

**EXPLORING THE POTENTIAL OF ARECA NUT (*Areca catechu*)
EXTRACTS AS SENSITIZER FOR DYE SENSITIZED SOLAR CELL:
A SOLVENT-BASED STUDY**



BY

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ABSTRACT

Dye-sensitized solar cells (DSSCs) offer a promising avenue for sustainable and clean energy generation due to their low-cost fabrication and potential for utilizing natural dyes. This study investigates the influence of solvent selection on the performance of DSSCs sensitized with natural dye extracted from Areca nut (*Areca catechu*). DSSCs made with TiO₂ nanoporous semiconducting photoanode layer sensitized with natural dye extracted from areca nut using various solvents. An iodine-based electrolyte system with a redox couple of iodide/triiodide (I^-/I_3^-) was used and Platinum (Pt) coated conductive glass substrate was used as a counter electrode and TiO₂ nanoparticles were prepared and the X-ray diffraction (XRD) analysis confirmed good crystallinity and an anatase phase. A critical film thickness of TiO₂ was identified for effective adsorption of dye molecules. Various solvents were used for dye extraction, including acetonitrile and tert-butanol, acetone, ethanol, deionized water, chloroform, and toluene. The UV-Visible spectroscopy studies shown that only polar solvents (acetonitrile and tert-butanol, acetone, ethanol, and deionized water) extract natural dyes with light absorption peaks observed between the wavelength 412 nm and 580 nm. The J-V characteristic studies showed a maximum conversion efficiency of about 0.42% and 0.40% obtained for the DSSC device prepared using acetone and ethanol as solvents with the main contributor is the short circuit current. Enhancement in the conversion efficiency and the performance can be owed to the critical thickness of the TiO₂ film and the degree of polarity of the solvent that were used to make the DSSC devices in this study.

Key words: Dye-Sensitized solar cell, Natural dye, *Areca catechu*, TiO₂ nanoparticles, polar solvent, Eco-friendly

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