IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

THE EFFECT OF MOLECULAR WEIGHT ACID ON THE PERFORMANCE PARAMETERS OF INSULATION WITH VEGETABLE OIL

PRIYANKA D[1], ALEXPANDIAN M[2]

[1]PRIYANKA D, Assisstant Professor/ EEE, Unnamalai Institute of Technology , Suba Nagar, Kovilpatti,India
[2]ALEXPANDIAN M, Assisstant Professor/ EEE,Unnamalai Institute of Technology , Suba Nagar,Kovilpatti,India

***Abstract* -** To determine whether oxidative byproducts of acid production are present in the properties of vegetables,
Based on insulating liquids, a research of the effects of adding acid to vegetable oil is suggested in this work to examine the properties of the chosen oil used as liquid insulation in transformers when exposed to acidic conditions. Sunflower oil, Rice bran oil, Cottonseed oil, and Safflower oil are chosen as base oil samples for the experiment, the addition of acetic acid at doses of 5 and 10 ml to oil samples in order to evaluate the overall changes in breakdown voltage. Sample characteristics have been measured in accordance with the global norm. The experimental findings suggest the oil samples .

Keywords: acetic acid, flash point, fire point, viscosity, and breakdown voltage

I.INTRODUCTION

Nowadays, there is a higher need for electrical equipment with highly functional and dependable insulating materials in the application field of the transmission network of the power system. Because they will ascertain how the electrical apparatus will behave dynamically under different operating circumstances. Liquid insulations are a crucial type of insulation utilized in equipment because they meet the needs for insulation and a cooling medium.
In oil-filled transformers, liquid insulation is typically utilized to provide insulation and between live conducting components cooling. Even Although mineral oil has favorable physicochemical and dielectric properties as liquid insulation, it has drawbacks as well, including the fact that it is not biodegradable, that it emits poisonous fumes, that there are fewer petroleum resources available for future uses, etc. Vegetable oil-based liquid insulations are becoming more popular among researchers for use in transformers due to their biodegradable nature, environmental friendliness, and safety compared to conventional mineral oil, which is being employed due to its restrictions. Additionally, insulation made of vegetable oil has demonstrated improved performance.
Insulating liquid. Moisture in oil is undesirable, although it cannot be completely avoided. As air moisture enters the system and paper insulation and oil begin to break down over time, moisture is incorporated into liquid insulation.

1.SAMPLE SELECTION FOR BASE OIL:

Along with its high monounsaturated and low poly
Natural ester oil has a high fatty acid concentration and is oxidation-resistant. We will therefore search for the following oil samples. Based on geographic accessibility, cost, and prior research, rice bran oil (RBO), safflower oil (SAO), and sunflower oil (SUO) Cottonseed oil(CSO) have been chosen for evaluation.

1.1 PROPOSED SAMPLES

Vegetable insulating oil's acid value increases with increased oxidation time; initially, growth is very small, but as oxidation time increases, acid value growth rate increases gradually. Additionally, oil-paper insulation exhibits a greater shift in acid value than pure insulating materials

Table 1: Proposed oil samples

Sample	Composition
Base Sample 1	Sunflower Oil
Base Sample 2	Rice Bran Oil
Base Sample 3	Safflower oil
Base Sample 4	Cottonseed oil

Table 2 : Blended oil samples

Sample	**Composition**
Base Sample 1	Sunflower Oil
Base Sample 2	Rice Bran Oil
Base Sample 3	Safflower Oil
Base Sample 4	Cottonseed Oil
Acid Mixed Sample 1	Sunflower Oil + 5ml Acetic Acid
Acid Mixed Sample 2	Rice Bran Oil + 5ml Acetic Acid
Acid Mixed Sample 3	Safflower Oil + 5ml Acetic Acid
Acid Mixed Sample 4	Cotton seedoil + 5ml Acetic Acid
Acid Mixed Sample 5	Sunflower Oil + 10ml Acetic Acid
Acid Mixed Sample 6	Rice Bran Oil + 10ml Acetic Acid
Acid Mixed Sample 7	Safflower Oil + 10ml Acetic Acid
Acid Mixed Sample 8	Cotton seedoil + 10ml Acetic Acid

1.2 SAMPLE PREPARATION

The methods and procedures for measuring the properties of the acetic acid inclusion with the oil samples are followed. Breakdown

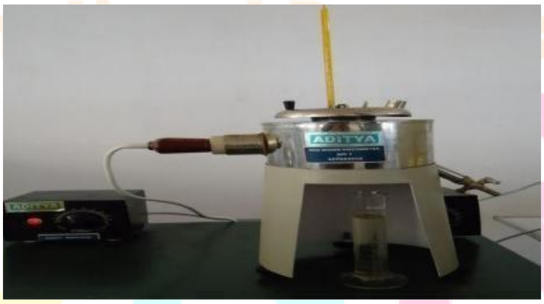

Fig**1 : Redwood viscometer**

voltage is observed to decrease at a faster pace when acid concentration rises. As soon as 10ml of acetic acid is added externally, the breakdown voltage value of the oil samples drastically decreases to around 50% of the typical value without acid inclusion. Vegetable oil sample samples' viscosity and pour point increased after acids were added. The following section discusses the potential reason for this variation. The oil sample's flash point temperature is slightly lower than it would be without the addition of acid.

1.3 Properties of oil samples

The fluid protection's breakdown voltage reflects how well it can withstand the electrical pressure that is produced during working conditions. . The breakdown voltage of oil testing is calculated at a specified voltage that results in breakdown between anodes under approved test conditions by putting a voltage across the cathode at a rising rate of 2kV/s. The test is repeated five to multiple times for the purpose of processing the dielectric breakdown voltage of oil tests, and the mean of the obtained breakdown voltage is taken into account as the final breakdown voltage of the oil test. In Figure 2, the breakdown voltage unit is shown.

Fig2 : Breakdown voltage kit

Since fluid protection also functions as a coolant, its viscosity is much more crucial to stay within the reference range for usual working temperatures. Thickness may have an impact on cooling and the operation of cooling-related devices.
The lowest temperature at which fluid streams under approved conditions is known as the pour point of fluid protection. Oil stream below the pour point may be problematic, and the stream is further constrained by consistency.

Fig3 : Pour point

Table 3: Properties of blended samples

sample	Oil quantity	Oil quantity	Oil quantity
Blended Sample1	250	250	250
Blended Sample2	250	125	125
Blended Sample3	250	125	250
Blended Sample4	125	125	250

1.4 Measurements and properties of oil samples

This section discusses the significance of key factors such breakdown voltage, viscosity and pour point as well as experimental testing techniques. By applying a voltage across the electrode at a rising rate of 2kV/s across the electrode, the breakdown voltage of oil samples is measured at a specific voltage that causes breakdown between electrodes under specified test conditions. To ascertain the dielectric breakdown voltage of oil samples, the test is carried out five to six times. viscosity can affect cooling and how cooling-related equipment functions. Viscosity may have an impact on cooling and the performance of cooling-related machinery. According to IEEE Standard C57.14 from 2018, a liquid's viscosity is a measurement of how resistant it is to flow. According to ASTM D445, the viscosity of liquid insulation is computed in a redwood viscometer. It is determined by timing the passage of 50 ml of oil samples through an aperture in a viscometer under carefully regulated conditions.
The pour point of liquid insulation is the lowest temperature at which liquid flows in a certain circumstance. Below the pour point, oil flow can be challenging, as viscosity restricts flow.

Table 4 : Base sample oils

Properties	**SUO**	**SAO**	**RBO**	**CAO**
BDV(KV)	**35**	**36**	**38**	**37**
Viscosity(cst)	**43**	**45**	**48**	**52**
Pour Point(^{0}c)	**9**	**6**	**6**	**9**

The breakdown voltage of any fluid protection is a crucial characteristic that determines its ability to withstand the electrical pressure produced inside the operating transformer. IEEE guidelines state that the base value of breakdown voltage of Esters in general should have a 35kV. Every oil test that was selected for this evaluation has a breakdown voltage that is greater than 35 kV in the fundamental analysis of its attributes. In light of a significant breakdown voltage property, observed chosen regular esters may have desirable properties as fluid protection for usage in transformers**.**

The majority of the time, vegetable oil-based fluid protections are more sticky than the traditional mineral oil used in transformers. It is evident from this examination that the obtained consistency values for vegetable oil tests are significantly greater than the predetermined standard value. It can be inferred from the literature that the unsaturated fat components of vegetable oil are the primary rationale for the higher value of thickness. Because these thickness ranges for the vegetable oil under examination are outside of the acceptable range. Direct application of ordinary esters could cause problems with cooling.

For the use of regular esters in cold climates, the pour point temperature should be much lower than the values obtained. In light of the writing that is available for decreasing pour point, a few techniques should be used to lower pour guide from its generally anticipated esteem toward the specified range.

2.PROPERTIES OF ACID INCLUDED BASE OIL SAMPLES:

Table5 : Properties of oil samples

Properties	SUO+ACID 5ML	SAO+ACID 5ML	RBO+ACID 5ML	CAO+ACID 5ML
Breakdown voltage(kv)	39	39	35	36
Viscosity(cst)	55	56	58	60
Pour Point(^{0}c)	6	3	6	6

Table 6 : Properties of Blended Oil Samples

Properties	SUO+ACID 10ML	SAO+ACID 10ML	RBO+ACID 10ML	CAO+ACID 10ML
Breakdown voltage(kv)	18	19	20	21
Viscosity(cst)	58	60	62	64
Pour Point(^{0}c)	9	8	6	9

Breakdown voltage is observed to decrease at a faster pace when acid concentration rises. As soon as 10ml of acetic acid is added externally, the breakdown voltage value of the oil samples drastically decreases to around 50% of the typical value without acid inclusion. Vegetable oil sample samples' viscosity and pour point increased after acids were added.

3.CONCLUSION

This study looks at experimental analysis of the effects of acid inclusion on the characteristics of oil samples made from vegetable oil. The findings showed that the acid definitely affects how oil sample attributes change, although the rate of change varies depending on the amount of acid present. Increased ionic conductivity, changes in the content of fatty acids, bubble production due to dissolved hydrogen gas, and high-pressure generation in the oil samples are all potential explanations of property modifications brought on by acid inclusion. To confirm that vegetable oil is an acceptable replacement for conventional mineral oil, additional experimental study using oil samples may be carried out. Future work can concentrate on the following: an investigation could be expanded to assess the impact.

4. REFERENCES

[1]AhamadkamalM.S.,BashirN.and MuhammadN.A ., 'Insulating Properties of VegetableOils and their Blends',IEEE Conference Publication,pp- 455-458;2013.

[2]. Akure, Nigeria and Akinola. A.O ., 'The Effects of Transesterification and Blending on the Fatty Acid Profiles of vegetable Oils',Saudi Journal of Engineering and Technology.;Vol-1,No-2; pp- 2415-6264, 2016.

[3]. Aliyu A.O. and Ahmad Tijjani.,'Transesterification and Epoxidation of Oil Extracts from Selected Plants for Use as Bio-transformer Oil Transesterification and Epoxidation of Oil Extracts from Selected Plants for Use as Bio-transformer Oil ',International Research Journal of Pure & Applied Chemistry ; pp- 2231-3443, 2017

[4].Antony Pradeep J., K.Kishore Kumar, D.Balasubramanian., 'Biofuel ProductionUsing Butanol and Used Transformer Oil American Journal of Engineering Research (AJER) Volume-5, pp-285-293;2016