

Experimental study on the partial discharge characteristics of palm oil and coconut oil based Al₂O₃ Nanofluids in the presence of sodium dodecyl sulfate

ABSTRACT

This experimental study aims to examine the partial discharge (PD) properties of palm oil and coconut oil (CO) based aluminum oxide (Al₂O₃) nanofluids with and without surfactants. The type of surfactant used in this study was sodium dodecyl sulfate (SDS). The volume concentrations range of Al₂O₃ dispersed in oil samples was varied from 0.001% to 0.05%. The ratio of surfactants to nanoparticles was set to 1:2. In total, two different types of refined, bleached and deodorized palm oil (RBDPO) and one type of CO were measured for PD. Mineral oil (MO) was also examined for comparison purpose. PDIV measurements for all samples were carried out based on rising voltage method whereby a needle-sphere electrode configuration with a gap distance of 50 mm was chosen in this study. Al₂O₃ improves the PDIVs of RBDPO, CO and MO whereby the highest improvements of PDIVs are 34%, 39.3% and 27%. The PD amplitude and repetition rate of RBDPO improve by 38% and 81% while for CO, it can increase up to 65% and 80% respectively. The improvement of PD amplitude and repetition rate for MO are 18% and 95%, regardless with and without SDS. Without SDS, the presence of Al₂O₃ could cause 26%, 75% and 65% reductions of the average emission of light signals for RBDPOA, RBDPOB and CO with the improvement of PD characteristics but both events do not correlate at the same volume concentration of Al₂O₃. On the other hand, the average emission of light signal levels of the oils increases with the introduction of SDS. The emission of light signal in MO does not correlate with the PD characteristics improvement either with or without SDS.

Keyword: Partial discharge; PDIV; Palm oil; Coconut oil; Al₂O₃; Nanofluids; SDS