Supplementary data

Representative figure for the nuclear magnetic resonance analysis of synthesized samples is given in the Figure S1.
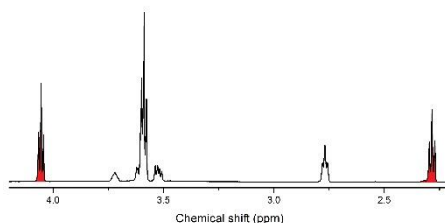

Figure S1. Conversion determinatation via nuclear magnetic resonance – integration of the areas under the signals at around 2.3 and 4.0 ppm.

When all 29 experiments are considered, the following results are obtained using the Response Surface Methodology, with an empirical quadratic model whose equation is:

$$\text{Conversion} = 93.2 + 1.58333A + 1.58333B + 22.8333C + 5.5D + 1.5AB - 7.25AC - 4.5AD - 4.25BC - 2BD - 5CD - 3.30833A^2 + 1.19167B^2 - 18.1833C^2 - 2.43333 D^2 \tag{S1}$$

the R^2-value obtained with this model was 0.97.

Table S1. Part of ANOVA for quadratic model.

Source	Sum of Squares	Degrees of freedom	Mean Squares	F-value	Probability p
Model	9460.38	14	675.74	27.63	< 0.0001
A	30.08	1	30.08	1.23	0.2861
B	30.08	1	30.08	1.23	0.2861
C	6256.33	1	6256.33	255.82	< 0.0001
D	363.00	1	363.00	14.84	0.0018
Residual	342.38	14	24.46		
Cor. Total	9802.76	28			

Diagnostics for the model simulated and the graphs obtained are given below (Figure S2–S6).
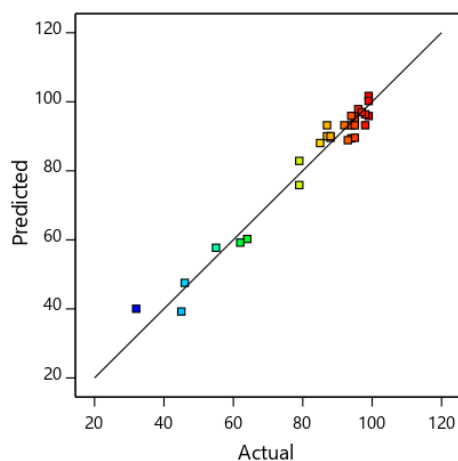
Figure S2. Comparison of calculated and experimentally determined conversion values.
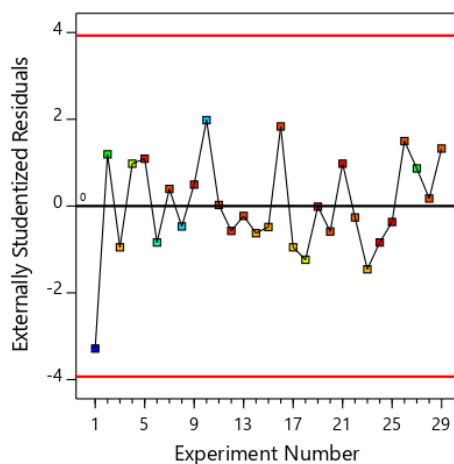

Figure S3. Graphical representation of the distribution of residues, r_s depending on the ordinal number of the experiment.
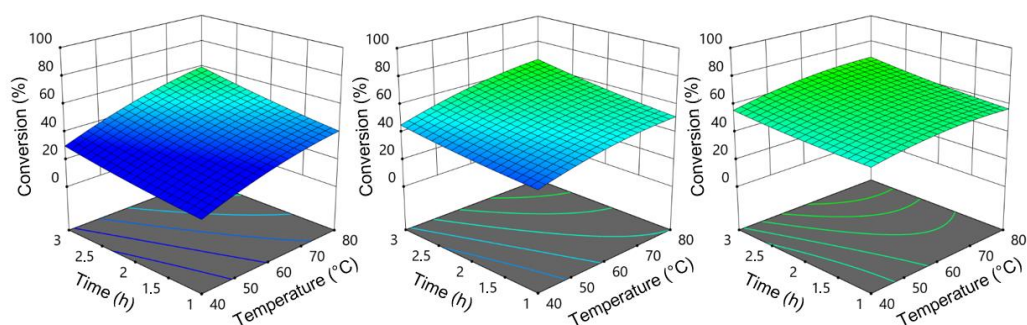

Figure S4. The 3D plots obtained when the molar ratio of the reactants was the lowest (4:1) and the value of the mass fraction of the catalyst was the lowest (1 %, left), medium (2 %, in the middle) and the highest (3 %, right)
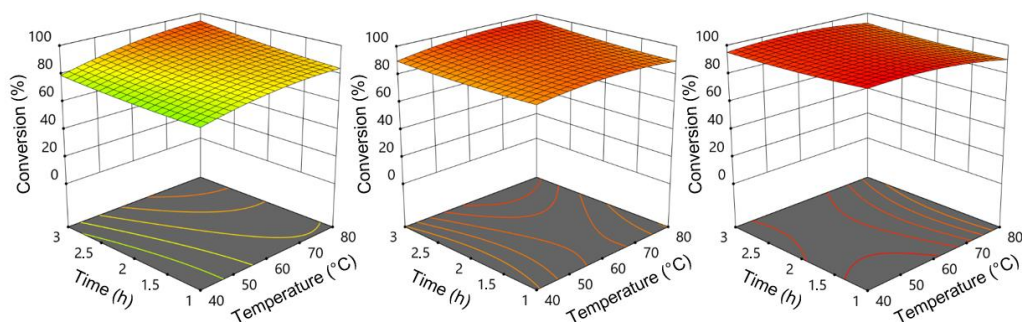
Figure S5. The 3D plots obtained when the molar ratio of the reactants was medium (7:1) and the value of the mass fraction of the catalyst was the lowest (1 %, left), medium (2 %, in the middle) and the highest (3 %, right).
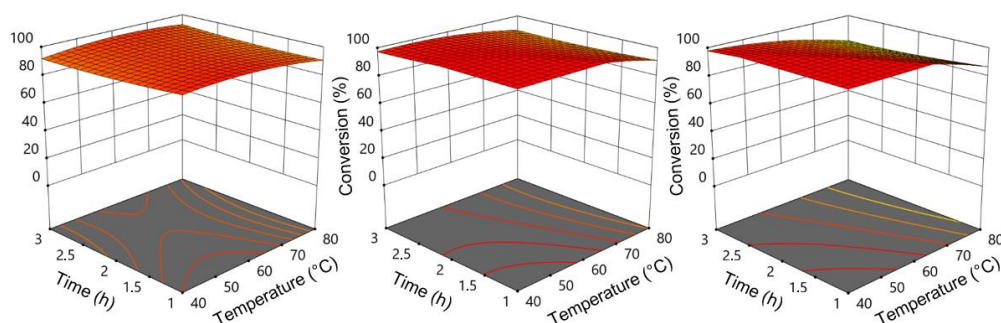

Figure S6. The 3D plots obtained when the molar ratio of the reactants was the highest (10:1) and the value of the mass fraction of the catalyst was the lowest (1 %, left), medium (2 %, in the middle) and the highest (3 %, right).

Table S2. Composition of the prepared blends (D – mineral diesel without additives, FAOCE – fatty acid octyl esters, O – 1-octanol).

Sample name	Diesel / vol%	FAOCE / vol%	1-octanol / vol%
D80FAOCE20	80.0	20.0	0.0
D85FAOCE15	85.0	15.0	0.0
D90FAOCE10	90.0	10.0	0.0
D92.5FAOCE7.5	92.5	7.5	0.0
D95FAOCE5	95.0	5.0	0.0
D97.5FAOCE2.5	97.5	2.5	0.0
D80FAOCE15O5	80.0	15.0	5.0
D80FAOCE10O10	80.0	10.0	10.0
D80FAOCE5O15	80.0	5.0	15.0
D90FAOCE7.5O2.5	90.0	7.5	2.5
D90FAOCE5O5	90.0	5.0	5.0
D90FAOCE2.5O7.5	90.0	2.5	7.5

Table S3. The property results of diesel, 1-octanol, FAOCE and their blends.

Blend	Viscosity (mm²/s)	Density (kg/m³)	CFPP (°C)	Wear scar diameter (μm)
D100	2.600	826.3	-8	571
FAOCE100	4.613	881.5	0	190
D80FAOCE20	3.365	836.9	-8	280
D85FAOCE15	3.163	834.4	-7	230
D90FAOCE10	2.980	831.8	-7	350

D92.5FAOCE7.5	2.883	830.7	-6	350
D95FAOCE5	2.802	829.3	-7	310
D97.5FAOCE2.5	2.703	828.2	-7	400
D80FAOCE15O5	3.164	834.2	-7	/
D80FAOCE10O10	3.005	831.2	-7	270
D80FAOCE5O15	2.910	828.9	-7	/
D90FAOCE7.5O2.5	2.847	830.4	-7	/
D90FAOCE5O5	2.770	828.6	-7	300
D90FAOCE2.5O7.5	2.716	827.9	-8	/
O100	5.303	828.4	-17	410

Representative figure for the differential scanning calorimetry analysis of the prepared blend is given in the Figure S7.
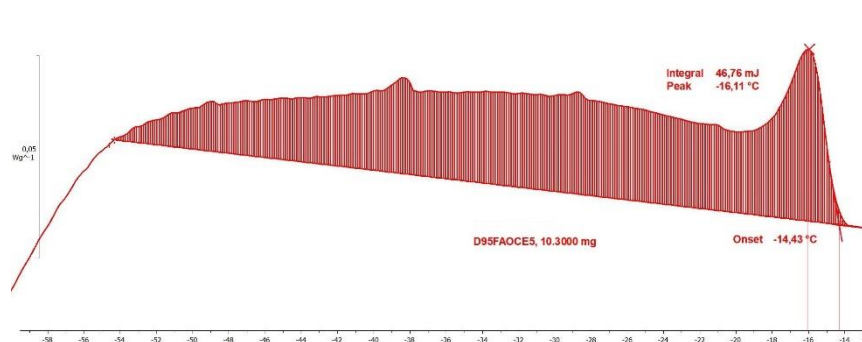

Figure S7. An example of the differential scanning calorimetry curve analysis.