Chemoenzymatic synthesis of key lactones (S)-γ-hydroxymethyl-α,β-butenolide and (S)-γ-hydroxymethyl-γ-butyrolactone via lipase-mediated Baeyer-Villiger oxidation of levoglucosenone

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Electronic Supplementary Information (ESI)

1H NMR spectrum of industrial grade levoglucosenone (LGO) S2

13C NMR spectrum of industrial grade levoglucosenone (LGO) S3

FT-IR spectrum of (S)-γ-hydroxymethyl-α,β-butenolide (HBO) S4

1H NMR spectrum of (S)-γ-hydroxymethyl-α,β-butenolide (HBO) S5

13C NMR spectrum of (S)-γ-hydroxymethyl-α,β-butenolide (HBO) S6

FT-IR spectrum of 2,3-dehydro levoglucosenone (2H-LGO) S7

1H NMR spectrum of 2,3-dehydro levoglucosenone (2H-LGO) S8

13C NMR spectrum of 2,3-dehydro levoglucosenone (2H-LGO) S9

FT-IR spectrum of (S)-γ-hydroxymethyl-γ-butyrolactone (2H-HBO) S10

1H NMR spectrum of (S)-γ-hydroxymethyl-γ-butyrolactone (2H-HBO) S11

13C NMR spectrum of (S)-γ-hydroxymethyl-γ-butyrolactone (2H-HBO) S12
1H NMR spectrum of industrial grade levoglucosenone (IGO)
FT-IR Spectrum of (5)-γ-Hydroxymethyl-4,5-butenolide (HBO)
$^1$H NMR spectrum of (S)-$\gamma$-hydroxymethylen-o-$\gamma$-butenolic acid (HBO)
13C NMR spectrum of (5)-7-hydroxymethyl-2,6-p-butenolide (HBO)
FT-IR spectrum of 2,3-dehydrolevoglucosenone (2H-LGD)
$^1$H NMR spectrum of 2',3'-dehydroydroxybicyclo[2.2.1]heptane-2-one (2H-16G)
FT-IR spectrum of (S)-α- hydroxy methyl- α-butyrolactone (ZH-HBO)
1H NMR spectrum of (S)-γ-hydroxyethyl-β-butyrolactone (2H-HBO)
NMR spectrum of (S)-\(\gamma\)-hydroxymenthyl-\(\gamma\)-butyrolactone (2H-5BO)