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APPENDICES

Appendix A Determination of equilibrium time of adsorption and desorption.

A1. Temperature effect

A1.1 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on GAC adsorbent

A1.1.1 at 30°C

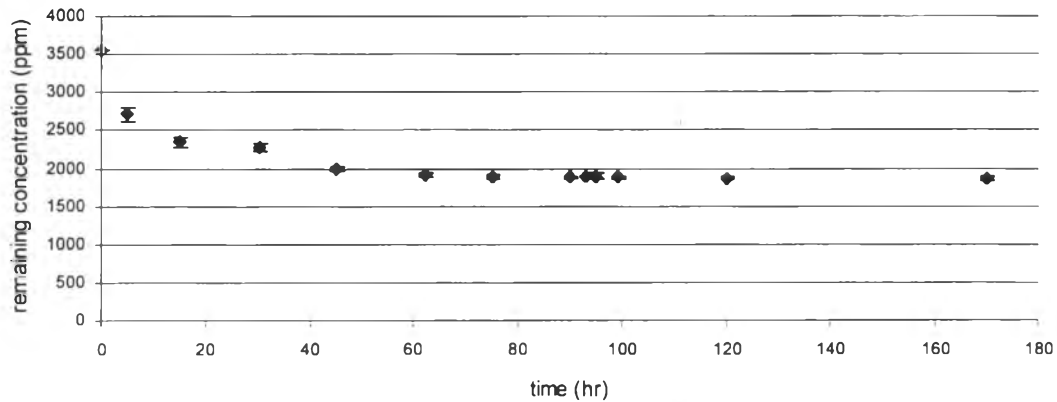


Figure A1 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on GAC adsorbent at 30°C.

A1.1.2 at 40°C

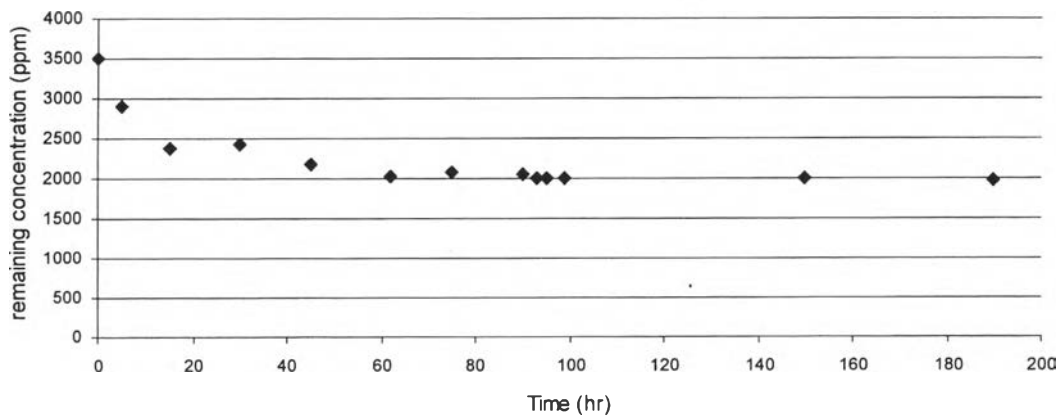


Figure A2 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on GAC adsorbent at 40°C.

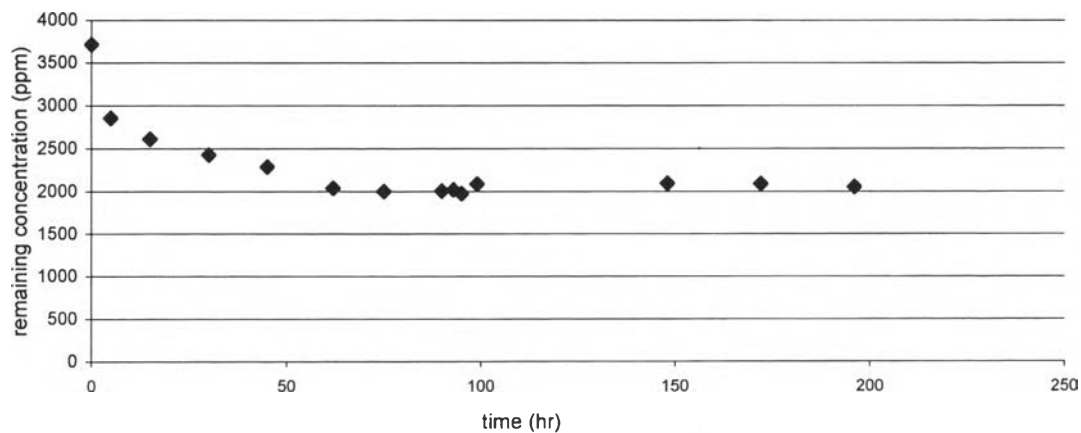
A1.1.3 at 50°C

Figure A3 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on GAC adsorbent at 50°C.

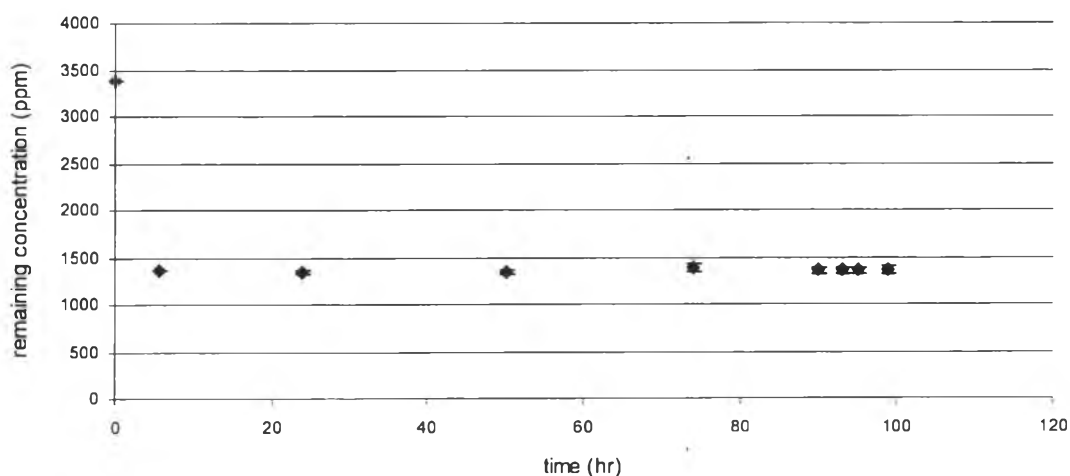
A1.2 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on XAD-4 adsorbent**A1.2.1 at 30°C**

Figure A4 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on XAD-4 adsorbent at 30°C.

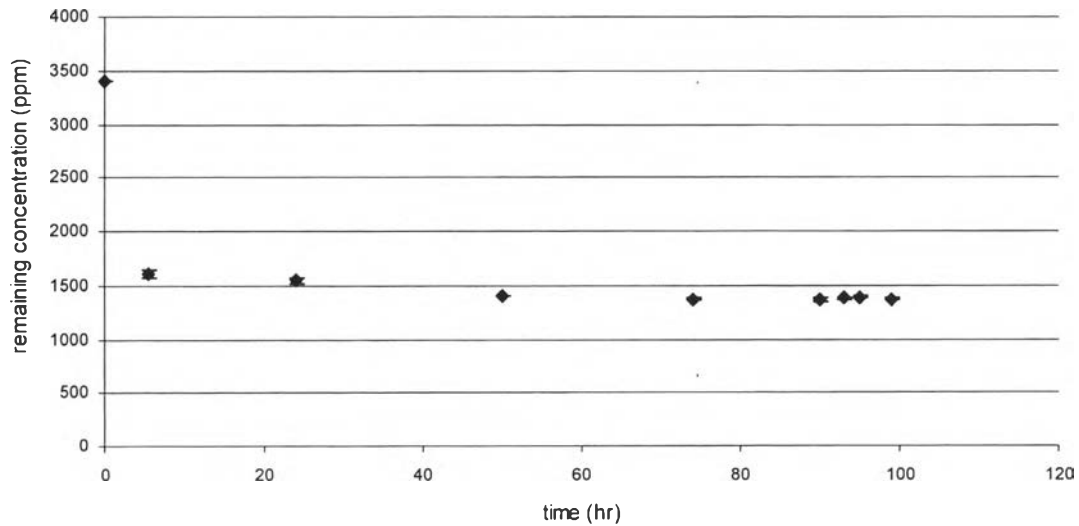
A1.2.2 at 40°C

Figure A5 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on XAD-4 adsorbent at 40°C.

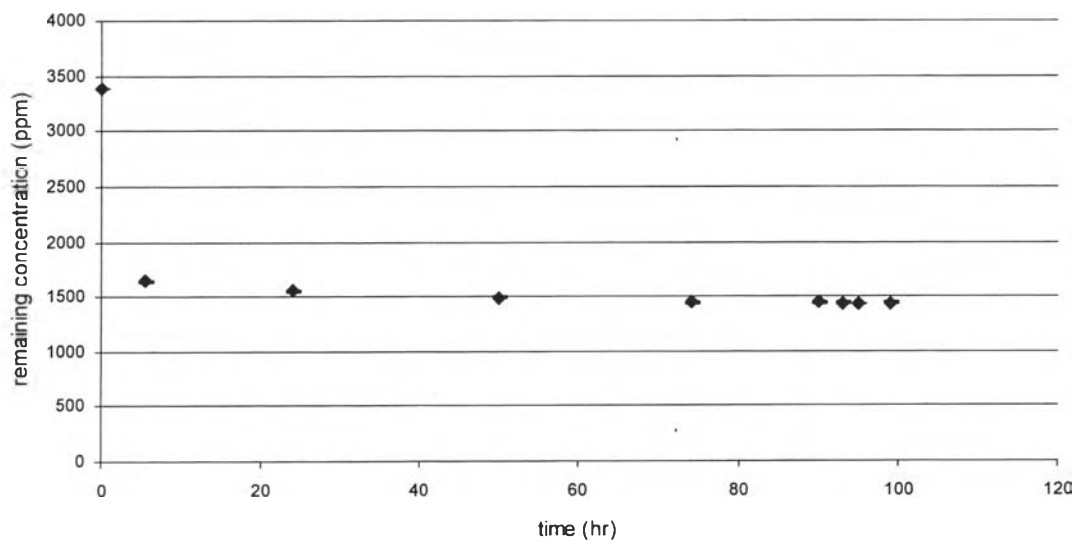
A1.2.3 at 50°C

Figure A6 Determination of equilibrium time for adsorption of sodium dodecyl sulfate on XAD-4 adsorbent at 50°C.

A1.3 Determination of equilibrium time for desorption of sodium dodecyl sulfate on GAC adsorbent

A1.3.1 at 30°C

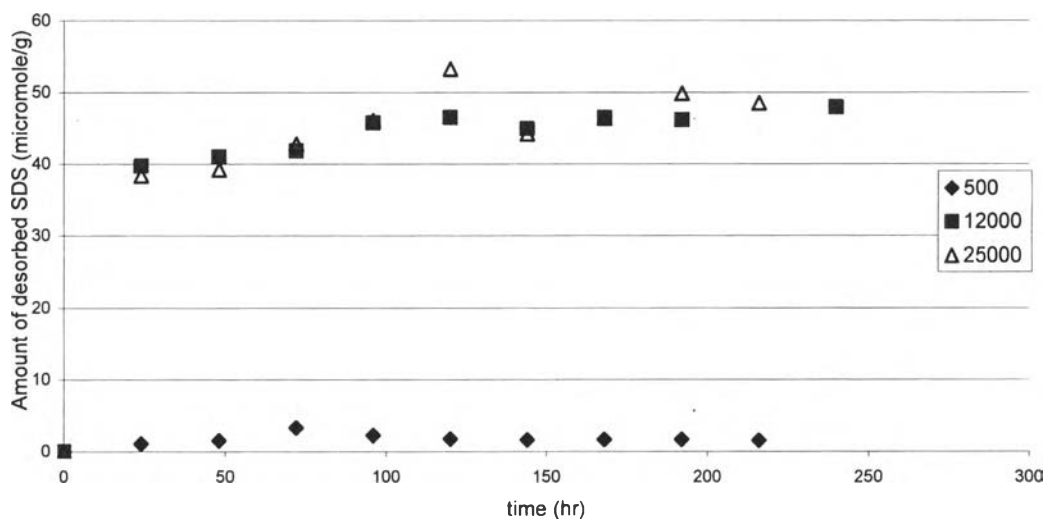


Figure A7 Determination of equilibrium time for desorption of sodium dodecyl sulfate on GAC adsorbent at 30°C.

A1.3.2 at 40°C

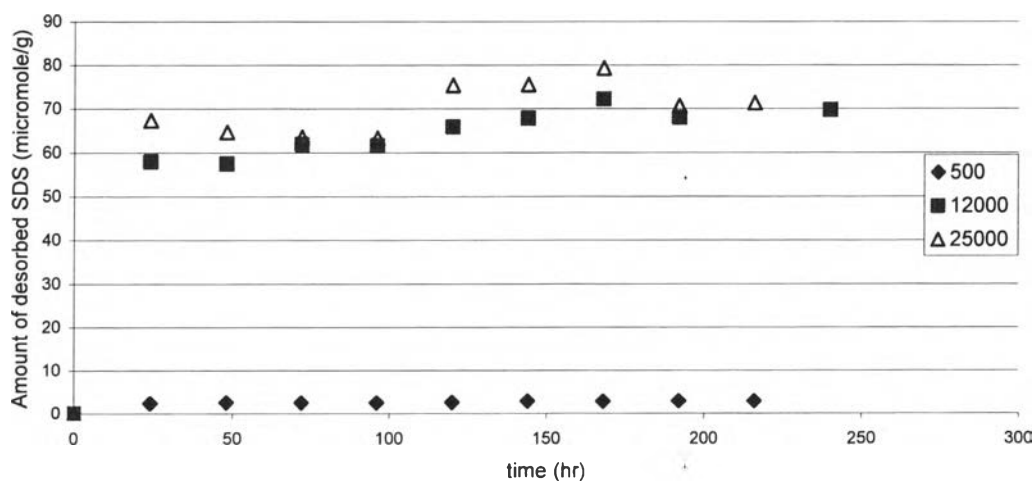


Figure A8 Determination of equilibrium time for desorption of sodium dodecyl sulfate on GAC adsorbent at 40°C.

A1.3.3 at 50°C

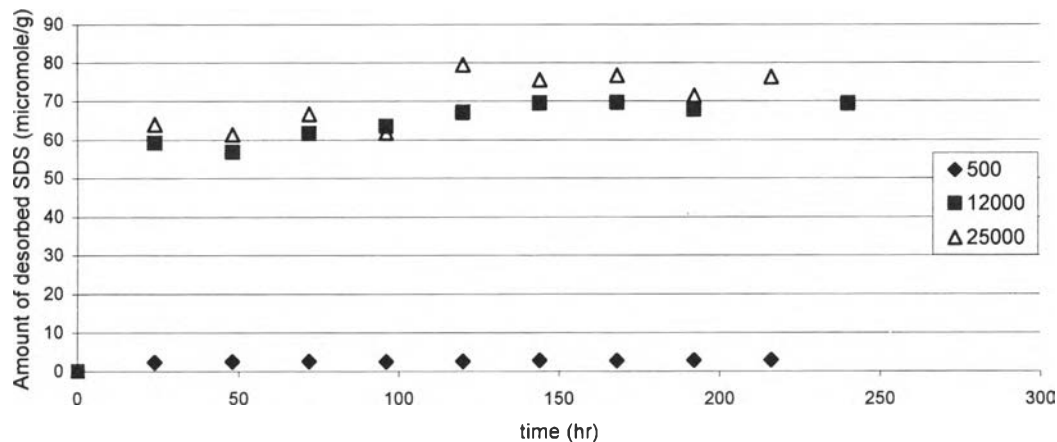


Figure A9 Determination of equilibrium time for desorption of sodium dodecyl sulfate on GAC adsorbent at 50°C.

A1.4 Determination of equilibrium time for desorption of sodium dodecyl sulfate on XAD-4 adsorbent

A1.4.1 at 30°C

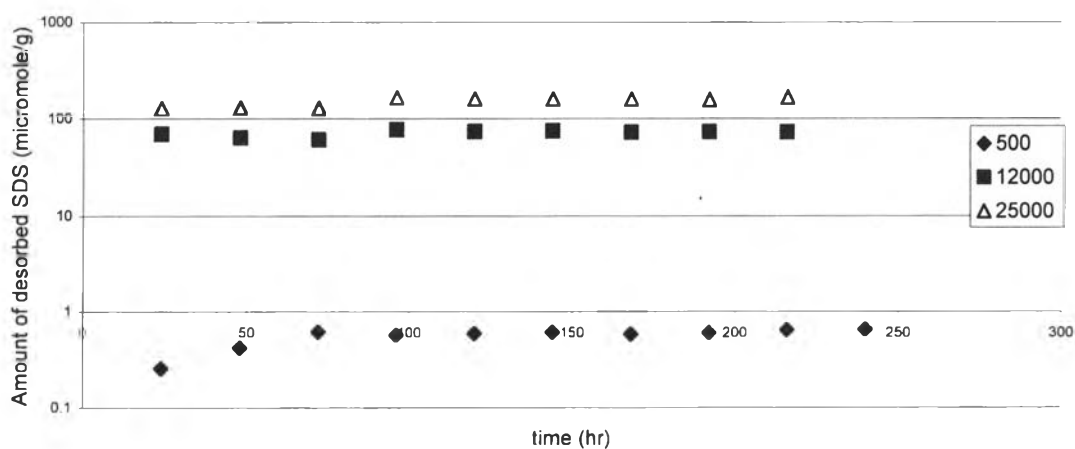


Figure A10 Determination of equilibrium time for desorption of sodium dodecyl sulfate on XAD-4 adsorbent at 30°C.

A1.4.2 at 40°C

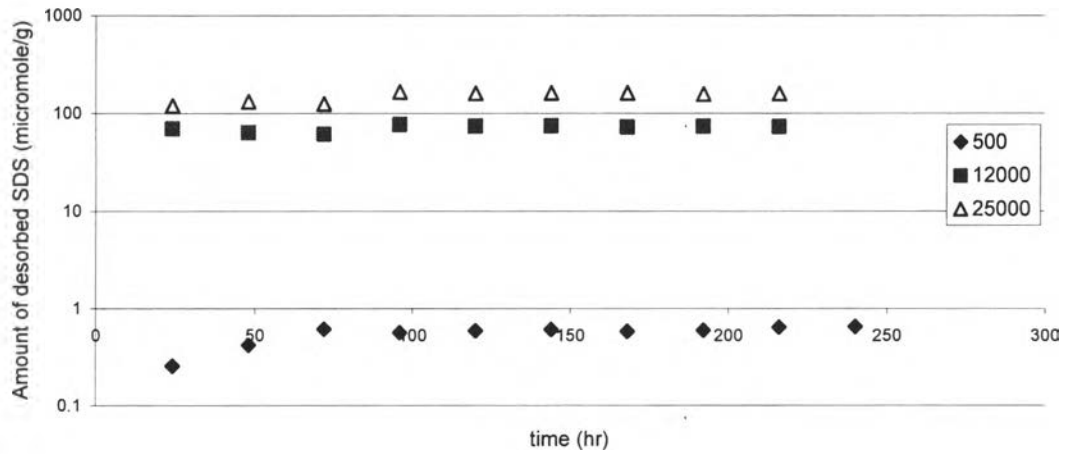


Figure A11 Determination of equilibrium time for desorption of sodium dodecyl sulfate on XAD-4 adsorbent at 40°C.

A1.4.3 at 50°C

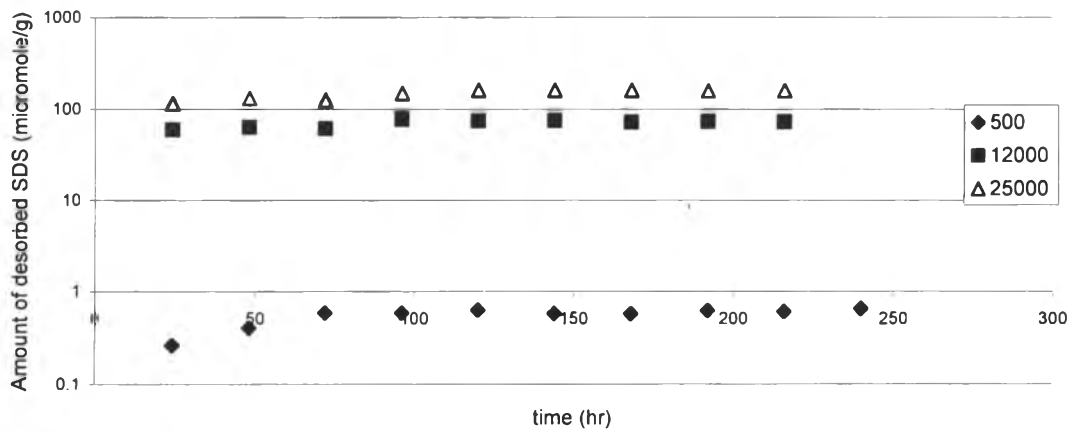


Figure A12 Determination of equilibrium time for desorption of sodium dodecyl sulfate on XAD-4 adsorbent at 50°C.

A2. Ionic strength effect

A2.1 Determination of equilibrium time for adsorption of sodium dodecyl sulfate mixing with sodium chloride on GAC adsorbent

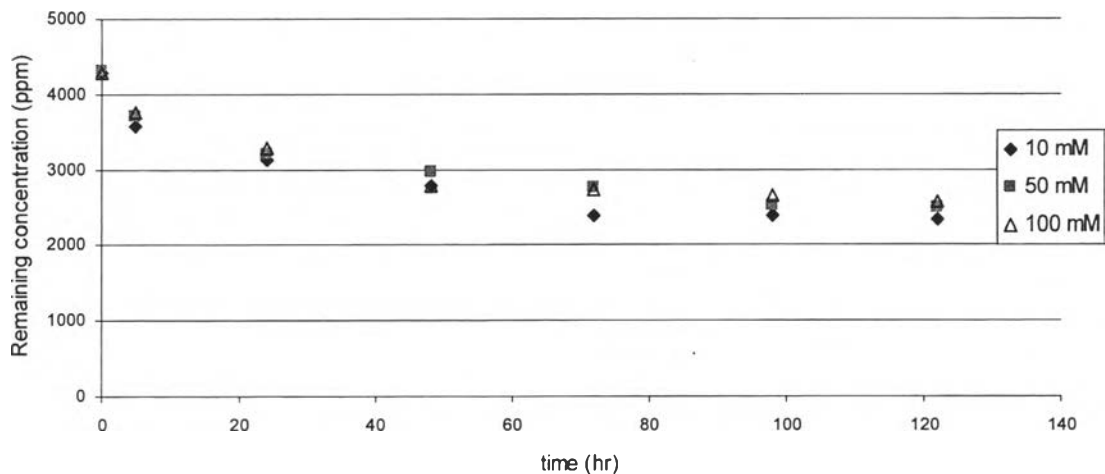


Figure A13 Determination of equilibrium time for adsorption of sodium dodecyl sulfate mixing with 10, 50, and 100 mM of NaCl on GAC adsorbent at 30°C.

A2.2 Determination of equilibrium time for adsorption of sodium dodecyl sulfate mixing with sodium chloride on XAD-4 adsorbent

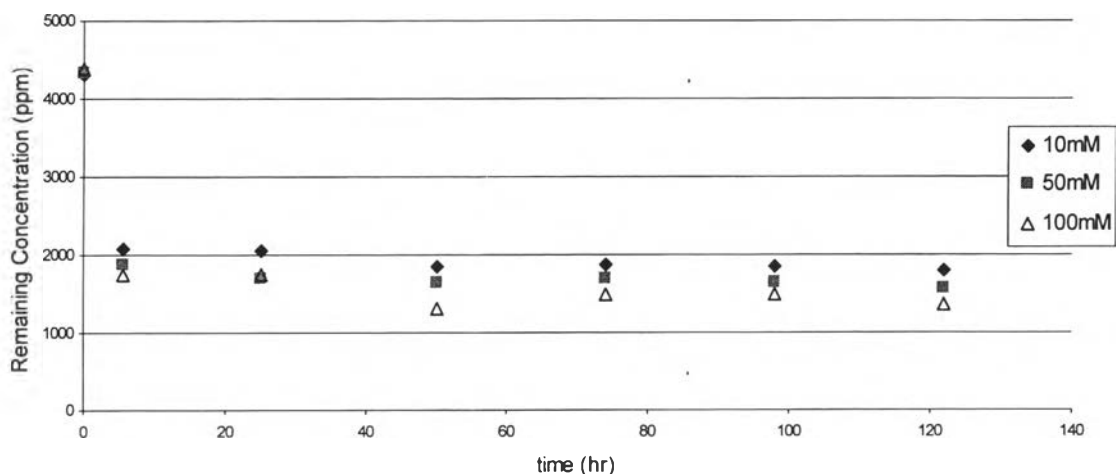


Figure A14 Determination of equilibrium time for adsorption of sodium dodecyl sulfate mixing with 10, 50, and 100 mM of NaCl on XAD-4 adsorbent at 30°C.

A2.3 Determination of equilibrium time for desorption of sodium dodecyl sulfate mixing with sodium chloride on GAC adsorbent

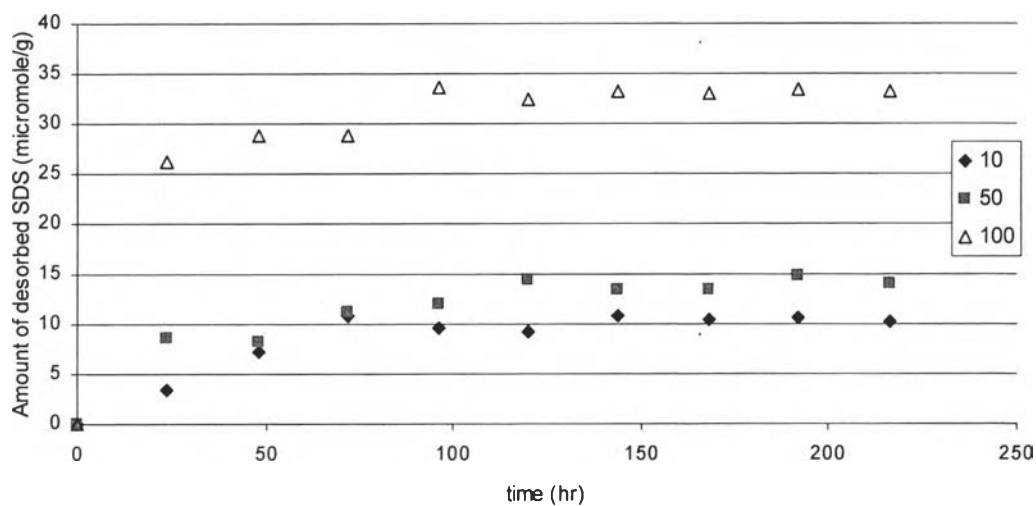


Figure A15 Determination of equilibrium time for desorption of sodium dodecyl sulfate mixing with 10, 50, and 100 mM of NaCl on GAC adsorbent at 30°C.

A2.4 Determination of equilibrium time for desorption of sodium dodecyl sulfate mixing with sodium chloride on XAD-4 adsorbent

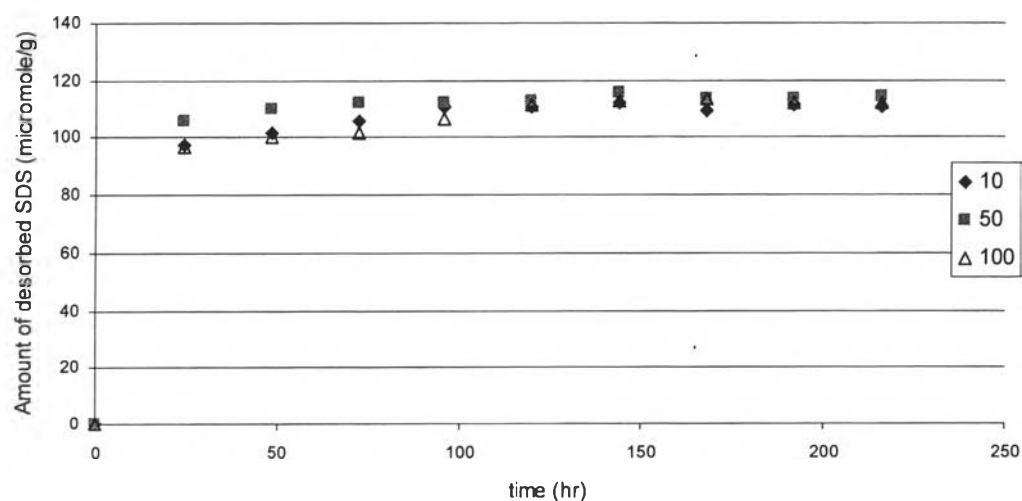


Figure A16 Determination of equilibrium time for desorption of sodium dodecyl sulfate mixing with 10, 50, and 100 mM of NaCl on XAD-4 adsorbent at 30°C.

A3. Effect of surfactant's structure

A3.1 Determination of equilibrium time for adsorption of sodium octanoate on GAC adsorbent

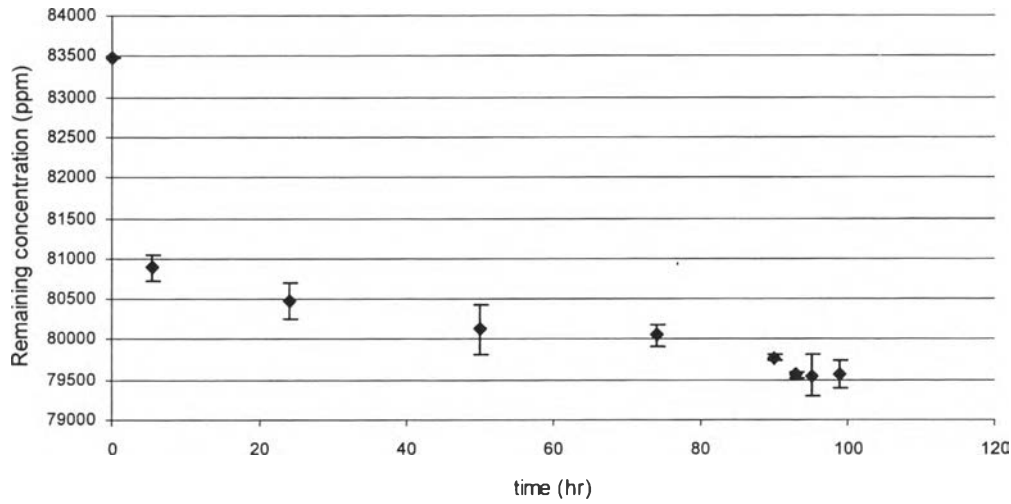


Figure A17 Determination of equilibrium time for adsorption of sodium octanoate on GAC at 30°C.

A3.2 Determination of equilibrium time for adsorption of sodium octanoate on XAD-4 adsorbent

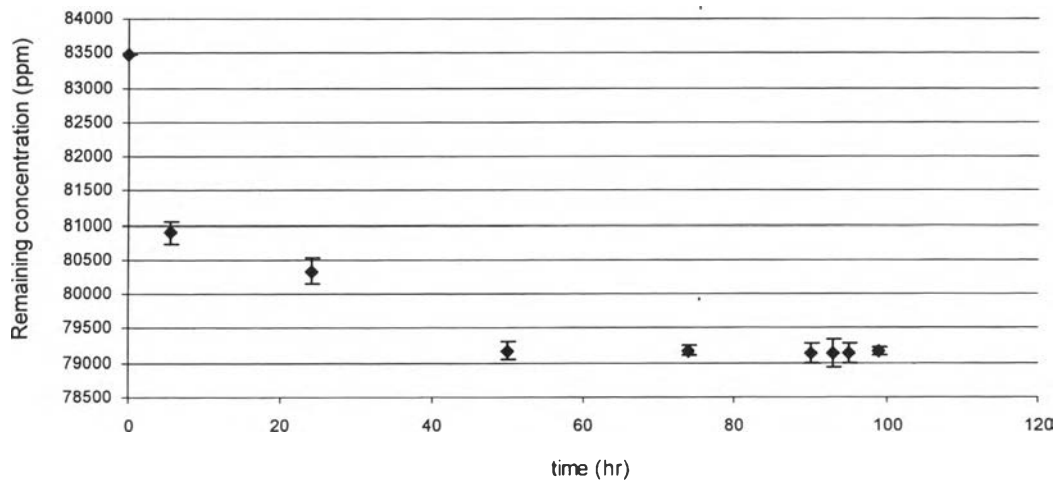


Figure A18 Determination of equilibrium time for adsorption of sodium octanoate on XAD-4 at 30°C.

A3.3 Determination of equilibrium time for desorption of sodium octanoate on GAC adsorbent

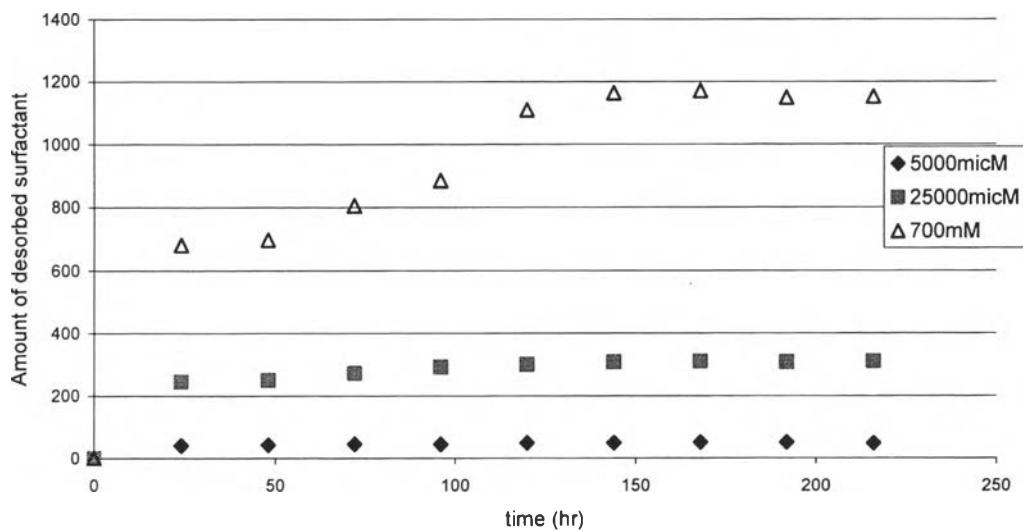


Figure A19 Determination of equilibrium time for desorption of sodium octanoate on GAC at 30°C.

A3.4 Determination of equilibrium time for desorption of sodium octanoate on XAD-4 adsorbent

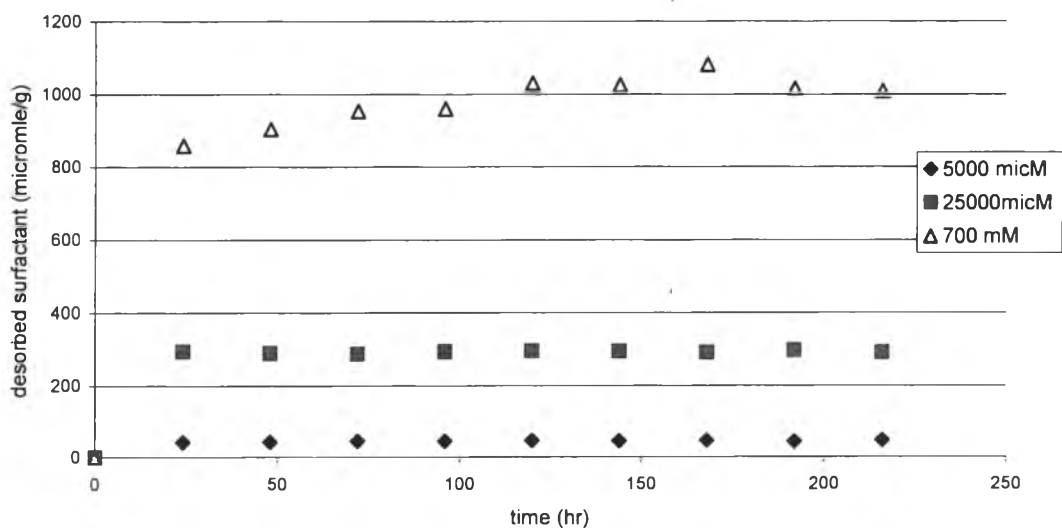


Figure A20 Determination of equilibrium time for desorption of sodium octanoate on XAD-4 at 30°C.

Appendix B Calibration curve for TOC.

B1. with sodium dodecyl sulfate (SDS)

prepared concentration		detected concentration
micromolar	ppm	ppm
20000	2880	2908
10000	1440	1518
5000	720	603.9
1000	144	139.1
500	72	92.29
100	36	28.2

Table B1 Data of calibration curve of SDS with TOC analyzer.

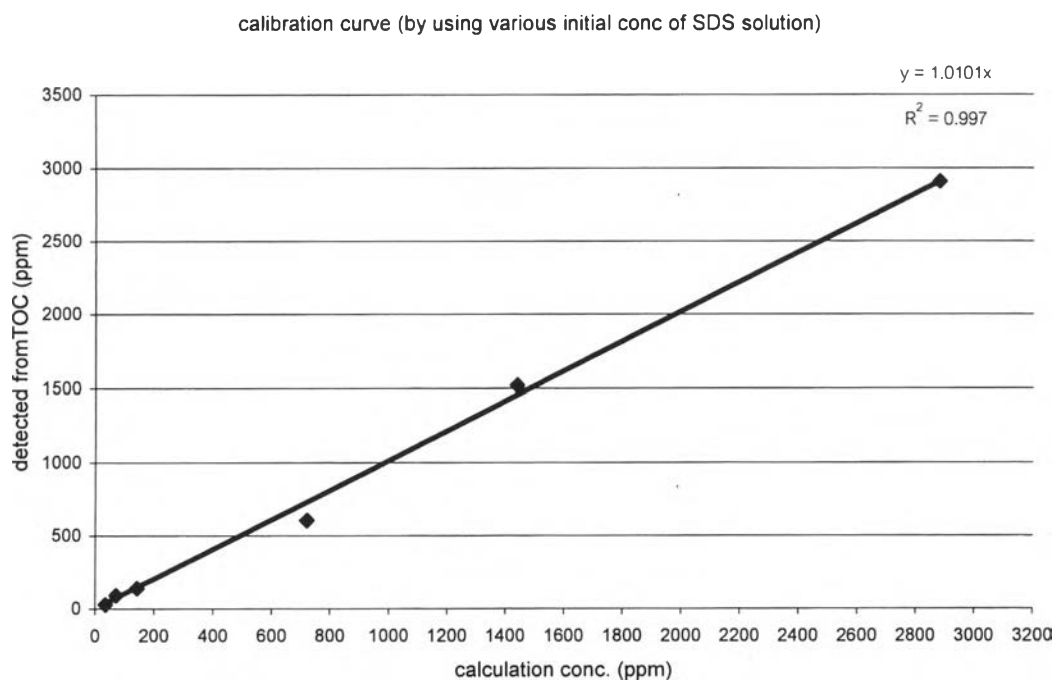
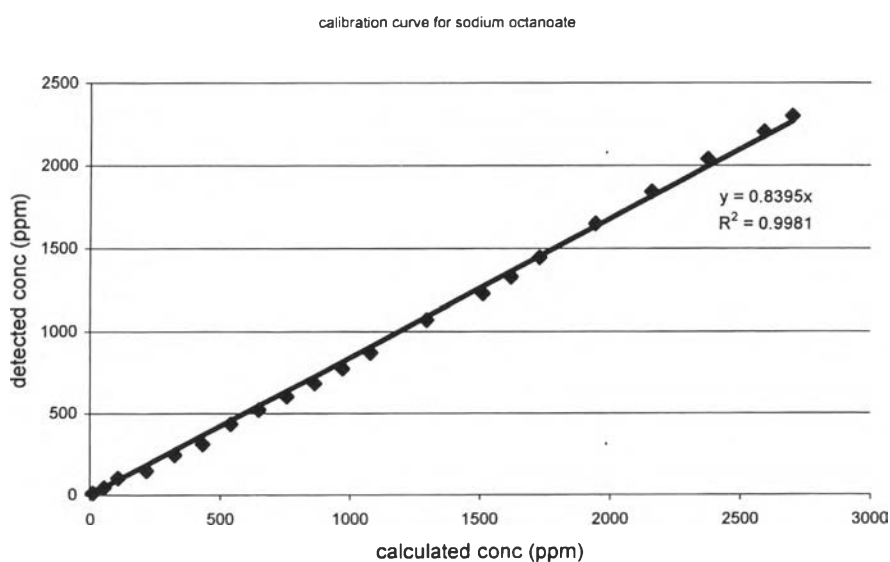


Figure B1 Calibration curve of SDS with TOC analyzer.

B2. with sodium octanoate

prepared concentration		detected concentration
micromolar	ppm	ppm
100	10.8	12.28
500	54	44.61
1000	108	102.5
2000	216	147.4
3000	324	242
4000	432	308.8
5000	540	432.8
6000	648	521.2
7000	756	601.3
8000	864	683.2
9000	972	774.7
10000	1080	872.2
12000	1296	1069
14000	1512	1225
15000	1620	1326
16000	1728	1443
18000	1944	1648
20000	2160	1841
22000	2376	2040
24000	2592	2205
25000	2700	2300

Table B2 Data of calibration curve of Sodium octanoate with TOC analyzer.**Figure B2** Calibration curve of Sodium octanoate with TOC analyzer.

Appendix C Sample of calculation.

C1. Adsorption isotherm.

Considering initial concentration 25,000 μM of SDS adsorb on GAC at 30°C, only the amount of carbon in SDS will be measured by TOC in the unit of ppm;

$$\begin{aligned} 25,000 \mu\text{mol/l} &= 25,000 \times 10^{-6} \times 288.4 \times 1,000 \\ &= 7,210 \text{ mg/l or} \\ &= 7,210 \text{ ppm} \end{aligned}$$

but only amount of carbon will be detected by TOC thus,

$$\begin{aligned} \text{detected concentration} &= (7,210 \times 12 \times 12) / 288.4 \\ &= 3,600 \text{ ppm} \end{aligned}$$

by theoretical, it should be 3,600 ppm but for the real experiment it was 3,618 ppm

After that it was converted due to the calibration experiment.

$$\text{cal. Concentration} = 3,618 / 1.0101 = 3,581.82 \text{ ppm}$$

Remark; molecular weight of SDS = 288.4

molecular weight of carbon atom = 12

SDS contain 12 atoms of carbon

When the equilibrium was reached, concentration of aqueous solution was detected by TOC analyzer again. Assume that it was 2,031 ppm, the process of converting detected concentration to cal. concentration will be the same.

$$\text{equilibrium cal. concentration} = 2,031 / 1.0101 = 2010.69 \text{ ppm}$$

Thus, the amount of SDS adsorb on GAC = 3,581.82 - 2,010.69

$$= 1,571.13 \text{ ppm}$$

Convert ppm to micromolar by using covering graph

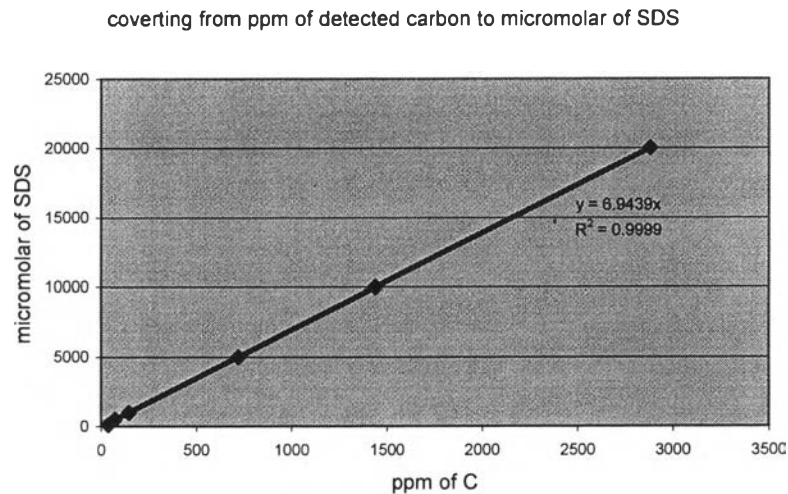


Figure C1 Converting curve from ppm unit to micromolar of SDS.

The amount of SDS adsorb on GAC = $1,571.13 \times 6.9439 = 10,909.78$ micromolar

Due to 10 ml of SDS solution was mixed with 0.1 g of GAC adsorbent

Then, the amount of SDS adsorb on GAC = $(10,909.78 \times 10) / (0.1 \times 1,000)$
 $= 1,090.98$ micromole/g

C2. Desorption isotherm

After the adsorption isotherm was completed, the equivalent desorption isotherm can perform by diluting the equilibrium concentration of adsorption with a factor of 5.

The initial concentration of SDS for desorption = $13,962.04 / 5 = 2,792.41$ micromolar

After the equilibrium time was reached, the equilibrium concentration = 456.59 ppm

or = 456.59×6.9439 micromolar
 $= 3,170.50$ micromolar

The amount of desorbed SDS = $3,170.50 - 2,792.41 = 378.10$ micromolar

$= (378.10 \times 10) / (0.1 \times 1,000)$
 $= 37.81$ micromole/g

The amount of adsorbed SDS on GAC surface after desorption process

$= 1,090.98 - 37.81$
 $= 1,053.17$ micromole/g

The amount of adsorbed and desorbed SDS in the unit of micromole/g of adsorbent are plotted versus equilibrium concentration. For XAD-4 adsorbent, the process of calculation will be the same except the used amount of adsorbent was changed from 0.1 g to 0.2 g.

Appendix D Raw data.

D1. Temperature effect

D1.1 Adsorption and desorption isotherm of SDS on GAC adsorbent at 30°C

Adsorption isotherm			Desorption isotherm		
Ce (μM)	Q (micromole/g)	SD	Ce (μM)	Q (micromole/g)	SD
32.32	6.79	0.21	24.84	4.95	0.23
49.89	44.50	0.28	29.06	41.99	0.52
58.17	82.93	0.12	43.89	79.70	0.53
70.16	172.13	0.22	58.80	168.35	1.98
139.31	330.55	1.44	67.92	327.05	2.58
237.55	399.85	4.11	72.51	397.35	1.05
411.57	461.71	7.36	113.06	458.64	5.03
720.77	515.76	19.67	196.79	510.50	15.97
777.04	595.51	2.41	169.46	596.68	6.36
1093.21	851.04	18.86	299.49	833.37	29.92
1737.35	865.68	19.99	390.54	865.59	19.38
2573.63	995.85	7.09	654.77	994.21	38.33
3682.65	1109.75	6.50	926.51	1095.30	7.88
3774.77	1180.28	16.51	989.24	1166.51	14.87
5696.87	1081.56	37.17	1220.77	1083.78	62.57
6986.98	1134.04	46.01	1629.02	1110.87	44.08
9172.26	1103.87	53.04	2195.02	1040.45	31.41
11755.34	1042.86	94.97	2639.80	1013.98	79.56
12976.70	1112.52	60.19	2749.44	1080.15	42.00
13943.14	1092.87	47.17	2946.63	1066.76	59.64

Table D1 Adsorption and desorption isotherm of SDS on GAC adsorbent at 30°C.

D1.2 Adsorption and desorption isotherm of SDS on GAC adsorbent at 40°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
36.86	6.34	0.40
49.36	44.55	0.32
67.10	82.04	0.24
80.96	171.05	0.06
107.69	333.71	0.09
168.84	406.72	1.73
316.27	471.24	1.47
604.38	527.40	14.27
1203.26	552.89	20.58
1287.82	831.58	4.58
1562.11	883.21	6.11
2310.51	1022.16	5.44
3793.85	1098.63	17.00
4314.65	1126.29	3.79
4892.79	1161.97	41.62
5879.04	1244.83	17.48
8047.71	1216.32	31.74
10328.89	1185.50	5.04
11743.88	1235.80	32.35
12470.28	1240.15	38.89

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
30.77	4.00	0.93
31.09	41.70	0.68
36.71	79.71	0.19
60.37	166.44	1.76
63.80	329.60	2.14
66.21	404.28	1.65
85.28	469.04	1.35
156.05	515.85	25.56
268.56	563.52	30.72
339.58	820.39	5.75
439.14	864.25	13.56
675.00	1000.87	12.92
1111.60	1068.46	8.07
1321.50	1080.43	7.96
1465.64	1133.48	26.22
1816.92	1154.98	66.85
2011.24	1176.15	47.80
2639.97	1128.08	38.54
2717.94	1198.88	21.31
2784.16	1211.14	26.25

Table D2 Adsorption and desorption isotherm of SDS on GAC adsorbent at 40°C.

D1.3 Adsorption and desorption isotherm of SDS on GAC adsorbent at 50°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
62.01	5.30	1.01
78.20	56.50	0.25
81.65	97.77	0.12
87.43	194.12	0.41
102.37	393.18	1.04
163.66	475.47	1.27
339.39	582.88	2.42
575.94	622.01	1.80
769.94	786.88	6.22
929.66	887.55	3.96
1250.29	963.47	13.71
2362.53	1061.87	33.01
3253.69	1170.24	18.27
3862.76	1207.50	19.16
5007.36	1187.17	44.72
6420.07	1287.27	65.87
7848.92	1293.37	44.72
10096.30	1262.66	50.67
12298.42	1249.75	71.87
13421.25	1210.80	44.08

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
27.94	4.15	0.83
31.34	53.95	0.48
41.71	95.24	0.34
57.10	190.15	0.30
63.00	388.92	0.82
85.72	468.70	4.16
145.66	576.50	5.31
223.01	608.61	7.20
307.03	771.57	5.93
381.03	865.45	6.48
481.85	935.46	12.61
747.31	1044.24	32.57
1129.06	1117.59	20.95
1278.88	1161.18	21.14
1699.71	1117.34	46.94
2041.03	1195.19	54.08
2263.93	1223.95	35.18
2736.95	1190.89	43.13
2945.02	1228.53	21.08
3148.96	1164.33	32.66

Table D3 Adsorption and desorption isotherm of SDS on GAC adsorbent at 50°C.

D1.4 Adsorption and desorption isotherm of SDS on XAD-4 adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
204.27	21.94	0.22
214.00	84.54	0.00
212.63	88.73	3.63
222.66	190.57	0.22
237.38	234.05	0.02
290.90	293.87	0.10
346.99	322.45	0.08
430.11	410.43	0.46
556.65	462.43	0.93
740.84	507.21	1.18
1119.16	593.10	0.05
1599.69	667.82	1.82
1936.31	700.07	0.86
2214.04	733.25	11.56
3180.13	805.63	1.46
3656.19	856.32	10.67
5000.83	886.10	6.64
6673.05	906.14	9.51
7585.98	897.17	1.70

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
61.45	19.32	0.03
78.58	82.75	0
66.93	89.61	0.18
95.56	188.02	0.09
160.79	228.38	0.37
92.48	292.15	0.48
115.53	320.15	0.46
255.80	401.94	2.96
342.33	450.88	1.93
413.87	493.92	2.09
620.70	573.26	7.53
1120.54	627.79	4.20
1354.04	651.73	6.20
1489.70	680.90	7.79
1800.42	747.41	4.76
2029.69	791.40	0.15
2752.19	798.50	14.65
3353.14	805.22	5.56
3488.79	798.59	0.19

Table D4 Adsorption and desorption isotherm of SDS on XAD-4 adsorbent at 30°C.

D1.5 Adsorption and desorption isotherm of SDS on XAD-4 adsorbent at 40°C

Adsorption isotherm			Desorption isotherm			Second adsorption		
Ce (μM)	Q (micromole/g)	SD	Ce (μM)	Q (micromole/g)	SD	Ce (μM)	Q (micromole/g)	SD
175.28	14.59	0.22	66.90	11.68	0.02	49.17	34.57	0.60
184.51	35.08	0.26	62.92	32.27	0.30	91.02	78.99	0.43
185.01	80.46	0.31	62.72	79.25	0.34	421.84	160.05	0.42
206.35	166.36	0.31	122.54	162.43	0.11	1478.93	280.78	1.80
236.09	207.08	0.32	232.72	197.80	0.56	2155.60	328.42	0.35
282.45	243.88	0.16	376.35	227.88	0.58	2861.61	374.26	0.35
384.95	294.68	0.18	628.70	267.12	0.76	3760.10	411.34	1.84
481.37	392.52	0.32	745.42	360.07	2.06	4375.83	522.23	1.56
679.33	439.68	0.76	1010.55	395.95	2.68	5183.58	564.36	15.54
790.56	476.74	0.42	1305.00	419.40	1.31	8522.05	687.04	8.34
1267.19	555.00	1.66	1886.70	473.51	2.10	10758.54	764.96	1.55
1859.77	622.99	6.69	2424.62	520.35	8.17	13343.34	795.42	13.62
2249.78	651.61	0.65	2744.98	536.86	0.81	16048.45	746.68	14.72
2558.91	685.30	6.56	3012.62	560.26	7.83	17408.44	747.48	2.37
3112.07	744.61	2.70	3446.17	602.24	1.85	20440.08	747.54	3.63
4139.58	791.54	3.97	4022.59	629.98	0.20	23545.05	751.46	2.14
5298.15	821.26	1.91	4316.82	658.01	1.14	25852.58	753.10	7.01
6566.26	857.88	0.26	4451.45	700.97	9.83	29470.84	757.68	11.07
7525.25	850.49	12.58	4668.11	693.75	14.66	29477.72	765.83	14.41

Table D5 Adsorption and desorption isotherm of SDS on XAD-4 adsorbent at 40°C.

D1.6 Adsorption and desorption isotherm of SDS on XAD-4 adsorbent at 50°C

Adsorption isotherm			Desorption isotherm			Second adsorption		
Ce (μM)	Q (micromole/g)	SD	Ce (μM)	Q (micromole/g)	SD	Ce (μM)	Q (micromole/g)	SD
267.51	9.97	2.74	85.67	6.31	4.01	49.85	29.02	4.06
218.17	33.40	0.54	67.89	30.50	0	89.07	77.19	0.70
224.13	78.51	0.11	80.57	76.72	0.50	423.74	157.78	1.36
212.47	166.05	0.03	132.54	161.55	0.15	1471.82	280.55	1.86
309.74	203.40	1.46	230.16	194.99	1.32	2159.50	325.41	2.70
335.43	241.23	1.15	389.92	225.09	3.29	2865.05	371.29	4.36
504.04	288.72	2.01	762.84	255.62	2.09	3762.40	400.12	3.93
605.41	386.32	0.69	745.88	355.08	2.87	4940.91	489.00	7.97
701.20	438.59	0.51	1083.65	391.42	1.59	5714.29	533.29	7.33
892.54	471.65	4.10	1453.03	407.92	5.01	9479.89	627.67	11.65
1417.52	547.48	2.18	1912.71	466.02	12.14	13176.06	636.67	18.97
1960.60	617.95	2.14	2511.59	511.97	1.83	15721.91	668.11	7.67
2311.43	648.53	2.05	2832.97	569.26	12.76	18047.77	678.65	4.34
2509.18	687.79	13.09	2865.74	569.60	20.17	19619.73	646.25	25.36
3510.33	724.69	3.58	3549.29	582.33	0.58	21173.36	690.95	5.11
4407.91	778.12	4.42	3972.53	623.57	6.65	24674.76	687.05	6.59
5626.52	804.84	12.12	4418.68	640.17	12.07	27250.39	669.63	10.60
7296.10	821.38	11.20	4580.23	665.33	18.01	30144.54	688.36	14.82
8865.77	783.46	19.81	4446.18	649.81	16.78	29940.60	700.22	4.70

Table D6 Adsorption and desorption isotherm of SDS on GAC adsorbent at 50°C.

D2. Effect of ionic strength

D2.1 Adsorption and desorption isotherm of SDS + 10 mM of NaCl on GAC adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
45.12	7.46	0.40
42.73	51.80	0.44
48.41	97.45	1.23
44.54	195.59	0.38
50.91	408.13	0.67
105.28	497.84	3.82
209.52	592.94	15.70
378.44	676.41	0.78
624.43	760.43	13.01
967.24	832.02	13.52
1584.79	927.69	9.72
1887.04	1015.70	16.98
3902.86	1166.09	28.75
4949.62	1207.16	67.49
5238.12	1255.99	64.43
8627.46	1158.35	3.89
10552.31	1183.10	5.83
12034.90	1202.57	39.16
14081.20	1145.06	59.50
15135.86	1135.83	41.77

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
33.31	5.03	0.52
29.91	49.25	0.39
41.08	94.31	1.22
45.84	191.90	0.56
55.59	403.59	1.40
92.29	490.72	4.28
95.56	593.67	2.71
213.07	662.67	2.03
323.48	740.57	14.96
422.62	809.10	11.61
596.09	899.77	12.70
690.25	984.42	14.00
1040.11	1127.34	8.71
1260.78	1180.07	59.39
1358.85	1224.87	63.18
1923.82	1078.02	85.89
2202.58	1188.92	36.00
2615.96	1181.68	31.96
2880.63	1138.62	56.08
3155.04	1123.05	32.37

Table D7 Adsorption and desorption isotherm of SDS in 10 mM of NaCl solution on GAC adsorbent at 30°C.

D2.2 Adsorption and desorption isotherm of SDS + 50 mM of NaCl on GAC adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
54.18	7.69	0.42
49.75	55.78	0.79
59.29	84.26	0.52
58.99	192.43	1.44
58.61	388.05	1.35
81.88	485.95	2.46
162.48	589.94	3.96
247.79	648.03	8.12
563.59	734.21	5.11
686.90	925.36	0.91
1054.03	1059.82	2.92
1848.37	1255.36	33.32
4206.66	1278.70	3.34
5242.81	1267.21	2.77
6566.26	1245.54	30.08
8959.72	1246.11	41.28
10857.08	1279.80	30.08
13298.66	1265.93	32.57
15362.14	1267.19	21.40
16798.91	1258.26	40.79

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
37.77	5.00	0.56
38.52	52.49	0.93
42.75	81.17	0.67
57.90	187.82	1.43
50.44	384.17	1.67
57.28	481.86	1.29
115.63	580.05	2.92
96.11	643.37	9.32
179.73	727.50	4.34
216.11	917.49	3.75
293.90	1051.51	3.44
490.31	1230.89	10.32
882.51	1274.58	3.88
1115.38	1260.94	3.11
1339.38	1250.75	16.64
1800.77	1255.04	53.13
2496.81	1267.38	30.65
2885.44	1218.71	58.86
3236.04	1250.83	26.09
3422.11	1289.10	89.05

Table D8 Adsorption and desorption isotherm of SDS in 50 mM of NaCl solution on GAC adsorbent at 30°C.

**D2.3 Adsorption and desorption isotherm of SDS + 100 mM of NaCl on
GAC adsorbent at 30°C**

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
79.90	3.42	0.40
76.32	43.28	1.27
71.16	84.04	0.33
75.40	176.21	0.56
71.08	360.68	0.22
77.84	455.42	0.21
100.20	536.91	1.35
295.37	611.03	7.80
481.95	667.44	2.98
620.25	738.85	6.27
756.88	798.74	5.43
1397.58	1000.03	11.75
2941.13	1225.83	25.27
3993.84	1205.80	19.35
5096.04	1186.33	39.88
6233.77	1216.23	27.34
7846.98	1248.77	38.81
10222.16	1206.49	39.66
11562.17	1286.97	28.67
12813.55	1247.76	41.16

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
32.62	1.76	0.30
42.44	39.65	1.70
40.56	81.41	0.38
50.26	172.70	1.45
63.79	355.72	1.92
59.29	451.05	0.70
64.69	532.45	0.85
113.66	605.57	7.66
151.33	661.94	2.34
249.37	726.32	6.35
293.88	784.49	6.05
856.10	940.01	7.39
1483.51	1118.64	26.39
1057.81	1148.49	72.92
1064.17	1181.83	43.53
1291.20	1211.79	24.69
1923.48	1213.36	28.81
2254.60	1198.25	26.87
2429.90	1257.57	15.38
2917.98	1212.23	12.13

Table D9 Adsorption and desorption isotherm of SDS in 100 mM of NaCl solution on GAC adsorbent at 30°C.

D2.4 Adsorption and desorption isotherm of SDS + 10 mM of NaCl on XAD-4 adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
269.48	10.28	0.40
268.43	31.43	0.18
280.36	73.46	0.14
286.92	151.05	0.31
302.52	193.14	0.50
349.36	229.39	0.23
421.93	267.91	0.16
526.86	298.51	0.10
642.01	329.50	0.28
780.25	480.35	1.56
1129.70	491.75	1.66
1697.99	515.59	0.92
2040.11	704.71	0.41
2415.23	715.52	1.43
3228.25	753.92	2.19
4167.07	816.97	11.40
5899.67	831.05	0.35
7710.63	835.37	7.50
8311.23	832.15	4.96

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
66.28	7.45	0.43
66.02	28.61	0
68.16	72.86	0.23
94.87	149.18	0.32
148.42	188.74	0.62
255.75	220.10	0.48
445.40	249.86	0.64
635.87	271.99	0.76
721.13	299.86	0.78
958.99	440.21	4.16
1389.10	433.60	2.40
1962.66	434.43	0.84
2182.87	615.97	0.55
2451.21	617.11	1.49
2949.15	640.95	5.17
3696.17	673.84	10.54
3879.26	696.09	0.65
4060.75	709.44	6.30
4184.49	706.04	7.89

Table D10 Adsorption and desorption isotherm of SDS in 10 mM of NaCl solution on XAD-4 adsorbent at 30°C.

D2.5 Adsorption and desorption isotherm of SDS + 50 mM of NaCl on XAD-4 adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
274.63	10.03	0.04
282.15	30.75	0.53
276.56	73.65	0.17
285.47	151.13	0.44
294.46	193.54	0.44
305.11	231.61	0.25
358.16	271.09	0.19
402.36	304.73	0.39
463.89	338.40	1.85
623.03	488.21	0.67
830.66	506.71	2.39
1314.74	534.75	1.43
1565.55	728.44	1.01
1866.19	742.97	0.92
2440.44	793.31	2.14
3816.93	834.48	3.58
5520.89	849.99	3.34
7264.02	857.70	0.99
8448.72	825.28	1.24

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
70.76	7.45	0.43
71.93	28.61	0.11
68.44	72.86	0.23
84.92	149.18	0.32
109.49	188.74	0.62
176.28	220.10	0.48
279.52	249.86	0.64
403.30	271.99	0.76
586.55	299.86	0.78
788.73	440.21	4.16
1097.39	433.60	2.40
1584.56	434.43	0.84
2127.88	615.97	0.55
2450.52	617.11	1.49
2981.46	640.95	5.17
3297.45	673.84	10.54
3528.89	696.09	0.65
3784.39	709.44	6.30
3954.19	706.04	7.89

Table D11 Adsorption and desorption isotherm of SDS in 50 mM of NaCl solution on XAD-4 adsorbent at 30°C.

D2.6 Adsorption and desorption isotherm of SDS + 100 mM of NaCl on XAD-4 adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
273.24	10.10	0.03
268.52	31.43	0.48
271.70	73.89	0.67
290.49	150.88	0.59
274.31	194.55	0.11
315.45	231.09	0.24
317.14	273.15	0.26
366.43	306.53	0.77
445.60	339.32	0.67
511.37	493.80	0.80
637.33	516.37	0.58
911.55	554.91	0.78
1148.72	749.28	1.17
1363.89	768.08	2.01
1882.92	821.19	1.85
3196.86	865.48	3.00
4825.42	884.77	7.41
6499.81	895.92	3.40
7726.44	861.39	7.94

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
80.13	6.67	0.88
112.60	26.62	1.01
67.57	73.23	0.37
76.28	149.97	0.60
110.68	191.76	0.87
137.76	227.36	0.07
206.26	266.00	0.36
319.85	294.20	0.91
473.56	320.09	1.10
683.39	464.74	0.35
904.22	480.68	5.84
1447.08	491.67	1.74
1731.45	674.20	1.77
2024.30	680.51	1.00
2576.09	711.99	1.87
2975.04	748.70	3.31
3302.49	767.90	3.43
3519.50	784.94	2.32
3577.70	759.77	6.54

Table D12 Adsorption and desorption isotherm of SDS in 100 mM of NaCl solution on XAD-4 adsorbent at 30°C.

D3. Effect of structural of surfactant

D3.1 Adsorption and desorption isotherm of sodium octanoate on GAC adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
84.13	3.71	0.83
100.52	46.31	0.46
146.25	91.53	2.79
288.89	184.64	2.12
1043.87	313.85	10.23
1526.48	365.63	6.20
1567.02	456.32	3.33
2191.19	499.67	8.99
2734.95	546.22	3.71
3170.15	596.56	23.65
3573.56	642.03	12.37
6044.71	942.97	14.30
7446.29	1033.33	15.60
8083.52	1065.56	4.26
8927.64	1060.56	2.25
10200.81	1210.08	15.77
11849.35	1275.74	11.48
13224.36	1361.04	18.16
14334.66	1387.33	17.59
14978.05	1405.16	4.41
21179.38	1466.65	23.66
44564.67	1527.03	37.88
78860.87	1626.85	64.27
102669.87	1722.07	112.36
135751.00	1866.19	99.34
158346.75	2055.16	122.98
206332.40	2330.16	109.28
271325.52	2713.26	110.29
365076.21	3308.85	123.48
420940.60	3347.45	138.78
480665.30	3397.08	274.93
520536.92	3380.54	252.40
571548.32	3352.97	82.54
617651.60	3308.85	193.15
678313.81	3264.73	171.81
738865.73	3408.11	96.15

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
39.17	1.47	0.28
69.64	39.98	1.26
78.44	87.73	0.38
207.77	169.64	6.11
551.84	279.54	14.05
786.40	317.52	3.87
1058.72	381.79	3.61
1296.33	413.86	2.27
1497.07	453.92	5.94
1744.31	485.53	18.84
2007.37	512.76	6.95
2483.84	820.76	3.96
2995.61	878.15	6.10
3275.02	899.73	1.41
3195.61	919.55	25.03
3961.43	1017.96	14.99
4517.68	1064.20	11.49
4989.01	1126.63	26.63
5434.23	1137.14	13.13
5747.19	1133.31	18.21
6790.31	1211.20	15.18
10751.55	1343.17	36.21
16386.15	1565.45	52.04
23595.76	1415.89	50.00
29867.87	1594.42	70.29
35364.23	1685.67	17.59
47257.70	1731.04	26.15
63272.52	1812.51	27.40
85846.22	2013.99	161.75
95531.95	2213.07	45.51
107831.68	2150.75	206.05
118307.86	1960.49	254.97
127903.51	1993.58	170.56
135398.05	2122.07	119.19
146758.43	2155.16	190.48
160572.87	2128.14	91.03

Table D13 Adsorption and desorption isotherm of sodium octanoate on *GAC* adsorbent at 30°C.

D3.2 Adsorption and desorption isotherm of sodium octanoate on XAD-4 adsorbent at 30°C

Adsorption isotherm

Ce (μM)	Q (micromole/g)	SD
379.86	9.19	0.83
793.09	13.42	2.42
1435.67	34.98	2.12
2949.84	61.63	1.60
3798.56	69.21	0.97
4534.96	79.76	3.04
5541.77	82.31	2.53
6301.52	94.78	2.65
7096.01	101.99	1.73
7993.07	100.04	1.00
9614.78	292.98	2.61
11154.49	331.25	2.72
11900.82	341.91	5.46
12514.80	350.92	2.23
14161.87	406.99	5.60
15882.47	436.22	9.94
16599.39	511.77	4.68
17143.51	553.22	7.45
17448.66	579.05	12.48
23044.29	640.08	43.82
44713.56	756.07	14.34
79136.61	799.64	30.42
103269.14	831.07	30.42
136258.35	907.73	32.76
159045.29	992.65	15.60
209413.30	1011.04	94.35
273384.36	1253.69	66.48
358458.52	1985.31	109.19
405811.81	2132.37	66.48
471547.58	2154.43	93.80
511400.82	2147.07	88.47
561989.43	2154.43	78.25
606842.70	2194.87	68.88
669343.16	2080.90	152.96
729123.01	2191.19	100.08

Desorption isotherm

Ce (μM)	Q (micromole/g)	SD
121.88	3.19	0.16
361.40	3.29	0.97
828.43	7.92	1.72
1425.56	19.85	0.30
1670.60	23.67	0.79
1937.15	28.25	1.99
2154.43	31.22	1.71
2456.27	33.78	1.51
2825.02	31.70	3.02
3055.17	27.21	1.14
3486.79	214.79	7.04
4034.22	241.09	0.53
4231.46	249.13	16.65
4590.84	246.53	2.64
6593.06	218.95	1.02
7296.01	230.24	22.13
8319.91	258.97	4.86
8944.92	274.47	0.62
9522.86	274.60	8.90
10744.20	333.31	24.27
16213.35	392.54	15.67
21970.75	492.47	26.67
25621.51	582.69	14.97
29680.37	786.29	21.53
35529.67	868.39	32.64
44566.50	876.84	36.45
61404.86	917.29	32.01
90552.14	1042.29	196.54
103081.64	1036.40	95.88
114022.90	1130.52	9.36
122199.43	1130.52	80.18
131530.38	1151.11	14.34
143059.88	1197.80	50.23
153214.36	1110.30	41.64
167148.29	1125.01	96.93

Table D14 Adsorption and desorption isotherm of sodium octanoate on XAD-4 adsorbent at 30°C.

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