Jatropha Curcas Methyl Ester Oil Obtaining as Vegetable Insulating Oil

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ABSTRACT

This paper presents a new vegetable oil that is jatropha curcas seeds oil as a substitute for mineral oil. This product has several advantages among which the fact that it is non-food crops and may be grown on low fertile soils and areas where annual rainfall levels are significantly lower than those required by other plants used to extract other vegetable oils such as rape-seeds, sunflower, corn, soybeans, grape-seeds and sesame. The considered natural ester oil is processed by alkali base catalyzed esterification process using potassium hydroxide (KOH) to produce jatropha curcas methyl ester oil (JMEO). The physicochemical (water content, relative density, viscosity, acidity, visual examination, color, iodine number, corrosivity, flash point, pour point) and electrical (breakdown voltage under ac, dc and impulse voltages) properties of JMEO are presented and discussed. A gas chromatography (GC) analysis is also achieved to identify the methyl ester components in JMEO. The breakdown voltage of JMEO is compared to that of mineral oil (MO). It is found that the average breakdown voltage of JMEO and MO under different voltage waveforms are too close.

Index Terms — **New vegetable oil, Physicochemical and electrical properties, breakdown voltage, water content, viscosity, acidity.**

1 INTRODUCTION

THE interest to use vegetable oils in place of mineral and synthetic esters oils has been well documented in many papers [1–4]. So these natural esters have successfully replaced mineral oil as insulation in small and mean distribution transformers since the late 1990s [5, 6]. They are increasingly being used to improve fire safety, provide environmental benefits, sustainability, and enhance insulation life. The challenge is to extend the use of these products to high voltage power transformers. On the other hand, most of researchers developing natural esters as insulating fluids in transformers use vegetable oils issued from seeds of food crops (rape-seeds, sunflower, corn, soybeans, grape-seeds, sesame, etc.). Therefore, it is needed to divert our attention to non-food materials so that the searches of new material alternatives for replacing mineral oil do not interfere with foodstuffs.

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This paper presents a new vegetable oil we called “JMEO (jatropha curcas methyl ester oil)” obtained by alkali base catalyzed esterification process of jatropha curcas oil derived from jatropha fruit seeds. Jatropha curcas plants can grow and thrive on barren soils, in tropical and sub-tropical regions. We first describe the chemical process we have performed for producing JMEO and then the physicochemical (water content, relative density, viscosity, acidity, visual examination, color, iodine number, corrosivity, flash point, pour point) and electrical (AC, DC and impulse breakdown voltages) properties of JMEO. Finally, we compare the breakdown voltage of JMEO to that of mineral oil (MO) of naphthenic type and discuss the suitability of this new vegetable insulating oil.

2 JATROPA CURCAS OIL

Jatropha curcas is a “miracle tree” and certainly a highly interesting plant with potential uses, particularly as biofuel to help in combating the energy crisis throughout the world and

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