Palladium nanoparticles *in situ* synthesized on *Cyclea barbata* pectin as a heterogeneous catalyst for Heck coupling in water, reduction of nitrophenols and alkynes.

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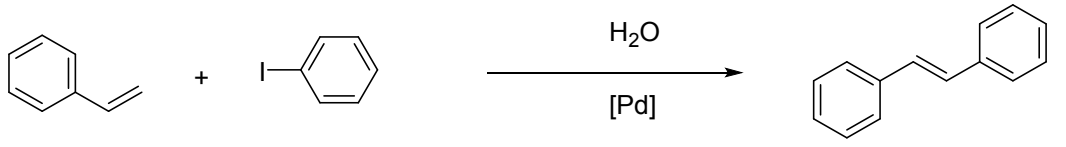
Supplementary Data

Table S1. Comparison of the results obtained from various palladium-based catalyst system for the Heck coupling reaction in water.



Catalyst	**T (°C)**	**Time (h)**	**[Pd] (% mol)**	**Yield (%)**	**Ref.**
PTFE-Pd NPs	90	15	1.0	91	[1]
Pd -TOTPS	150	6	0.03	60	[2]
PdNPs@PS–IL[Cl]	100	6	0.2	42	[3]
Pd@Cellulose	90	6	0.12	98	[4]
Pd@ PS-PEG	50	20	10	92	[5]
PdNPs@Pectin	90	6	0.5	90	This work

Table S2. Summary for catalytic performance of PdNPs@Pectin for reduction of nitrophenols.

Substrates	time (s)	k (10^{-3}, s^{-1})	R^2	TON	TOF (10^{-5}, s^{-1})
o-nitrophenol	600	2.93	0.972	0.0289	4.82
m-nitrophenol	360	2.88	0.973	0.0289	8.03
p-nitrophenol	840	2.42	0.991	0.0289	3.44

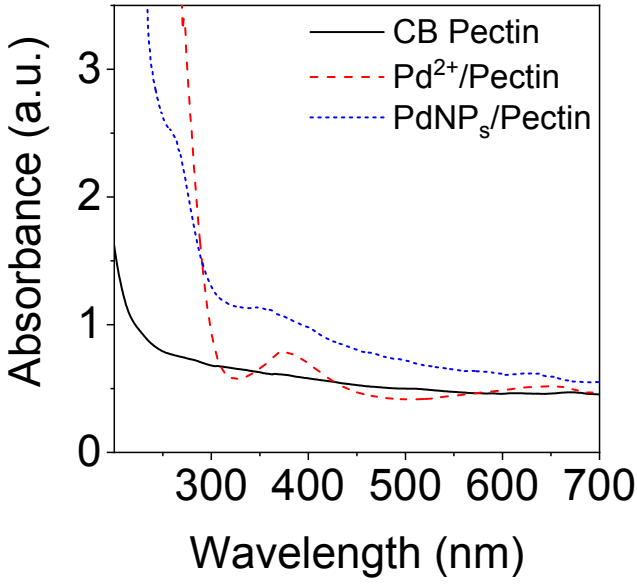


Figure S1. UV-Vis spectra of *C. barbata* pectin, Pd^{2+}@Pectin and PdNPs@Pectin

Catalytic activity for Heck Coupling

1,2-diphenylethene. ^{1}H-NMR ($CDCl_3$, 500 MHz, ppm): δ = 7.53 (m, 4H); 7.37 (m, 4H); 7.27 (m, 2H); 7.11 (s, 2H).

1-methyl-4-styrylbenzene. ^{1}H-NMR ($CDCl_3$, 500 MHz, ppm): δ = 7.51 (m, 2H); 7.42 (d, J 8.5 Hz, 2H); 7.36 (m, 2H); 7.25 (m, 1H), 7.17 (d, J 7.5 Hz, 2H), 7.07 (dd J 16.5, 3.5 Hz, 2H), 2.36 (s, 3H).

1-fluoro-4-styrylbenzene. ^{1}H-NMR ($CDCl_3$, 500 MHz, ppm): δ = 7.50 (m, 4H); 7.37 (m, 2H); 7.28 (m, 1H); 7.09 (m, 4H).

1,2-di-p-tolylethene. ^{1}H-NMR ($CDCl_3$, 500 MHz, ppm): δ = 7.40 (d, J 8Hz, 4H); 7.16 (d, J 8 Hz, 4H); 7.03 (s, 2H); 2.35 (s, 6H).

1-fluoro-4-(4-methylstyryl)benzene. ^{1}H-NMR ($CDCl_3$, 500 MHz, ppm): δ = 7.47 (m, 2H); 7.39 (d, J 8.0 Hz, 2H); 7.17 (d, J 7.5 Hz, 2H); 7.05 (m, 2H), 7.00 (m, 2H), 2.36 (s, 3H).

1,2-bis(4-fluorophenyl)ethene. ^{1}H-NMR ($CDCl_3$, 500 MHz, ppm): δ = 7.47 (m, 4H); 7.01 (m, 4H); 6.97 (s, 2H).

Catalytic activity for reduction of alkynes

(Z)-2-(hex-3-en-1-yloxy)tetrahydro-2H-pyran. ^{1}H-NMR ($CDCl_3$, 500 MHz, ppm): 5.49-5.44 (dtt, J_1 11Hz, J_2 7Hz, J_3 1.5 Hz 1H), 5.39-5.33 (dt, J_1 10.5 Hz, J_2 7.5 Hz, J_3 1.5 Hz, 1H), 4.59 (m, 1H), 3.90-3.71 (m, 2H), 3.43-3.40 (m, 2H), 2.37-2.33 (m, 2H), 2.08-2.05 (m, 2H), 1.85-1.49 (m, 6H), 0.98-0.95 (t, J 7.5 Hz, 3H). ^{13}C-NMR ($CDCl_3$, 125 MHz, ppm): 133.6, 125.0, 98.7, 67.1, 62.3, 30.7, 27.9, 25.5, 20.6, 19.6.

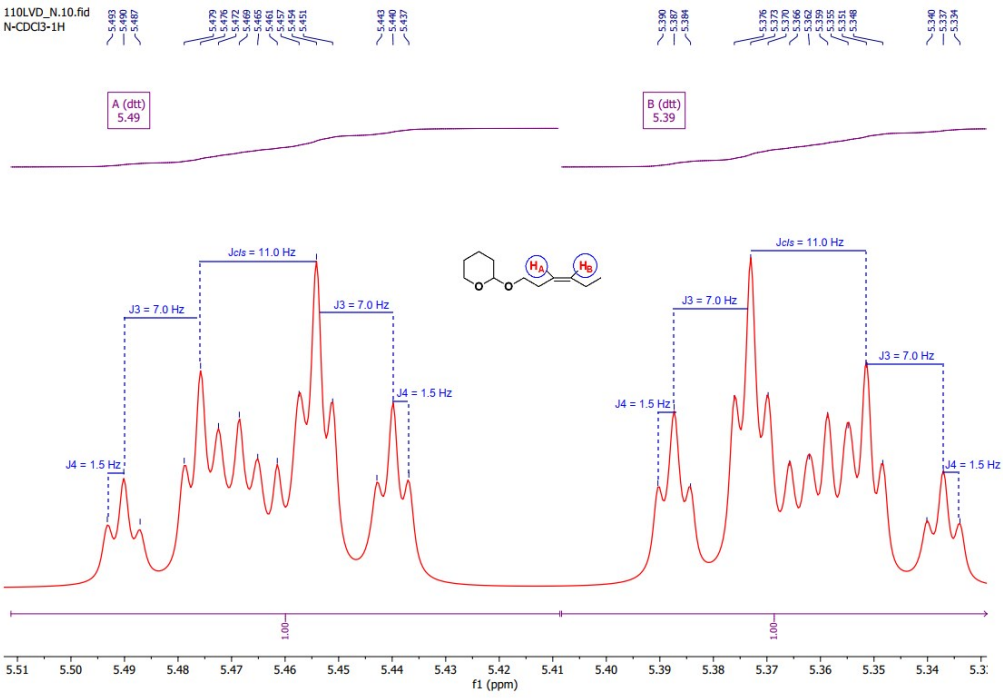


Figure S2. The two protons *(Z)* configuration of (*Z*)-2-(hex-3-en-1-yloxy)tetrahydro-2H-pyran.

2-(but-3-en-1-yloxy)tetrahydro-2H-pyran. Bp: 85°C/10 mmHg. n_D^{29} = 1.449. GC-MS, *m/z*: 41, 55, 70, 85 (100), 101, 115, 129, 155.

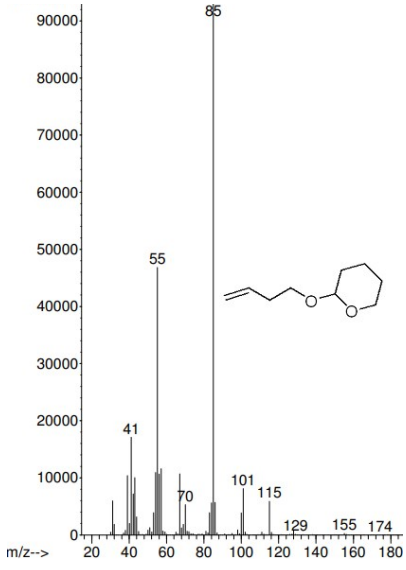


Figure S3. GC-MS spectrum of 2-(but-3-en-1-yloxy)tetrahydro-2H-pyran from reduction of 2-(but-3-yn-1-yloxy)tetrahydro-2H-pyran

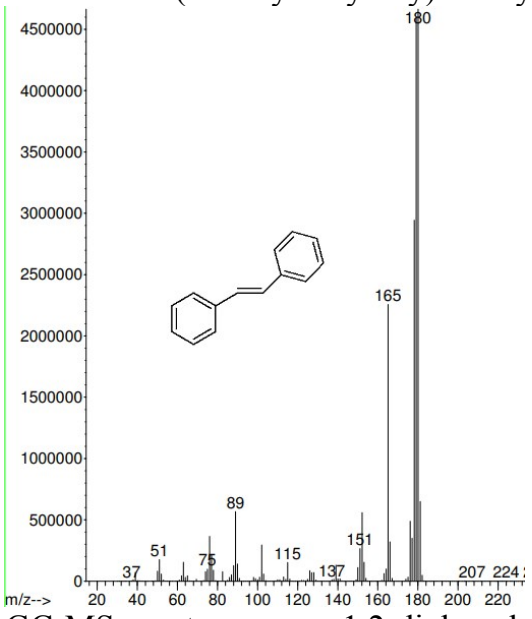


Figure S4. GC-MS spectrum *trans*-1,2-diphenylethene from Sonogashira coupling

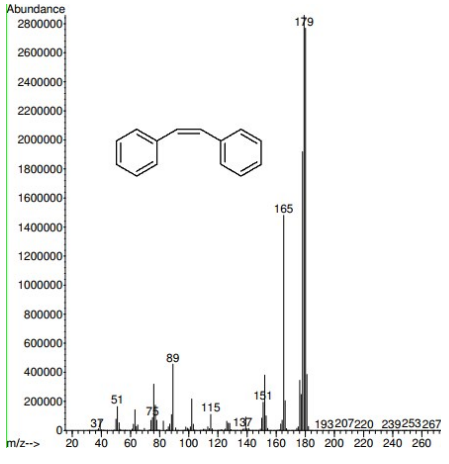


Figure S5. GC-MS spectrum of *cis*-1,2-diphenylethene from reduction of 1,2-diphenylethyne

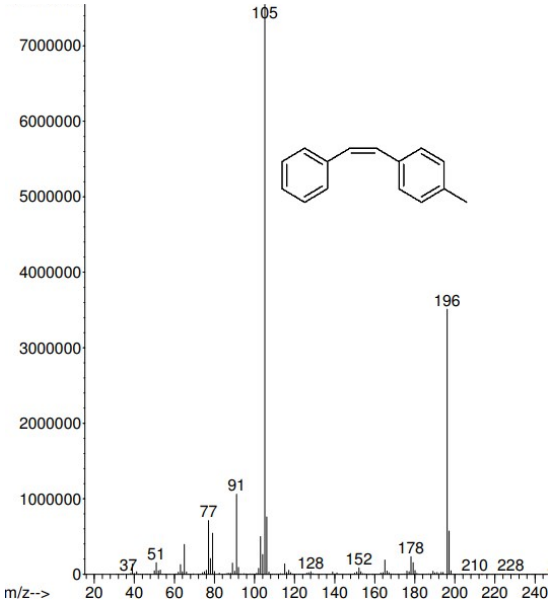


Figure S6. GC-MS spectrum *cis*-1-methyl-4-styrylbenzene from reduction of 1-methyl-4-(phenylethynyl)benzene

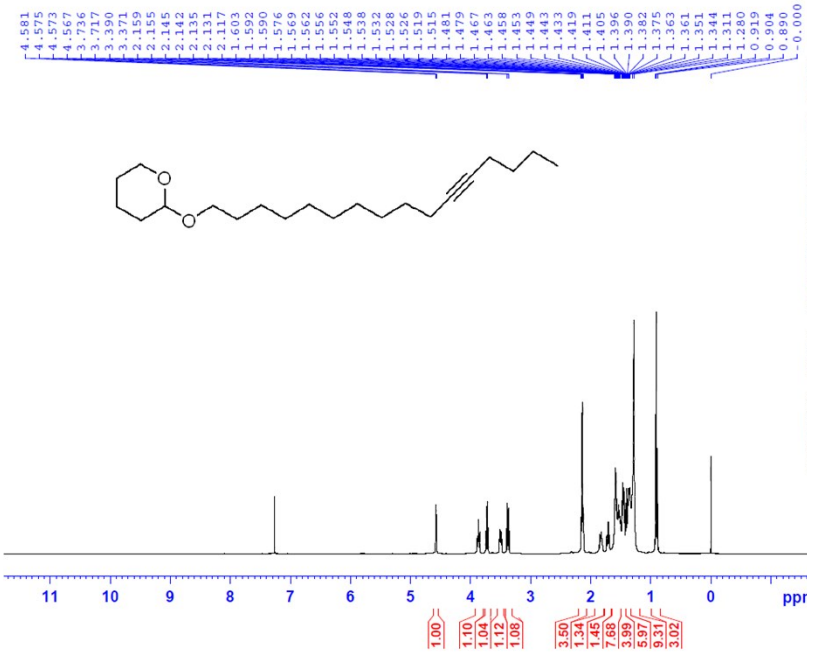


Figure S7. ^{1}H NMR spectrum of 2-(dodec-11-yn-1-yloxy)tetrahydro-2H-pyran (**3**)

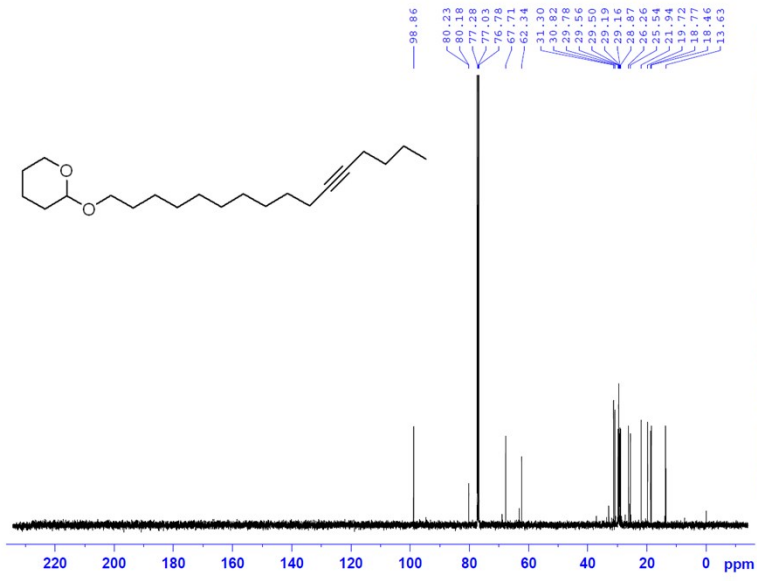


Figure S8. ^{13}C NMR spectrum of 2-(dodec-11-yn-1-yloxy)tetrahydro-2H-pyran (**3**)

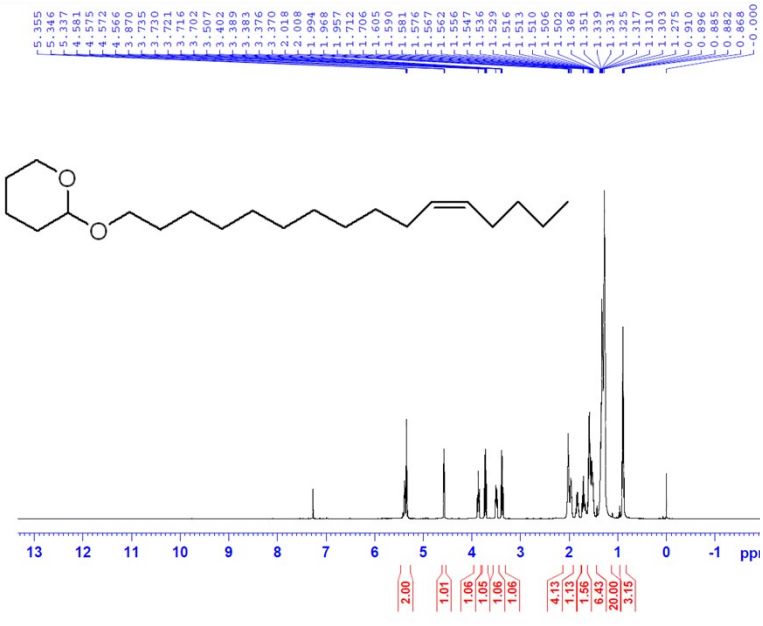


Figure S9. ^{1}H NMR spectrum of 2-(dodec-11-en-1-yloxy)tetrahydro-2H-pyran (**4**)

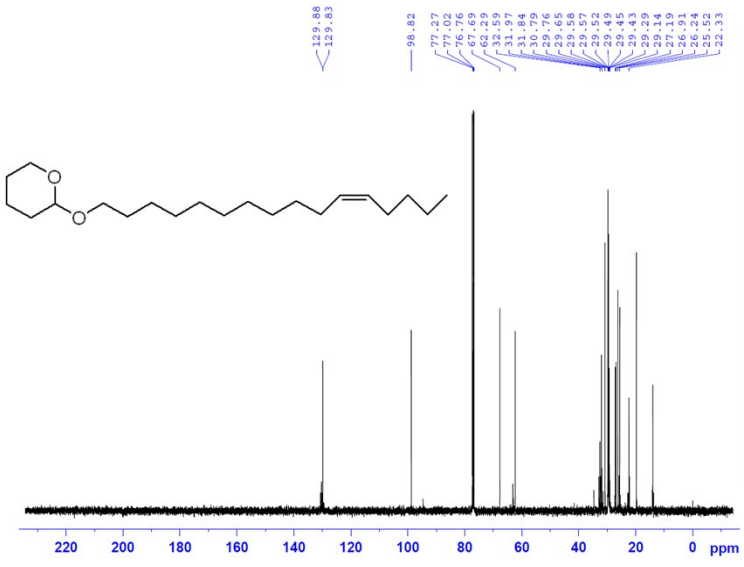


Figure S10. ^{13}C NMR spectrum of 2-(dodec-11-en-1-yloxy)tetrahydro-2H-pyran (**4**)

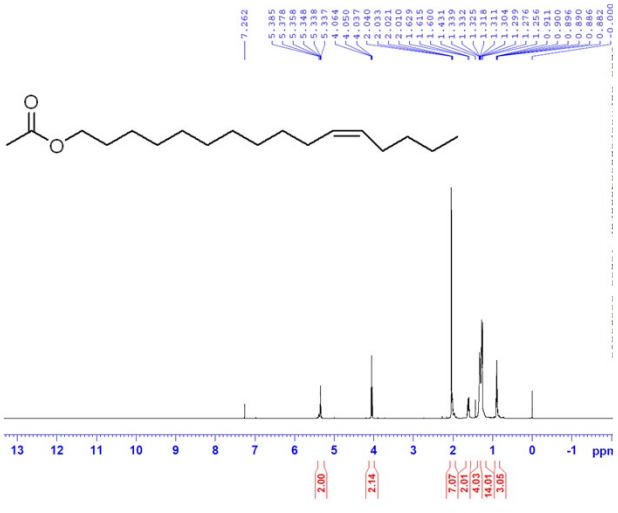


Figure S11. ^{1}H NMR spectrum of (*Z*)-11-hexadecenyl acetate (**5**)

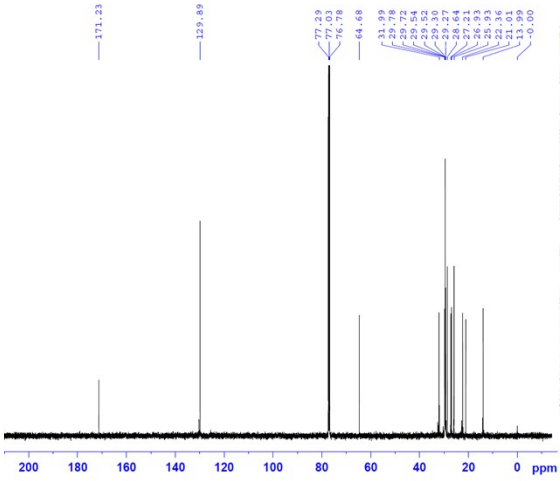


Figure S12. ^{13}C NMR spectrum of (*Z*)-11-hexadecenyl acetate (**5**)

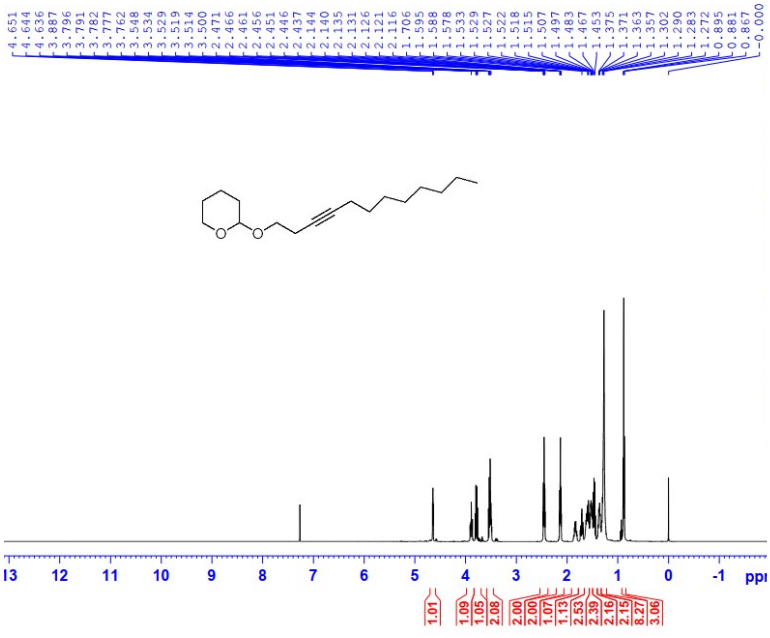


Figure S13. ^{1}H NMR spectrum of 2-(dodec-3-yn-1-yloxy)tetrahydro-2H-pyran (**8**)

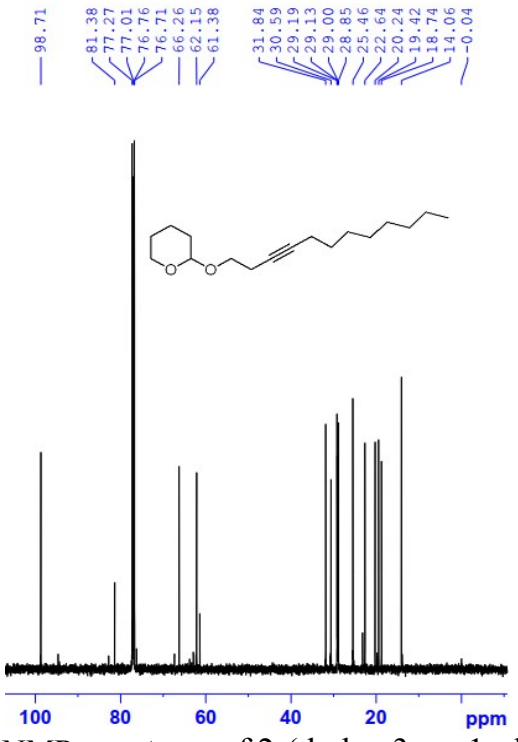


Figure S14. ^{13}C NMR spectrum of 2-(dodec-3-yn-1-yloxy)tetrahydro-2H-pyran (**8**)

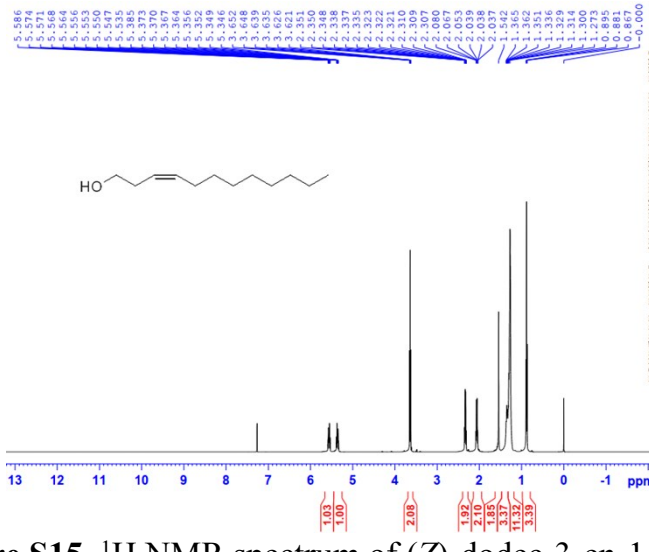


Figure S15. ^{1}H NMR spectrum of (*Z*)-dodec-3-en-1-ol (**9**)

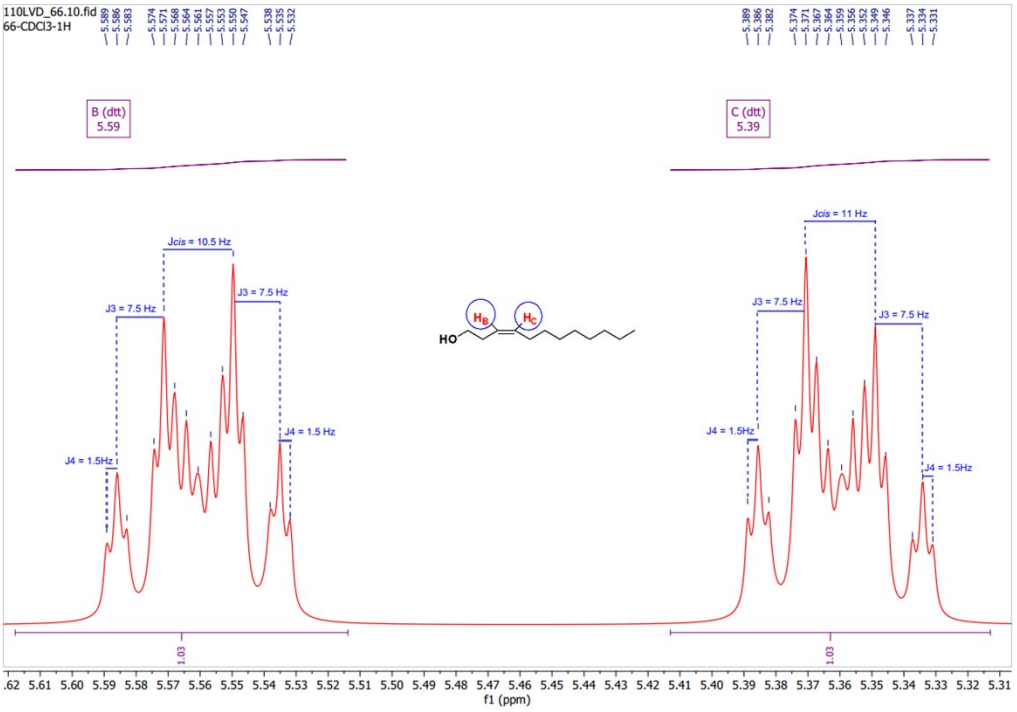


Figure S16. The two protons *(Z)* configuration of (*Z*)-dodec-3-en-1-ol (**9**)

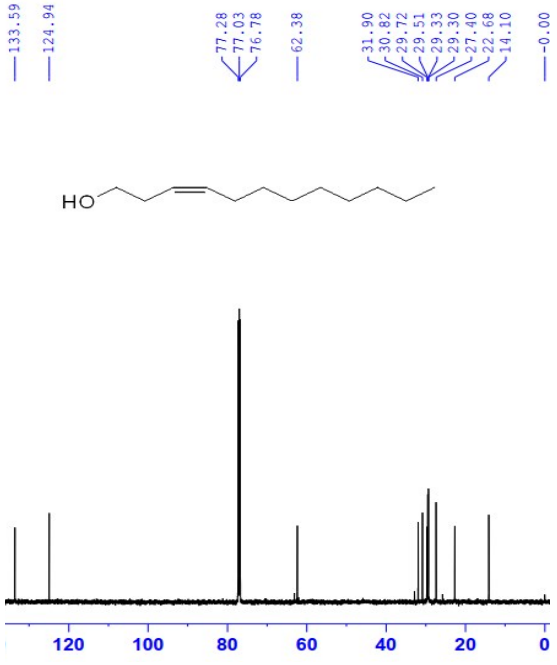


Figure S17. ^{13}C NMR spectrum of (*Z*)-dodec-3-en-1-ol (**9**)

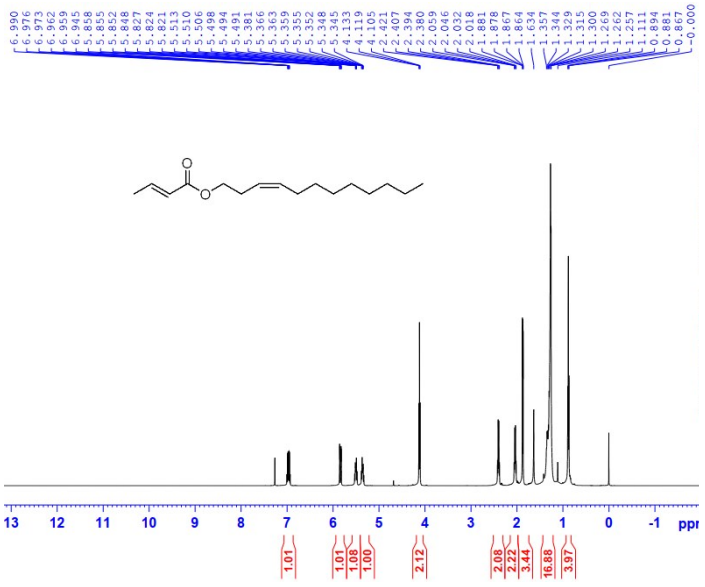


Figure S18. ^{1}H NMR spectrum of (*Z*)-Dodec-3-en-1-yl (*E*)-2-butenoate (**10**)

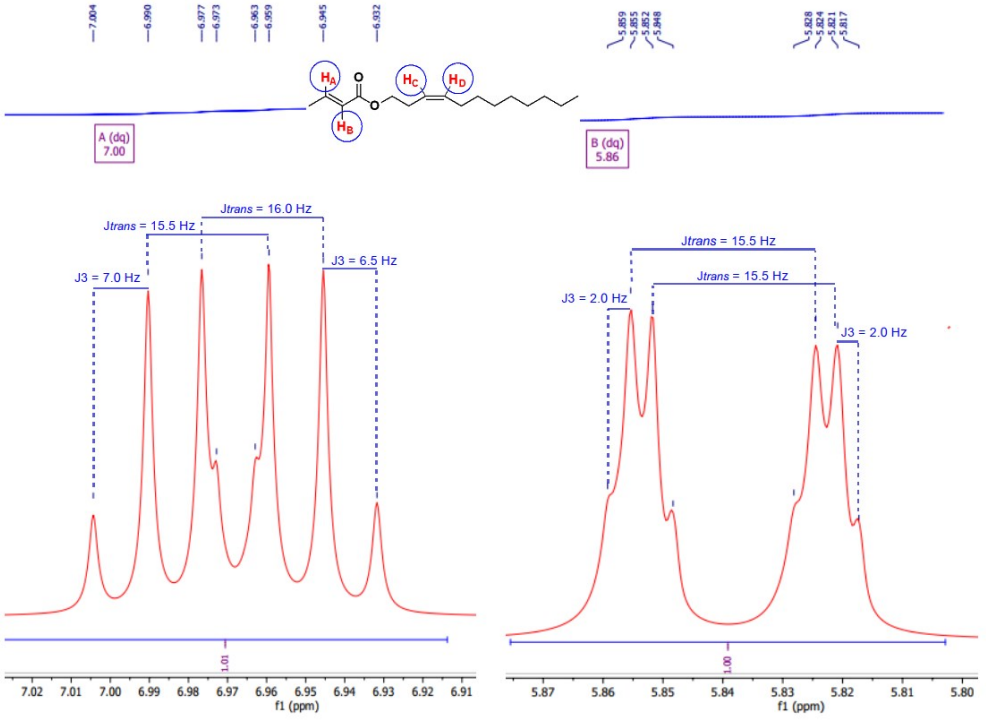


Figure S19. The two protons *(E)*-configuration of (*Z*)-Dodec-3-en-1-yl (*E*)-2-butenoate (**10**)

Figure S20. The two protons *(Z)* configuration of (*Z*)-Dodec-3-en-1-yl (*E*)-2-butenoate (**10**)

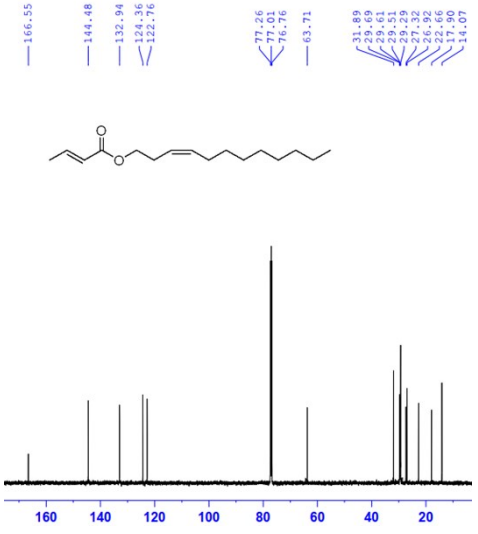


Figure S21. ^{13}C NMR spectrum of (*Z*)-Dodec-3-en-1-yl (*E*)-2-butenoate (**10**)

References

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