

IISER Bhopal develops organic solar cell using vitamin B12 derivative

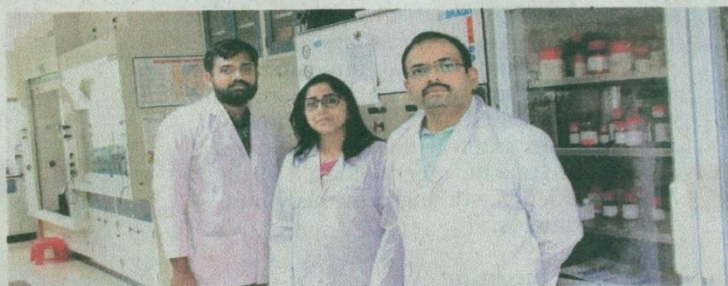
The synthesised material absorbs light much like porphyrin in natural chlorophyll

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Researchers at the Indian Institute of Science Education and Research (IISER) Bhopal have developed cheaper and more flexible organic solar cells using a synthetic derivative of vitamin B12.

An organic solar cell is made up of acceptor and donor materials. The donor absorbs light from solar radiation and the harvested energy is passed to the electrodes with the help of the acceptor. In the present study, published in *ACS Applied Materials and Interfaces*, the researchers synthesised the donor using an artificial aromatic chemical (corrole) which has a similar structure to the corrin ring in vitamin B12. The artificially synthesised corrole (Cor-BODIPY) absorbs light much like porphyrin in natural chlorophyll.

"Corroles have very good photophysical properties. They show excellent absorption in the visible light range and are highly stable. They are very flex-



Corroles show excellent absorption in the visible light range and are highly stable, says Jeyaraman Sankar (right).

ible unlike the silicon solar cells and so could be used in flexible electronics," says Dr. Jeyaraman Sankar from the institute and corresponding author of the work.

Another commercially available organic molecule was used as an acceptor. "The molecule is electron deficient and so can be used as an acceptor, while the corrole is the electron source. We carried out light absorption and emission studies," says Dr. Ruchika Mishra, Research Associate at the institute and the first author of the paper.

The organic cells developed by the team showed three absorption bands between 400-650 nm – whole visible range of the solar spectrum – with a maximum absorption at 420 nm. The ability to turn the light absorbed to electricity (power conversion efficiency) was 2.5%.

The researchers enhanced the performance of the solar cells by coating them with different solvents. The surface morphology was investigated after the treatment and microscopy images showed that the treat-

ment helped improve the alignment of the Cor-BODIPY donor by forming a denser molecular packing on the active surface. This treatment more than doubled the power conversion efficiency from 2.5% to 6.6%.

"Many solar cells made of porphyrins which started with 1% efficiency have now reached over 10% due to appropriate improvements. Further optimisation can help increase the efficiency of our cells too. More studies are also being carried out to ascertain its stability and the results look promising," adds Ruchika.

Corroles are currently used as sensors, catalysts and in biomedical imaging. This is the first study wherein a corrole has been utilised for a bulk heterojunction solar cell as a donor material. The authors hope that this study shall open up a new window and may pave way for its development as a low-cost, efficient photovoltaic material with a wide range of absorption and increased flexibility.