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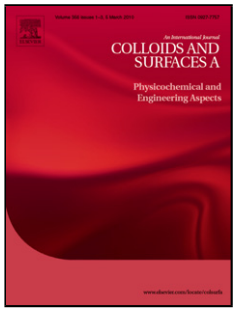

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A Comparative Investigation on Effects of Nanoparticles on Characteristics of Natural Esters - based Nanofluids

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Abstract

The effects of transformer oil-based nanofluids have been broadly investigated and showcased a magnificent improvement in performance. But in natural esters based nanofluids characteristic performance persist virtually unexplored and still, there is a room for investigation. This work aims to examine the effect of three dissimilar types of nanoparticles such as Aluminum Oxide (Al_2O_3), Boron Nitrate (BN) and Ferrous Ferric Oxide (Fe_3O_4) at various volume concentrations on the characteristic performance of natural esters. Honge oil (HO), Neem oil (NO), Mustard oil (MO) and Punna oil (PO) is considered as the base fluid for investigation. The characteristic performances of base fluids are tested before and after blending of nanoparticles as per standards. The findings are quite promising because the performance of nanofluids shows a significant improvement.

Index Terms – Natural esters, nanoparticles, nanofluids, dielectric properties.

1. Introduction

Increasing competition among transformer industries and environmental concerns forces the transformer industries to use biodegradable liquid insulation [1]. Advantages of natural ester (NE) liquid insulation when compared with mineral oil (MO) liquid insulation are higher breakdown strength, fire safety, better hydrophilicity, asset life extension, biodegradability and availability drive research and development activities [2]. However, the limited number of research works and cost hinders the usage of NE in specific applications [3]. In order to have an extensive application, NEs have to exhibit a high standard of electrical performance over a long span under all conditions. Hence there is a need to analyze the performance of NEs under various conditions.

Over the decades, great efforts are taken to prepare nanofluids by blending nanoparticles with liquid insulation at various volume concentration and well-blended nanoparticles enhanced the electrical and thermal properties [4-6]. In specific, these two prime properties of nanofluids are crucial for the transformer industry in the view of reducing the size and weight. In the field of