Natural dye-sensitized solar cells (nDSSCs) based on extracted natural dyes and develop nDSSCs based power bank

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Natural Dye-Sensitized Solar Cells (nDSSCs) have gained attention for their use of natural dyes and electrode materials, with a focus on efficiency and absorption spectra. Promising results have been obtained with various natural dyes, such as Blue butterfly pea flower dye achieving 0.142% efficiency, Spinach Seeds dye achieving 0.067%, and Yellow Allamanda flower dye achieving 0.038%. These findings demonstrate the potential of natural dyes as efficient sensitizers in nDSSCs. The process of pigment extraction involved a rotary evaporator, which was applied to conductive glass coated with titanium dioxide (TiO2). The resulting solar cell immersed in the dye as the electrolyte, and its light absorption and efficiency were evaluated. The absorption spectra revealed that each natural dye had specific absorption characteristics, allowing effective light harvesting in nDSSCs. FTO glasses with nano TiO2 exhibited higher current density and open-circuit voltage compared to FTO glasses with normal TiO2 powder and ITO glasses with TiO2 fine powder. This study supports the potential of natural dyes as efficient sensitizers and highlights the possibility of using recycled electrode materials, such as FTO glasses from used nDSSCs and ITO glasses from recycled LCD panels, to enhance nDSSC performance. In conclusion, this research demonstrates the promising performance of natural dyes in nDSSCs and provides valuable insights into efficiency and absorption spectra. The use of recycled electrode materials promotes sustainability and circular economy principles. Future studies should focus on stability enhancement, process optimization, and scalability of nDSSC technology for commercialization and integration with other energy conversion systems.

Keywords: Natural dye-sensitized solar cells, natural dyes, power conversion efficiency, photovoltaics, renewable energy