Pre-breakdown Phenomena in New Vegetable Oil - based Jatropha Curcas Seeds as Substitute of Mineral Oil in High Voltage Equipment

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ABSTRACT

Due to their high biodegradability, non-toxicity and higher fire safety guarantee, vegetable-based oils are considered today as a potential substitute for mineral and synthetic liquids for electrical insulation and especially in high voltage power transformers. However most of known vegetable oils are derived from food materials (rape-seeds, sunflower, soybeans, palms, corns and others). And one has to be vigilant to the fact that the replacement of mineral oil by natural ester fluids based on "renewably sourced" vegetable oils, does not create new problems as this could cause global food crisis due to diversion of food into insulating material oils or others (fuel). An interesting product can be jatropha curcas oil (JCO) extracted from the fruit seeds of jatropha curcas plants ("miracle tree") which is non-food crops. These plants can be grown on marginal or degraded soils and thus enables to avoid the need to utilize those more fertile soils currently being used by smallholders to grow their staple crops; and they readily grow in areas where annual rainfall levels are significantly lower than those required by other species such as rape-seeds, sunflower, palm, soybeans, corns and others. This paper presents an experimental study of streamers phenomena in jatropha curcas methyl ester oil (JMEO) and mineral oil (MO) under positive and negative lightning impulse voltages (1.2/50 µs); JMEO is obtained by alkali base catalyzed trans-esterification process of JCO to reduce the viscosity and acidity. It is shown that basing on the streamer characteristics (shape, stopping length, velocity, current and electrical charge), JMEO could constitute a potential substitute for mineral for electrical insulation and especially in high voltage power transformers.

Index Terms - **JMEO, streamer, final length, velocity, vegetable oil.**

1 INTRODUCTION

MINERAL oils have been widely used in high voltage equipment since the last ten decades (especially in high voltage power transformers). However, due to limitation of sources of mineral oils which are non-renewable material and the fact that they are poorly biodegradable (the biodegradability of typical mineral oils is not more than 30 %), industrials and researchers have been encouraged to look for alternative materials for their replacement. Vegetable-based oils are considered today as a potential substitute for mineral and synthetic liquids for electrical insulation and especially in high voltage power transformers. They are characterized by a high

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