

## **Evaluation on the lightning breakdown voltages of palm oil and coconut oil under non-uniform field at small gap distances**

### **ABSTRACT**

In recent years, there are a number of studies that have been carried out to explore the alternative for Mineral Oil (MO) as dielectric insulating fluid in transformers due to the increasing tight regulation on safety and environment. Vegetable oils have been identified as suitable candidate since it is biodegradable, non-toxic and high flash/fire points which ensure more in-service safety. Among the types of vegetable oils considered for transformers application are Palm Oil (PO) and Coconut Oil (CO). This paper presents an experimental study on the lightning breakdown voltages of PO and CO under non-uniform electric field based on needle-sphere electrodes configuration at 3 small gap distances. The type of PO used in this study is Refined Bleached and Deodorized Palm Oil (RBDPO) Olein. The main focus of this study is to examine the lightning breakdown performance of RBDPO and CO under different test conditions and assess its suitability as dielectric insulating fluid in transformers. The effect of voltage polarities (positive and negative) and testing methods (rising voltage, up-and-down and multiple-voltage) were investigated. The data obtained from all tests were analysed by Weibull distribution in order to determine the withstand voltages for each type of oils. It was found that the breakdown voltages of RBDPO and CO are comparable with MO under positive lightning impulse. Under negative lightning impulse, the breakdown voltage of MO is slightly higher than RBDPO and CO. There is no significant effect of testing methods and voltage polarities on lightning breakdown voltages of RBDPO and CO. Based on the statistical analysis, it is found that the breakdown voltages of RBDPO and CO at 1% probability are slightly lower than MO.

**Keyword:** Palm oil; Coconut oil; Lightning breakdown voltage; Non-uniform field; Transformers