Supplementary Material

Table S-1. Empirical models suggested by CCD method for the first set of experiment.

Actual Equation= $a+bX_1 + cX_2 + dX_1X_2+e X_{1+}^2 fX_{2+}^2 gX_1^2X_2 + hX_1X_{2+}^2iX_1^3 + jX_2^3$					
X_1: Temperature (°C)			X_2: Molar ratio of catalyst		
Coefficient	a	*b*	*c*	*d*	*e*
Conversion	52.87999	0.026473	-1.71343	-0.00645	0.000223
MOB S.[a]	50.64618	-0.276942	-0.548246	-0.006226	0.000940
MUB S.	106.03750	-1.90021	-0.008195	0.003237	0.003237
i-C_7 S.	146.94111	-1.02250	-2.38141	-0.012093	0.003610
Crack S.	17.29500	0.181367	2.97243	0.010488	-0.000103
RON	65.10028	-0.015558	-8.17812	-0.000327	0.000216
Hydro S.	25.03583	-0.208100	-0.038457	-0.000103	0.000440
Coefficient	*f*	*g*	*h*	*i*	*j*
Conversion	0.144870	7.78026E-06	0.000098	-5.35191E-07	-0.002746
MOB S.	0.132558	4.87662E-06	0.000079	-1.09431E-06	-0.002908
MUB S.	0.224967	9.04762E-06	0.000068	-4.00000E-06	-0.004347
i-C_7 S.	0.334956	0.000011	0.000128	-4.26667E-06	-0.006791
Crack S.	-0.353533	-0.000010	-0.000095	-5.33333E-07	0.006933
RON	0.501172	0.000013	-0.000144	-5.00000E-07	-0.007798
Hydro S.	0.001136	0	0	0	0

[a]All the S. denotes for selectivity.

Table S-2. Empirical models suggested by CCD method for the second set of experiment.

Actual Equation= $a+bX_1 + cX_2 + dX_1X_2+eX_{1+}^2 fX_{2+}^2 gX_1^2X_2 + hX_1X_2^2+iX_1^3 + jX_2^3$					
	X_1: Time (hr)		X_2: Molar ratio of catalyst		
Coefficient	a	b	c	d	e
Conversion	55.24823	-0.117690	-0.273136	0.000828	0.000963
MOB S.[a]	17.48370	-0.017038	-0.714765	0.000692	0.000123
MUB S.	27.28079	-0.062580	-2.93383	-0.000698	0.002332
i-C_7 S.	44.07897	-0.075749	-3.45689	-0.000058	0.002175
Crack S.	52.06788	0.111803	3.95475	-0.000428	-0.003420
Hydro S.	2.15170	0.024833	-0.143399	-0.000246	-0.000122
Coefficient	f	g	h	i	j
Conversion	0.010898	0	0	0	0
MOB S.	0.079583	-7.77475E-07	-0.000015	-5.74609E-07	-0.001624
MUB S.	0.201104	-5.70967E-07	0.000019	-0.000021	-0.003516
i-C_7 S.	0.269264	-3.98688E-06	9.90713E-06	-0.000018	-0.004955
Crack S.	-0.288695	5.48439E-06	-4.75965E-6	0.000029	0.005164
Hydro S.	0.003160	0	0	0	0

[a]All the S. denotes for selectivity.

Table S-3. The significant terms of RSM models for both sets of experiments.

X_1: Temperature (°C)			X_1: Time (hr)		
X_2: Molar ratio of catalyst			X_2: Molar ratio of catalyst		
	Source	F-value		Source	F-value
Conversion	X_2	34.46	Conversion	X_2	55.36
MOB S.[b]	X_2^2	56.18	MOB S.[b]	X_2^2	39632
MUB S.	X_2	66.90	MUB S.	X_2	349
i-C_7 S.	X_2	50.14	i-C_7 S.	X_2^2	3608
Crack S.	X_2	45.25	Crack S.	X_2	1484
Hydro S.	X_1	76.52	Hydro S.	X_2^2	17.33
RON	X_2	403.11	-		