

Dielectric Properties of Mineral Oil Blended with Soyabean Oil for Power Transformers: A Laboratory Investigation

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Abstract : The power transformer is a critical equipment in the transmission and distribution network that must be managed to ensure uninterrupted power service. The liquid insulation is essential for the proper functioning of the transformer, as it serves as both coolant and insulating medium, which influences the transformer's durability. Further, the insulating state of a power transformer has a significant impact on its reliability. Mineral oil derived from petroleum crude oil has been employed as liquid dielectrics for decades due to its superior functional characteristics, however as a resource for the same are getting depleted over the years. Research is undertaken across the globe to identify a viable substitute for mineral oil. Further, alternate insulating oils are being investigated for better environmental impact, biodegradability and economics. Several combinations of vegetable oil derived natural esters are being inspected by researchers across the globe in these domains. In this work, mineral oil is blended with soyabean oil with various proportions and dielectric properties such as dielectric breakdown voltage, relative permittivity, dissipation factor, viscosity, flash and fire point have been investigated according to international standards. A quantitative comparison is made among various samples and is observed that the blended oil sample of equal proportion of mineral oil and soyabean oil, MO50+SO50 exhibits superior dielectric properties such as breakdown voltage of 65kV, dissipation factor of 0.0044, relative permittivity of 3.1680 that are closer to the range of values recommended for power transformer applications. Also, Breakdown voltage values of all the investigated oil samples obeyed the Weibull and Normal probability distribution.

Keywords : blended oil, dielectric breakdown, liquid insulation, power transformer

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