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Electrostatic loading and photoredox-based release of molecular cargo from oligoviologen-crosslinked microparticles

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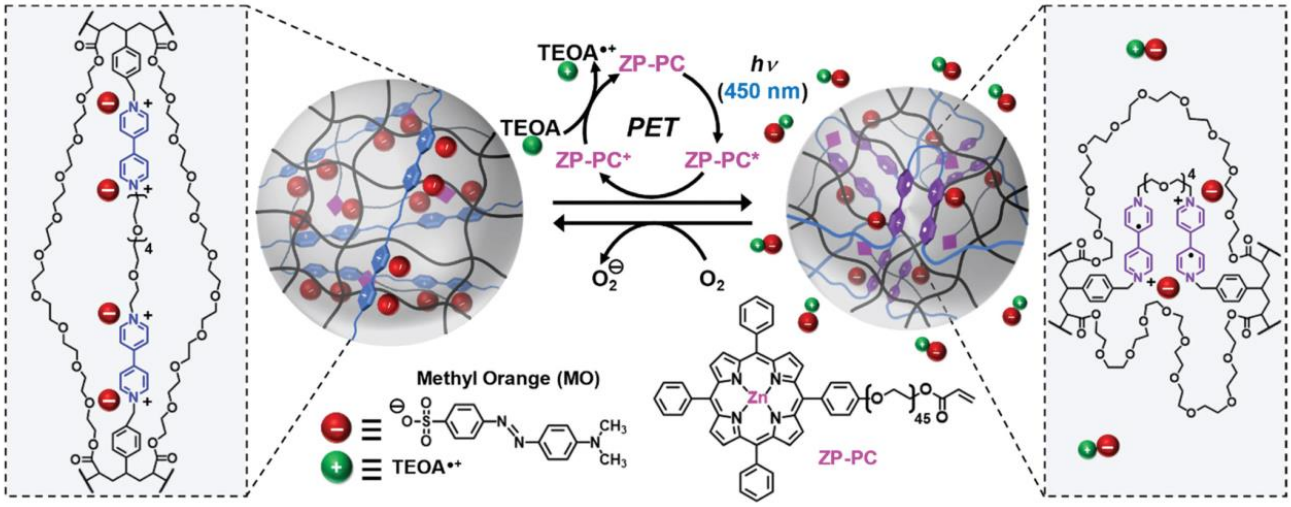

Who are the corresponding authors and what are their research areas?

Jonathan C. Barnes: he completed his B.S. and M.S. degrees in chemistry at the University of Kentucky in 2006. In 2016, he began his independent career at WUSTL where his group is focused on synthesizing new functional polymers to make redox-responsive photodynamic materials, targeted polymeric nanomaterials for drug combination therapies, and developing novel topologically complex polymers and materials influenced by the mechanical bond.

What is the main claim of the article?

Existing methods for cargo release lack specific loading interactions and involve permanent damage to the microparticle for cargo release; here the authors describe a novel method for electrostatic loading of a negatively charged molecular cargo into microparticles cross-linked with oligoviologens, in which the cargo can be released in a controlled manner upon activation by visible light.

How is it demonstrated?

Negatively charged methyl orange (MO) was chosen as the molecular load since its release can be controlled by absorption spectroscopy. To demonstrate MO release, kinetic release experiments were performed with different batches of microparticles. Microparticles with and without irradiation, without integrated photocatalyst, or without viologen crosslinker were analyzed by Uv-vis spectroscopy to demonstrate that optimal loading release is achieved when all components are present.

What are the typical experimental conditions?

^{1}H NMR: for the characterization of the compounds and to verify the loading of the methyl orange as counterion of the viologen units.

DLS measurements: All light scattering experiments were performed in triplicate with 10 scans for each analysis. Preparation of microparticles: 100 µL of a 2 mg·mL^{-1} suspension of microparticles in MeOH was diluted up to 1 mL with pure H_2O in a small scintillation vial. The microparticles were then reduced by addition of 200 µL of 1M $Na_2S_2O_4$ solution in H_2O and analyzed.

SEM imaging: The microparticles loaded in a suspension of MeOH were drawn up and plated onto clean silicon wafers by glass pipette. The images were recorded at 2,000x, 6,500x, 10,000x, 20,000x, and 65,000x magnification. The images were then analysed using ImageJ software to calculate the size and distribution of the microparticles.

Uv-vis: to control the release of methyl orange from the microparticles. The aliquots were then analysed within a window of 350 – 600 nm.

Which are the key related papers?

1. *Macromol. Rapid Commun.,* **2018**, 39, 1700781
2. *Chem. Sci.,* **2020**, 11, 10910–10920