Supporting Information

Improving Energy Relay Dyes for Dye-Sensitized Solar Cells by Use of a Group of Uniform Materials Based on Organic Salts (GUMBOS)

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Table S1. Melting point of GUMBOS.

GUMBOS	Melting Point (°C)
[RhB][NTf2]	91
[RhB][BETI]	88
[TC1][NTf2]	235
[TC1][BETI]	215
[TC1][TPB]	231
[PC][NTf2]	248
[PC][BETI]	247
$[P66614]_4[TCPP]$	128

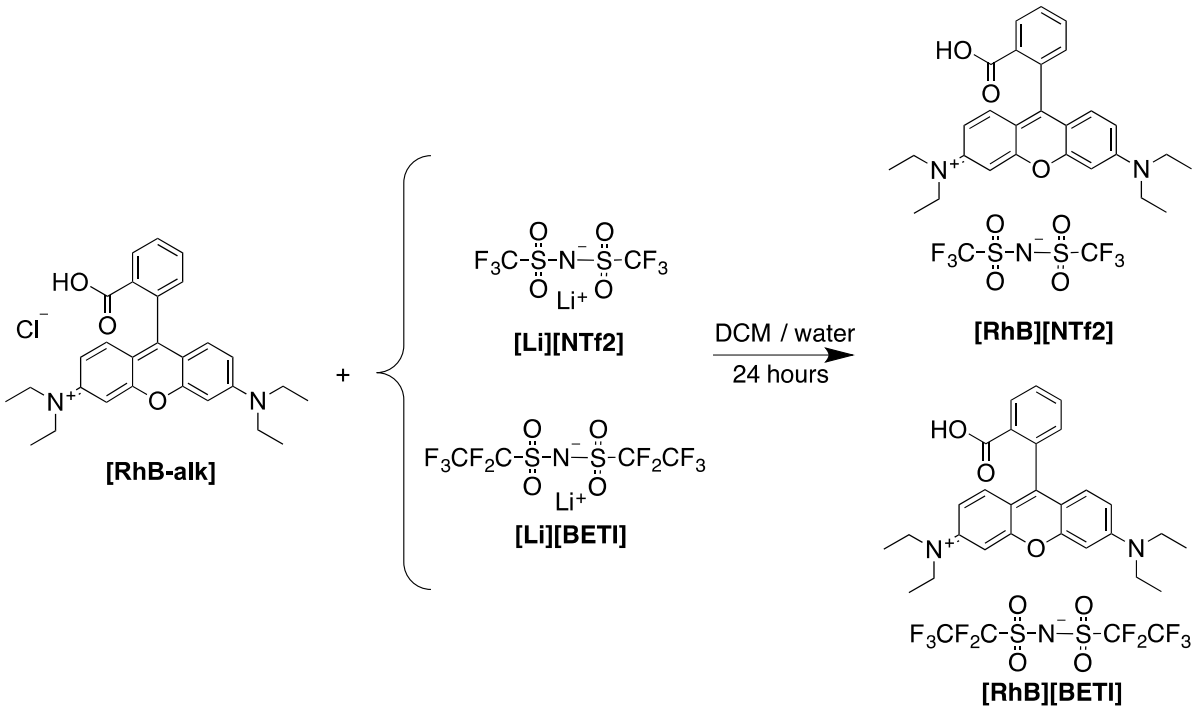

Figure S1. Formation of Rhodamine B (RhB)-based GUMBOS.

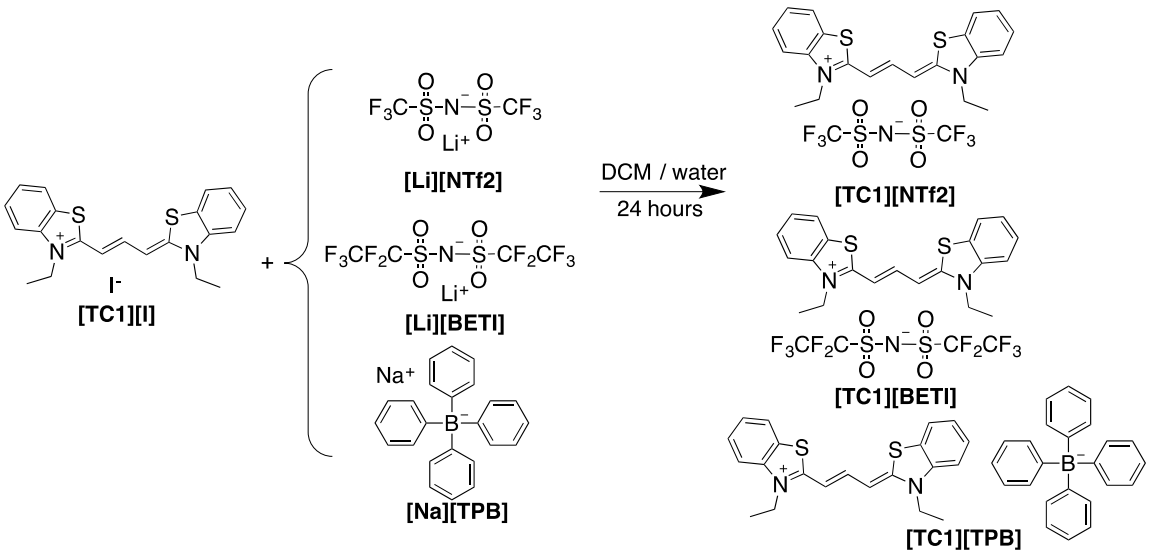

Figure S2. Formation of 3,3′-diethylthiacarbocyanine (TC1)-based GUMBOS.

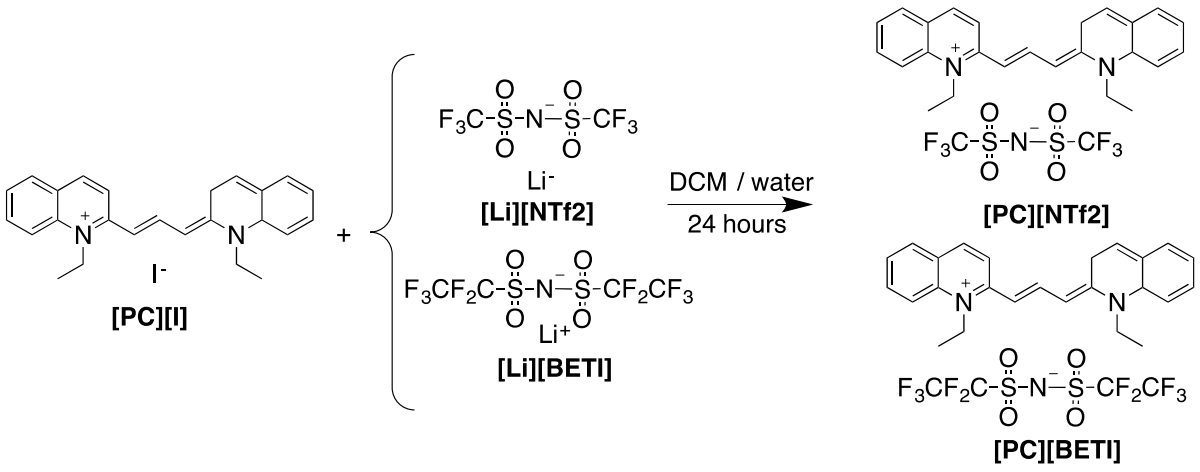

Figure S3. Formation of 1,1'-diethyl-2,2'-carbocyanine iodide (PC)-based GUMBOS.

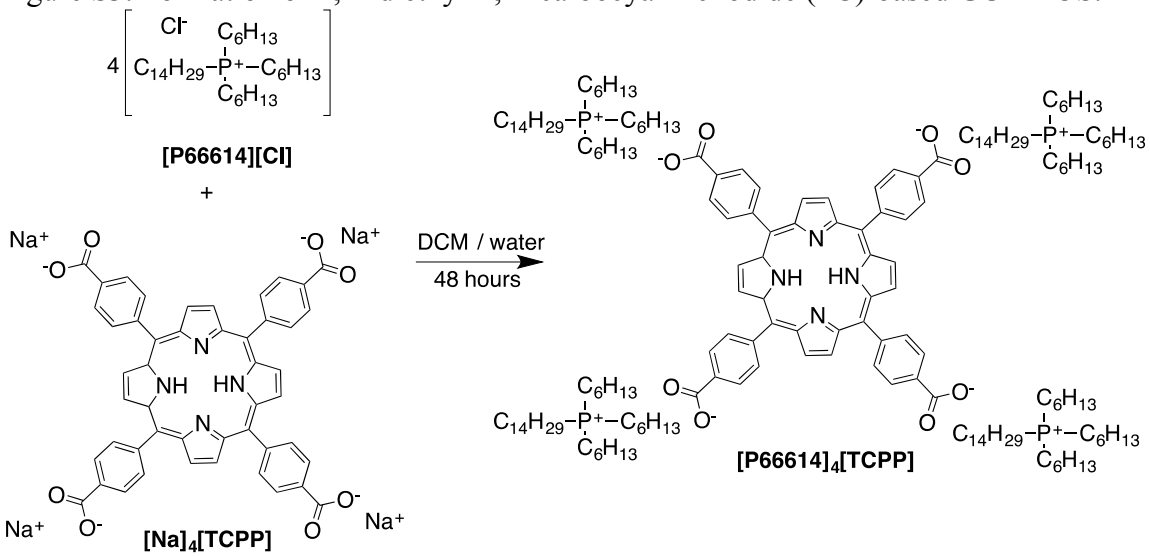

Figure S4. Formation of meso-tetra(4-carboxyphenyl) porphine (TCPP)-based GUMBOS.

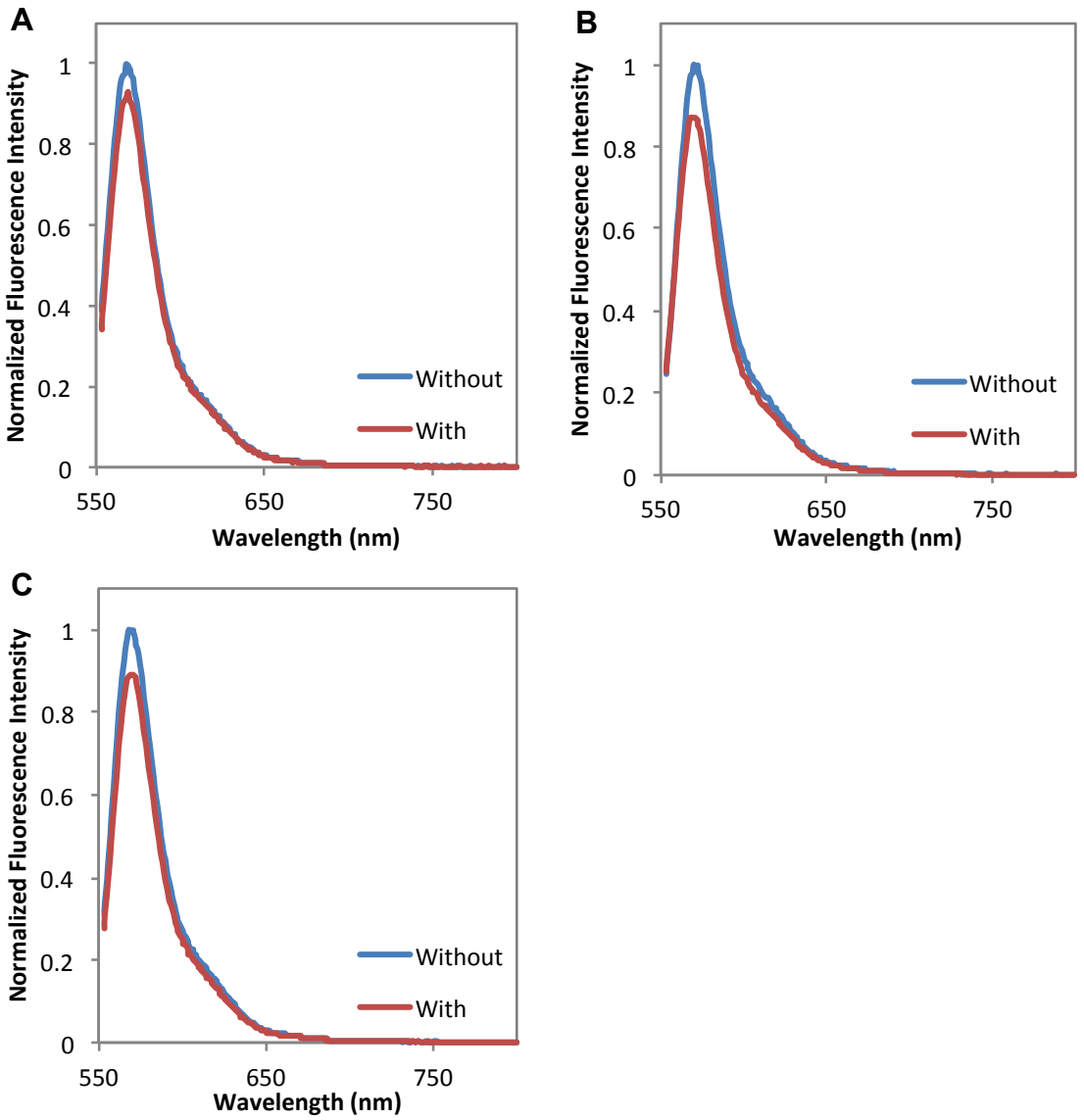

Figure S5: Normalized fluorescence intensity of parent dyes (A) [RhB][Cl], (B) [RhB][NTf2], and (C) [RhB][BETI] in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.

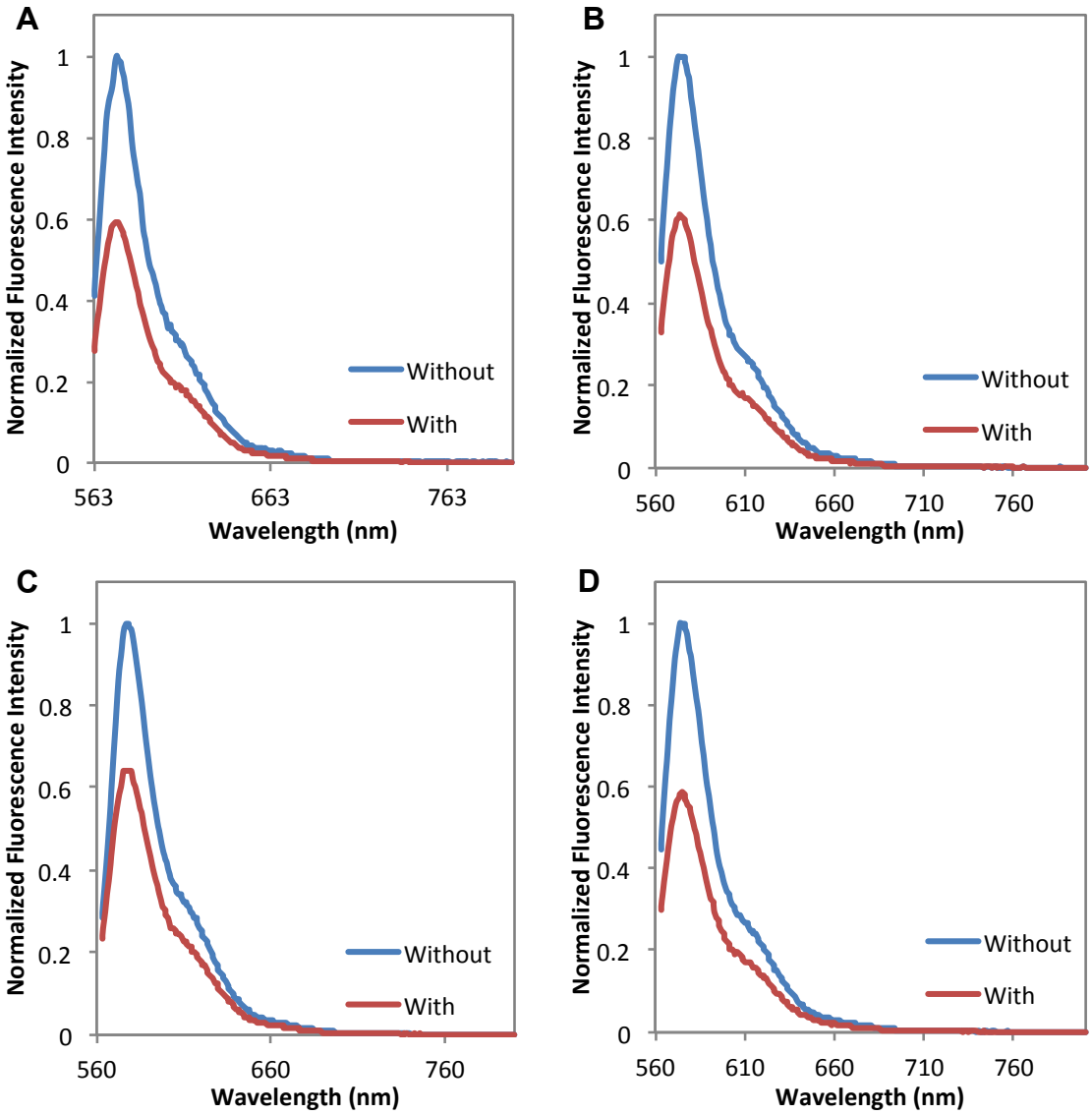

Figure S6: Normalized fluorescence intensity of parent dyes (A) [TC1][I], (B) [TC1][NTf2], (C) [TC1][BETI], and (D) [TC1][TPB] in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.

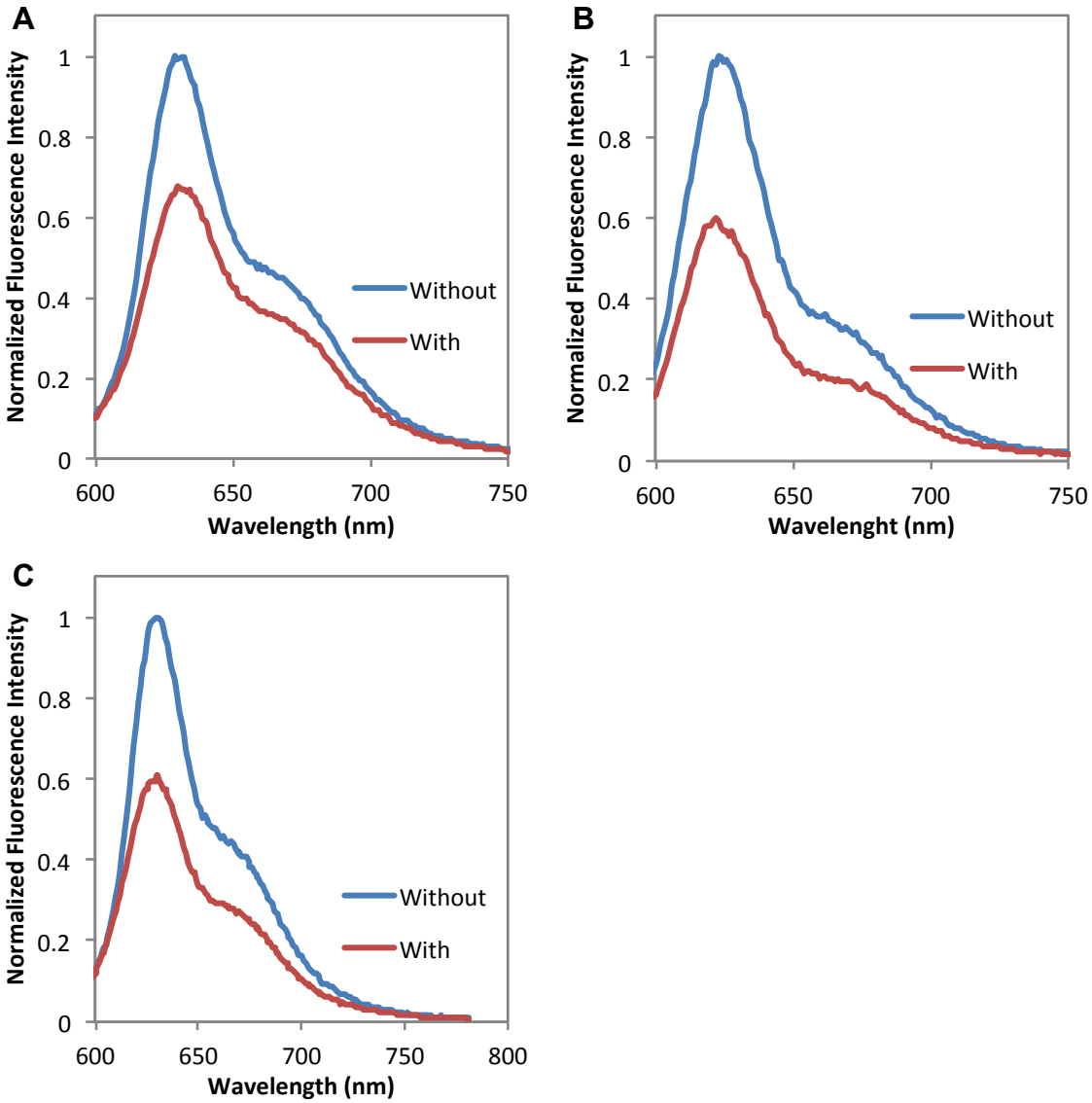

Figure S7: Normalized fluorescence intensity of parent dyes (A) [PC][I], (B) [PC][NTf2], and (C) [PC][BETI] in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.

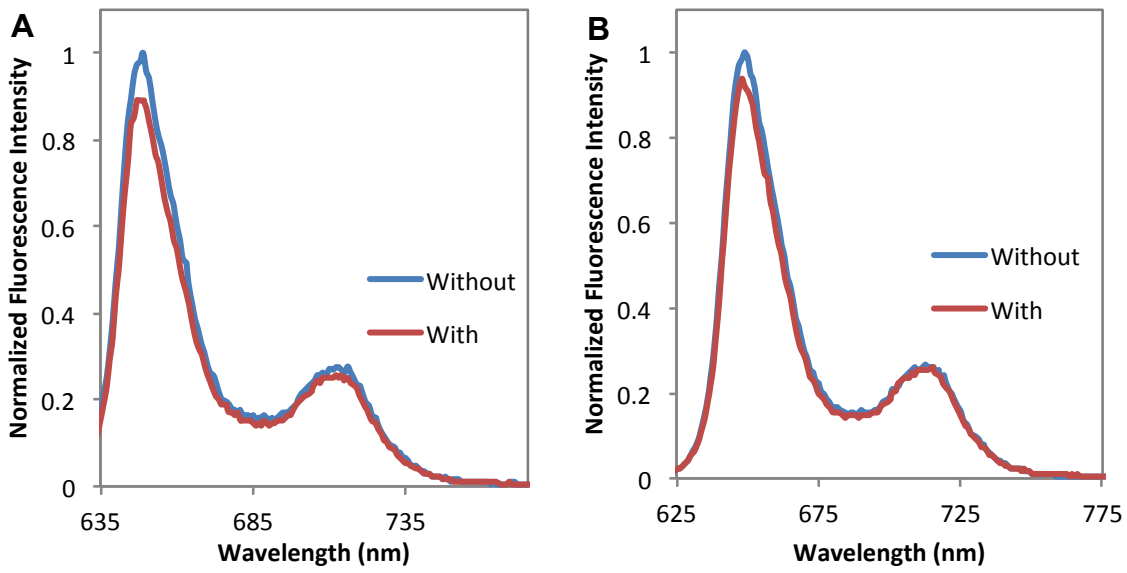

Figure S8: Normalized fluorescence intensity of parent dyes (A) $[H]_4[TCPP]$ and (B) $[P66614]_4[TCPP]$ in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.

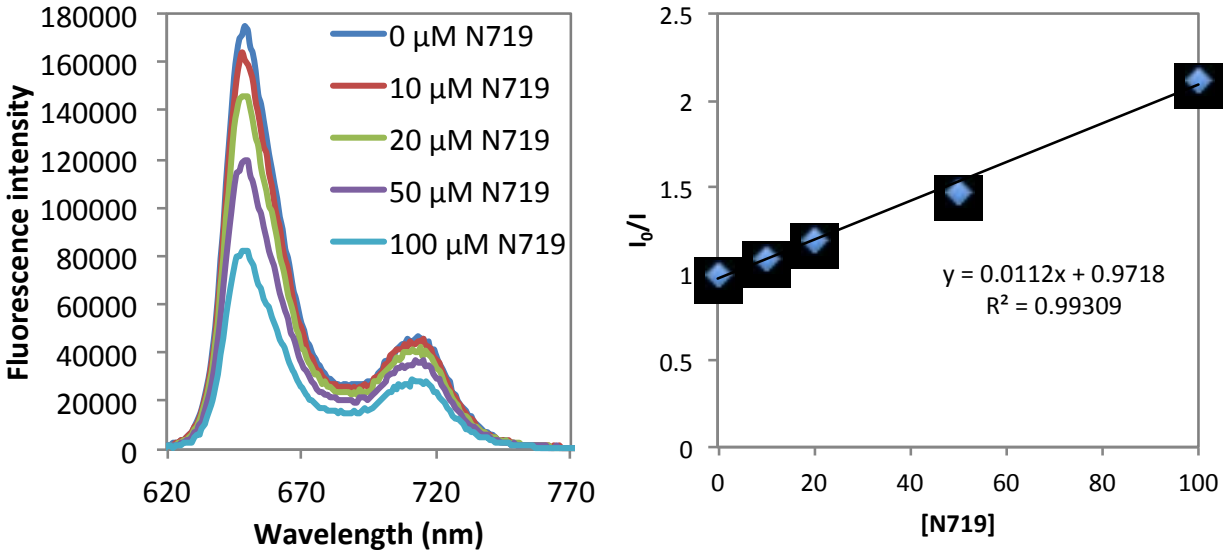

Figure S9: Fluorescence intensity (left) of $[P66614]_4[TCPP]$ in the absence and presence of N719 (acceptor). Concentration of $[P66614]_4[TCPP]$ was held at 10 µM. Stern-Volmer plot (right) of $[P66614]_4[TCPP]$ in the absence and presence of N719 (acceptor). I_0, I, and [N719] represent the initial fluorescence intensity, fluorescence intensity, and concentration of N719.

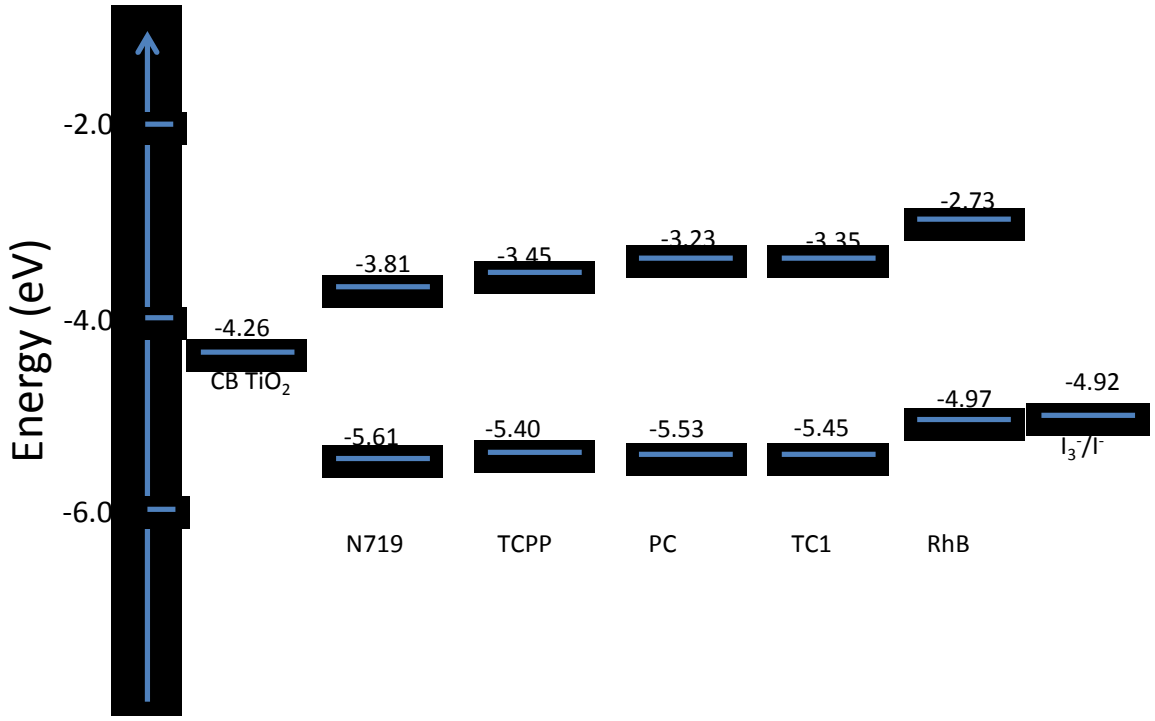

Figure S10: Energy levels of parent dyes, titanium dioxide, and I_3^-/I^-. The highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) energy levels are acquired from electrochemical measurements and band gap was determined from absorption onset wavelength.

Electrochemical data was taken from the following papers:

P. E. Kolic, N. Siraj, S. Hamdan, B. P. Regmi and I. M. Warner, *J. Phys. Chem. C*, 2016, **120**, 5155-5163.

A. N. Jordan, S. Das, N. Siraj, S. L. de Rooy, M. Li, B. El-Zahab, L. Chandler, G. A. Baker and I. M. Warner, *Nanoscale*, 2012, **4**, 5031-5038.

Z. Zhang, Y. Yu and P. Wang, *ACS Applied Materials & Interfaces*, 2012, **4**, 990-996.

G. Pepe, J. M. Cole, P. G. Waddell and S. McKechnie, *Molecular Systems Design & Engineering*, 2016, **1**, 86-98.

M. M. Rahman, M. J. Ko and J.-J. Lee, *Nanoscale*, 2015, **7**, 3526-3531.