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APPENDIX A

Experimental data from photocatalytic study

A.1 Effect of amount of TiO_2 catalyst

Time (min)	C/C_o at different amount of catalyst					
	blank	0.2 g/l	0.35 g/l	0.5 g/l	0.7 g/l	1.0 g/l
0	1	1	1	1	1	1
30	0.3446	0.3592	0.2832	0.2331	0.249	0.2438
60	0.1489	0.1040	0.0986	0.0628	0.0750	0.0706
90	0.0751	0.0673	0.0342	0.0242	0.0165	0.0337
120	0.0392	0	0	0	0	0
150	0	0	0	0	0	0

Time (min)	TOC/TOC_o at different amount of catalyst					
	blank	0.2 g/l	0.35 g/l	0.5 g/l	0.7 g/l	1.0 g/l
0	1	1	1	1	1	1
30	0.7897	0.7855	0.8398	0.7599	0.6535	0.6838
60	0.7850	0.7298	0.6635	0.6425	0.5851	0.6022
90	0.7739	0.7043	0.6577	0.6080	0.5382	0.5479
120	0.7708	0.6848	0.6522	0.5869	0.5252	0.5226
150	0.7511	0.6785	0.6451	0.5783	0.4892	0.5084
180	0.7503	0.6761	0.6380	0.5780	0.4744	0.4846
240	0.7412	0.6575	0.6225	0.5775	0.4448	0.4608
300	0.7400	0.6480	0.6070	0.5101	0.4151	0.4183
360	0.7320	0.6439	0.5915	0.5017	0.3855	0.3909

A.2 Effect of calcination temperature of TiO_2

Time (min)	C/C_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.2331	0.2887	0.3729	0.3589
60	0.0628	0.0759	0.1741	0.1685
90	0.0242	0.0346	0.0745	0.0733
120	0	0	0.0248	0.0402
150	0	0	0	0

Time (min)	TOC/TOC_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.7599	0.7739	0.7743	0.7800
60	0.6425	0.6973	0.7552	0.7707
90	0.6080	0.6618	0.7539	0.7614
120	0.5869	0.6552	0.7473	0.7570
150	0.5783	0.6487	0.7412	0.7520
180	0.5780	0.6171	0.7351	0.7444
240	0.5775	0.5855	0.7288	0.7368
300	0.5101	0.5539	0.7226	0.7325
360	0.5017	0.5223	0.7163	0.7217

A.3 Effect of initial pH of 4-chlorphenol solution

Time (min)	C/C_0 at different initial pH			
	pH 3	pH 5	pH 7	pH 9
0	1	1	1	1
30	0.2948	0.2617	0.2493	0.3250
60	0.1117	0.0893	0.1080	0.1434
90	0.0633	0.0242	0.0324	0.0703
120	0	0	0	0
150	0	0	0	0

Time (min)	TOC/TOC_0 at different initial pH			
	pH 3	pH 5	pH 7	pH 9
0	1	1	1	1
30	0.7994	0.7664	0.7602	0.7146
60	0.7521	0.7045	0.6984	0.6951
90	0.7014	0.6796	0.6956	0.6736
120	0.6928	0.6715	0.6755	0.6685
150	0.6872	0.6596	0.6672	0.6536
180	0.6816	0.6525	0.6513	0.6574
240	0.6498	0.6385	0.6346	0.6475
300	0.6370	0.6245	0.6338	0.6224
360	0.6253	0.6111	0.6086	0.6193

A.4 Comparison between Degussa P25 and sol-gel TiO_2

Time (min)	C/C_o	
	Degussa P25	Sol-gel TiO_2
0	1	1
30	0.5904	0.3592
60	0.3836	0.1040
90	0.2737	0.0673
120	0.1825	0
150	0.1203	0
180	0.0546	0
210	0	0

Time (min)	TOC/TOC_o	
	Degussa P25	Sol-gel TiO_2
0	1	1
30	0.7721	0.7853
60	0.6782	0.7298
90	0.6400	0.7043
120	0.6269	0.6848
150	0.5894	0.6785
180	0.5395	0.6761
240	0.4790	0.6575
300	0.4187	0.6480
360	0.3341	0.6439

A.5 Pt/TiO_2 at different %Pt loading

Time (min)	C/C_o at different %Pt loading					
	0 %Pt	0.2 %Pt	0.5 %Pt	1.0 %Pt	1.5 %Pt	2.0 %Pt
0	1	1	1	1	1	1
30	0.2331	0.2622	0.3040	0.2904	0.2951	0.3348
60	0.0628	0.0880	0.1059	0.1010	0.1105	0.1393
90	0.0242	0.0321	0.0483	0.0458	0.0347	0.1017
120	0	0	0	0	0	0.0313
150	0	0	0	0	0	0

Time (min)	TOC/TOC_o at different %Pt loading					
	0 %Pt	0.2 %Pt	0.5 %Pt	1.0 %Pt	1.5 %Pt	2.0 %Pt
0	1	1	1	1	1	1
30	0.7599	0.8573	0.6189	0.8742	0.7402	0.7396
60	0.6425	0.7147	0.5478	0.6536	0.6683	0.6833
90	0.6080	0.5720	0.5256	0.5342	0.6453	0.6740
120	0.5869	0.5623	0.4715	0.4734	0.6172	0.6608
150	0.5783	0.5526	0.4620	0.4643	0.6154	0.6496
180	0.5780	0.5441	0.4605	0.4512	0.5972	0.6384
240	0.5775	0.5226	0.4316	0.4232	0.5682	0.6272
300	0.5101	0.5011	0.4244	0.4072	0.5467	0.6160
360	0.5017	0.4796	0.4174	0.3912	0.5321	0.5210

A.6 5%SiO_2-TiO_2 at different calcination temperature

Time (min)	C/C_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.2673	0.2751	0.3056	0.3098
60	0.0819	0.0875	0.1031	0.1138
90	0.0375	0.0394	0.0422	0.0440
120	0	0	0	0
150	0	0	0	0

Time (min)	TOC/TOC_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.7266	0.7461	0.7788	0.8195
60	0.6565	0.6821	0.7092	0.7513
90	0.6387	0.6598	0.6955	0.7467
120	0.6218	0.6521	0.6815	0.7314
150	0.6049	0.6441	0.6695	0.7178
180	0.5875	0.6101	0.6579	0.7056
240	0.5700	0.5927	0.6561	0.6843
300	0.5525	0.5673	0.6350	0.6586
360	0.5296	0.5476	0.6073	0.6514

A.7 10%SiO_2-TiO_2 at different calcination temperature

Time (min)	C/C_0 at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.2076	0.2115	0.2601	0.2757
60	0.0664	0.0737	0.0858	0.0791
90	0.0226	0.0202	0.0211	0.0295
120	0	0	0	0
150	0	0	0	0

Time (min)	TOC/TOC_0 at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.7154	0.7216	0.7647	0.8369
60	0.6522	0.6610	0.6900	0.7794
90	0.6031	0.6538	0.6685	0.7405
120	0.5998	0.6072	0.6478	0.7344
150	0.5582	0.5955	0.6404	0.7015
180	0.5503	0.5837	0.6378	0.6929
240	0.5420	0.5112	0.5960	0.6617
300	0.4876	0.5032	0.5541	0.6172
360	0.4582	0.5003	0.5295	0.5697

A.8 20%SiO_2-TiO_2 at different calcination temperature

Time (min)	C/C_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.3398	0.3840	0.3216	0.3306
60	0.1327	0.1562	0.1346	0.1222
90	0.0595	0.0620	0.0486	0.0676
120	0.0290	0.0384	0	0.0332
150	0	0	0	0

Time (min)	TOC/TOC_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.7043	0.8101	0.8082	0.8255
60	0.6725	0.7331	0.7661	0.7973
90	0.6531	0.6941	0.7346	0.7585
120	0.6458	0.6795	0.7141	0.7369
150	0.6352	0.6672	0.7004	0.7268
180	0.6035	0.6355	0.6697	0.7119
240	0.5952	0.6018	0.6527	0.7053
300	0.5588	0.5681	0.5928	0.6847
360	0.5275	0.5300	0.5563	0.6617

A.9 30%SiO_2-TiO_2 at different calcination temperature

Time (min)	C/C_0 at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.3944	0.4018	0.3711	0.4035
60	0.1855	0.2042	0.1784	0.1921
90	0.08095	0.1006	0.0798	0.0914
120	0.0383	0.0472	0.0392	0.0575
150	0	0	0	0

Time (min)	TOC/TOC_0 at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.8208	0.7979	0.8443	0.8200
60	0.7895	0.7438	0.7985	0.7788
90	0.7584	0.6850	0.7659	0.7632
120	0.7088	0.6766	0.7603	0.7475
150	0.6923	0.6579	0.7479	0.7386
180	0.6761	0.6448	0.7334	0.7196
240	0.6533	0.6317	0.7263	0.7183
300	0.6092	0.6206	0.6928	0.6793
360	0.5702	0.6094	0.6625	0.6606

A.10 Pt/TiO_2-SiO_2 at different calcination temperature

Time (min)	C/C_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.2955	0.3033	0.2895	0.3036
60	0.1107	0.1140	0.1151	0.1173
90	0.0465	0.0441	0.0385	0.0415
120	0	0	0	0
150	0	0	0	0

Time (min)	TOC/TOC_o at different calcination temperature			
	400 °C	500 °C	600 °C	700 °C
0	1	1	1	1
30	0.6914	0.7193	0.7466	0.7761
60	0.5945	0.6242	0.6643	0.7093
90	0.5708	0.5977	0.6389	0.6792
120	0.5320	0.5782	0.6173	0.6541
150	0.5261	0.5677	0.6060	0.6372
180	0.5202	0.5534	0.6038	0.6246
240	0.4962	0.5316	0.5861	0.6121
300	0.4890	0.5083	0.5699	0.5782
360	0.4682	0.4873	0.5333	0.5832

APPENDIX B

Experimental data from adsorption experiment

B.1 Weight of catalyst used at different 4-chlorophenol concentration

Weight of catalyst (g)	4-chlorophenol concentration		
	0.5 Mm	1.0 mM	2.0 mM
TiO_2	0.0355	0.0351	0.0346
5%SiO_2TiO_2	0.0333	0.0350	0.0348
10%SiO_2TiO_2	0.0341	0.0346	0.0347
20%SiO_2TiO_2	0.0317	0.0312	0.0318
30%SiO_2TiO_2	0.0325	0.0330	0.0334

B.2 The actual initial concentration of 4-chlorophenol from HPLC

4-chlorophenol concentration (mM)	Actual 4-chlorophenol Concentration (mM)
0.5	0.4697
1.0	0.9636
2.0	1.9306

B.3 The solution phase concentration of 4-chlorophenol at equilibrium adsorption (C_S)

Catalyst	C_S (mM)		
	C_o= 0.4697 mM	C_o= 0.9636 mM	C_o= 1.9306 mM
TiO_2	0.4675	0.9606	1.9264
5%SiO_2-TiO_2	0.4671	0.9592	1.9236
10%SiO_2-TiO_2	0.4636	0.9556	1.9208
20%SiO_2-TiO_2	0.4674	0.9608	1.9267
30%SiO_2-TiO_2	0.4682	0.9611	1.9271

B.4 The amount of 4-chlorophenol adsorbed on the catalyst at equilibrium (S_{ad})

$$S_{ad} = \frac{(C_S - C_o) \text{ x Volume of solution}}{\text{Weight of catalyst}}$$

Catalyst	S_{ad} (mmol/g)		
	C_o = 0.4697 mM	C_o = 0.9636 mM	C_o = 1.9306 mM
TiO_2	1.252×10^{-3}	1.741×10^{-3}	2.408×10^{-3}
5%SiO_2-TiO_2	1.585×10^{-3}	2.540×10^{-3}	3.991×10^{-3}
10%SiO_2-TiO_2	3.584×10^{-3}	4.656×10^{-3}	5.604×10^{-3}
20%SiO_2-TiO_2	1.490×10^{-3}	1.781×10^{-3}	2.446×10^{-3}
30%SiO_2-TiO_2	0.940×10^{-3}	1.515×10^{-3}	2.079×10^{-3}

B.5 C_S/S_{ad} at different %Si and 4-chlorophenol concentration

Catalyst	C_S/S_{ad} (g/l)		
	C_o = 0.4697 mM	C_o = 0.9636 mM	C_o = 1.9306 mM
TiO_2	373.4156	551.7082	799.8367
5%SiO_2-TiO_2	294.7050	377.6719	481.9800
10%SiO_2-TiO_2	129.3475	205.2138	342.7864
20%SiO_2-TiO_2	313.7368	539.604	787.7314
30%SiO_2-TiO_2	497.9886	634.3333	926.8500

B.6 Calculation of adsorption constant from graph

Catalyst	Slope ($1/S_{ad}^{max}$)	Intercept ($1/(K_{ad}S_{ad}^{max})$)	K_{ad} (slope/intercept)
TiO_2	287.40	253.630	1.1330
5%SiO_2-TiO_2	125.75	244.370	0.5146
10%SiO_2-TiO_2	145.92	63.322	2.3044
20%SiO_2-TiO_2	315.44	194.270	1.6237
30%SiO_2-TiO_2	295.19	356.130	0.8289

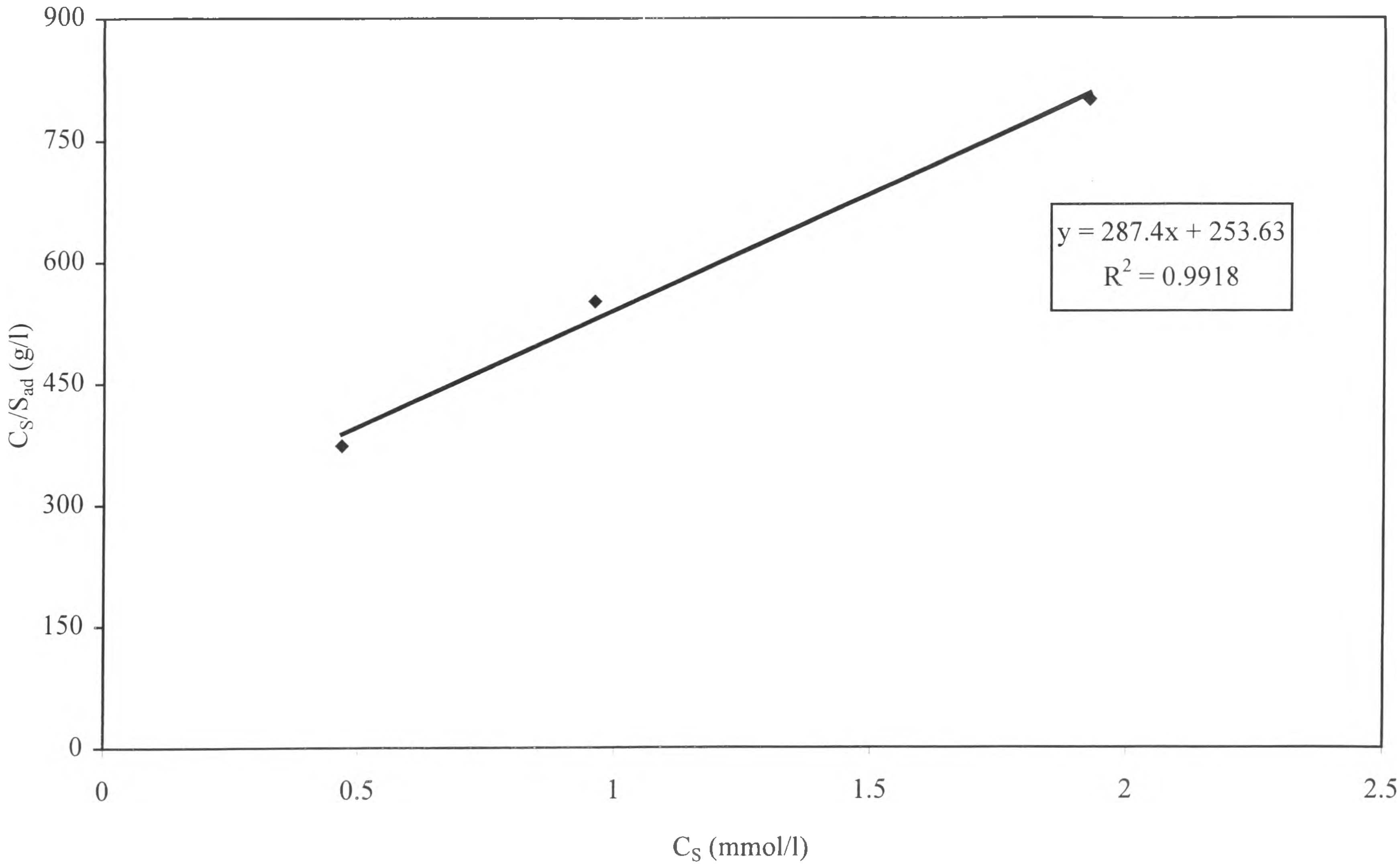

Figure A.1 The relationship between C_S/S_{ad} and C_S of TiO_2

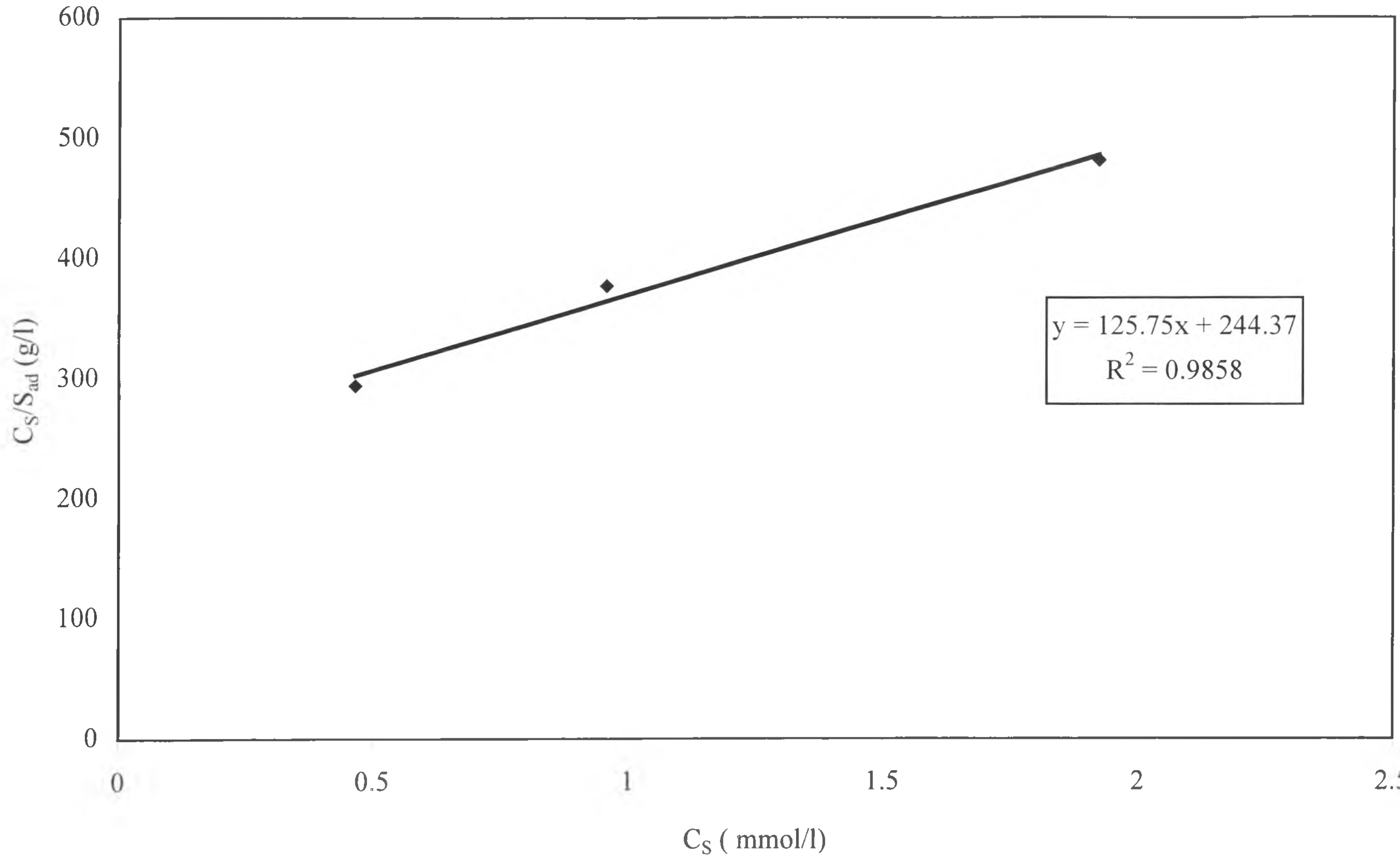

Figure A.2 The relationship between C_S/S_{ad} and C_S of 5%SiO_2-TiO_2

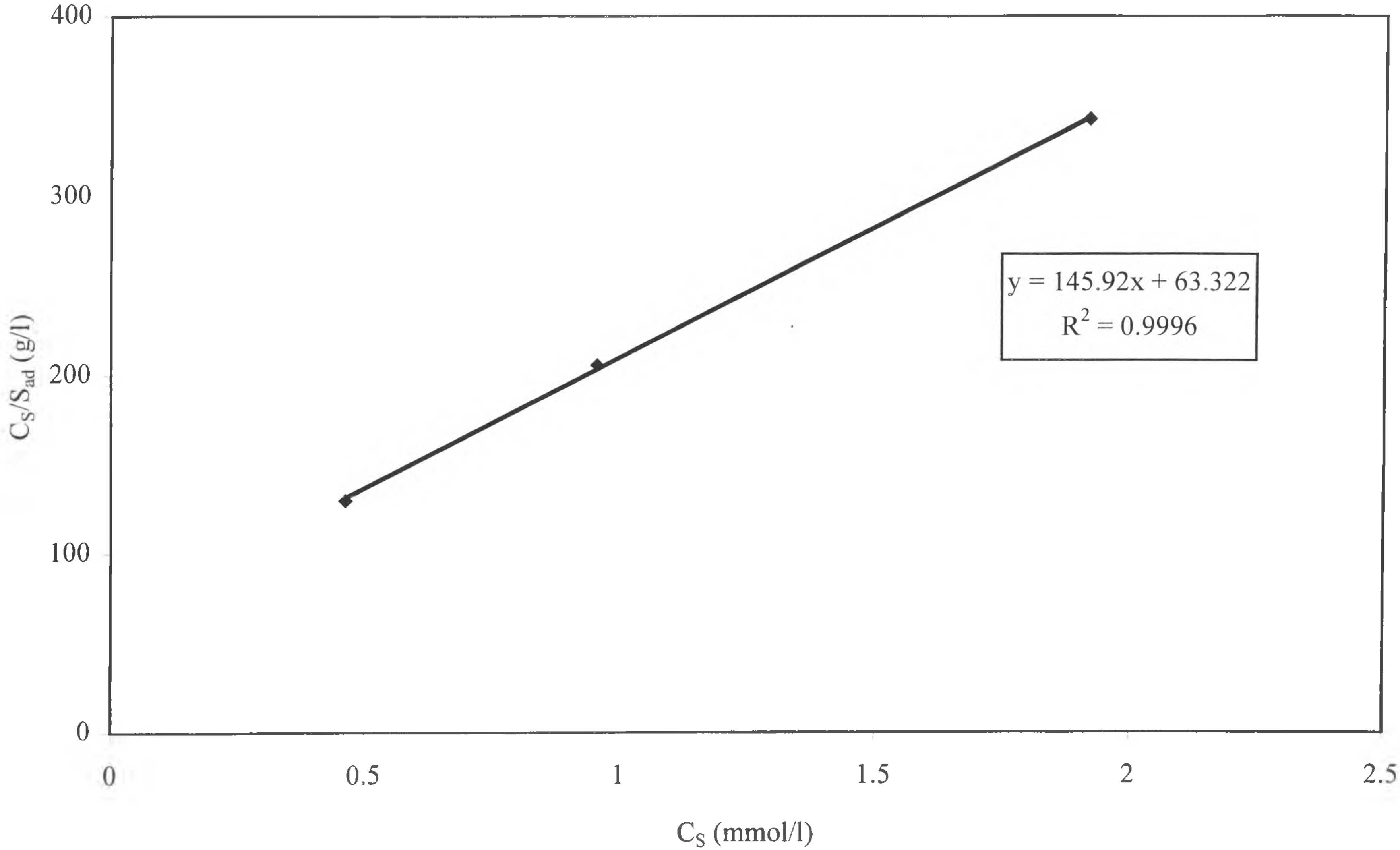

Figure A.3 The relationship between C_S/S_{ad} and C_S of 10% SiO_2-TiO_2

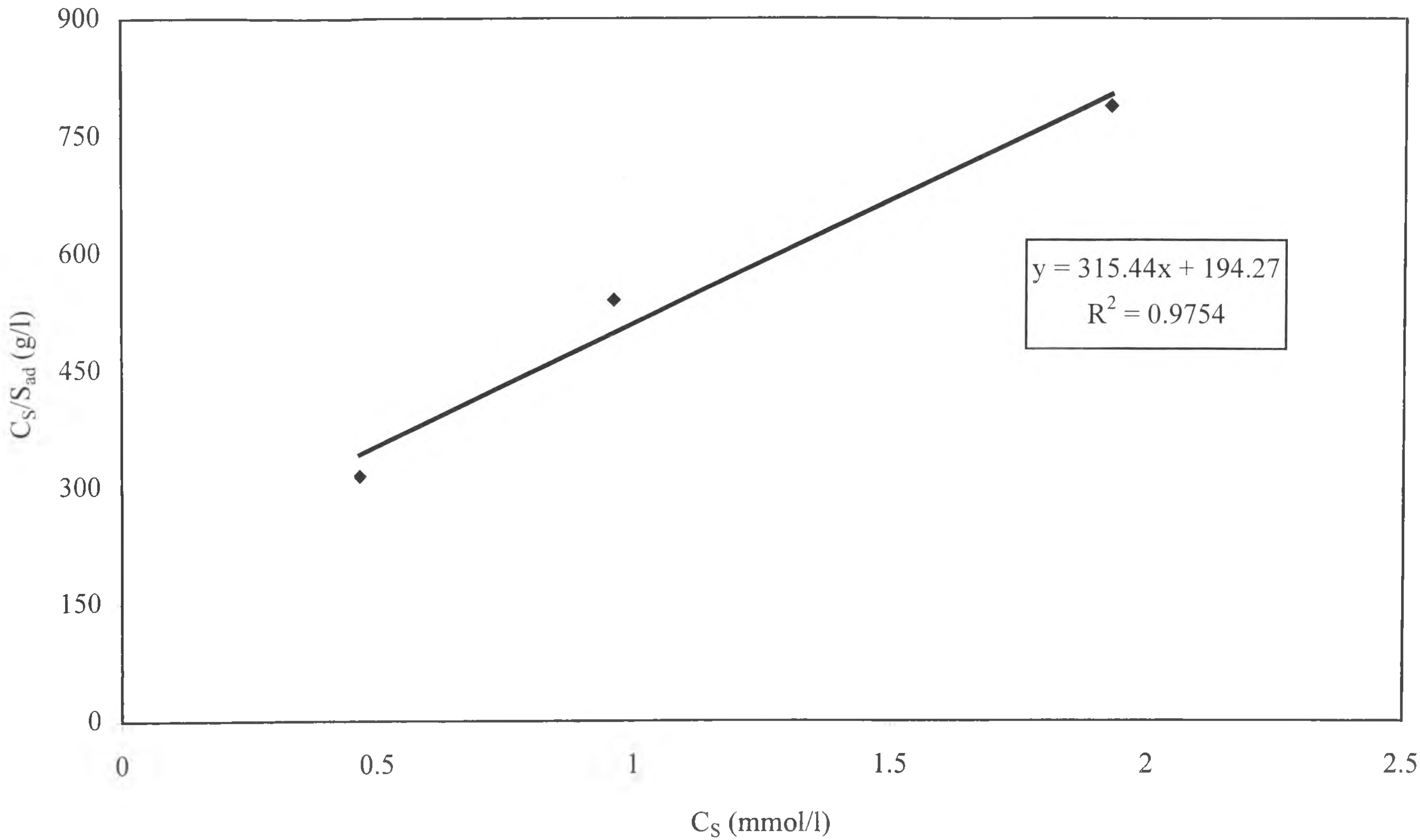

Figure A.4 The relationship between C_S/S_{ad} and C_S of 20%SiO_2-TiO_2

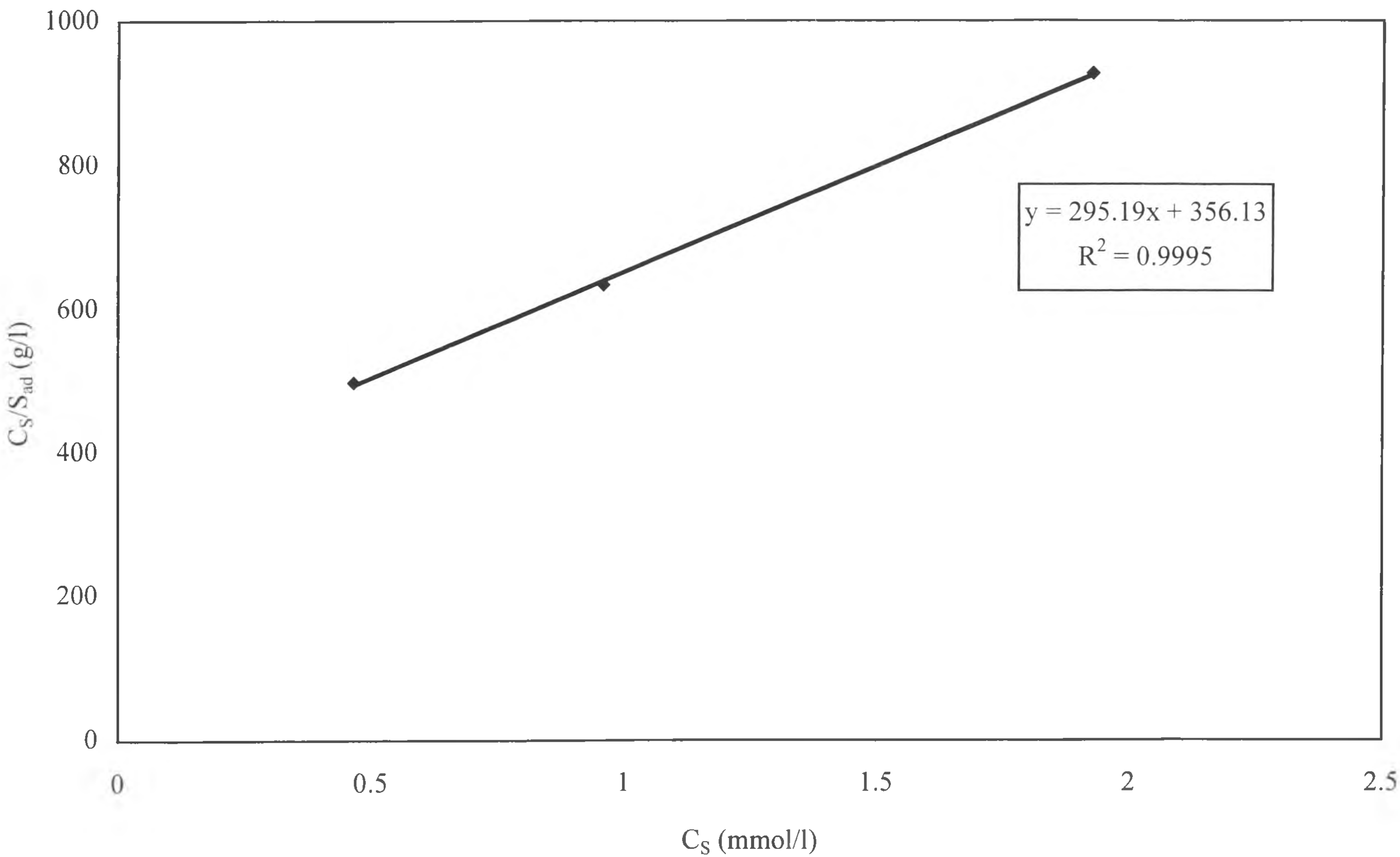

Figure A.5 The relationship between C_S/S_{ad} and C_S of 30%SiO_2-TiO_2

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