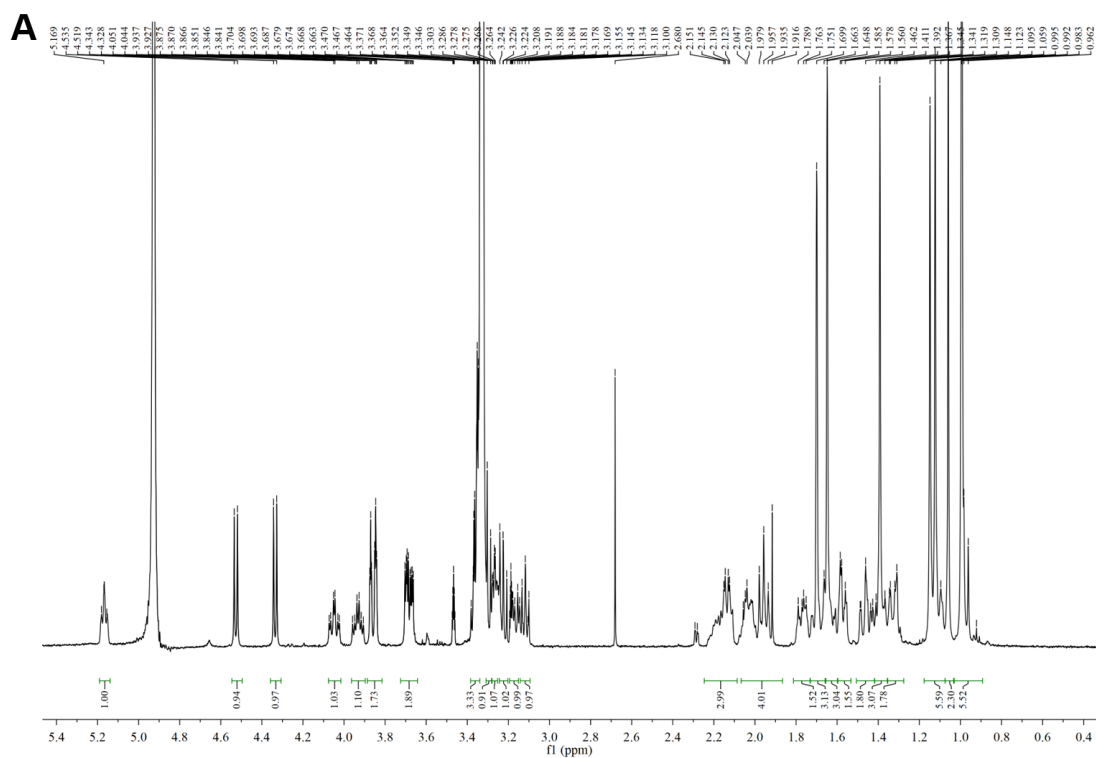
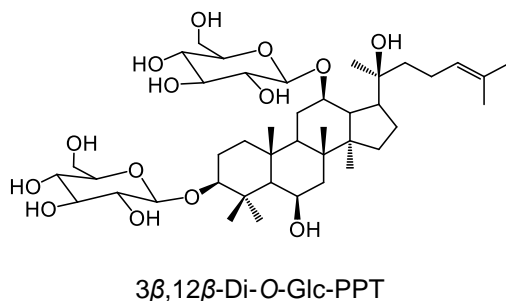
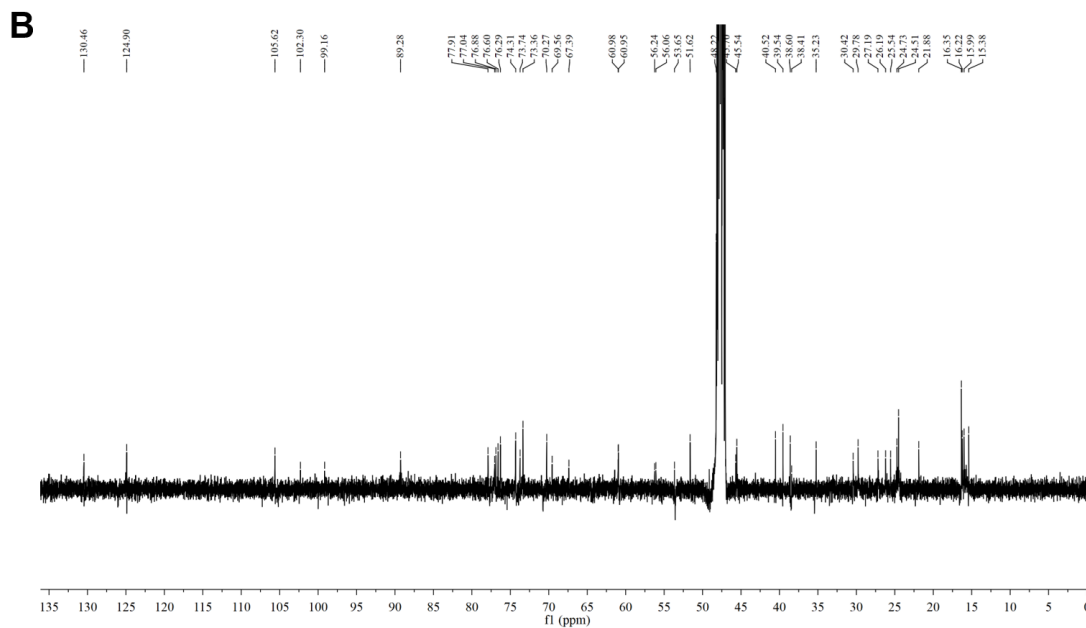


Supplementary Information

Figure S1. The ^1H -NMR (A) and ^{13}C -NMR (B) spectra of 3,12-Di-*O*- β -D-glucopyranosyl-dammar-24-ene- $3\beta,6\alpha,12\beta,20S$ -tetraol (3 $\beta,12\beta$ -Di-*O*-Glc-PPT) extracted from strain YPUT.



^1H -NMR (500MHz, in Methanol- d_4) δ 5.15 (1H, t, J = 6Hz, H-24), 4.52 (1H, d, J = 8Hz, H-1''), 4.33 (1H, d, J = 7.5Hz, H-1'), 4.02 (1H, td, J = 11Hz, 5Hz, H-6), 3.14 (1H, d, J = 5Hz, H-3), 3.10 (1H, m, H-12), 1.70 (3H, s, H-28), 1.65 (3H, s, H-26), 1.39 (3H, s, H-27), 1.15 (3H, s, H-29), 1.12 (3H, s, H-21), 1.06 (3H, s, H-19), 1.00 (6H, s, H-30/H-18).



^{13}C -NMR (125 MHz, Methanol- d_4) δ 130.46 (C-25), 124.90 (C-24), 89.28 (C-3), 77.91 (C-12), 73.36 (C-20), 67.39 (C-6), 60.98 (C-5), 53.63 (C-17), 51.62 (C-14), 48.22 (C-9), 45.57 (C-13), 45.54 (C-7), 40.52 (C-8), 39.54 (C-4), 38.60 (C-10), 38.41 (C-1), 35.23 (C-22), 30.42 (C-11), 29.78 (C-28), 27.19 (C-15), 26.19 (C-2), 25.54 (C-21), 24.73 (C-16), 24.51 (C-26), 21.88 (C-23), 16.35 (C-18 and C-27), 16.22 (C-19), 15.99 (C-30), 15.38 (C-29), 105.62 (C-1'), 73.74 (C-2'), 76.88 (C-3'), 70.27 (C-4'), 76.60 (C-5'), 60.95 (C-6'), 99.16 (C-1''), 74.31 (C-2''), 76.29 (C-3''), 69.56 (C-4''), 77.04 (C-5''), 60.98 (C-6').

Table S1. The HPLC conditions for analysis and preparation of products from the engineered strains.

Method	Gradient	Product
1	0 min, 10% acetonitrile; 20 min, 55% acetonitrile; 30 min, 70% acetonitrile; 31 min, 100% acetonitrile; 40 min, 100%	$3\beta,20S$ -Di- <i>O</i> -Glc-DM
	acetonitrile; 41 min, 10% acetonitrile; 50 min, 10%	$3\beta,12\beta$ -Di- <i>O</i> -Glc-PPD
	acetonitrile	$3\beta,12\beta$ -Di- <i>O</i> -Glc-PPT
		PPT
2	0 min, 20% acetonitrile; 20 min, 85% acetonitrile; 30 min, 100% acetonitrile; 40 min, 100% acetonitrile; 41 min, 20%	$3\beta,20S$ -Di- <i>O</i> -Glc-DM
	acetonitrile; 50 min, 20% acetonitrile	$3\beta,12\beta$ -Di- <i>O</i> -Glc-PPD
		PPD
		DM