Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Response surface methodology as an efficient tool for optimizing of Fischer-Tropsch process over a novel Fe-Mn nano catalyst

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Tables:

Table S1. Textural properties of the precursor and Fe-Mn-resol/SiO_2 catalyst before and after the test.

	Specific surface area (m^2/g)		Pore volume (cm^3/g)	Pore diameter (Å)
	BET	BJH	BJH	BJH
Precursor	165.10	166.20	0.47	16.37
Before test	346.50	346.80	0.78	17.61
After test	303.80	303.20	0.57	16.29

Table S2. Response surface quadratic evaluation of data. [a]

Term [a]	Std. Err. [b]	VIF	Ri-Squared	Power at 5 % alpha level for effect of		
				0.5 Std Dev.%	1 Std. Dev.%	2 Std. Dev.%
A	0.2	1.00	0.000	20.9	63.0	99.5
B	0.2	1.00	0.000	20.9	63.0	99.5
C	0.2	1.00	0.000	20.9	63.0	99.5
D	0.2	1.00	0.000	20.9	63.0	99.5
AB	0.25	1.00	0.000	15.5	46.5	96.2
AC	0.25	1.00	0.000	15.5	46.5	96.2
AD	0.25	1.00	0.000	15.5	46.5	96.2
BC	0.25	1.00	0.000	15.5	46.5	96.2
BD	0.25	1.00	0.000	15.5	46.5	96.2
CD	0.25	1.00	0.000	15.5	46.5	96.2
A^2	0.19	1.05	0.0476	68.7	99.8	99.9
B^2	0.19	1.05	0.0476	68.7	99.8	99.9
C^2	0.19	1.05	0.0476	68.7	99.8	99.9
D^2	0.19	1.05	0.0476	68.7	99.8	99.9

[a] A, B, C and D are representive of H_2/CO molar ratio, GHSV, pressure and temperature, respectively. The products terms of the main factors represent the interaction parameters.

[b] Standard error (basis stdandaard deviation = 1.0)

Table S3. Optimized conditions for obtaining the maximum LHCs selectivity.

Run	H_2/CO	GHSV (min^{-1})	P (bar)	T (°C)	χ_{CO} (%)	ROH (%)	HHCs (%)	LHCs (%)	Desirability
1	2.50	6.00	4.00	358.05	81.20	5.55	36.27	51.81	0.768
2	2.50	6.00	4.00	358.56	81.23	5.54	36.29	51.79	0.767
3	2.50	6.00	4.00	363.97	81.42	5.37	36.40	51.60	0.767
4	2.49	6.00	4.00	353.40	80.97	5.66	36.23	51.92	0.767
5	2.50	6.00	4.00	352.32	80.60	5.68	36.16	52.02	0.767
6	2.50	6.00	4.00	364.96	81.41	5.34	36.42	51.56	0.767
7	2.47	6.00	4.00	355.66	81.56	5.63	36.36	51.74	0.766
8	2.47	6.00	4.00	364.85	81.92	5.37	36.56	51.41	0.765
9	2.46	6.00	4.00	349.11	80.84	5.75	36.24	51.95	0.765
10	2.50	6.00	4.05	363.34	81.41	5.41	36.47	51.53	0.764
11	2.49	6.00	4.00	346.10	79.70	5.76	36.06	52.20	0.764

Figures:

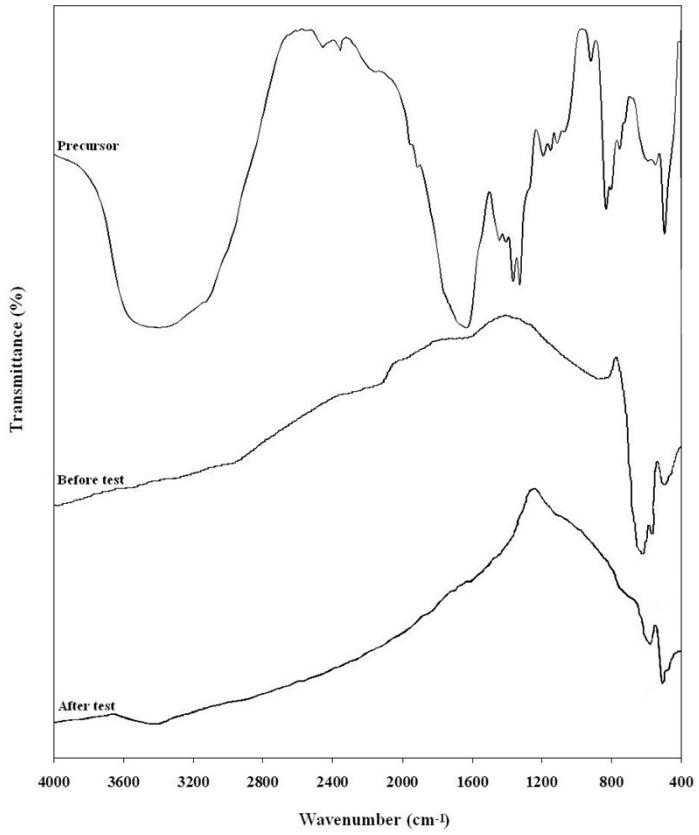


Fig. S1. FT-IR spectra of precursor and Fe-Mn-resol/SiO_2 catalyst before and after the test.

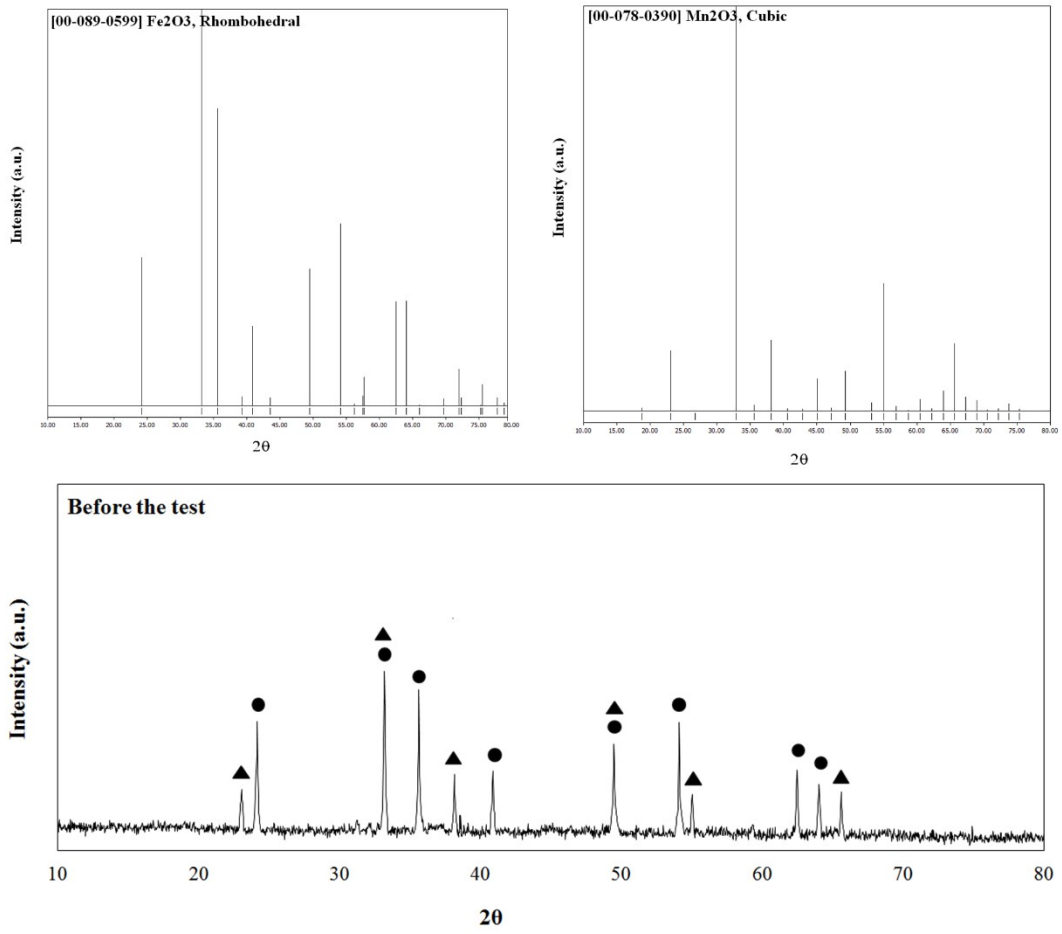


Fig. S2. XRD patterns of the catalyst before the test. ●Fe_2O_3 (rhombohedral); ▲Mn_2O_3 (cubic).

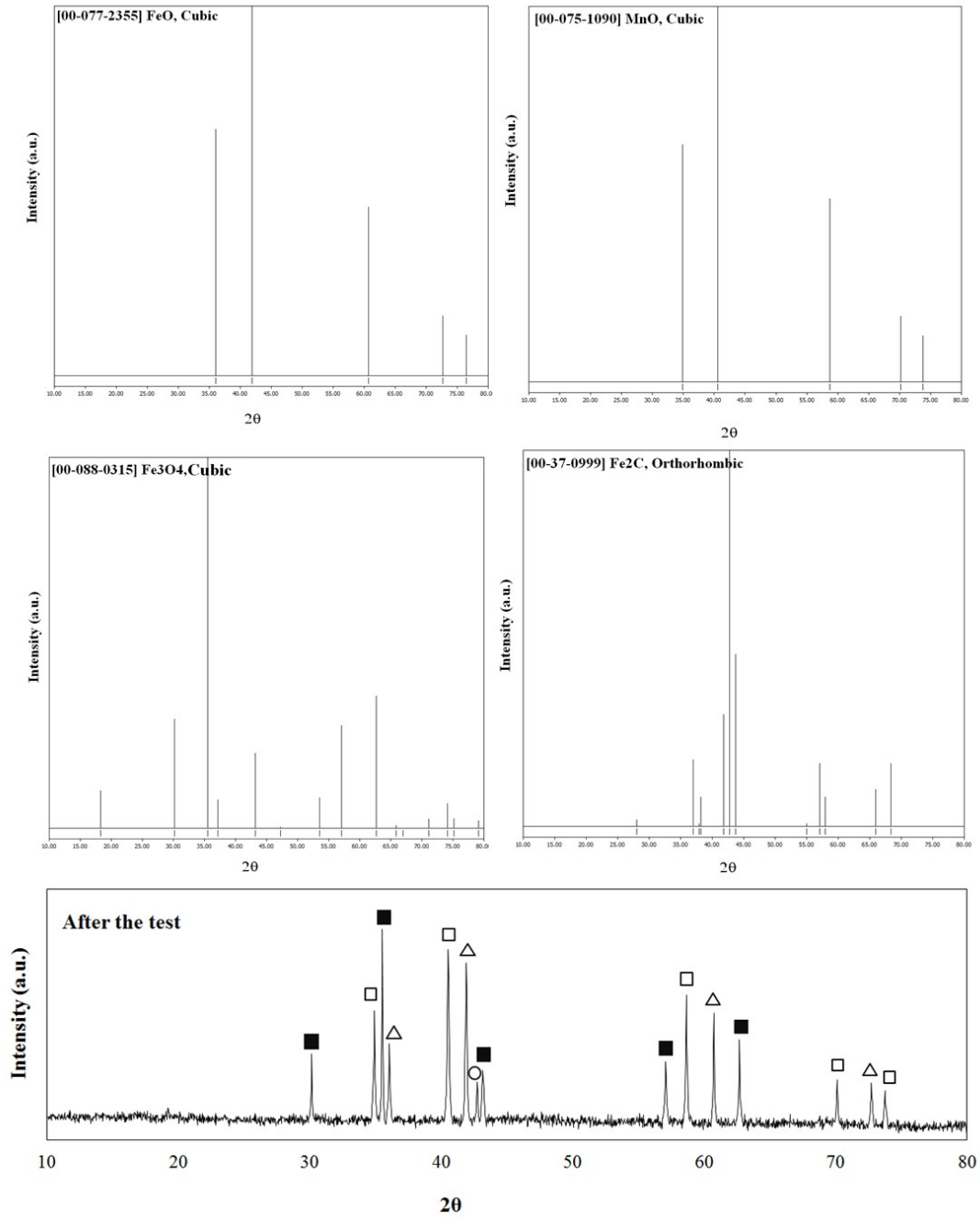


Fig. S3. XRD patterns of the catalyst after the test. ■Fe_3O_4 (cubic); ○Fe_2C (orthorhombic); ΔFeO (cubic); □MnO (cubic).

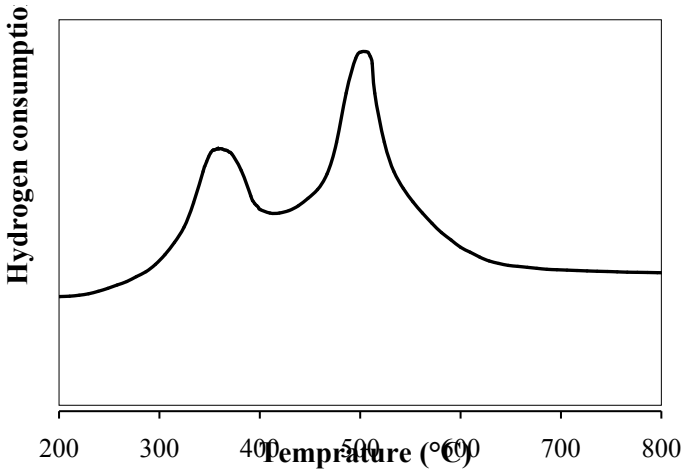


Fig. S4. TPR profile of the Fe-Mn-resol/SiO_2 catalyst before the test.

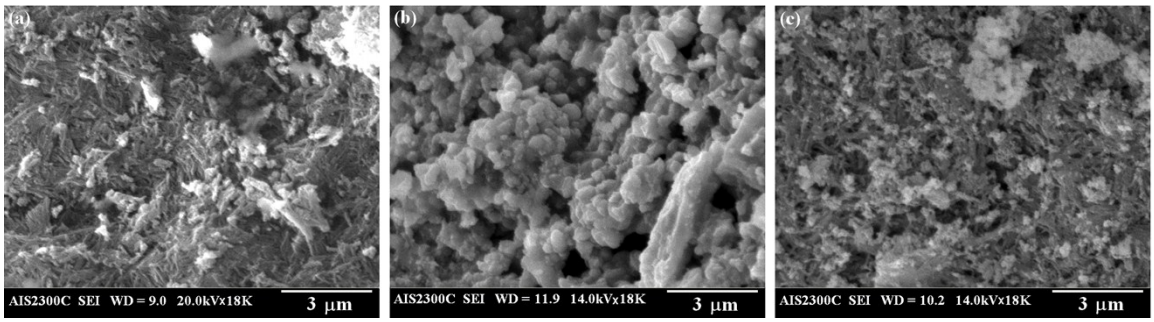


Fig. S5. SEM images of Fe-Mn-resol/SiO_2 catalyst in (a) precursor, (b) catalyst before and (c) after the test.

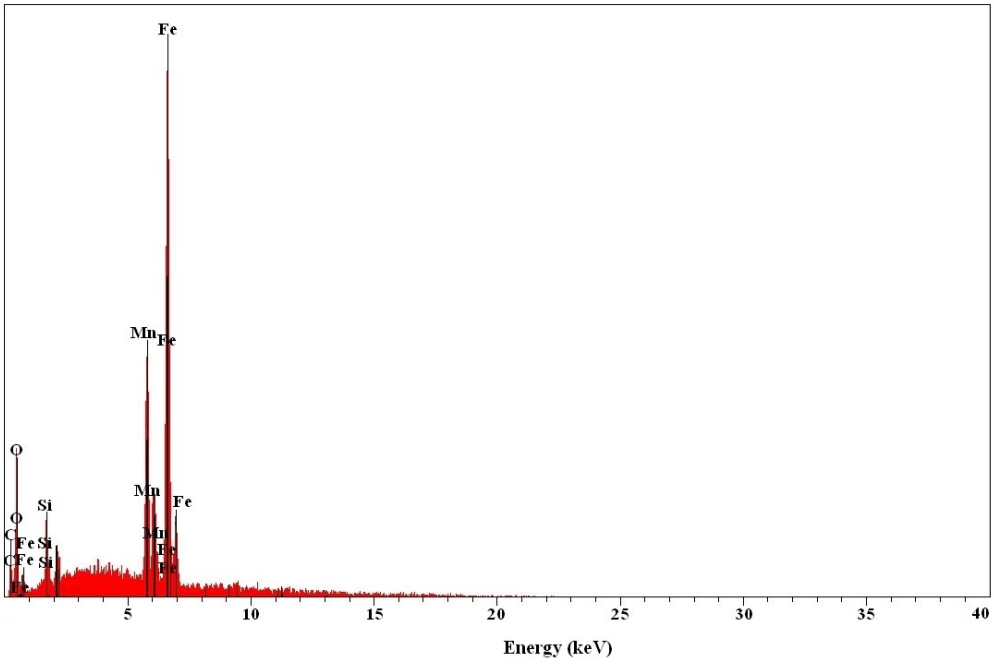


Fig. S6. The EDX spectrum of the Fe-Mn-resol/SiO_2 catalyst before the test.

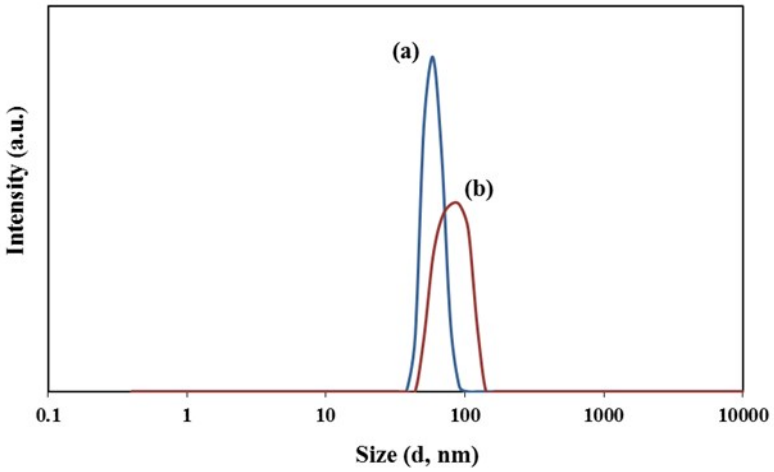
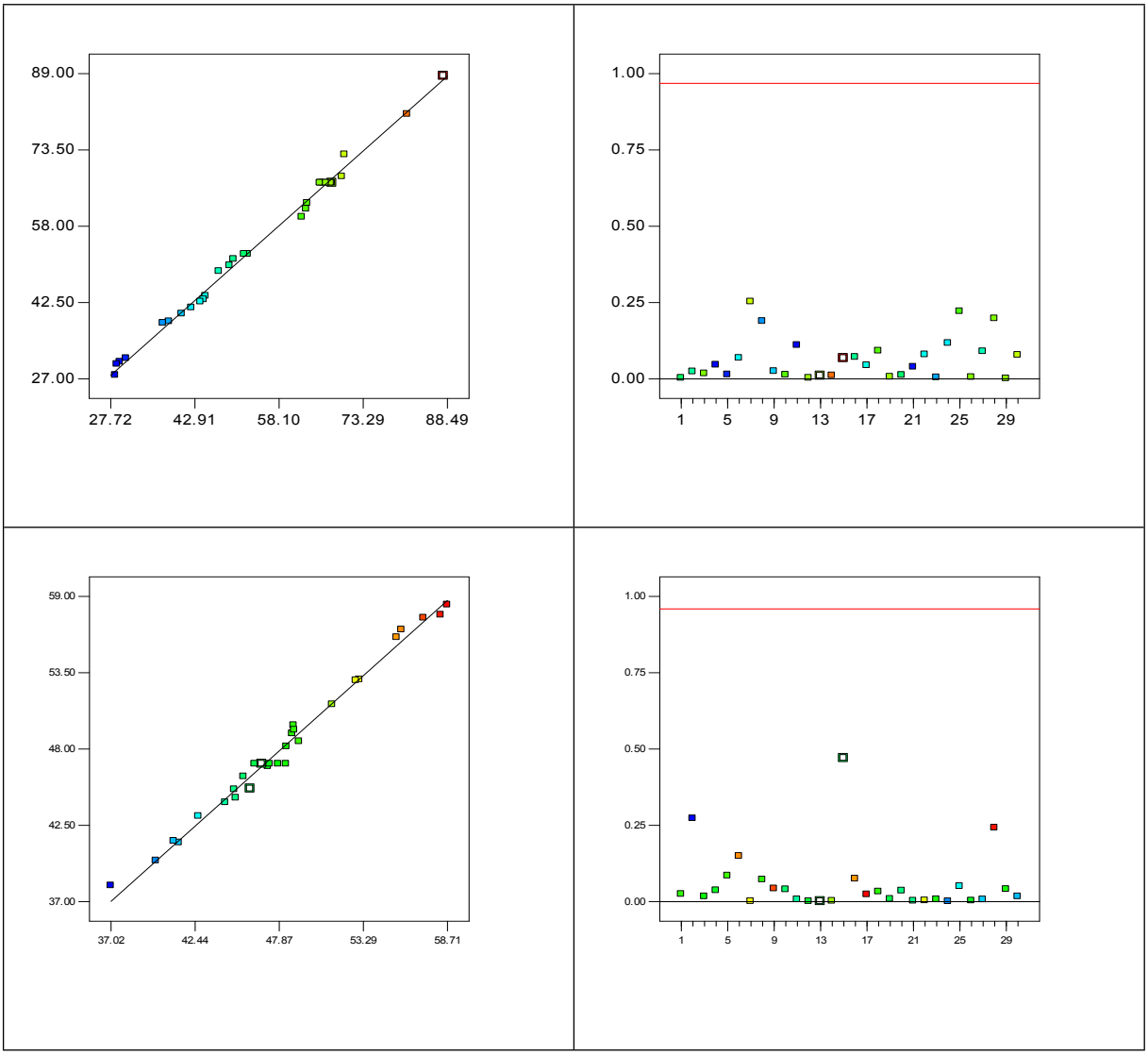


Fig. S7. The size distribution of the catalyst (a) before and (b) after the test.


89.00
73.50
58.00
42.50
27.00
27.72
42.91
58.10
73.29
88.49
1.00
0.75
0.50
0.25
0.00
1
5
9
13
17
21
25
29
59.00
53.50
48.00
42.50
37.00
37.02
42.44
47.87
53.29
58.71
1.00
0.75
0.50
0.25
0.00
1
5
9
13
17
21
25
29

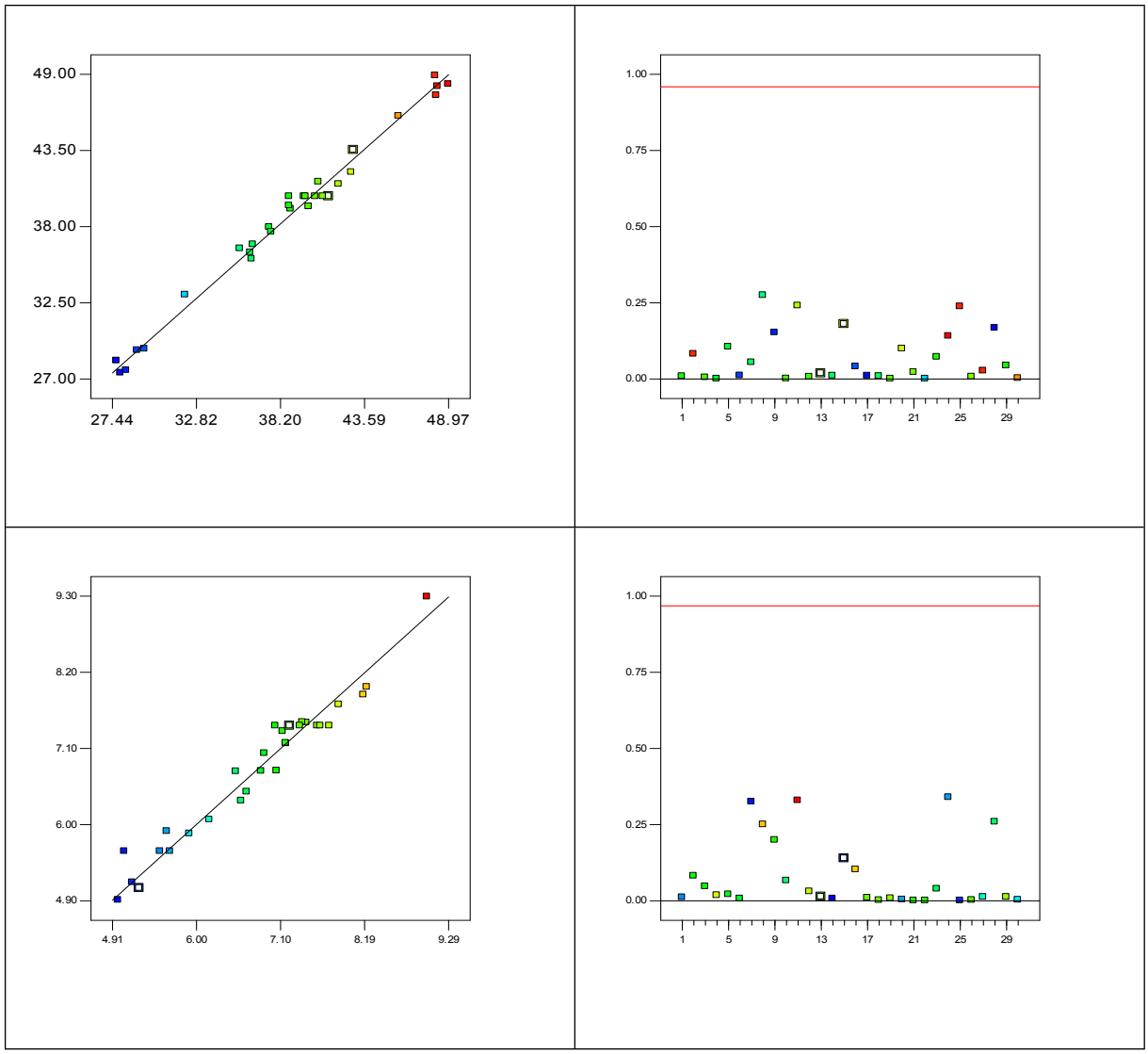


Fig.S8 The predicted *versus* actual and Cook's distance plots of all responses.