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## AC Analysis of Synthesized Nanofluids from Palm Kernel Oil for Transformer Insulation

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The work presented in this paper revealed the effect of insulating ( $\text{Al}_2\text{O}_3$ ) and semiconductive ( $\text{TiO}_2$ ) nanoparticles on green alternative insulating methyl ester oil synthesized from palm kernel oil. It also investigates the optimal concentration of the nanoparticle for dielectric improvement. The nanoparticle was functionalized with oleic acid before dispersion into the methyl ester to modify the stability of the mixture. The characterization of the nanoparticles was done using Scanning Electron Microscopy coupled with electron dispersive X-ray analysis (EDX). The nanofluids were prepared by dispersing 0.2, 0.4, 0.6, 0.8 and 1wt% of nanoparticle into the methyl ester. The effect of this nanoparticles on loss tangent, conductivity and AC breakdown voltage of the synthesized methyl ester was done, analyzed and compared. It was observed on both sides of nanoparticle that the loss tangent and conductivity reduces with an increasing concentration of nanoparticles. The AC breakdown result was analyzed with Weibull statistical tools and it was observed that the loading of both nanoparticles increases the characteristic AC breakdown strength of methyl ester with an optimum performance at 0.6wt%. The result revealed that  $\text{Al}_2\text{O}_3$  nanofluid possesses the highest dielectric properties with low loss, low conductivity and high characteristic breakdown strength. The obtained results for both nanoparticles are promising because of improvement in dielectric properties with a noticeable one for  $\text{Al}_2\text{O}_3$  nanofluid.

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