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# Evaluation of the Probable Use of Neem Oil in Capacitors and Determination of Dielectric Constant

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***Abstract: Abstract:*** *This is a research project which evaluation of the probable use of neem oil in capacitors and the determination of dielectric constant was dealt with. Dielectric value of neem oil was determined in the laboratory as 27. 5kv and a comprehensive procedure of finding it was also presented. Based on the studies of the literature, and the results of the dielectric value obtained, neem oil can be effectively used as a transformer oil for 11kv transformer. Therefore it can be concluded that neem oil can be classified as transformer oil because of it's dielectric value of 27.5kv, it was also conducted that neem oil can be used in capacitors, based on the facts available,*

***Keywords:*** *Neem oil, capacitor, transformer*

## INTRODUCTION

## CAPACITOR

A capacitor is a passive electronic component that stores energy in the form of an electrostatic field. In it's simplest form, a capacitor consist of two conducting plates separated by an insulating material called Dielectric. The capacitance of a capacitor is directly proportional to the surface areas of the plates, and is inversely proportional to the separation between the plates, capacitance also depend on the dielectric constant of the substance separating the plates. The standard unit of capacitance is the farad, abbreviated F. This a large units, more common units are the microfarad, abbreviated MF (1MF = $10^{-6}$F) and the picofarad, abbreviated PF (1PF = $10^{-12}$F)

Large capacitors are use in the power supplies of electronic equipment of all types, including computers and their peripherals. In these systems, the capacitors smooth out the rectified utility AC, providing – pure, battery – like DC.

Several determinations of the dielectric constant of water have been reported in the literature during the past half century. However, much of this work was not conducted with sufficient accuracy to provide data adequate for reference purposes. Several investigators employed varied experimental techniques in which the accuracy was stated or has been inferred to be of the order of 0.1 percent, report values that are in close agreement at room temperature but not at higher and lower temperatures. Discrepancies amounting to a percent or more exist at higher temperatures (Drake *et al.*, 1930). However, there are many techniques for dielectric constant measurements. The lumped circuit techniques are only suitable for low frequencies and high loss materials (Nyfors, & Vainikainen, 1989). Adequate sample thickness must be used in order to obtain an accurate measurement result. Open-ended coaxial probes have been investigated by many researchers (Stuchly & Stuchly, 1980; Mosig *et al.*, 1981; Misra *et al.*, 1990; Nyshadham, *et al.*, 1991; & Chen and Ji, 1994).

## MATERIAL AND METHOD

### MATERIAL USED

- Neem oil
- Dialar Transformer oil (Texaco)

### APPARATUS

- 60kv foster transformer oil tester (in England)
- Reagent Bottles
- Cylinder
- Stop watch (clock)
- (220 v)
- Half litre Measuring Bottle

### METHOD

The foster testing machine was connected to the power source a half litre standard dialar transformer oil from Texaco was then measured using the half litre measuring bottle. This standard oil was put in the testing machine and switched one and tested so as to ascertain the working condition of the testing machine prior to the test under study. The machine was okay when tested using standard transformer oil. Then half litre of the sample oil (Neem oil) was measured using the measuring bottle and then transferred into the already Neem oil used container mounted in the machine was then covered and the machine switched and the time was noted immediately the machine was switched on, then after few second, bubbles were seen appearing in the oil, which indicates the passage of voltage in the oil. While the meter started reading. The bubbles grew in number and size with time, until a point when sparks were observed, which indicated the machine was just about tripping off. At this point, the time (5 minutes) and the meter reading were noted and the machine was switch off. The same procedure then repeated three time after allowing the machine and the oil to cool for four to five minutes. In all the trials, the time and meter reading were recorded and the average was then taken to obtain the dielectric strength of the Neem oil. The result and calculations for values are as shown in table 1.

Table 1the Test Result of the Neem Oil

| S/N | SAMPLE | TIME (MINS) | METER READING (KV) |
|---|---|---|---|
| i. | Neem Oil | 5 | 30 |
| ii. | Neem Oil | 5 | 25 |
| iii. | Neem Oil | 7 | 28 |
| iv. | Neem Oil | 6 | 27 |

The average value was obtained as follows:

$$\therefore \frac{Sum\ of\ all\ meter\ reading\ recorded}{Number\ of\ trials\ repeated}$$

$$= \frac{(30+25+28+27)Kv}{4}$$

$$= \frac{110}{4} \qquad = 27.5kv$$

Average dielectric value = 27.5kv

**DISCUSSION**

The purpose of this work was to determine the probable viability of Neem tree oil as capacitor oil. The principle behind this work would remain calm, i.e without getting decomposed or burnt, when a certain amount of current is passed through it. In other words, the dielectric constant of the oil was determined. To use any particular oil as a dielectric constant, the function which indicates the resistance of the oil to electric pressure must be known.

The ream oil which was my sample oil has a dielectric constant of 27.5kv. the average of four different readings was taken to arrive at the dielectric constant value shown above. The machine used for determining the dielectric value had a meter which was calibrated from 0 – 60kv and whether an oil is tested, it gives a voltage value with the rate depending on the degree of its resistance to electric pressure when current is passed through its otherwise known as its dielectric strength. Four slightly different values were recorded for the neem oil sample.

For determining the capacity of transformer an oil of certain dielectric strength can be used is 2Y + 1 = X, where Y is the voltage rating of the transformer and X is the dielectric strength of the oil for an oil to be used as a capacitor oil, it should not have a dielectric strength of less than 23kv.

Now for the Neem oil, use the formular, the voltage rating of the transformer. A Neem oil can serve as its capacitor oil as follows:

$2Y + 1 = X$

Where X = 27.5kv (Dielectrics strength of the Neem Oil).

$2Y + 1 = 27.5$

$2Y = 27.5 - 1$

$$\therefore \frac{2Y}{2} = \frac{26.5}{2}$$

$$Y = \frac{26.5}{2}$$

$Y = 13.5Kv$

With a dielectric strength (insulating strength) of 27.5 kv the neem oil can be used for a 13.5kv transformer from the calculations seen above, which is based for determining the voltage rating of a transformer when determining a probable oil to be used as a capacitor oil.

## CONCLUSION

This research work was conducted successfully using Neem tree oil to serve as capacitor oil which can be used as a dielectric constant. Average value was taken from four (4) different readings in the test results obtained above. Insulating capacity with equal value of 27.5Kv were computed and has the potential to function effectively in a transformer of 13.5Kv

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