Supplementary Information

Algae Response to Engineered Nanoparticles: Current Understanding, Mechanisms and Implications

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Appendix S1. The detailed processes of meta-analysis on algal response to NPs.

To perform meta-analysis, we first made a database by searching the literature in the Google Scholar database up to September 2018, using combinations of relevant terms (algae, nanoparticles, photosynthesis, chlorophyll, oxidative stress, cell density or permeability). In total, 1420 publications were found. The following criteria were applied to select appropriate studies: (i) studies including no NPs exposure (control) and NPs exposure (treatment) experimental plots were selected; (ii) at least one of the selected physiological traits (e.g., PSII, chlorophyll, ROS, Peroxidase (POD), superoxide dismutase (SOD), malonaldehyde (MDA), cell density/ permeability) was measured; (iii) control and NPs exposure treatment data were used for multifactorial studies and the interacting effects were excluded; and (iv) means and sample sizes had to be reported. Finally, we screened the publications according to the above criteria, and 29 peer-reviewed publications that reported the changes of algae physiological parameters in response to NPs exposure were selected (Table S1). These publications summarized 676 observations, and the compiled database included 9 variables related to algae physiological traits (PSII, chlorophyll a, chlorophyll b, SOD, POD, MDA, ROS, cell density, Cell permeability) (Table S1).

The mean magnitude of NPs-mediated changes in algae physiological parameters were calculated, using the natural logarithm of the response ratio (lnR)[1] of the mean responses in the presence NPs (T) and the absence of NPs (C). The mean effect size= ln(T/C), which was considered as significantly different from zero if its 95 % confidence intervals (CIs) did not include zero.[2] For interpretation of the results, mean effects and confidence intervals were back-transformed using the formula: (EXP(lnR)−1) × 100 and reported as the percentage changes between control and NPs exposure.

We assessed potential publication bias in the overall database, using funnel plot and the "trim and fill" method.[2] In order to assess the robustness of the observed overall effects of NPs exposure on algae physiological parameters, fail-safe numbers (Nfs) were calculated, using Rosenberg's weighted method ($\alpha = 0.05$) (Rosenberg, 2005) (See Table 2).

In order to explore sources of heterogeneity, we performed meta-regressions to explore how multiple moderator variables could affect the NP-mediated changes on algae physiological parameters. Moderator analyses were performed only when there were at least two levels with large enough sample size ($n \geq 2$). We used mixed-effects models to estimate the effect of each moderator variable (NPs type, NPs modification, NPs dose and algae species) on the magnitude of NPs exposure. NPs size was excluded from the moderator variable as some studies presented the size information in ranges. This model assumes that differences among studies within a group are due to random variation, whereas variation between groups is fixed. With this model, the between-group homogeneity (Q_B) was used to estimate the significance of each categorical moderator.[2] If the Q_B was significant, we inferred that the mean effect size differed between moderator levels, and two moderator levels were considered to be significantly different from one another if their 95 % CIs did not overlap.[3]

All meta-analyses were performed with the R software v3.3.2[4] using the package 'metafor'.[5]

References

1. L. V Hedges, J. Gurevitch and P. S. Curtis, The meta-analysis of response ratios in experimental ecology, *Ecology*, 1999, **80**, 1150–1156.
2. M. D. Jennions, C. J. Lortie, M. S. Rosenberg and H. R. Rothstein, in *Handbook of*

meta-analysis in ecology and evolution, ed. J. Koricheva, J. Gurevitch and K. Mengersen, Princeton University Press, Princeton, 2013, pp. 207-236.

3. Z. Xiao, X. Wang, J. Koricheva, A. Kergunteuil, R. C. Le Bayon, M. Liu and S. Rasmann, Earthworms affect plant growth and resistance against herbivores: A meta-analysis, *Functional Ecology*, 2018, **32**, 150-160.
4. R Development Core Team. R: A language and environment for statistical computing. Vienna, Austria, 2016, http://www.R-project.org.
5. W.Viechtbauer, Conducting meta-analyses in R with the metafor package, *J. Stat. Softw.*, 2010, **36**, 1–48.

Table S1. Study list and dataset used for meta-analysis

Ref.	Country	NPs name	NPs type	NPs modification	NPs size	NPs dose (ppm)	Algae species	Performance	Sample size	LnR	Variance (LnR)	NPs-mediated changes (%)	Variance (%)
1	China	NiO	Metal oxides	Unmodified	20	1 - 10	*C. vulgaris*	Chlorophyll a	3	-0.0133	0.0006	-1.3218	0.0564
1	China	NiO	Metal oxides	Unmodified	20	10 - 50	*C. vulgaris*	Chlorophyll a	3	-0.0178	0.004	-1.7623	0.0354
1	China	NiO	Metal oxides	Unmodified	20	10 - 50	*C. vulgaris*	Chlorophyll a	3	-0.1417	0.0002	-13.2160	0.0163
1	China	NiO	Metal oxides	Unmodified	20	10 - 50	*C. vulgaris*	Chlorophyll a	3	-0.6375	0.0015	-47.1365	0.1508
1	China	NiO	Metal oxides	Unmodified	20	10 - 50	*C. vulgaris*	Chlorophyll a	3	-1.9284	0.0150	-85.4626	1.5138
2	China	MWCNT	Carbon	Unmodified	< 10	1 - 10	*Chlorella sp.*	ROS	3	0.1780	0.0034	19.4813	0.3357
2	China	MWCNT	Carbon	Unmodified	< 10	1 - 10	*Chlorella sp.*	ROS	3	0.2713	0.0038	31.1690	0.3781
2	China	MWCNT	Carbon	Unmodified	< 10	10 - 50	*Chlorella sp.*	ROS	3	0.6155	0.0021	85.0658	0.2150
2	China	MWCNT	Carbon	Unmodified	< 10	10 - 50	*Chlorella sp.*	ROS	3	0.6768	0.0042	96.7544	0.4233
2	China	MWCNT	Carbon	Unmodified	< 10	50 - 100	*Chlorella sp.*	ROS	3	0.6500	0.0029	91.5589	0.2904
2	China	MWCNT	Carbon	Unmodified	20 - 40	1 - 10	*Chlorella sp.*	ROS	3	0.1335	0.0016	14.2859	0.1584
2	China	MWCNT	Carbon	Unmodified	20 - 40	1 - 10	*Chlorella sp.*	ROS	3	0.3567	0.0007	42.8576	0.0679
2	China	MWCNT	Carbon	Unmodified	20 - 40	10 - 50	*Chlorella sp.*	ROS	3	0.4925	0.0035	63.6375	0.3536
2	China	MWCNT	Carbon	Unmodified	20 - 40	10 - 50	*Chlorella sp.*	ROS	3	0.5798	0.0028	78.5717	0.2842
2	China	MWCNT	Carbon	Unmodified	20 - 40	50 - 100	*Chlorella sp.*	ROS	3	0.6190	0.0021	85.7151	0.2139
2	China	MWCNT	Carbon	Unmodified	60 - 100	1 - 10	*Chlorella sp.*	ROS	3	0.1560	0.0008	16.8841	0.0764
2	China	MWCNT	Carbon	Unmodified	60 - 100	1 - 10	*Chlorella sp.*	ROS	3	0.3567	0.0011	42.8576	0.1065
2	China	MWCNT	Carbon	Unmodified	60 - 100	10 - 50	*Chlorella sp.*	ROS	3	0.5835	0.0021	79.2220	0.2088
2	China	MWCNT	Carbon	Unmodified	60 - 100	10 - 50	*Chlorella sp.*	ROS	3	0.6050	0.0009	83.1179	0.0926
2	China	MWCNT	Carbon	Unmodified	60 - 100	50 - 100	*Chlorella sp.*	ROS	3	0.5943	0.0006	81.1700	0.0613
2	China	MWCNT	Carbon	Unmodified	< 10	1 - 10	*Chlorella sp.*	MDA	3	0.1586	0.0110	17.1874	1.1103
2	China	MWCNT	Carbon	Unmodified	< 10	1 - 10	*Chlorella sp.*	MDA	3	0.4758	0.0233	60.9373	2.3620
2	China	MWCNT	Carbon	Unmodified	< 10	10 - 50	*Chlorella sp.*	MDA	3	0.9471	0.0117	157.8121	1.1745
2	China	MWCNT	Carbon	Unmodified	< 10	10 - 50	*Chlorella sp.*	MDA	3	1.4358	0.0148	320.3105	1.4900

2	China	MWCNT	Carbon	Unmodified	< 10	50 - 100	*Chlorella sp.*	MDA	3	1.5482	0.0098	370.3129	0.9808
2	China	MWCNT	Carbon	Unmodified	20 - 40	1 - 10	*Chlorella sp.*	MDA	3	0.1452	0.0155	15.6249	1.5624
2	China	MWCNT	Carbon	Unmodified	20 - 40	1 - 10	*Chlorella sp.*	MDA	3	0.6118	0.0159	84.3747	1.6021
2	China	MWCNT	Carbon	Unmodified	20 - 40	10 - 50	*Chlorella sp.*	MDA	3	1.1641	0.0120	220.3122	1.2049
2	China	MWCNT	Carbon	Unmodified	20 - 40	10 - 50	*Chlorella sp.*	MDA	3	1.5075	0.0117	351.5624	1.1799
2	China	MWCNT	Carbon	Unmodified	20 - 40	50 - 100	*Chlorella sp.*	MDA	3	1.5712	0.0094	381.2495	0.9451
2	China	MWCNT	Carbon	Unmodified	60 - 100	1 - 10	*Chlorella sp.*	MDA	3	0.2719	0.0139	31.2499	1.3950
2	China	MWCNT	Carbon	Unmodified	60 - 100	1 - 10	*Chlorella sp.*	MDA	3	0.5506	0.0160	73.4374	1.6084
2	China	MWCNT	Carbon	Unmodified	60 - 100	10 - 50	*Chlorella sp.*	MDA	3	1.1494	0.0100	215.6246	1.0026
2	China	MWCNT	Carbon	Unmodified	60 - 100	10 - 50	*Chlorella sp.*	MDA	3	1.5482	0.0099	370.3129	0.9968
2	China	MWCNT	Carbon	Unmodified	60 - 100	50 - 100	*Chlorella sp.*	MDA	3	1.5647	0.0102	378.1233	1.0241
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	1 - 10	*P. tricornutum*	ROS	3	0.1426	0.0353	15.3226	3.5916
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	10 - 50	*P. tricornutum*	ROS	3	0.2167	0.0105	24.1935	1.0604
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	10 - 50	*P. tricornutum*	ROS	3	0.3502	0.0120	41.9354	1.2115
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	50 - 100	*P. tricornutum*	ROS	3	0.3155	0.0107	37.0967	1.0734
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	50 - 100	*P. tricornutum*	ROS	3	0.3559	0.0114	42.7419	1.1419
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	100 - 200	*P. tricornutum*	ROS	3	0.5173	0.0139	67.7419	1.3987
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	100 - 200	*P. tricornutum*	ROS	3	0.9818	0.0230	166.9352	2.3220
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	1 - 10	*P. tricornutum*	Cell density	3	0.0632	0.0037	6.5217	0.3721
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	10 - 50	*P. tricornutum*	Cell density	3	0.0900	0.0041	9.4203	0.4151
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	10 - 50	*P. tricornutum*	Cell density	3	0.0426	0.0043	4.3478	0.4269
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	50 - 100	*P. tricornutum*	Cell density	3	-0.0073	0.0047	-0.7246	0.4745
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	50 - 100	*P. tricornutum*	Cell density	3	-0.0910	0.0055	-8.6957	0.5514

3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	100 - 200	*P. tricornutum*	Cell density	3	-0.1315	0.0052	-12.3188	0.5248
3	Italy	CdSe/ZnS	Quantun dots	Doped	3.5	100 - 200	*P. tricornutum*	Cell density	3	-0.2829	0.0090	-24.6377	0.9039
4	Canada	Ag	Metal	Unmodified	50	< 1	*C. vulgaris*	ROS	3	0.0889	0.0025	9.3024	0.2488
4	Canada	Ag	Metal	Unmodified	50	< 1	*C. vulgaris*	ROS	3	0.1306	0.0028	13.9536	0.2831
4	Canada	Ag	Metal	Unmodified	50	1 - 10	*C. vulgaris*	ROS	3	0.6696	0.0023	95.3490	0.2310
4	Canada	Ag	Metal	Unmodified	50	1 - 10	*C. vulgaris*	ROS	3	0.9209	0.0011	151.1631	0.1127
4	Canada	Ag	Metal	Unmodified	50	< 1	*D. tertiolecta*	ROS	3	0.0995	0.0025	10.4653	0.2459
4	Canada	Ag	Metal	Unmodified	50	< 1	*D. tertiolecta*	ROS	3	0.1204	0.0024	12.7908	0.2405
4	Canada	Ag	Metal	Unmodified	50	1 - 10	*D. tertiolecta*	ROS	3	0.8083	0.0022	124.4191	0.2212
4	Canada	Ag	Metal	Unmodified	50	1 - 10	*D. tertiolecta*	ROS	3	1.3775	0.0238	296.5118	2.4120
4	Canada	Ag	Metal	Unmodified	50	< 1	*C. vulgaris*	Chlorophyll	3	-0.0960	0.0023	-9.1526	0.2298
4	Canada	Ag	Metal	Unmodified	50	< 1	*C. vulgaris*	Chlorophyll	3	-0.1418	0.0021	-13.2203	0.2106
4	Canada	Ag	Metal	Unmodified	50	1 - 10	*C. vulgaris*	Chlorophyll	3	-0.4038	0.0026	-33.2203	0.2562
4	Canada	Ag	Metal	Unmodified	50	1 - 10	*C. vulgaris*	Chlorophyll	3	-0.7102	0.0021	-50.8474	0.2124
4	Canada	Ag	Metal	Unmodified	50	< 1	*D. tertiolecta*	Chlorophyll	3	-0.1575	0.0023	-14.5763	0.2291
4	Canada	Ag	Metal	Unmodified	50	< 1	*D. tertiolecta*	Chlorophyll	3	-0.2231	0.0023	-20.0000	0.2283
4	Canada	Ag	Metal	Unmodified	50	< 1	*D. tertiolecta*	Chlorophyll	3	-0.5690	0.0023	-43.3898	0.2305
4	Canada	Ag	Metal	Unmodified	50	1 - 10	*D. tertiolecta*	Chlorophyll	3	-1.4243	0.0035	-75.9322	0.3493
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	< 1	*C. reinhardtii*	ROS	4	0.0155	0.0183	1.5629	1.8425
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	1 - 10	*C. reinhardtii*	ROS	4	0.3298	0.0088	39.0629	0.8802
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	1 - 10	*C. reinhardtii*	ROS	4	0.4951	0.0064	64.0629	0.6416
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	10 - 50	*C. reinhardtii*	ROS	4	0.4463	0.0058	56.2505	0.5861
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	10 - 50	*C. reinhardtii*	ROS	4	0.4661	0.0073	59.3752	0.7374
5	Canada	CuO	Metal oxides	Coated	81	< 1	*C. reinhardtii*	ROS	4	0.1038	0.0090	10.9381	0.9001
5	Canada	CuO	Metal oxides	Coated	81	1 - 10	*C. reinhardtii*	ROS	4	0.6033	0.0076	82.8124	0.7603

5	Canada	CuO	Metal oxides	Coated	81	1 - 10	*C. reinhardtii*	ROS	4	0.8383	0.0100	131.2505	1.0027
5	Canada	CuO	Metal oxides	Coated	81	10 - 50	*C. reinhardtii*	ROS	4	1.2347	0.0051	243.7505	0.5143
5	Canada	CuO	Metal oxides	Coated	81	10 - 50	*C. reinhardtii*	ROS	4	1.3626	0.0052	290.6257	0.5214
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	< 1	*C. reinhardtii*	PSII	4	0.0155	0.0183	1.5629	1.8425
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	1 - 10	*C. reinhardtii*	PSII	4	-0.0813	0.0121	-7.8124	1.2200
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	1 - 10	*C. reinhardtii*	PSII	4	-0.0813	0.0061	-7.8124	0.6112
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	10 - 50	*C. reinhardtii*	PSII	4	-0.1335	0.0062	-12.4999	0.6239
5	Canada	CuO	Metal oxides	Unmodified	30 - 40	10 - 50	*C. reinhardtii*	PSII	4	-0.2469	0.0218	-21.8749	2.2084
5	Canada	CuO	Metal oxides	Coated	81	< 1	*C. reinhardtii*	PSII	4	0.1038	0.0090	10.9381	0.9001
5	Canada	CuO	Metal oxides	Coated	81	1 - 10	*C. reinhardtii*	PSII	4	-0.0157	0.0072	-1.5624	0.7238
5	Canada	CuO	Metal oxides	Coated	81	1 - 10	*C. reinhardtii*	PSII	4	0.0606	0.0076	6.2505	0.7622
5	Canada	CuO	Metal oxides	Coated	81	10 - 50	*C. reinhardtii*	PSII	4	-0.7577	0.0186	-53.1250	1.8728
5	Canada	CuO	Metal oxides	Coated	81	10 - 50	*C. reinhardtii*	PSII	4	-2.0794	0.2549	-87.5000	29.0389
6	Canada	Fe3O4	Metal oxides	Unmodified	195.9	10 - 50	*C. vulgaris*	Cell density	3	-0.0938	0.0093	-8.9552	0.9298
6	Canada	Fe3O4	Metal oxides	Unmodified	195.9	10 - 50	*C. vulgaris*	Cell density	3	-0.0840	0.0005	-8.0597	0.0522
6	Canada	Fe3O4	Metal oxides	Unmodified	195.9	10 - 50	*C. vulgaris*	Cell density	3	-0.0873	0.0017	-8.3582	0.1713
6	Canada	Fe3O4	Metal oxides	Unmodified	195.9	50 - 100	*C. vulgaris*	Cell density	3	-0.2306	0.0121	-20.5970	1.2148
6	Canada	Fe3O4	Metal oxides	Unmodified	195.9	100 - 200	*C. vulgaris*	Cell density	3	-0.4205	0.0007	-34.3284	0.0738
6	Canada	Fe3O4	Metal oxides	Unmodified	195.9	200 - 500	*C. vulgaris*	Cell density	3	-0.6493	0.1650	-47.7612	17.9354

6	Canada	Co0.2Zn0.8Fe2O4	Metal oxides	Unmodified	176.5	10 - 50	*C. vulgaris*	Cell density	3	-0.0873	0.0091	-8.3582	0.9181
6	Canada	Co0.2Zn0.8Fe2O4	Metal oxides	Unmodified	176.5	10 - 50	*C. vulgaris*	Cell density	3	-0.1170	0.0004	-11.0448	0.0432
6	Canada	Co0.2Zn0.8Fe2O4	Metal oxides	Unmodified	176.5	10 - 50	*C. vulgaris*	Cell density	3	-0.1204	0.0015	-11.3433	0.1523
6	Canada	Co0.2Zn0.8Fe2O4	Metal oxides	Unmodified	176.5	50 - 100	*C. vulgaris*	Cell density	3	-0.1408	0.0005	-13.1343	0.0490
6	Canada	Co0.2Zn0.8Fe2O4	Metal oxides	Unmodified	176.5	100 - 200	*C. vulgaris*	Cell density	3	-0.2382	0.0003	-21.1940	0.0316
6	Canada	Co0.2Zn0.8Fe2O4	Metal oxides	Unmodified	176.5	200 - 500	*C. vulgaris*	Cell density	3	-0.2458	0.0003	-21.7910	0.0350
6	Canada	Co0.5Zn0.5Fe2O4	Metal oxides	Unmodified	347.2	10 - 50	*C. vulgaris*	Cell density	3	-0.0552	0.0004	-5.3731	0.0350
6	Canada	Co0.5Zn0.5Fe2O4	Metal oxides	Unmodified	347.2	10 - 50	*C. vulgaris*	Cell density	3	-0.0521	0.0005	-5.0746	0.0459
6	Canada	Co0.5Zn0.5Fe2O4	Metal oxides	Unmodified	347.2	10 - 50	*C. vulgaris*	Cell density	3	-0.0808	0.0004	-7.7612	0.0353
6	Canada	Co0.5Zn0.5Fe2O4	Metal oxides	Unmodified	347.2	50 - 100	*C. vulgaris*	Cell density	3	-0.0905	0.0025	-8.6567	0.2525
6	Canada	Co0.5Zn0.5Fe2O4	Metal oxides	Unmodified	347.2	100 - 200	*C. vulgaris*	Cell density	3	-0.1581	0.0004	-14.6269	0.0399
6	Canada	Co0.5Zn0.5Fe2O4	Metal oxides	Unmodified	347.2	200 - 500	*C. vulgaris*	Cell density	3	-0.1722	0.0004	-15.8209	0.0364
7	Bahrain	Fe3O4	Metal oxides	Unmodified	20	100 - 200	*Picochlorum. sp*	Chlorophyll a	3	-0.1645	0.0070	-15.1658	0.6981
7	Bahrain	Fe3O4	Metal oxides	Unmodified	40	100 - 200	*Picochlorum. sp*	Chlorophyll a	3	0.0372	0.0085	3.7917	0.8560
7	Bahrain	Fe3O4	Metal oxides	Unmodified	> 100	100 - 200	*Picochlorum. sp*	Chlorophyll a	3	-0.0737	0.0128	-7.1090	1.2837
8	China	GO	Carbon	Unmodified	0.5 - 5	< 1	*C. vulgaris*	ROS	3	0.1688	0.0008	18.3904	0.0831
8	China	GO	Carbon	Unmodified	0.5 – 5	< 1	*C. vulgaris*	ROS	3	0.1591	0.0012	17.2413	0.1218
8	China	GO	Carbon	Unmodified	0.5 - 5	1 - 10	*C. vulgaris*	ROS	3	0.1492	0.0015	16.0923	0.1523
8	China	GO	Carbon	Unmodified	0.5 - 5	1 - 10	*C. vulgaris*	ROS	3	0.4244	0.0022	52.8733	0.2234
8	China	C-SWCNT	Carbon	Unmodified	0.5 - 5	< 1	*C. vulgaris*	ROS	3	0.2615	0.0007	29.8850	0.0731
8	China	C-SWCNT	Carbon	Unmodified	0.5 - 5	< 1	*C. vulgaris*	ROS	3	0.2526	0.0014	28.7360	0.1370

8	China	C-SWCNT	Carbon	Unmodified	0.5 - 5	1 - 10	*C. vulgaris*	ROS	3	0.2703	0.0009	31.0341	0.0936
8	China	C-SWCNT	Carbon	Unmodified	0.5 - 5	1 - 10	*C. vulgaris*	ROS	3	0.7046	0.0025	102.2989	0.2526
8	China	GO	Carbon	Unmodified	0.5 - 5	< 1	*C. vulgaris*	Chlorophyll a	3	-0.0821	0.0057	-7.8821	0.5667
8	China	GO	Carbon	Unmodified	0.5 - 5	< 1	*C. vulgaris*	Chlorophyll a	3	-0.0821	0.0061	-7.8821	0.6166
8	China	GO	Carbon	Unmodified	0.5 - 5	1 - 10	*C. vulgaris*	Chlorophyll a	3	-0.0929	0.0062	-8.8671	0.6207
8	China	GO	Carbon	Unmodified	0.5 - 5	1 - 10	*C. vulgaris*	Chlorophyll a	3	-0.0351	0.0101	-3.4482	1.0196
8	China	C-SWCNT	Carbon	Unmodified	0.5 - 5	< 1	*C. vulgaris*	Chlorophyll a	3	-0.0351	0.0045	-3.4482	0.4506
8	China	C-SWCNT	Carbon	Unmodified	0.5 - 5	< 1	*C. vulgaris*	Chlorophyll a	3	-0.0454	0.0058	-4.4339	0.5792
8	China	C-SWCNT	Carbon	Unmodified	0.5 - 5	1 - 10	*C. vulgaris*	Chlorophyll a	3	-0.0768	0.0044	-7.3896	0.4439
8	China	C-SWCNT	Carbon	Unmodified	0.5 - 3	1 - 10	*C. vulgaris*	Chlorophyll a	3	-0.2763	0.0083	-24.1381	0.8376
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*K. brevis*	Cell density	3	-0.0105	0.0010	-1.0457	0.0997
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*S. costatum*	Cell density	3	0.0070	0.0074	0.7043	0.7468
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*K. brevis*	Chlorophyll a	3	-0.0099	0.0035	-0.9834	0.3477
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*K. brevis*	Chlorophyll a	3	0.0354	0.0016	3.6067	0.1559
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*K. brevis*	Chlorophyll a	3	-0.2736	0.0020	-23.9345	0.2022
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*K. brevis*	Chlorophyll a	3	-0.7645	0.0014	-53.4425	0.1402
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*S. costatum*	Chlorophyll a	3	-0.1593	0.0137	-14.7258	1.3791
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*S. costatum*	Chlorophyll a	3	-0.3685	0.0102	-30.8218	1.0213
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*S. costatum*	Chlorophyll a	3	-0.4089	0.0107	-33.5616	1.0759
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*S. costatum*	Chlorophyll a	3	-0.9583	0.1059	-61.6437	11.1715
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*K. brevis*	MDA	3	0.4233	0.0734	52.7028	7.6153
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*K. brevis*	MDA	3	0.4666	0.0851	59.4597	8.8844
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*K. brevis*	MDA	3	0.6304	0.0739	87.8381	7.6645

9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*K. brevis*	MDA	3	0.8861	0.0732	142.5679	7.5946
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*S. costatum*	MDA	3	0.1881	0.0262	20.6898	2.6547
9	China	TiO2	Metal oxides	Unmodified	10 - 30	1 - 10	*S. costatum*	MDA	3	0.5296	0.0398	69.8281	4.0608
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*S.costatum*	MDA	3	0.8848	0.0318	142.2421	3.2299
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*S.costatum*	MDA	3	1.0116	0.0380	175.0004	3.8689
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*K. brevis*	ROS	3	0.9140	0.0030	149.4257	0.3019
9	China	TiO2	Metal oxides	Unmodified	10 - 30	10 - 50	*S. costatum*	ROS	3	0.2022	0.0488	22.4038	4.9979
10	Brazil	Cr2O3	Metal oxides	Unmodified	< 100	1 - 10	*C. reinhardtii*	Cell density	3	-0.0104	0.0248	-1.0332	2.5079
10	Brazil	Cr2O3	Metal oxides	Unmodified	< 100	50 - 100	*C. reinhardtii*	Cell density	3	0.1517	0.0011	16.3759	0.1101
10	Brazil	Cr2O3	Metal oxides	Unmodified	< 100	500 - 1000	*C. reinhardtii*	Cell density	3	-0.0822	0.0128	-7.8950	1.2888
10	Brazil	Cr2O3	Metal oxides	Unmodified	< 100	> 2000	*C. reinhardtii*	Cell density	3	-1.5970	0.0047	-79.7492	0.4751
11	China	RGO	Carbon	Unmodified	0.2 - 5	1 - 10	*S. obliquus*	ROS	5	0.2469	0.0130	27.9999	1.3117
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	ROS	5	0.6454	0.0194	90.6663	1.9638
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	ROS	5	0.8065	0.0188	123.9999	1.8973
11	China	RGO	Carbon	Unmodified	0.2 - 5	50 - 100	*S. obliquus*	ROS	5	0.8587	0.0190	136.0001	1.9152
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	ROS	5	0.9908	0.0215	169.3337	2.1714
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	ROS	5	1.2355	0.0161	244.0003	1.6239
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	ROS	5	1.3137	0.0146	272.0006	1.4680
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	ROS	5	1.4414	0.0195	322.6667	1.9723
11	China	RGO	Carbon	Unmodified	0.2 - 5	1 - 10	*S. obliquus*	Chlorophyll a	5	-0.2703	0.0018	-23.6824	0.1802
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	Chlorophyll a	5	-0.2119	0.0031	-19.0980	0.3137
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	Chlorophyll a	5	-0.4713	0.0042	-37.5786	0.4198
11	China	RGO	Carbon	Unmodified	0.2 - 5	50 - 100	*S. obliquus*	Chlorophyll a	5	-1.9400	0.0038	-85.6294	0.3804
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	Chlorophyll a	5	-2.3472	0.0021	-90.4367	0.2080

11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	Chlorophyll a	5	-2.2505	0.0025	-89.4650	0.2503
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	Chlorophyll a	5	-2.1006	0.0042	-87.7615	0.4203
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	Chlorophyll a	5	-2.5895	0.0151	-92.4946	1.5167
11	China	RGO	Carbon	Unmodified	0.2 - 5	1 - 10	*S. obliquus*	Chlorophyll b	5	-0.1907	0.0056	-17.3579	0.5569
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	Chlorophyll b	5	-0.0552	0.0047	-5.3669	0.4684
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	Chlorophyll b	5	0.1656	0.0079	18.0146	0.7938
11	China	RGO	Carbon	Unmodified	0.2 - 5	50 - 100	*S. obliquus*	Chlorophyll b	5	-1.1239	0.0148	-67.4986	1.4877
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	Chlorophyll b	5	-0.8578	0.0050	-57.5905	0.5008
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	Chlorophyll b	5	-0.5567	0.0160	-42.6909	1.6128
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	Chlorophyll b	5	-0.3337	0.0075	-28.3731	0.7511
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	Chlorophyll b	5	-1.0683	0.0039	-65.6408	0.3901
11	China	RGO	Carbon	Unmodified	0.2 - 5	1 - 10	*S. obliquus*	MDA	5	0.5188	0.0018	68.0001	0.1794
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	MDA	5	0.6098	0.0028	84.0006	0.2796
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	MDA	5	2.4631	0.0150	1074.1463	1.5079
11	China	RGO	Carbon	Unmodified	0.2 - 5	50 - 100	*S. obliquus*	MDA	5	3.1125	0.0033	2147.6485	0.3352
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	MDA	5	3.9954	0.0037	5334.6112	0.3700
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	MDA	5	4.1389	0.0018	6173.2884	0.1835
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	MDA	5	4.4646	0.0019	8588.6827	0.1935
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	MDA	5	4.7038	0.0030	10936.9683	0.2996
11	China	RGO	Carbon	Unmodified	0.2 - 5	1 - 10	*S. obliquus*	Cell permeability	5	0.5173	0.0014	67.7419	0.1413
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	Cell permeability	5	0.5973	0.0004	81.7204	0.0366
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	Cell permeability	5	0.8240	0.0005	127.9569	0.0468
11	China	RGO	Carbon	Unmodified	0.2 - 5	50 - 100	*S. obliquus*	Cell permeability	5	1.0126	0.0103	175.2686	1.0342
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	Cell permeability	5	1.1058	0.0043	202.1506	0.4290
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	Cell permeability	5	1.4412	0.0052	322.5808	0.5176
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	Cell permeability	5	1.3479	0.0033	284.9458	0.3331

11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	Cell permeability	5	1.4762	0.0013	337.6345	0.1260
11	China	RGO	Carbon	Unmodified	0.2 - 5	1 - 10	*S. obliquus*	POD	5	0.9410	0.0107	156.2499	1.0797
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	POD	5	1.3218	0.0040	275.0003	0.4022
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	POD	5	2.3454	0.0114	943.7549	1.1480
11	China	RGO	Carbon	Unmodified	0.2 - 5	50 - 100	*S. obliquus*	POD	5	2.8478	0.0067	1624.9968	0.6742
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	POD	5	3.0386	0.0053	1987.4994	0.5335
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	POD	5	2.6524	0.0041	1318.7479	0.4127
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	POD	5	2.4092	0.0052	1012.4989	0.5183
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	POD	5	1.3049	0.0197	268.7499	1.9926
11	China	RGO	Carbon	Unmodified	0.2 - 5	1 - 10	*S. obliquus*	SOD	5	0.3307	0.0025	39.1893	0.2525
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	SOD	5	0.3307	0.0045	39.1893	0.4511
11	China	RGO	Carbon	Unmodified	0.2 - 5	10 - 50	*S. obliquus*	SOD	5	1.6100	0.0275	400.2601	2.7892
11	China	RGO	Carbon	Unmodified	0.2 - 5	50 - 100	*S. obliquus*	SOD	5	2.5691	0.0014	1205.4410	0.1412
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	SOD	5	2.7367	0.0014	1443.6606	0.1363
11	China	RGO	Carbon	Unmodified	0.2 - 5	100 - 200	*S. obliquus*	SOD	5	2.5764	0.0014	1214.9694	0.1410
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	SOD	5	1.7009	0.0198	447.9045	2.0039
11	China	RGO	Carbon	Unmodified	0.2 - 5	200 - 500	*S. obliquus*	SOD	5	1.6565	0.0108	424.0811	1.0895
12	Bahrain	ZnO	Metal oxides	Unmodified	50	1 - 10	*Picochlorum. sp*	Chlorophyll a	3	0.3606	0.0093	43.4209	0.9303
12	Bahrain	TiO2	Metal oxides	Unmodified	21	1 - 10	*Picochlorum. sp*	Chlorophyll a	3	0.2388	0.0028	26.9734	0.2806
12	Bahrain	ZnO/TiO2	Metal oxides	Unmodified	21 - 50	1 - 10	*Picochlorum. sp*	Chlorophyll a	3	0.2593	0.0023	29.6051	0.2295
12	Bahrain	ZnO	Metal oxides	Unmodified	50	1 - 10	*Picochlorum. sp*	Cell density	3	1.7568	0.0875	479.4119	9.1432
12	Bahrain	TiO2	Metal oxides	Unmodified	21	1 - 10	*Picochlorum. sp*	Cell density	3	1.2939	0.0912	264.7072	9.5443
12	Bahrain	ZnO/TiO2	Metal oxides	Unmodified	21- 50	1 - 10	*Picochlorum. sp*	Cell density	3	1.5235	0.0856	358.8244	8.9423
13	China	Ag	Metal	Coated	10	< 1	*S. costatum*	ROS	3	0.2187	0.0314	24.4440	3.1867
13	China	Ag	Metal	Coated	10	< 1	*S. costatum*	ROS	3	0.7985	0.0139	122.2220	1.3965
13	China	Ag	Metal	Coated	10	1 - 10	*S. costatum*	ROS	3	1.3053	0.0154	268.8890	1.5493

13	China	Ag	Metal	Coated	10	10 - 50	*S. costatum*	ROS	3	1.4244	0.0136	315.5560	1.3717
13	China	Ag	Metal	Coated	10	< 1	*S. costatum*	Chlorophyll a	3	0.0456	0.0002	4.6672	0.0181
13	China	Ag	Metal	Coated	10	< 1	*S. costatum*	Chlorophyll a	3	0.0263	0.0001	2.6671	0.0116
13	China	Ag	Metal	Coated	10	1 - 10	*S. costatum*	Chlorophyll a	3	-0.0339	0.0001	-3.3329	0.0123
13	China	Ag	Metal	Coated	10	10 - 50	*S. costatum*	Chlorophyll a	3	-0.0762	0.0001	-7.3329	0.0077
13	China	Ag	Metal	Coated	10	< 1	*S. costatum*	Cell density	3	-0.1960	0.0003	-17.8008	0.0299
13	China	Ag	Metal	Coated	10	< 1	*S. costatum*	Cell density	3	-0.3396	0.0002	-28.7955	0.0244
13	China	Ag	Metal	Coated	10	1 - 10	*S. costatum*	Cell density	3	-0.6273	0.0004	-46.5967	0.0371
13	China	Ag	Metal	Coated	10	10 - 50	*S. costatum*	Cell density	3	-0.7864	0.0005	-54.4501	0.0479
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	ROS	4	2.9749	0.0012	1858.8280	0.1190
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	ROS	4	0.0000	0.0043	0.0000	0.4335
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	MDA	4	2.8717	0.0103	1666.6674	1.0349
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	MDA	4	1.7731	0.0120	488.8888	1.2058
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	POD	4	0.2616	0.0082	29.8961	0.8281
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	POD	4	0.7483	0.0088	111.3395	0.8847
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	CAT	4	-0.2028	0.0188	-18.3540	1.8941
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	CAT	4	0.3755	0.0031	45.5705	0.3090
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	Chlorophyll a	4	-0.1145	0.0014	-10.8225	0.1376
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	Chlorophyll a	4	-0.4588	0.0034	-36.7966	0.3388
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	Chlorophyll a	4	-0.8273	0.0059	-56.2770	0.5911
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*M. aeruginosa*	Chlorophyll a	4	-1.8048	0.0066	-83.5498	0.6634
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	Chlorophyll a	4	0.0506	0.0038	5.1947	0.3767
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	Chlorophyll a	4	0.0710	0.0042	7.3591	0.4225
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	Chlorophyll a	4	0.0129	0.0041	1.2985	0.4088
14	China	Ag	Metal	Unmodified	9 - 10	< 1	*C. vulgaris*	Chlorophyll a	4	-0.4452	0.0037	-35.9307	0.3717
15	China	TiO2	Metal oxides	Unmodified	15	1 - 10	*P. tricornutum*	Chlorophyll a	3	-0.1124	0.0002	-10.6300	0.0182
15	China	TiO2	Metal oxides	Unmodified	15	10 - 50	*P. tricornutum*	Chlorophyll a	3	-0.1347	0.0000	-12.5985	0.0027
15	China	TiO2	Metal oxides	Unmodified	15	1 - 10	*P. tricornutum*	Cell density	3	-0.0840	0.0018	-8.0568	0.1803
15	China	TiO2	Metal	Unmodified	15	1 - 10	*P. tricornutum*	Cell density	3	-0.0892	0.0056	-8.5305	0.5574

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15	China	TiO2	Metal oxides	Unmodified	15	10 - 50	*P. tricornutum*	Cell density	3	-0.3446	0.0053	-29.1469	0.5306
15	China	TiO2	Metal oxides	Unmodified	15	10 - 50	*P. tricornutum*	Cell density	3	-0.4246	0.0039	-34.5970	0.3875
15	China	TiO2	Metal oxides	Unmodified	15	50 - 100	*P. tricornutum*	Cell density	3	-0.6979	0.0053	-50.2367	0.5310
15	China	TiO2	Metal oxides	Unmodified	15	100 - 200	*P. tricornutum*	Cell density	3	-0.7417	0.0026	-52.3696	0.2575
15	China	TiO2	Metal oxides	Unmodified	15	1 - 10	*P. tricornutum*	Cell permeability	3	0.4626	0.1785	58.8235	19.5398
15	China	TiO2	Metal oxides	Unmodified	15	1 - 10	*P. tricornutum*	Cell permeability	3	1.4708	0.0302	335.2931	3.0656
15	China	TiO2	Metal oxides	Unmodified	15	10 - 50	*P. tricornutum*	Cell permeability	3	1.6994	0.0287	447.0588	2.9117
15	China	TiO2	Metal oxides	Unmodified	15	10 - 50	*P. tricornutum*	Cell permeability	3	2.0382	0.0113	667.6463	1.1377
15	China	TiO2	Metal oxides	Unmodified	15	50 - 100	*P. tricornutum*	Cell permeability	3	1.9204	0.0085	582.3529	0.8520
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.1746	0.0025	-16.0166	0.2544
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.3077	0.0020	-26.4887	0.1998
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-0.2856	0.0003	-24.8464	0.0277
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-1.9116	0.0790	-85.2157	8.2210
16	China	CQDs	Quantun dots	Doped	< 10	50 - 100	*C. pyrenoidosa*	Chlorophyll a	3	-2.0939	0.0006	-87.6797	0.0608
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.3581	0.0003	-30.0971	0.0311
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.3664	0.0003	-30.6797	0.0262
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-0.4821	0.0007	-38.2528	0.0742
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-0.8192	0.0004	-55.9224	0.0414

16	China	CQDs	Quantun dots	Doped	< 10	50 - 100	*C. pyrenoidosa*	Chlorophyll a	3	-5.5510	0.0206	-99.6117	2.0842
16	China	CQDs	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.1665	0.0013	-15.3361	0.1264
16	China	CQDs	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.3248	0.0029	-27.7314	0.2889
16	China	CQDs	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-0.2990	0.0003	-25.8408	0.0309
16	China	CQDs	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-0.5235	0.0014	-40.7565	0.1390
16	China	CQDs	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	Chlorophyll a	3	-2.3153	0.0076	-90.1261	0.7600
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Chlorophyll a	3	-1.5663	0.0029	-79.1188	0.2870
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Chlorophyll a	3	-2.1633	0.0015	-88.5058	0.1543
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Chlorophyll a	3	-3.0388	0.0006	-95.2107	0.0593
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Chlorophyll a	3	-2.7612	0.0001	-93.6781	0.0060
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Chlorophyll a	3	-2.7023	0.0003	-93.2950	0.0332
16	China	CdS	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Chlorophyll a	3	-0.2364	0.0002	-21.0523	0.0205
16	China	CdS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.3919	0.0000	-32.4213	0.0017
16	China	CdS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-2.8675	0.0018	-94.3158	0.1844
16	China	CdS	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-2.8311	0.0004	-94.1053	0.0439
16	China	CdS	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	Chlorophyll a	3	-5.4702	0.0833	-99.5789	8.6918
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Chlorophyll a	3	-0.1067	0.0008	-10.1180	0.0758
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	Chlorophyll a	3	-0.3887	0.0016	-32.2094	0.1640
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	Chlorophyll a	3	-0.8207	0.0015	-55.9866	0.1469

16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	100 - 200	*C. pyrenoidosa*	Chlorophyll a	3	-1.1867	0.0007	-69.4773	0.0651
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	500 - 1000	*C. pyrenoidosa*	Chlorophyll a	3	-2.6010	0.0008	-92.5801	0.0813
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.0818	0.0009	-7.8550	0.0861
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.2747	0.0032	-24.0178	0.3157
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.3009	0.0012	-25.9817	0.1230
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	Cell density	3	-1.1200	0.0009	-67.3716	0.0857
16	China	CQDs	Quantun dots	Doped	< 10	50 - 100	*C. pyrenoidosa*	Cell density	3	-1.4015	0.0009	-75.3776	0.0942
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.1005	0.0005	-9.5576	0.0493
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.1024	0.0005	-9.7346	0.0466
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	Cell density	3	-0.1798	0.0009	-16.4602	0.0893
16	China	CQDs	Quantun dots	Doped	< 10	50 - 100	*C. pyrenoidosa*	Cell density	3	-0.4732	0.0005	-37.6989	0.0504
16	China	CQDs	Quantun dots	Doped	< 10	200 - 500	*C. pyrenoidosa*	Cell density	3	-2.2938	0.0107	-89.9115	1.0778
16	China	CQDs	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.1415	0.0001	-13.1983	0.0098
16	China	CQDs	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.1513	0.0001	-14.0444	0.0089
16	China	CQDs	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	Cell density	3	-0.2164	0.0003	-19.4587	0.0326
16	China	CQDs	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	Cell density	3	-0.5267	0.0002	-40.9475	0.0211
16	China	CQDs	Quantun dots	Unmodified	< 10	200 - 500	*C. pyrenoidosa*	Cell density	3	-1.6905	0.0005	-81.5567	0.0526
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Cell density	3	-0.8593	0.0001	-57.6530	0.0083
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Cell density	3	-1.3016	0.0002	-72.7891	0.0152

16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Cell density	3	-2.2824	0.0000	-89.7959	0.0035
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Cell density	3	-2.2496	0.0014	-89.4558	0.1423
16	China	CdTe	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-2.2824	0.0015	-89.7959	0.1517
16	China	CdS	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	Cell density	3	-0.1309	0.0002	-12.2692	0.0207
16	China	CdS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.1347	0.0000	-12.6053	0.0031
16	China	CdS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-1.9112	0.0011	-85.2101	0.1077
16	China	CdS	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	Cell density	3	-2.1545	0.0011	-88.4034	0.1121
16	China	CdS	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	Cell density	3	-2.5384	0.0024	-92.1009	0.2417
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	Cell density	3	-0.0747	0.0003	-7.2013	0.0266
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	Cell density	3	-0.1925	0.0002	-17.5119	0.0159
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	Cell density	3	-0.4236	0.0007	-34.5333	0.0675
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	100 - 200	*C. pyrenoidosa*	Cell density	3	-0.6915	0.0001	-49.9181	0.0057
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	500 - 1000	*C. pyrenoidosa*	Cell density	3	-2.0456	0.0013	-87.0703	0.1336
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	-0.1462	0.0161	-13.5972	1.6260
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	-0.3293	0.0170	-28.0551	1.7180
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	-0.3317	0.0158	-28.2272	1.5878
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	MDA	3	-0.2163	0.0156	-19.4492	1.5704
16	China	CQDs	Quantun dots	Doped	< 10	50 - 100	*C. pyrenoidosa*	MDA	3	0.8830	0.0155	141.8244	1.5625
16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	0.2087	0.0048	23.2014	0.4853

16	China	CQDs	Quantun dots	Doped	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	0.0828	0.0050	8.6331	0.5032
16	China	CQDs	Quantun dots	Doped	< 10	10 - 50	*C. pyrenoidosa*	MDA	3	0.1969	0.0075	21.7626	0.7486
16	China	CQDs	Quantun dots	Doped	< 10	50 - 100	*C. pyrenoidosa*	MDA	3	0.1608	0.0072	17.4460	0.7231
16	China	CQDs	Quantun dots	Doped	< 10	200 - 500	*C. pyrenoidosa*	MDA	3	0.3282	0.0094	38.8489	0.9415
16	China	CQDs	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	0.0315	0.0049	3.1983	0.4923
16	China	CQDs	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	-0.1032	0.0009	-9.8081	0.0875
16	China	CQDs	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	MDA	3	0.0600	0.0015	6.1834	0.1516
16	China	CQDs	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	MDA	3	0.2107	0.0034	23.4542	0.3405
16	China	CQDs	Quantun dots	Unmodified	< 10	200 - 500	*C. pyrenoidosa*	MDA	3	0.3248	0.0013	38.3795	0.1319
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	MDA	3	-0.7583	0.0455	-53.1532	4.6504
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	MDA	3	-0.5987	0.0321	-45.0450	3.2613
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	MDA	3	-0.6152	0.0310	-45.9459	3.1523
16	China	CdTe	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	MDA	3	1.6723	0.0278	432.4324	2.8153
16	China	CdTe	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	2.1246	0.0278	736.9369	2.8148
16	China	CdS	Quantun dots	Unmodified	< 10	< 1	*C. pyrenoidosa*	MDA	3	-0.0910	0.0447	-8.6957	4.5740
16	China	CdS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	1.4035	0.0242	306.9565	2.4539
16	China	CdS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	1.2161	0.0248	237.3913	2.5123
16	China	CdS	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	MDA	3	1.6702	0.0249	431.3043	2.5230
16	China	CdS	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	MDA	3	2.3198	0.0233	917.3913	2.3566

16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	1 - 10	*C. pyrenoidosa*	MDA	3	-0.0211	0.0027	-2.0833	0.2664
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	10 - 50	*C. pyrenoidosa*	MDA	3	0.0000	0.0106	0.0000	1.0617
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	50 - 100	*C. pyrenoidosa*	MDA	3	1.1787	0.0036	225.0000	0.3623
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	100 - 200	*C. pyrenoidosa*	MDA	3	1.8686	0.0099	547.9167	0.9967
16	China	CuInS2/ZnS	Quantun dots	Unmodified	< 10	500 - 1000	*C. pyrenoidosa*	MDA	3	3.1418	0.0020	2214.5833	0.1979
17	China	ZnO	Metal oxides	Unmodified	50	< 1	*S. costatum*	Cell density	3	-0.2899	0.0097	-25.1679	0.9717
17	China	ZnO	Metal oxides	Unmodified	50	1 - 10	*S. costatum*	Cell density	3	-0.5380	0.0138	-41.6108	1.3866
17	China	ZnO	Metal oxides	Unmodified	50	1 - 10	*S. costatum*	Cell density	3	-1.1645	0.0065	-68.7920	0.6548
17	China	ZnO	Metal oxides	Unmodified	50	1 - 10	*S. costatum*	Cell density	3	-1.5227	0.0165	-78.1879	1.6637
17	China	ZnO	Metal oxides	Unmodified	50	1 - 10	*S. costatum*	Cell density	3	-1.9594	0.0119	-85.9061	1.2013
17	China	ZnO	Metal oxides	Unmodified	50	1 - 10	*S. costatum*	MDA	3	0.2601	0.0050	29.7102	0.4969
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	Chlorophyll a	3	0.1603	0.0068	17.3911	0.6819
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	Chlorophyll a	3	0.2446	0.0178	27.7171	1.8005
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	Chlorophyll a	3	0.3572	0.0105	42.9347	1.0591
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	Chlorophyll a	3	0.4376	0.0119	54.8911	1.1954
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	Chlorophyll a	3	0.4515	0.0078	57.0650	0.7804
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	Chlorophyll a	3	0.0104	0.0082	1.0453	0.8268
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	Chlorophyll a	3	0.1636	0.0071	17.7701	0.7120
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	Chlorophyll a	3	0.2701	0.0073	31.0106	0.7291

18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	Chlorophyll a	3	0.3194	0.0084	37.6308	0.8395
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	Chlorophyll a	3	0.1956	0.0068	21.6028	0.6870
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	PSII	3	-0.0529	0.0002	-5.1565	0.0239
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	PSII	3	-0.0865	0.0001	-8.2874	0.0125
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	PSII	3	-0.1150	0.0002	-10.8656	0.0164
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	PSII	3	-0.1529	0.0003	-14.1805	0.0267
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	PSII	3	-0.1856	0.0002	-16.9429	0.0193
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	PSII	3	-0.4603	0.0037	-36.8888	0.3668
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	PSII	3	-0.9502	0.0026	-61.3332	0.2583
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	PSII	3	-1.1820	0.0039	-69.3334	0.3859
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	PSII	3	-1.1120	0.0043	-67.1110	0.4326
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	PSII	3	-1.5660	0.0101	-79.1111	1.0130
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	Cell density	3	-0.0570	0.0005	-5.5394	0.0486
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	Cell density	3	-0.1076	0.0003	-10.2043	0.0274
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	Cell density	3	-0.1958	0.0005	-17.7843	0.0521
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	Cell density	3	-0.2770	0.0006	-24.1983	0.0595
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	Cell density	3	-0.3243	0.0004	-27.6968	0.0449
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	Cell density	3	0.1114	0.0143	11.7836	1.4408
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	Cell density	3	0.0825	0.0135	8.5989	1.3571

18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	Cell density	3	-0.0590	0.0132	-5.7323	1.3327
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	Cell density	3	-0.1473	0.0134	-13.6942	1.3541
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	Cell density	3	-0.3289	0.0136	-28.0254	1.3742
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	MDA	3	0.6050	0.0102	83.1327	1.0266
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	MDA	3	0.7402	0.0101	109.6394	1.0201
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	MDA	3	0.9187	0.0079	150.6034	0.7931
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	MDA	3	1.3463	0.0112	284.3369	1.1276
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	MDA	3	1.5499	0.0093	371.0842	0.9386
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	MDA	3	-0.1030	0.0033	-9.7902	0.3260
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	MDA	3	0.5220	0.0043	68.5320	0.4277
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	MDA	3	0.7036	0.0058	102.0975	0.5825
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	MDA	3	0.7705	0.0037	116.0835	0.3669
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	MDA	3	1.0774	0.0021	193.7062	0.2067
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	SOD	3	1.4481	0.0056	325.4909	0.5593
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	SOD	3	1.7311	0.0039	464.7070	0.3878
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	SOD	3	2.0496	0.0031	676.4701	0.3072
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	SOD	3	1.9763	0.0023	621.5716	0.2348
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	SOD	3	2.0696	0.0026	692.1563	0.2646
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	SOD	3	-0.1304	0.0021	-12.2221	0.2072

18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	SOD	3	0.0111	0.0024	1.1112	0.2382
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	SOD	3	0.6301	0.0021	87.7779	0.2065
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	SOD	3	1.0336	0.0073	181.1115	0.7376
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	SOD	3	1.4740	0.0048	336.6666	0.4825
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	POD	3	0.6723	0.0108	95.8678	1.0817
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	POD	3	0.8390	0.0110	131.4050	1.1058
18	China	TiO2	Metal oxides	Unmodified	5 - 10	1 - 10	*P. tricornutum*	POD	3	1.0449	0.0102	184.2978	1.0273
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	POD	3	1.0847	0.0115	195.8685	1.1605
18	China	TiO2	Metal oxides	Unmodified	5 - 10	10 - 50	*P. tricornutum*	POD	3	1.1068	0.0105	202.4795	1.0584
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	POD	3	-0.0827	0.0126	-7.9365	1.2720
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	POD	3	0.1609	0.0107	17.4604	1.0768
18	China	CeO2	Metal oxides	Unmodified	10 - 30	1 - 10	*P. tricornutum*	POD	3	0.9567	0.0133	160.3172	1.3424
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	POD	3	1.8204	0.0105	517.4600	1.0535
18	China	CeO2	Metal oxides	Unmodified	10 - 30	10 - 50	*P. tricornutum*	POD	3	1.7758	0.0109	490.4762	1.1003
19	Bahrain	GO	Carbon	Unmodified	< 20	< 1	*Picochlorum. sp*	Chlorophyll a	3	0.6931	0.0009	100.0000	0.0871
19	Bahrain	GO	Carbon	Unmodified	< 20	1 - 10	*Picochlorum. sp*	Chlorophyll a	3	0.2856	0.0194	33.0576	1.9578
19	Bahrain	GO	Carbon	Unmodified	< 20	1 - 10	*Picochlorum. sp*	Chlorophyll a	3	0.1946	0.0027	21.4875	0.2690
19	Bahrain	GO	Carbon	Unmodified	< 20	1 - 10	*Picochlorum. sp*	Chlorophyll a	3	-0.1230	0.0022	-11.5705	0.2249
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C.autotrophica*	ROS	3	0.0000	0.2483	0.0000	28.1842
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C.autotrophica*	ROS	3	0.1942	0.2473	21.4281	28.0568
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C.autotrophica*	ROS	3	0.5390	0.6925	71.4289	99.8635
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C.autotrophica*	ROS	3	0.4964	0.2461	64.2856	27.9038

20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C.autotrophica*	ROS	3	2.4669	0.2428	1078.5755	27.4833
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	ROS	3	0.7855	0.0302	119.3540	3.0684
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	ROS	3	-0.2985	0.0171	-25.8064	1.7288
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	ROS	3	0.3502	0.0572	41.9354	5.8839
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	ROS	3	0.7557	0.0455	112.9040	4.6512
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	ROS	3	1.8339	0.0049	525.8060	0.4942
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C.autotrophica*	ROS	3	0.2877	0.3656	33.3329	44.1387
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C.autotrophica*	ROS	3	-0.0800	0.1986	-7.6922	21.9646
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C.autotrophica*	ROS	3	0.5559	0.3074	74.3589	35.9872
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C.autotrophica*	ROS	3	-0.7191	0.2072	-51.2821	23.0282
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C.autotrophica*	ROS	3	-1.1787	0.2060	-69.2307	22.8775
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	ROS	3	-1.3700	0.0609	-74.5901	6.2748
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	ROS	3	-1.6685	0.1257	-81.1475	13.3993
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	ROS	3	-0.1988	0.2968	-18.0327	34.5509
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	ROS	3	-0.1889	0.2166	-17.2130	24.1885
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	ROS	3	-0.3497	0.1018	-29.5082	10.7160
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	Chlorophyll a	3	-0.0051	0.0006	-0.5102	0.0645
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	Chlorophyll a	3	-0.0852	0.0054	-8.1633	0.5419
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	Chlorophyll a	3	-0.1782	0.0076	-16.3266	0.7592
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C. autotrophica*	Chlorophyll a	3	-0.6830	0.0032	-49.4898	0.3185
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C. autotrophica*	Chlorophyll a	3	-0.0963	0.0133	-9.1837	1.3402
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	Chlorophyll a	3	0.0891	0.0009	9.3168	0.0851
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	Chlorophyll a	3	0.0426	0.0084	4.3478	0.8483
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	Chlorophyll a	3	0.0366	0.0006	3.7267	0.0571

20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	Chlorophyll a	3	0.0661	0.0041	6.8323	0.4122
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	Chlorophyll a	3	-1.0210	0.0957	-63.9752	10.0414
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C. autotrophica*	Chlorophyll a	3	-0.0153	0.0004	-1.5229	0.0389
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C. autotrophica*	Chlorophyll a	3	-0.0257	0.0008	-2.5381	0.0753
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C. autotrophica*	Chlorophyll a	3	-0.0205	0.0014	-2.0305	0.1393
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C. autotrophica*	Chlorophyll a	3	0.0447	0.0013	4.5685	0.1260
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C. autotrophica*	Chlorophyll a	3	0.0151	0.0008	1.5229	0.0843
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	Chlorophyll a	3	0.0123	0.0005	1.2422	0.0513
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	Chlorophyll a	3	0.0603	0.0016	6.2112	0.1604
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	Chlorophyll a	3	0.0062	0.0011	0.6211	0.1086
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	Chlorophyll a	3	0.1865	0.0047	20.4969	0.4761
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	Chlorophyll a	3	0.1004	0.0013	10.5590	0.1316
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	PSII	3	-0.1173	0.0000	-11.0672	0.0047
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	PSII	3	-0.1084	0.0003	-10.2767	0.0254
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	PSII	3	-0.1443	0.0002	-13.4387	0.0195
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C. autotrophica*	PSII	3	-0.4835	0.0005	-38.3399	0.0514
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C. autotrophica*	PSII	3	-1.6622	0.0522	-81.0277	5.3637
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	PSII	3	-0.0622	0.0045	-6.0345	0.4540
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	PSII	3	-0.0577	0.0067	-5.6035	0.6718
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	PSII	3	0.0043	0.0048	0.4309	0.4812
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	PSII	3	-0.0761	0.0043	-7.3277	0.4260
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	PSII	3	-1.7579	0.2594	-82.7586	29.6143
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C. autotrophica*	PSII	3	-0.0281	0.0004	-2.7667	0.0373
20	Spain	CeO2	Metal	Unmodified	< 25	< 1	*C. autotrophica*	PSII	3	-0.0486	0.0000	-4.7431	0.0044

			oxides										
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*C. autotrophica*	PSII	3	-0.0569	0.0010	-5.5336	0.1008
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C. autotrophica*	PSII	3	-0.0611	0.0004	-5.9288	0.0398
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C. autotrophica*	PSII	3	-0.0119	0.0003	-1.1857	0.0282
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	PSII	3	-0.0262	0.0045	-2.5862	0.4516
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	PSII	3	-0.1189	0.0043	-11.2069	0.4321
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	PSII	3	-0.0174	0.0050	-1.7241	0.4975
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	PSII	3	-0.2156	0.0058	-19.3966	0.5814
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	PSII	3	-0.1534	0.0056	-14.2242	0.5625
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	Cell density	3	0.3276	0.0059	38.7597	0.5900
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	Cell density	3	0.2091	0.0064	23.2558	0.6456
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*C. autotrophica*	Cell density	3	0.2278	0.0086	25.5814	0.8684
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C. autotrophica*	Cell density	3	-1.2489	0.0097	-71.3178	0.9732
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*C. autotrophica*	Cell density	3	-2.2208	0.0126	-89.1473	1.2671
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	Cell density	3	-0.0826	0.0307	-7.9269	3.1141
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	Cell density	3	-0.1726	0.0282	-15.8536	2.8637
20	Spain	Ag	Metal	Unmodified	< 15	< 1	*D. salina*	Cell density	3	-0.2095	0.0673	-18.9024	6.9564
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	Cell density	3	-0.7561	0.0499	-53.0487	5.1129
20	Spain	Ag	Metal	Unmodified	< 15	1 - 10	*D. salina*	Cell density	3	-2.1041	0.0407	-87.8049	4.1550
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*Cautotrophica*	Cell density	3	0.2779	0.0132	32.0312	1.3261
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*Cautotrophica*	Cell density	3	0.2169	0.0106	24.2187	1.0696
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*Cautotrophica*	Cell density	3	0.3185	0.0064	37.5000	0.6428
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C. autotrophica*	Cell density	3	0.2660	0.0066	30.4687	0.6667

20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*C. autotrophica*	Cell density	3	0.1519	0.0177	16.4062	1.7808
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	Cell density	3	0.2183	0.0298	24.3904	3.0204
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	Cell density	3	-0.0694	0.0294	-6.7073	2.9866
20	Spain	CeO2	Metal oxides	Unmodified	< 25	< 1	*D. salina*	Cell density	3	-0.1094	0.0297	-10.3657	3.0141
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	Cell density	3	-0.0959	0.0397	-9.1463	4.0538
20	Spain	CeO2	Metal oxides	Unmodified	< 25	1 - 10	*D. salina*	Cell density	3	-0.2171	0.0382	-19.5122	3.8919
21	Spain	TiO2	Metal oxides	Unmodified	38	1 - 10	*C. reinhardtii*	ROS	3	0.0260	0.0009	2.6316	0.0877
21	Spain	TiO2	Metal oxides	Unmodified	38	1 - 10	*C. reinhardtii*	ROS	3	0.1466	0.0062	15.7895	0.6218
21	Spain	TiO2	Metal oxides	Unmodified	38	1 - 10	*P. tricornutum*	ROS	3	2.6810	0.0181	1360.0000	1.8242
21	Spain	TiO2	Metal oxides	Unmodified	38	1 - 10	*P. tricornutum*	ROS	3	2.9857	0.0000	1880.0000	0.0034
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	ROS	3	0.3947	0.0283	48.3869	2.8656
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	ROS	3	0.8967	0.0302	145.1611	3.0633
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	ROS	3	0.8287	0.0430	129.0320	4.3910
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	ROS	3	1.0546	0.0285	187.0966	2.8883
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	ROS	3	1.2574	0.0291	251.6126	2.9533
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	ROS	3	0.6931	0.0468	100.0000	4.7947
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	ROS	3	0.0870	0.0120	9.0908	1.2086
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	ROS	3	1.8506	0.0045	536.3639	0.4465
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	ROS	3	1.7452	0.0217	472.7263	2.1887
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	ROS	3	1.2130	0.2075	236.3639	23.0630
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	ROS	3	-0.1382	0.0395	-12.9034	4.0318
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	ROS	3	0.1769	0.0400	19.3549	4.0838
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	ROS	3	0.5173	0.0991	67.7417	10.4178
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	ROS	3	0.7707	0.0288	116.1286	2.9181

22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	ROS	3	0.7707	0.0448	116.1286	4.5822
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	ROS	3	0.3483	0.2976	41.6667	34.6605
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	ROS	3	0.1542	0.0295	16.6667	2.9966
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	ROS	3	1.4069	0.0379	308.3333	3.8581
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	ROS	3	1.7778	0.0024	491.6667	0.2384
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	ROS	3	2.0369	0.0112	666.6675	1.1238
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	ROS	3	0.8329	0.0377	129.9997	3.8385
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	ROS	3	0.3830	0.0413	46.6665	4.2207
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	ROS	3	0.3600	0.0486	43.3332	4.9773
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	ROS	3	0.2877	0.0539	33.3330	5.5391
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	ROS	3	0.1823	0.0535	20.0000	5.4954
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	ROS	3	1.0033	0.0653	172.7278	6.7530
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	ROS	3	1.7610	0.0145	481.8184	1.4579
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	ROS	3	1.5724	0.0103	381.8179	1.0404
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	ROS	3	1.2397	0.0695	245.4547	7.1938
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	ROS	3	2.0907	0.0029	709.0913	0.2927
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1967	0.0044	21.7392	0.4373
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.2822	0.0047	32.6087	0.4756
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.0426	0.0052	4.3478	0.5254
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1032	0.0051	10.8696	0.5105
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.2144	0.0049	23.9131	0.4873
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.3159	0.0423	-27.0833	4.3257
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.6131	0.0330	-45.8333	3.3597
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.5754	0.0344	-43.7500	3.4979
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.4372	0.0339	-35.4167	3.4522
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.3159	0.0717	-27.0833	7.4371
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1054	0.0106	11.1111	1.0705
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1252	0.0062	13.3333	0.6185
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1054	0.0042	11.1111	0.4258
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Chlorophyll a	3	-0.2513	0.0085	-22.2222	0.8505
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Chlorophyll a	3	-0.3102	0.0044	-26.6667	0.4431

22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.3747	0.0333	-31.2500	3.3813
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.4372	0.0287	-35.4167	2.9119
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.2603	0.0371	-22.9167	3.7820
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Chlorophyll a	3	-0.1576	0.0286	-14.5833	2.8966
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Chlorophyll a	3	0.1719	0.0546	18.7500	5.6140
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.2231	0.0080	25.0000	0.7993
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1476	0.0094	15.9091	0.9447
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1476	0.0125	15.9091	1.2556
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.1278	0.0127	13.6364	1.2813
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*C. reinhardtii*	Chlorophyll a	3	0.0660	0.0116	6.8182	1.1699
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*P. tricornutum*	Chlorophyll a	3	0.3694	0.0524	44.6808	5.3804
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*P. tricornutum*	Chlorophyll a	3	0.2930	0.0555	34.0425	5.7018
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*P. tricornutum*	Chlorophyll a	3	0.0817	0.0468	8.5106	4.7878
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*P. tricornutum*	Chlorophyll a	3	0.3983	0.0560	48.9362	5.7590
22	Spain	Ag	Metal	Unmodified	30-50	> 2000	*P. tricornutum*	Chlorophyll a	3	0.0000	0.0490	0.0000	5.0264
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	PSII	3	0.0157	0.0014	1.5873	0.1387
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	PSII	3	-0.3145	0.0355	-26.9842	3.6167
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	PSII	3	-0.0488	0.0009	-4.7620	0.0918
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	PSII	3	-0.1919	0.0150	-17.4604	1.5113
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	PSII	3	-0.7091	0.0681	-50.7937	7.0439
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	PSII	3	-0.1232	0.0021	-11.5942	0.2111
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	PSII	3	-0.2268	0.0022	-20.2897	0.2194
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	PSII	3	-0.1911	0.0019	-17.3912	0.1855
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	PSII	3	-0.1566	0.0018	-14.4927	0.1848
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	PSII	3	-0.0146	0.0020	-1.4493	0.2041
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	PSII	3	0.1054	0.0134	11.1111	1.3508
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	PSII	3	-0.0656	0.0163	-6.3493	1.6400
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	PSII	3	-0.0488	0.0076	-4.7620	0.7613
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	PSII	3	-0.7091	0.0587	-50.7937	6.0461
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	PSII	3	-0.6466	0.1225	-47.6190	13.0340
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	PSII	3	-0.1381	0.0027	-12.9032	0.2661

22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	PSII	3	-0.1138	0.0018	-10.7528	0.1825
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	PSII	3	-0.1018	0.0037	-9.6774	0.3709
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	PSII	3	0.0000	0.0017	0.0000	0.1736
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	PSII	3	-0.1759	0.0016	-16.1290	0.1608
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	PSII	3	0.0616	0.0004	6.3491	0.0381
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	PSII	3	0.0764	0.0004	7.9364	0.0372
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	PSII	3	0.0616	0.0008	6.3491	0.0753
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	PSII	3	0.0313	0.0021	3.1745	0.2059
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	PSII	3	0.0313	0.0065	3.1745	0.6495
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	PSII	3	0.0000	0.0017	0.0000	0.1736
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	PSII	3	0.0524	0.0031	5.3764	0.3093
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	PSII	3	0.0107	0.0015	1.0752	0.1540
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	PSII	3	-0.0328	0.0018	-3.2258	0.1759
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	PSII	3	-0.0553	0.0041	-5.3764	0.4151
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Cell density	3	-1.6835	0.0292	-81.4286	2.9613
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Cell density	3	-2.3026	0.0544	-90.0000	5.5930
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Cell density	3	-1.3041	0.0355	-72.8572	3.6160
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Cell density	3	-1.5404	0.0331	-78.5714	3.3692
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*C. reinhardtii*	Cell density	3	-2.0513	0.0437	-87.1428	4.4639
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Cell density	3	-0.1020	0.0022	-9.7015	0.2223
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Cell density	3	-0.0938	0.0117	-8.9552	1.1802
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Cell density	3	-0.0458	0.0032	-4.4776	0.3163
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Cell density	3	-0.0938	0.0022	-8.9552	0.2217
22	Spain	Ag	Metal	Unmodified	< 2	> 2000	*P. tricornutum*	Cell density	3	-0.6074	0.0094	-45.5224	0.9470
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Cell density	3	-1.1896	0.0310	-69.5652	3.1515
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Cell density	3	-1.8362	0.0528	-84.0580	5.4217
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Cell density	3	-3.5410	0.1113	-97.1014	11.7774
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Cell density	3	-4.2341	0.3613	-98.5507	43.5247
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*C. reinhardtii*	Cell density	3	-4.2341	0.3613	-98.5507	43.5247
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Cell density	3	-0.0549	0.0027	-5.3435	0.2727
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Cell density	3	-0.4208	0.0121	-34.3511	1.2156

22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Cell density	3	-0.6267	0.0022	-46.5649	0.2217
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Cell density	3	-0.4685	0.0021	-37.4046	0.2143
22	Spain	Ag	Metal	Unmodified	< 15	> 2000	*P. tricornutum*	Cell density	3	-0.9834	0.0069	-62.5954	0.6964
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	Cell density	3	0.5512	0.0450	73.5294	4.6047
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	Cell density	3	0.5680	0.0390	76.4706	3.9816
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	Cell density	3	0.3655	0.0622	44.1176	6.4164
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	Cell density	3	0.2803	0.0422	32.3529	4.3070
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*C. reinhardtii*	Cell density	3	-0.0606	0.0471	-5.8824	4.8275
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	Cell density	3	-0.3319	0.0128	-28.2443	1.2928
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	Cell density	3	-0.4093	0.0178	-33.5878	1.8001
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	Cell density	3	-0.1931	0.0084	-17.5573	0.8408
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	Cell density	3	-0.4093	0.0196	-33.5878	1.9751
22	Spain	Ag	Metal	Unmodified	30 - 50	> 2000	*P. tricornutum*	Cell density	3	-0.1838	0.0091	-16.7939	0.9166
23	China	GO	Carbon	Unmodified	40 - 60	200 - 500	*C. pyrenoidosa*	ROS	3	0.6245	0.0059	86.7257	0.5929
23	China	rGO	Carbon	Unmodified	40 - 60	10 - 50	*C. pyrenoidosa*	ROS	3	1.0315	0.0079	180.5311	0.7949
23	China	MG	Carbon	Unmodified	40 - 60	10 - 50	*C. pyrenoidosa*	ROS	3	0.4317	0.0051	53.9825	0.5100
23	China	GO	Carbon	Unmodified	40 - 60	200 - 500	*C. pyrenoidosa*	MDA	3	2.4325	0.0515	1038.7085	5.2837
23	China	rGO	Carbon	Unmodified	40 - 60	10 - 50	*C. pyrenoidosa*	MDA	3	2.6344	0.0542	1293.5480	5.5734
23	China	MG	Carbon	Unmodified	40 - 60	10 - 50	*C. pyrenoidosa*	MDA	3	2.2631	0.0572	861.2897	5.8883
24	China	Cu	Metal	Unmodified	10 - 30	< 1	*P. tricornutum*	MDA	4	0.1471	0.0021	15.8415	0.2053
24	China	Cu	Metal	Unmodified	10 - 30	1 - 10	*P. tricornutum*	MDA	4	0.3121	0.0015	36.6335	0.1527
24	China	Cu	Metal	Unmodified	10 - 30	< 1	*P. tricornutum*	Chlorophyll a	4	0.0543	0.0007	5.5795	0.0706
24	China	Cu	Metal	Unmodified	10 - 30	1 - 10	*P. tricornutum*	Chlorophyll a	4	-1.4621	0.0198	-76.8241	2.0046
24	China	Cu	Metal	Unmodified	10 - 30	< 1	*P. tricornutum*	ROS	4	-0.1155	0.0027	-10.9091	0.2689
24	China	Cu	Metal	Unmodified	10 - 30	1 - 10	*P. tricornutum*	ROS	4	1.0165	0.0019	176.3638	0.1913
25	China	TiO2	Metal oxides	Unmodified	< 25	1 - 10	*A. tamarense*	ROS	3	0.2822	0.0001	32.6083	0.0090
25	China	TiO2	Metal oxides	Unmodified	< 25	10 - 50	*A. tamarense*	ROS	3	0.4340	0.0042	54.3481	0.4241
25	China	TiO2	Metal oxides	Unmodified	< 25	100 - 200	*A. tamarense*	ROS	3	1.7954	0.0232	502.1742	2.3421
25	China	ZnO	Metal	Unmodified	< 50	1 - 10	*A. tamarense*	ROS	3	0.1603	0.0001	17.3912	0.0114

			oxides										
25	China	ZnO	Metal oxides	Unmodified	< 50	10 - 50	*A. tamarense*	ROS	3	0.8718	0.0071	139.1306	0.7077
25	China	ZnO	Metal oxides	Unmodified	< 50	100 - 200	*A. tamarense*	ROS	3	0.9916	0.0011	169.5647	0.1063
25	China	Al2O3	Metal oxides	Unmodified	< 13	1 - 10	*A. tamarense*	ROS	3	-0.1151	0.0032	-10.8696	0.3178
25	China	Al2O3	Metal oxides	Unmodified	< 13	10 - 50	*A. tamarense*	ROS	3	0.0426	0.0013	4.3478	0.1303
25	China	Al2O3	Metal oxides	Unmodified	< 13	100 - 200	*A. tamarense*	ROS	3	0.0834	0.0133	8.6959	1.3422
26	Spain	GO	Carbon	Unmodified	681	1 - 10	*C. reinhardtii*	ROS	9	0.1484	0.0003	16.0004	0.0304
26	Spain	GO	Carbon	Unmodified	681	1 - 10	*C. reinhardtii*	Cell permeability	9	0.0756	0.0002	7.8570	0.0213
27	Nigeria	TiO2	Metal oxides	Unmodified	< 21	< 1	*C. ellipsoides*	MDA	3	0.0979	0.0002	10.2801	0.0212
27	Nigeria	TiO2	Metal oxides	Unmodified	< 21	< 1	*C. ellipsoides*	SOD	3	-3.0372	0.0083	-95.2030	0.8292
27	Nigeria	TiO2	Metal oxides	Unmodified	< 21	< 1	*C. ellipsoides*	POD	3	0.2107	0.0002	23.4481	0.0236
28	Italy	TiO2	Metal oxides	Unmodified	25	< 1	*D. tertiolecta*	Cell density	3	-0.0274	0.0005	-2.7026	0.0484
28	Italy	TiO2	Metal oxides	Unmodified	25	< 1	*D. tertiolecta*	Cell density	3	-0.0305	0.0004	-3.0027	0.0436
28	Italy	TiO2	Metal oxides	Unmodified	25	1 - 10	*D. tertiolecta*	Cell density	3	-0.0619	0.0012	-6.0063	0.1199
28	Italy	TiO2	Metal oxides	Unmodified	25	1 - 10	*D. tertiolecta*	Cell density	3	-0.0429	0.0005	-4.2040	0.0462
28	Italy	TiO2	Metal oxides	Unmodified	25	1 - 10	*D. tertiolecta*	Cell density	3	-0.0336	0.0005	-3.3037	0.0513
28	Italy	TiO2	Metal oxides	Unmodified	25	1 - 10	*D. tertiolecta*	ROS	3	0.9694	0.1245	163.6367	13.2626
28	Italy	TiO2	Metal oxides	Unmodified	25	1 - 10	*D. tertiolecta*	Chlorophyll a	3	-0.1398	0.0500	-13.0435	5.1230
28	Italy	TiO2	Metal oxides	Unmodified	25	1 - 10	*D. tertiolecta*	Chlorophyll b	3	-0.0791	0.0249	-7.6088	2.5259
29	China	ZnO	Metal	Unmodified	40 - 50	< 1	*M. aeruginosa*	ROS	3	0.1917	0.0306	21.1271	3.1121

			oxides										
29	China	ZnO	Metal oxides	Unmodified	40 - 50	< 1	*M. aeruginosa*	ROS	3	0.5164	0.0197	67.6060	1.9893
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	ROS	3	0.8790	0.0202	140.8456	2.0456
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	ROS	3	1.0603	0.0241	188.7321	2.4359
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	ROS	3	1.2864	0.0240	261.9717	2.4249
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	ROS	3	1.0939	0.0193	198.5912	1.9483
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	ROS	3	1.0456	0.0255	184.5070	2.5843
29	China	ZnO	Metal oxides	Unmodified	40 - 50	< 1	*M. aeruginosa*	Chlorophyll a	3	0.0021	0.0000	0.2091	0.0013
29	China	ZnO	Metal oxides	Unmodified	40 - 50	< 1	*M. aeruginosa*	Chlorophyll a	3	-0.0243	0.0000	-2.4043	0.0019
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	Chlorophyll a	3	-0.0542	0.0000	-5.2795	0.0016
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	Chlorophyll a	3	-0.0449	0.0000	-4.3907	0.0015
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	Chlorophyll a	3	-0.0259	0.0000	-2.5611	0.0015
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	Chlorophyll a	3	-0.0378	0.0000	-3.7114	0.0015
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	Chlorophyll a	3	-0.0931	0.0000	-8.8863	0.0016
29	China	ZnO	Metal oxides	Unmodified	40 - 50	< 1	*M. aeruginosa*	PSII	3	0.0246	0.0012	2.4910	0.1247
29	China	ZnO	Metal oxides	Unmodified	40 - 50	< 1	*M. aeruginosa*	PSII	3	0.0246	0.0015	2.4910	0.1504
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	PSII	3	-0.0216	0.0011	-2.1354	0.1087
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	PSII	3	-0.0700	0.0016	-6.7616	0.1586
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	PSII	3	-0.1788	0.0006	-16.3702	0.0638

29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	PSII	3	-0.5385	0.0011	-41.6370	0.1136
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	PSII	3	-0.6685	0.0014	-48.7546	0.1372
29	China	ZnO	Metal oxides	Unmodified	40 - 50	< 1	*M. aeruginosa*	MDA	3	0.2429	0.0003	27.5002	0.0337
29	China	ZnO	Metal oxides	Unmodified	40 - 50	< 1	*M. aeruginosa*	MDA	3	0.5380	0.0004	71.2504	0.0368
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	MDA	3	0.7117	0.0003	103.7504	0.0321
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	MDA	3	1.0604	0.0003	188.7498	0.0308
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	MDA	3	1.2563	0.0003	251.2500	0.0276
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1 - 10	*M. aeruginosa*	MDA	3	1.3610	0.0003	290.0003	0.0263
29	China	ZnO	Metal oxides	Unmodified	40 - 50	1-10	*M. aeruginosa*	MDA	3	1.4079	0.0002	308.7502	0.0236

Reference:

1. N. Gong, K. Shao, W. Feng, Z. Lin, C. Liang and Y. Sun, Biotoxicity of nickel oxide nanoparticles and bio-remediation by microalgae *Chlorella vulgaris*, *Chemosphere*, 2011, **83**, 510-516.
2. Z. Long, J. Ji, K. Yang, D. Lin and F. Wu, Systematic and quantitative investigation of the mechanism of carbon nanotubes' toxicity toward algae, *Environ. Sci. Technol*., 2012, **46**, 8458-8466.
3. E. Morelli, P. Cioni, M. Posarelli and E. Gabellieri, Chemical stability of CdSe quantum dots in seawater and their effects on a marine microalga, *Aquat Toxicol.*, 2012, **122-123**, 153-162.
4. A. Oukarroum, S. Bras, F. Perreault and R. Popovic, Inhibitory effects of silver nanoparticles in two green algae, *Chlorella vulgaris* and *Dunaliella tertiolecta*, *Ecotox. Environ. Safe.*, 2012, **78**, 80-85.
5. F. Perreault, A. Oukarroum, S. P. Melegari, W. G. Matias and R. Popovic, Polymer coating of copper oxide nanoparticles increases nanoparticles uptake

and toxicity in the green alga *Chlamydomonas reinhardtii*, *Chemosphere*, 2012, **87**, 1388-1394.

6. L. Barhoumi and D. Dewez, Toxicity of superparamagnetic iron oxide nanoparticles on green alga *Chlorella vulgaris*, *Biomed Res Int.*, 2013, **2013**, 647974.
7. L. J. Hazeem, F. A. Waheed, S. Rashdan, M. Bououdina, L. Brunet, C. Slomianny, R. Boukherroub and W. A. Elmeselmani, Effect of magnetic iron oxide (Fe_3O_4) nanoparticles on the growth and photosynthetic pigment content of *Picochlorum sp*., *Environ. Sci. Pollut. Res. Int*, 2015, 22, 11728-11739.
8. X. Hu, S. Ouyang, L. Mu, J. An and Q. Zhou, Effects of graphene oxide and oxidized carbon nanotubes on the cellular division, microstructure, uptake, oxidative stress, and metabolic profiles, *Environ. Sci. Pollut. R*., 2015, **49**, 10825-10833.
9. F. Li, Z. Liang, X. Zheng, W. Zhao, M. Wu and Z. Wang, Toxicity of nano-TiO_2 on algae and the site of reactive oxygen species production, *Aquat. Toxicol*., **2015**, 158, 1-13.
10. C. H. da Costa, F. Perreault, A. Oukarroum, S. P. Melegari, R. Popovic and W. G. Matias, Effect of chromium oxide (III) nanoparticles on the production of reactive oxygen species and photosystem II activity in the green alga *Chlamydomonas reinhardtii*, Sci. *Total Environ*., 2016, **565**, 951-960.
11. S. Du, P. Zhang, R. Zhang, Q. Lu, L. Liu, X. Bao and H. Liu, Reduced graphene oxide induces cytotoxicity and inhibits photosynthetic performance of the green alga *Scenedesmus obliquus*, *Chemosphere*, 2016, **164**, 499-507.
12. L. J. Hazeem, M. Bououdina, S. Rashdan, L. Brunet, C. Slomianny and R. Boukherroub, Cumulative effect of zinc oxide and titanium oxide nanoparticles on growth and chlorophyll a content of *Picochlorum sp*., *Environ. Sci. Pollut. Res. Int*., 2016, **23**, 2821-2830.
13. J. Huang, J. Cheng and J. Yi, Impact of silver nanoparticles on marine diatom *Skeletonema costatum*. *J. Appl. Toxicol*., 2016, **36**, 1343-1354.
14. H. Qian, K. Zhu, H. Lu, M. Lavoie, S. Chen, Z. Zhou, Z. Deng, J. Chen and Z. Fu, Contrasting silver nanoparticle toxicity and detoxification strategies in *Microcystis aeruginosa* and *Chlorella vulgaris*: New insights from proteomic and physiological analyses, *Sci. Total Environ*., 2016, **572**, 1213-1221.
15. Y. Wang, X. Zhu, Y. Lao, X. Lv, Y. Tao, B. Huang, J. Wang, J. Zhou and Z. Cai, TiO_2 nanoparticles in the marine environment: Physical effects responsible for the toxicity on algae *Phaeodactylum tricornutum*, *Sci. Total Environ*., 2016, **565**, 818-826.
16. A. Xiao, C. Wang, J. Chen, R. Guo, Z. Yan and J. Chen, Carbon and metal quantum dots toxicity on the microalgae *Chlorella pyrenoidosa*, *Ecotox. Environ. Safe*., 2016, **133**, 211-217.
17. B. Zhang, J. Wang, L. Tan and X. Chen, Toxic effects of nano-ZnO on marine microalgae *Skeletonema costatum*: Attention to the accumulation of

intracellular Zn, *Aquat. Toxicol*., 2016, **178**, 158-164.

18. X. Y. Deng, J. Cheng, X. L. Hu, L. Wang, D. Li and K. Gao, Biological effects of TiO_2 and CeO_2 nanoparticles on the growth, photosynthetic activity, and cellular components of a marine diatom *Phaeodactylum tricornutum*, *Sci. Total Environ*., 2017, **575**, 87-96.
19. L. J. Hazeem, M. Bououdina, E. Dewailly, C. Slomianny, A. Barras, Y. Coffinier, S. Szunerits and R. Boukherroub, Toxicity effect of graphene oxide on growth and photosynthetic pigment of the marine alga *Picochlorum sp*. during different growth stages, *Environ. Sci. Pollut. Res. Int*., 2017, **24**, 4144-4152.
20. M. Sendra, J. Blasco and C. V. M. Araújo, Is the cell wall of marine phytoplankton a protective barrier or a nanoparticle interaction site? Toxicological responses of *Chlorella autotrophica* and *Dunaliella salina* to Ag and CeO_2 nanoparticles, Ecol. Indic., 2017, DOI: 10.1016/j.ecolind.2017.08.050.
21. M. Sendra, I. Moreno-Garrido, M. P. Yeste, J. M. Gatica and J. Blasco, Toxicity of TiO_2, in nanoparticle or bulk form to freshwater and marine microalgae under visible light and UV-A radiation, *Environ. Pollut*., 2017, **227**, 39-48.
22. M. Sendra, M. P. Yeste, J. M. Gatica, I. Moreno-Garrido and J. Blasco, Direct and indirect effects of silver nanoparticles on freshwater and marine microalgae (*Chlamydomonas reinhardtii* and *Phaeodactylum tricornutum*), *Chemosphere*, 2017, **179**, 279-289.
23. J. Zhao, X. Cao, Z. Wang, Y. Dai and B. Xing, Mechanistic understanding toward the toxicity of graphene-family materials to freshwater algae, *Water Res*., 2017, **111**, 18-27.
24. Y. Zhu, J. Xu, T. Lu, M. Zhang, M. Ke, Z. Fu, X. Pan and H. Qian, A comparison of the effects of copper nanoparticles and copper sulfate on *Phaeodactylum tricornutum* physiology and transcription, *Environ. Toxicol. Pharmacol.*, 2017, **56**, 43-49.
25. M. Li, D. Chen, Y. Liu, C. Y. Chuang, F. Kong, P. J. Harrison, X. Zhu and Y. Jiang, Exposure of engineered nanoparticles to *Alexandrium tamarense* (Dinophyceae): Healthy impacts of nanoparticles via toxin-producing dinoflagellate, *Sci. Total Environ*., 2018, **610-611**, 356-366.
26. I. Martín-de-Lucía, M. C. Campos-Mañas, A. Agüera, F. Leganés, F. Fernández-Piñas and R. Rosal, Combined toxicity of graphene oxide and wastewater to the green alga *Chlamydomonas reinhardtii*, *Environ. Sci.: Nano*, 2018, **5**, 1729-1744.
27. M. M. Matouke, D. T. Elewa and K. Abdullahi, Binary effect of titanium dioxide nanoparticles ($nTiO_2$) and phosphorus on microalgae (*Chlorella 'Ellipsoides* Gerneck, 1907), *Aquat. Toxicol*., 2018, **198**, 40-48.

28. E. Morelli, E. Gabellieri, A. Bonomini, D. Tognotti, G. Grassi and I. Corsi, TiO_2 nanoparticles in seawater: Aggregation and interactions with the green alga *Dunaliella tertiolecta*, *Ecotox. Environ. Safe*., 2018, **148**, 184-193.
29. Y. Tang, H. Xin, S. Yang, M. Guo, T. Malkoske, D. Yin and S. Xia, Environmental risks of ZnO nanoparticle exposure on *Microcystis aeruginosa*: Toxic effects and environmental feedback, *Aquat. Toxicol*., 2018, **204**, 19-26.

Table S2. The effects of moderators on the magnitude of NPs toxicity on algae physiological parameters.

Physiological parameters	Moderator variable.	Grouping variable	n	Mean effect (lnR)	Mean effect (%)	95% CIs (%)	*p* value
ROS	Overall	Q =140040.4, df = 140, $p < 0.001$, $I^2 = 99.56\%$	**141**	**0.6406**	**90**	**69 to 113**	**< 0.001**
		Q =141016.9, df = 171, $p < 0.001$, $I^2 = 99.65\%$	**172**	**0.8462**	**133**	**107to 162**	**< 0.001**
	NPs type	**Carbon**	**35**	**0.5395**	**72**	**38 to 114**	**< 0.001**
		Metal	**56**	**0.8418**	**132**	**94 to 178**	**< 0.001**
		Metal oxides	**43**	**0.5043**	**66**	**35 to104**	**< 0.001**
		Quantun dots	7	0.4112	51	-8 to 148	0.104
		(Q_B =8.08, df = 3, $p = 0.044$)					
	NPs modification	**Coated**	**9**	**0.8798**	**141**	**55 to 275**	**< 0.001**
		Doped	7	0.4112	51	-9 to 150	0.110
		Unmodified	**125**	**0.6346**	**89**	**7 to 113**	**< 0.001**
		(Q_B = 1.92, df = 2, $p = 0.382$)					
	NPs dose	< 1	29	0.1921	21	-5 to 55	0.128
		> 2000	**30**	**0.9392**	**156**	**102 to 224**	**< 0.001**
		1-10	**44**	**0.6402**	**90**	**56 to 130**	**< 0.001**
		10-50	**22**	**0.6572**	**93**	**48 to 152**	**< 0.001**
		100-200	**7**	**0.9391**	**156**	**59 to 312**	**< 0.001**
		200-500	**3**	**1.1217**	**207**	**49 to 535**	**0.002**
		50-100	**6**	**0.5652**	**76**	**6 to 193**	**0.030**
		(Q_B = 21.95, df = 6, $p = 0.001$)					
	Algae species	***A. tamarense***	**9**	**0.4982**	**65**	**10 to 146**	**0.0147**
		C. autotrophica	10	0.2215	25	-24 to 105	0.3832
		C. pyrenoidosa	**3**	**0.6951**	**100**	**0 to 301**	**0.0496**
		C. reinhardtii	**28**	**0.5289**	**70**	**34 to 114**	**< 0.001**
		C. vulgaris	13	0.3233	38	-1 to 92	0.0559
		Chlorella sp.	**15**	**0.4578**	**58**	**16 to 115**	**0.0036**
		D. salina	10	0.0368	4	-32 to 57	0.8625
		D. tertiolecta	**5**	**0.6515**	**92**	**10 to 233**	**0.0206**
		M. aeruginosa	**8**	**1.1459**	**215**	**104 to 385**	**< 0.001**

		P. tricornutum	**26**	**1.1104**	**204**	**138 to 287**	**< 0.001**
		S. costatum	**5**	**0.8047**	**124**	**29 to 288**	**0.0041**
		S. obliquus	**8**	**0.9417**	**156**	**67 to 295**	**< 0.001**
		(Q_B = 39.06 df = 11, p < 0.001)					
POD	Overall	Q = 4947.27, df = 20, p < 0.001, I^2 = 99.38%	**21**	**1.3087**	**270**	**150 to 449**	**< 0.001**
		Q = 5303.63, df = 21, p < 0.001, I^2 = 99.42%	**22**	**1.3779**	**297**	**166 to 491**	**< 0.001**
	NPs type	**Carbon**	**8**	**2.1116**	**726**	**416 to 1224**	**< 0.001**
		Metal	2	0.5048	66	-35 to 325	0.2941
		Metal oxides	**11**	**0.8707**	**139**	**60 to 257**	**< 0.001**
		(Q_B = 18.47, df = 2, p < 0.001)					
	NPs dose	< 1	3	0.404	50	-11 to 151	0.1252
		1-10	**7**	**0.6479**	**91**	**36 to 169**	**0.0002**
		10-50	**6**	**1.5743**	**383**	**234 to 598**	**< 0.001**
		100-200	**2**	**2.8449**	**1620**	**815 to 3132**	**< 0.001**
		200-500	**2**	**1.8758**	**553**	**243 to 1140**	**< 0.001**
		(Q_B = 53.32, df = 4, p < 0.001)					
	Algae species	***P. tricornutum***	**10**	**0.9383**	**156**	**66 to 294**	**< 0.001**
		S. obliquus	**8**	**2.115**	**726**	**410 to 1237**	**< 0.001**
		(Q_B = 12.67, df = 1 p < 0.001)					
SOD	Overall	Q = 9042.73, df = 18, p < 0.001, I^2 = 99.83%	**19**	**1.1984**	**231**	**82 to 505**	**< 0.001**
		Q = 9042.73, df = 18, p < 0.001, I^2 = 99.83%	**19**	**1.1984**	**231**	**82 to 505**	**< 0.001**
	NPs type	**Carbon**	**8**	**1.6895**	**442**	**119 to 1239**	**< 0.001**
		Metal oxides	**11**	**0.8423**	**132**	**7 to 402**	**0.032**
		(Q_B = 1.95, df = 1 p = 0.162)					
	NPs dose	**1-10**	**7**	**0.866**	**138**	**40 to 305**	**0.0014**
		10-50	**6**	**1.4154**	**312**	**131 to 633**	**< 0.001**
		100-200	**2**	**2.6566**	**1325**	**428 to 3747**	**< 0.001**
		200-500	**2**	**1.6785**	**436**	**96 to 1366**	**0.0011**
		(Q_B = 10.27, df = 3, p = 0.0163)					
	Algae species	***P. tricornutum***	**10**	**1.229**	**242**	**98 to 491**	**< 0.001**
		S.obliquus	**8**	**1.6901**	**442**	**194 to 901**	**< 0.001**
		(Q_B = 1.21, df = 1 p = 0.271)					
	Overall	Q = 37029.73, df = 86, p < 0.001, I^2 = 99.83%	**87**	**1.0016**	**172**	**115 to 245**	**< 0.001**

		Q = 56220.8, df = 104, p < 0.001, I^2 = 99.86%	**105**	**1.3025**	**268**	**191 to 365**	**< 0.001**
	NPs type	**Carbon**	**26**	**1.7698**	**487**	**298 to 767**	**< 0.001**
		Metal	**4**	**1.2714**	**257**	**33 to 859**	**< 0.001**
		Metal oxides	**27**	**0.7455**	**111**	**44 to 209**	**< 0.001**
		Quantun dots	30	0.5297	70	18 to 144	0.104
		(Q_B =23.42, df = 3, p < 0.001)					
	NPs modification	Doped	10	0.0842	9	-44 to 113	0.8056
		Unmodified	**77**	**1.1214**	**207**	**141 to 293**	**< 0.001**
		(Q_B = 8.13, df = 1, p = 0.004)					
	NPs dose	< 1	11	0.4885	63	-4 to 178	0.0726
		1-10	**35**	**0.5206**	**68**	**25 to 127**	**0.0006**
MDA		**10-50**	**23**	**1.1076**	**203**	**109 to 338**	**< 0.001**
		50-100	**9**	**3.3387**	**2718**	**923 to 7760**	**< 0.001**
		100-200	**3**	**2.454**	**1063**	**429 to 2460**	**< 0.001**
		200-500	**5**	**1.393**	**303**	**124 to 624**	**< 0.001**
		(Q_B = 49.00, df = 5, p < 0.001)					
	Algae species	***C. pyrenoidosa***	**33**	**0.6971**	**101**	**45 to 177**	**< 0.001**
		Chlorella sp.	**15**	**0.9779**	**166**	**65 to 328**	**< 0.001**
		K. brevis	**4**	0.602	83	**-30 to 375**	0.2169
		M. aeruginosa	**8**	**1.1789**	**225**	**70 to 522**	**0.0004**
		P. tricornutum	**12**	**0.7148**	**104**	**20 to 248**	**0.0083**
		S. costatum	5	0.5719	77	**-23 to 307**	0.1782
		S. obliquus	**8**	**3.0016**	**1912**	**951 to 3751**	**< 0.001**
		(Q_B = 42.96, df = 6, p < 0.001)					
	Overall	Q = 133303.2, df = 143, p < 0.001, I^2 = 99.91%	**144**	**-0.4853**	**-38**	**-46 to -29**	**< 0.001**
		Q = 133303.2, df = 143, p < 0.001, I^2 = 99.91%	**144**	**-0.4853**	**-38**	**-46 to -29**	**< 0.001**
	NPs type	**Metal**	**44**	**-0.7315**	**-52**	**-62 to -39**	**< 0.001**
		Metal oxides	63	-0.1424	-13	-29 to 5	0.1504
		Quantun dots	**37**	**-0.7742**	**-54**	**-64 to -41**	**< 0.001**
		(Q_B = 21.26, df = 2, p < 0.001)					
	NPs modification	Coated	4	-0.4873	-39	-73 to 40	0.2469
		Doped	17	-0.39	-32	-55 to 1	0.0565
		Unmodified	**123**	**-0.4983**	**-39**	**-48 to -29**	**< 0.001**

Cell density		(Q_B = 0.24, df = 2, p = 0.884)					
	NPs dose	< 1	22	-0.3026	-26	-48 to 4	0.0863
		1-10	**40**	**-0.8447**	**-57**	**-68 to -42**	**< 0.001**
		10-50	**25**	**-0.3497**	**-30**	**-45 to -9**	**0.0076**
		50-100	12	-0.2862	-25	-46 to 4	0.0816
		100-200	7	-0.3809	-32	-63 to 26	0.2199
		200-500	**5**	**-1.021**	**-64**	**-83 to -25**	**0.0064**
		500-1000	**2**	**-0.5397**	**-42**	**-63 to -7**	**0.0229**
		> 2000	31	-1.0722	-66	89 to 7	0.0658
		(Q_B = 12.45, df = 7, p = 0.086)					
	Algae species	*C. autotrophica*	10	-0.1458	-14	-44 to 35	0.5187
		C. pyrenoidosa	**30**	**-0.9429**	**-61**	**-70 to -50**	**< 0.001**
		C. reinhardtii	**19**	**-1.1075**	**-67**	**-76 to -54**	**< 0.001**
		C. vulgaris	18	-0.167	-15	-39 to 18	0.3211
		D. salina	10	-0.3565	-30	-56 to 10	0.1246
		D. tertiolecta	5	-0.0393	-4	-48 to 79	0.9013
		P. tricornutum	**38**	**-0.2374**	**-21**	**-37 to -1**	**0.0399**
		Picochlorum sp.	**3**	**1.5252**	**360**	**93 to 995**	**0.0006**
		S. costatum	**10**	**-0.7383**	**-52**	**-69 to -26**	**0.001**
		(Q_B = 60.19, df = 8, p < 0.001)					
Cell permeability	Overall	Q = 2834.79, df = 13, p < 0.001, I^2 = 99.57%	**14**	**1.151**	**216**	**133 to -330**	**< 0.001**
		Q = 2834.79, df = 13, p < 0.001, I^2 = 99.57%	**14**	**1.151**	**216**	**133 to -330**	**< 0.001**
	NPs type	**Carbon**	**9**	**0.9304**	**154**	**87 to 244**	**< 0.001**
		Metal oxides	**5**	**1.6179**	**404**	**223 to 686**	**< 0.001**
		(Q_B = 6.26, df = 1, p = 0.0123)					
	NPs dose	**1-10**	**4**	**0.6285**	**87**	**4 to -238**	**0.0366**
		10-50	**4**	**1.2749**	**258**	**104 to 529**	**< 0.001**
		50-100	**2**	**1.2733**	**257**	**62 to 688**	**0.0016**
		100-200	**2**	**1.4123**	**311**	**87 to 803**	**0.0004**
		200-500	**2**	**1.4677**	**334**	**96 to 863**	**0.0003**
		(Q_B = 4.32, df = 4, p = 0.363)					
	Algae species	***P. tricornutum***	**5**	**1.6441**	**418**	**256 to 652**	**< 0.001**
		S. obliquus	**8**	**1.038**	**182**	**116 to 269**	**< 0.001**

		(Q_B = 6.69, df = 1, p < 0.001)					
PSII	Overall	Q = 2381.27, df = 76, p < 0.001, I^2 = 99.37%	**77**	**-0.2056**	**-18**	**-25 to -12**	**< 0.001**
		Q = 2381.27, df = 76, p < 0.001, I^2 = 99.37%	**77**	**-0.2056**	**-18**	**-25 to -12**	**< 0.001**
	NPs type	**Metal**	**40**	**-0.1449**	**-13**	**-22 to -4**	**0.0073**
		Metal oxides	**37**	**-0.2671**	**-23**	**-31 to -15**	**< 0.001**
		(Q_B = 2.50, df = 1, p = 0.113)					
	NPs modification	Coated	5	-0.2897	-25	-46 to 4	0.0855
		Unmodified	**72**	**-0.2009**	**-18**	**-24 to -11**	**< 0.001**
		(Q_B = 0.26, df = 1, p = 0.608)					
	NPs dose	< 1	16	-0.0398	-4	-17 to 11	0.5802
		1-10	23	-0.0901	-9	-18 to 2	0.0962
		10-50	**8**	**-0.3174**	**-27**	**-35 to -18**	**< 0.001**
		> 2000	**30**	**-0.6385**	**-47**	**-57 to -35**	**< 0.001**
		(Q_B = 28.67, df = 3, p < 0.001)					
	Algae species	***C. autotrophica***	**10**	**-0.2266**	**-20**	**-35 to -2**	**0.0347**
		C. reinhardtii	25	-0.1406	-13	-25 to 0	0.0509
		D. salina	10	-0.1367	-13	-30 to 9	0.221
		M. aeruginosa	7	-0.2041	-18	-36 to 5	0.1073
		P. tricornutum	**25**	**-0.2801**	**-24**	**-34 to -14**	**< 0.001**
		(Q_B = 2.45, df = 4, p = 0.653)					
	Overall	Q = 209072.1, df = 152, p < 0.001, I^2 = 99.97%	**153**	**-0.4371**	**-35**	**-45 to -25**	**< 0.001**
		Q = 209072.1, df = 152, p < 0.001, I^2 = 99.97%	**153**	**-0.4371**	**-35**	**-45 to -25**	**< 0.001**
	NPs type	Carbon	20	-0.0095	-1	-59 to 140	0.9832
		Metal	**54**	**-1.2297**	**-71**	**-83 to -49**	**< 0.001**
		Metal oxides	**49**	**-1.4631**	**-77**	**-86 to -60**	**< 0.001**
		Quantun dots	**30**	**-0.2995**	**-26**	**-37 to -13**	**0.0002**
		(Q_B = 25.53, df = 3, p < 0.001)					
	NPs modification	Coated	4	-0.0095	-1	-61 to 151	0.984
		Doped	**10**	**-1.2204**	**-70**	**-84 to -47**	**< 0.001**
		Unmodified	**139**	**-0.3931**	**-33**	**-42 to -21**	**< 0.001**
		(Q_B = 7.82, df = 1, p = 0.020)					
		< 1	**48**	**-0.4313**	**-35**	**-49 to --17**	**0.0006**
		> 2000	30	-0.0266	-3	-26 to 28	0.8495

Chlorophyll a	NPs dose	1 - 10	48	-0.1497	-14	-31 to 7	0.1706
		10-50	**24**	**-0.4972**	**-39**	**-55 to -18**	**0.0013**
		100-200	**6**	**-1.0035**	**-63**	**-80 to -33**	**0.0011**
		200-500	**2**	**-2.3428**	**-90**	**-97 to -73**	**< 0.001**
		50-100	**6**	**-2.9668**	**-95**	**-97 to -91**	**< 0.001**
		(Q_B = 97.28, df = 6, p < 0.001)					
	Algae species	*C. autotrophica*	10	-0.1047	-10	-44 to 45	0.6666
		C. pyrenoidosa	**30**	**-1.4812**	**-77**	**-83 to -70**	**< 0.001**
		C. reinhardtii	15	0.0883	9	-26 to 61	0.6572
		C. vulgaris	17	-0.2204	-20	-44 to 16	0.2376
		D. salina	10	-0.0286	-3	-40 to 57	0.9068
		K. brevis	4	-0.2534	-22	-63 to 65	0.5091
		M. aeruginosa	11	-0.3147	-27	-54 to 15	0.1737
		P. tricornutum	29	-0.0402	-4	-28to 28	0.7824
		Picochlorum sp.	10	0.1712	19	-26 to 91	0.4822
		S. costatum	8	-0.2272	-20	-53 to 36	0.4079
		S. obliquus	**8**	**-1.52**	**-78**	**-87 to -63**	**< 0.001**
		(Q_B = 98.72 df = 10, p < 0.001)					
Chlorophyll b	Overall	Q = 261.44, df = 8, p < 0.001, I^2 = 96.70%	**9**	**-0.4568**	**-36**	**-53 to -14**	**< 0.001**
		Q = 261.44, df = 8, p < 0.001, I^2 = 99.97%	**9**	**-0.4568**	**-36**	**-53 to -14**	**< 0.001**
	NPs dose	1-10	2	-0.1404	-13	-44 to 34	0.5237
		10-50	2	0.0532	5	-30 to 59	0.8007
		100-200	**2**	**-0.7161**	**-51**	**-68 to -25**	**0.0009**
		200-500	**2**	**-0.7085**	**-51**	**-67 to -26**	**0.0007**
		(Q_B = 10.28, df = 3, p = 0.016)					

Sample size (n), mean effect size, 95% CI, and p value for levels within moderators, and test for heterogeneity among levels within moderators (Q_B), degrees of freedom (df) and p value are shown in bracket. lnR, 95% CIs and p value considering the entire database by the 'trim and fill' method are shown with underline. The percentage of total variability that is due to between-study variation (I^2) is shown for the overall data base. Significant responses of algae physiological parameters to NPs exposure are shown in bold (p < 0.05).