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Adaptive Dye-Sensitized Solar Cell

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Introduction

An adaptive dye-sensitized solar cell is basically a form of artificial photosynthesis that mimics the way a leaf converts sunlight into energy for growth. A dye sensitized solar cell converts sunlight in useful electricity while being adaptive to our everyday environment. This research focused on finding a cost effective and efficient way to print and adapt solar cells into electronics, common plastics and wood materials without compromising cost or efficiency.

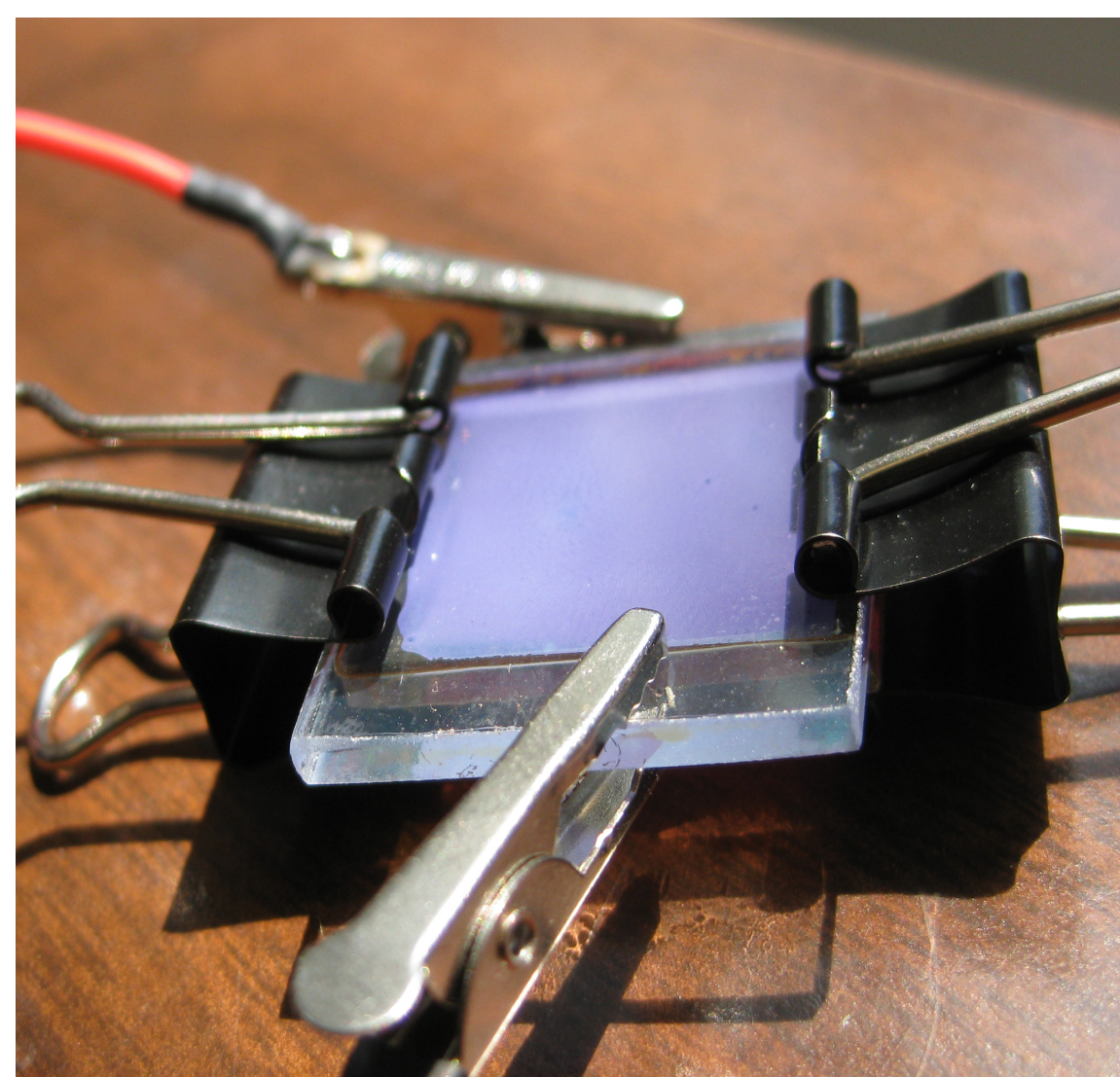


Figure 2:
Prepared Dye sensitized solar cell With glass substrate.

Methods

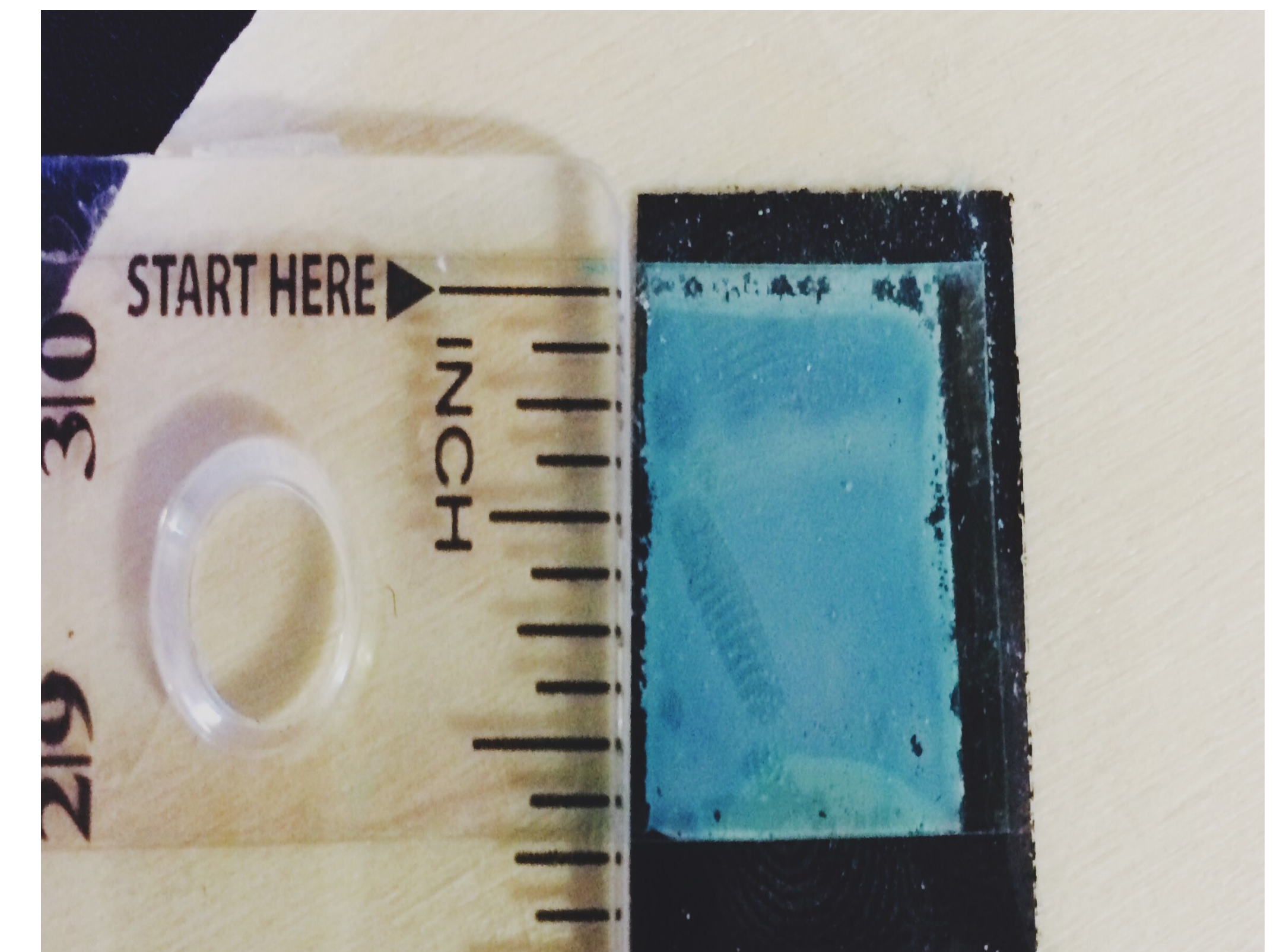
Replaced costly materials with alternatives:

- (a) ITO electrode was replaced with carbon cloth which offered flexibility, low electric resistance and high conductivity.
- (b) Glass substrate was replaced with pouch laminating plastic with benefits of protection a flexible substrate and UV protection.
- (c) Inorganic dye was replaced with organic dye and anthocyanin, taken from grapes and fruit.

Results

- (a) Voltages of 0.133, 0.093 and 0.094 millivolt were achieved when replaced with a carbon structure.
- (b) Flexible Dye-Sensitized Solar Cell was able to be bent and twisted with the use of glass substrate and polymer.
- (c) The use of plastic as a UV shield give the cell a long lasting result.
- (d) Materials used could be replicated for mass adoption because of the low cost to acquire these materials, making the overall cell affordable.

Figure 2: Dye-Solar cell layered on carbon

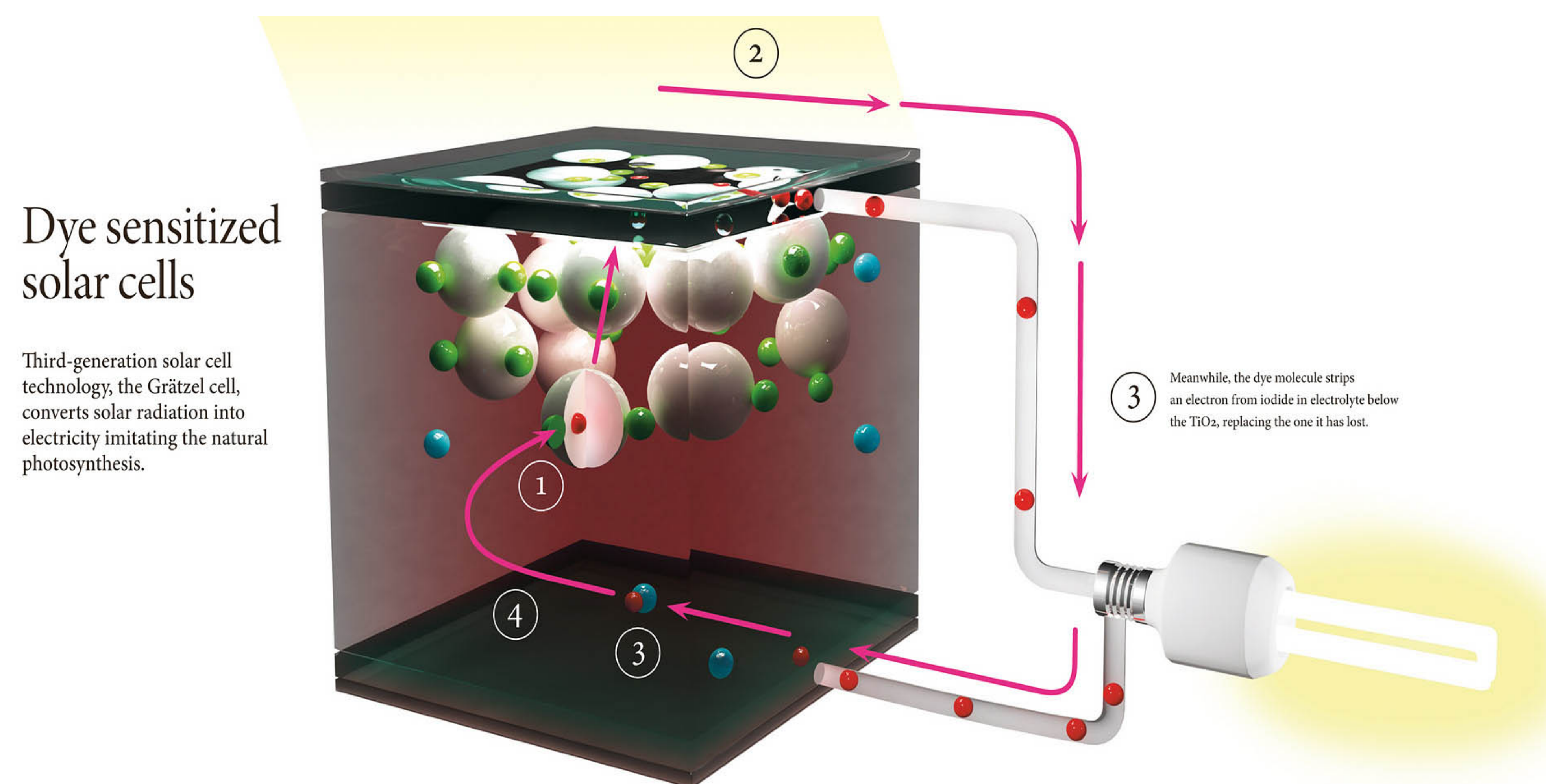


Conclusions

As progress is made more research is needed to solve some of the problems facing Dye-Sensitized solar cell in these areas:

- (a) Cell electrolyte for charge transport.
- (b) Suitable manufacturing technique.
- (c) Replacing rare earth element used e.g platinum catalyst with organic element.

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Dye sensitized solar cells

Third-generation solar cell technology, the Grätzel cell, converts solar radiation into electricity imitating the natural photosynthesis.

① Sunlight entering the cell strikes the dye molecules on the surface of the titanium dioxide (TiO₂). Energy to be absorbed creates an excited state of the dye, from which an electron is injected into the TiO₂-particles.

② The released electrons move by diffusion to the anode on top and transfer to an external circuit.

③ Meanwhile, the dye molecule strips an electron from iodide in electrolyte below the TiO₂, replacing the one it has lost.

④ The iodide recovers its missing electron by mechanically diffusing to the bottom of the cell, where the counter electrode re-introduces the electrons after flowing through the external circuit.

Figure 1: Dye sensitized solar cell structure.

