Solar cell design using diverse plant pigments

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A member of the Faculty of Biology of the Lomonosov Moscow State University, in cooperation with colleagues, has optimized and characterized TiO_2-based solar cell design using diverse plant pigments. The study involved two types of solar cells with two photosensitizers, thylakoid membrane preparations and anthocyanin-enriched raspberry extracts. The project results have been published in the *International Journal of Hydrogen Energy*.

Suleyman Allakhverdiev, one of the article authors, says, "To understand processes occurring in the solar cells, investigations characterizing the efficiency and stability with regard to environmental factors are also required. For this aim, novel instrumentation for the investigation of environmental effects on photocurrent generated by solar cells has been designed and constructed. The system reflects conditions required for effective and stable functioning of the solar cells. We've designed and studied solar cells in which components of the photosynthetic apparatus are used as photosensitizers. With the help of the stabilizing compounds, we have increased the active stable operation time of a system by four to six times. We've also proved the possibility of applying long-wave forms of chlorophyll, capable of absorbing low-energy photons, which aren't absorbed by usual chlorophyll molecules."

In order to create the solar cell, the scientists used methods of immobilization of various biological pigment-protein complexes on the surface of nanostructured titanium dioxide.

The scientist concludes: "In the future, we are going to use complexes of

isolated reaction centers of photosynthesis as sensitizers in such systems, as well as chlorophyll molecules which are able to absorb light in far red and near infrared spectral ranges. Biological systems used as photosensitizers are inexpensive and environmentally safe. Moreover, the same principle could be applied to the creation of photocatalytic water cleavage systems with the outcome of molecular hydrogen, which could be a promising alternative to fossil fuel. Creation of artificial photobiosynthesis systems could meet ever-increasing needs for cheap, environmentally safe and energy-rich fuel types."

More information: R.A. Voloshin et al, Optimization and characterization of TiO 2 -based solar cell design using diverse plant pigments, *International Journal of Hydrogen Energy* (2016). DOI: 10.1016/j.ijhydene.2016.11.148

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