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SUPPLEMENTARY DATA

Screening of microalgae and LED grow light spectra for effective removal of dissolved nutrients from cold-water recirculating aquaculture system (RAS) wastewater

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Table S.1. Differences in growth responses or nutrient removal among six species of green microalgae (Microalga) in two different media (Medium), tested with two-way ANOVA (upper; Run as a random factor) and Kruskal-Wallis H tests (lower). df: degree of freedom; MS: mean squares; F: value of the F statistic; p: significance level; N: number of samples; χ^2 : value of the chi-square statistic. Den: density; SGR: specific growth rate; R_N : removal rate of $\text{NO}_3\text{-N}$; R_P : removal rate of $\text{PO}_4\text{-P}$; V_P : cell uptake rate of $\text{PO}_4\text{-P}$; $N\%$: percentage of $\text{NO}_3\text{-N}$ removal; V_N : cell uptake rate of $\text{NO}_3\text{-N}$; $P\%$: percentage of $\text{PO}_4\text{-P}$ removal. Remarkd in bold, statistically significant values ($p < 0.05$).

Variable	Source	df	MS	F	p
<i>Den</i>	Microalga	5	16.783	35.406	0.000
	Medium	1	0.368	0.776	0.388
	Microalga*Medium	5	0.398	0.84	0.536
	Run	2	0.874	1.845	0.182
	Error	22	0.474		
<i>SGR</i>	Microalga	5	0.037	2.384	0.072
	Medium	1	0.034	2.187	0.153
	Microalga*Medium	5	0.015	1.007	0.437
	Run	2	0.021	1.348	0.280
	Error	22	0.015		
R_N	Microalga	5	2.998	9.098	0.000
	Medium	1	0.117	0.354	0.558
	Microalga*Medium	5	0.403	1.222	0.332
	Run	2	4.590	13.931	0.000
	Error	22	0.330		
R_P	Microalga	5	0.001	0.733	0.606
	Medium	1	0.502	276.685	0.000
	Microalga*Medium	5	0.001	0.490	0.780
	Run	2	0.035	19.569	0.000
	Error	22	0.002		
V_P	Microalga	5	5.807	131.212	0.000
	Medium	1	0.336	7.602	0.012
	Microalga*Medium	5	0.095	2.138	0.099
	Run	2	0.013	0.291	0.750
	Error	22	0.044		
$N\%$	Microalga	5	1572.128	10.439	0.000
	Medium	1	835.114	5.545	0.028
	Microalga*Medium	5	154.398	1.025	0.427
	Run	2	73.205	0.486	0.621
	Error	22	150.597		
Variable	Source	N	χ^2	df	p
V_N	Microalga	36	32.545	5	0.000
	Medium	36	0.042	1	0.837
$P\%$	Microalga	36	8.068	5	0.153

Table S.2. Differences in growth responses or nutrient removal among four species of non-green microalgae (Microalga) in two different media (Medium), tested with two-way ANOVA (upper; Run as a random factor) and Kruskal-Wallis H tests (lower). df: degree of freedom; MS: mean squares; F: value of the F statistic; p: significance level; N: number of samples; χ^2 : value of the chi-square statistic. SGR: specific growth rate; R_N : removal rate of $\text{NO}_3\text{-N}$; R_P : removal rate of $\text{PO}_4\text{-P}$; V_N : cell uptake rate of $\text{NO}_3\text{-N}$; N%: percentage of $\text{NO}_3\text{-N}$ removal; P%: percentage of $\text{PO}_4\text{-P}$ removal; Den: density; V_P : cell uptake rate of $\text{PO}_4\text{-P}$. Remarkd in bold, statistically significant values ($p < 0.05$).

Variable	Source	df	MS	F	<i>p</i>
SGR	Microalga	3	0.032	3.838	0.034
	Medium	1	0.039	4.681	0.048
	Microalga*Medium	3	0.030	3.589	0.041
	Run	2	0.007	0.821	0.460
	Error	14	0.008		
R_N	Microalga	3	0.221	8.272	0.002
	Medium	1	0.010	0.360	0.558
	Microalga*Medium	3	0.010	0.370	0.776
	Run	2	0.034	1.263	0.313
	Error	14	0.027		
R_P	Microalga	3	0.003	27.987	0.000
	Medium	1	0.004	38.884	0.000
	Microalga*Medium	3	0.001	8.241	0.002
	Run	2	0.000	0.769	0.482
	Error	14	0.000		
V_N	Microalga	3	12.368	0.049	0.985
	Medium	1	782.498	3.094	0.100
	Microalga*Medium	3	78.611	0.311	0.817
	Run	2	828.115	3.275	0.068
	Error	14	252.884		
N%	Microalga	3	747.256	5.996	0.008
	Medium	1	4.735	0.038	0.848
	Microalga*Medium	3	44.188	0.355	0.787
	Run	2	111.437	0.894	0.431
	Error	14	124.632		
P%	Microalga	3	1282.815	11.878	0.000
	Medium	1	123.261	1.141	0.303
	Microalga*Medium	3	92.554	0.857	0.486
	Run	2	169.254	1.567	0.243
	Error	14	108.002		
Variable	Source	N	χ^2	df	<i>p</i>
Den	Microalga	24	16.411	3	0.001
	Medium	24	49.500	1	0.186
V_P	Microalga	24	11.028	3	0.012
	Medium	24	56.000	1	0.347

Table S.3. Differences in growth responses or nutrient removal among three species of green microalgae (Microalga) on three different LED grow light spectra (Spectrum), tested with two-way ANOVA (Run as a random factor). *df*: degree of freedom; *MS*: mean squares; *F*: value of the *F* statistic; *p*: significance level. *Den*: density; *SGR*: specific growth rate; *DW*: dry weight; *Chl a*: chlorophyll-a concentration; *R_N*: removal rate of NO₃-N; *R_P*: removal rate of PO₄-P; *V_N*: cell uptake rate of NO₃-N; *V_P*: cell uptake rate of PO₄-P; *N%*: percentage of NO₃-N; *P%*: percentage of PO₄-P removal. Remarked in bold, statistically significant values (*p* < 0.05).

Variable	Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
<i>Den</i>	Microalga	2	119.577	55.312	0.000
	Spectrum	2	0.522	0.241	0.788
	Microalga*Spectrum	4	0.305	0.141	0.964
	Run	2	13.807	6.387	0.009
	Error	16	2.162		
<i>SGR</i>	Microalga	2	0.075	7.909	0.004
	Spectrum	2	0.006	0.634	0.543
	Microalga*Spectrum	4	0.000	0.048	0.995
	Run	2	0.052	5.461	0.016
	Error	16	0.009		
<i>DW</i>	Microalga	2	0.043	6.101	0.011
	Spectrum	2	0.004	0.515	0.607
	Microalga*Spectrum	4	0.002	0.290	0.880
	Run		0.089	12.568	0.001
	Error	16	0.007		
<i>Chl a</i>	Microalga	2	20.019	31.267	0.000
	Spectrum	2	0.778	1.215	0.323
	Microalga*Spectrum	4	0.184	0.287	0.882
	Run	2	70.453	110.036	0.000
	Error	16	0.640		
<i>R_N</i>	Microalga	2	1.456	25.021	0.000
	Spectrum	2	0.043	0.732	0.496
	Microalga*Spectrum	4	0.037	0.641	0.641
	Run	2	8.338	143.266	0.000
	Error	16	0.058		
<i>R_P</i>	Microalga	2	0.027	48.902	0.000
	Spectrum	2	0.000	0.080	0.923
	Microalga*Spectrum	4	0.000	0.080	0.987
	Run	2	0.066	118.797	0.000
	Error	16	0.001		
<i>V_N</i>	Microalga	2	5.158	70.641	0.000
	Spectrum	2	0.022	0.304	0.742
	Microalga*Spectrum	4	0.006	0.079	0.988
	Run	2	0.119	1.627	0.227
	Error	16	0.073		
<i>V_P</i>	Microalga	2	0.009	41.583	0.000

	Spectrum	2	0.000	0.221	0.804
	Microalga*Spectrum	4	0.000	0.272	0.891
	Run	2	0.002	7.166	0.006
	Error	16	0.000		
<i>N%</i>	Microalga	2	392.461	37.779	0.000
	Spectrum	2	10.564	1.017	0.384
	Microalga*Spectrum	4	7.847	0.755	0.569
	Run	2	2620.119	252.220	0.000
	Error	16	10.388		
<i>P%</i>	Microalga	2	2929.713	501.371	0.000
	Spectrum	2	2.951	0.505	0.613
	Microalga*Spectrum	4	6.875	1.176	0.358
	Run	2	8.637	1.478	0.258
	Error	16	5.843		

Table S.4. Differences in growth responses or nutrient removal of *H. pluvialis* on three different LED grow light spectra, tested with one-way ANOVA and Welch ANOVA. F: value of the F statistic; df: degrees of freedom; p: significance level. Den: density; SGR: specific growth rate; DW: dry weight; Chl a: chlorophyll-a concentration; R_N : removal rate of $\text{NO}_3\text{-N}$; R_P : removal rate of $\text{PO}_4\text{-P}$; V_N : cell uptake rate of $\text{NO}_3\text{-N}$; V_P : cell uptake rate of $\text{PO}_4\text{-P}$; $N\%$: percentage of $\text{NO}_3\text{-N}$; $P\%$: percentage of $\text{PO}_4\text{-P}$ removal. Remarked in bold, statistically significant values.

Variable	Analysis	F	df1	df2	p
<i>Den</i>	ANOVA	1.5	2	6	0.301
<i>SGR</i>	ANOVA	2.4	2	6	0.167
<i>DW</i>	ANOVA	5.4	2	6	0.046
<i>Chl a</i>	ANOVA	15.5	2	6	0.004
R_N	Welch ANOVA	22.6	2	3.5	0.010
R_P	ANOVA	22.8	2	6	0.002
V_N	Welch ANOVA	30.2	2	3.6	0.006
V_P	ANOVA	4.2	2	6	0.073
$N\%$	Welch ANOVA	21.8	2	3.5	0.011
$P\%$	ANOVA	35.9	2	6	0.000