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Investigation On Performance Characteristics of Vegetable Oil by using Cuo Nanoparticles

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Abstract

This research shows how the physical, electrical, and thermal properties of vegetable oil (Cso) differ based on the nano particle composition. Cuo nanoparticles were individually injected into vegetable oil (Cso) with particle volume fractions ranging from 0.1 percent to 0.4 percent to generate nanofluids (NFs) that act on the oil's fundamental properties. Using IEC and ASTM standards, it was able to estimate qualities such as flash point, breakdown voltage (BDV), firepoint, and viscosity at room temperature. As the vegetable oil (cso) oil is heated in the presence of nanoparticles, the breakdown voltage increases. The viscosity has altered as the size of the nanoparticles has increased, and the flash and fire points have increased from 10°C to 15°C.

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

I-INTRODUCTION

In the transmission and circulation organization, transformers are the most urgent and significant part. The Protecting oil (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 was noted 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 oil based 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

Cuo nanoparticles . The nanofluids was used to overcome the 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(SUO).They have seen that the combinations of nanoparticles (Al2O3,SiO2and Fe3O4) is additionally performed utilizing typical and weibull laws[9]. In the existing work, Tio2, Sio2, Al2o3 and Cuo nanoparticles are used, I now use CUO nanoparticles, because they have higher dielectric and thermal properties. Vegetable oil(SUO) is a complex compound of hundreds of different chemical compounds, with many molecules comprising carbon and hydrogen. Although vegetable oil(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 (Cso), 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 Cuo nanoparticle coordinated in vegetable oil (Cso) for the current study were investigated for various volume centralizations of Cuo nanofluids.

II. Experimental Details

A. Preparation of Nanofluids

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

Figure. 1 magnetic stirrer setup

Cuo 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 Cuo 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 Cuo 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.

Figure .3 Oil test cup

The gap space for oil breakdown voltage measurement is adjusted to 2.5mm. First, the oil cup is cleaned using the provided transformer oil. It is then filled with transformer oil, the dielectric strength of which is not fixed. It is permissible to stand appropriately and regardless of stature at least 40mm from the cathode's highest point. Two anodes are used in the oil test. The cup is filled with oil, and the bar of the testing pack is immersed in the oil to a depth of 40mm.The breakdown of the optional voltage is noticed as the stock is transferred through the variac.

C. Flash point and Fire point measurements :

Low combustibility is one of the primary concepts being researched for improved fluid protection.The temperature at which the moulded smoke is ready to burn through is referred to as the fire point.In line with ASTM D 93, the flash and fire points are calculated from the ambient temperature using the Pensky Martin closed cup apparatus. Figure 4 depicts the Pensky Martin sealed cup analyzer.The model was placed in a metal test cup, and the temperature was raised using a temperature-controlled electric boiler. The temperature corresponding to the flash point was found in the model using a small test fire and ephemeral flames on the oil surface. heating a 50 ml oil test

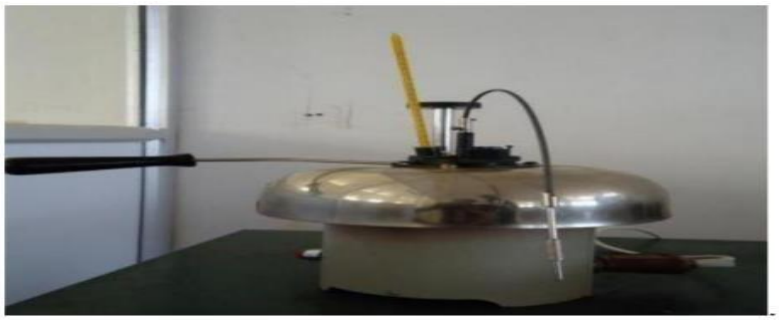

Figure .4 Pensky martin apparatus

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 vegetable 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.

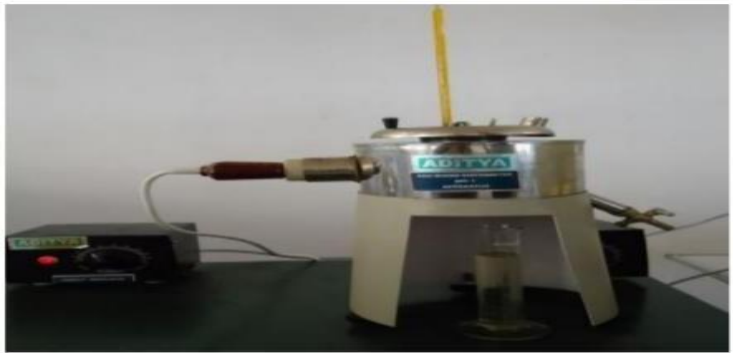

Figure .5 Redwood viscometer

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 standardsASTM and IEC . The properties are shown in Table 1.

Table 1 : PROPERTIES OF BASE FLUIDS

Properties	Values
Breakdown Voltage (kv)	35kv
Flash point	190°C
Fire point	200°C
Viscosity(csk)	60 centistokes

B. Breakdown voltage :

Given that transformer oil is meant to be used as an electrical cover in high-voltage transformer devices, the breakdown voltage of transformer oil-based nanofluids must be considered. If the oil's breakdown voltage cannot prevent the transformer from reaching its maximum electric field strength, the oil will burn.As a result, premium transformer oil must have a high breakdown voltage. The breakdown voltage of Cuo-containing vegetable oil-based nanofluids was investigated. The after-sample measurements are shown in Table 2..

TABLE 2. NANOFLUIDS MEASUREMENTS OF BREAKDOWN (AFTER SAMPLESPREPARATION)

Cuo nanoparticles Volume fraction(vol%)	Breakdown voltage (kv)
0.1	20
0.2	22
0.3	24
0.4	26

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

Cuo nanoparticles volume fractions (vol%)	Breakdown Voltage (kv)
0.1	35
0.2	40
0.3	42
0.4	45

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 (Cso) 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 thenanoparticles expands. Table 3 demonstrates that the flash point of nanofluids is similar to that of base liquids, whereas the 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

Cuo nanoparticle volume fractions(vol%)	Flashpoint	Firepoint
0.1	190	200
0.2	200	210
0.3	210	220
0.4	220	230

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.

The consistency of the base and nanofluids degrades dramatically as temperatures rise. As seen in Table 4, the thickness of nanofluids decreases with increasing volume fraction. When the temperature used to determine the viscosity of vegetable oil (Cso) for internal use is normal.The viscosity of vegetable oil (Cso) is more usual when compared to other oils. A few ways for lowering viscosity levels have been proposed in the literature. As a result, the research vegetable oil (Cso) should be used as transformers by raising the viscosity.

TABLE 5 VISCOSITY MEASUREMENTS OF NANOFLUIDS

Cuo nanoparticle volume fractions(Vol%)	Viscosity(csk)
0.1	60
0.2	62
0.3	64
0.4	66

IV.CONCLUSION

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

1. According to the findings of the assessment, Cuo nanoparticles are added to vegetable oil (Cso), which assembles the breakdown voltage. The breakdown voltage of nanofluids increases as the particle volume portion of nanoparticles expands.
2. The inclusion of nanoparticles increases the flash point (Cso) of vegetable oil. In the meantime, the temperature at the fire places has climbed from 10 to 15 degrees Celsius..
3. When Cuo nanoparticles dissolve in vegetable oil (Cso), the viscosity range broadens...
4. According to the findings, adding nanoparticles to vegetable oil (Cso) improves the breakdown voltage, fire point, and viscosity.

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