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Characteristics Investigation of Vegetable oil(RBO) by using H -bn Nanoparticles

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Abstract

This study demonstrates how the physical, electrical, and thermal characteristics of vegetable oil(RBO) vary depending on the nano particle composition. With particle volume fractions ranging from 0.1 percent to 0.4 percent, h-BN nanoparticles were individually injected into the vegetable oil(RBO) to form nanofluids (NFs) that act on the oil's fundamental properties. At room temperature, it was possible to predict properties including flash point, breakdown voltage (BDV), firepoint, and viscosity, depending on IEC and ASTM standards. The breakdown voltage will rise as the vegetable oil(RBO) oil is heated in the presence of nanoparticles. The viscosity has changed as nanoparticles have grown in size, and the flash point and fire point have expanded from 10°C to 15°C.

Keywords: **Vegetable oil(RBO)(SUO) , Nanoparticles, Nanofluids, blending , transformers.**

I-INTRODUCTION

In the transmission and circulation organization, transformers are the most urgent and significant part. The Protectingoil (Transformer oil) is utilized to give electrical protection to inside components of transformers just as fill in as a hotness trade medium. The transformer's optimal activity is determined by the transformer oil's electrical, physical, and chemical properties[1]. The dielectric protection method is to be faulted for most of transformer disappointments.Nanoparticles, of course, are mixed into transformer oil to work on securing properties[2]. The transformation of magnetite nanoparticles into transformer nanoparticles increases the dielectric strength of the AC and driving circuits.The outer attractive field direction, on the other hand, determines the scattering of magnetite nanoparticles in transformer oil.The magnetite nanoparticles constructed a scaffold across the field hole between the anodes in an attractive field, bringing down the transformer oil's dielectric strength[3]. These liquids ought to have adequate dielectric solidarity to support the possible scope of electrical pressure produced during administration The dielectricstrength of halfand half nanofluids was analyzed, and a decrease wasnoted when contrasted with unadulterated oil. The dielectric strength of half and half nanofluids was analyzed, and a decrease was noted when contrasted with unadulterated oil[4-5]. It have explored of lightning motivation breakdown voltage of regular and engineered ester oilbased Fe2o3,Al2o3,Sio2 nanofluids[6]. The dielectric consistent increments and the dielectric misfortune steady declines with the consideration of nanoparticles. From the writing study, larger part properties have choosen Tio2,Al2o3,Cuo and Sio2 as nanoparticles. The principle worry of the previously mentioned nanoparticles is that theyhave a lower grating coefficient esteem and are more costly. Most of distributed examination centers around the effectof nanoparticles on the warms and dielectric properties of greasing up oils[7]. The researched of the dielectric and warm properties of Non-Edible cottonseed oil by infusing h-bn nanoparticles . The nanofluids was used to overcomethe confined dielectric and warm properties of cottonseed oil. The dielectric and warm properties were altogether worked on in CSO based nanofluids[8]. The explore the impact of nanoparticles blends on AC breakdown voltage of vegetable oil(RBO)(SUO).They have seen that the combinations of nanoparticles (Al2O3,SiO2and Fe3O4) is additionally performedutilizing typical and weibull laws[9]. In the existing work, Tio2, Sio2, Al2o3 and Cuo nanoparticles are used, I now use H-BN nanoparticles, because they have higher dielectric and thermal properties. Vegetable oil(RBO)(SUO) is a complex compound of hundreds of different chemical compounds, with many molecules comprising carbon and hydrogen. Although vegetable oil(RBO)(SUO) continues to be a major technological solution compared to the economy, its environmental impact must be considered.

In order to improve the physical and electrical properties of vegetable oil(RBO) (SUO), nanoparticles are added to transformer oil and their qualities are examined at room temperature. This work aims to improve the way that hexagonal boron nitride is presented in terms of its actual properties.The viscosity, flashpoint, fire point, breakdown voltage, and execution of the h-bn nanoparticle coordinated in vegetable oil(RBO) (SUO) for the current study were investigated for various volume centralizations of h-bn nanofluids.

II. Experimental Details

A. Preparation of Nano fluids

In our review, the h-BN nanoparticles were included in a vegetable oil(RBO)(RBO) to create the nano fluids. The h-BN nanofluids were arranged utilizing underneath referenced cycle with different volume focuses from 0.1to 0.4%.

Figure. 1 magnetic stirrer setup

H-bn nanoparticles and base oil are combined using an eye-catching stirrer. The magnetic stirrer's speed and each sample's temperature were held at 1500 rpm and 40°C for a total of three hours during the scattering of nanoparticles. The arrangement is then supplemented with the calculated amount of h-BN and stirred for an additional 30 minutes at the same temperature. After that, a test sonicator is used to sonicate for an hour in order to obtain consistent scattering. Figure 2 displays the h-BN nanofluid samples at various volume concentrations.

Figure .2 Preparation of samples

B. Breakdown voltage measurements:

The breakdown voltage of fluid protection is a proportion of the capacity of fluid protection to endure electrical pressure created in working circumstances.

At the room temperature, by using oil test cup the sample's breakdown voltage were measured with specified standard(IEC 60156). Fig3 shows that the oil test cup. The oil testing cup has set up transformer capable of giving upto 60 kv..

For the breakdown voltage measurement of oil,the gap space is set as 2.5mm. First the oil cup is washed with given transformer oil. It is then loaded up with transformer oil, whose dielectric strength is not set in stone. It is permitted to stand adequately and regardless to a stature at least 40mm from the highest point of the cathode. The oil test is giventwo anodes. The oil is filled inside the cup, the bar of the testing pack is inundated in the oil for a profundity of 40mm.The stock is shifted through the variac the breakdown of the optional voltage is noted.

Figure .3 Oil test cup

C. Flash point and Fire point measurements :

One of the key ideas being investigated for enhanced fluid protection is low combustibility. The fire point is the temperature at which the moulded smoke is ready to burn through.The flash point and fire points are determined from the ambient temperature using the Pensky Martin closed cup apparatus in accordance with ASTM D 93. The Pensky Martin sealed cup analyzer is depicted in Figure 4.The model was placed in a metal test cup, and a temperature-controlled electric boiler was used to raise the temperature. With the use of a small test fire and ephemeral fire on the oil surface, the temperature corresponding to the flash point was found in the model.

heating a 50 ml oil test

Figure .4 Pensky martin apparatus

D. viscosity measurement :

The transformer oil should have a medium consistency, with the idea that oil will flow freely in the transformer tank for cooling purposes. The temperature affects the oil's consistency.

The viscosity is the physical property of transformer oil which is measured by the apparatus called redwood viscometer by the standard ASTM D 445.The redwood viscometer is displayed in Figure 5.

In a silver plated oil cup, the model was filled. Allow the movement of test through the ball valve(orifice) to accumulate the model in the test recepticle by opening the ball valve(orifice). Measure the amount of time required for a social gathering with 50 mL of test in a recepticle. Since then, viscosity hasn't been fixed in stone.There is a littleaperture of normal size beneath the falling head.

Figure .5 Redwood viscometer

III. Results and Discussions

A. Properties of Base oil

The properties of base oil (Transformer oil) were measured at room temperature according to as per the standards ASTM and IEC . The properties are shown in Table 1.

Table 1 : PROPERTIES OF BASE FLUIDS

Properties	Values
Breakdown Voltage (kv)	32kv
Flash point	160°C
Fire point	175°C
Viscosity(csk)	40 centistokes

B. Breakdown voltage :

Given that transformer oil is intended to serve as an electrical cover in transformer devices that operate in high-voltage environments, the breakdown voltage of transformer oil-based nanofluids needs to be taken into consideration. The oil will ignite if the breakdown voltage of the oil cannot stop the transformer from reaching its maximum electric field strength.Accordingly, a high breakdown voltage is a crucial property of premium transformer oil. The breakdown voltage of transformer oil-based nanofluids containing h-bn was studied. Table 1 displays the after-sample measurements. Figure 6 displays the after-samples measurement graph. As indicated in Table 2, the sample of the nanofluids took longer than the basic fluid. The breakdown voltage assessment curve for the models is shown in Figure 7 before.

TABLE 2. NANOFLUIDS MEASUREMENTS OF BREAKDOWN (AFTER SAMPLES PREPARATION)

h-bn nanoparticles Volume fraction(vol%)	**Breakdown voltage (kv)**
0.1	15
0.2	17
0.3	21
0.4	25

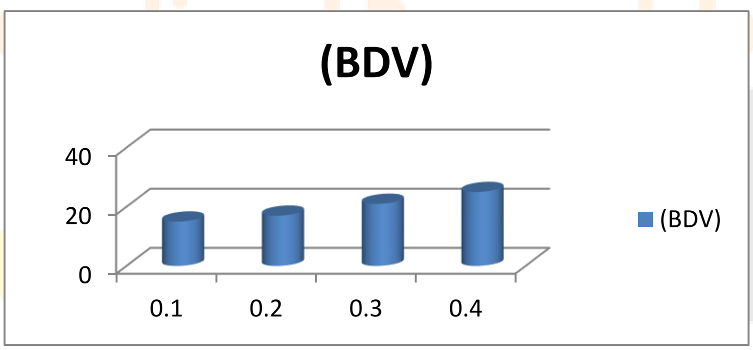

Figure 6. Breakdown voltage (after sample preparation)

TABLE 3 .NANOFLUIDS MEASUREMENTS OF BREAKDOWN VOLTAGE (AFTER HEATING OF SAMPLES UPTO 100◦C)

h-bn nanoparticles volume fractions (vol%)	**Breakdown Voltage (kv)**
0.1	40
0.2	45
0.3	47
0.4	49

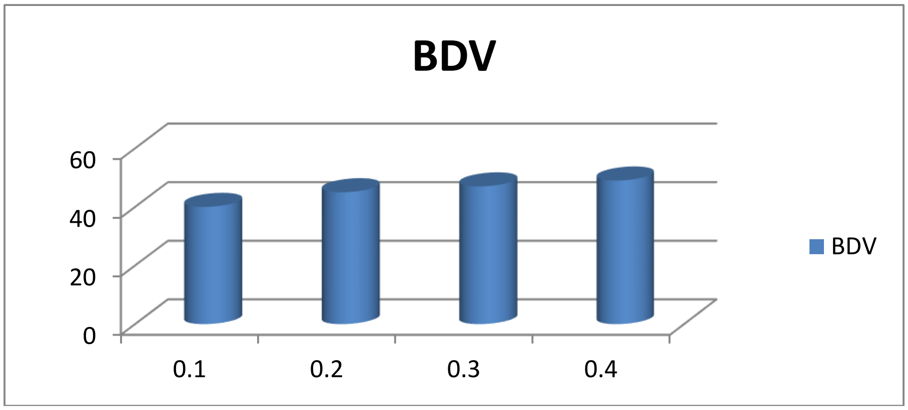

Figure 7. Breakdown voltage (after heated upto 100°C)

C. Flash point and Fire point :

The thermal characteristics of transformer oil, known as the flash point and fire point, determine when air will ignite. Table 3 shows the purposeful Fire point and Flash point of vegetable oil(RBO) and nanofluids at ambient temperature. It is no longer necessary to start when estimating a fluid's flash point. This should not be confused with the autostart temperature, which has no start source needed. When the source of the start is removed at the flash point, the fume may stop consuming. The phrase "streak guide" refers to both flammable and combustible fluids. To determine the risk associated with a material's ability to support burning, fire point is used.

It has been demonstrated that the Fire point and Flash point of nanoparticles are constantly expanding as the volume fraction of the nanoparticles expands. Table 3 demonstrates that the flash point of nanofluids is similar to that of base liquids, whereasthe fire point of nanofluids increases from 10 to 15 degrees Celsius when compared to base liquid.The example will maintain ignition for 5 seconds at the fire location.Figures 8 and 9 provide a graphic depicting the analysis of Fire point and Flash point. The flash point and fire points are increased because the ignitions repeats as the liquid temperature continues to rise.

TABLE 4 NANOFLUIDS MEASUREMENTS OF FLASH AND FIRE POINT

h-bn nanoparticle volume fractions(vol%)	Flashpoint	Firepoint
0.1	180	190
0.2	185	195
0.3	190	200
0.4	195	205

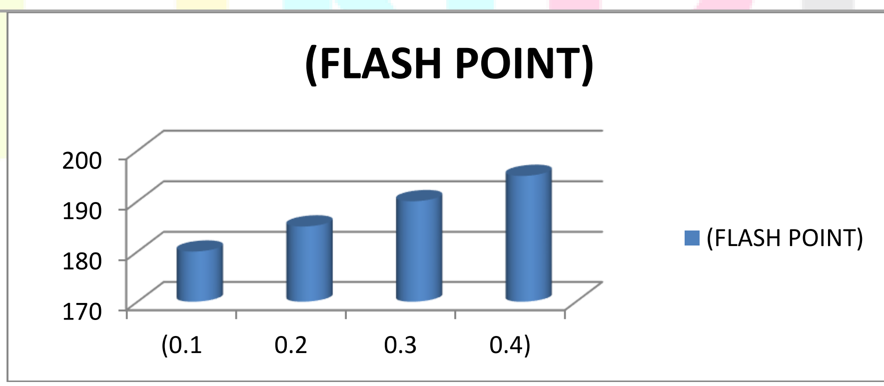

Figure 8. Various samples of flash point measurements

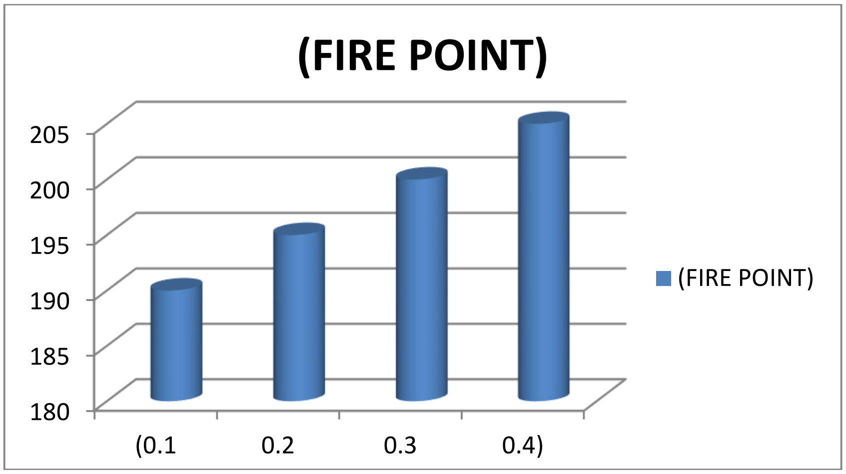

Figure 9. Various samples of fire point measurements

D. Viscosity :

A high viscosity indicates good stream protection, whereas a low consistency indicates poor stream protection.viscosity changes were directly proportional to temperature. viscosity is likewise impacted by pressure, high tension makes the consistency increment and hence the heap conveying limit of the oil additionally increments.

Figure 10 shows the viscosity advantages of base vegetable oil(RBO) and the arranged unique volume rates of nanofluids at varied temperatures. With rising temperatures, base and nanofluid consistency rapidly decreases. The thickness of nanofluids decreases in different volume fractions, as seen in Table 4. When the temperature used to measure the viscosity of vegetable oil(RBO) for internal use is comparatively normal.When compared to vegetable oil(RBO), the viscosity of the vegetable oil(RBO) is more typical. In the literature, a few methods for reducing viscosity levels have been suggested. As a result, the research vegetable oil(RBO) should be operated as transformers using viscosity-increasing procedures.

TABLE 5 VISCOSITY MEASUREMENTS OF NANOFLUIDS

h-bn nanoparticle volume fractions(Vol%)	Viscosity(csk)
0.1	42
0.2	45
0.3	47
0.4	49

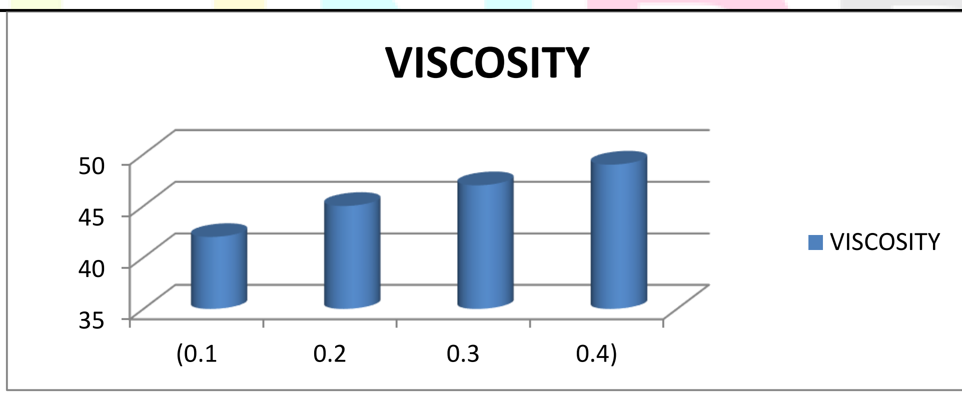

Figure 10. Various sample measurement of viscosity.

IV. CONCLUSION

Nanofluids were created in this study by dispersing nanoparticles in vegetable oil(RBO). At normal temperature, the essentialfeatures of nanofluids were examined.

1. 1. In accordance with the evaluation's findings, h-bn nanoparticles are added to (RBO), which assembles the breakdown voltage. As the particle volume portion of nanoparticles expands, the breakdown voltage of nanofluids rises.

2.2. The addition of nanoparticles raises the flash point of vegetable oil(RBO). The temperature at the fire spots has risen from 10 to 15 degrees Celsius in the interim.

3.3. When h-bn nanoparticles dissolve in vegetable oil(RBO), the spectrum of viscosities increases..

4. The results show that adding nanoparticles to vegetable oil(RBO) enhances the breakdown voltage, fire point, and viscosity.

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