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INFLUENCE CHITOSAN AND CARBON NANODOTS (CNDs) OF THE CONTACT OIL

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Abstract

The purpose of this work was to investigate of contact oil, Influence Chitosan and NanoDots (CNDs) of contact oil were been evaluated test conditions to simulated before and after. Bending test for polyester resin material were better before being smeared with chitosan powder, which increased by about 17 MPa. This means there is an increase in the quality of a material visually. Tensile test specimen for polyester resin material and tensile test specimen for polyester resin mixed chitosan powder shows that the results of the bending test were better after being smeared with chitosan powder, which increased by about 3 MPa. One of the most basic mechanical tests that can be performed on a base material. This test is easy to perform and provides many results regarding the characteristics of the material being tested. the tensile test after chitosan powder is better. Compress test for polyester resin material were better before being smeared with chitosan powder, which increased by about 2 MPa. This means there is an increase in the quality of a material visually.

Keywords: Chitosan, NanoDot, Filter, Contact Oil.

1. INTRODUCTION

In engine, the friction between two moving parts (e.g. gears) cannot be eliminated as part of their main function and can only be reduced to a certain level. Besides that, the friction can cause the heat and can damage the components. This friction between two moving parts cause very high maintenance cost and the replacement of the components as a result of the malfunction. The friction also contributes to the overall energy losses: 40-60% [1-2].

An effective lubrication system plays an important role in mechanical equipment, due to about eighty percent of mechanical failure caused by friction and wear [3,4]. Conventional lubricants are mainly composed of mineral base oils containing saturated hydrocarbon polymers and compounds with sulfur and phosphorus. With complexity of service condition growing, the original additives hardly meet the requirements of equipment lubrication. However, some nanoparticles (NPs) additives, which has the characteristics of small size, large specific surface area and strong surface activity, can significantly improve the lubrication performance. Researches [3,5] suggest the optimal concentration in base oils is between 0.2% and 2% for most nanoadditives, and tribological enhancement generally are classified into three types including physical deposition mechanism [6,7], chemical reaction mechanism [8,9] and self-repair mechanism [10,11].

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The friction occurred on the moving part can be reduced using lubricants that create additional layers between the moving components. In order to enhance the capability of the lubricant to reduce the friction and to eliminate the heat, a modification in the lubricant was applied by several researchers using material additives. The utilization of additives in lubricants presents many advantages, as they are relatively insensitive to temperature, and tribochemical reactions are limited, compared to traditional additives [12]. Another advantage by using material additives, such as metal oxide and hydrate particles is its ability to change their solubility under the effect of surface modification[13].

Recently, studies on lubricants with additives such as nanoparticles have attracted the interest of many researches. Nanolubricants have raised great interest in tribology management; the idea was by mixing the various kinds of nanoparticles made of polymer, metal, organic and inorganic materials into the lubricating oil. From the combination, many studies report that nano lubricants are effective in decreasing wear and friction caused by high pressures and temperatures [14], [15], [16], [17], [18]. However, the reduction of friction and antiwear performance depends on various factors, including compatibility with a base lubricant/oil, their sizes and morphologies, as well as volume friction.

Bajing ren, et al (2019) in research Tribological properties and anti-wear mechanism of ZnO@graphene core-shell nanoparticles as lubricant additives. During the preparation of nano additives, all chemical reagents used are of analytical grade. A synthetic ester lubricant (SparkM40) for common engines is employed as the modified base oil, the expected ZnO NPs with different morphologies are prepared by the concentration variation of the alkaline solution based on the hydrothermal synthesis method [21].

Xiyangyuan ye, et.al (2019) with the research about Evaluating tribological properties of the stearic acid-based organic nanomaterials as additives for aqueous lubricants. The SSA solutions show promising results in reducing friction and wear for various friction pairs under a range of loads and shearing velocities, and can be used as potential lubricants in various processes [22].

Summarizing the research of the rheology and the wear of the particle additives in lubricant, the authors have found that some problems, such as the dispersibility, the stability, the uniformity, and the medium compatibility need an improvement and then study Chitosan and NanoDot (CNDs) as filter for contact oil as additives for enchanging the wear resistance were been evaluated test conditions to simulated before and after [30,31].

2. MATERIALS AND METHODS

First, the mold is smeared with wax on the inner wall in order to make it easier to open the product from the mold when it dries. Prepare the polyester resin as a matrix. Mix Chitosan and Carbon NanoDot powder into the polyester resin.Pour the catalyst into the c powder and polyester resin, the purpose of the catalyst is to harden the mixture of polyester resin and c powder. Pour the mixture into the mold to get a homogeneous product. Close tightly with a hubcap in the shortest time at most 12 hours [30,31]. Bending, tensile and compress tests were carried out.

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3. RESULTS AND DISCUSSIONS

3.1. Bending Test

Figure 1: Bending Test Specimens for Polyester Resin Materials

Figure 1 show Before bending test, some specimens were immersed in water while the others were immersed in natural sea water from Black Sea, at room temperature and the water absorption was periodically recorded in case of each type of composite material analysed by considering the recommendations of the actual European Standards [23]. With this purpose in view, all specimens made of the both laminated composites were firstly, before immersion, dried during 3 days at 40°C [24].

Figure 2: Bending Test Specimens of Polyester Resin Mixed with Chitosan and NanoDots (CNDs)

Figure 2 shows that the results of the bending test were better after being smeared with chitosan and nanodots (CNDs), which increased by about 17 MPa. This means there is an increase in the quality of a material visually [24].

Table 1: Bending Test Results between polyester resin and chitosan/NanoDots (CNDs)

Name of Specimen	Stress Maksimum (MPa)
Polyester Resin	63.17261888
Polyester Resin Mixed with Chitosan and NanoDots (CNDs)	80.96986135

Table 1 show in this work, a bending test was carried out by comparing polyester resin with Chitosan and NanoDots (CNDs), resulting in results of 63.17261888 MPa and 80.96986135 MPa. From the results of the bending test there was an increase of around 17 MPa. Bending test, or also known as buckling test, is one of the important methods in the field of materials mechanics. This test is carried out to evaluate the ability of a material to with stand bending loads until deformation or cracking occurs. This shows that the oil's flexibility is better, meaning less wear [25,26].

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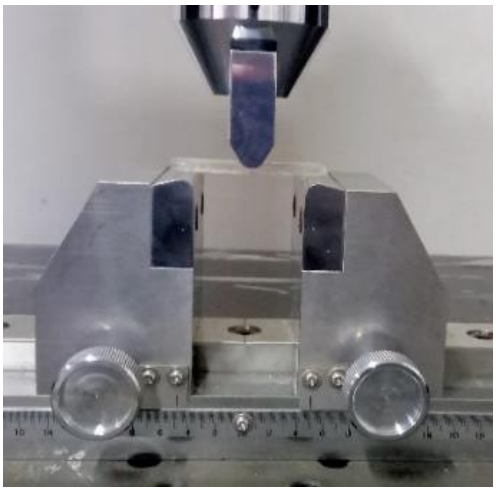

Figure 3: Tools use for Bending Test for Polyester Resin Material

Figure 3 shows tools use for bending test for polyester resin material were better before being smeared with chitosan and Carbon NanoDots powder. [Bending test or curve test is a form of testing to determine the quality of a material visually. Apart from that, the bending test is also used to measure the strength of the material due to loading and the elasticity of the welded joints in both weld metal and HAZ [26].

Figure 4: Bending Test of Polyester Resin Material Mixed with Chitosan and Carbon NanoDot (CNDs)

Figure 4 shows tools use for bending test for polyester resin with Chitosan and Carbon NanoDots, its result better before. This means there is an increase in the quality of a material visually [26].

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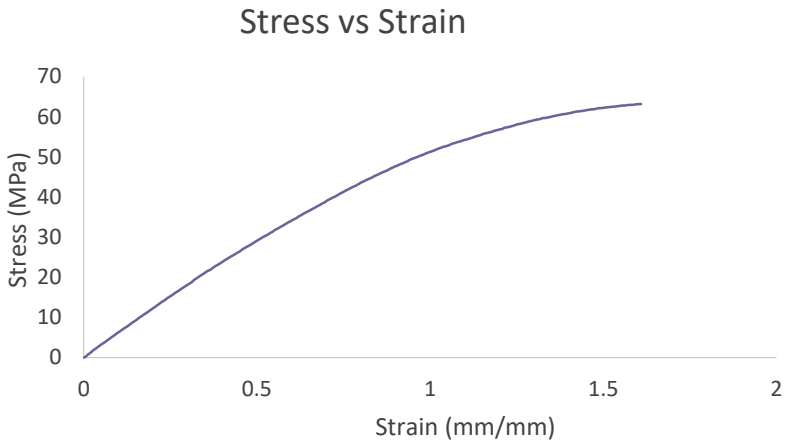

Figure 5: Polyester Resin Material Chart

Figure 5 shows tools use for bending test for polyester resin material were better after being smeared with Chitosan powder, which increased by about 17 MPa. The stress vs strain graph shows a linear increase; this means the results obtained are getting better [27].

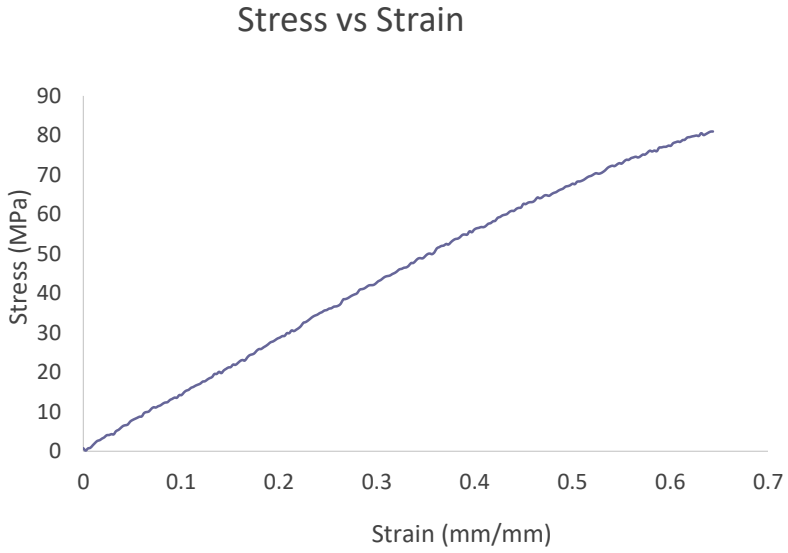

Figure 6: Polyester Resin Material Chart with Chitosan and Carbon NanoDots powder

Figure 6 shows polyester resin material chart linear, make better before 1,5/80 after 0,6/100, stress refers to the force applied to a material per unit area and while strain is a deformation or change in the shape of the material that result from the applied force [28].

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3.2. Tensile Test

Figure 7: Tensile Test Specimens for Polyester Resin Materials

Figure 7 show tensile test with polyester resin specimens for initial testing after wards with Chitosan and Carbon NanoDots to see the effect and better results. a type of strength test used to determine the strength of a material. This is a measure of the amount of force that a material can withstand before it breaks or cracks [28,29].

Figure 8: Tensile Test Specimens of Polyester Resin Mixed with Chitosan Powder

Figure 8 shows that the results of the tensile test were better after being smeared with chitosan and nanodots (CNDs), which increased by about 3 MPa. This means there is an increase in the quality of a material visually [28,29].

Table 2: Tensile Test Results between polyester resin and chitosan/NanoDots (CNDs)

Name of Specimen	Stress Maksimum (MPa)
Polyester Resin	13.23884491
Polyester Resin Mixed with Chitosan Powder	16.90215544

Table 2 show tensile test specimen for polyester resin material and tensile test specimen for polyester resin mixed chitosan and carbon nanodots powder shows that the results of the bending test were better after being smeared with chitosan powder, which increased by about 3 MPa. One of the most basic mechanical tests that can be performed on a base material. This test is easy to perform and provides many results regarding the characteristics of the material being tested. The tensile test after chitosan and carbon nanodots powder is better [29].

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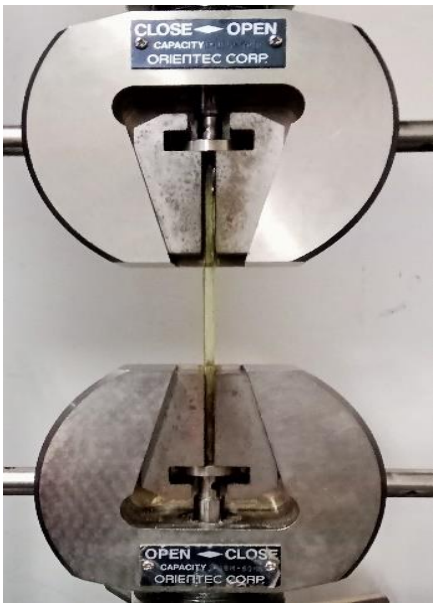

Figure 9: Tensile Test for Polyester Resin Materials

Figure 9 shows tools use for tensile test for polyester resin material were better before being smeared with chitosan powder, which increased by about 3 MPa. This means there is an increase in the quality of a material visually [29].

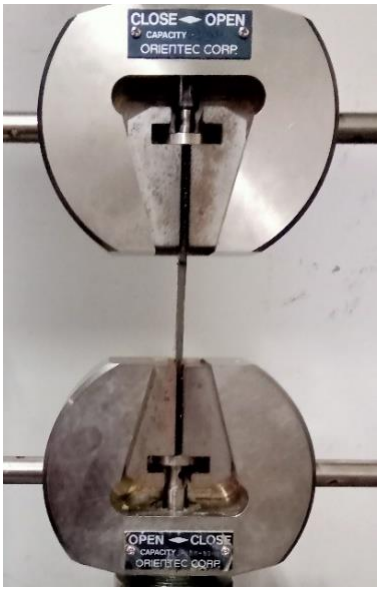

Figure 10: Tensile Test for Polyester Resin Materials Mixed with Chitosan Powder

Figure 10 shows polyester resin material chart linear, stress refers to the force applied to a material per unit area and while strain is a deformation or change in the shape of the material that result from the applied force [28,29].

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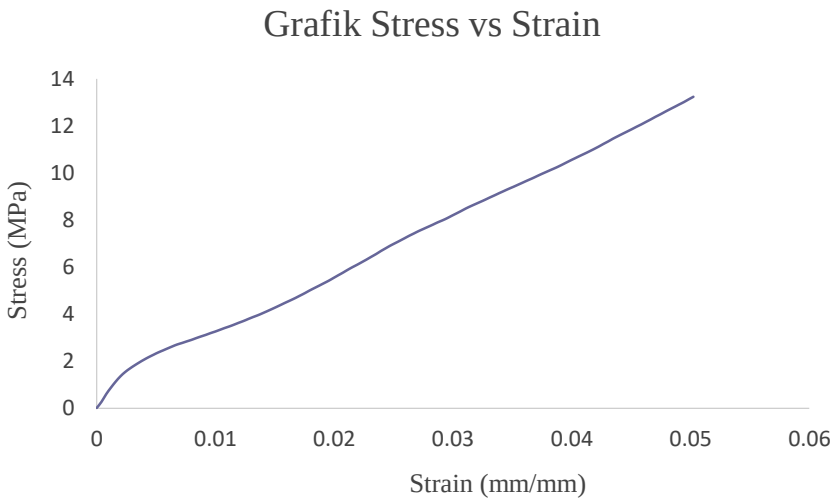

Figure 11: Polyester Resin Material Chart

Figure 11 shows polyester resin material chart linear, stress refers to the force applied to a material per unit area and while strain is a deformation or change in the shape of the material that result from the applied force [29].

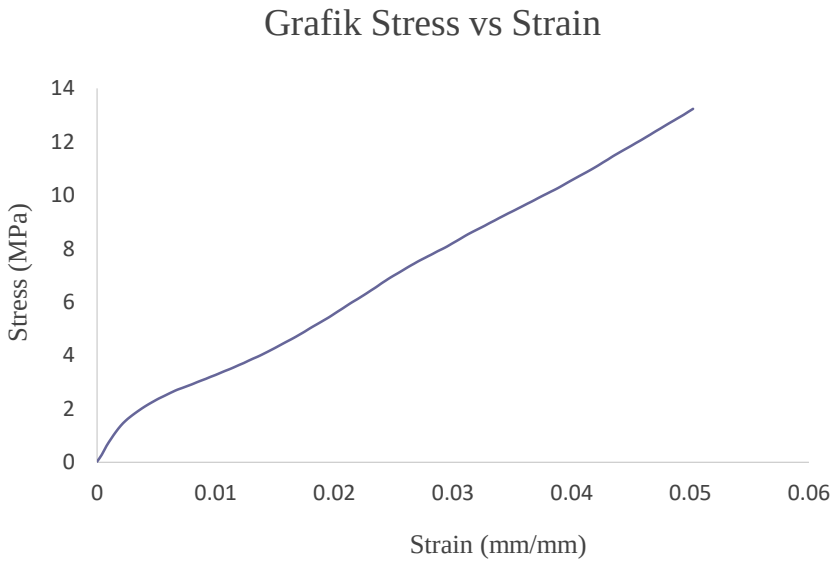

Figure 12: Polyester Resin Mixed with Chitosan Powder

Figure 12 shows polyester resin material chart with chitosan powder linear with the same result 0,06/14, stress refers to the force applied to a material per unit area and while strain is a deformation or change in the shape of the material that result from the applied force [28].

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3.3 Compress Test

Figure 13: Specimens for Polyester Resin Materials

Figure 13 shows compression tests are used to determine a material's behavior under applied crushing loads, and are typically conducted by applying compressive pressure to a test specimen for polyester resin material (usually of either a cuboid or cylindrical geometry) using platens or specialized fixtures on a universal testing machine [28].

Figure 14: Compress Test Specimen Material Polyester Resin Mixed with Chitosan and carbon nanodots Powder

Figure 14 show compress test specimen for polyester resin material and tensile test specimen for polyester resin mixed chitosan and carbon nanodots powder shows that the results of the bending test were better. One of the most basic mechanical tests that can be performed on a base material [29]. This test is easy to perform and provides many results regarding the characteristics of the material being tested. the tensile test after chitosan and carbon nanodots powder is better.

Table 3: Compress Test Results between polyester resin and chitosan/NanoDots (CNDs)

Name of Specimen	Stress Maksimum (MPa)
Polyester Resin	8.623490514
Polyester Resin Mixed with Chitosan Powder	10.08277306

Tabel 3 shows after being smeared with chitosan and carbon nanodots powder, which increased by about 2 MPa. These results show an improvement towards the better after adding chitosan and carbon nanodots powder. specimens are pressed together in essentially the opposite of a tensile test, which pulls the specimens apart [29].

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Figure 15: Compress Test for Polyester Resin Materials

Figure 15 Show tools use for compress test for polyester resin material were better before being smeared with chitosan powder, which increased by about 2 MPa. This means there is an increase in the quality of a material visually [29].

Figure 16: Compress Test of Polyester Resin Mixed with Chitosan and carbon nanodots Powder

Figure 16 Shows tools use for compress test for polyester resin material were better before being smeared with chitosan powder, which increased by about 2 MPa. This means there is an increase in the quality of a material visually [29].

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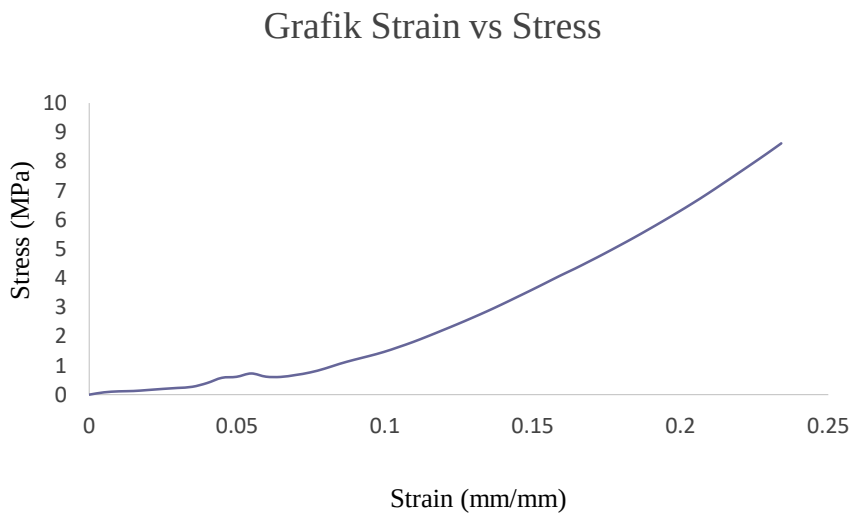

Figure 17: Polyester resin material

Figure 17 shows polyester resin material chart with chitosan powder linear with the same result 0,25/10 and 0,06/12, stress refers to the force applied to a material per unit area and while strain is a deformation or change in the shape of the material that result from the applied force [29].

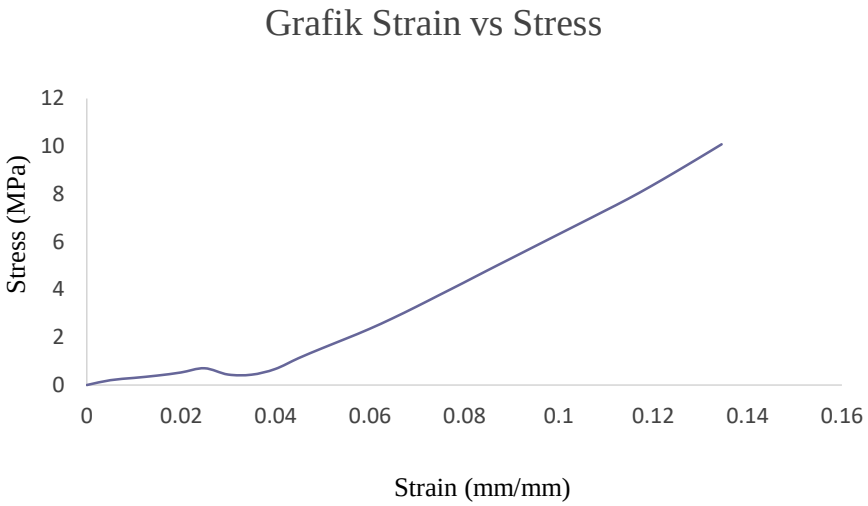

Figure 18: Polyester Resin Mixed with Chitosan and Carbon NanoDots Powder

Figure 18 shows polyester resin material chart with chitosan powder linear with the same result 0,25/10 and 0,06/12, stress refers to the force applied to a material per unit area and while strain is a deformation or change in the shape of the material that result from the applied force. The pressure applied by a specified specimen under specified environmental conditions to the compression of the entire specified surface [29].

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4. CONCLUSIONS

Influence Chitosan and NanoDots (CNDs) of contact oil were been evaluated test conditions to simulated before and after. Bending test for polyester resin material were better before being smeared with chitosan powder, which increased by about 17 MPa. This means there is an increase in the quality of a material visually.

Tensile test specimen for polyester resin material and tensile test specimen for polyester resin mixed chitosan powder shows that the results of the bending test were better after being smeared with chitosan powder, which increased by about 3 MPa. One of the most basic mechanical tests that can be performed on a base material. This test is easy to perform and provides many results regarding the characteristics of the material being tested. The tensile test after chitosan powder is better.

Compress test for polyester resin material were better before being smeared with chitosan powder, which increased by about 2 MPa. This means there is an increase in the quality of a material visually.

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