Supporting Information

Living diatom microalgae for desiccation-resistant electrodes in biophotovoltaic devices

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Number of pages: 6

Number of Figures: 5

Number of Equations: 4

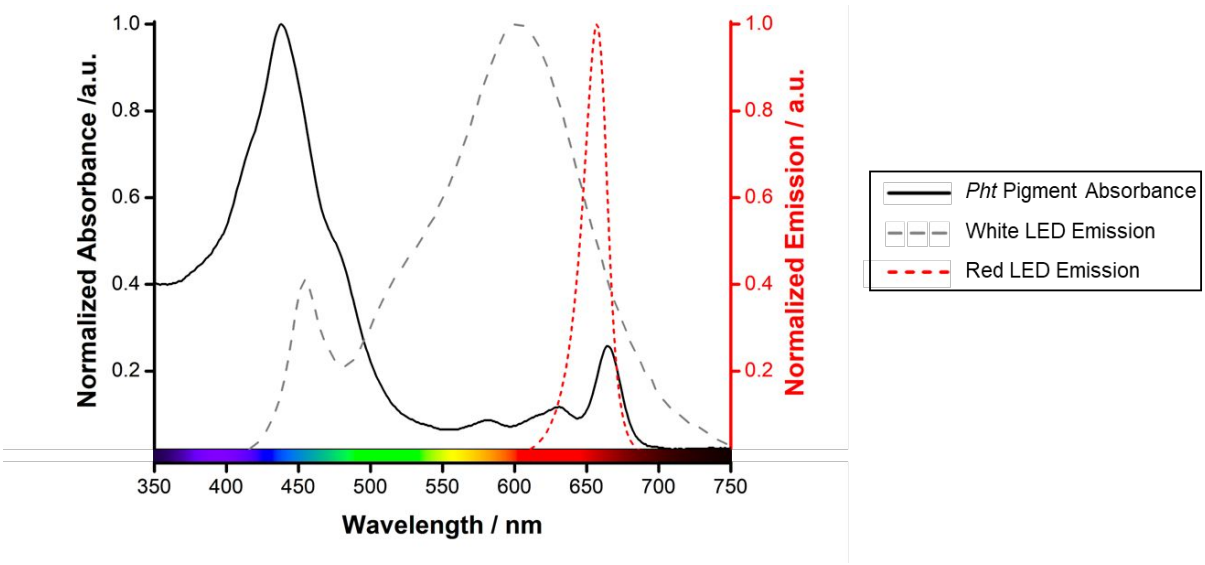

Figure S1. Absorption spectrum of pigments extracted from *Phaeodactylum. tricornutum* in ethanol (black line). Light emission spectra of the white and red LED sources used for CA experiments (red dashed and red dotted lines, respectively). Maximum peaks in all spectra have been set to 1.

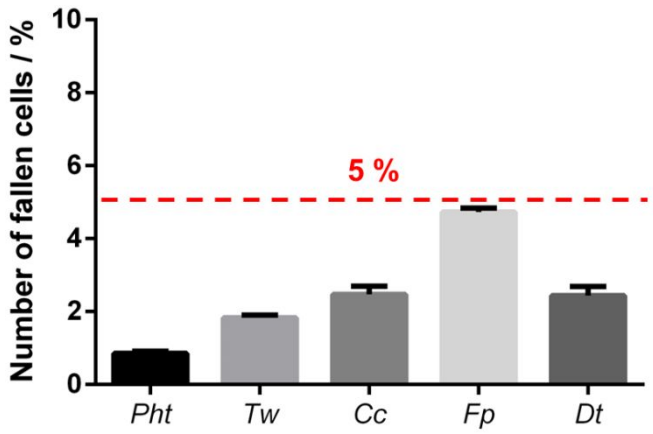

Figure S2. Average percentage of cells fallen from the biophotoanodes after a 45 min CA experiment carried out for each microalgal species. Fallen cells were recovered from the BPV electrolytic solution after the CA experiment.

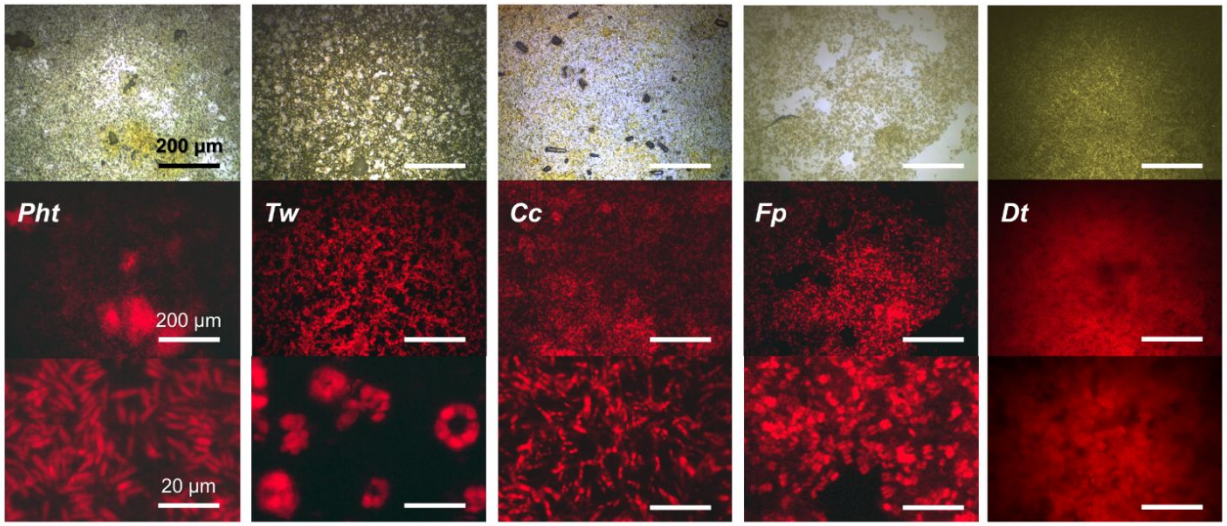

Figure S3. Microscopy images of the ITO biophotoanodes prepared with each microalgal species. Bright field images at 20x (top row); chloroplast fluorescence images at 20x (middle row) and at 100x (bottom row). Fluorescence images were recorded using an excitation passband filter (λ_{ex}= 568 ± 10 nm) and emission filter (λ_{em} > 600 nm).

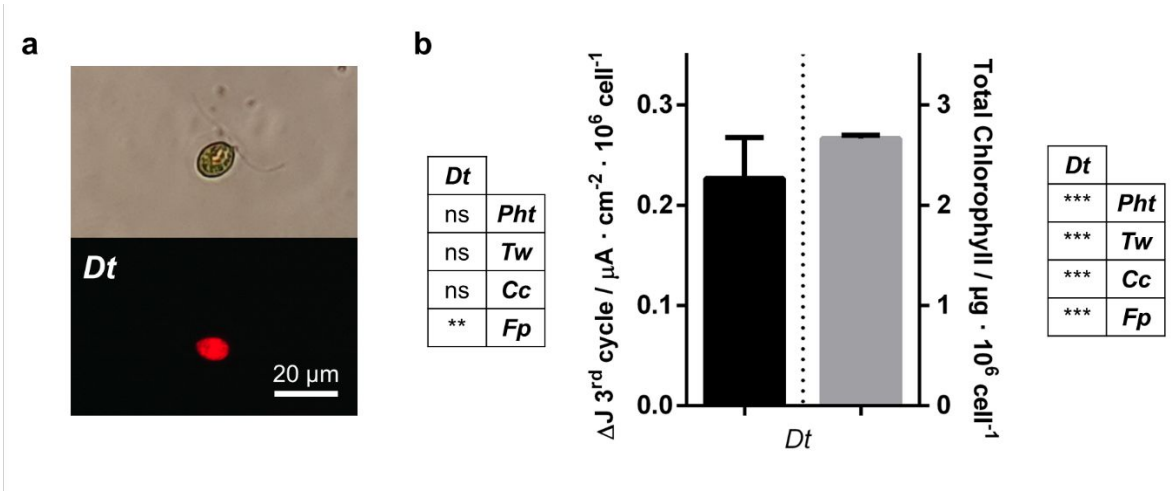

Figure S4. (a) Bright field image (top) of green microalga *Dunaliella tertiolecta* (*Dt*), and chloroplast fluorescence image (bottom), both at 100x. (b) Average photocurrent density at the third light cycle (left), and total chlorophyll content (right) of *Dt*, normalized to 10^6 cells. Tables report the pairwise tests showing the statistical differences in the chlorophyll content and photocurrent output for the investigated species.

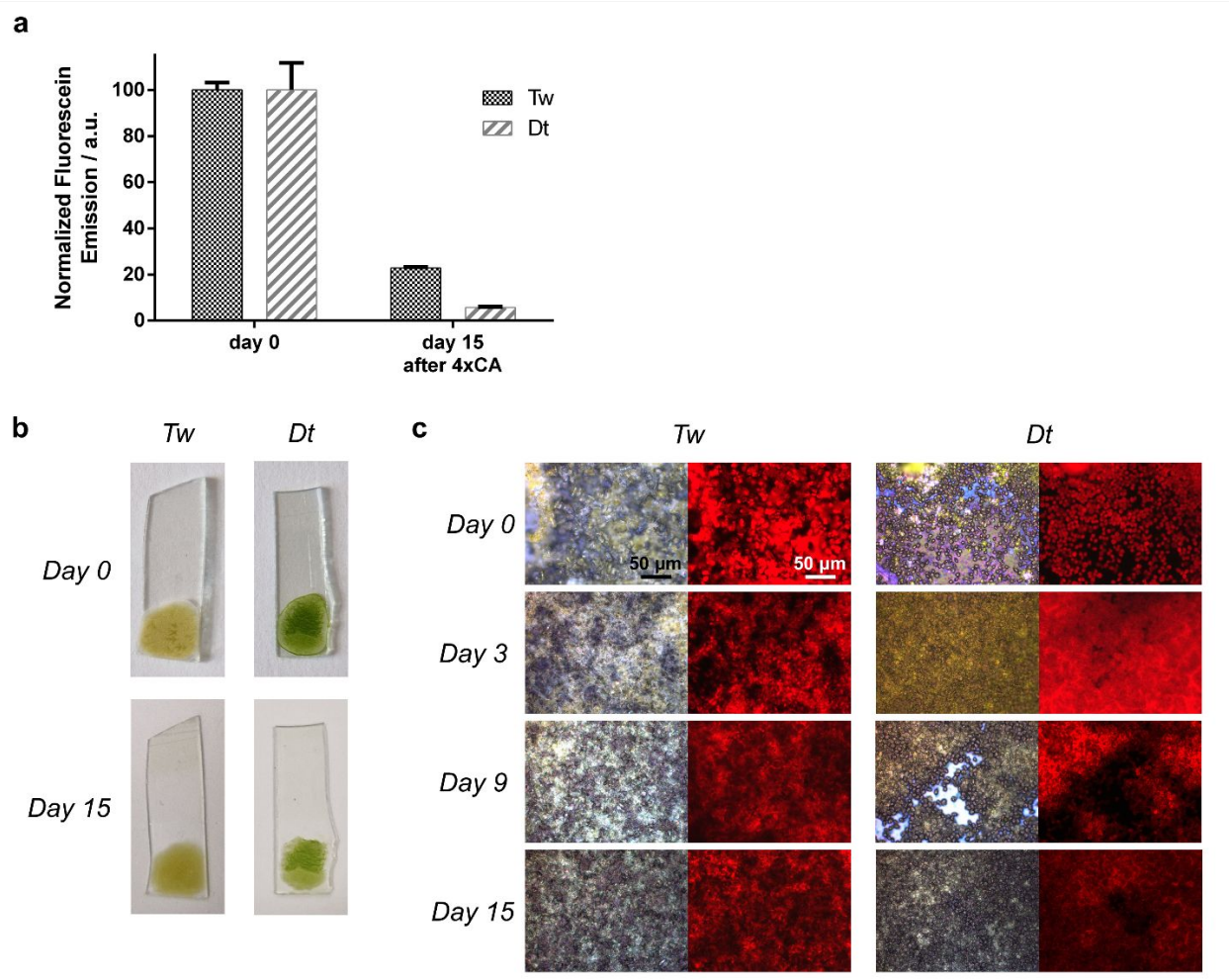

Figure S5. (a) Mean fluorescein emission (λ_{ex} = 488 nm, λ_{em} = 511 nm) in the FDA viability assay of *Tw* and *Dt* cells from the bioanodes performed at day 0 and at day 15 after four CA experiments. (b) Pictures showing a slight detachment of *Tw* and *Dt* cells from the biophotoanodes at day 15 and after 4 CA with respect to day 0. (c) Bright field and chloroplast fluorescence images (both at 50x) of *Tw* and *Dt* coated electrodes at days 0 and after 15 respectively.

Calculation of the Internal Quantum Efficiency (IQE)

According to **Equation 1**, *IQE* is defined as the moles of electrons *e* per second pumped into the circuit (N_e) divided by the moles of absorbed photons (γ) per second (N_{ap}).

$$IQE = N_e/N_{ap} \qquad \textbf{Equation 1}$$

Where N_e and N_{ap} can be calculated by **Equations 2** and **3** respectively, as follows:

$$N_e = J/F \qquad \textbf{Equation 2}$$

$$N_{ap} = N_p \times (1 - T) = N_p \times A \qquad \textbf{Equation 3}$$

Where J is the maximum current density produced, F is the Faraday constant (96500 C/mol), T and A are the biophotoanode film transmittance and absorbance respectively and N_p is the number of photons emitted by the light source reaching the biophotoanode surface per second, that is determined by the **Equation 4**:

$$N_p = E \times \lambda/(h \times c) \qquad \textbf{Equation 4}$$

where E is the irradiance of the monochromatic light source, λ is the emission wavelength, h is the Planck's constant (6.626×10^{-34} J×s) and c is the light speed (2.99×10^{8} m/s). Considering that the light source has E = 30 mW/cm^2 at λ = 660 nm, the numerical value of N_p results:

$N_p = (30\times10^{-3}$ J/(cm^2×s) × 660 $\times10^{-9}$ m)/ (6.626×10^{-34} J×s ×2.99×10^{8} m/s) = 9.99×10^{16} γ/(cm^2×s)

The average absorbance of *Tw* and *Dt* biophotoanodes are A = 0.0253 and 0.0529, respectively. Therefore, we can calculate N_{ap} by using **Equation 3** obtaining:

$(N_{ap})_{Tw} = 2.52\times10^{-15}$ γ/(cm^2×s); $(N_{ap})_{Dt} = 5.28\times10^{-15}$ γ/(cm^2×s)

The average current density values for *Tw* and *Dt* are J = 0.296×10^{-6} and 0.226×10^{-6} A/cm^2 respectively. These values are used to calculate N_e by using **Equation 2**, and finally *IQE* from **Equation 1**, resulting in the following values:

$(IQE)_{Tw}$ = 0.073 ± 0.015 %; $(IQE)_{Dt}$ = 0.026 ± 0.007 %