

SUPPORTING INFORMATION

for

“Scale-Up Investigation of the Continuous Phase-Transfer Catalyzed Hypochlorite Oxidation of Alcohols and Aldehydes”

by Yanjie Zhang, Stephen C. Born and Klavs F. Jensen*

*Department of Chemical Engineering, Massachusetts Institute of
Technology, Cambridge, Massachusetts 02139*

HPLC, GC method and details for factorial design of experiments

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HPLC method. All the samples were analyzed with reversed phase HPLC or GC-FID. For the HPLC samples, the reaction mixture was collected for 3 residence times into a vial containing saturated sodium sulfite and 5ul of its organic phase was added into 1ml of water/acetonitrile mixture (water:acetonitrile=1:1). The HPLC method for measuring oxidation of 1-phenylethanol was as follows: samples were run on a Supelco Ascentis® Express C18 HPLC column (2.7 micron L×I.D. 15cm×4.6mm) at a flow rate of 0.8 ml/min. The aqueous mobil phase (A) contained 0.17% of phosphoric acid and the organic mobil phase (O) consisted of methanol and acetonitrile (methanol:acetonitrile=1:1). The two phases were run with a ratio of A:O=85:15 for 6 minutes. HPLC yields and conversions were thus calculated by comparing with standard curves generated from a series of known standards for both starting material and products.

GC method. GC samples were prepared by collecting the reaction mixture for 1.5 min and then diluting with ethyl acetate and a known amount of dodecane (internal standard) in a volumetric flask. The GC-FID method for measuring oxidation of 3-nitrobenzyl alcohol and benzaldehyde was as follows: The GC column was Agilent 1909S-413 HP-5MS. Oven temperature was held at 70° C for one minute and then increased linearly to 300°C over 9.67 min with a final hold of 1 min.

Factorial design. A full factorial design was performed for the oxidation of 1-phenylethanol and 3-nitrobenzyl alcohol respectively with two factors (concentration, residence time) and three levels (lowest, medium and highest). The detailed experimental design and results are shown in Table 1s, 2s and Figure 1s, 2s respectively. The response

surface was defined as conversion or yield and obtained through fitting the data to the second order model (Eqn 1s)

$$y = A + Bx_1 + Cx_2 + Dx_1^2 + Ex_1x_2 + Fx_2^2 \quad (\text{Eqn 1s})$$

Table 1s. Full factorial design of oxidation of 1-phenylethanol. ($Q_A:Q_0=2.5:1$ and the pH of aqueous phase is 9.4) (2 factors: concentration and residence time, 3 levels are indicated in the table; “-1” indicates lowest level, “0” indicates medium level and “1” indicates highest level).

	Concentration (M)	Residence Time (min)	Conversion (%)	Yield (%)
1	1.4 (0)	1 (0)	82	75
2	1.4 (0)	0.5 (-1)	92	83
3	1.4 (0)	1.5 (1)	100	96
4	0.8 (-1)	1 (0)	86	83
5	0.8 (-1)	0.5 (-1)	100	93
6	0.8 (-1)	1.5 (1)	100	100
7	2 (1)	1 (0)	69	62
8	2 (1)	0.5 (-1)	95	81
9	2 (1)	1.5 (1)	98	88

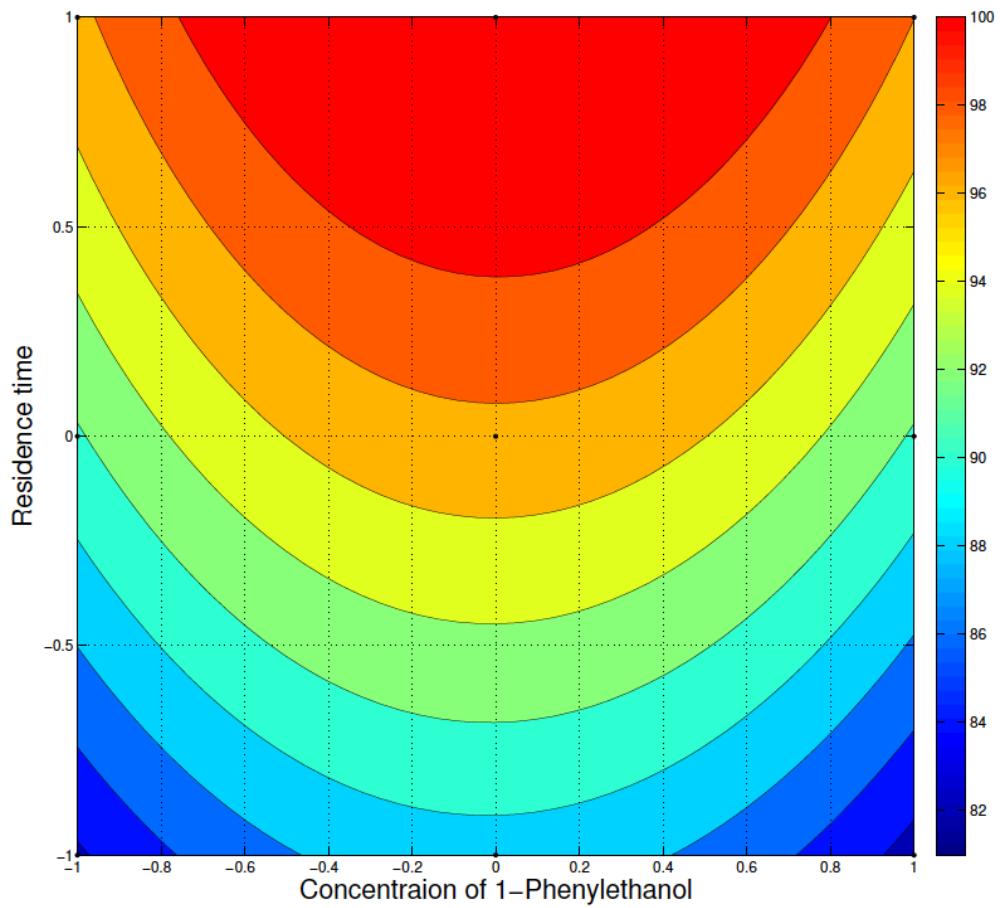


Figure 1s. Response surface of oxidation of 1-phenylethanol. The response was defined as conversion of 1-phenylethanol

Table 2s. Full factorial design for oxidation of 3-nitrobenzyl alcohol. (2 factors: concentration and residence time, 3 levels are indicated in the table; medium level was coded as 0, lowest level was coded as -1, highest level was coded as 1).

	Concentration (M)	Residence Time (min)	Conversion (%)	Yield (%)
1	0.8 (0)	1 (0)	100	83
2	0.8 (0)	0.5 (-1)	100	73
3	0.8 (0)	1.5 (1)	100	81
4	0.55 (-1)	1 (0)	100	76
5	0.55 (-1)	0.5 (-1)	100	61
6	0.55 (-1)	1.5 (1)	100	81
7	1.1 (1)	1 (0)	100	70
8	1.1 (1)	0.5 (-1)	100	61
9	1.1 (1)	1.5 (1)	100	78

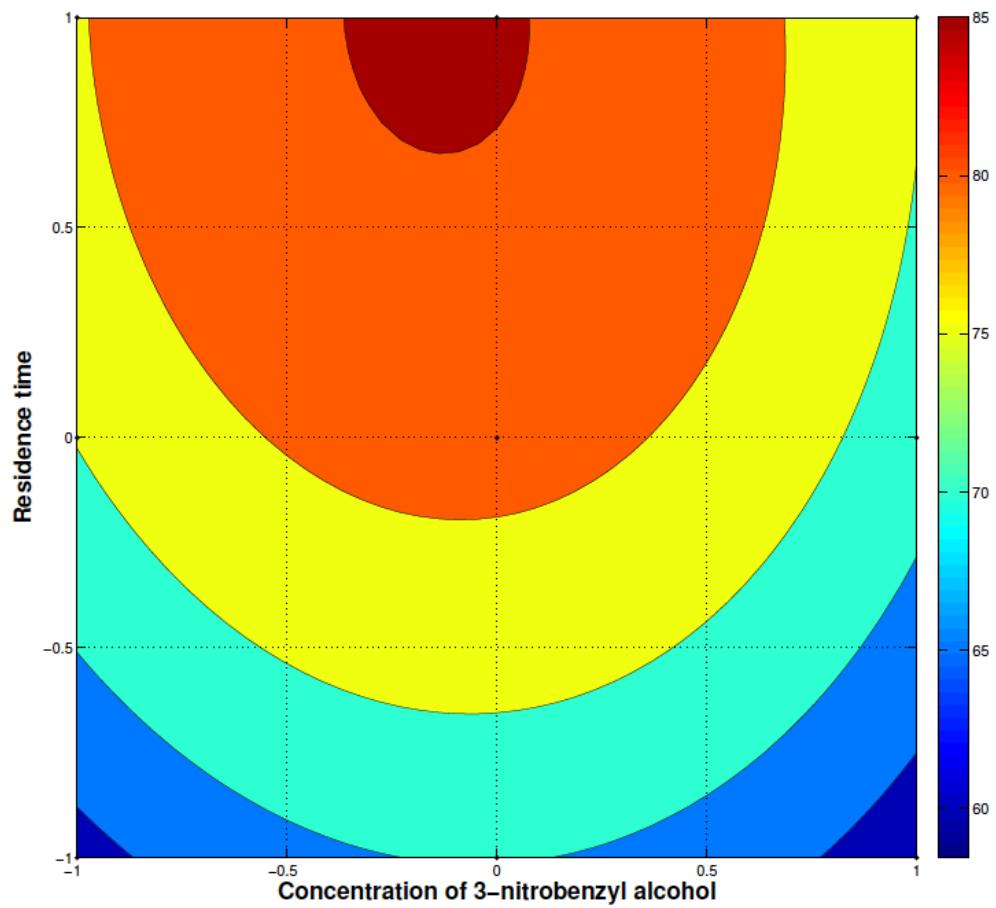


Figure 2s. Response surface for oxidation of 3-nitrobenzyl alcohol. The response was defined as yield of methyl 3-nitrobenzoate