Sustainable Production of Raw Materials from Waste Cooking Oils

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Content

Table S1. Penalty points for the EcoScale

Parameter	Penalty points
1. Yield	(100 - yield%)/2
2. Price of reaction components (to obtain 10 mmol of end product)	
Inexpensive (< $10)	0
Expensive (> $10 and < $50)	3
Very expensive (> $50)	5
3. Safety	
N (dangerous for environment)	5
T (toxic)	5
F (highly flammable)	5
E (explosive)	10
F+ (extremely flammable)	10
T+ (extremely toxic)	10
4. Technical setup	
Common setup	0
Instruments for controlled addition of chemicals	1
Unconventional activation technique	2
Pressure equipment, > 1 atm	3
Any additional special glassware	1
(Inert) gas atmosphere	1
Glove box	3
5. Temperature/time	
Room Temperature, < 1h	0
Room Temperature, < 24h	1
Heating, < 1h	2
Heating, < 24h	3
Cooling to 0°C	4
Cooling < 0°C	5
6. Workout and purification	
None	0
Cooling to room temperature	0
Adding solvent	0
Simple filtration	0
Removal of solvent with bp < 150°C	0
Crystallization and filtration	1
Removal of solvent with bp > 150°C	2
Solid phase extraction	2
Distillation	3
Sublimation	3
Liquid-liquid extraction	3
Classical chromatography	10

Table S2. Different treatments of WCO conducted.

Experiment	Water/oil ratio (wt%)	Temperature (°C)	pH	Bentonite (g)
1	40	25	6	0.6
2	10	70	2	0.6
3	40	70	2	0
4	10	25	6	0.6
5	40	70	6	0.6
6	10	25	6	0
7	40	25	2	0.6
8	40	70	2	0.6
9	40	70	6	0
10	10	70	2	0
11	10	70	6	0.6
12	40	25	2	0
13	10	25	2	0.6
14	10	25	2	0
15	10	70	6	0
16	40	25	6	0

Table S3. Optimization of recycling procedure, parameters and responses.

	Parameters	
	Lower value	**Higher value**
pH	2.0	6.0
Temperature (°C)	25	70
Oil/water ratio (wt%)	10	40
Bentonite (g)	0	0.6
	Responses	
	Oleic acid (%)	
	SFA (%)	

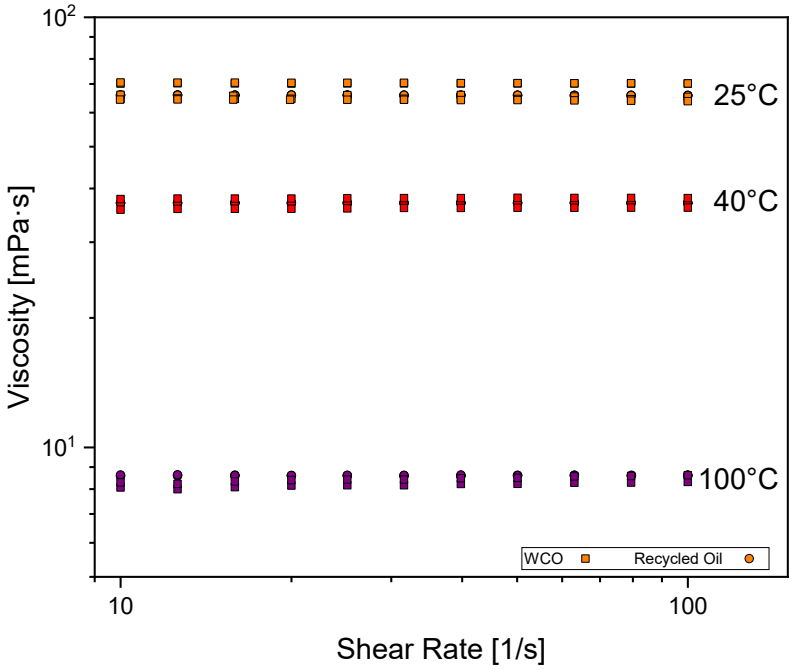

Figure S1. Viscosity curves for WCO and Recycled Oil at 25*C, 40*C and 100*C

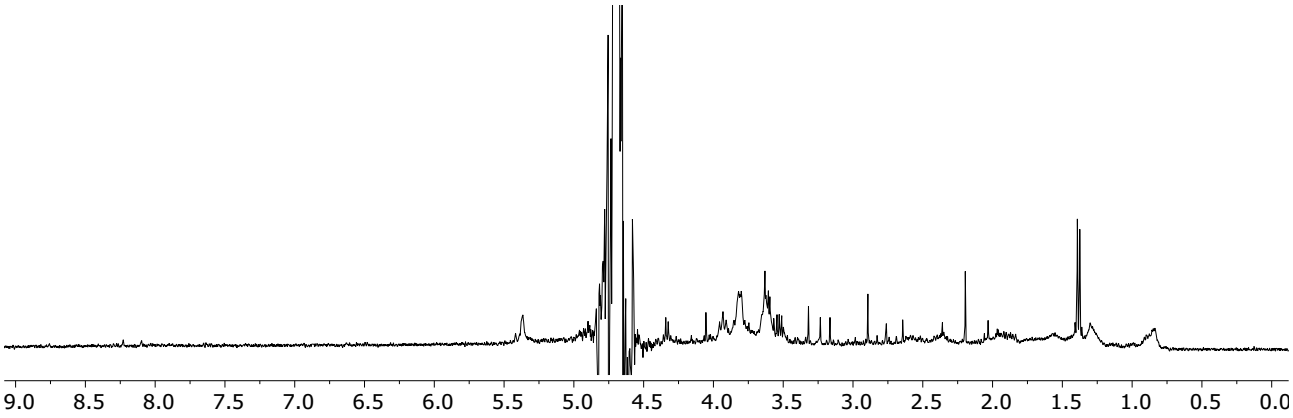

Figure S2. ^{1}H NMR (D_2O) of the fraction extracted with water from WCOs.

Figure S2 shows the presence of several signals relative to a complex mixture of organic compounds (containing C-H chemical groups). Most of the signals observed in the ^{1}H NMR spectrum appear in the range 0.5-5.5 ppm, which indicates the presence of not only alkanes but also possible unsaturated molecules or chemical containing heteroatoms. Apart from the two small signals between 8.0 and 8.5 ppm, no aromatic groups are present. NMR analysis of the wastewater confirms the removal of contaminants from the WCOs and demonstrate as the pH-mediated water treatment is effective in refining the starting WCO.

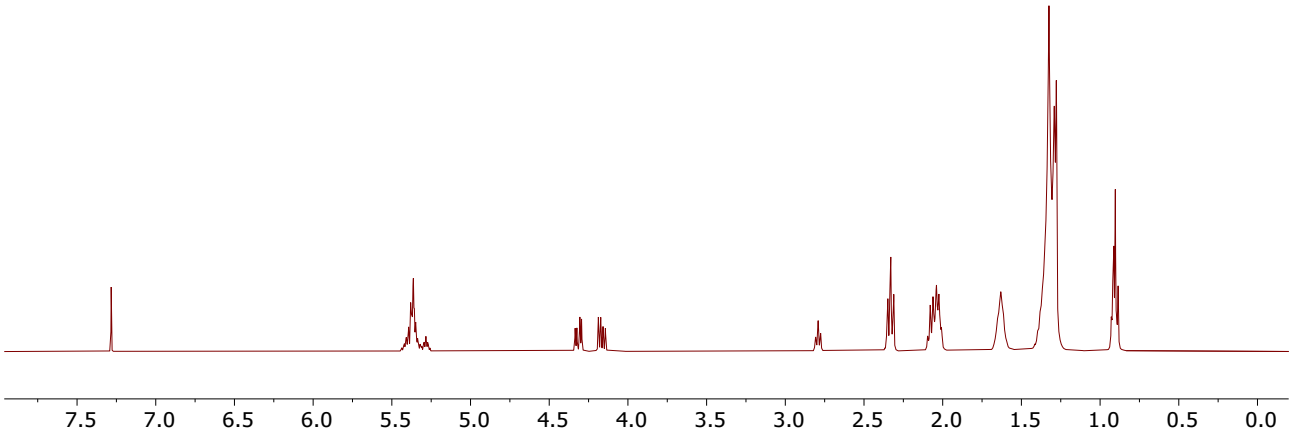

Figure S3. ^{1}H NMR of experiment 1.

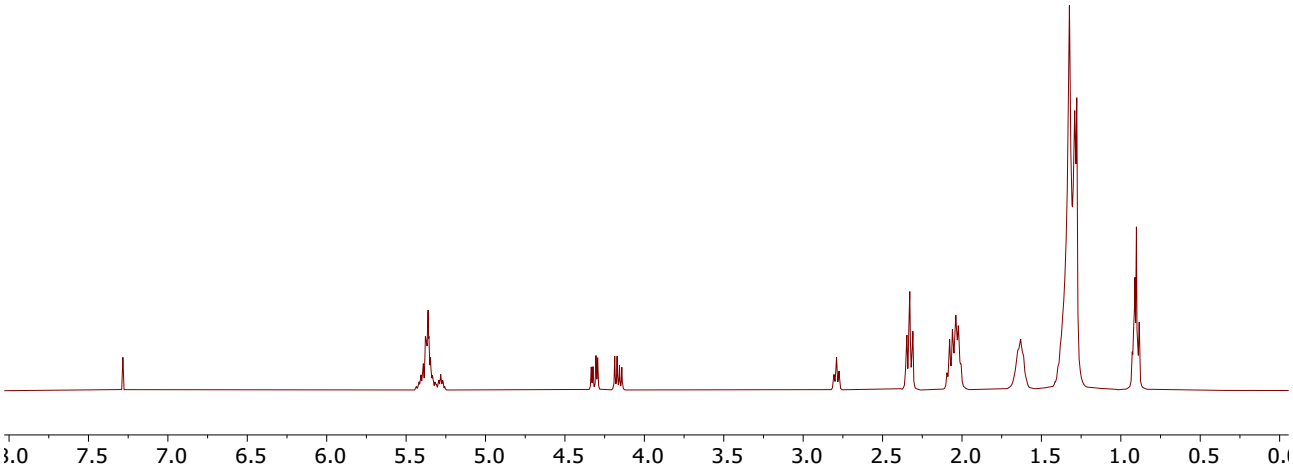

Figure S4. ^{1}H NMR of experiment 2.

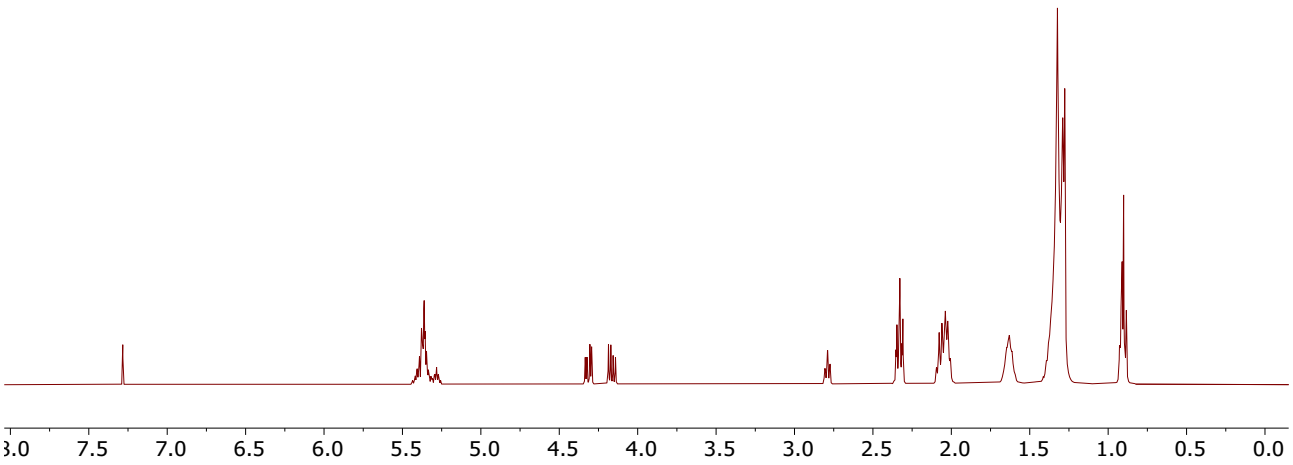

Figure S5. ^{1}H NMR of experiment 3.

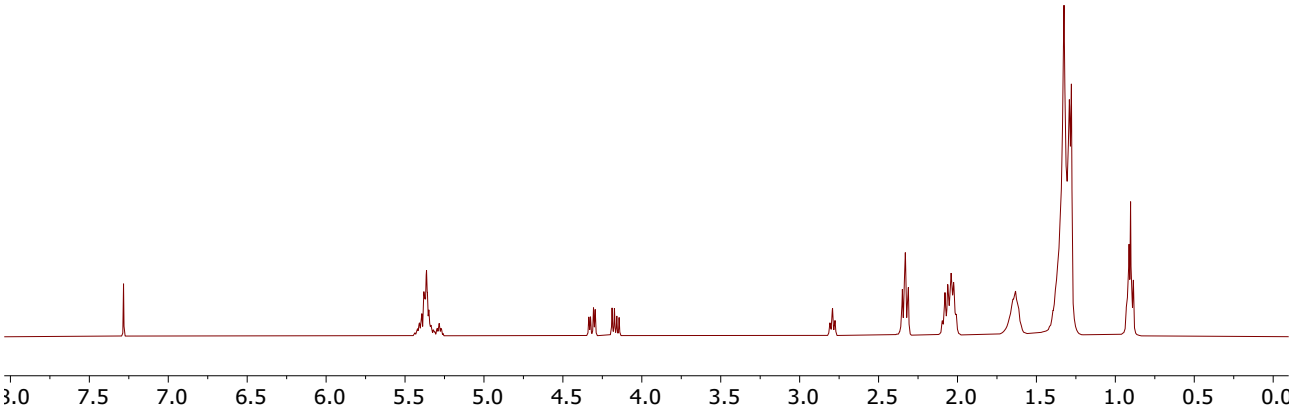

Figure S6. ^{1}H NMR of experiment 4.

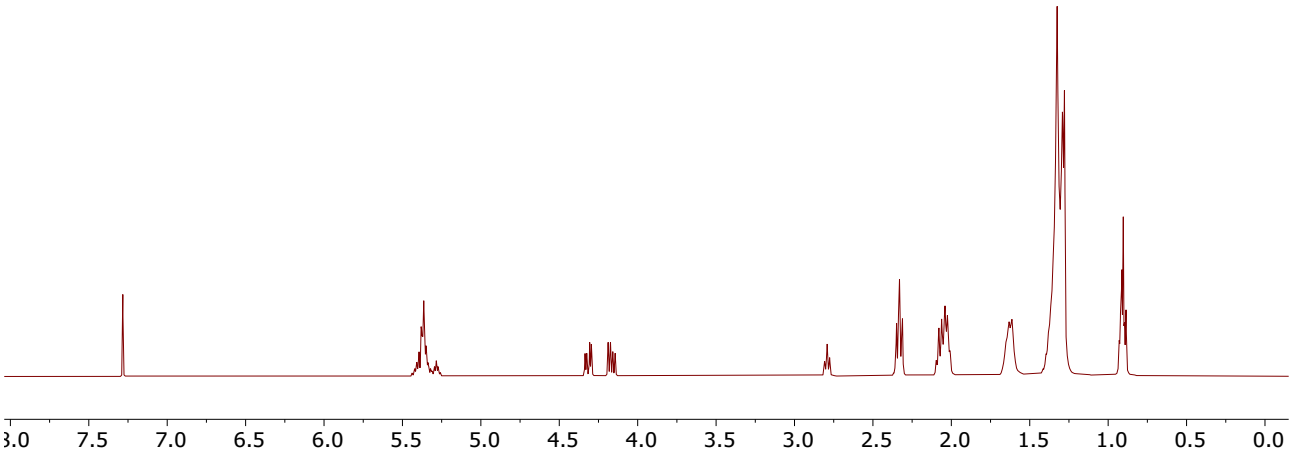

Figure S7. ^{1}H NMR of experiment 5.

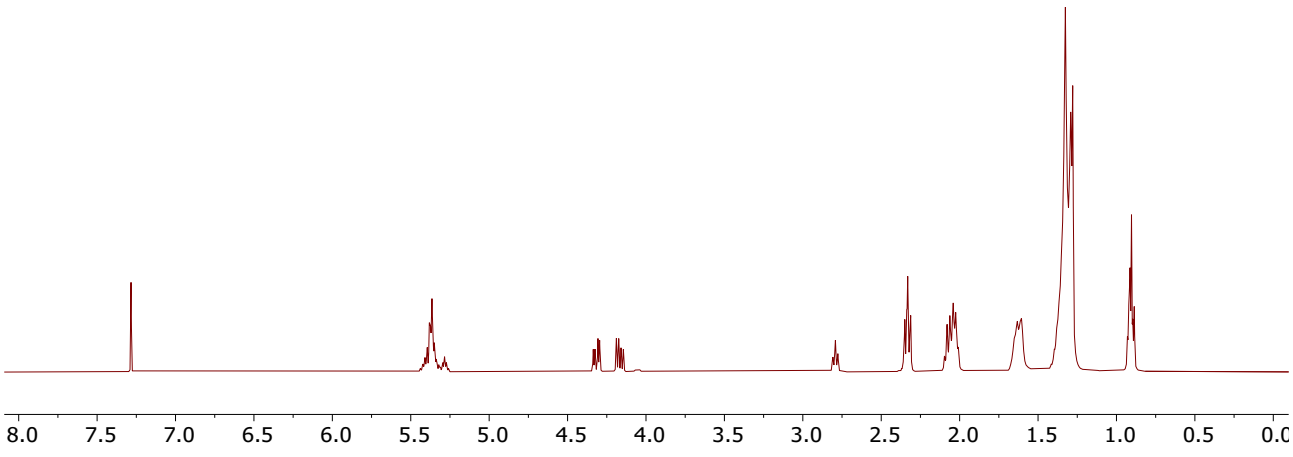

Figure S8. ^{1}H NMR of experiment 6.

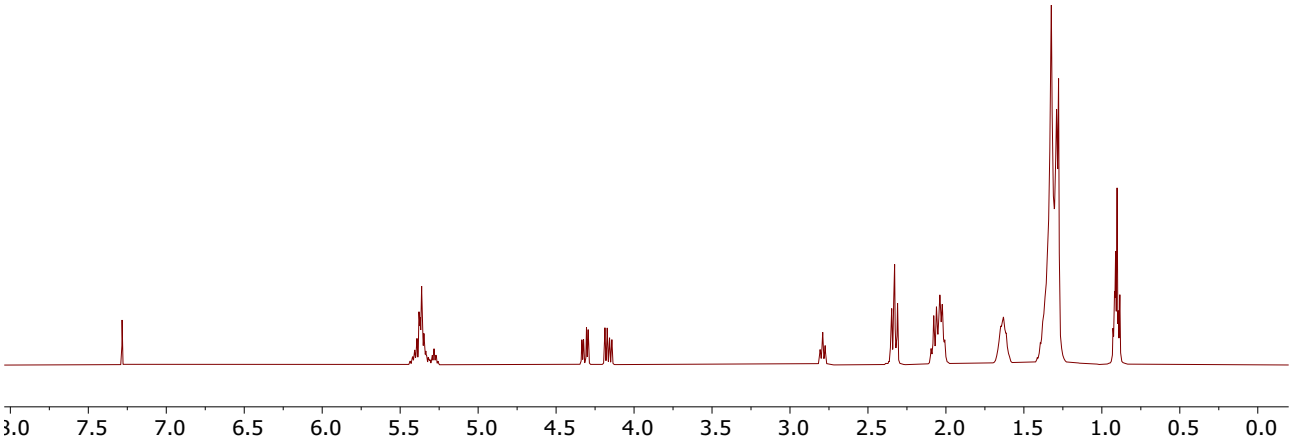

Figure S9. ^{1}H NMR of experiment 7.

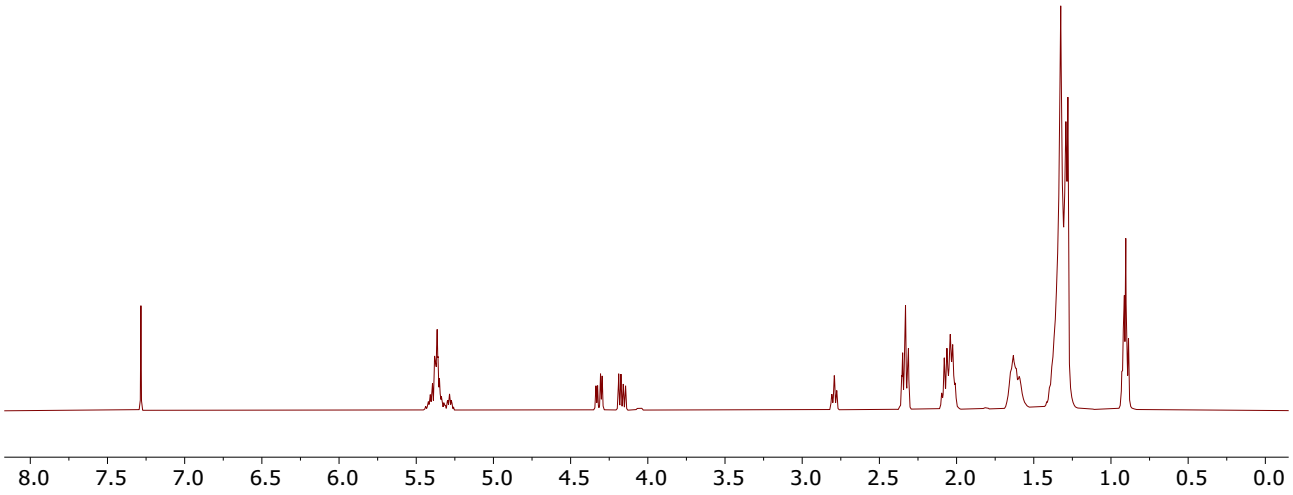

Figure S10. ^{1}H NMR of experiment 8.

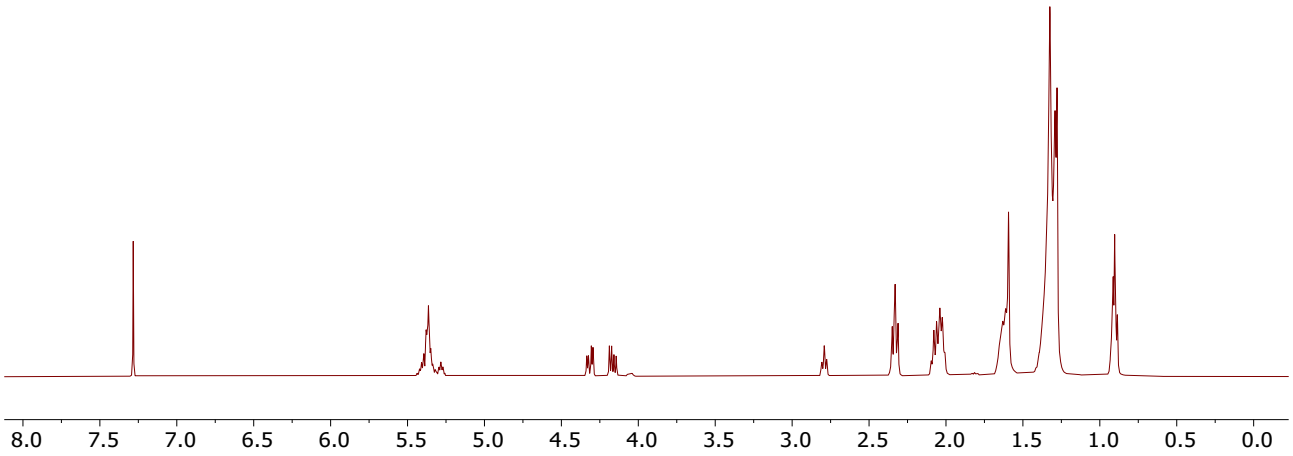

Figure S11. ^{1}H NMR of experiment 9.

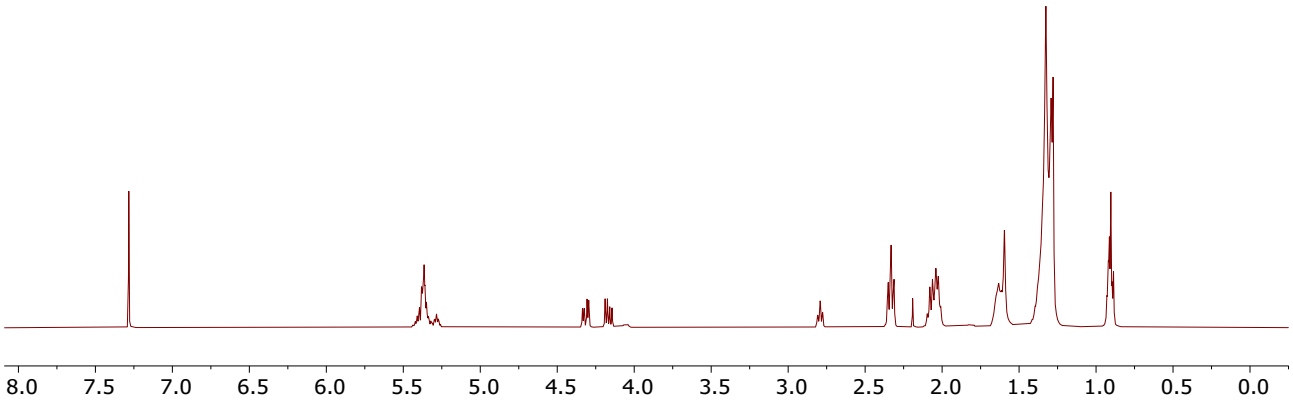

Figure S12. ^{1}H NMR of experiment 10.

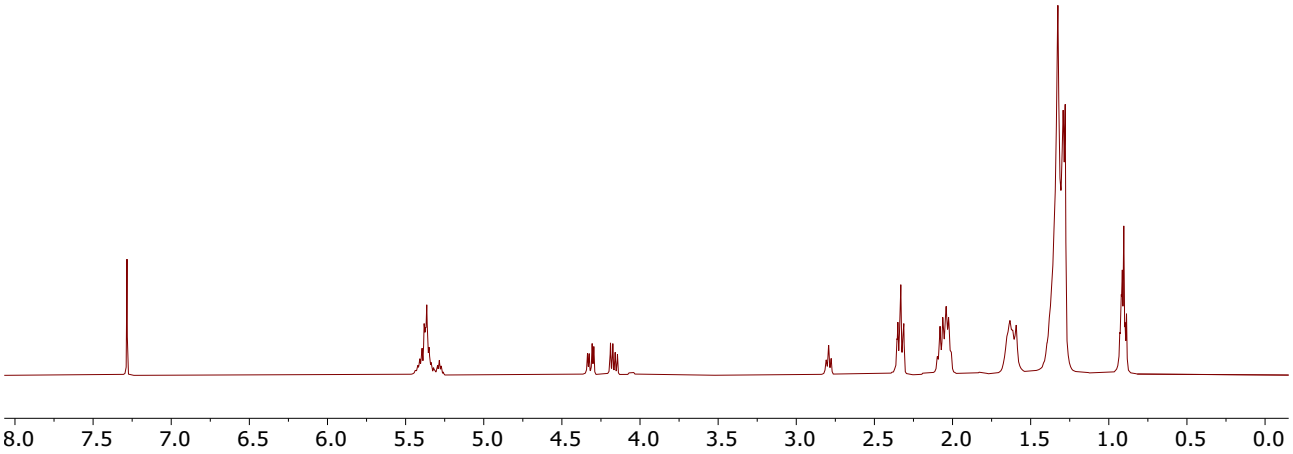

Figure S13. ^{1}H NMR of experiment 11.

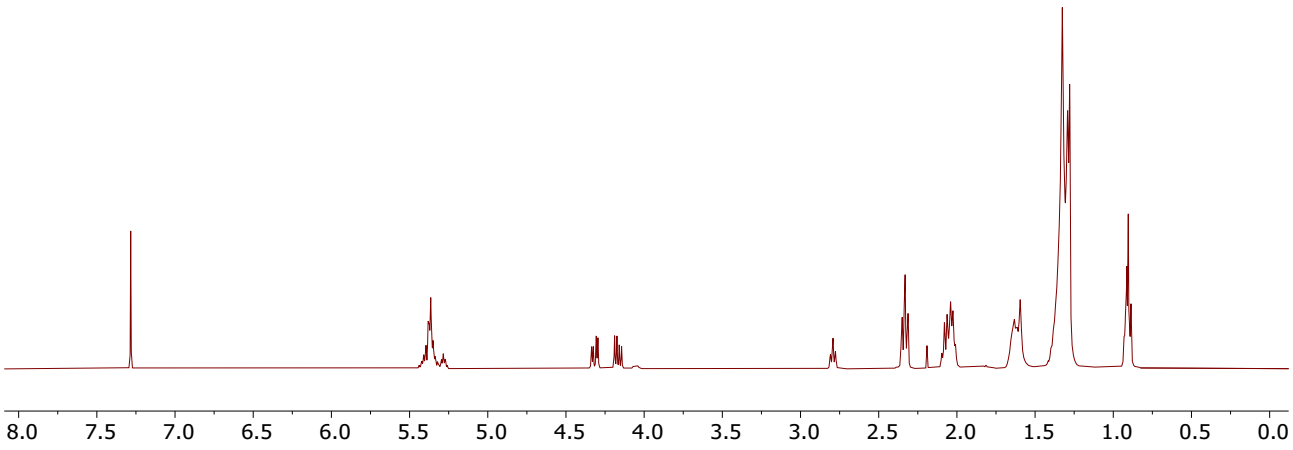

Figure S14. ^{1}H NMR of experiment 12.

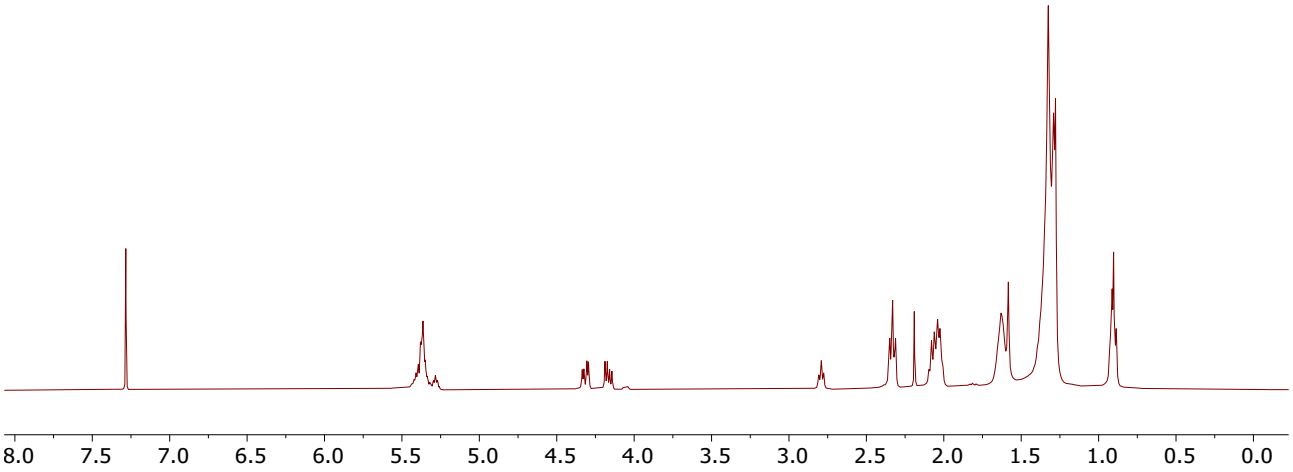

Figure S15. ^{1}H NMR of experiment 13.

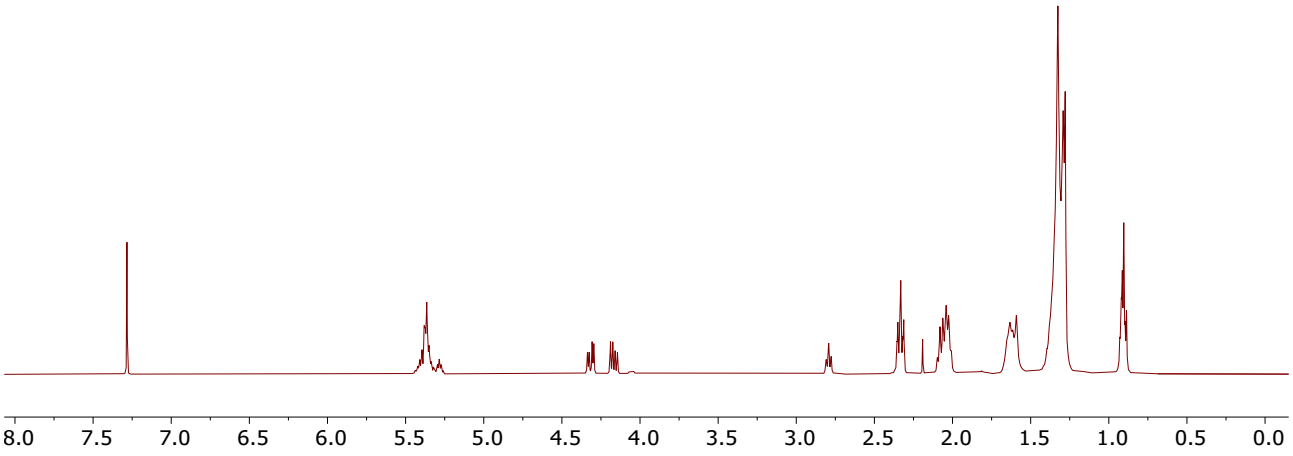

Figure S16. ^{1}H NMR of experiment 14.

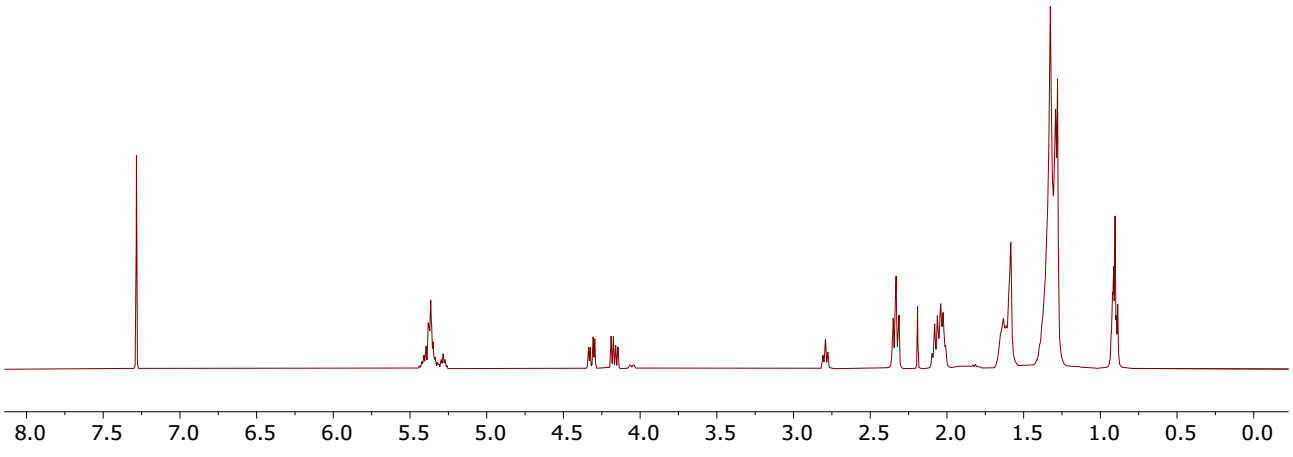

Figure S17. ^{1}H NMR of experiment 15.

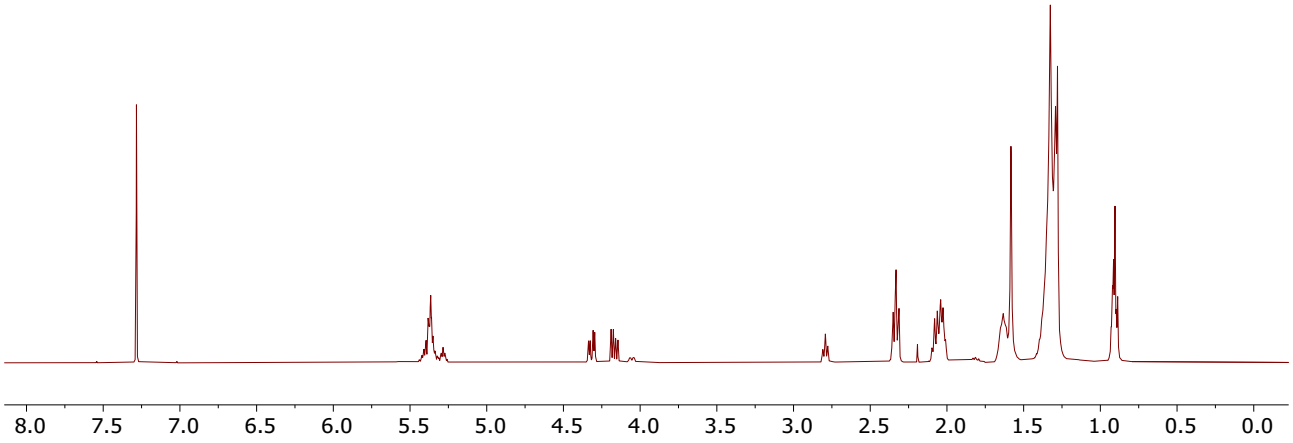

Figure S18. ^{1}H NMR of experiment 16.