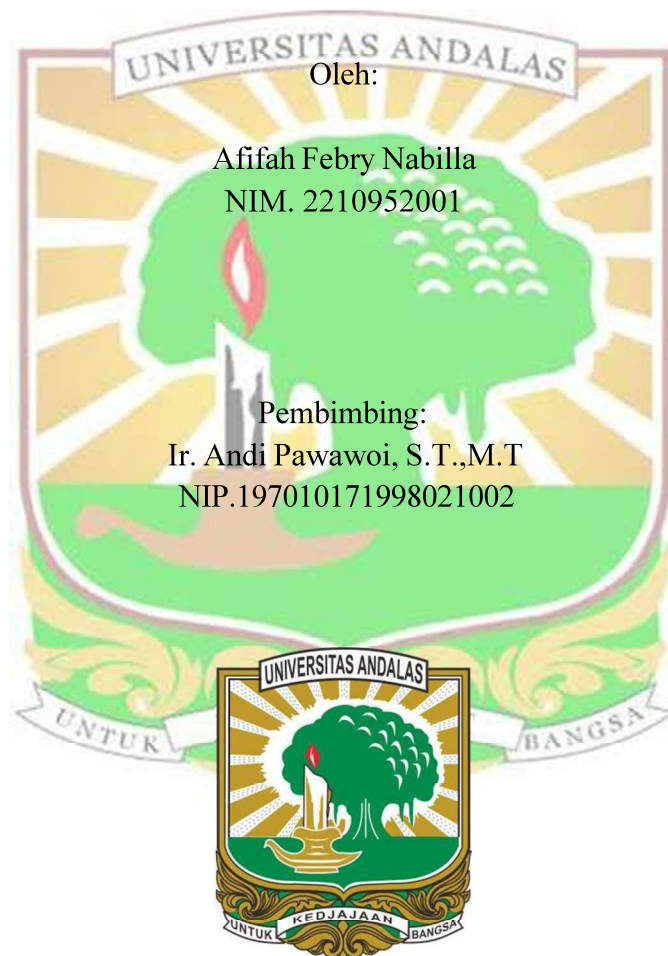


**Pengembangan Pelapis Panel Surya Berbasis Lilin Daun Pisang
melalui Penambahan Lapisan *Polyurethane* dan Komposit SiO_2 -
Silicone Sealant untuk Meningkatkan Efisiensi Panel Surya**

TUGAS AKHIR

Karya Ilmiah sebagai salah satu syarat untuk menyelesaikan jenjang strata satu
(S-1) di Departemen Teknik Elektro, Fakultas Teknik Universitas Andalas



**Program Studi Sarjana
Teknik Elektro Fakultas Teknik
Universitas Andalas**

Judul	Pengembangan Pelapis Panel Surya Berbasis Lilin Daun Pisang melalui Penambahan Lapisan <i>Polyurethane</i> dan Komposit SiO ₂ – <i>Silicone Sealant</i> untuk Meningkatkan Efisiensi Panel Surya	Afifah Febry Nabilla
Program Studi	Teknik Elektro	2210952001
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Abstrak Peningkatan suhu operasi akibat paparan radiasi matahari dapat menurunkan kinerja dan efisiensi panel surya. Penelitian ini bertujuan untuk mengetahui karakteristik pelapisan berbahan polyurethane, lilin daun pisang, serta komposit SiO₂-<i>silicone sealant</i>, serta menentukan konsentrasi optimum nanopartikel SiO₂ dan pengaruhnya terhadap temperatur, daya keluaran, dan efisiensi panel surya monokristalin 10 Wp. Variasi konsentrasi SiO₂ yang digunakan yaitu 1% hingga 5%. Karakteristik pelapisan dievaluasi melalui pengujian sudut kontak, transmitansi, dan kekuatan adhesi, kemudian ditentukan formulasi terbaik menggunakan metode <i>Weighted Sum Model</i> (WSM). Formulasi terbaik selanjutnya diaplikasikan pada panel surya dan dibandingkan dengan panel standar melalui pengujian lapangan selama empat minggu menggunakan sistem pengambilan data real-time. Hasil penelitian menunjukkan bahwa peningkatan konsentrasi SiO₂ meningkatkan sifat hidrofobik dan kekuatan adhesi, namun menurunkan transmitansi lapisan. Berdasarkan analisis WSM, konsentrasi SiO₂ optimum diperoleh pada variasi 1% dengan nilai transmitansi sebesar 97,76%, sudut kontak 107,44°, dan kekuatan adhesi 284,24 kPa. Penerapan pelapisan mampu menurunkan suhu operasi panel sebesar 7,37%, meningkatkan tegangan sebesar 3,59%, arus sebesar 3,22%, daya keluaran sebesar 6,48%, serta meningkatkan efisiensi panel surya dari 16,489% menjadi 17,532%. Dengan demikian, pelapisan berbahan polyurethane, lilin daun pisang, serta komposit SiO₂-silicone sealant berpotensi meningkatkan kinerja dan efisiensi panel surya.. Kata kunci : panel surya, pelapisan panel surya, nanopartikel SiO₂, efisiensi, hidrofobik.		

Title	<i>Development of Solar Panel Coatings Based on Banana Leaf Wax by Adding Polyurethane and SiO₂–Silicone Sealant Composite Layers to Improve Solar Panel Efficiency</i>	Afifah Febry Nabilla
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Abstract <i>The increase in operating temperature caused by continuous exposure to solar radiation can reduce the performance and efficiency of solar panels. This study aims to investigate the characteristics of a coating composed of polyurethane, banana leaf wax, and a SiO₂-silicone sealant composite, as well as to determine the optimum concentration of SiO₂ nanoparticles and their effect on the operating temperature, output power, and efficiency of a 10 Wp monocrystalline solar panel. The SiO₂ concentration was varied from 1% to 5%. The coating characteristics were evaluated through contact angle, transmittance, and adhesion strength tests, followed by the selection of the optimum formulation using the Weighted Sum Model (WSM). The selected formulation was then applied to a solar panel and compared with an uncoated panel through four weeks of outdoor testing using a real-time data acquisition system. The results showed that increasing the SiO₂ concentration improved the hydrophobicity and adhesion strength of the coating but reduced its optical transmittance. Based on the WSM analysis, the optimum SiO₂ concentration was obtained at 1%, providing a transmittance of 97.76%, a contact angle of 107.44°, and an adhesion strength of 284.24 kPa. The application of the coating reduced the panel operating temperature by 7.37%, increased the output voltage by 3.59%, current by 3.22%, output power by 6.48%, and improved the solar panel efficiency from 16.489% to 17.532%. These results indicate that the coating composed of polyurethane, banana leaf wax, and a SiO₂-silicone sealant composite has the potential to improve the performance and efficiency of solar panels.</i> <i>Keywords: solar panel, solar panel coating, SiO₂ nanoparticles, efficiency, hydrophobicity.</i>		