Technology Opportunity, Ref. No. UA-17/354

Water-Soluble, Organic Photoredox Catalysts with Powerfull Electrochemical and Photophysical Properties

Our water-soluble small-molecule organic dyes feature an unprecedented substitution pattern leading to photochemical and electrochemical properties unique from known organic dyes. They have shown high activity and stability as photoredox catalysts, also in combination with other catalytic systems.

Keywords Photoredox, Catalyst, Photosensitizer, Organic Synthesis

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Reference *Angew. Chem. Int. Ed.* **2018**, doi: 10.1002/ange.201711296.

Background Photoredox catalytic reactions typically rely on expensive, rare and often toxic transition metals and ligands that modulate their reactivity. These reactions are often performed in presence of highly energetic UV or blue light.

Invention The inventors discovered unprecedented water-soluble organic fluorophores. Structural variation allows adjustment of the electrochemical and photophysical properties:

Dye	$E_{1/2}(*C/C^-)$	$E_{1/2}(C/C^-)$	λ_{abs}	λ_{em}	$<\tau_F>$
1	+1.94 V	–0.48 V	473 nm	598 nm	19 ns
2	+1.81 V	–0.52 V	497 nm	576 nm	2.7 ns
3	+1.76 V	–0.47 V	503 nm	595 nm	2.9 ns
4	+1.89 V	–0.44 V	490 nm	570 nm	3.5 ns
5	+1.52 V	–0.83 V	506 nm	547 nm	4.5 ns
6	+1.31 V	–0.94 V	501 nm	584 nm	4.7 ns
7	+1.20 V	–1.20 V	498 nm	540 nm	4.4 ns
8	+1.02 V	–1.27 V	513 nm	595 nm	3.1 ns

The fluorophores provide an alternative to various transition metal-based photoredox catalysts and allow novel, sustainable commercial applications in catalysis under softer, less energetic blue to even green light. The mean singlet excited state lifetime ($<\tau_F>$) of these organic dyes was measured to be at least 2.7 ns in acetonitrile, which is an ideal prerequisite for electron transfer reactions.

Fields of Use Photoredox catalysis

Patent Status Patent filed EP 17/188,288

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