ABSTRAK

Transformator daya merupakan peralatan vital dalam sistem kelistrikan yang rentan mengalami penurunan kinerja akibat degradasi sistem isolasi. Penelitian ini bertujuan untuk menganalisis kondisi degradasi isolasi transformator daya berdasarkan data historis minyak transformator dari PT. PLN (PERSERO) UPT Bandung. Parameter yang dianalisis meliputi kadar furan, kadar air, tegangan tembus, kadar asam, *Interfacial Tension* dan hasil *Dissolved Gas Analysis* (DGA). Setiap parameter diklasifikasikan berdasarkan mekanisme degradasinya, lalu dihitung skor dan bobot untuk memperoleh *Insulation Condition Index* (ICI). Hasil ICI divalidasi menggunakan metode *Duval Triangle* sebagai pendukung analisis DGA. Hasil penelitian menunjukkan bahwa nilai ICI transformator berkisar antara 6 hingga 7, menandakan kondisi yang masih baik namun dengan indikasi awal degradasi. Akan tetapi, Transformator 2 dengan nilai ICI 4 menandakan bahwa keadaan minyak isolasi buruk dan didukung dengan zona *Duval Triangle* pada T2 memperlihatkan bahwa kerusakan termal pada minyak isolasi sudah terjadi dan menyebabkan kondisi transformator memburuk. Pendekatan ini dapat digunakan sebagai dasar dalam strategi pemeliharaan berbasis kondisi transformator.

Kata kunci: *Minyak transformator, Insulation Condition Index (ICI), Duval Triangle, degradasi isolasi*

ABSTRACT

Power transformer is vital equipment in electrical systems that are prone to performance degradation due to insulation system degradation. This study aims to analyze the condition of power transformer insulation degradation based on historical transformer oil data from PT. PLN (PERSERO) UPT Bandung. The parameters analyzed include furan content, water content, breakdown voltage, acid content, interfacial tension, and Dissolved Gas Analysis (DGA) results. Each parameter is classified based on its degradation mechanism, then scores and weights are calculated to obtain the Insulation Condition Index (ICI). The ICI results are validated using the Duval Triangle method as a supplement to the DGA analysis. The research results showed that the ICI values of the transformers ranged from 6 to 7, indicating good condition but with initial signs of degradation. However, Transformer 2 with an ICI value of 4 indicated poor insulation oil condition, supported by the Duval Triangle zone for T2, which showed that thermal damage to the insulation oil had already occurred, leading to deteriorating transformer condition. This approach can be used as a basis for condition-based maintenance strategies for transformers.

Keywords: Transformer oil, Insulation Condition Indeks (ICI), Duval Triangle, Insulation Degradation