

Laboratory Conditions

t= 18.2 C P= 0.777 atm

Experiment 1

Estimated Time to Cap= 3.75 hr

Cycle Time= 4 hr

Start Time= 12:30:00 AM

q=

Sample Number	Sample Time	Sample Interval (min)	Cycle 1 Sample NO3-N (mg/L)	Cycle 2 Sample NO3-N (mg/L)	Cycle 3 Sample NO3-N (mg/L)	Ave
1A	12:30:00 PM	0	0	0.1	0.3	0.133333
2A	12:54:00 PM	24	2	1.6	2.1	1.9
3A	1:18:00 PM	48	4.2	4.1	4.7	4.333333
4A	1:42:00 PM	72	11.7	11.4	11.1	11.4
5A	2:06:00 PM	96	13.7	14.3	15.5	14.5
6A	2:30:00 PM	120	18.7	19.8	18.6	19.03333
7A	2:54:00 PM	144	20.9	21.4	22.3	21.53333
8A	3:18:00 PM	168	22	21.6	23.2	22.26667
9A	3:42:00 PM	192	20.9	20	20.5	20.46667
10A	4:06:00 PM	216	21.2	20.3	22	21.16667
11A	4:30:00 PM	240	24.9	25.2	23.9	24.66667
EndA	4:35:00 PM	245				

NO3-N= 25 mg/L

SO4= 25 mg/L

outliers

192	20.9	20	20.5
216	21.2	20.3	22

Experiment 1 Freundlich Parameters Data

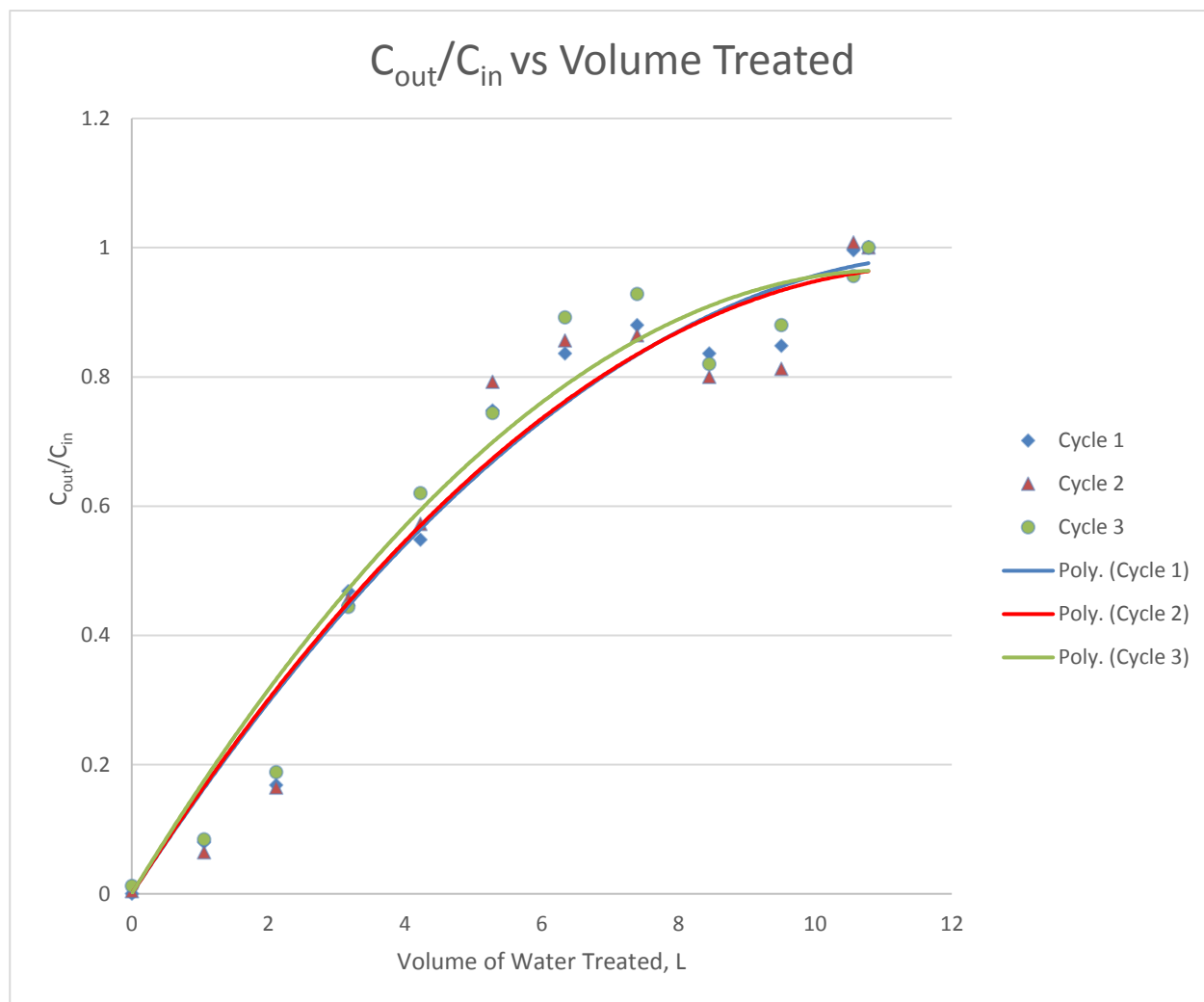
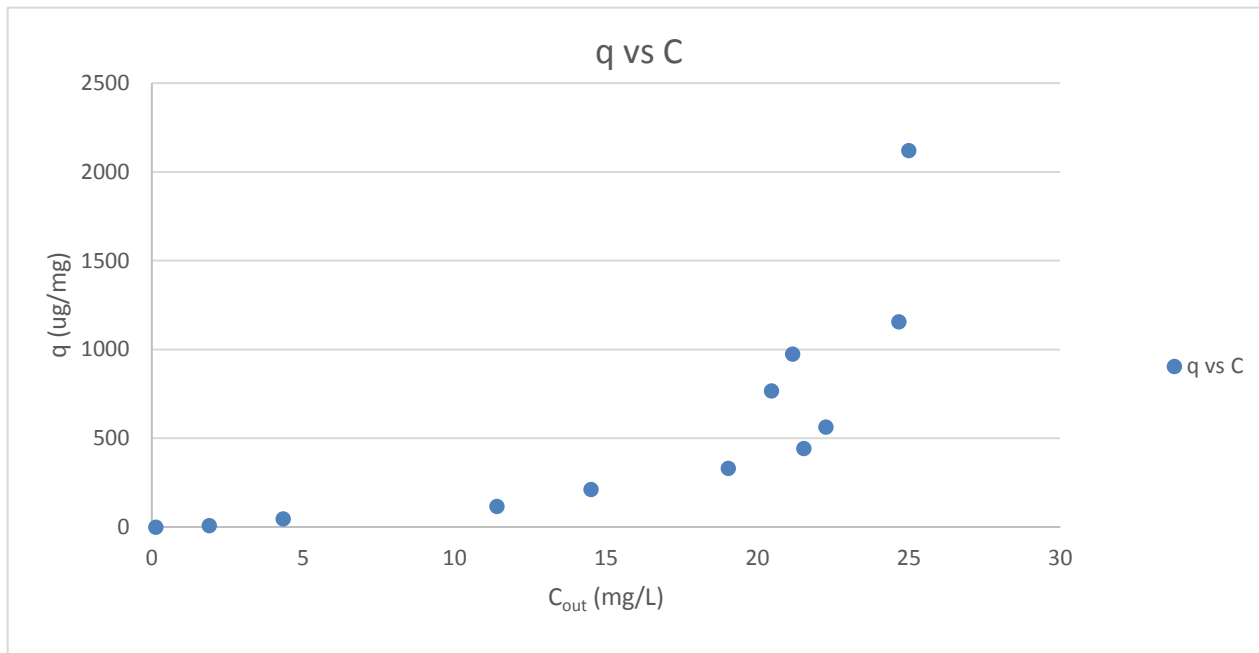
Sample Int. (min)	Cycle 1 NO3-N (mg/L)	Cycle 1 C _{in} /C _{out}	Cycle 2 NO3-N (mg/L)	Cycle 2 C _{in} /C _{out}	Cycle 3 NO3-N (mg/L)	Cycle 3 C _{in} /C _{out}
0	0	0	0.1	0.004	0.3	0.012
24	2	0.08	1.6	0.064	2.1	0.084
48	4.2	0.168	4.1	0.164	4.7	0.188
72	11.7	0.468	11.4	0.456	11.1	0.444
96	13.7	0.548	14.3	0.572	15.5	0.62
120	18.7	0.748	19.8	0.792	18.6	0.744
144	20.9	0.836	21.4	0.856	22.3	0.892
168	22	0.88	21.6	0.864	23.2	0.928
192	20.9	0.836	20	0.8	20.5	0.82
216	21.2	0.848	20.3	0.812	22	0.88
240	24.9	0.996	25.2	1.008	23.9	0.956
245	25	1	25	1	25	1

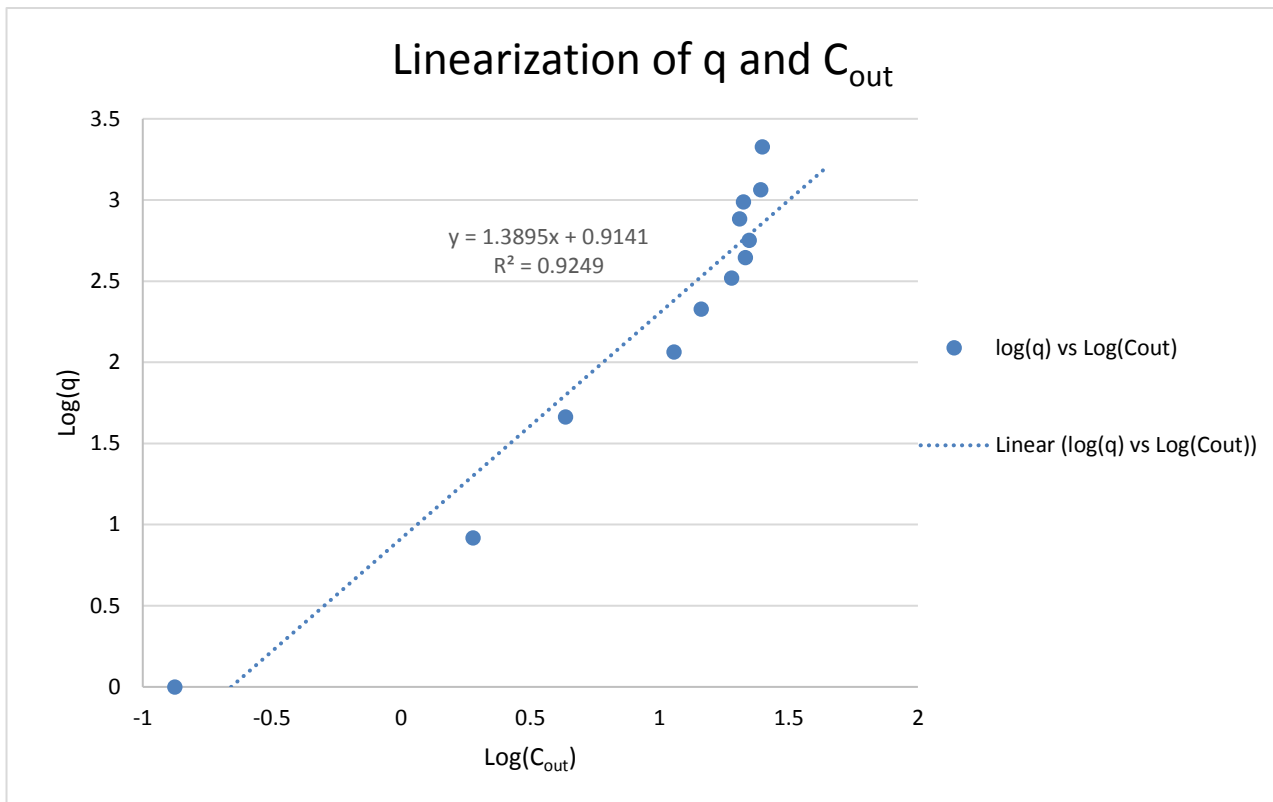
Experiment 1 Freundlich Parameters Data

Volume Treated (L)	Ave C_{in}/C_{out}	Ave C_f , mg/L	dX, ug	Sum(dx), ug	dm, mg/L	q, ug/mg
0	0.0053333333	0.13333333	11.308	11.308	0	0
1.056	0.076	1.9	25238.4	25249.71	3043.560606	8.296108
2.112	0.1733333333	4.33333333	44985.6	70235.31	1521.780303	46.15338
3.168	0.456	11.4	47203.2	117438.5	1014.520202	115.7577
4.224	0.58	14.5	44352	161790.5	760.8901515	212.6332
5.28	0.7613333333	19.033333	39072	200862.5	608.7121212	329.9795
6.336	0.8613333333	21.533333	23443.2	224305.7	507.260101	442.1907
7.392	0.8906666667	22.266667	20697.6	245003.3	434.7943723	563.4924
8.448	0.8186666667	20.466667	46464	291467.3	380.4450758	766.1219
9.504	0.8466666667	21.166667	38016	329483.3	338.1734007	974.3028
10.56	0.9866666667	24.666667	22176	351659.3	304.3560606	1155.421
10.78	1	25	280280	631939.3	298.1447124	2119.572

Experiment 1 Freundlich Parameters Data

log(q)	Log(cf)
0	-0.87506126
0.91887441	0.278753601
1.66420353	0.636822098
2.06354983	1.056904851
2.32763108	1.161368002
2.51848693	1.279514854
2.64560962	1.333111263
2.75088803	1.347655208
2.88429788	1.311047116
2.98869397	1.325652471
3.06274016	1.392110465
3.32624826	1.397940009





Where the slope is equal to $1/n$ and the y intercept is equal to K_f . Therefore from experiment 1 :

$$\begin{aligned} 1/n &= 1.3895 \\ K_f &= 8.205405 \end{aligned}$$

Example sizing column for one month:

$$\begin{aligned} C_i &= 20 \text{ mg/L-N} & C_f &= 2 \text{ mg/L-N} \\ Q &= 8640 \text{ gal/month} \end{aligned}$$

$$q = kC_{out}^{\left(\frac{1}{n}\right)} \quad q = 21.49716 \text{ ug NO}_3\text{-N/mg Resin}$$

Required Mass removed per month:

$$\text{mass}_{\text{NO}_3} = 5.88\text{E}+08 \text{ ug NO}_3\text{-N}$$

Required Resin to remove above mass:

$$\begin{aligned} \text{mass}_{\text{resin}} &= 27346.19 \text{ g dry resin} \\ \text{Volume}_{\text{resin}} &= 85.19063 \text{ L wet resin} \quad \text{or} \quad 3.008484 \text{ cft} \\ & & & 3.539393 \text{ cft} \end{aligned}$$