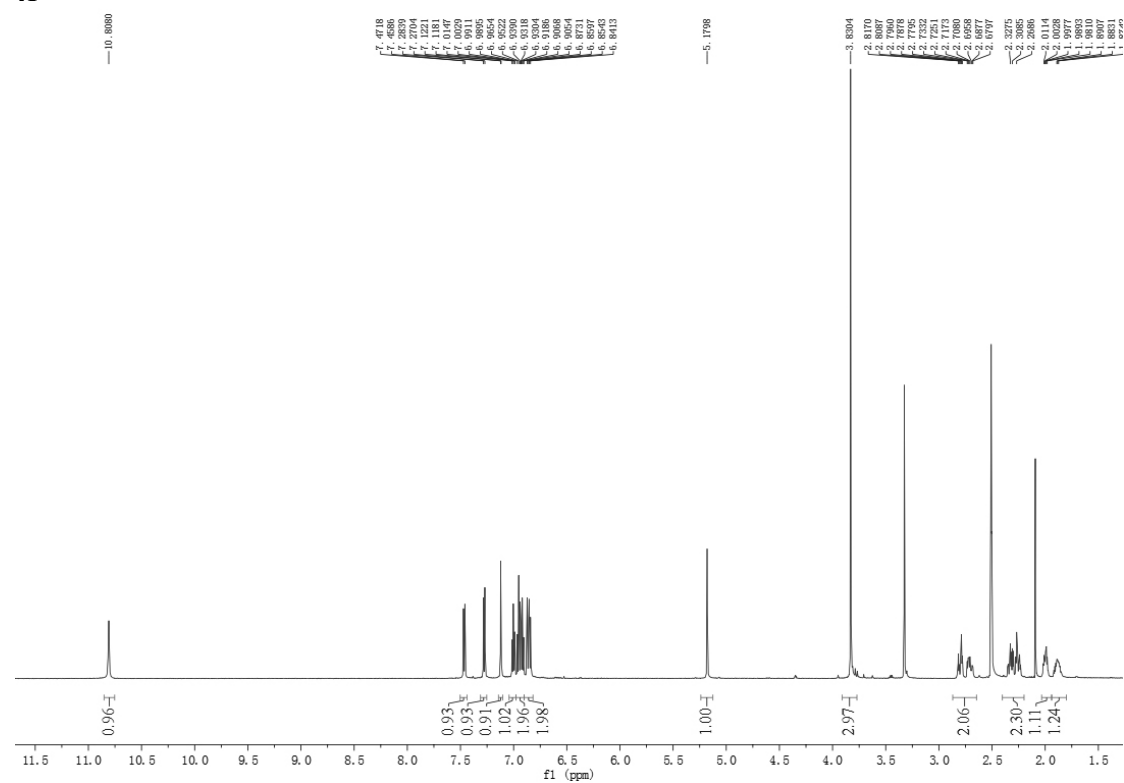
4a**4b**

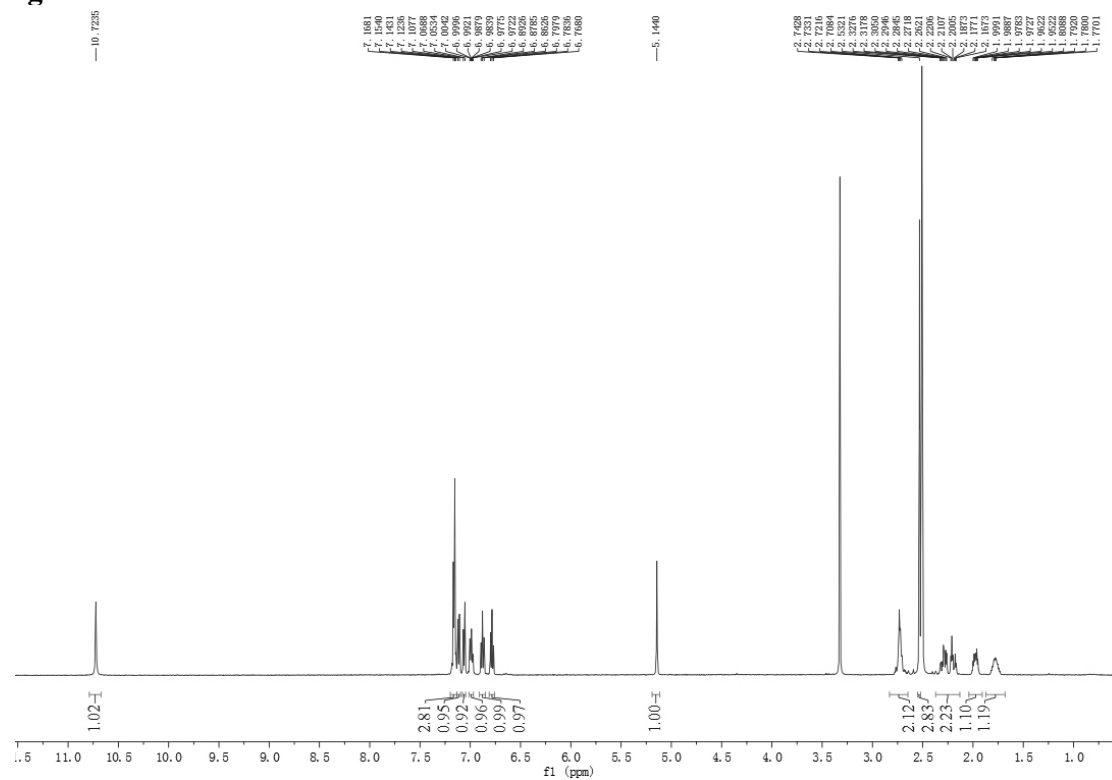
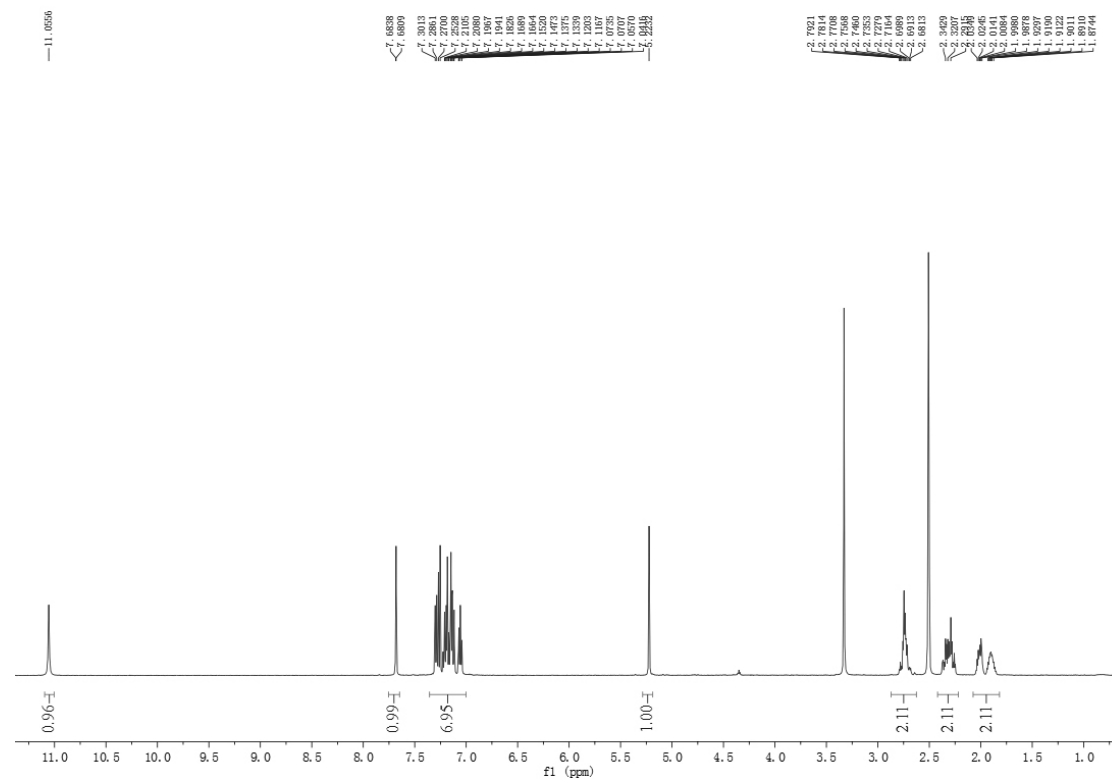
4c**4d**

4e

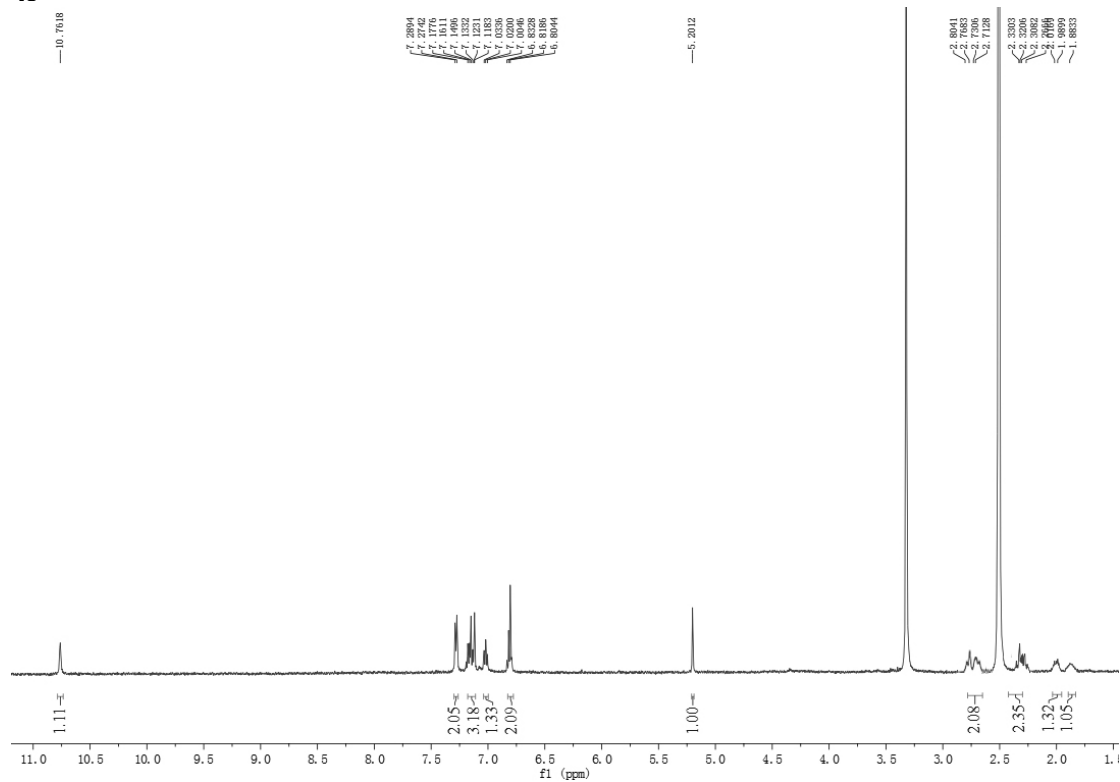


4f

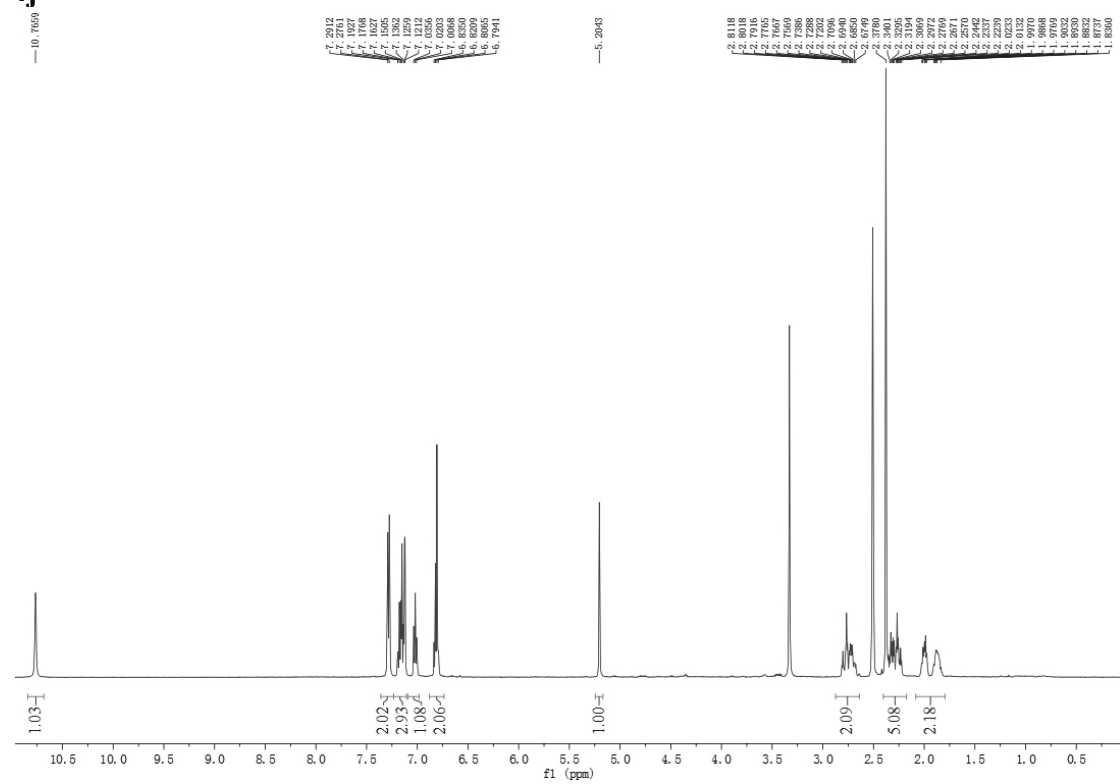


4g**4h**

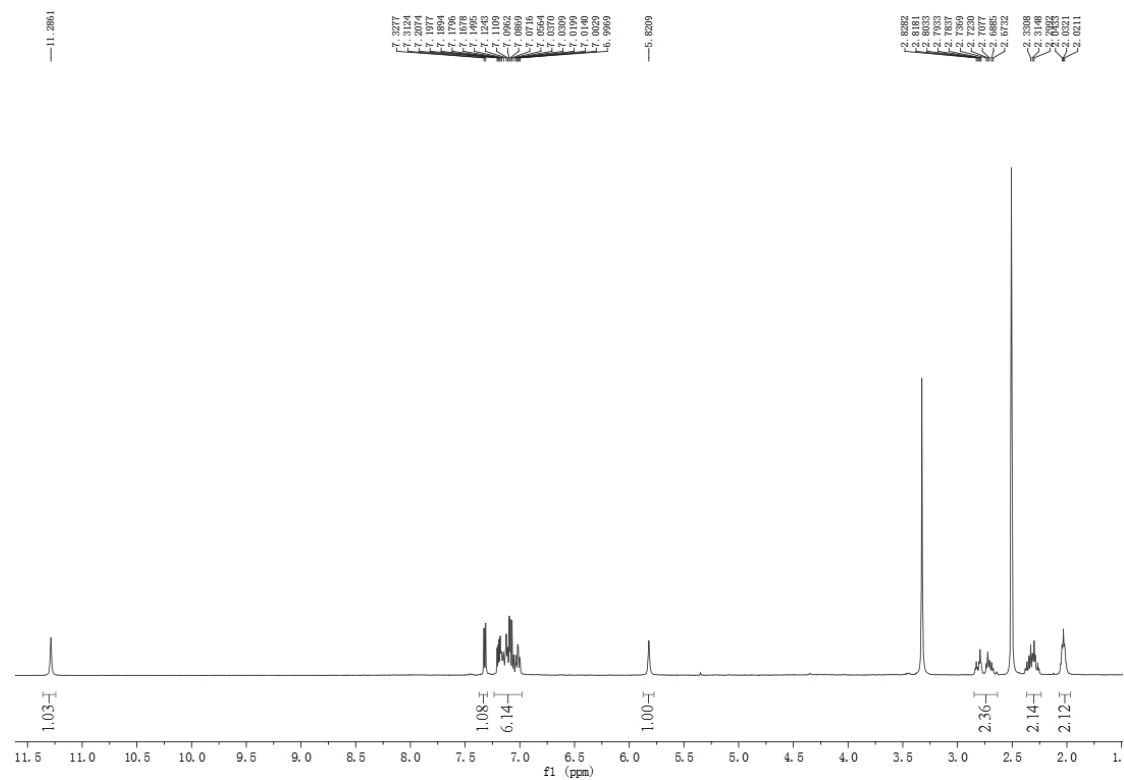
4i



4j



4l



4k

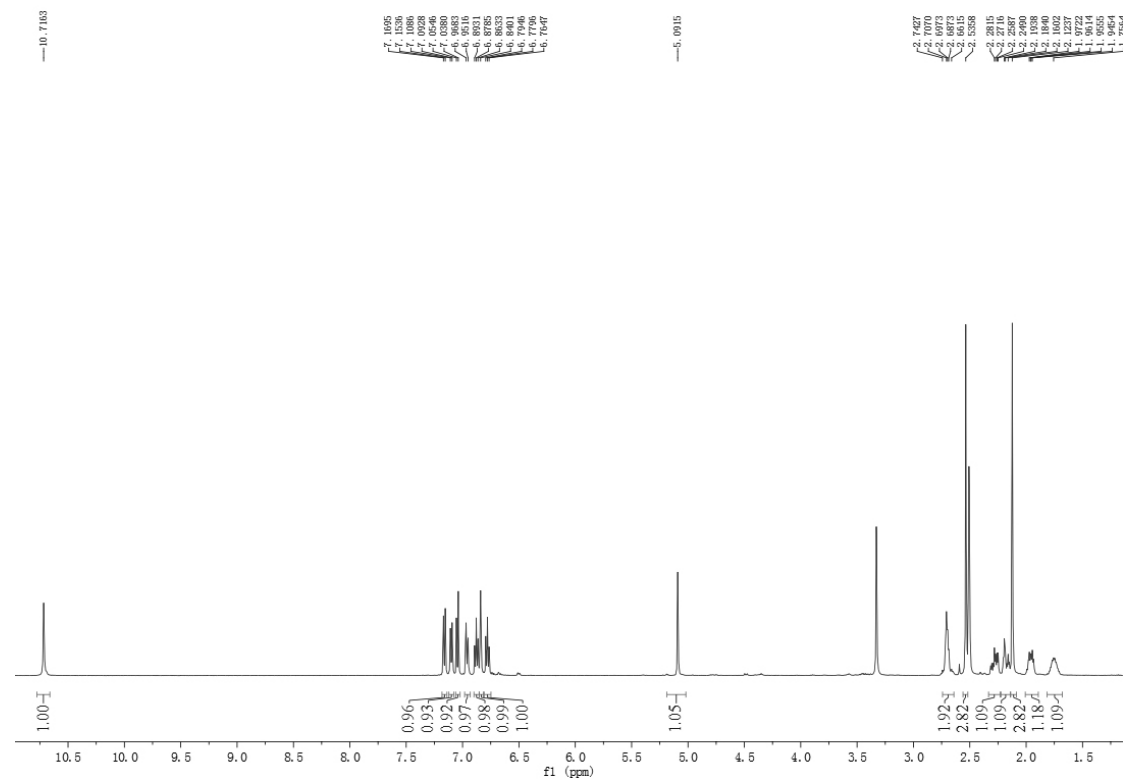


Figure S2. Spectra of products.