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Appendix A Kinetics Study of Metallic Mercury on Zeolites X, Y, L, Omega, Beta and CMG273 (Batch)

A1) Amount of metallic mercury adsorbed on Zeolite X as a function of time for two concentrations (low and high) at temperatures of 30°C, 40°C and 50°C.

Table A1.1 For low concentrations (30°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	610	0.00	0.1	610	0.00	0.1	610	0.00	0.00	0.00
2	15	0.1001	579	5.08	0.1007	560	8.14	0.1021	569	6.58	6.60	1.25
3	30	0.1001	510	16.38	0.1007	559	8.30	0.1021	534	12.20	12.29	3.30
4	60	0.1001	524	14.08	0.1007	504	17.26	0.1021	514	15.41	15.58	1.30
5	90	0.1001	510	16.38	0.1007	510	16.28	0.1021	510	16.06	16.24	0.13
6	120	0.1001	469	23.09	0.1007	510	16.28	0.1021	489	19.43	19.60	2.78
7	180	0.1001	483	20.80	0.1007	497	18.40	0.1021	490	19.27	19.49	0.99
8	240	0.1001	480	21.29	0.1007	480	21.16	0.1021	480	20.87	21.11	0.17
9	300	0.1001	483	20.80	0.1007	469	22.95	0.1021	476	21.52	21.76	0.90
10	360	0.1001	485	20.47	0.1007	478	21.49	0.1021	481	20.71	20.89	0.43
11	600	0.1001	481	21.13	0.1007	471	22.63	0.1021	476	21.52	21.76	0.64

Table A1.2 For low concentrations (40°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	483	0.00	0.1	483	0.00	0.1	483	0.00	0.00	0.00
2	15	0.1005	458	5.15	0.1009	460	4.72	0.1003	459	4.95	4.94	0.22
3	30	0.1005	460	4.74	0.1009	448	7.18	0.1003	454	5.99	5.97	1.22
4	60	0.1005	420	12.98	0.1009	430	10.88	0.1003	425	11.97	11.94	1.05
5	90	0.1005	378	21.63	0.1009	460	4.72	0.1003	419	13.21	13.19	8.46
6	135	0.1005	357	25.96	0.1009	478	1.03	0.1003	418	13.42	13.47	12.47
7	180	0.1005	389	19.36	0.1009	430	10.88	0.1003	410	15.07	15.10	4.24
8	240	0.1005	380	21.22	0.1009	410	14.98	0.1003	395	18.16	18.12	3.12
9	300	0.1005	352	18.75	0.1009	400	17.03	0.1003	396	17.96	17.91	0.86
10	420	0.1005	380	21.22	0.1009	390	19.08	0.1003	385	20.23	20.18	1.07
11	600	0.1005	371	23.07	0.1009	385	20.11	0.1003	378	* 21.67	21.62	1.48

Table A1.3 For low concentrations (50°C)

	Time (mins)	Run 1			Run 2			RUN 3			Average % adsorption	RSD
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent		
1	0	0.1	587	0.00	0.1	619	0.00	0.1	603	0.00	0.00	0.00
2	15	0.1005	550	6.27	0.1009	577	6.72	0.1003	560	7.11	6.70	0.42
3	30	0.1005	560	4.83	0.1009	558	9.77	0.1003	555	7.94	7.43	2.63
4	60	0.1005	545	7.12	0.1009	540	12.65	0.1003	549	8.93	9.57	2.82
5	90	0.1005	530	9.66	0.1009	560	9.45	0.1003	540	10.42	9.84	0.51
6	135	0.1005	540	7.97	0.1009	548	11.37	0.1003	543	9.92	9.75	1.71
7	180	0.1005	540	7.97	0.1009	530	14.25	0.1003	530	12.07	11.43	3.19
8	240	0.1005	538	8.31	0.1009	520	15.85	0.1003	525	12.90	12.35	3.80
9	300	0.1005	497	15.26	0.1009	531	14.09	0.1003	510	15.38	14.91	0.71
10	420	0.1005	500	14.75	0.1009	510	17.45	0.1003	515	14.55	15.58	1.62
11	600	0.1005	504	14.07	0.1009	497	19.53	0.1003	500	17.03	16.88	2.74

Table A1.4 For high concentrations (30°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	1227	0.00	0.1	1227	0.00	0.1	1227	0.00	0.00	0.00
2	15	0.101	1224	0.24	0.1011	1028	16.04	0.1021	1126	8.06	8.12	6.45
3	30	0.101	1009	17.59	0.1011	971	20.64	0.1021	990	18.92	19.05	1.25
4	60	0.101	944	22.84	0.1011	930	23.94	0.1021	937	23.15	23.31	0.47
5	90	0.101	909	25.66	0.1011	943	22.89	0.1021	926	24.03	24.19	1.14
6	135	0.101	902	26.23	0.1011	954	22.01	0.1021	928	23.87	24.03	1.73
7	180	0.101	840	31.23	0.1011	931	23.86	0.1021	885	27.30	27.46	3.01
8	240	0.101	837	31.47	0.1011	920	24.75	0.1021	878	27.86	28.03	2.75
9	300	0.101	840	31.23	0.1011	862	29.42	0.1021	851	30.01	30.22	0.75
10	360	0.101	834	31.71	0.1011	833	31.76	0.1021	833	31.45	31.64	0.14
11	600	0.101	830	32.03	0.1011	840	31.20	0.1021	835	31.29	31.51	0.37

Table A1.5 For high concentrations (40°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	1060	0.00	0.1	1159	0.00	0.1	1105	0.00	0.00	0.00
2	15	0.109	986	6.40	0.1027	1091	5.71	0.1008	1040	5.84	5.98	0.30
3	30	0.1022	958	9.42	0.1027	1030	10.84	0.1008	994	9.97	10.07	0.59
4	60	0.1022	920	12.92	0.1027	980	15.04	0.1008	983	10.95	12.97	1.67
5	90	0.1022	867	17.82	0.1027	973	15.63	0.1008	920	16.61	16.68	0.90
6	120	0.1022	832	21.05	0.1027	950	17.56	0.1008	897	18.67	19.09	1.45
7	180	0.1022	832	21.05	0.1027	950	17.56	0.1008	891	19.21	19.27	1.42
8	240	0.1022	840	20.31	0.1027	990	14.20	0.1008	915	17.06	17.19	2.50
9	300	0.1022	845	19.85	0.1027	910	20.92	0.1008	890	19.30	20.02	0.67
10	360	0.1022	835	20.77	0.1027	900	21.76	0.1008	870	21.10	21.21	0.41
11	600	0.1022	830	21.23	0.1027	895	22.18	0.1008	860	22.00	21.80	0.41

Table A1.6 For high concentrations (50°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	986	0.00	0.1	986	0.00	0.1	986	0.00	0.00	0.00
2	15	0.1003	940	4.65	0.104	920	6.44	0.1005	930	5.65	5.58	0.73
3	30	0.1003	916	7.08	0.0986	900	8.85	0.1005	885	10.19	10.25	2.61
4	60	0.1003	900	8.70	0.1015	870	11.59	0.1005	870	11.71	11.69	2.52
5	90	0.1003	895	9.20	0.1013	895	9.11	0.1005	895	9.18	9.17	0.04
6	135	0.1003	830	15.77	0.0996	887	10.08	0.1005	860	12.72	12.86	2.33
7	180	0.1003	832	15.57	0.1022	860	12.50	0.1005	846	14.13	14.07	1.25
8	240	0.1003	895	9.20	0.0998	840	14.84	0.1005	870	11.71	11.91	2.31
9	300	0.1003	860	12.74	0.0991	820	16.99	0.1005	840	14.73	14.82	1.74
10	420	0.1003	830	15.77	0.1035	804	17.83	0.1005	817	17.05	16.89	0.85
11	600	0.1003	810	17.80	0.0994	780	21.02	0.1005	795	19.27	19.36	1.32

A2) Amount of metallic mercury adsorbed on Zeolite Y as a function of time for two concentrations (low and high) at temperatures of 30°C, 40°C and 50°C.

Table A2.1 For low concentrations (30°C)

Time (mins)	RUN 1			RUN 2			RUN 3			Average		
	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/unit weight of adsorbent	% adsorption	RSD	
1	0	0.1	483	0.00	0.1	483	0.00	0.1	483	0.00	0.00	0.00
2	15	0.1007	420	12.95	0.1018	474	1.83	0.1024	447	7.28	7.35	4.54
3	30	0.1007	392	18.71	0.1018	450	6.71	0.1002	421	12.81	12.74	4.90
4	60	0.1007	392	18.71	0.1018	423	12.20	0.1005	407.5	15.55	15.49	2.66
5	90	0.1007	398	17.48	0.1018	404	16.07	0.1012	401	16.78	16.77	0.58
6	120	0.1007	410	15.01	0.1018	390	18.91	0.1016	400	16.91	16.95	1.59
7	180	0.1007	402	16.65	0.1018	390	18.91	0.1038	396	17.35	17.64	0.94
8	240	0.1007	390	19.12	0.1018	382	20.54	0.1031	386	19.48	19.71	0.60
9	300	0.1007	380	21.18	0.1018	389	19.12	0.1031	384.5	19.78	20.02	0.86
10	360	0.1007	387	19.74	0.1018	389	19.12	0.1009	388	19.49	19.45	0.26
11	600	0.1007	385	20.15	0.1018	391	18.71	0.1005	388	19.57	19.48	0.59

Table A2.2 For low concentrations (40°C)

Table A2.2 For low concentrations (40°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	590	0.00	0.1000	590	0.00	0.1	590	0.00	0.00	0.00
2	15	0.1015	570	3.34	0.1020	580	1.66	0.1003	575	2.53	2.51	0.69
3	30	0.1015	557	5.51	0.1020	561	4.82	0.1003	559	5.24	5.19	0.28
4	60	0.1015	517	12.19	0.1020	538	8.64	0.1003	527.5	10.56	10.46	1.45
5	90	0.1015	521	11.52	0.1020	532	9.64	0.1003	526.5	10.73	10.63	0.77
6	120	0.1015	504	14.36	0.1020	527	10.47	0.1003	515.5	12.59	12.47	1.59
7	180	0.1015	492	16.36	0.1020	517	12.13	0.1003	504.5	14.45	14.31	1.73
8	240	0.1015	480	18.37	0.1020	511	13.13	0.1003	495.5	15.97	15.82	2.14
9	300	0.1015	490	16.70	0.1020	496	15.62	0.1003	493	16.39	16.24	0.45
10	360	0.1015	491	16.53	0.1020	490	16.62	0.1003	490.5	16.81	16.65	0.12

Table A2.3 For low concentrations (50°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	587	0.00	0.1	619.00	0.00	0.1	603.00	0.00	0.00	0.00
2	15	0.1007	577	1.69	0.102	599.00	3.17	0.1011	588.00	2.46	2.44	0.60
3	30	0.1007	564	3.89	0.102	580.00	6.18	0.1011	572.00	5.09	5.05	0.93
4	60	0.1007	550	6.26	0.102	576.00	6.81	0.1011	563.00	6.56	6.54	0.23
5	90	0.1007	542	7.61	0.102	567.00	8.24	0.1011	554.00	8.04	7.96	0.26
6	135	0.1007	538	8.29	0.102	560.00	9.34	0.1011	549.00	8.86	8.83	0.43
7	180	0.1007	534	8.97	0.102	555.00	10.14	0.1011	544.00	9.68	9.59	0.48
8	240	0.1007	514	12.35	0.102	548.00	11.25	0.1011	531.00	11.81	11.80	0.45
9	300	0.1007	521	11.17	0.102	552.00	10.61	0.1011	536.00	10.99	10.92	0.23
10	420	0.1007	501	14.55	0.102	552.00	10.61	0.1011	526.00	12.63	12.60	1.61
11	600	0.1007	477	18.61	0.102	538.00	12.83	0.1011	507.00	15.75	15.73	2.36

Table A2.4 For high concentrations (30°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	1227	0.00	0.1	1227	0.00	0.1	1227	0.00	0.00	0.00
2	15	0.1004	1080	11.93	0.101	988	19.29	0.1017	1010	17.39	16.20	3.12
3	30	0.1004	901	26.46	0.101	915	25.18	0.1017	908	25.56	25.73	0.54
4	60	0.1004	908	25.89	0.101	859	29.69	0.1017	883	27.57	27.72	1.56
5	90	0.1004	894	27.03	0.1008	893	27.00	0.1017	893	26.77	26.93	0.12
6	135	0.1004	900	26.54	0.0991	886	28.04	0.1017	908	25.56	26.72	1.02
7	180	0.1004	840	31.41	0.1008	874	28.54	0.1017	857	29.65	29.87	1.18
8	240	0.1004	831	32.15	0.1008	864	29.35	0.1017	847	30.45	30.65	1.15
9	300	0.1004	852	30.44	0.0991	868	29.52	0.1017	860	29.41	29.79	0.46
10	420	0.1004	848	30.77	0.1008	861	29.59	0.1017	854	29.89	30.08	0.50
11	600	0.1004	850	30.60	0.1008	855	30.08	0.1017	852.5	30.01	30.23	0.26

Table A2.5 For high concentrations (40°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	1259	0.00	0.1	1259	0.00	0.1	1259	0.00	0.00	0.00
2	15	0.102	1091	13.08	0.1015	1119	10.96	0.1012	1105	12.09	12.04	3.78
3	30	0.102	1080	13.94	0.1015	1070	14.79	0.1012	1020	18.76	15.83	0.44
4	60	0.102	1060	15.50	0.1015	1040	17.14	0.1012	1080	14.05	15.56	2.00
5	90	0.102	1021	18.53	0.1015	1010	19.49	0.1012	1015	19.15	19.06	2.63
6	120	0.102	1000	20.17	0.1015	950	24.18	0.1012	1000	20.33	21.56	1.03
7	180	0.102	1110	11.60	0.1015	916	26.84	0.1012	1013	19.31	19.25	0.48
8	240	0.102	991	20.87	0.1015	980	21.83	0.1012	985.5	21.47	21.39	1.04
9	300	0.102	971	22.43	0.1015	989	21.13	0.1012	980	21.90	21.82	0.60
10	360	0.102	965	22.89	0.1015	970	22.62	0.1012	967.5	22.88	22.80	0.30
11	600	0.102	976	22.04	0.1015	974	22.30	0.1012	975	22.29	22.21	1.61

Table A2.6 For high concentrations (50°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	906	0.00	0.1	906	0.00	0.1	906	0.00	0.00	0.00
2	15	0.1026	890	1.72	0.1005	855	5.60	0.1024	872.5	3.61	3.64	1.58
3	30	0.1026	870	3.87	0.1005	896	1.10	0.1002	883	2.53	2.50	1.13
4	60	0.1026	865	4.41	0.1005	875	3.40	0.1005	870	3.95	3.92	0.41
5	90	0.1026	850	6.02	0.1005	853	5.82	0.1012	851.5	5.94	5.93	0.08
6	120	0.1026	832	7.96	0.1005	840	7.25	0.1016	836	7.60	7.60	0.29
7	180	0.1026	832	7.96	0.1005	830	8.35	0.1038	831	7.98	8.09	0.18
8	240	0.1026	845	6.56	0.1005	800	11.64	0.1031	822.5	8.94	9.05	2.08
9	300	0.1026	830	8.18	0.1005	789	12.85	0.1031	809.5	10.33	10.45	1.91
10	360	0.1026	814	9.90	0.1005	756	16.47	0.1009	785	13.24	13.20	2.69
11	600	0.1026	804	10.97	0.1005	760	16.03	0.1005	782	13.62	13.54	2.07

A3) Amount of metallic mercury adsorbed on CMG273 as a function of time for two concentrations (low and high) at temperatures of 30°C, 40°C and 50°C.

Table A3.1 For low concentrations (30°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	405	0.00	0.1	410	0.00	0.1	420	0.00	0.00	0.00
2	5	0.1047	353	12.26	0.101	360	12.07	0.1022	380	9.32	11.22	1.65
3	10	0.1047	320	20.05	0.101	330	19.32	0.1022	300	27.96	22.44	4.79
4	20	0.1047	260	34.20	0.101	300	26.56	0.1022	280	32.62	31.12	4.03
5	30	0.1047	227	41.98	0.101	250	38.64	0.1022	260	37.28	39.30	2.42
6	45	0.1047	200	48.35	0.101	190	53.13	0.1022	200	51.25	50.91	2.41
7	60	0.1047	180	53.06	0.101	190	53.13	0.1022	180	55.91	54.03	1.63
8	120	0.1047	105	70.75	0.101	120	70.03	0.1022	130	67.56	69.45	1.67
9	180	0.1047	60	81.36	0.101	70	82.11	0.1022	80	79.21	80.89	1.50
10	240	0.1047	38	86.55	0.101	45	88.14	0.1022	50	86.20	86.96	1.04
11	300	0.1047	30	88.44	0.101	38	89.83	0.1022	40	88.53	88.93	0.78

Table A3.2 For low concentrations (40°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	493	0.00	0.1	490	0.00	0.1	520	0.00	0.00	0.00
2	5	0.1034	390	20.18	0.1004	400	18.29	0.1031	411	20.33	19.60	1.13
3	10	0.1034	360	26.09	0.1004	350	28.46	0.1031	370	27.98	27.51	1.25
4	20	0.1034	334	31.25	0.1004	330	32.52	0.1031	350	31.71	31.83	0.64
5	30	0.1034	294	39.13	0.1004	280	42.69	0.1031	310	39.17	40.33	2.04
6	45	0.1034	277	43.31	0.1004	240	50.82	0.1031	250	50.36	48.16	4.21
7	60	0.1034	190	59.44	0.1004	200	58.95	0.1031	210	57.82	58.74	0.83
8	120	0.1034	132	70.87	0.1004	130	73.18	0.1031	130	72.74	72.26	1.22
9	180	0.1034	84	80.22	0.1004	90	81.31	0.1031	80	82.07	81.20	0.93
10	240	0.1034	31	90.56	0.1004	52	89.03	0.1031	50	87.67	89.09	1.45
11	300	0.1034	19	93.02	0.1004	15	96.55	0.1031	20	93.26	94.28	1.97

Table A3.3 For low concentrations (50°C)

	Time (mins)	Run 1			Run 2			RUN 3			Average % adsorption	RSD
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent		
1	0	0.1	493	0.00	0.1	490	0.00	0.1	520	0.00	0.00	0.00
2	5	0.1024	419	14.65	0.1019	374	23.23	0.1003	410	21.09	19.66	4.47
3	10	0.1024	384	21.53	0.1019	343	29.44	0.1003	380	26.84	25.94	4.03
4	20	0.1024	329	32.40	0.1019	294	39.25	0.1003	340	34.51	35.39	3.51
5	30	0.1024	290	40.17	0.1019	259	46.26	0.1003	270	47.93	44.79	4.09
6	45	0.1024	267	44.83	0.1019	238	50.47	0.1003	250	51.77	49.02	3.69
7	60	0.1024	223	53.49	0.1019	199	58.28	0.1003	220	57.52	56.43	2.57
8	120	0.1024	93	79.23	0.1019	83	81.51	0.1003	100	80.53	80.42	1.14
9	180	0.1024	57	86.34	0.1019	51	87.92	0.1003	60	88.20	87.49	1.00
10	240	0.1024	32	91.22	0.1019	29	92.33	0.1003	35	92.99	92.18	0.89
11	300	0.1024	10	95.66	0.1019	9	96.33	0.1003	8	98.17	96.72	1.30

Table A3.4 For high concentrations (30°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	900	0.00	0.1	980	0.00	0.1	921	0.00	0.00	0.00
2	5	0.1027	713	20.23	0.1018	810	17.04	0.1016	800	12.93	16.73	3.66
3	10	0.1027	664	25.53	0.1018	700	28.07	0.1016	700	23.62	25.74	2.23
4	20	0.1027	531	39.92	0.1018	610	37.09	0.1016	620	32.17	36.39	3.92
5	30	0.1027	427	51.17	0.1018	480	50.12	0.1016	510	43.92	48.40	3.92
6	45	0.1027	536	61.02	0.1018	380	60.14	0.1016	400	55.68	58.95	2.86
7	60	0.1027	266	68.59	0.1018	300	68.16	0.1016	320	64.23	66.99	2.41
8	120	0.1027	130	83.31	0.1018	120	86.20	0.1016	210	75.98	81.83	5.27
9	180	0.1027	90	87.63	0.1018	90	89.21	0.1016	150	82.40	86.41	3.57
10	240	0.1027	80	88.72	0.1018	80	90.21	0.1016	100	87.74	88.89	1.25
11	300	0.1027	60	90.88	0.1018	70	91.22	0.1016	60	92.01	91.37	0.58

Table A3.5 For high concentrations (40°C)

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	1080	0.00	0.1	1020	0.00	0.1	921	0.00	0.00	0.00
2	5	0.104	888	17.09	0.1004	850	16.60	0.1031	750	18.01	17.23	0.71
3	10	0.104	760	28.49	0.1004	780	23.44	0.1031	720	21.17	24.36	3.75
4	20	0.104	590	43.63	0.1004	600	41.01	0.1031	580	35.91	40.18	3.92
5	30	0.104	490	52.53	0.1004	500	50.78	0.1031	450	49.60	50.97	1.47
6	45	0.104	372	63.03	0.1004	410	59.57	0.1031	350	60.13	60.91	1.86
7	60	0.104	300	69.44	0.1004	340	66.40	0.1031	300	65.40	67.08	2.11
8	120	0.104	200	78.35	0.1004	230	77.14	0.1031	220	73.82	76.44	2.34
9	180	0.104	112	86.18	0.1004	120	87.88	0.1031	100	86.46	86.84	0.91
10	240	0.104	51	91.61	0.1004	52	94.52	0.1031	60	90.67	92.27	2.01
11	300	0.104	31	93.39	0.1004	40	95.70	0.1031	22	94.68	94.59	1.15

Table A3.6 For high concentrations (50°C)

	Time (mins)	Run 1			Run 2			RUN 3			Average % adsorption	RSD
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent		
1	0	0.1	1020	0.00	0.1	1080	0.00	0.1	921	0.00	0.00	0.00
2	5	0.1035	811	19.80	0.102	850	20.88	0.1025	750	18.11	19.60	1.39
3	10	0.1035	660	34.10	0.102	750	29.96	0.1025	600	34.00	32.69	2.37
4	20	0.1035	510	48.31	0.102	620	41.76	0.1025	650	28.71	39.59	9.98
5	30	0.1035	400	58.73	0.102	510	51.74	0.1025	450	49.89	53.45	4.66
6	45	0.1035	300	68.20	0.102	350	66.27	0.1025	250	71.08	68.52	2.42
7	60	0.1035	230	74.83	0.102	260	74.44	0.1025	220	74.26	74.51	0.29
8	120	0.1035	120	85.25	0.102	180	81.70	0.1025	100	86.97	84.64	2.69
9	180	0.1035	50	91.88	0.102	100	88.96	0.1025	60	91.21	90.68	1.53
10	240	0.1035	20	94.72	0.102	50	93.50	0.1025	35	93.85	94.03	0.63
11	300	0.1035	10	95.67	0.102	20	96.22	0.1025	8	96.71	96.20	0.52

A4) Amount of metallic mercury adsorbed on Zeolite Beta as a function of time for 1000 ppb of metallic mercury at 30°C and 50°C.

Table A4.1 At 30°C

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	835	0.00	0.1	835	0.00	0.1	835	0.00	0.00	0.00
2	5	0.101	769	7.83	0.1038	790	5.19	0.101	780	6.52	6.51	1.08
3	15	0.101	787	5.69	0.1038	800	4.04	0.101	758	9.13	6.29	2.12
4	30	0.101	801	4.03	0.1038	790	5.19	0.101	788	5.57	4.93	0.66
5	45	0.101	795	4.74	0.1038	760	8.65	0.101	767	8.06	7.15	1.72
6	60	0.101	810	2.96	0.1038	720	13.27	0.101	767	8.06	8.10	4.21
7	75	0.101	811	2.85	0.1038	740	10.96	0.101	759	9.01	7.61	3.46
8	135	0.101	760	8.89	0.1038	740	10.96	0.101	740	11.26	10.37	1.05
9	195	0.101	738	11.50	0.1038	726	12.58	0.101	760	8.89	10.99	1.55
10	255	0.101	740	11.26	0.1038	750	9.81	0.101	740	11.26	10.78	0.69
11	330	0.101	759	9.01	0.1038	730	12.11	0.101	720	13.64	11.59	1.92

Table A4.2 At 40°C

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	835	0.00	0.1	835	0.00	0.1	835	0.00	0.00	0.00
2	5	0.102	792	5.05	0.104	790	5.18	0.1015	791	5.19	5.14	0.07
3	15	0.102	790	5.28	0.104	769	7.60	0.1015	785	5.90	6.26	0.98
4	30	0.102	790	5.28	0.104	780	6.33	0.1015	785	5.90	5.84	0.43
5	45	0.102	785	5.87	0.104	760	8.64	0.1015	773	7.37	7.29	1.13
6	60	0.102	780	6.46	0.104	720	13.24	0.1015	750	10.03	9.91	2.77
7	75	0.102	755	9.39	0.104	726	12.55	0.1015	741	11.15	11.03	1.29
8	135	0.102	766	8.10	0.104	653	20.96	0.1015	710	14.81	14.62	5.25
9	195	0.102	780	6.46	0.104	640	22.46	0.1015	699	16.05	14.99	6.57
10	255	0.102	775	7.04	0.104	648	21.53	0.1015	712	14.57	14.38	5.92
11	330	0.102	697	16.20	0.104	732	11.86	0.1015	715	14.22	14.09	1.77

A5) Amount of metallic mercury adsorbed on Zeolite Omega as a function of time for 1000 ppb of metallic mercury at 30°C and 50°C.

Table A5.1 At 30°C

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	835	0.00	0.1	835	0.00	0.1	835	0.00	0.00	0.00
2	5	0.1025	769	7.71	0.1038	790	5.19	0.101	780	6.52	6.47	1.03
3	15	0.1025	825	1.17	0.1038	800	4.04	0.101	758	9.13	4.78	3.29
4	30	0.1025	829	0.70	0.1038	790	5.19	0.101	788	5.57	3.82	2.21
5	45	0.1025	745	10.52	0.1038	760	8.65	0.101	767	8.06	9.08	1.05
6	60	0.1025	740	11.10	0.1038	720	13.27	0.101	767	8.06	10.81	2.13
7	75	0.1025	787	5.61	0.1038	740	10.96	0.101	759	9.01	8.53	2.21
8	135	0.1025	750	9.93	0.1038	740	10.96	0.101	740	*11.26	10.72	0.57
9	195	0.1025	720	13.44	0.1038	726	12.58	0.101	760	8.89	11.64	1.97
10	255	0.1025	710	14.60	0.1038	750	9.81	0.101	740	11.26	11.89	2.01
11	330	0.1025	713	14.25	0.1038	730	12.11	0.101	720	13.64	13.34	0.90

Table A5.2 At 50°C

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	835	0.00	0.1	835	0.00	0.1	835	0.00	0.00	0.00
2	5	0.1029	766	8.03	0.104	790	5.18	0.1015	778	6.73	6.65	1.16
3	15	0.1029	690	16.88	0.104	769	7.60	0.1015	785	5.90	10.13	4.82
4	30	0.1029	730	12.22	0.104	800	4.03	0.1015	765	8.26	8.17	3.34
5	45	0.1029	780	6.40	0.104	760	8.64	0.1015	770	7.67	7.57	0.92
6	60	0.1029	740	11.06	0.104	720	13.24	0.1015	730	12.39	12.23	0.90
7	75	0.1029	692	16.64	0.104	726	12.55	0.1015	709	14.87	14.69	1.68
8	135	0.1029	710	14.55	0.104	653	20.96	0.1015	682	18.11	17.87	2.62
9	195	0.1029	710	14.55	0.104	640	22.46	0.1015	699	16.05	17.68	3.43
10	255	0.1029	720	13.38	0.104	632	23.38	0.1015	676	18.76	18.51	4.08
11	330	0.1029	698	15.94	0.104	648	21.55	0.1015	673	19.11	18.86	2.29

A6) Amount of metallic mercury adsorbed on Zeolite L as a function of time for 1000 ppb of metallic mercury at 30°C and 50°C.

Table A6.1 At 30°C

Time (mins)	RUN 1			RUN 2			RUN 3			Average		
	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/unit weight of adsorbent	% adsorption	RSD	
1	0	0.1	835	0.00	0.1	835	0.00	0.1	835	0.00	0.00	0.00
2	5	0.1039	832	0.35	0.1007	830	0.59	0.103	810	2.91	1.28	1.15
3	15	0.1039	820	1.73	0.1007	815	2.38	0.103	802	3.84	2.65	0.88
4	30	0.1039	801	3.92	0.1007	800	4.16	0.103	795	4.65	4.24	0.30
5	45	0.1039	801	3.92	0.1007	805	3.57	0.103	810	2.91	3.46	0.42
6	60	0.1039	807	3.23	0.1007	803	3.81	0.103	800	4.07	3.70	0.35
7	75	0.1039	800	4.03	0.1007	790	5.35	0.103	790	5.23	4.87	0.59
8	135	0.1039	832	0.35	0.1007	768	7.97	0.103	792	5.00	4.44	3.14
9	195	0.1039	800	4.03	0.1007	780	6.54	0.103	795	4.65	5.08	1.07
10	255	0.1039	787	5.53	0.1007	784	6.07	0.103	790	5.23	5.61	0.34
11	330	0.1039	780	6.34	0.1007	780	6.54	0.103	790	5.23	6.04	0.58

Table A6.2 At 50°C

	Time (mins)	RUN 1			RUN 2			RUN 3			Average	
		Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	Weight of adsorbent (gram)	Remaining concentration (ppb)	% adsorption/ unit weight of adsorbent	% adsorption	RSD
1	0	0.1	840	0.00	0.1	840	0.00	0.1	840	0.00	0.00	0.00
2	5	0.0999	811	3.46	0.1	810	3.57	0.1	811	3.51	3.51	0.05
3	15	0.0999	815	2.86	0.1	800	4.76	0.1	808	3.81	3.81	0.78
4	30	0.0999	800	4.77	0.1	832	0.95	0.1	816	2.86	2.86	1.56
5	45	0.0999	794	5.48	0.1	790	5.95	0.1	792	5.71	5.72	0.19
6	60	0.0999	775	7.75	0.1	800	4.76	0.1	788	6.25	6.25	1.22
7	75	0.0999	780	7.75	0.1	790	5.95	0.1	783	6.85	6.85	0.73
8	135	0.0999	770	7.15	0.1	800	4.76	0.1	790	5.95	5.95	0.97
9	195	0.0999	760	8.34	0.1	790	5.95	0.1	780	7.14	7.15	0.98
10	255	0.0999	770	9.53	0.1	780	7.14	0.1	770	8.33	8.34	0.98
11	330	0.0999	770	8.34	0.1	775	7.74	0.1	773	8.04	8.04	0.25

Appendix B Adsorption Isotherms for Metallic Mercury on Zeolites X, Y, L, Beta, Omega and CMG273 at 30°C, 40°C and 50°C with Equilibration Time of 8 hrs (Batch)

Table B1.1 For Zeolite X at 30°C

	RUN 1				RUN 2			RUN 3			Average			Amount of adsorbed Hg, $\mu\text{g/g}$ of adsorbant	Solid phase conc., q, $\mu\text{mole/g}$ of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Eq. Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD	conc, q $\mu\text{mole/g}$ of Adsorbant		
1	838	0.1001	654	654	0.1006	583	585	0.1003	640	641	626	4.81	3.123	21.157	0.10547
2	777	0.101	571	573	0.1003	560	561	0.1	550	550	561	1.68	2.798	21.577	0.10757
3	597	0.1017	394	397	0.1012	431	433	0.0991	425	423	418	3.60	2.084	17.907	0.08927
4	520	0.1021	280	285	0.1024	394	397	0.0999	337	337	340	13.48	1.693	18.043	0.08995
5	474	0.1009	300	302	0.1031	286	292	0.1002	293	293	296	1.46	1.473	17.848	0.08898
6	320	0.1019	146	149	0.0996	160	164	0.1007	153	154	156	3.94	0.777	16.420	0.08186
7	225	0.1031	111	114	0.102	97	100	0.1011	104	105	106	5.77	0.531	11.858	0.05912

Table B1.2 For Zeolite X at 40°C

		RUN 1			RUN 2			RUN 3			Average				
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	RSD	Fluid phase conc, C (µmole/L)	Amount of adsorbed Hg, µg/g of adsorbant	Solid phase conc, q µmole/g of adsorbant
1	825	0.1005	740	740	0.1018	710	630	0.1001	603	603	658	9.03	3.280	16.712	0.08331
2	752	0.1008	530	532	0.1003	606	606	0.1004	568	569	569	5.36	2.837	18.333	0.09139
3	604	0.1034	414	420	0.1005	430	431	0.0997	410	409	420	2.08	2.095	18.340	0.09143
4	534	0.1026	350	355	0.1023	405	408	0.1006	390	391	384	5.77	1.917	14.981	0.07468
5	462	0.1022	271	275	0.1027	380	382	0.1009	315	316	325	13.58	1.618	13.761	0.06860
6	308	0.1007	225	226	0.1003	150	150	0.1019	188	190	189	16.26	0.940	11.891	0.05928
7	250	0.1009	151	152	0.1024	134	137	0.1014	143	144	144	4.29	0.719	10.580	0.05275

Table B1.3 For Zeolite X at 50°C

	RUN 1				RUN 2			RUN 3			Average			Fluid phase conc, C (µmole/L)	Amount of adsorbed Hg, µg/g of adsorbant	Solid phase conc, q µmole/g of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	RSD				
1	848	0.1015	715	717	0.1009	678	680	0.1009	697	690	695	2.27	3.467	15.251	0.07603	
2	755	0.1023	690	691	0.1021	520	525	0.1004	605	600	605	11.25	3.018	14.957	0.07456	
3	626	0.1021	485	488	0.099	490	489	0.0995	488	500	492	1.13	2.454	13.382	0.06672	
4	561	0.1032	393	398	0.1006	480	480	0.1008	437	450	443	7.67	2.208	11.810	0.05888	
5	456	0.0998	364	364	0.1002	339	339	0.1033	352	325	343	4.68	1.708	11.332	0.05649	
6	320	0.0995	224	224	0.1035	220	223	0.1023	222	239	229	3.21	1.140	9.137	0.04555	
7	201	0.12	121	134	0.1005	131	131	0.1017	126	120	129	4.80	0.641	7.244	0.03611	

Table B2.1 For Zeolite Y at 30°C

	RUN 1				RUN 2			RUN 3			Average		Amount of Fluid phase conc, C (µmole/L)	adsorbed Hg, µg/g of adsorbant	Solid phase conc, q µmole/g of Adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	838	0.0992	644	642	0.1006	583	585	0.1009	614	616	614	3.85	3.062	22.385	0.11159
2	777	0.1016	572	575	0.1002	560	560	0.1003	566	567	567	1.07	2.829	20.957	0.10448
3	597	0.1005	389	390	0.0998	431	431	0.0993	410	409	410	4.05	2.043	18.721	0.09333
4	520	0.1003	272	273	0.101	394	395	0.0991	333	331	333	15.02	1.661	18.690	0.09318
5	474	0.0995	295	294	0.0993	286	285	0.0994	291	289	289	1.33	1.443	18.461	0.09203
6	320	0.1005	150	151	0.1025	160	164	0.1006	155	156	157	3.42	0.782	16.309	0.08130
7	225	0.1023	105	108	0.1021	97	100	0.1011	101	102	103	3.25	0.515	12.177	0.06071

Table B2.2 For Zeolite Y at 40°C

	RUN 1				RUN 2			RUN 3			Average		Amount of Fluid phase conc, C (μmole/L)	adsorbed Hg, μg/g of adsorbant	Solid phase conc, q μmole/g of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	825	0.1004	730	730	0.1018	703	630	0.1008	603	605	655	8.28	3.266	16.995	0.08473
2	752	0.0993	528	527	0.1003	598	598	0.1004	563	564	563	5.17	2.807	18.935	0.09440
3	604	0.1005	442	443	0.101	414	415	0.0998	428	427	429	2.61	2.137	17.501	0.08725
4	534	0.1008	347	349	0.1	416	416	0.1012	382	384	383	7.23	1.909	15.140	0.07548
5	462	0.1022	270	274	0.1027	378	380	0.0999	324	324	326	13.28	1.625	13.614	0.06787
6	308	0.1009	230	231	0.1003	146	146	0.1009	188	189	188	18.35	0.940	11.900	0.05933
7	250	0.0999	154	154	0.1004	144	144	0.1019	149	151	150	2.64	0.746	10.026	0.04998

Table B2.3 For Zeolite Y at 50°C

50°C		RUN 1			RUN 2			RUN 3			Average		Fluid phase conc, C (µmole/L)	Amount of adsorbed Hg, µg/g of adsorbant	Solid phase conc, q µmole/g of adsorbant
Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD				
1	848	0.1016	710	712	0.1007	658	659	0.1009	684	685	686	3.15	3.418	16.235	0.08094
2	755	0.1035	680	683	0.1028	529	535	0.1003	605	605	608	9.91	3.029	14.745	0.07351
3	626	0.1018	480	483	0.0992	500	499	0.0993	490	489	490	1.38	2.444	13.580	0.06770
4	561	0.101	390	392	0.1002	500	500	0.0991	445	444	445	9.94	2.220	11.575	0.05770
5	456	0.1032	364	367	0.1002	339	339	0.0994	352	351	352	3.21	1.756	10.368	0.05169
6	320	0.1028	225	228	0.1021	230	232	0.1006	228	228	229	0.83	1.142	9.084	0.04528
7	201	0.1038	121	124	0.1004	132	132	0.1011	127	127	128	2.68	0.637	7.316	0.03647

Table B3.1 For CMG273 at 30°C

	RUN 1			RUN 2		RUN 3		Average		Fluid phase conc, C ($\mu\text{mole/L}$)	Amount of adsorbed Hg, $\mu\text{g/g}$ of adsorbant	Solid phase conc, q $\mu\text{mole/g}$ of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	900	0.1009	92	0.1007	80	0.1013	85	86	4.92	0.427	81.433	0.40597
2	860	0.1021	80	0.1001	70	0.1007	60	70	8.16	0.349	79.000	0.39384
3	800	0.1006	60	0.101	50	0.0998	65	58	6.24	0.291	74.167	0.36974
4	760	0.1022	42	0.102	35	0.1	50	42	6.13	0.211	71.767	0.35778
5	390	0.103	30	0.1019	20	0.102	15	22	6.24	0.108	36.833	0.18362
6	300	0.1009	25	0.1	15	0.1008	10	17	6.24	0.083	28.333	0.14125
7	210	0.1055	13	0.102	10	0.101	8	10	2.05	0.052	19.967	0.09954

Table B3.2 For CMG273 at 40°C

	RUN 1		RUN 2		RUN 3		Average		RSD	Fluid phase conc, C ($\mu\text{mole/L}$)	Amount of adsorbed Hg, $\mu\text{g/g}$ of adsorbant	Solid phase conc, q $\mu\text{mole/g}$ of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)				
1	1080	0.1031	40	0.1017	48	0.1001	50	46	4.32	0.229	103.400	0.51548
2	799	0.1009	31	0.1	39	0.1005	42	37	4.64	0.186	76.167	0.37971
3	655	0.1007	26	0.1006	30	0.0999	20	25	4.11	0.126	62.967	0.31391
4	561	0.1012	20	0.102	19	0.101	18	19	0.82	0.095	54.200	0.27020
5	393	0.103	10	0.1025	9	0.1011	15	11	2.62	0.056	38.167	0.19027
6	245	0.1004	4	0.1003	10	0.1017	6	7	2.49	0.033	23.833	0.11882
7	126	0.1034	2	0.1021	4	0.102	4	3	0.94	0.017	12.267	0.06115

Table B3.3 For CMG273 at 50°C

	RUN 1		RUN 2		RUN 3		Average			Fluid phase conc, C ($\mu\text{mole/L}$)	Amount of adsorbed Hg, $\mu\text{g/g}$ of adsorbant	Solid phase conc, q $\mu\text{mole/g}$ of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	Eq. Hg conc./0.1g of adsorbent (ppb)	RSD			
1	921	0.0996	10	0.1008	6	0.1011	9	8	1.70	0.042	91.267	0.45499
2	734	0.1004	7	0.101	10	0.1005	15	11	3.30	0.053	72.333	0.36060
3	655	0.0995	8	0.1001	8	0.1012	12	9	1.89	0.047	64.567	0.32188
4	645	0.1015	10	0.101	9	0.101	10	10	0.47	0.048	63.533	0.31673
5	440	0.1005	11	0.1012	7	0.103	8	8	0.47	0.038	43.233	0.21553
6	212	0.1047	12	0.1029	3	0.1001	2	2	0.74	0.010	20.993	0.10466
7	178	0.1044	2.8	0.1022	1.5	0.1042	2	2	0.54	0.010	17.590	0.08769

Table B4.1 For Zeolite Omega at 30°C

	RUN 1				RUN 2			RUN 3			Average		Fluid phase conc, C (μ mole/L)	Amount of adsorbed Hg, μ g/g of adsorbant	Solid phase conc, q μ mole/g of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	1020	0.101	825	827	0.1005	850	851	0.1007	840	841	840	1.17	4.186	18.032	0.08990
2	978	0.0985	804	801	0.1001	800	800	0.1005	810	811	804	0.59	4.009	17.388	0.08668
3	874	0.0987	699	697	0.1	731	731	0.0996	720	719	716	1.99	3.568	15.831	0.07892
4	774	0.0986	676	675	0.101	640	641	0.099	630	629	648	3.00	3.231	12.584	0.06273
5	662	0.097	547	543	0.0995	560	559	0.0998	560	560	554	1.38	2.763	10.776	0.05372
6	442	0.1019	373	374	0.102	370	371	0.1004	350	350	365	2.92	1.821	7.665	0.03821
7	264	0.099	222	222	0.1019	210	211	0.1009	210	210	214	2.38	1.069	4.965	0.02475

Table B4.2 For Zeolite Omega at 50°C

	RUN 1				RUN 2			RUN 3			Average		Fluid phase conc, C (µmole/L)	Amount of adsorbed Hg, µg/g of adsorbant	Solid phase conc, q µmole/g of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	1020	0.0995	807	806	0.1018	803	807	0.1008	840	841	818	2.02	4.078	20.193	0.10067
2	900	0.1013	766	768	0.1003	700	701	0.1004	750	751	740	3.85	3.687	16.036	0.07994
3	874	0.0994	727	726	0.101	700	702	0.0998	730	730	719	1.73	3.585	15.482	0.07718
4	794	0.1025	637	641	0.1	690	690	0.1012	640	642	658	3.49	3.278	13.645	0.06802
5	662	0.101	564	565	0.1027	550	553	0.0999	530	530	549	2.65	2.738	11.274	0.05620
6	452	0.1004	368	368	0.1003	350	350	0.1009	400	400	373	5.56	1.860	7.897	0.03937
7	234	0.1016	188	189	0.1004	200	200	0.1019	160	161	183	8.87	0.914	5.059	0.02522

Table B5.1 For Zeolite L at 30°C

	RUN 1				RUN 2			RUN 3			Average		Fluid phase conc, C (µmole/L)	Amount of adsorbed Hg, µg/g of adsorbant	Solid phase conc, q µmole/g of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	1050	0.1041	951	955	0.1005	960	960	0.1007	941	942	952	0.82	4.748	9.763	0.04867
2	930	0.1048	874	877	0.1001	800	800	0.1005	850	850	842	3.77	4.199	8.764	0.04369
3	874	0.1031	755	759	0.1	790	790	0.0996	780	780	776	1.68	3.869	9.793	0.04882
4	794	0.104	712	715	0.101	740	741	0.099	700	699	718	2.38	3.581	7.575	0.03777
5	662	0.1	604	604	0.0995	590	590	0.0998	620	620	605	2.05	3.014	5.748	0.02866
6	442	0.1023	427	427	0.102	370	371	0.1004	390	390	396	5.86	1.976	4.568	0.02277
7	254	0.1013	232	232	0.1019	220	221	0.1009	210	210	221	4.04	1.102	3.290	0.01640

Table B5.2 For Zeolite L at 50°C

50°C		RUN 1			RUN 2			RUN 3			Average		Fluid phase conc, C (μmole/L)	Amount of adsorbed Hg, μg/g of adsorbant	Solid phase conc, q μmole/g of adsorbant
Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD				
1	1050	0.1013	941	942	0.1018	803	907	0.1008	951	952	934	2.07	4.655	11.627	0.05796
2	900	0.1009	870	767	0.1003	700	777	0.1004	800	800	782	1.78	3.896	11.847	0.05906
3	874	0.1033	766	735	0.101	700	702	0.0998	780	780	739	4.33	3.683	13.529	0.06745
4	794	0.1018	730	731	0.1	690	690	0.1012	650	652	691	4.69	3.445	10.305	0.05138
5	662	0.1036	594	596	0.1027	550	573	0.0999	550	550	573	3.31	2.857	8.892	0.04433
6	452	0.1026	356	358	0.1003	350	360	0.1009	400	400	373	5.22	1.859	7.903	0.03940
7	234	0.1005	170	170	0.1004	200	210	0.1019	180	181	187	8.96	0.933	4.689	0.02338

Table B6.1 For Zeolite Beta at 30°C

	RUN 1				RUN 2			RUN 3			Average		Fluid phase conc, C (μ mole/L)	Amount of adsorbed Hg, μ g/g of adsorbant	Solid phase conc, q μ mole/g of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	1020	0.1001	930	930	0.1009	950	951	0.1009	960	961	947	1.34	4.721	7.292	0.03635
2	978	0.1022	922	923	0.1002	900	900	0.1006	910	910	911	1.03	4.543	6.674	0.03327
3	874	0.1017	811	812	0.0997	810	810	0.0997	820	820	814	0.53	4.058	6.010	0.02996
4	704	0.1012	650	651	0.0998	640	640	0.1001	630	630	640	1.31	3.192	6.380	0.03181
5	662	0.101	604	605	0.0999	590	590	0.1006	600	600	598	1.03	2.983	6.371	0.03176
6	473	0.1011	449	449	0.1005	430	430	0.1001	424	424	435	2.47	1.166	3.849	0.01919
7	264	0.1016	241	241	0.1018	230	231	0.1009	235	235	236	1.87	1.175	2.826	0.01409

Table B6.2 For Zeolite Beta at 50°C

	RUN 1				RUN 2			RUN 3			Average		Fluid phase conc, C ($\mu\text{mole/L}$)	Amount of adsorbed Hg, $\mu\text{g/g}$ of adsorbant	Solid phase conc, q $\mu\text{mole/g}$ of adsorbant
	Initial Hg conc. (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	Weight of adsorbent (gram)	Equilibrium Hg conc. (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	eq. Hg conc./ 0.1g adsorbent (ppb)	RSD			
1	1050	0.1003	946	946	0.1015	909	911	0.101	970	971	943	2.60	4.700	10.727	0.05348
2	978	0.1042	883	887	0.1005	850	851	0.1006	950	840	859	2.33	4.283	11.884	0.05925
3	834	0.1038	691	696	0.1002	700	700	0.1	680	720	706	1.47	3.517	12.850	0.06406
4	794	0.1039	640	646	0.0998	690	690	0.1015	640	642	659	3.28	3.287	13.472	0.06716
5	662	0.1047	596	599	0.1022	550	552	0.1001	570	570	574	3.34	2.861	8.818	0.04396
6	452	0.1005	390	390	0.1008	410	410	0.1005	380	380	394	3.17	1.963	5.833	0.02908
7	234	0.1046	195	197	0.1002	200	200	0.1015	210	190	196	2.14	0.975	3.841	0.01915

Appendix C Data Sheets (Continuous Systems)

C1) Adsorption of 560 ppb of metallic mercury in n- heptane (flow rate 1.0 ml/min) on adsorbent CMG273 (0.5 g of CMG273 diluted in 1:1 ratio with SiC) at 50°C and 7 bar.

Table C1.1 Adsorption phase

	Total Time (Hrs)	Feed wt. (gram)	Sample wt. (gram)	Outlet Conc. (ppb)	Total Hg (micro-gram)	C/C0
	0	Inlet feed pump		562		
		Outlet feed pump		557		
1	1	35	23	16	0.549	0.029
2	2	80	23	19	0.652	0.034
3	3	129	23	18	0.618	0.032
4	4	178	23	14	0.481	0.025
5	5	224	23	16	0.549	0.029
6	6	272	23	16	0.549	0.029
7	8	365	23	13	0.446	0.023
8	10	447	23	18	0.618	0.032
9	12	530	23	23	0.790	0.041
10	14	603	23	27	0.927	0.048
11	16	678	23	33	1.133	0.059
12	18	773	23	34	1.167	0.061
13	20	858	23	32	1.099	0.057
14	22	961	23	50	1.716	0.090
15	24	1023	23	58	1.991	0.104
16	26	1106	23	55	1.888	0.099
17	29	1223	23	60	2.060	0.108
	30	Slop	832	29	36.012	
		Inlet feed pump		840		
		Outlet feed pump		5726		
				TOTAL	53.245	

Table C1.2 Desorption phase (feed n-hepatne only)

	Total Time (Hrs)	Feed Weight (gram)	Sample Weight (gram)	Outlet Conc. (ppb)	Total Hg (micro-gram)
1	2	126	23	52	1.785
2	4	228	23	33	1.133
3	6	356	23	25	0.858
4	8	447	23	19.3	0.663
5	10	581	23	18.9	0.649
6	13	703	23	16	0.549
7	16	885	23	15.5	0.532
	16.5	Slop	724	18	19.451
		Inlet feed pump		107	
		Outlet feed pump		79	
				TOTAL	25.620

Mass Balance

$$\text{Total Hg 'ENTER' in Adsorption Phase} = (1223 \times 560) / (0.67 \times 1000)$$

$$= 1022.209 \mu\text{g}$$

$$\text{Total Hg 'OUT' from Adsorption Phase} = 53.245 \mu\text{g}$$

$$\text{Total Hg 'OUT' from Desorption Phase} = 25.620 \mu\text{g}$$

$$\text{Accumulation of Hg on Solid Phase} = 943.345 \mu\text{g}$$

$$\text{Mercury concentration in solid phase} = 0.1258 \%$$

- C2) Adsorption of 4500 ppb of metallic mercury in heavy naphtha (flow rate 1.0 ml/min) on adsorbent CMG273 (1.0 g of CMG273 diluted in 1:1 ratio with SiC) at 50°C and 7 bar.

Table C2.1 Adsorption phase

	Total Time (Hrs)	Feed Weight (gram)	Sample wt. (gram)	Outlet Conc. (ppb)	Total Hg out (micro-gram)	C/C0
	0	Initial Conc. Reactor Bottom Final Conc.		4370 4580 4560		
1	1	119	22	498	14.42	0.111
2	2	166	24	726	22.93	0.161
3	4	266	22.2	607	17.73	0.135
4	6	358	22.4	807	23.79	0.179
5	8	452	23.1	997	30.30	0.221
6	10	541	23.2	1140	34.80	0.253
7	12	635	22.9	1320	39.77	0.293
8	14	734	23	1577	47.73	0.350
9	16	826	23	1634	49.45	0.363
10	18	903	22.9	1748	52.67	0.388
11	20.5	1020	23.1	2432	73.92	0.540
		Slop	770	1026	1039.50	
		Total =	1021.8		1447.00	

Table C2.2 Desorption phase (feed n-hepatne only)

	Total Time (Hrs)	Feed Weight (gram)	Sample wt. (ppb)	Outlet Conc. (ppb)	Total Hg out (micro-gram)
1	4	195	20.7	265	8.19
2	8	328	22	70	2.30
3	12	505	22.5	41	1.38
4	15	630	21.8	45	1.46
		Slop	543	50	40.52
				TOTAL	53.85

Mass Balance

$$\begin{aligned} \text{Total Hg 'ENTER' in Adsorption Phase} &= (1020 \times 4503.3) / (0.76 \times 1000) \\ &= 6043.90 \mu\text{g} \end{aligned}$$

$$\text{Total Hg 'OUT' from Adsorption Phase} = 1447.00 \mu\text{g}$$

$$\text{Total Hg 'OUT' from Desorption Phase} = 53.85 \mu\text{g}$$

$$\text{Accumulation of Hg on Solid Phase} = 4543.05 \mu\text{g}$$

$$\text{Mercury concentration in solid phase} = 0.4543 \%$$

- C3) Adsorption of 574 ppb of metallic mercury in heavy naphtha (flow rate 1.0 ml/min) on adsorbent CMG273 (1.0 g of CMG273 diluted in 1:1 ratio with SiC) at 50°C and 7 bar (repeat of C2 but with HN instead of n-heptane).

Table C3.1 Adsorption phase

	Total Time (Hrs)	Feed Weight (gram)	Sample wt. (gram)	Outlet Conc. (ppb)	Total Hg (micro-gram)	C/C0
	0	Feed 1	932	517	634.005	
	20.5	Feed 2	986	498	646.089	
	40.5	Feed 3	140	336	61.895	
	43.5	Feed 3	1042	730	1000.868	
1	1	83	21.4	52	1.464	0.091
2	3	178	23.5	35	1.082	0.061
3	5.25	273	23.9	26	0.818	0.045
4	6.5	331	23.3	24	0.736	0.042
5	8.5	421	22.3	26	0.763	0.045
6	10.5	508	21	29	0.801	0.051
7	12.5	600	23.5	29	0.897	0.051
8	14.5	692	21.4	29	0.817	0.051
9	16.7	782	24.9	24	0.786	0.042
10	18.5	862	22.7	25	0.747	0.044
11	20	927	22.6	20	0.595	0.035
12	22.5	1064	22.5	19	0.563	0.033
13	24.2	1137	23	18	0.545	0.031
14	28.7	1327	21.7	18	0.514	0.031
15	31.3	1515	22.7	16	0.478	0.028
16	33	1580	23.4	19	0.585	0.033
17	35.5	1693	23.3	18	0.552	0.031
18	38	1805	23.5	16	0.495	0.028
19	40.5	1918	22.5	15	0.444	0.026
20	44	2080	24	12	0.379	0.021
21	46.5	2197	21.6	17	0.483	0.030
22	49	2308	23.5	26	0.804	0.045
23	52.5	2504	22	40	1.158	0.070
24	54	2578	23.1	46	1.398	0.080
25	57	2705	24	47	1.484	0.082
26	61	2885	23	38	1.150	0.066
27	63	2965	23.7	28	0.873	0.049
28	66	3100	22.8	23	0.690	0.040
		Slop	2365	23	71.572	
				TOTAL	93.672	

Table C3.2 Desorption phase (pure heavy naphtha as feed)

	Total Time (Hrs)	Feed Weight (gram)	Sample wt. (gram)	Outlet Conc. (ppb)	Total Hg (micro-gram)
	0	Total feed	810	3.3	3.517
		Slop	766	10	10.079
1	4.25	211	24	53	1.674
2	7	331	24	46	1.453
3	10	467	24	39	1.232
4	13	596	24	33	1.042
5	16	715	24	26	0.821
6	18	810	24	12	0.379
				Total	16.679

Mass Balance

Total Hg 'ENTER' in Adsorption Phase = 2342.858 μg

Total Hg 'ENTER' in Desorption Phase = 3.517 μg

Total Hg 'OUT' from Adsorption Phase = 93.67 μg

Total Hg 'OUT' from Desorption Phase = 16.68 μg

Accumulation of Hg on Solid Phase = 2236.02 μg

Mercury concentration in solid phase = 0.2236 %

- C4) Adsorption of 800 ppb of metallic mercury in n- heptane (flow rate 1.0 ml/min) on adsorbent CMG273 (0.5 g of CMG273 diluted in 1:1 ratio with SiC) at 50°C and 7 bar (repeat of C1 but with heavy naphtha instead of n-heptane).

Table C4.1 Adsorption phase

	Total Time (Hrs)	Feed Weight (gram)	Outlet Conc. (ppb)	Total Hg (micro-gram)
	Feed 1 (t=00 hrs)	930	728	1010.507
	Feed 2 (t=24 hrs)	900	722	969.851
	Feed 3 (t=48 hrs)	934	769	1072.009
	Feed 3 (t=72 hrs)	877	975	1276.231
	Slop (Total at t=97 hrs)	3641	147	798.846
				C/Co
1	0.2	35	55	0.069
2	2.2	132	41	0.051
3	5.5	256	38	0.048
4	8	352	42	0.053
5	11.5	485	37	0.046
6	14.5	600	38	0.048
7	17.5	701	39	0.049
8	20	796	40	0.050
9	22	871	43	0.054
10	24	930	48	0.060
11	26	1034	59	0.074
12	29	1137	68	0.085
13	32	1248	79	0.099
14	35	1358	90	0.113
15	38	1530	108	0.135
16	41.5	1584	118	0.148
17	43.5	1661	140	0.175
18	46	1752	134	0.168
19	48	1825	152	0.190
20	52.2	1986	190	0.238
21	56	2128	212	0.265
22	59.2	2248	224	0.281
23	64	2425	204	0.255
24	68	2598	194	0.243
25	73	2764	222	0.278
26	76.2	2890	220	0.276
27	80	3009	230	0.288
28	85.2	3206	242	0.303
29	88	3305	256	0.321
30	93.2	3505	250	0.313
31	96.5	3621	252	0.316

Table C4.2 Desorption phase (pure heavy naphtha as feed)

	Total Time (Hrs)	Feed Weight (gram)	Outlet Conc. (ppb)	Total Hg (micro-gram)
	Feed Drum (t=0 hrs)		570	505.470
	Feed Drum (t=7.5 hrs)		603	(avg.)
	Slop (Total at t=8 hrs)	655	240	206.842
1	0	30	412	
2	2	207	161	
3	3.2	320	153	
4	5.2	471	127	
5	7	617	111	
6	7.5	655	105	

Mass Balance

Total Hg 'ENTER' in Adsorption Phase = 4328.599 μg

Total Hg 'ENTER' in Desorption Phase = 505.470 μg

Total Hg 'OUT' from Adsorption Phase = 798.85 μg

Total Hg 'OUT' from Desorption Phase = 206.84 μg

Total Hg accumulated on Solid Phase = 3828.38 μg

Mercury concentration in solid phase = 0.3828%

Appendix D Calculations for Overall Mass Transfer Coefficient

The overall mass transfer coefficient (k) can be estimated by using correlation, which was defined as:

$$\frac{1}{kK} = \frac{R_p}{3k_f} + \frac{R_p^2}{15\varepsilon_p D_p} + \frac{D_l}{v^2} \left(\frac{1-\varepsilon}{\varepsilon} \right) + \frac{r_c^2}{15KD_c} \quad (1)$$

where k is overall mass transfer constant (1/sec), K is equilibrium constant or Henry's constant, R_p is adsorbent pallet radius, ε is voidage of adsorbent bed, ε_p is porosity of adsorbent particle, v is interstitial velocity of fluid, k_f is external fluid film mass transfer coefficient, D_l is axial dispersion coefficient, D_p is effective pore diffusivity, D_c is intercrystalline diffusivity and r_c is crystal or micro particle radius.

Intercrystalline diffusivity (D_c) can be calculated as:

$$\frac{q_t}{q_\infty} = 2 \left(\frac{A}{V} \right) \left(\frac{D_c t}{\pi} \right)^{1/2} \quad (2)$$

where A/V = ratio of external area to particle volume ($3/r_c$ for spherical particle), q_t , q_∞ is mass adsorbed (at time t and at $t \rightarrow \infty$).

Effective pore diffusivity (D_p) can be calculated as:

$$\frac{i}{D_p} = \frac{\tau}{\varepsilon_p} \left(\frac{i}{D_m} + \frac{1}{D_k} \right) \quad (3)$$

where D_k is Knudsen diffusivity can be calculated as shown below:

$$D_k = 9700 r_p \sqrt{\frac{T}{M}} \quad (4)$$

where r_p is mean pore radius (cm), T is in $^{\circ}\text{K}$, M is molecular weight of diffusing species and τ is tortuosity ($=3$ for spherical particles).

External fluid film mass transfer coefficient (k_f) can be determined by correlation given by Wakao and Funazkri as:

$$3 < \text{Re} < 10^4 \quad \text{Sh} = 2 + 1.1 \text{Re}^{0.6} \text{Sc}^{0.33} \quad (5)$$

where,
$$\text{Sh} = \frac{2k_f R_p}{D_m} \quad (6)$$

$$\text{Re} = \frac{2R_p G}{\mu} \quad (7)$$

$$\text{Sc} = \frac{\mu}{\rho D_m} \quad (8)$$

where D_m is molecular diffusivity (cm^2/sec), G is superficial mass flux ($\text{g}/\text{cm}^2 \cdot \text{sec}$), μ is viscosity of fluid ($\text{g}/\text{cm} \cdot \text{sec}$), ρ is density of fluid (g/cm^3).

Molecular diffusivity of A in B for liquid can be calculated by empirical expression given by Wilke-Chang equation as:

$$D_m = 7.4 \times 10^{-8} \frac{\sqrt{\psi_B M_B T}}{\mu V_A^{0.6}} \quad (9)$$

where ψ_B is association parameter (1.0 for heptane), M_B is molecular weight of B, T is absolute temperature, V is molar volume of solute A ($\text{cm}^3/\text{g-mole}$) and μ is viscosity of solution (centi-poise)

Axial dispersion coefficient (D_1) can be determined by Wen and Fen correlation as:

$$\frac{1}{Pe} = \frac{0.3}{\text{Re} \cdot \text{Sc}} + \frac{1}{\left(1 + \frac{3.8}{\text{Re} \cdot \text{Sc}}\right)} \quad (10)$$

where Pe is Peclet number defined as $\left(\frac{2R_p \mu}{D_1 \rho} \right)$

for: $0.008 < Re < 400$ and $0.28 < Sc < 2.2$

Appendix E Calculation for Void Space Between Particles

Basis: Volume (V) = 1000 cc

Bulk density, r_B (g/cc) = 0.5000

Total weight of adsorbent per 1000 cc, $W = r_B \times V = 500$

Particle density, $r_p = \text{weight}/(\text{system volume} - \text{void volume})$
 $= W/(V - V')$

where V' is void volume and r_p is particle density (=0.75 g/cc)

Putting all values in above expression V' can be calculated as 333.3 cc.

Now, void space between the pellet, $e = V'/V = 333.3/1000 = 0.33$

Appendix F Instability of Mercury in Continuous System

	Adsorption Phase			Desorption Phase		
	Prepared Stock Solution Conc. (ppb)	Achieved conc. (Feed Drum) (ppb)	Achieved conc. (Rector) (ppb)	Prepared Stock Solution Conc. (ppb)	Achieved conc. (Feed Drum) (ppb)	Achieved conc. (Rector) (ppb)
Test 1 (n-Heptane)	560 (t = 0)	840 (t=30 hrs)	5276 (t=30 hrs)	Pure n-Heptane	107 (t=16 hrs)	79 (t=16 hrs)
Test 2 (Heavy Naphtha)	4370 (t=0)	4560 (t=21 hrs)	4580 (t=21 hrs)	Pure n-Heptane	50 (t=15 hrs)	--
Test 3 (Heavy Naphtha)	972 (0 hrs) 821 (20 hrs) 652 (40 hrs) 1500 (44 hrs)	517 (20 hrs) 498 (40 hrs) 336 (44 hrs) 730 (66 hrs)	-- -- -- 4000 (t=66 hrs)	Heavy Naphtha (1-4 ppb of Hg)	--	--
Test 4 (n-Heptane)	800 (t=0)	728 (t=24 hrs) 722 (t=48 hrs) 769 (t=72 hrs) 975 (t=96 hrs)		Heavy Naphtha (1-4 ppb of Hg)	603 (t=8 hrs)	842 (t=8 hrs)

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