Supporting Information

Light-Emitting Diode Power Conversion Capability and CO_2 Fixation Rate of Microalgae Biofilm Cultured Under Different Light Spectra

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S1. The culture medium for microalgae

The *Chlorella pyrenoidosa* and *Chlorella ellipsoidea* were cultured in the BG-11 medium. The composition of BG-11 medium can be found in Table S1, and S2. Note that during biofilm cultivation, the culture medium was solidified with 1% agar.

Table 1. The composition of BG-11 medium.

Medium Components	Mother Solution（g/100 mL）	Dosage （mL /L）
$NaNO_3$	15.0	10
K_2HPO_4	4.0	1
$MgSO_4·7H_2O$	7.5	1
$CaCl_2·2H_2O$	3.6	1
Citric acid	0.6	1
Ferric ammonium citrate	0.6	1
$EDTANa_2$	0.1	1
Na_2CO_3	2.0	1
A5 (Trace metal solution)	-	1

Table S2. The composition of A5 solution for BG-11 medium.

Components	Concentration（$g·L^{-1}$）
H_3BO_3	2.86
$MnCl_2·4H_2O$	2.86
$ZnSO_4·7H_2O$	0.22
$Na_2MoO_4·2H_2O$	0.02
$CuSO_4·5H_2O$	0.08
$Co(NO_3)_2·6H_2O$	0.05

S2. Protein and carbohydrate determination

For the protein, its content was qualitatively measured using a colorimetric method (Dorsey et al., 1978; Lowry et al., 1951), in which microalgae biomass was pretreated with thermal alkaline and bovine serum albumin was used as the standard sample. The relationship between the content of bovine serum albumin and the optical density of solution can be found in Figure S1.

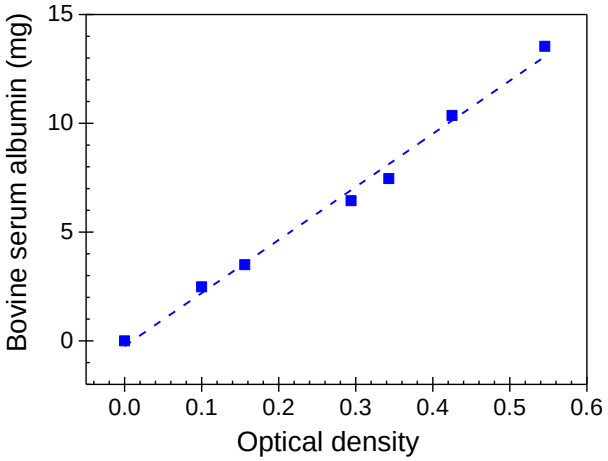

Figure S1. The relationship between the content of bovine serum albumin and the optical density of solution.

Moreover, for the carbohydrate, its content was determined with the phenol-sulfuric method (Hellebust et al., 1978; Mercz, 1994), in which the glucose was used as the standard sample. The relationship between the content of glucose and the optical density of solution can be found in Figure S2.

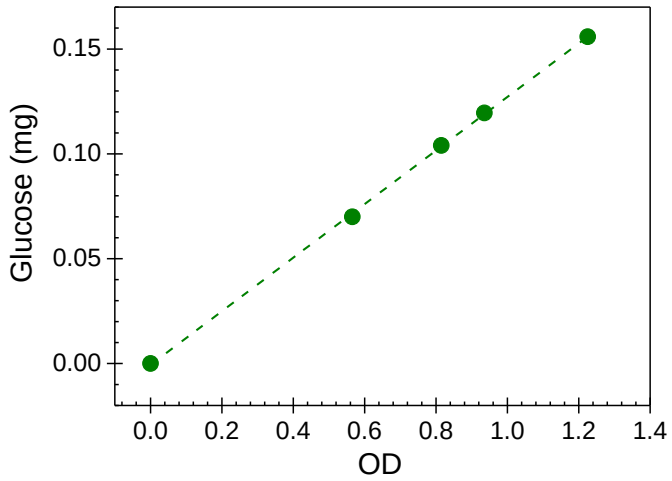

Figure S2. The relationship between the content of glucose and the optical density of solution.

S3. Biochemical composition

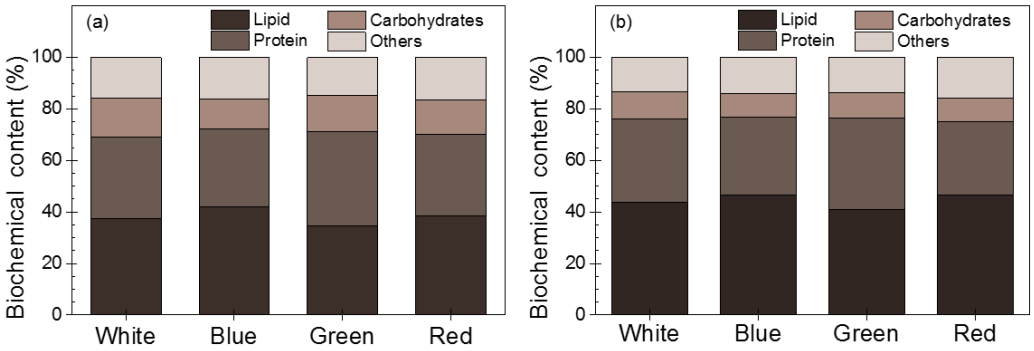

Figure S3. Biochemical composition for the *C. ellipsoidea* (a) and *C. pyrenoidosa* (b) cultured under different LEDs.

Table S3. The contents of carbon, nitrogen, hydrogen, and oxygen in microalgae determined with an elemental analyzer.

Strain	LEDs	N (%)	C (%)	H (%)	O (%)
C. ellipsoidea	White	2.45±0.23	49.46±0.22	7.82±0.22	40.27±0.38
	Blue	2.46±0.27	50.31±0.27	7.95±0.23	39.28±0.44
	Green	2.33±0.22	49.27±0.25	7.80±0.33	40.60±0.46
	Red	2.44±0.25	52.13±0.22	8.18±0.31	37.25±0.45
C. pyrenoidosa	White	4.82±0.28	54.88±0.30	8.50±0.24	31.80±0.47
	Blue	4.79±0.27	54.13±0.27	8.48±0.21	32.60±0.43
	Green	5.12±0.23	53.35±0.37	8.32±0.17	33.21±0.47
	Red	5.24±0.31	55.95±0.33	8.36±0.28	30.45±0.53

S4. Statistical analysis

A one-way ANOVA was performed using MATLAB software (9.6 MathWorks, USA), with value of 0.05 selected as significant. The P-values for the effect of light condition on LED power conversion capability and CO_2 fixation rate are 0.0001 and 0.0003, respectively, indicating that the light condition significantly influenced LED power conversion capability and CO_2 fixation rate for the microalgae biofilm cultivation.

Reference

1. Dorsey, T.E., McDonald, P., Roels, O.A. 1978. Measurements of phytoplankton-protein content with the heated biuret-folin assay. *Journal of Phycology*, 14(2), 167-171.
2. Hellebust, J.A., Stein, J.R., Craigie, J. 1978. *Handbook of phycological methods: physiological and biochemical methods*. Cambridge University Press.
3. Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randall, R.J. 1951. Protein measurement with the Folin phenol reagent. *Journal of biological chemistry*, 193(1), 265-275.
4. Mercz, T.I. 1994. *A study of high lipid yielding microalgae with potential for large-scale production of lipids and polyunsaturated fatty acids*. Murdoch University.