Supporting Information

Synthetic middle-distillate-range hydrocarbons via catalytic dimerization of branched C_6-C_8 olefins derived from renewable dimethyl ether

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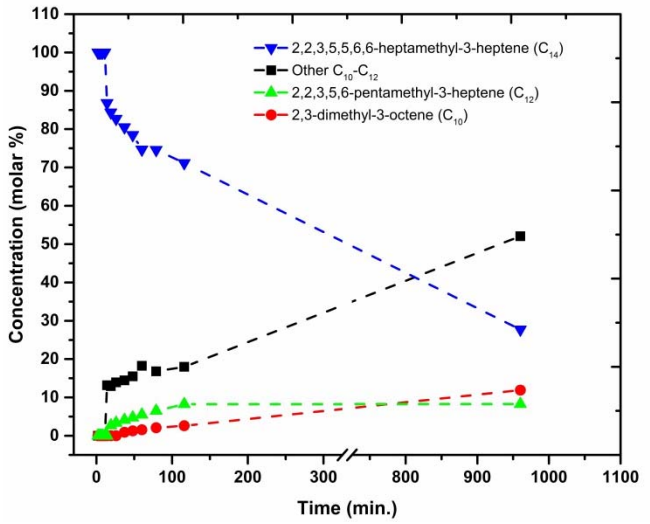
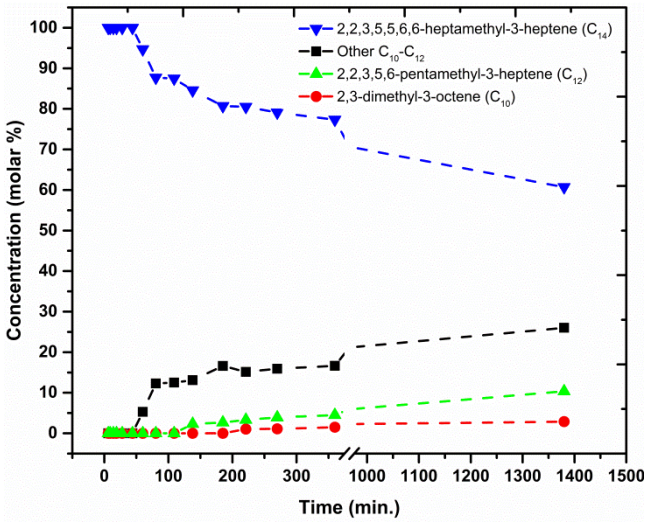
a)



b)



c)

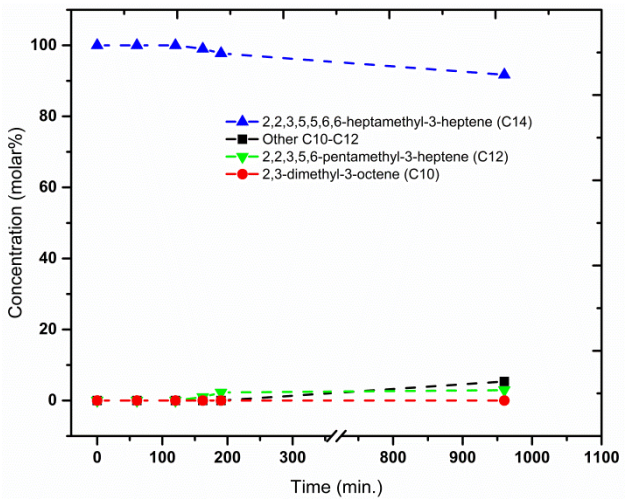


Figure S1: Evolution of different $C_{10} - C_{14}$ range products (as percentage) obtained from triptene dimerization over Amberlyst-35 at **(a)** 100 ˚C, **(b)** 80 ˚C and **(c)** 60 ˚C

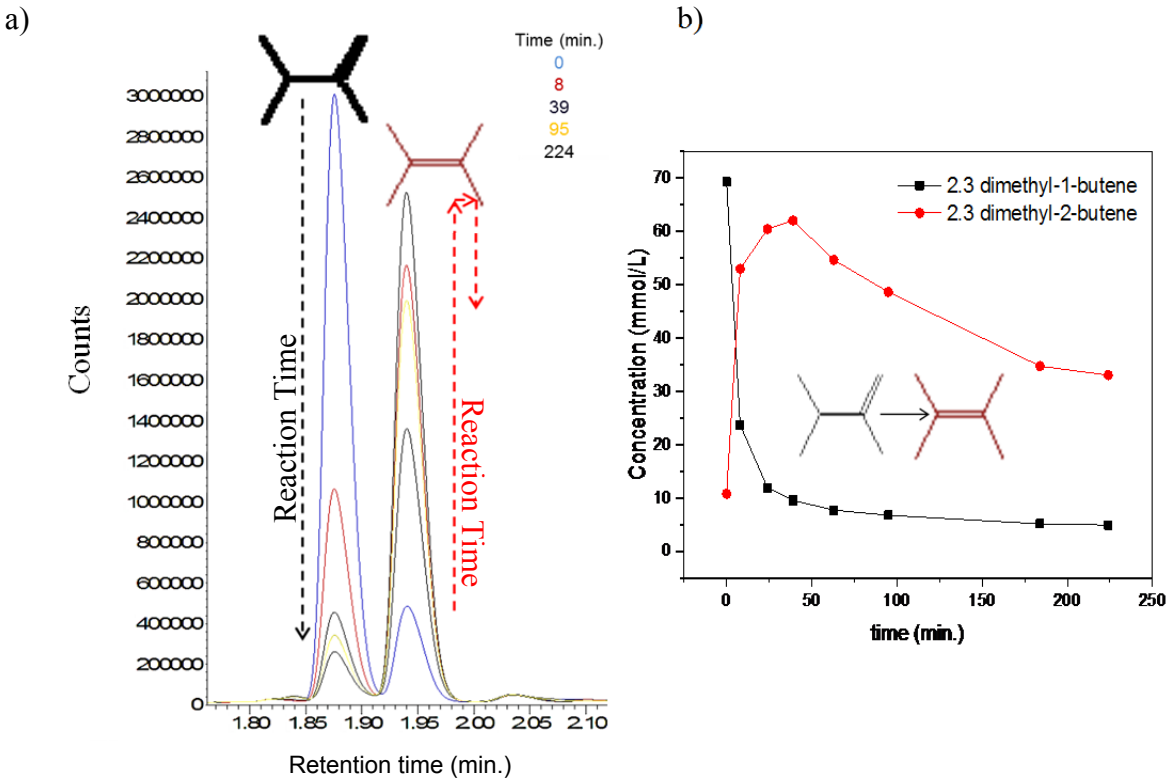


Figure S2: **(a)** FID signal and **(b)** Concentration-time profile corresponding to 2,3-dimethyl-1-butene during its reaction over Amberlyst-35 displaying quick initial isomerization to non-terminal 2,3-dimethyl-2-butene that converts at a relatively slower rate.

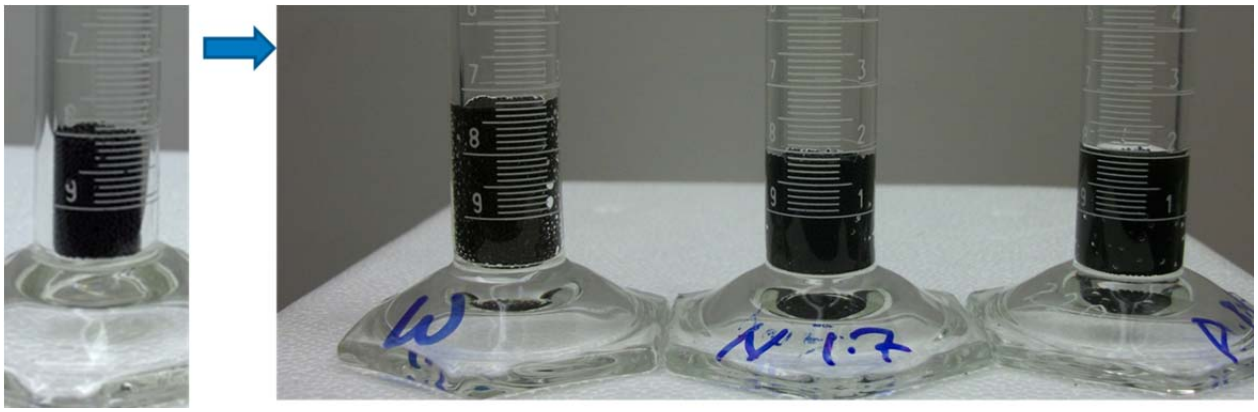


Figure S3: Photographs of Amberlyst-35 before and after exposure to solvent (from left to right: Amberlyst-35 with no solvent, with added water, nonane and pentadecane). In nonane and pentadecane, Amberlyst-35 exhibits negligible swelling as compared to swelling caused by water.

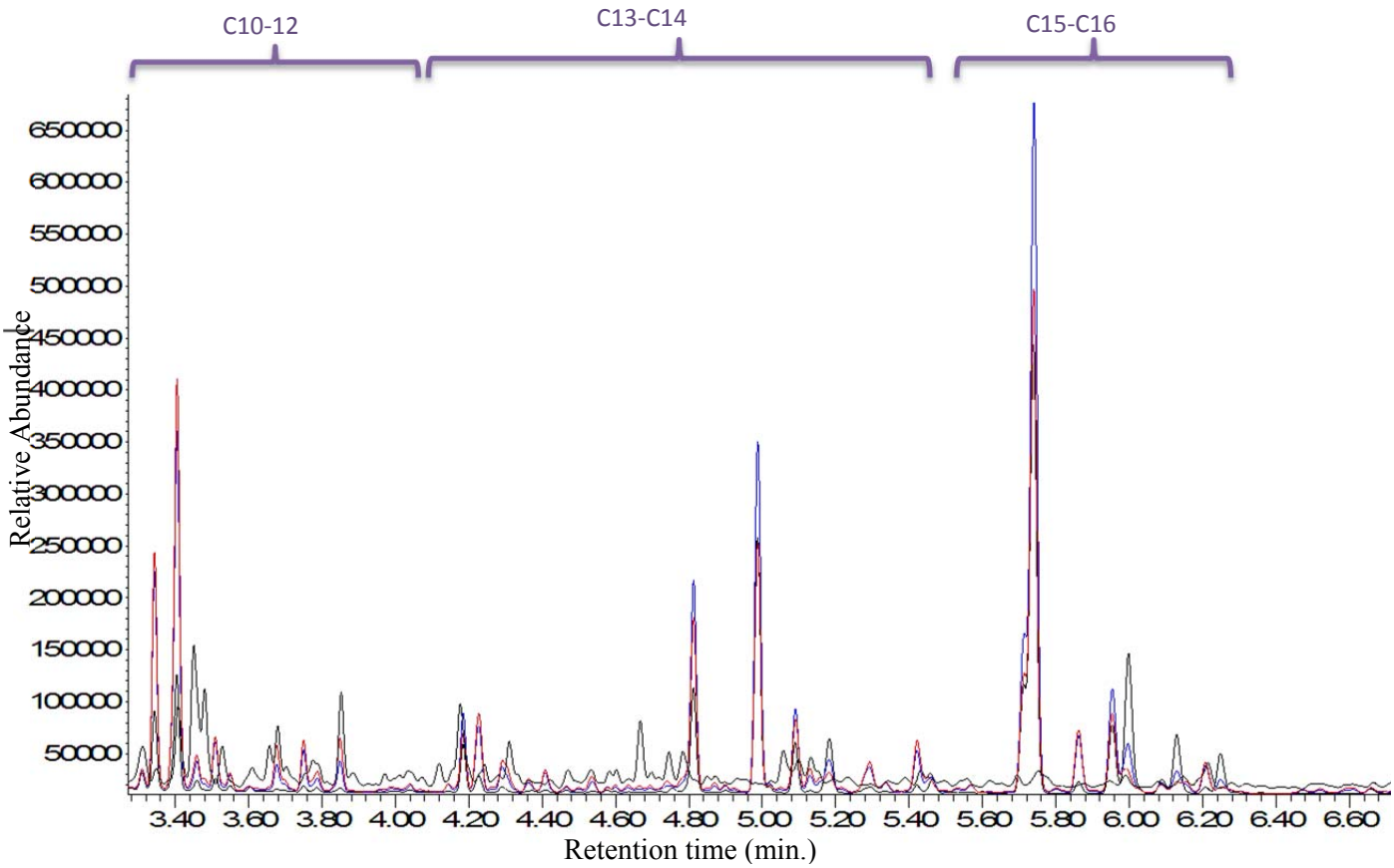
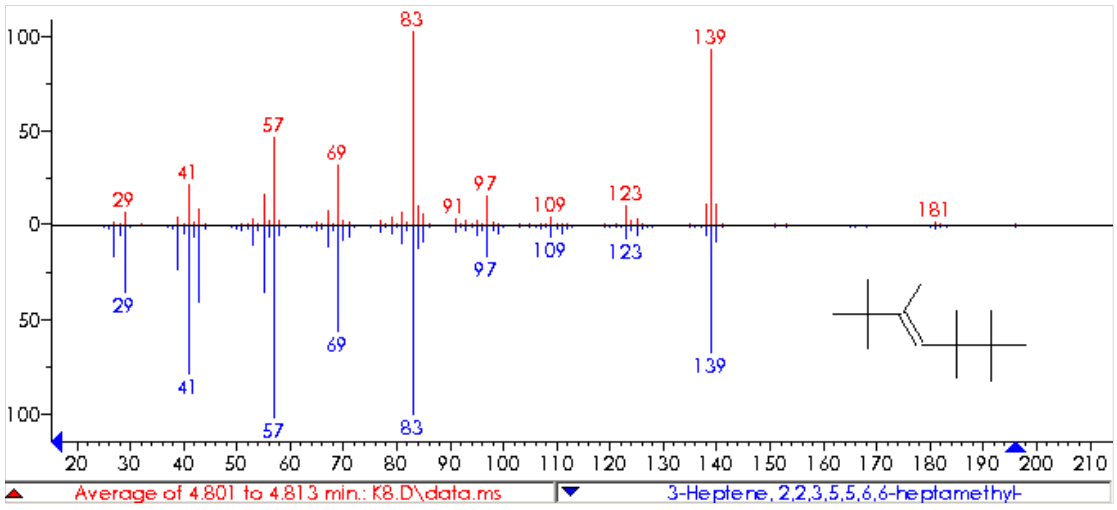
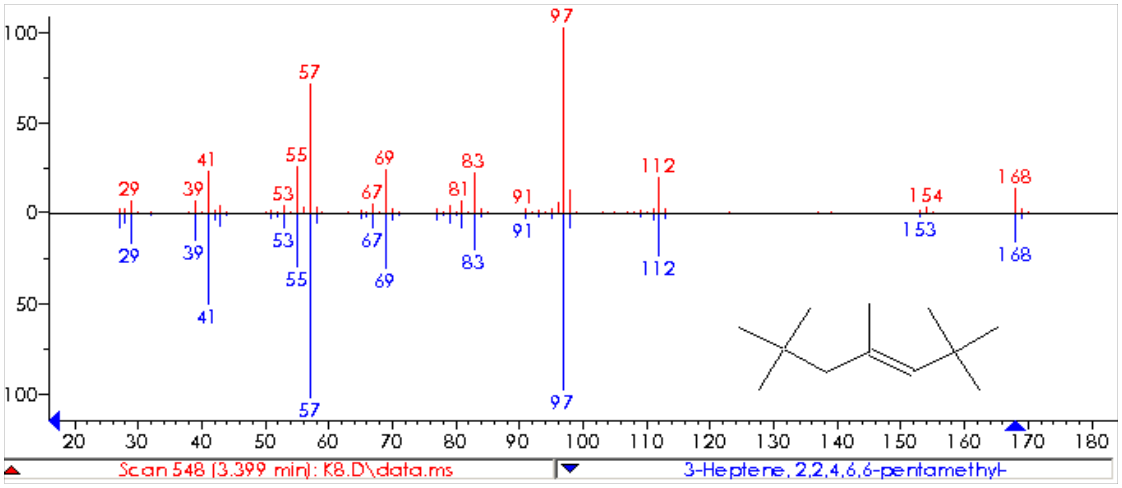


Figure S4: Representative gas chromatograms of major products from the dimerization and cross-coupling of mixed olefin feed during the first hours of reaction (t = 0.5h (blue trace); t = 2h (red trace); t = 3h (black trace)).

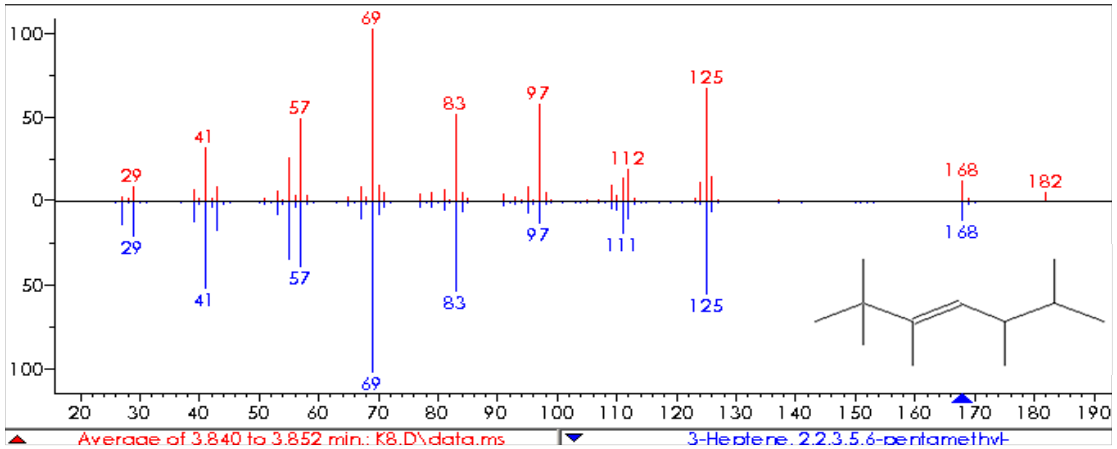
a)


Average of 4.801 to 4.813 min.: K8.D\data.ms
3-Heptene, 2,2,3,5,5,6,6-heptamethyl-

b)


Scan 548 (3.399 min): K8.D\data.ms
3-Heptene, 2,2,4,6,6-pentamethyl-

c)


Average of 3.840 to 3.852 min.: K8.D\data.ms
3-Heptene, 2,2,3,5,6-pentamethyl-

d)

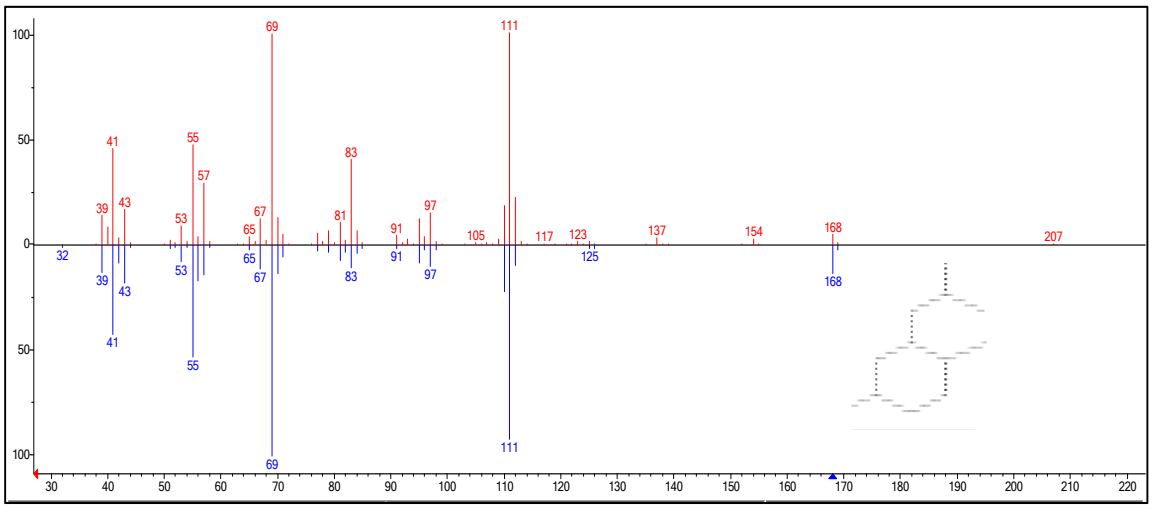
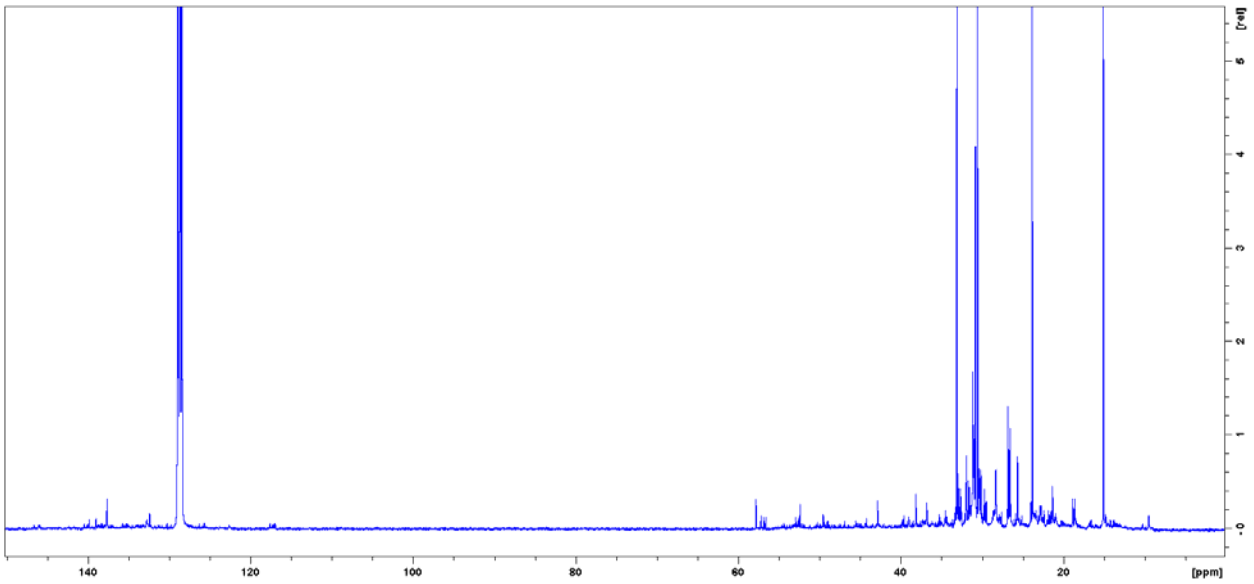
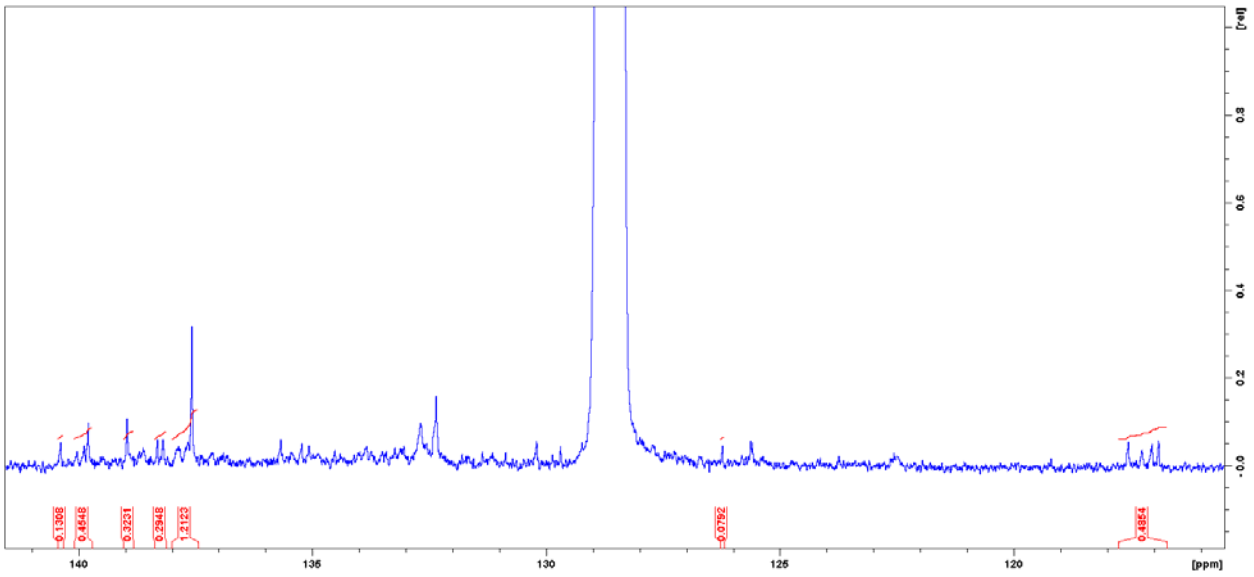


Figure S5: a) Mass spectrum of the major product from triptene dimerization co-located over the mass spectrum of 2,2,3,5,5,6,6-heptamethyl-3-heptene as provided in the NIST library. b) A mass spectrum of a C12 product co-located over the mass spectrum of 2,2,4,6,6-pentamethyl-3-heptene. c) A mass spectrum of another product co-located over the mass spectrum of 2,2,3,5,6-pentamethyl-3-heptene. d) A mass spectrum of another product co-located over the mass spectrum of 2-isobutyl-1,4-dimethylcyclohexane.

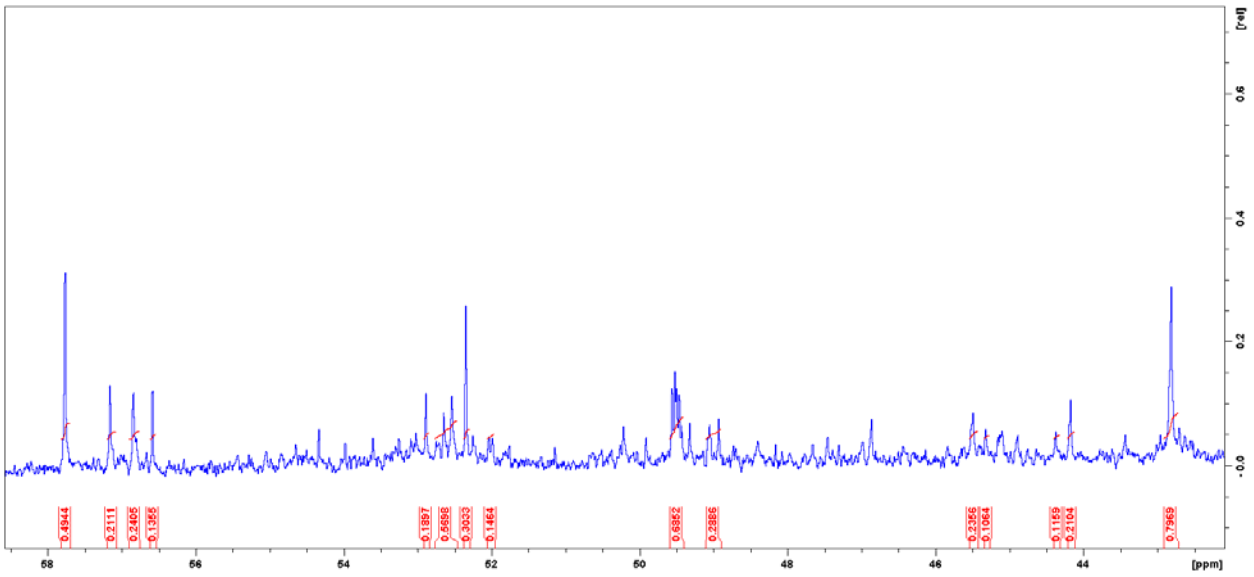
a)


140
120
100
80
60
40
20
[ppm]

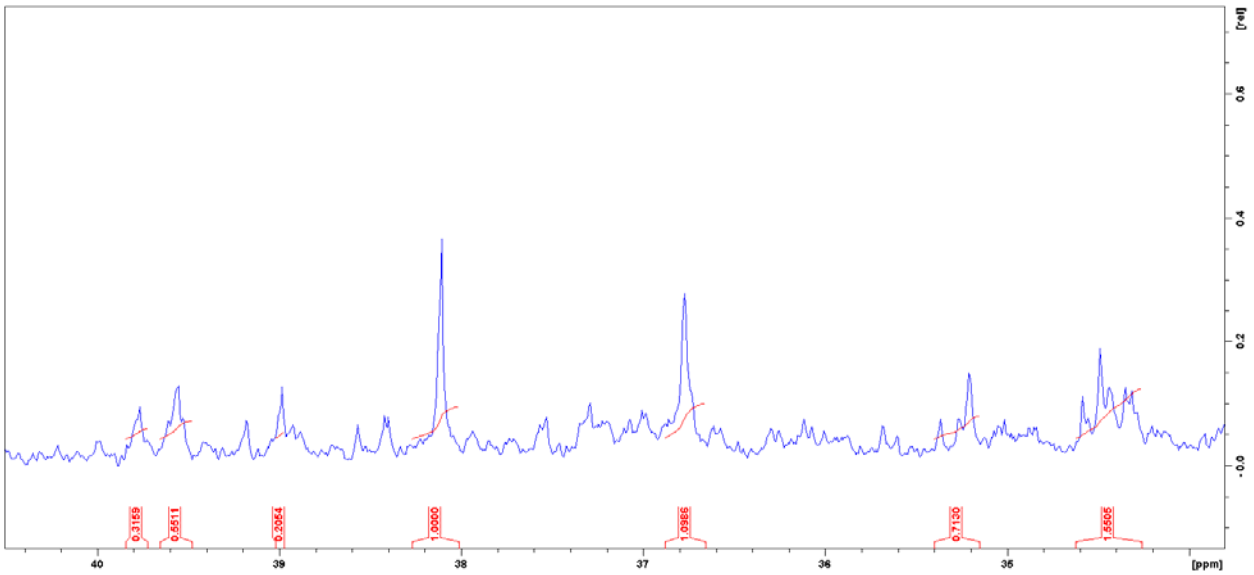
b)


0.1306
0.4648
0.3231
0.2946
1.2122
0.0792
0.4864
140
135
130
125
120
[ppm]

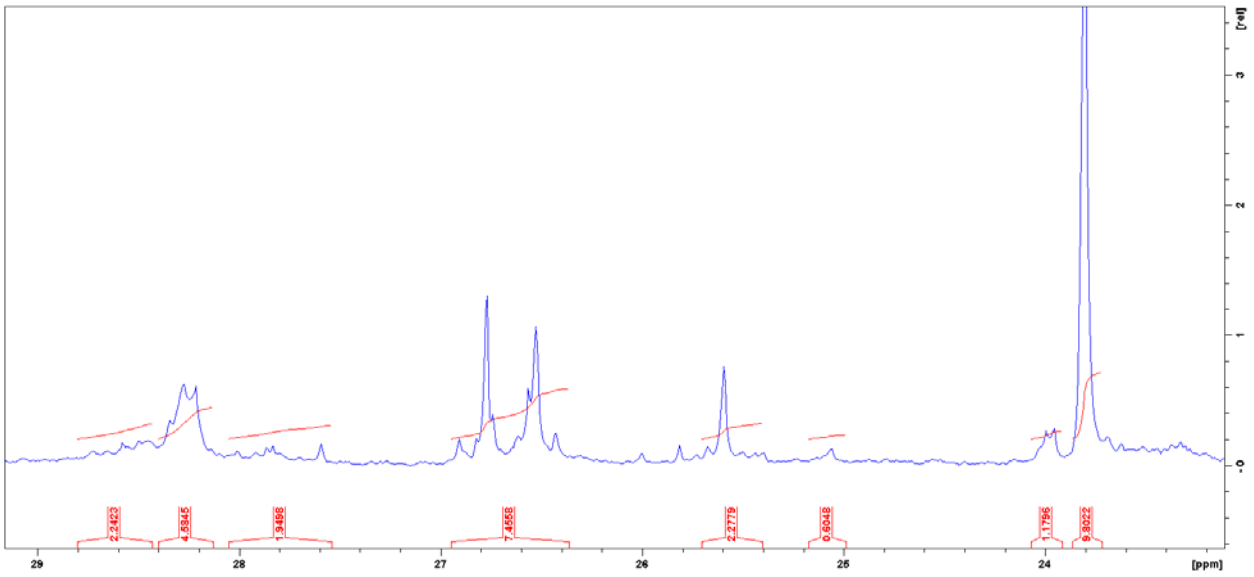
c)


0.4944
0.2111
0.2466
0.1355
0.1897
0.5698
0.3033
0.1464
0.6952
0.2886
0.2356
0.1064
0.1159
0.2104
0.7969
58
56
54
52
50
48
46
44
[ppm]
0.6
0.4
0.2
-0.0
[rel]

d)


0.3159
0.5511
0.2054
1.0000
1.0985
0.7130
1.5505
40
39
38
37
36
35
[ppm]
0.6
0.4
0.2
-0.0
[rel]

e)



f)

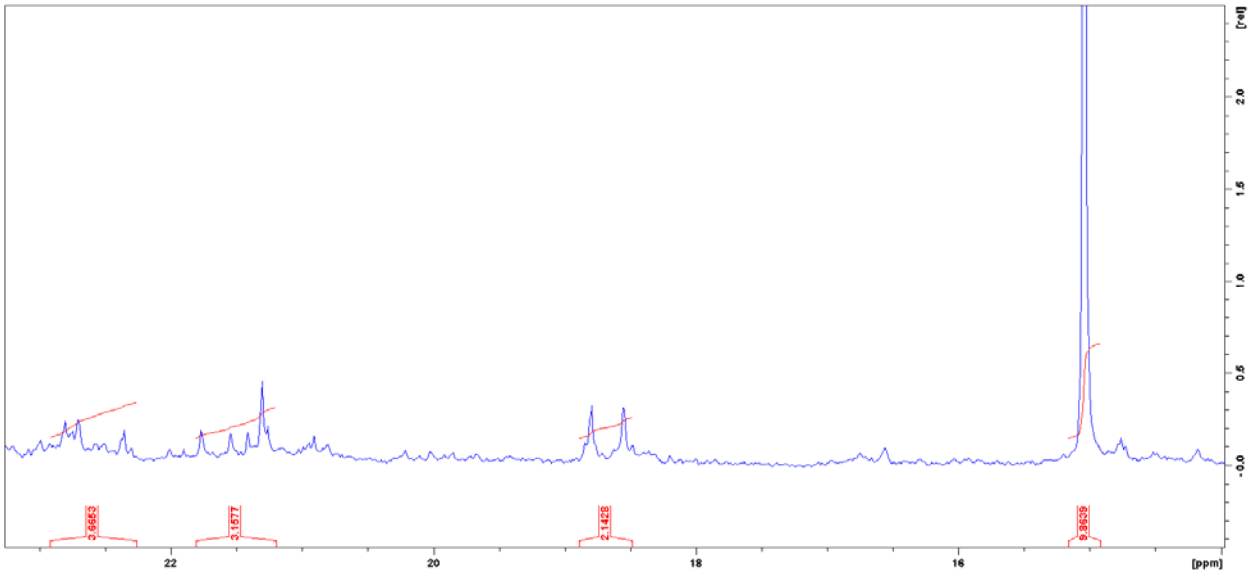


Figure S6: Representative 13C-NMR spectra of the product from coupling of mixed olefin feed: (a) Full 13C-NMR spectrum (the large peak at 128.6 ppm is Benzene (i.e., carrier medium)). An expanded view of (a) in the region of (b) 115-142 ppm, in the region of (c) 40-59 ppm, in the region of (d) 30-42 ppm, in the region of (e) 20-30 ppm and in the region of (f) 12-23 ppm.