Analysis of Photocatalytic Performance in TiO2-Dye Sensitized Solar Cells Doped with Nanostructure Diatoms

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Energy is a key problem in our modern society. Every year we require more energy than the last and fossil fuels are nonrenewable. Solar energy stands as a possible answer to the problem as the sun produces immense amounts of energy daily. There has been a large push to maximize the efficiency of organic solar cells in order to harness the most solar energy for the lowest cost. The purpose of this experiment was to determine if doping TiO2 with diatoms could increase the efficiency of a TiO2 dye-sensitized solar cell. To accomplish this, I created a novel method of incorporating diatoms. A specific concentration of diatomaceous earth was prepared in water, forming a diatomaceous earth (DE) solution; this was then added to the TiO2, creating different concentrations of DE-TiO2 solutions (6.25%, 25%, 50%). These solutions were applied to FTO glass and solar cells were assembled. For each concentration, thirty solar cells were made and tested. After testing these cells, the 25% DE-TiO2 solution concentration showed promising results. This concentration resulted in a 91.4% higher power output compared to the control (0% DE-TiO2 solution), and voltage and power readings were significantly different compared to all concentrations ($P<0.05$). The final efficiency of this 25% DE-TiO2 solution calculated to 10.64% compared to the control with an efficiency of 5.56%. The control's efficiency is considered low compared to available technology, many steps could have been taken to maximize the power output, however this was not the purpose of the experiment. The purpose was to isolate the diatoms' effect and observe if it brought a change in power output compared to the control. Future research may find a way to incorporate this method into a more efficient organic solar cell.

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