The Summer Undergraduate Research Fellowship (SURF) Symposium
7 August 2014
Purdue University, West Lafayette, Indiana, USA

Porphyrin interaction with DNA-based carbon nanotubes and regeneration for light harvesting

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ABSTRACT

Limitations to current solar cells include the high cost of pure silicon and poor current transfer within cells. An emerging alternative is single-walled carbon nanotubes (SWCNTs), which when combined with DNA and porphyrin chromophores can generate a current when absorbing light. We sought to find a chromophore and conditions that would promote bonding to the SWCNTs and improve light harvesting, while being able to regenerate on the film after being damaged. This was experimentally tested by first making SWCNT films on conducting glass slides. These were then functionalized in solutions of chromophore and spectra were measured to determine the bonding and absorbtion changes. Samples were also tested on an electrode system to measure photocurrents. Key shifts were noted for functionalization in porphyrin and defunctionalization in buffer solution, which caused the release of chromophore by DNA conformation change. The films consistently generated an electric current when exposed to light, with increased current from assembled SWCNT-DNA-porphyrin complexes. Through this testing we found that the regeneration was feasible with the solutions tested on the SWCNT films and chromophore solutions. Further research can be done regarding DNA bonding interactions with porphryin and SWCNTs to promote functionality of the light-harvesting donor-acceptor complex.

KEYWORDS

Solar cell, chromophore, porphyrin, carbon nanotubes

REFERENCES

(sample format provided below)

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