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# Study on PD Properties of Palm Fatty Acids Esters Oil

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## Introduction

Following the successful application of natural ester of triglyceride type as insulation liquid in transformer, natural ester of mono ester type with the benefit in higher fluidity [1], which was introduced for the same purpose. Since PD detection is an important method of early warning of deterioration of insulation, PD properties of the PFAE need to be investigated. Particular attention was paid on the effect of moisture content up to 188 ppm.

## Experimental Procedures

Palm fatty acid ester (PFAE) of three different moisture content levels, 102, 144, and 188 ppm, were used as samples. PD was generated by applying AC high voltage on the needle electrode of 10  $\mu\text{m}$  tip radius under needle-plane configuration. With an acrylic of 5mm thick on the plane surface, the gap between needle and acrylic was 5 mm. Application of voltage was started at 7 kV, and it was increased with the increment of 1 kV from 7 to 21 kV. PD pulses were detected using RC circuit, and PD measurement was conducted for 2 minutes at each voltage level using oscilloscope of Tektronix DPO 7504 type (Figure 1).

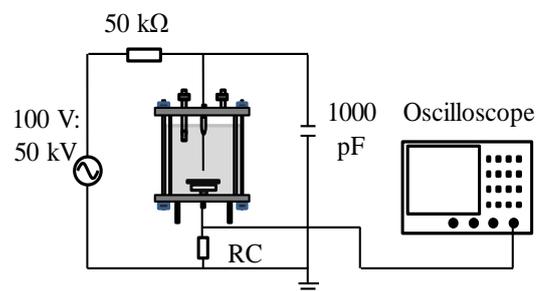


Figure 1 Experimental Set up

## Results and Discussion

Figure 2 and Figure 3 show relationships between, respectively, PD number and PD charge and applied voltage. Both PD number and PD charge increase with applied voltage. No significant different in PD properties of PFAE samples of three different moisture content levels, indicating that moisture content affects PD activity in the similar way to that of total breakdown. Moisture content up to 300 ppm does not cause a decrease in breakdown voltage of natural ester [2]. It should be noticed that relative water content is more useful than actual moisture content. The relative moisture content up to about 10% and 30% of unclean and clean insulation oils, respectively, do not significantly affect the breakdown voltage of oils, irrespective of oil type [2]. With the moisture solubility of PFAE at room temperature is 1100 ppm (assumed), the largest relative moisture content of tested sample is about 17%.

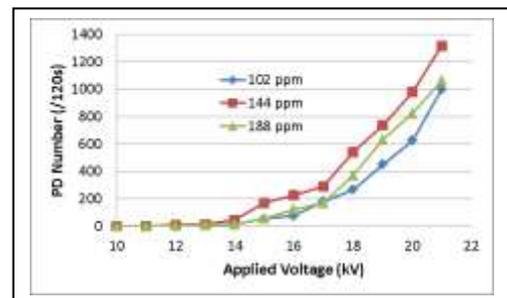


Figure 2 PD Number vs Applied Voltage

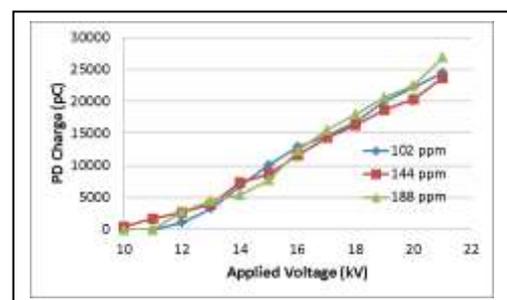


Figure 3 Average PD Charge vs Applied Voltage

## Acknowledgement

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## References

- [1] Yasutoshi Kasahara, et al., Journal of the American Oil Chemists' Society, (2012).
- [2] WG A2.35, CIGRE, (2010).