Synthesis of Dyes for DSSC's with a Novel Type of Acceptor Moiety: An Attractive Way to Low Cost and Eco-Friendly Energy Production

Chechekina, Olga (School: Moscow South-Eastern School Named After V. I. Chuikov)

Energy is essential for industrialization but traditional energy sources have a bad impact on our environment. Therefore, researchers are interested in using alternative energy sources such as solar energy. Dye-Sensitized Solar Cells (DSSC's) have attracted attention as inexpensive and flexible means of generating clean energy. However, the efficiency of solar energy conversion has not reached its maximum values yet. Therefore, this project is dedicated to the synthesis of Donor-Acceptor (D-A) and Donor-π-Acceptor (D-π-A) dyes with new hydrazonocyclopentadiene acceptor moiety, which is expected to be crucial in terms of efficiency. Hydrazonocyclopentadienes are proposed due to their highly polarized structures, which enhances the intramolecular charge separation. In this work we extended the scope of the two approaches to the synthesis of D-A chromophores containing arylhydrazonocyclopentadiene acceptor moieties and proposed a pathway to the synthesis of dyes containing a stilbene linker. Also during the work, we optimized the procedure for the synthesis of a number of starting compounds, proposed milder reaction conditions and the use of more available reagents. We have obtained a series of D-A and D-π-A dyes. Moreover, we discovered and investigated a rearrangement of some of the products to form condensed conjugated cycles, which occurs on silica gel. Hydrazonocyclopentadiene derivatives exhibited intensive absorption within the solar spectrum, thus, demonstrating their potential use in DSSC's. All target compounds were purified and characterized using 1H, 13C NMR spectroscopy, GC-MS, and the optical properties of our compounds were investigated by means of absorption spectroscopy including the investigation of their solvatochromic behavior.