

The effect of polarity on the lightning breakdown voltages of palm oil and coconut oil under a non-uniform field for transformers application

ABSTRACT

This paper presents a study of the lightning breakdown voltages of Palm Oil (PO) and Coconut Oil (CO) under a non-uniform field with consideration on the polarity effect at various gap distances. All tests were carried based on a needle-sphere electrode configuration and various gap distances ranging from 2 to 25 mm under positive and negative voltage polarities. Three different testing techniques were used in this study including rising-voltage, up-and-down and multiple-voltage methods. The PO used in this study was Refined, Bleached and Deodorised Palm Oil (RBDPO) Olein. Three different samples of RBDPO and one sample of CO were tested. The Weibull distribution was used as a statistical approach to determine the withstand voltages of all samples at 1% and 50% probabilities for each type of oil. Under positive voltage polarity, it was found that the 50% breakdown voltages of RBDPO and CO were comparable with Mineral Oil (MO) whereby the highest percentage of difference among all gap distances was less than 15%. RBDPO and CO have lower 50% breakdown voltages than MO under a negative lightning impulse for which the highest percentage of difference can be up to 40%.

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