

General Base Catalysis vs Medium Effects in the Hydrolysis of an RNA Model.

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Supplementary material

Tables of Kinetic Data

S.1 *tert*-Butylammonium Salt of 3,4-Dichlorophenoxymethyl Uridine Phosphate 4b

S. 1.1 Primary Data

S.1.2 Zero Buffer Concentration Rate Constants

S.2 *tert*-Butylammonium Salt of 4-Nitrophenoxymethyl Uridine Phosphate 4a

S.2.1 Primary Data

S.2.2 Primary Data for Salt and Solvent Effect Experiments

S.2.3 Primary Data for 50% Carbonate Buffers with Added Solvents

S.2.4 Zero Buffer Concentration Rate Constants

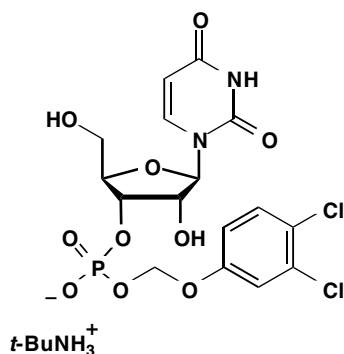
S.2.5 Second Order Rate Constants

S.2.6 Second Order Rate Constants for Salt and Solvent Effect Experiments

S.2.7 Solvent-Effect-Corrected Second Order Rate Constants for Imidazole Buffers

General. Buffers were prepared with degassed, triply distilled water and class A volumetric glassware. Compounds of the highest available purity were used and the desired fraction of free base was achieved by the addition of KOH or HCl as appropriate. Ionic strength was maintained with KCl unless indicated otherwise; pHs were measured with a Russell CMAWL electrode and a Radiometer PHM82 pH meter at the temperature of interest.

S.1 *tert*-Butylammonium Salt of 3,4-Dichlorophenoxymethyl Uridine Phosphate 4b



S. 1.1 Primary Data

$\lambda = 305$ or 245 nm, 70°C , Gilford 2600. All buffers have a total ionic strength of 1.0 M.

Buffer (free base)	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$	R
HCl [†]	0.10	1.00	140.0	0.999
	0.01	2.00	21.9	0.999
Formate 30%	1.00	3.20	2.85	0.992
	0.60	3.21	1.36	0.987
	0.20	3.21	1.20	0.996
Formate 50%	1.00	3.62	0.59	0.990
	0.60	3.61	0.74	0.984
	0.20	3.61	0.56	0.990
Formate 70%	1.00	4.07	0.23	0.998
	0.60	4.01	0.13	0.996
	0.20	3.98	0.21	0.992
Phosphate 30%	0.40	6.07	0.105	0.999
	0.24	6.05	0.079	0.999
	0.08	6.04	0.060	0.999
Phosphate 50%	0.40	6.55	0.282	1.000
	0.24	6.49	0.226	0.999
	0.08	6.44	0.178	0.999
Phosphate 70%	0.30	6.97	0.428	1.000
	0.18	6.90	0.303	1.000
	0.06	6.83	0.441	0.999
Tris 30%	1.00	6.83	1.08	0.999
	0.60	6.92	0.75	0.997

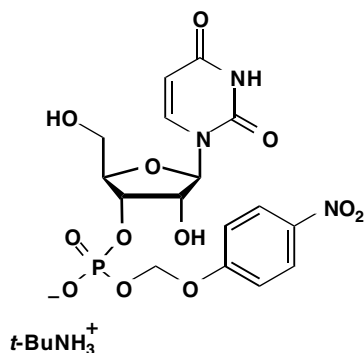
Tris 50%	0.20	6.94	0.51	1.000
	1.00	7.27	2.18	0.998
	0.60	7.30	1.48	0.999
Tris 70%	0.20	7.31	1.20	0.997
	1.00	7.72	3.93	1.000
	0.60	7.74	3.57	0.999
Carbonate 30%	0.20	7.74	2.92	1.000
	0.60	9.26	90.3	1.000
	0.36	9.22	95.4	1.000
Carbonate 50%	0.12	9.18	85.8	0.999
	0.50	9.66	136.8	1.000
	0.30	9.60	135.1	0.999
Carbonate 70%	0.10	9.53	126.8	1.000
	0.40	10.05	266.3	0.999
	0.24	9.98	302.9	1.000
	0.08	9.89	283.8	1.000

† pH of HCl solutions calculated using $\gamma_{\text{H}} = 1$

S.1.2 Zero Buffer Concentration Rate Constants

Buffer	free base	pH	$\log(k_0/\text{s}^{-1})$	+/-
HCl	-	1.00	-1.85	0.01
	-	2.00	-2.66	0.01
Formate	30%	3.21	-3.74	0.10
	50%	3.61	-4.20	0.10
	70%	4.03	-4.72	0.09
Phosphate	30%	6.05	-5.09	0.08
	50%	6.49	-4.64	0.07
	70%	6.90	-4.41	0.06
Tris	30%	6.90	-4.45	0.05
	50%	7.29	-4.05	0.06
	70%	7.73	-3.57	0.03
Carbonate	30%	9.22	-2.04	0.02
	50%	9.60	-1.88	0.02
	70%	9.98	-1.55	0.03

S.2 *tert*-Butylammonium Salt of 4-Nitrophenoxyethyl Uridine Phosphate 4a



S.2.1 Primary Data

$\lambda = 408 \text{ nm}$, $70 \text{ }^\circ\text{C}$, Gilford 2600. Buffer total ionic strength is 1.0 M unless marked * where total ionic strength is 0.2 M.

Buffer (free base)	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$	R
TMEDA monocation 50%	0.50	5.63	0.3858	0.9999
	0.30	5.75	0.1978	0.9999
	0.10	5.81	0.1186	0.9999
3,4-Lutidine 60% *	0.20	5.98	0.1523	0.9993
	0.12	6.03	0.1448	0.9993
	0.04	6.04	0.1386	0.9995
3,4-Lutidine 70% *	0.20	6.18	0.1939	0.9999
	0.12	6.22	0.1855	0.9997
	0.04	6.26	0.1806	0.9997
3,4-Lutidine 80% *	0.20	6.41	0.2631	1.0000
	0.12	6.47	0.2413	1.0000
	0.04	6.52	0.2349	0.9993
Bistris 40%	1.00	5.88	0.1245	0.9992
	0.60	5.92	0.1135	0.9996
	0.20	5.96	0.8752	0.9991
Bistris 60%	1.00	6.27	0.2920	0.9998
	0.60	6.27	0.2668	0.9993
	0.20	6.31	0.2468	0.9998
Bistris 68%	1.00	6.45	0.3935	0.9999
	0.60	6.46	0.3635	1.0000
	0.20	6.47	0.3362	1.0000
Bistris 80%	1.00	6.73	0.7865	0.9999

	0.60	6.75	0.7561	1.0000
	0.20	6.77	0.7194	1.0000
Bistris 90%	1.00	7.11	1.775	0.9994
	0.60	7.10	1.749	0.9997
	0.20	7.10	1.714	0.9999
Imidazole 20%	1.00	5.65	0.3227	0.9996
	0.60	5.70	0.1895	0.9996
	0.20	5.75	0.0893	0.9997
Imidazole 30%	1.00	5.92	0.4803	0.9996
	0.60	5.96	0.3052	0.9998
	0.20	6.00	0.1795	0.9999
Imidazole 40%	1.00	6.16	0.769	0.9995
	0.60	6.18	0.544	0.9995
	0.20	6.20	0.317	0.9995
Imidazole 40%	1.00	6.16	0.656	0.9996
	0.60	6.18	0.490	0.9998
	0.20	6.20	0.404	0.9999
Imidazole 50%	1.00	6.34	0.874	0.9998
	0.60	6.36	0.703	0.9995
	0.20	6.40	0.464	0.9999
Imidazole 60%	1.00	6.56	1.184	0.9997
	0.60	6.56	0.926	0.9997
	0.20	6.53	0.700	0.9999
Imidazole 70%	1.00	6.76	1.509	0.9998
	0.60	6.71	1.252	0.9999
	0.20	6.74	0.988	0.9999
Imidazole 80	1.00	7.01	2.246	0.9998
	0.60	7.02	1.940	0.9999
	0.20	7.02	1.754	0.9999
Imidazole 90%	1.00	7.41	4.006	1.0000
	0.60	7.39	3.797	0.9999
	0.20	7.39	3.588	1.0000
Pipes 20%	0.30	5.93	0.0792	0.9998
	0.18	5.90	0.0876	1.0000
	0.06	5.87	0.0841	0.9999
Pipes 30%	0.30	6.15	0.1722	0.9998
	0.18	6.14	0.1627	0.9998
	0.06	6.12	0.1593	0.9998

Buffer (free base)	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$	R
Pipes 40%	0.30	6.33	0.2880	0.9999
	0.18	6.29	0.2848	0.9999
	0.06	6.28	0.2656	0.9999
Pipes 50%	0.30	6.51	0.4297	0.9994
	0.18	6.49	0.4015	1.0000
	0.06	6.48	0.3698	1.0000
Pipes 50%	0.30	6.51	0.3882	0.9997
	0.18	6.49	0.4410	0.9997
	0.06	6.48	0.3893	0.9994
Pipes 60%	0.30	6.69	0.6035	0.9998
	0.18	6.66	0.6141	0.9999
	0.06	6.66	0.6646	1.0000
Pipes 70%	0.30	6.89	0.9093	0.9999
	0.18	6.88	0.9519	1.0000
	0.06	6.85	1.0290	0.9999
Pipes 80%	0.30	7.13	1.616	0.9999
	0.18	7.10	1.717	0.9998
	0.06	7.09	1.828	1.0000
Pipes 90%	0.30	7.49	3.325	0.9997
	0.18	7.47	3.655	0.9998
	0.06	7.43	3.756	0.9999
Phosphate 30%	0.40	6.07	0.1145	1.0000
	0.24	6.05	0.1010	1.0000
	0.08	6.04	0.0979	1.0000
Phosphate 50%	0.40	6.55	0.427	1.0000
	0.24	6.49	0.387	1.0000
	0.08	6.44	0.344	1.0000
Phosphate 70%	0.30	6.97	1.098	0.9999
	0.18	6.90	1.040	0.9999
	0.06	6.83	0.890	1.0000
1-Methylimidazole 40%	1.00	6.30	0.467	0.9980
	0.60	6.37	0.459	0.9996
	0.20	6.43	0.426	0.9994

1-Methylimidazole 50%	1.00	6.49	0.601	0.9994
	0.60	6.54	0.569	0.9997
	0.20	6.58	0.606	0.9995
1-Methylimidazole 60%	1.00	6.67	0.802	0.9995
	0.60	6.71	0.794	0.9996
	0.20	6.76	0.845	0.9995
1-Methylimidazole 70%	1.00	6.88	1.125	0.9998
	0.60	6.91	1.189	0.9997
	0.20	6.95	1.321	0.9997
1-Methylimidazole 80%	1.00	7.13	1.622	1.0000
	0.60	7.16	1.903	1.0000
	0.20	7.19	2.214	1.0000
1-Methylimidazole 90%	1.00	7.45	3.323	0.9999
	0.60	7.50	3.805	1.0000
	0.20	7.53	4.734	0.9999
4-Methylimidazole 20%	1.00	6.10	0.578	0.9997
	0.60	6.18	0.469	0.9996
	0.20	6.26	0.252	0.9996
4-Methylimidazole 30%	1.00	6.38	0.935	0.9998
	0.60	6.46	0.728	0.9999
	0.20	6.52	0.587	1.0000
4-Methylimidazole 40%	1.00	6.61	1.449	1.0000
	0.60	6.68	1.173	1.0000
	0.20	6.73	1.065	1.0000
4-Methylimidazole 40%	1.00	6.61	1.330	1.0000
	0.60	6.68	1.232	0.9998
	0.20	6.73	0.973	0.9999
4-Methylimidazole 50%	1.00	6.82	1.190	0.9999
	0.60	6.88	1.718	0.9999
	0.20	6.92	1.394	1.0000
4-Methylimidazole 60%	1.00	7.04	2.562	1.0000
	0.60	7.09	2.346	1.0000
	0.20	7.12	2.100	1.0000
4-Methylimidazole 70%	1.00	7.27	3.558	1.0000
	0.60	7.30	3.361	1.0000
	0.20	7.30	3.235	1.0000
4-Methylimidazole 80%	1.00	7.52	5.41	0.9994
	0.60	7.54	5.26	0.9999

	0.20	7.54	5.05	0.9999
4-Methylimidazole 80%	1.00	7.52	5.34	0.9994
	0.60	7.54	5.20	0.9999
	0.20	7.54	5.23	0.9999
4-Methylimidazole 90%	1.00	7.91	10.17	1.0000
	0.60	7.91	10.93	1.0000
	0.20	7.90	11.08	1.0000
2-Methylimidazole 50%	1.00	7.14	3.164	1.0000
	0.60	7.18	3.097	1.0000
	0.20	7.27	2.985	1.0000
Triethanolamine 50%	1.00	7.26	2.486	1.0000
	0.60	7.29	2.731	0.9999
	0.20	7.32	2.908	0.9998
Tris 10%	1.00	6.18	0.745	0.9999
	0.60	6.22	0.461	0.9997
	0.20	6.19	0.324	0.9998
Tris 20%	1.00	6.56	1.461	0.9998
	0.60	6.64	1.143	0.9995
	0.20	6.68	0.869	0.9999
Tris 30%	1.00	6.83	2.327	0.9997
	0.60	6.92	1.830	1.0000
	0.20	6.94	1.449	1.0000
Tris 40%	1.00	7.04	3.605	0.9998
	0.60	7.07	2.968	0.9999
	0.20	7.11	2.259	0.9999
Tris 50%	1.00	7.27	4.762	1.0000
	0.60	7.30	3.845	1.0000
	0.20	7.31	3.244	1.0000
Tris 60%	1.00	7.44	6.55	0.9999
	0.60	7.44	5.62	0.9999
	0.20	7.47	4.87	0.9999
Tris 70%	1.00	7.72	9.01	0.9999
	0.60	7.74	7.89	0.9999
	0.20	7.74	7.07	0.9999
Tris 80%	1.00	7.86	14.19	0.9999
	0.60	7.88	13.17	0.9992
	0.20	7.89	11.92	0.9999

Buffer (free base)	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$	R
Tris 90%	1.00	8.26	28.17	1.0000
	0.60	8.24	27.69	1.0000
	0.20	8.22	26.51	1.0000
TMPDA monocation 50%	0.50	7.33	3.640	0.9999
	0.30	7.43	4.380	1.0000
	0.10	7.52	5.096	1.0000
Morpholine 10%	1.00	6.88	2.182	0.9999
	0.60	6.91	1.756	0.9998
	0.20	6.94	1.358	0.9999
Morpholine 30%	1.00	7.55	7.348	0.9995
	0.60	7.55	6.754	0.9996
	0.20	7.60	6.010	1.0000
Morpholine 50%	1.00	7.95	14.24	0.9995
	0.60	7.97	13.94	0.9999
	0.20	8.00	13.48	0.9997
Morpholine 70%	1.00	8.36	26.48	1.0000
	0.60	8.38	27.78	0.9997
	0.20	8.39	29.39	0.9999
Morpholine 90%	1.00	8.94	70.39	1.0000
	0.60	8.97	90.11	0.9999
	0.20	8.95	96.15	0.9999
TMBDA monocation 50%	0.50	8.05	13.10	1.0000
	0.30	8.14	16.21	1.0000
	0.10	8.21	21.45	1.0000
DABCO 50%	1.00	8.39	32.04	1.0000
	0.60	8.43	34.03	1.0000
	0.20	8.46	36.41	1.0000
TMEDA 50%	1.00	8.64	35.47	1.0000
	0.60	8.70	51.24	1.0000
	0.20	8.74	69.49	1.0000
Carbonate 30%	0.60	9.26	138.0	0.9998
	0.36	9.22	131.1	0.9996
	0.12	9.18	134.8	0.9998

Carbonate 50%	0.50	9.66	253.1	0.9990
	0.30	9.60	234.1	0.9990
	0.10	9.53	244.4	0.9990
Carbonate 70%	0.40	10.05	455.4	0.9990
	0.24	9.98	413.5	0.9990
	0.08	9.89	330.6	0.9990

S.2.2 Primary Data for Salt and Solvent Effect Experiments

Buffer (free base)	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$	R
<u>Imidazole 50%</u>				
I=0.5 M, 0% glycerol (w/w)	0.50	6.35	0.493	0.9998
I=0.5, 40% glycerol (4.4 M)	0.50	6.30	0.365	1.0000
I=0.5, 60% glycerol (6.6 M)	0.50	6.24	0.301	1.0000
<u>Imidazole 70%</u>				
I=0.5 M, 0% glycerol (w/w)	0.50	6.75	0.828	0.9997
I=0.5, 40% glycerol (4.4 M)	0.50	6.70	0.677	1.0000
I=0.5, 60% glycerol (6.6 M)	0.50	6.64	0.498	1.0000
<u>Imidazole 90%</u>				
I=0.5 M, 0% glycerol (w/w)	0.50	7.36	2.626	1.0000
I=0.5, 40% glycerol (4.4 M)	0.50	7.28	1.814	1.0000
I=0.5, 60% glycerol (6.6 M)	0.50	7.23	1.426	1.0000
<u>Imidazole 50%</u>				
0.5 M piperidineHCl	1.00	6.25	0.750	0.9980
	0.60	6.27	0.529	1.0000
	0.20	6.28	0.320	1.0000
<u>Imidazole 70%</u>				
0.7 M piperidineHCl	1.00	6.64	1.176	0.9999
	0.60	6.62	0.875	0.9999
	0.20	6.62	0.668	1.0000
<u>Imidazole 80%</u>				
0.8 M piperidineHCl	1.00	6.84	1.609	0.9999
	0.60	6.87	1.391	0.9998
	0.20	6.87	1.171	0.9999

Imidazole 90%

0.9 M piperidineHCl	1.00	7.23	2.726	0.9999
	0.60	7.19	2.558	0.9999
	0.20	7.20	2.220	1.0000

Imidazole 50%

0.5 M KCl	1.00	6.34	0.852	0.9995
	0.60	6.37	0.577	0.9998
	0.20	6.39	0.326	0.9999

Imidazole 70%

0.7 M KCl	1.00	6.79	1.511	0.9999
	0.60	6.77	1.133	0.9999
	0.20	6.77	0.801	0.9999
0.7 M KCl	1.00	6.78	1.485	0.9999
	0.60	6.77	1.123	0.9999
	0.20	6.79	0.807	1.0000

Imidazole 90%

0.9 M KCl	1.00	7.43	4.019	1.0000
	0.60	7.43	3.778	1.0000
	0.60	7.42	3.602	0.9999
	0.20	7.40	3.475	0.9999

Imidazole 50%

I=1.0 M (piperidine HCl)	1.00	6.25	0.699	0.9993
	0.60	6.26	0.500	0.9997
	0.20	6.25	0.339	0.9999

Imidazole 70%

I=1.0 M (piperidine HCl)	1.00	6.64	1.168	0.9999
	0.60	6.62	0.941	1.0000
	0.20	6.62	0.706	1.0000

Imidazole 90%

I=1.0 M (piperidine HCl)	1.00	7.23	2.799	1.0000
	0.60	7.19	2.643	1.0000
	0.20	7.20	2.358	1.0000

Imidazole 50%

I=0.5 M (KCl) and	0.5	6.35	0.439	0.9994
[Imid]+[pyrrole] = 0.25 M	0.3	6.37	0.243	0.9998
	0.1	6.40	0.241	0.9999
I=0.5 M (KCl) and	0.5	6.35	0.497	0.9997
[Imid]+[pyrrole] = 0.25 M	0.3	6.37	0.258	0.9997
	0.1	6.40	0.250	0.9996

Buffer (free base)	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$	<i>R</i>
<u>Imidazole 70%</u>				
I=0.5 M (KCl) and	0.5	6.73	0.835	0.9998
[Imid]+[pyrrole] = 0.35 M	0.3	6.76	0.658	0.9998
	0.1	6.76	0.433	1.0000
<u>Imidazole 90%</u>				
I=0.5 M (KCl) and	0.5	7.35	2.535	1.0000
[Imid]+[pyrrole] = 0.45 M	0.3	7.36	2.334	1.0000
	0.1	7.35	1.928	0.9999
<u>Imidazole 50%</u>				
0.5 M (pipHCl) and	0.5	6.29	0.407	0.9993
[Imid]+[pyrrole] = 0.25 M	0.3	6.30	0.196	0.9994
	0.1	6.30	0.126	0.9999
<u>Imidazole 70%</u>				
0.5 M (pipHCl) and	0.5	6.67	0.778	0.9998
[Imid]+[pyrrole] = 0.35 M	0.3	6.64	0.528	0.9998
	0.1	6.65	0.284	0.9998
<u>Imidazole 90%</u>				
0.5 M (pipHCl) and	0.5	7.23	2.253	0.9999
[Imid]+[pyrrole] = 0.45 M	0.3	7.24	1.837	0.9999
	0.1	7.23	1.369	0.9999
<u>Morpholine 90%</u>				
I=1.0 M (piperidineHCl)	1.00	8.64	47.00	1.0000
	0.60	8.58	43.87	0.9999
	0.20	8.40	34.48	1.0000
I=0.7 M (KCl)	1.00	8.88	61.65	1.0000
I=0.4 (KCl)	1.00	8.81	44.32	1.0000
I=0.2 (KCl)	1.00	8.75	31.43	1.0000
I=1.0 M (piperidineHCl)	1.00	8.65	46.00	1.0000
I=0.7 (piperidineHCl)	1.00	8.67	41.70	1.0000
I=0.4 (piperidineHCl)	1.00	8.70	34.72	0.9999

Buffer (free base)	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$	<i>R</i>
<u>Morpholine 90%</u>				
I=1.0 M (pipHCl); 2% (v/v) dioxane (0.23 M)	1.00	8.93	70.2	1.0000
I=1.0 (pipHCl); 10% dioxane (1.18 M)	1.00	8.91	51.0	0.9999
I=1.0 (pipHCl); 20% dioxane (2.35 M)	1.00	8.87	33.4	0.9999
<u>Carbonate 50%</u>				
1.0 M Imidazole	0.30	9.64	291	0.9998
0.6 M Imidazole	0.30	9.60	309	0.9999
0.2 M Imidazole	0.30	9.55	302	0.9999
1.0 M Dioxane	0.30	9.72	325	0.9999
0.6 M Dioxane	0.30	9.64	291	0.9999
0.2 M Dioxane	0.30	9.55	313	0.9999
0.5 M Pyrrole	0.30	9.59	285	0.9999
0.3 M Pyrrole	0.30	9.55	291	0.9999
0.1 M Pyrrole	0.30	9.51	308	0.9999
I=1.0 M KCl	0.30	9.50	293	0.9999
I=0.8 KCl	0.30	9.53	299	1.0000
I=0.6 KCl	0.30	9.59	273	0.9998

S.2.3 Primary Data for 50% Carbonate Buffers with Added Solvents Corrected to pH 9.50

(using the local pH rate profile gradient of 0.6)

Buffer additive	Conc. $\times \text{mol}^{-1}\text{dm}^3$	pH	$k_{\text{obs}}/\text{s}^{-1}$ $\times 10^4$
1.0 M Imidazole	0.30	9.50	240
0.6 M Imidazole	0.30	9.50	269
0.2 M Imidazole	0.30	9.50	282
1.0 M Dioxane	0.30	9.50	240
0.6 M Dioxane	0.30	9.50	240
0.2 M Dioxane	0.30	9.50	292
0.5 M Pyrrole	0.30	9.50	252
0.3 M Pyrrole	0.30	9.50	271
0.1 M Pyrrole	0.30	9.50	304
I=1.0 M (KCl)	0.30	9.50	293
I=0.8 (KCl)	0.30	9.50	279
I=0.6 (KCl)	0.30	9.50	242

S.2.4 Zero Buffer Concentration Rate Constants

Buffer	free base	pH	$\log(k_0/\text{s}^{-1})$	+/-
TMEDA monocation	50%	5.73	-5.43	0.37
3,4-Lutidine	60%	6.02	-4.87	0.02
	70%	6.22	-4.75	0.01
	80%	6.47	-4.65	0.02
Bistris	40%	5.92	-5.09	0.03
	60%	6.28	-4.63	0.01
	68%	6.46	-4.49	0.01
	80%	6.75	-4.15	0.01
	90%	7.10	-3.77	0.01
Imidazole	20%	5.70	-5.76	0.20
	30%	5.96	-5.02	0.07
	40%	6.18	-4.57	0.03
	50%	6.37	-4.43	0.03
	60%	6.55	-4.24	0.01
	70%	6.74	-4.07	0.01
	80%	7.02	-3.79	0.01
	90%	7.39	-3.46	0.01
Pipes	20%	5.70	-5.07	0.02
	30%	6.14	-4.81	0.01
	40%	6.30	-4.56	0.02
	50%	6.49	-4.45	0.01
	60%	6.67	-4.24	0.02
	70%	6.87	-3.98	0.01
	80%	7.11	-3.73	0.01
	90%	7.46	-3.41	0.02
Phosphate	30%	6.05	-5.04	0.10
	50%	6.49	-4.49	0.01
	70%	6.90	-4.07	0.02
1-Methylimidazole	40%	6.37	-4.38	0.01
	50%	6.54	-4.22	0.02
	60%	6.71	-4.07	0.01
	70%	6.91	-3.87	0.02

	80%	7.16	-3.63	0.01
	90%	7.49	-3.30	0.02
4-Methylimidazole	20%	6.18	-4.72	0.10
	30%	6.45	-4.31	0.03
	40%	6.67	-4.03	0.04
	50%	6.87	-3.89	0.02
	60%	7.08	-3.70	0.01
	70%	7.29	-3.51	0.01
	80%	7.53	-3.29	0.01
	90%	7.91	-2.94	0.01
2-Methylimidazole	50%	7.18	-3.53	0.01
Triethanolamine	50%	7.27	-3.52	0.01
Tris	10%	6.20	-4.71	0.10
	20%	6.63	-4.15	0.02
	30%	6.90	-3.92	0.02
	40%	7.07	-3.71	0.01
	50%	7.29	-3.55	0.02
	60%	7.45	-3.36	0.01
	70%	7.73	-3.18	0.01
	80%	7.88	-2.94	0.01
	90%	8.24	-2.58	0.01
TMPDA monocation	50%	7.43	-3.37	0.02
Morpholine	10%	6.91	-3.94	0.01
	30%	7.57	-3.24	0.01
	50%	7.97	-2.88	0.01
	70%	8.38	-2.52	0.01
	90%	8.95	-1.99	0.02
TMBDA monocation	50%	8.13	-2.63	0.02
DABCO	50%	8.43	-2.43	0.01
TMEDA	50%	8.69	-2.11	0.01
Carbonate	30%	9.22	-1.87	0.01
	50%	9.60	-1.61	0.01
	70%	9.98	-1.40	0.05

S.2.5 Second Order Rate Constants

Buffer	free base	$k_2/\text{s}^{-1}\text{mol}^{-1}\text{dm}^3$ $\times 10^5$	+/-
TMEDA monocation	50%	6.5	1.5
3,4-Lutidine	60%	0.9	0.07
	70%	0.8	0.1
	80%	1.8	0.5
	90%	6.1	0.3
Bistris	40%	0.46	0.1
	60%	0.57	0.03
	68%	0.72	0.02
	80%	0.84	0.05
	90%	0.76	0.06
Imidazole	20%	3.0	0.15
	30%	3.8	0.3
	40%	4.4	0.3
	50%	5.1	0.5
	60%	6.0	0.1
	70%	6.5	0.05
	80%	6.1	0.5
	90%	5.2	0.05
Pipes	20%	0.0	0.1
	30%	0.5	0.1
	40%	0.9	0.5
	50%	0.0	1.1
	60%	-2.5	1.0
	70%	-5.0	1.0
	80%	-8.8	0.2
	90%	-17.9	5.0
Phosphate	30%	0.5	0.2
	50%	2.60	0.01
	70%	8.7	2.2
1-Methylimidazole	40%	0.5	0.07
	50%	-0.1	0.5
	60%	-0.5	0.4
	70%	-2.5	0.5

Buffer	free base	$k_2/\text{s}^{-1}\text{mol}^{-1}\text{dm}^3$ $\times 10^5$	+/-
1-Methylimidazole	80%	-7.4	0.2
	90%	-17.6	0.3
4-Methylimidazole	20%	4.1	0.8
	30%	4.4	0.5
	40%	4.9	0.7
	50%	6.3	1.0
	60%	5.8	0.2
	70%	5.0	0.8
	80%	3.0	0.8
	90%	-11.0	4.3
2-Methylimidazole	50%	2.2	0.3
Triethanolamine	50%	-5.2	0.4
Tris	10%	5.3	0.7
	20%	7.4	0.3
	30%	11.0	0.6
	40%	16.8	0.1
	50%	19.0	0.7
	60%	21.0	0.6
	70%	24.2	0.8
Tris	80%	28.4	1.0
	90%	23.1	1.0
TMPDA monocation	50%	42	4
Morpholine	10%	10.4	0.2
	30%	16.7	1.0
	50%	9.4	0.3
	70%	-36.4	0.2
	90%	-278	60
TMBDA monocation	50%	-208	30
DABCO	50%	-55	3
TMEDA	50%	-425	17

S.2.6 Second Order Rate Constants for Salt and Solvent Effect Experiments

Buffer		free base	$k_2/\text{s}^{-1}\text{mol}^{-1}\text{dm}^3$ $\times 10^5$	+/-
Imidazole	0.5 M piperidineHCl	50%	5.4	0.1
	0.7 M piperidineHCl	70%	6.3	0.6
	0.9 M piperidineHCl	90%	6.3	1.2
Imidazole	0.5 M KCl	50%	5.6	0.2
	0.7 M KCl	70%	8.9	0.2
	0.9 M KCl	90%	7.0	1.0
Imidazole	I=1.0 M (piperidineHCl)	50%	4.5	0.3
	I=1.0 (piperidineHCl)	70%	5.8	0.1
	I=1.0 (piperidineHCl)	90%	5.5	0.9
Imidazole				
I=0.5 M (KCl); [Im]+[pyrrole] = 0.25 M		50%	5.7	1.0
I=0.5 (KCl); [Im]+[pyrrole] = 0.35 M		70%	10.0	0.7
I=0.5 (KCl); [Im]+[pyrrole] = 0.45 M		90%	15.2	2.0
Imidazole				
I=0.5 M (PipHCl); [Im]+[pyrrole] = 0.25M		50%	7.0	2.0
I=0.5 (PipHCl); [Im]+[pyrrole] = 0.35 M		70%	12.3	0.1
I=0.5 (PipHCl); [Im]+[pyrrole] = 0.45 M		90%	22.1	0.7
Morpholine	I=1.0 M (piperidineHCl)	90%	155	50

S.2.7 Solvent-Effect-Corrected Second Order Rate Constants for

Imidazole Buffers

Buffer	free base	$k_2/\text{s}^{-1}\text{mol}^{-1}\text{dm}^3$ $\times 10^5$
Imidazole	20%	3.0
	30%	3.8
	40%	4.5
	50%	5.3
	60%	6.3
	70%	7.1
	80%	7.5
	90%	8.8