RINGKASAN

Keandalan sistem distribusi tenaga listrik sangat bergantung pada kondisi transformator, terutama kualitas minyak isolasinya. Minyak transformator yang mengalami *degradasi* dapat menyebabkan gangguan internal yang berisiko tinggi terhadap kontinuitas operasional industri. Penelitian ini bertujuan untuk menganalisis kelayakan minyak transformator di PT Lontar Papyrus Pulp and Paper Industry sebelum dan sesudah proses purifikasi, menggunakan metode *Dissolved Gas Analysis* (DGA) dan *Breakdown Voltage* (BDV). Tiga sampel minyak transformator diuji untuk mengidentifikasi kandungan gas terlarut menggunakan metode interpretasi DGA, meliputi *Total Dissolved Combustible Gases* (TDCG), *Key Gas, Rasio Roger, Rasio Doernenburg*, dan *Duval Triangle*, serta dilakukan pengujian kekuatan *dielektrik* melalui uji BDV. Hasil analisis menunjukkan bahwa sebelum purifikasi, seluruh unit menunjukkan indikasi gangguan termal dengan nilai BDV rendah (18,7–28 kV) dan kandungan gas degradasi tinggi seperti CO_2, CO, C_2H_4, dan C_2H_6. Setelah purifikasi, terjadi penurunan signifikan kadar gas degradasi dan peningkatan nilai BDV hingga 80,1 kV. Hasil ini menunjukkan korelasi negatif antara konsentrasi gas degradasi dan nilai BDV, serta efektivitas metode purifikasi dalam meningkatkan kualitas minyak isolasi. Dengan demikian, integrasi interpretasi DGA dan uji BDV terbukti efektif untuk diagnosis kondisi transformator dan sangat direkomendasikan dalam program pemeliharaan prediktif guna meningkatkan keandalan sistem kelistrikan industri.

Kata Kunci: *Dissolved Gas Analysis*, *Breakdown Voltage*, Interprestasi DGA Minyak Transformator, Purifikasi.

SUMARRY

The reliability of power distribution systems strongly depends on the condition of transformers, particularly the quality of their insulating oil. Degraded transformer oil can lead to internal faults that pose significant risks to industrial operational continuity. This study aims to evaluate the feasibility of transformer oil at PT Lontar Papyrus Pulp and Paper Industry before and after the purification process, using Dissolved Gas Analysis (DGA) and Breakdown Voltage (BDV) methods. Three transformer oil samples were tested to identify dissolved gas content using DGA interpretation methods, including Total Dissolved Combustible Gases (TDCG), Key Gas, Roger Ratio, Doernenburg Ratio, and the Duval Triangle. Dielectric strength was also assessed through BDV testing. The results show that prior to purification, all units indicated thermal faults, with low BDV values (18.7–28 kV) and high concentrations of degradation gases such as CO_2, CO, C_2H_4, and C_2H_6. Post-purification, a significant reduction in gas content and an increase in BDV up to 80.1 kV were observed. These findings demonstrate a negative correlation between degradation gas concentration and BDV, confirming the effectiveness of purification in improving oil quality. Therefore, the integration of DGA interpretation and BDV testing is proven to be effective for transformer condition diagnosis and is highly recommended for predictive maintenance programs to enhance industrial power system reliability.

Keywords: *Dissolved Gas Analysis, Breakdown Voltage, DGA interpretation, Transformer Oil, Duval Triangle, Purification*