

Photocatalytic degradation of binary mixture of toxic dyes by HKUST-1 MOF and HKUST-1-SBA-15 in rotating packed bed reactor under blue LED illumination: central composite design optimization

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Table S1. CCD matrix and responses

Run	Block	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	HKUST-1-SBA-15		HKUST-1	
								R% _{MG}	R% _{SO}	R% _{MG}	R% _{SO}
1	1	10	10	1000	0.4	0.15	75	71.03	66.16	67.02	62.65
2	1	15	15	800	0.3	0.2	60	61.32	58.27	55.92	54.78
3	1	20	10	1000	0.4	0.25	75	69.85	93.02	65.15	89.43
4	1	15	15	800	0.3	0.2	60	62.11	58.61	56.75	54.49
5	1	20	10	600	0.4	0.15	75	26.38	39.98	22.27	36.28
6	1	20	20	1000	0.2	0.15	45	32.42	29.18	27.85	25.54
7	1	15	15	800	0.3	0.2	60	59.47	59.56	55.06	54.69
8	1	10	10	600	0.2	0.25	45	39.76	35.71	34.46	31.36
9	1	10	20	600	0.4	0.25	45	61.25	39.55	56.71	35.31
10	1	20	20	1000	0.2	0.25	45	39.05	34.67	34.52	30.87
11	1	10	10	1000	0.2	0.25	75	84.02	79.25	78.83	74.95
12	1	20	20	1000	0.4	0.15	45	39.66	35.86	36.02	32.21
13	1	10	10	1000	0.4	0.25	45	83.79	81.22	79.33	77.35
14	1	10	10	600	0.2	0.15	75	36.83	31.87	32.36	27.87
15	1	20	10	600	0.2	0.25	75	34.95	56.62	30.48	52.27
16	1	20	10	600	0.4	0.25	45	41.46	58.06	35.54	54.19
17	1	15	15	800	0.3	0.2	60	62.73	58.34	58.25	54.75
18	1	10	20	600	0.2	0.25	75	56.87	38.63	52.48	34.43
19	1	20	20	600	0.4	0.25	75	59.13	54.34	54.69	50.29
20	1	20	10	1000	0.2	0.15	45	32.67	48.52	27.66	45.45
21	1	15	15	800	0.3	0.2	60	62.52	57.88	58.11	54.73
22	1	20	20	600	0.2	0.15	45	10.31	6.53	5.87	2.35
23	1	15	15	800	0.3	0.2	60	61.83	58.66	57.36	54.81
24	1	10	20	1000	0.4	0.25	75	95.91	78.51	92.14	74.88
25	1	10	20	600	0.4	0.15	75	44.68	24.23	40.21	20.45
26	1	10	10	600	0.4	0.15	45	36.32	32.50	31.85	28.43
27	1	10	20	1000	0.2	0.15	45	49.54	29.45	45.06	26.09
28	1	20	20	1000	0.2	0.15	75	39.24	34.37	35.32	30.96
29	2	5	15	800	0.3	0.2	60	86.51	65.44	82.32	61.8
30	2	15	15	800	0.5	0.2	60	49.45	45.81	45.13	41.45
31	2	15	15	800	0.3	0.3	60	67.36	64.93	62.92	60.95
32	2	15	15	400	0.3	0.2	60	24.96	21.72	20.37	17.86
33	2	15	15	800	0.1	0.2	60	18.71	15.72	14.68	12.14
34	2	15	15	800	0.3	0.1	60	25.06	21.25	19.89	17.38
35	2	15	15	800	0.3	0.2	90	68.77	65.91	65.07	62.25
36	2	15	25	800	0.3	0.2	60	61.06	41.72	56.72	37.89
37	2	15	15	1200	0.3	0.2	60	68.36	65.42	63.12	60.73
38	2	15	15	800	0.3	0.2	30	43.38	39.75	38.85	35.57
39	2	25	15	800	0.3	0.2	60	42.93	60.46	39.46	56.53
40	2	15	5	800	0.3	0.2	60	63.11	81.33	58.25	77.57
41	2	15	15	800	0.3	0.2	60	59.82	56.96	55.47	53.71
42	2	15	15	800	0.3	0.2	60	61.03	57.38	56.40	53.62

Table S2. ANOVA for HKUST-1-SBA-15

Source of variation	Degree of Freedom	MG				SO			
		Sum of Squares	Mean Square	F Value	p-value Prob > F	Sum of Squares	Mean Square	F Value	p-value Prob > F
Block	1	8	8			9.37	9.37		
Model	27	15123.01	560.11	626.47	< 0.0001	15711.57	581.91	2317.76	< 0.0001
X ₁	1	2528.72	2528.72	2828.29	< 0.0001	34.51	34.51	137.44	< 0.0001
X ₂	1	7.8	7.8	8.72	0.0112	2193.23	2193.23	8735.71	< 0.0001
X ₃	1	2428.84	2428.84	2716.58	< 0.0001	2521.58	2521.58	10043.53	< 0.0001
X ₄	1	1203.16	1203.16	1345.69	< 0.0001	1202.50	1202.50	4789.60	< 0.0001
X ₅	1	2363.63	2363.63	2643.65	< 0.0001	2681.05	2681.05	10678.70	< 0.0001
X ₆	1	886.44	886.44	991.45	< 0.0001	967.45	967.45	3853.38	< 0.0001
X ₁ X ₂	1	30.88	30.88	34.54	< 0.0001	2.55	2.55	10.17	0.0071
X ₁ X ₃	1	30.86	30.86	34.51	< 0.0001	10.54	10.54	41.96	< 0.0001
X ₁ X ₄	1	0.33	0.33	0.37	0.5551	7.56	7.56	30.12	0.0001
X ₁ X ₅	1	22.86	22.86	25.57	0.0002	5.40	5.40	21.51	0.0005
X ₁ X ₆	1	16.3	16.3	18.23	0.0009	9.58	9.58	38.17	< 0.0001
X ₂ X ₃	1	5.66	5.66	6.32	0.0258	3.20	3.20	12.77	0.0034
X ₂ X ₄	1	0.31	0.31	0.35	0.5666	0.34	0.34	1.37	0.2630
X ₂ X ₅	1	0.013	0.013	0.014	0.9072	6.20	6.20	24.69	0.0003
X ₂ X ₆	1	0.48	0.48	0.54	0.4762	0.15	0.15	0.61	0.4487
X ₃ X ₄	1	29.37	29.37	32.85	< 0.0001	0.91	0.91	3.64	0.0787
X ₃ X ₅	1	25.31	25.31	28.31	0.0001	17.83	17.83	71.01	< 0.0001
X ₃ X ₆	1	3.51	3.51	3.93	0.0689	3.44	3.44	13.68	0.0027
X ₄ X ₅	1	141.3	141.3	158.04	< 0.0001	154.07	154.07	613.65	< 0.0001
X ₄ X ₆	1	2.23	2.23	2.49	0.1384	2.64	2.64	10.52	0.0064
X ₅ X ₆	1	64.82	64.82	72.5	< 0.0001	141.99	141.99	565.55	< 0.0001
X ₁ ²	1	36.78	36.78	41.14	< 0.0001	59.91	59.91	238.64	< 0.0001
X ₂ ²	1	5.53	5.53	6.18	0.0273	32.86	32.86	130.86	< 0.0001
X ₃ ²	1	375.97	375.97	420.51	< 0.0001	383.18	383.18	1526.20	< 0.0001
X ₄ ²	1	1377.96	1377.96	1541.21	< 0.0001	1415.49	1415.49	5637.95	< 0.0001
X ₅ ²	1	400.97	400.97	448.47	< 0.0001	410.12	410.12	1633.52	< 0.0001
X ₆ ²	1	37.45	37.45	41.89	< 0.0001	42.55	42.55	169.49	< 0.0001
Residual	13	11.62	0.89			3.26	0.25		
Lack of Fit	7	3.86	0.55	0.43	0.855	1.57	0.22	0.79	0.6197
Pure Error	6	7.76	1.29			1.70	0.28		
Cor Total	41	15142.63				15724.21			

Table S3. ANOVA for HKUST-1

Source of variation	Degree of Freedom	MG				SO			
		Sum of Squares	Mean Square	F Value	p-value Prob > F	Sum of Squares	Mean Square	F Value	p-value Prob > F
Block	1	10.74	10.74			8.70	8.70		
Model	27	15155.42	561.31	605.02	< 0.0001	15731.55	582.6499	25201.22	< 0.0001
X ₁	1	2506.10	2506.10	2701.25	< 0.0001	35.39	35.39	1530.79	< 0.0001
X ₂	1	3.24	3.24	3.49	0.0842	2216.23	2216.23	95857.91	< 0.0001
X ₃	1	2440.46	2440.46	2630.50	< 0.0001	2557.2	2557.2	110606	< 0.0001
X ₄	1	1233.48	1233.48	1329.53	< 0.0001	1200.81	1200.81	51938.17	< 0.0001
X ₅	1	2334.52	2334.51	2516.30	< 0.0001	2635.29	2635.29	113983.6	< 0.0001
X ₆	1	942.27	942.27	1015.64	< 0.0001	989.89	989.89	42815.59	< 0.0001
X ₁ X ₂	1	34.35	34.35	37.03	< 0.0001	3.435	3.43	148.14	< 0.0001
X ₁ X ₃	1	30.95	30.95	33.36	< 0.0001	9.33	9.33	403.70	< 0.0001
X ₁ X ₄	1	1.425	1.42	1.54	0.2371	8.25	8.25	357.01	< 0.0001
X ₁ X ₅	1	27.00	27.00	29.10	0.0001	5.63	5.63	243.72	< 0.0001
X ₁ X ₆	1	12.31	12.31	13.27	0.0030	10.89	10.89	471.42	< 0.0001
X ₂ X ₃	1	3.95	3.95	4.26	0.0595	2.57	2.57	111.098	< 0.0001
X ₂ X ₄	1	0.18	0.18	0.19	0.6691	0.82	0.82	35.33	< 0.0001
X ₂ X ₅	1	0.41	0.41	0.44	0.5173	6.22	6.22	269.25	< 0.0001
X ₂ X ₆	1	1.06	1.06	1.14	0.3041	0.063	0.063	2.72	0.1233
X ₃ X ₄	1	21.91	21.91	23.61	0.0003	1.29	1.29	55.68	< 0.0001
X ₃ X ₅	1	24.40	24.39	26.29	0.0002	20.01	20.01	865.39	< 0.0001
X ₃ X ₆	1	5.08	5.088	5.47	0.0360	4.25	4.25	183.91	< 0.0001
X ₄ X ₅	1	137.04	137.04	147.71	< 0.0001	165.79	165.79	7171.29	< 0.0001
X ₄ X ₆	1	2.55	2.55	2.75	0.1210	1.42	1.42	61.57	< 0.0001
X ₅ X ₆	1	67.70	67.70	72.98	< 0.0001	141.38	141.38	6115.05	< 0.0001
X ₁ ²	1	50.12	50.12	54.02	< 0.0001	61.46	61.46	2658.39	< 0.0001
X ₂ ²	1	5.20	5.19	5.60	0.0341	33.84	33.84	1463.66	< 0.0001
X ₃ ²	1	396.21	396.21	427.06	< 0.0001	406.68	406.68	17589.86	< 0.0001
X ₄ ²	1	1339.04	1339.04	1443.31	< 0.0001	1427.67	1427.67	61750.48	< 0.0001
X ₅ ²	1	415.51	415.51	447.87	< 0.0001	414.09	414.09	17910.96	< 0.0001
X ₆ ²	1	30.33	30.33	32.69	< 0.0001	43.75	43.75	1892.24	< 0.0001
Residual	13	12.06	0.93			0.30	0.02		
Lack of Fit	7	3.76	0.54	0.39	0.8790	0.23	0.03	2.84	0.1124
Pure Error	6	8.30	1.38			0.07	0.01		
Cor Total	41	15178.22				15740.55			