**Introduction**

Photosystem I - Integral membrane protein
- Part of electron transfer chain
- Creates charge gradient and allows plant cells to store energy

Why is PSI useful for solar technology?
- High quantum efficiency
- Abundant in nature
- Stable

Polymers as mediator allow:
- Enhanced electron transfer
- Reduced directional effects
- Possible 3-D network
- Future work in solid state studies

Previous work includes:
- Usage of aqueous mediators to mimic electron transfer chain
- Embedding of PSI in poly-aniline films
- Creation of thick PSI films

**Objective**

- Synthesize Polymers
- Characterize Polymers
- Investigate Polymers as Solid Mediators
- Investigate Polymers as Aqueous Mediators

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**Methods**

Reaction utilizes the Menshutkin mechanism and converts a tertiary amine to a quaternary ammonium salt. Monomers (4,4'-bipyridine and p-dibromoxylene or 1,3-dibromopropane) were dissolved in acetonitrile and stirred throughout reaction.

Polymers created were:
- Poly(xyl viologen) 3.5 day reaction, RT, 62.2% yield
- Poly(propyl viologen) 1 day reaction, refluxed, 2.2% yield

Two Types of Electrochemical Cells

- Silicon substrate cell
- Reference electrode
- Counter electrode
- Working electrode
- Gold macroelectrode cell
- Alternating electrode
- Codeposited

CVs were run in 100mM KCl solution, generated formal potentials which are unique for each polymer.

- i-t curve generation:
  - 633 nm high-pass lamp shone on sample
  - 100mM KCl, 5mM sodium ascorbate (for Au test), 1 mg/mL polymer
  - Held at open-circuit potential
  - 20 seconds dark, 20 seconds light, 20 seconds dark

CVs show different curve shapes for each polymer and have different formal potentials.

**Results**

- PPV and PXV showed potential for use as aqueous mediator
- PPV did not adhere to gold, and thus could not be used for deposition methods
- Lead to study of performance as aqueous mediator
- Outperformed control and PPV, compared favorably with currently preferred mediator

CVs were run in 100mM KCl solution, generated formal potentials which are unique for each polymer.

- PPV spectrum isn’t clean; suggests reaction did not reach completion
- PPV spectrum clean, confirms molecular structure, gives rough molecular weight of 1.2kDa
- PPV adhered well to gold surface
- Codeposition was tested by preparing PPV-PSI solutions in varying concentrations
- Showed increased photocurrents over solely PSI electrodes

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**Conclusions, Future Directions, and Acknowledgements**

- Two polymers were synthesized for use in PSI assemblies
- PXV showed potential for use as an aqueous mediator
- PPV was capable of being codeposited onto gold; resulted in photocurrent improvements over both non-PSI control and layered deposition
- Future work could focus on viability of PPV-PSI codepositions as solid-state mediators for solar cells


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