

ANALISIS MINYAK NYAMPLUNG SEBAGAI BAHAN ISOLASI LISTRIK CAIR ALTERNATIF UNTUK MENGGANTIKAN MINYAK TRAFO DAYA

Lukman, Yanuar Zulardiansyah Arief, Adhes Gamayel, Sinka Wilyanti

Fakultas Teknik Dan Ilmu Komputer, Universitas Global Jakarta, Indonesia

Email: lukmanpraci@gmail.com, yanuar@jgu.ac.id, adhes@jgu.ac.id,
sinka@jgu.ac.id

Abstract

In the operation of electric power distribution, the transformer can be said to be the heart of the transmission and distribution of electric power. In recent years the use of vegetable oil is increasing. The purpose of this study was to test and analyze a mix-ture of transformer oil and nyamplung oil (*Calophyllum Inophyllum*) as transformer insulation and also to obtain the best composition of nyamplung oil which can be used as an alternative to transformer oil. This research method tested the parameters of nyamplung oil and a mixture of nyamplung oil and mineral oil (Shell Diala S4), such as; viscosity, flash point, density, pour point, acidity, moisture content and breakdown voltage. The sample test results are then compared with standard mineral oil according to IEC 60296-2003. From the analysis conducted, it was found that TRNY10 oil mixture (10% transformer oil and 90% mineral oil) has the best potential as power transformer oil.

Keywords: *Power Transformer; Nyamplung Oil (Calophyllum Inophyllum); Mineral Oil; Breakdown Voltage; Viscosity; Flash Point; Density; Pour Point; Acidity; Moisture Content.*

Introduction

In an era of increasingly advanced world economic development the need for electricity will also increase. In the operation of distributing electric power, the transformer can be said to be the heart of transmission and distribution. Transformer failure creates the biggest problem for transmission and distribution (Mustaghfiroh, 2020). In this condition a transformer is expected to operate optimally continuously without stopping. Given the hard work of a transformer like this, the best way to care and maintain it is also required (Nurhayat, 2016).

There are two types of transformers when viewed from the cooling system, namely dry transformers using air as a cooling medium and wet transformers using oil as a cooling medium (YAQIN & MUHAINI, n.d.). The wet transformer has several advantages over the dry type. Wet transformers have a greater level of energy

How to cite:	Lukman, Yanuar Zulardiansyah Arief, Adhes Gamayel, Sinka Wilyanti, (2023) Performance Analysis of Nyamplung Oil (<i>Calophyllum Inophyllum</i>) as an Alternative Liquid Electrical Insulation Material to Replace For Power Transformer Oil, <i>Equivalent</i> , (5)1. Equivalent: Jurnal Ilmiah Sosial Teknik. https://doi.org/10.46799/jequi.v5i1.139
E-ISSN:	2775-0833
Published by:	Ridwan Institute

efficiency, smoother sound, and longer operating life. The oil in the transformer besides being a coolant also functions as an insulator (KARO, n.d.).

Since the 1940s various types of petroleum-based oils have been widely used as transformer oils (Subamia, 2011). These products play an important role around the world. Transformer mineral oil is a type of biodegradable oil. Oil reserves will eventually run out. Petroleum is polluting our environment. Thousands of transformers are located in populated areas, industries, shopping centers and near waterways, so the possibility of contamination will be even higher (Oktaviani & Simanjuntak, 2020).

We can't think of a world without petroleum products. But all of that is not easily available. Oil changes are also difficult. This is a factor why finding other sources of insulation oil is so important (Togatorop & Lestari, 2022).

Indonesia is an agricultural country that has many plants as a source of oil which are spread all over the archipelago, one of which is the nyamplung plant. Nyamplung (*Calophyllum Inophyllum*) is a plant that grows a lot in Indonesia (Akbar & Akhir, 2018).

In this study the authors evaluate the possibility of replacing petroleum-based oils with vegetable oils, namely Nyamplung seed oil with transformer oil (AMALIA & Sidik, 2020).

Research methods

The research was carried out using a real experimental method (true experimental research). In this study, the mixing of Shell Diala S4 transformer oil and vegetable oil with different variables was carried out, then physical and chemical properties were tested. The independent variable is a variable whose magnitude is determined and the value of this variable is not influenced by other variables.

Results and Discussion

Test result

From the test results for nyamplung oil and a mixture of nyamplung oil and transformer oil using each method, the values for viscosity, density, flash point, pour point, acidity, water content and breakdown voltage can be determined (BURNER & ATOMIZING, n.d.).

The results of this test will be compared with the standard parameters of new iso-alation oil according to IEC 60296-2003 (Raharjo, 2009). Density test, pour point, acidity, and water content were tested in the laboratory of PT. Sucofindo. Viscosity and flash point tests were carried out in the laboratory of PT. Indoluminium (Suripto, 2017)(Eri, 2020). The breakdown voltage test was tested at PT Seiki. The test sample can be seen in Figure 1 (Suripto, 2017).

Figure 1. Tested oil samples



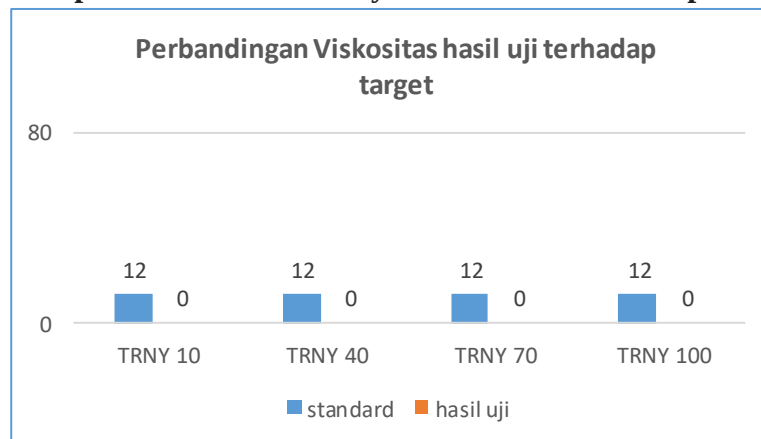
Viscosity Test Results

Viscosity is a measure of the amount of resistance provided by the oil to flow, or a measure of the magnitude of the internal shear pressure of a liquid material (Wonda & Negara, 2018).

Table 1. Viscosity Test Results

NO	JENIS CAMPURAN	VICSOSITY @40°C (Cst)
1	TRNY10	9.93
2	TRNY40	16.3
3	TRNY70	30.14
4	TRNY100	61.93

Pictures 2. Comparison of the viscosity values of various sample concentrations



Density Test Results

Density is the mass weight of oil per unit volume (kg/l) at 15 oC. The density test method refers to the ASTM D4052-18 standard (Wonda & Negara, 2018).

Table 3. Density Test Results

NO	JENIS CAMPURAN	DENSITAS @15°C (Kg/L)
----	----------------	-----------------------

Performance Analysis of Nyamplung Oil (*Calophyllum Inophyllum*) as an Alternative Liquid Electrical Insulation Material to Replace For Power Transformer Oil

1	TRNY10	0.82
2	TRNY40	0.85
3	TRNY70	0.90
4	TRNY100	0.92

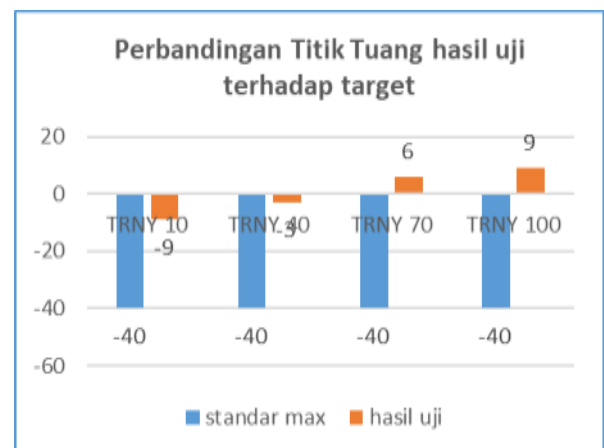


Flash Point Test Results

The flash point is the lowest temperature at which oil vapor starts to ignite (Jakfar & Sudarmanta, 2014). The flash point is tested with reference to ASTM – 93 standard.

Table 4. Flash Point Test Results

NO	JENIS CAMPURAN	TITIK NYALA (°C)
1	TRNY10	152
2	TRNY40	162
3	TRNY70	170
4	TRNY100	202



Pour Point Test Results

The pour point is the lowest temperature at which oil can flow when cooled and under certain temperature conditions (Irsyad, n.d.). This test uses the ASTM D9-17b method.

Table 5. Pour Point Test Results

NO	JENIS CAMPURAN	TITIK TUANG (°C)
1	TRNY10	-9
2	TRNY40	-3
3	TRNY70	+6
4	TRNY100	+9



Conclusion

From the test results of several parameters of nyamplung oil and a mixture of nyamplung oil and Shell Diala S4 transformer oil, it can be concluded: 1). TRNY10 (10% nyamplung oil and 90% power transformer mineral oil) has potential as an alternative to power transformer oil. 2). The water content is still quite high because the nyamplung oil was not pre-treated before being tested to reduce the water content, such as using a hot plate – magnetic stirrer.

BIBLIOGRAFI

- akbar, F. M., & Akhir, T. (2018). Analisa Karakteristik Minyak Isolasi Transformator Daya 11 Kva Menggunakan Metode Dga Dan Breakdown Voltage Pada Gardu Kilang Pertamina Ru-Ii Dumai. *Teknik Elektro Its. Surabaya*.
- Amalia, D., & Sidik, M. A. B. (2020). *Karakteristik Nano-Fluida Berbasiskan Palm Oil Mill Effluent Sebagai Bahan Baku Minyak Isolator Transformator*. Sriwijaya University.
- Burner, S. B. B. P. A., & Atomizing, A. S. F. I. N. B. (N.D.). *Pemanfaatan Oli Bekas Dengan Pencampuran Minyak Tanah*.
- Eri, S. (2020). Analisis Karakteristik Minyak Transformator Starlite 400 Kva Terhadap Tegangan Tembus. *Jurnal Sains & Teknologi Fakultas Teknik*, 10(1), 91–99.
- Irsyad, A. (N.D.). *Analisis Tegangan Tembus Minyak Campuran Sebagai Isolasi Cair Dengan Elektroda Setengah Bola*.
- Jakfar, A., & Sudarmanta, B. (2014). Pembuatan Dan Pengujian Biodiesel Biji Nyamplung Pada Mesin Diesel Multi Injeksi Dengan Variasi Komposisi Campuran Biodiesel Dan Biosolar. *Prosiding Seminar Nasional Manajemen Teknologi Xx, Fakultas Teknologi Dan Industri, Itsn, Surabaya*.
- Karo, P. S. P. M. (N.D.). *Analisis Teknik Permainan Gendang Singindungi Lagu*.
- Mustaghfiroh, S. (2020). Konsep “Merdeka Belajar” Perspektif Aliran Progresivisme John Dewey. *Jurnal Studi Guru Dan Pembelajaran*, 3(1), 141–147.
- Nurhayat, D. (2016). Evaluasi Dan Pengembangan Model Coaching Dalam Peningkatan Kompetensi Kepemimpinan Pada Pendidikan Dan Pelatihan Kepemimpinan Tingkat Ii Di Pusat Kajian Dan Pendidikan Dan Pelatihan Aparatur I Lembaga Administrasi Negara. *Jurnal Wacana Kinerja: Kajian Praktis-Akademis Kinerja*

- Dan Administrasi Pelayanan Publik*, 19(1), 89–120.
- Oktaviani, R., & Simanjuntak, Y. M. (2020). Analisis Pengujian Dga Menggunakan Metoda Chromatography Gas Sebagai Indikasi Kegagalan Minyak Isolasi Transformator Gi 150 Kv Kota Baru. *Jurnal Teknik Elektro Universitas Tanjungpura*, 2(1).
- Raharjo, W. P. (2009). *Pemanfaatan Oli Bekas Dengan Pencampuran Minyak Tanah Sebagai Bahan Bakar Pada Atomizing Burner*.
- Subamia, I. D. P. (2011). Optimalisasi Eksistensi Laboratorium Pendidikan Sebagai Wahana Strategis Revitalisasi Pendidikan Karakter Berlandaskan Kearifan Lokal. *Prosiding Seminar Nasional Mipa*.
- Suripto, S. (2017). Pengujian Karakteristik Minyak Transformator Gedung 72 Batan Serpong. *Prima-Aplikasi Dan Rekayasa Dalam Bidang Iptek Nuklir*, 13(2), 19–28.
- Togatorop, E. C. D., & Lestari, R. H. (2022). Implementasi Gerak Dan Lagu Dalam Meningkatkan Perkembangan Motorik Kasar Anak Usia Dini Melalui Pembelajaran Daring. *Ceria (Cerdas Energik Responsif Inovatif Adaptif)*, 5(4), 459–463.
- Wonda, E., & Negara, E. I. M. Y. (2018). Analisis Karakteristik Fenomena Pre-Breakdown Voltage Berbasis Pengujian Pada Media Isolasi Cair, Minyak Jagung. Yaqin, A., & Muhaini, F. (N.D.). *Aliran-Aliran Filsafat Pendidikan*.

Copyright holder:

Lukman, Yanuar Zulardiansyah Arief, Adhes Gamayel, Sinka Wilyanti (2023)

First publication right:

Equivalent: [Jurnal Ilmiah Sosial Teknik](#)

This article is licensed under:

