

Table S1 Product distribution (Wt %) at various reaction conditions for disproportionation of ethylbenzene over fresh HZ80 catalyst.

Temp (°C)/ time (S)	Conversion (%)	Gases	Benzene	Other (T, X, TMB)	DEB	EB
400/20	46.92	3.36	25.10	5.64	12.82	53.08
350/20	42.17	1.48	20.45	3.62	16.62	57.83
15	31.46	0.70	15.36	0.00	15.40	68.54
13	29.61	1.37	14.34	3.20	10.70	70.39
10	22.44	0.93	11.49	1.50	8.51	77.56
7	21.09	1.04	10.92	1.40	7.73	78.91
5	18.14	0.79	8.75	2.43	6.17	81.86
3	12.52	0.65	6.63	0.66	4.58	87.48
300/20	27.53	0.29	13.04	0.77	13.44	72.47
15	24.40	0.24	11.68	1.08	11.39	75.60
13	21.95	0.12	11.44	0.90	9.49	78.05
10	14.74	0.08	8.28	0.13	6.25	85.26
7	10.90	0.11	5.72	0.19	4.88	89.10
5	7.94	0.00	4.94	0.10	2.89	92.06
3	6.46	0.07	3.61	0.16	2.62	93.54
250/20	9.37	0.00	5.18	0.19	4.00	90.63
15	6.27	0.00	3.54	0.12	2.61	93.73
10	4.78	0.00	2.78	0.12	1.88	95.22
5	3.76	0.00	2.08	0.19	1.49	96.24
3	2.83	0.00	1.91	0.14	0.77	97.17

Table S2 Product distribution (Wt %) at various reaction conditions for alkylation of ethylbenzene with ethanol over fresh HZ80 catalyst.

Temp (°C)/ time (S)	Conversion (%)	Gases	Benzene	Other (T, X, TMB)	DEB	EB	Ethanol
Pure Feed						83.78	16.15
400/20	52.08	15.69	19.77	12.95	9.13	40.15	2.32
15	47.29	14.51	16.82	11.72	9.70	44.16	3.09
10	37.79	11.72	13.08	8.27	9.94	52.12	4.86
7	31.55	10.42	12.34	7.07	6.38	57.34	6.44
5	21.97	6.30	6.13	4.90	9.47	65.37	7.83
3	13.96	5.56	6.21	2.55	3.23	72.08	10.37
350/20	45.88	10.88	10.06	10.03	21.24	45.35	2.44
15	40.15	9.49	9.48	8.17	18.77	50.14	3.94
10	33.32	7.66	6.55	6.13	18.48	55.86	5.32
5	22.26	5.58	3.98	3.73	13.82	65.13	7.75
300/20	42.89	7.41	5.04	6.51	30.61	47.84	2.59
15	38.25	6.98	4.55	5.14	28.16	51.74	3.42
10	30.99	5.66	3.42	3.97	23.90	57.81	5.23
5	18.34	3.76	1.84	1.93	15.49	68.42	8.55
250/20	29.19	5.34	2.10	3.78	25.74	59.32	3.72
15	23.80	6.05	1.28	2.26	23.04	63.84	3.54
10	20.68	5.77	0.93	2.14	19.44	66.46	5.26
5	9.60	5.58	0.45	1.26	11.00	75.74	5.97

Table S3 Product distribution (Wt %) at various reaction conditions for alkylation of ethylbenzene with ethanol over spent HZ80 catalyst.

Temp (°C)/ time (S)	Conversion (%)	Gases	Benzene	Other (T, X, TMB)	DEB	EB	Ethanol
Pure Feed						83.78	16.15
400/20	47.56	11.52	10.96	10.95	20.50	43.93	2.14
15	42.37	10.02	9.41	8.49	20.84	48.28	2.96
10	35.74	7.92	6.98	6.75	19.94	53.84	4.56
7	29.36	6.84	5.40	5.47	16.99	59.18	6.11
5	20.50	5.49	4.01	2.05	14.47	66.60	7.38
3	16.58	4.21	2.70	2.46	11.58	69.89	9.16
350/20	43.59	7.20	4.88	6.91	31.39	47.26	2.36
15	41.90	6.75	4.24	5.92	31.37	48.68	3.04
10	32.66	5.30	2.93	4.34	26.18	56.42	4.83
5	19.14	3.81	1.72	2.34	16.40	67.74	7.99
300/20	33.49	5.38	2.01	4.55	29.56	55.72	2.78
15	29.24	5.02	1.62	3.35	27.14	59.28	3.60
10	21.09	4.35	0.99	2.52	20.36	66.11	5.67
5	8.88	3.33	0.43	0.91	8.93	76.34	10.06
250/20	13.20	8.42	0.25	2.61	13.23	72.72	2.77
15	8.64	9.02	0.21	1.46	9.15	76.54	3.61
10	4.59	8.29	0.15	0.99	5.69	79.94	4.95
5	5.00	8.18	0.16	0.00	5.69	79.59	6.49