

Procuring Natural Dye for Solar Cell Using Leaf Waste

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1. Introduction

The increase of energy demand nowadays is a global issue. Thus research for developing alternative energy that is more eco friendly is also increasing significantly especially continued research of solar cells. In India, the Dye Sensitized Solar Cell (DSSC), the third generation of Solar cells that use Ruthenium as the dye, has been developed to produce electricity by Researchers of the Indian Institute of technology. Despite the fact that DSSC Ruthenium performs well in producing electricity, it still cannot be mass produced as ruthenium is a rare material that is not easy to get in India. Thus the need to develop a local material that can be used as dye for DSSC to replace ruthenium. As India has many species of plants and their leaves waste contain pigment still not optimally used, the aim of this research is to examine the potency of developing natural dye from Jati (*Jasminum grandiflorum*), Filicium, and Rambutan (*Nepheleium lappaceum*) leaves waste to substitute ruthenium in DSSC.

2. Experiment

In this research, [1] we used pigment separated using thin layer chromatography from Jati, Filicium, and Rambutan leaves waste extract as natural dye for Dye Sensitized Solar Cell (DSSC). [2] To compare the performance of the DSSC based on natural dye to DSSC Ruthenium, we conducted 3 kinds of analysis: light absorption characterization, electrical characterization, and electrical stability testing. [3] As Dye Sensitized Solar Cell produces electricity by converting photons from the sunlight into electron movement, the light absorption testing was conducted by using the UV-Visible Spectrophotometer in order to know how effective the natural dye was in absorbing the sunlight compared to Ruthenium.[4] In order to know the electrical characteristic and stability, the prototype was tested under a sun simulator at 500 watt/sqm and connected to a potentiometer.

3. Result

Results of the light absorption characterization showed that Jati, Filicium, and Rambutan each have absorption spectra that are almost the same as Ruthenium Z907.

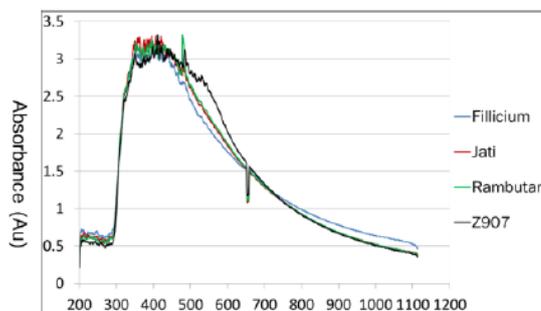


Figure 1: Absorption spectra

The Fig 1 shows that natural dye actually has the potency to substitute ruthenium in DSSC. Results of the electrical characterization in Table 1 show that every DSSC has a different electrical characteristic depending on the type of the Dye.

Table 1: Electrical Characterization Result

Sample DSSC	Efficiency (%)	P max (mW)	Voc (mV)	Isc (mA)
Jati	0.13	0.068	549	0.22
Filicium	0.10	0.051	549	0.20
Rambutan	0.07	0.036	447	0.18
Ruthenium	0.23	0.15	814	0.38

The electrical characterization result is shown by the fig 2.

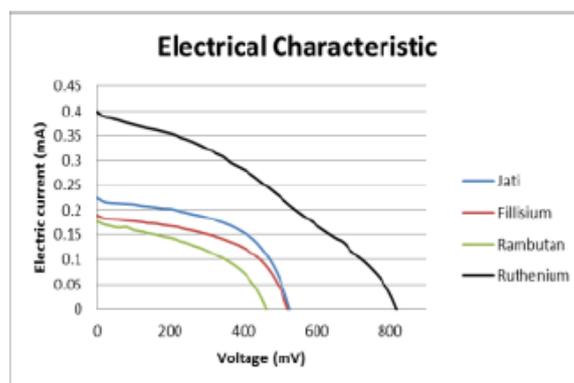


Figure 2

From the graph and table above we can observe that the voltage and electrical current of the DSSC Ruthenium are still the highest ones. However, the DSSC Jati also has potent electrical characteristic and stability so if it can be improved, it will have the potency to substitute ruthenium.

4. Conclusion

From this research we can conclude that natural dye from Jati leaves waste has the highest potency to substitute ruthenium in DSSC because it has the most optimum absorption spectra and electrical characteristic amongst the other natural dye samples. However, the dye from leaves waste still needs to be improved because the electrical characteristic is still much lower than ruthenium.

References

- [1] Martineau, David. 2011. Dye Solar Cells for Real The Assembly Guide for Making your Own Solar Cells. Aubone: Solaronix
- [2] Nugrahawati, Dewi. 2012. “Fabrikasi Dye Sensitized Solar Cell Menggunakan Rosa Damascena Mill Sebagai Pewarna Alami berbasis Antosianin”. Skripsi. Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Sebelas Maret Surakarta