

Tables

Table 1: Design factors for growing algae under stress conditions

Components	Units	Low	High	-alpha	+alpha
NaNO ₃	g/l	0.43	1.07	0	1.50
K ₂ HPO ₄	g/l	0.03	0.07	0	0.10
KH ₂ PO ₄	g/l	0.06	0.14	0	0.20
Time	days	10.11	21.89	2	30
Light intensity	lux	2898	7102	0	10000

Table 2: Experimentation runs and response for different nitrate, phosphates and light intensity for the growth of algae species

Run	<i>Factors</i>					<i>Response</i>			
						<i>C.pyrenoidosa</i>		<i>S. abundans</i>	
	A:NaNO ₃ g/l	B:K ₂ HPO ₄ g/l	C:KH ₂ PO ₄ g/l	D:Time Days	E:Light intensity lux	Dry Biomass (mg/L)	Lipid Yield %	Dry Biomass (mg/L)	Lipid Yield %
1	1.07	0.07	0.14	10.11	7102	12.47	5.61	10	26.95
2	1.5	0.05	0.1	16	5000	61	8.85	54	30.68
3	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
4	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
5	0.43	0.03	0.06	10.11	2898	20	14.5	86	14.88
6	1.07	0.03	0.14	21.89	2898	78.32	1.4	30	52.51
7	0.43	0.07	0.06	10.11	7102	44.73	6.26	35	21.28
8	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
9	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
10	0.75	0.05	0	16	5000	17.63	36.3	154	9.92
11	1.07	0.07	0.14	21.89	7102	30	32.33	31	10.59
12	1.07	0.07	0.06	21.89	7102	33	20.3	17	12.86
13	0.43	0.07	0.14	21.89	2898	25	6.8	54	27.96
14	0.43	0.07	0.06	10.11	2898	64	2.03	106	17.86
15	1.07	0.03	0.06	10.11	2898	21.96	10.93	123	13.28
16	0	0.05	0.1	16	5000	53	3.96	60	30.7
17	1.07	0.03	0.06	21.89	2898	30	7	67	31.01
18	1.07	0.03	0.14	21.89	7102	52	19.62	27	15.67

19	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
20	0.75	0.05	0.1	16	10000	38	1.84	1	2.5
21	0.43	0.03	0.14	10.11	2898	20.94	7.64	27	56.98
22	0.75	0.1	0.1	16	5000	24	3.33	37	43.32
23	0.75	0.05	0.2	16	5000	23.4	26.5	107	24.03
24	1.07	0.03	0.14	10.11	7102	12	15	2	55.85
25	1.07	0.03	0.06	21.89	7102	23.08	2.6	3	10
26	0.75	0.05	0.1	30	5000	26	4.62	53	24.17
27	0.43	0.07	0.14	10.11	2898	25.97	8.86	42	32.33
28	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
29	0.75	0.05	0.1	2	5000	1.72	5.81	65	28.91
30	0.43	0.03	0.06	10.11	7102	5	14	34	11.43
31	1.07	0.03	0.06	10.11	7102	4	7.5	26	11.6
32	0.43	0.03	0.14	21.89	2898	77	5.45	43	28.81
33	0.43	0.03	0.06	21.89	2898	54	2.41	49	36.76
34	1.07	0.07	0.14	10.11	2898	41	1.46	70	29.49
35	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
36	0.75	0	0.1	16	5000	24	5.42	3	23.03
37	0.43	0.03	0.06	21.89	7102	29.39	8.51	36	6.49
38	0.43	0.07	0.06	21.89	2898	46	10	66	25.15
39	0.43	0.07	0.06	21.89	7102	55	6.55	32	20.42
40	0.43	0.07	0.14	21.89	7102	27.34	10.24	106	13.65
41	1.07	0.07	0.06	21.89	2898	42	7.38	105	27.69
42	0.75	0.05	0.1	16	5000	99.02	22.42	51	26.86
43	1.07	0.03	0.14	10.11	2898	29	4.14	38	40.17
44	1.07	0.07	0.14	21.89	2898	36	4.72	58	28.14
45	0.43	0.03	0.14	10.11	7102	6	1.67	44	31.14
46	0.43	0.03	0.14	21.89	7102	43	3.95	91	8.37
47	0.43	0.07	0.14	10.11	7102	8.9	1.12	32	32.64
48	0.75	0.05	0.1	16	0	34.32	2.04	39	23.87
49	1.07	0.07	0.06	10.11	7102	3	16.67	44	11.09
50	1.07	0.07	0.06	10.11	2898	56.98	8.07	222	8.6

Table 3: ANOVA for optimization of multinutrients in biomass concentration in *C. pyrenoidosa*

Source	Sum of Squares	Degrees of freedom	Mean Square	F Value	p-value Prob > F	
Model	42344.8	20	2117.24	20.44	< 0.0001	Significant
A-NaNO ₃	18.66	1	18.66	0.18	0.6743	
B-K ₂ HPO ₄	48.22	1	48.22	0.47	0.5005	
C-KH ₂ PO ₄	0.98	1	0.98	9.49 x10 ⁻³	0.9231	
D-Time	3040.99	1	3040.99	29.36	< 0.0001	
E-Light intensity	1689.4	1	1689.4	16.31	0.0004	
AB	43.99	1	43.99	0.42	0.5197	
AC	807.42	1	807.42	7.8	0.0092	
AD	9.24	1	9.24	0.089	0.7673	
AE	85.02	1	85.02	0.82	0.3724	
BC	2258.93	1	2258.93	21.81	< 0.0001	
BD	1661.76	1	1661.76	16.04	0.0004	
BE	36.64	1	36.64	0.35	0.5566	
CD	446.86	1	446.86	4.31	0.0468	
CE	0.45	1	0.45	4.31 x10 ⁻³	0.9481	
DE	243.32	1	243.32	2.35	0.1362	
A ²	3597.17	1	3597.17	34.73	< 0.0001	
B ²	10704.6	1	10704.6	103.35	< 0.0001	
C ²	11676	1	11676	112.73	< 0.0001	
D ²	13648.1	1	13648.1	131.77	< 0.0001	
E ²	7645.55	1	7645.55	73.82	< 0.0001	
Residual	3003.66	29	103.57			
Lack of Fit	3003.66	22	136.53			
Pure Error	0	7	0			
Cor Total	45348.4	49				

Table 4: Analysis of variance table for optimization of multi-nutrients for biomass concentration
in *S. abundans*

Source	Sum of Squares	Degrees of freedom	Mean Square	F Value	p-value Prob > F	
Model	74462.6	20	3723.13	33.73	< 0.0001	Significant
A-NaNO ₃	13.6	1	13.6	0.12	0.7281	
B-K ₂ HPO ₄	3419.75	1	3419.75	30.98	< 0.0001	
C-KH ₂ PO ₄	4838.37	1	4838.37	43.83	< 0.0001	
D-Time	551.39	1	551.39	5	0.0333	
E-Light intensity	11520	1	11520	104.37	< 0.0001	
AB	990.13	1	990.13	8.97	0.0056	
AC	3528	1	3528	31.96	< 0.0001	
AD	2244.5	1	2244.5	20.33	< 0.0001	
AE	7503.13	1	7503.13	67.98	< 0.0001	
BC	325.13	1	325.13	2.95	0.0968	
BD	105.13	1	105.13	0.95	0.3372	
BE	1458	1	1458	13.21	0.0011	
CD	7080.5	1	7080.5	64.15	< 0.0001	
CE	10440.1	1	10440.1	94.58	< 0.0001	
DE	4005.13	1	4005.13	36.29	< 0.0001	
A ²	41.25	1	41.25	0.37	0.5458	
B ²	1792.29	1	1792.29	16.24	0.0004	
C ²	10666.5	1	10666.5	96.63	< 0.0001	
D ²	82.04	1	82.04	0.74	0.3957	
E ²	1792.29	1	1792.29	16.24	0.0004	
Residual	3201	29	110.38			
Lack of Fit	3201	22	145.5			
Pure Error	0	7	0			

Cor Total	77663.6	49
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Table 5: Analysis of variance Lipid Yield for *C. pyrenoidosa*

Source	Sum of Squares	Degree of freedom	Mean Square	F Value	p-value Prob > F
Model	3280.39	20	164.02	7.59	< 0.0001 (Significant)
A-NaNO ₃	101.7	1	101.7	4.71	0.0384
B-K ₂ HPO ₄	6.76	1	6.76	0.31	0.5802
C-KH ₂ PO ₄	33.35	1	33.35	1.54	0.224
D-Time	10.15	1	10.15	0.47	0.4985
E-Light intensity	108.85	1	108.85	5.04	0.0326
AB	37.45	1	37.45	1.73	0.1982
AC	15.62	1	15.62	0.72	0.402
AD	24.75	1	24.75	1.15	0.2933
AE	199.6	1	199.6	9.24	0.005
BC	0.19	1	0.19	8.75 x 10 ⁻³	0.9261
BD	165.07	1	165.07	7.64	0.0098
BE	28.84	1	28.84	1.34	0.2573
CD	91.87	1	91.87	4.25	0.0482
CE	26.28	1	26.28	1.22	0.2791
DE	74.24	1	74.24	3.44	0.074
A ²	552.51	1	552.51	25.58	< 0.0001
B ²	685.42	1	685.42	31.73	< 0.0001
C ²	88.97	1	88.97	4.12	0.0517
D ²	628.69	1	628.69	29.1	< 0.0001
E ²	863.74	1	863.74	39.98	< 0.0001
Residual	626.47	29	21.6		
Lack of Fit	626.47	22	28.48		

Pure Error	0	7	0
Cor Total	3906.86	49	

Table 6: ANOVA for Response Surface Quadratic model –Lipid yield for *S. abundans*

Source	Sum of Squares	Degree of freedom	Mean Square	F Value	p-value Prob > F	
Model	5875.015	20.000	293.751	7.008	0.000	significant
A-NaNO ₃	0.011	1.000	0.011	0.000	0.987	
B-K ₂ HPO ₄	20.768	1.000	20.768	0.495	0.487	
C-KH ₂ PO ₄	1379.147	1.000	1379.147	32.904	0.000	
D-Time	115.610	1.000	115.610	2.758	0.108	
E-Light intensity	1142.114	1.000	1142.114	27.248	0.000	
AB	158.020	1.000	158.020	3.770	0.062	
AC	96.709	1.000	96.709	2.307	0.140	
AD	56.101	1.000	56.101	1.338	0.257	
AE	11.317	1.000	11.317	0.270	0.607	
BC	295.549	1.000	295.549	7.051	0.013	
BD	31.860	1.000	31.860	0.760	0.390	
BE	181.023	1.000	181.023	4.319	0.047	
CD	1014.864	1.000	1014.864	24.213	0.000	
CE	30.949	1.000	30.949	0.738	0.397	
DE	687.927	1.000	687.927	16.413	0.000	
A ²	22.738	1.000	22.738	0.542	0.467	
B ²	64.691	1.000	64.691	1.543	0.224	
C ²	177.019	1.000	177.019	4.223	0.049	
D ²	0.490	1.000	0.490	0.012	0.915	
E ²	334.862	1.000	334.862	7.989	0.008	
Residual	1215.529	29.000	41.915			
Lack of Fit	1215.529	22.000	55.251			
Pure Error	5875.015	20.000	293.751	7.008	0.000	significant
Cor Total	0.011	1.000	0.011	0.000	0.987	

