Área: FQ

Exploratory study of the photoconversion efficiency of Ipê dyes for future application as co-sensitizers in pyrimidine-based DSSCs

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Palavras Chave: *Bioenergy, Organic Synthesis, Co-sensitization, Anthocyanins, Materials*.

Highlights

Exploratory study on Ipê natural dyes as low-cost sensitizers, evaluating their photoconversion efficiency for potential co-sensitization in pyrimidine-based DSSCs.

Resumo/Abstract

This work presents initial tests using dyes extracted from *Handroanthus impetiginosus* (purple Ipê) and *Handroanthus albus* (yellow Ipê) applied in TiO_2-based dye-sensitized solar cells (DSSCs). These devices, originally proposed by O'Regan and Grätzel (1991), rely on photo-sensitizers capable of absorbing visible light and injecting electrons into the semiconductor. Natural pigments, especially anthocyanins, have gained attention as low-cost and renewable sensitizers suitable for sustainable photovoltaic applications [2].

Electrochemical analyses (OCP,j-E, j–t) were performed under simulated AM 1.5 sunlight to evaluate the preliminary photoconversion behavior of the Ipê dyes. As shown in Table 1, the purple Ipê dye exhibited superior performance, reaching 0.56% efficiency and 1.9 $mA{\cdot}cm^{-2}$ photocurrent, while the yellow Ipê dye achieved 0.03%. Although efficiencies remain modest, these exploratory results demonstrate the potential of anthocyanin-based natural dyes as viable photo-sensitizers for low-cost solar cells. Future studies will focus on applying these pigments as co-sensitizers in conjunction with synthetic pyrimidine dyes, which have shown improved charge transfer and temporal stability in DSSCs [3].

Table 1:Photovoltaic parameters of TiO_2-based DSSCs using natural Ipê dyes

Corante	OCP (V)	Jsc (mA*cm^{-2})	FF	η (%)
Ipê Amarelo	0,57	0,09	0,47	0,03
Ipê Roxo	0,56	1,9	0,52	0,56

$$\eta(\%) = \frac{Eca\ Jsc\ FF}{\text{Pin}} * 100$$

Agradecimentos/Acknowledgments

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1. O'REGAN, B.; GRÄTZEL, M. Nature, v. 353, p. 737–740, 1991.
2. LONGO, C.; PAOLI, M.-A. Journal of the Brazilian Chemical Society, v. 14, p. 889–901, 2003.
3. DUERTO, I. et al. Dyes and Pigments, v. 203, 110310, 2022. DOI: 10.1016/j.dyepig.2022.110310.