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Formulation and Comparison of Neem Based Hydarulic Oil with Brake Fluid

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Abstract:
This paper presents the formulation and testing results of a neem based hydraulic oil. The production of bio based hydraulic oil as an alternative to brake fluid . Neem oil used as based substance and various additives were added to get a desired characteristic of fluid. The property tested for neem based hydraulic oil is boiling point , freezing point 192°C , -28°C respectively and viscosities as 0.145 , 0.136 , 0.118, 0.109 cm^2/ s from range of 70 to 85°C for the tested temperature. Also, mineral based oils tested for the same properties, boiling point, freezing point 152 °C, -40°C mineral goods, including hydraulic fluids fracturing and use, are wreakinghave on our ecosystem. Brakingfluid is a type of hydraulic fluid that is used in hydraulic braking and clutch applications in cars, motorbikes, light trucks, and somebicycles[1].Hydraulic fluids may also be used in excavators, hydraulic brakes, power steering systems, transmissions, trucks, elevators, industrial machinery, and automobiles. Some of the most common brake fluids used in autos, DOT 3, 4, and 5.1, use polyoxyalkylene glycol ethers,petroleum derivatives as their basis ingredients [10]. They comprise a mixtureof glycol ethers containing ethylene, methyl, propylene, and butyl groups, in addition to polyethylene oxide. Glycol ethers may damage the reproductive system and causes birth abnormalities. The hydraulic fluid is the working fluid that completely powers the hydraulic brake system, so power and pressure gearbox is simple with the usage of brake fluid. It is utilized to convert force into pressure and intensify braking forces. Because liquids are not significantly compressible, bulk forces are directly transferred to compress the chemical bonds of the fluid. The brake is a mechanism that applies frictional resistance. respectively and viscosities as 0.066, 0.058 0.053 and 0.042 cm^2/s from range of 70 to 85°C for the tested temperature. The study highlights the potential of neem oil as a sustainable alternative in hydraulic applications. These findings contribute to the ongoing exploration of ecofriendly hydraulic oil for industrial applications.

Keywords: Neem oil, additives, hydraulic oil, Bio-hydraulic brake fluid DOT 3, 4,5.1.

Introduction:

The processing requirement for bio-based alternatives to mineral products has long damaging green- house gas emissions from

Methodology:

The extraction of Neem oil is a complex process and there are several methods used to extract the oil from the seeds. These include mechanical pressing, cold press process. which is the most common method,

solvent extraction, and steam pressure extraction. Each method has its own advantages and disadvantages, and it is important to choose the right method for the desired application.

Cold Press Method:

1. **Harvesting Neem seeds:** The seeds of the neem tree (Aza- dirachta- Indica) are used to obtain neem oil. It should be in dry condition before using for the process.
2. **Cleaning and drying:** Remove any contaminants or debris from the neem seeds. Allow the seeds to completely dry to reduce moisture content.
3. **Pressing:** After finishing the extraction, filter the oil to eliminate any leftover seed particles. For this, you can use cheesecloth or muslin material. Pour the oil through the cloth over the collection container.
4. **Storage:** To keep the extracted neem oil safe from light, store it in a dark glass bottle. Light exposure might impair the oil's quality. Keep the oil cool and dark, away from direct sunlight.

Materials needed:

1. Neem oil
2. Graphite powder
3. Monoethylene Glycol
4. Detergent
5. Stirring Equipment
6. Filtration System
7. Storage Container

Graphite

A beneficial fluid has minimal contact between its component parts and the walls of the vessel in which it is housed. The fluid's total viscosity index was boosted by using graphite particles dissolved in methanol as a friction modifier. Graphite also serves as an anti-wear agent in the composition.

Mono ethylene glycol:

It is not desirable for brake or clutch fluids to freeze in the hoses orpipelines, as this Make use of a cold-press extraction machine. These machines are designed to extract oil at low temperatures yet maintain the oil's inherent characteristics intact. Set up and activate the machine exactly to the manufacturer's instructions. Place the neem seeds in the machine's hopper.

Collection of oil

The oil extracted by the machine will be collected in a separate container. Assemble a clean and dry container to collect the neem oil.

Straining

may cause the force transmission to fail. Even as temperature change brake fluids must retain a low amount of compressibility .

when the brake pedal is depressed the brake caliper piston force should working temperature adding contaminating moisture into the fluid mass on cooling to function as both an antifreeze and a coolant a small amount of monoethtleneglycol lubricant which is also soluble in most organic solvents was added to added to the formulation recipe.

1. **Detergent:**

Detergent oils emulsify water and distribute and suspend other pollutants such as varnish and sludge. This

keeps components free of deposits, but it also means that pollutants do not settle out and must be provided in proportion. Fluid cooling is critical because the fluid may boil in its pots at very high.
These can be desirable qualities in mobile hydraulic systems, which, unlike industrial systems, have minimal chance for settling

2. Appearance and odor – Amber with a pungent/garlic Oduor
3. pH value – 5.0 to 6.0
4. Freezing Point – 46.4°F(8°C)
5. Boiling Point - 347°F (175°C)
6. Flash Point - 200°F (93.3°C)

Procedure:

1. Neem oil selection

Choose high-quality, cold pressed neem oil for the base. Ensure that the neem oil is free from impurities.

2. Measurement of Oil quantity

Determine the required quantity of neem oil based on the desiredvolume of hydraulic oil. Use agraduated cylinder or anotherprecise measuring tool

3. Add graphite

Measure the appropriate amountof graphite powder. Graphite is added to improve lubrication properties. The amount will depend on the volume of neem oil, and it's typically added in small proportions.

4. Incorporate Monoethylene Glycol

Measure the desired quantity of monoethylene glycol. This additive is commonly used in hydraulic fluids to improve low- temperature properties. Adjust the amount based on the desired characteristics of the hydraulic oil.

5. Introduce detergent

Measure the required amount of hydraulic oil detergent additive. This helps in and precipitation of impurities at the reservoir due to its tiny volume. The fundamental issue with these fluids is that they have good water emulsifying capacity, which means that if water is present, it is not separated out of the fluid. Water accelerates the ageing of the oil, lowers lubricity and filterability, shortens seal life, and causes corrosion and cavitation. Emulsified water can be converted to steam in highly loaded areas of the system

Physical and Chemical Properties of Neem Based Oil

1. Physical state – Liquid

maintaining cleanliness by dispersing and suspending contaminants. Adjust the quantity based on the specific detergent used and the desired cleaning properties.

2. Storage

Store the neem-based hydraulic oil in a clean, dry, and sealed.

3. Viscosity Measurement

Measure the viscosity of the neem-based hydraulic oil using a viscometer. Adjust the viscosity by adding more neem oil or additives as necessary to meet the desired specifications.

4. Filtration

Filter the hydraulic oil to remove any remaining particles or impurities. This step is crucial for ensuring the cleanliness of the final product.

5. Quality Control Testing

Fig. 01 Adding additives

Fig 02 Measurement Viscosity:

Fig No. 03 Neem Based Hydraulic Oil

Conduct additional quality control tests, such

Sr number	Chemicals andbase oil	Function in Fluid	Mass used (grm/ml)
1.	Neem Base Oil	Base oil	200
2.	Graphite	Friction modifier and anti-wear	3-5
3.	Monoethyleneglycol	Antifreeze Glycol	5
4.	Detergent	Suspend vanish and sludge	1-2

as oxidation stability and thermal stability, to ensure the hydraulic oil meets industry standards

Physical and chemical properties of Neem base hydraulic oil :

1. Physical state – Liquid
2. Appearance and odor – Amber with a pungent and garlic smell
3. pH value – 6.0
4. Freezing Point – 14°F (-10°C)
5. Boiling Point – 377.6°F (192°C)

Result and Discussion:

Table 01 – Formation of bio hydraulic oil

Temperature	70°C	75°C	80°C	85°C
Neem based oil	0.1366	0.1332	0.1016	0.085
Neem based hydraulic oil	0.145	0.136	0.118	0.109
DOT 3 (Hydraulic oil)	0.066	0.058	0.053	0.042

Table 02 – Comparison of viscosity of neem-based oil, neem hydraulic oil, dot3 hydraulic oil

SR number	Fluid	Freezing Point °C	Boiling Point °C
1	Neem Based	8	175
2	Neem Hydraulic oil	-10	192
3	DOT 3	-40	152

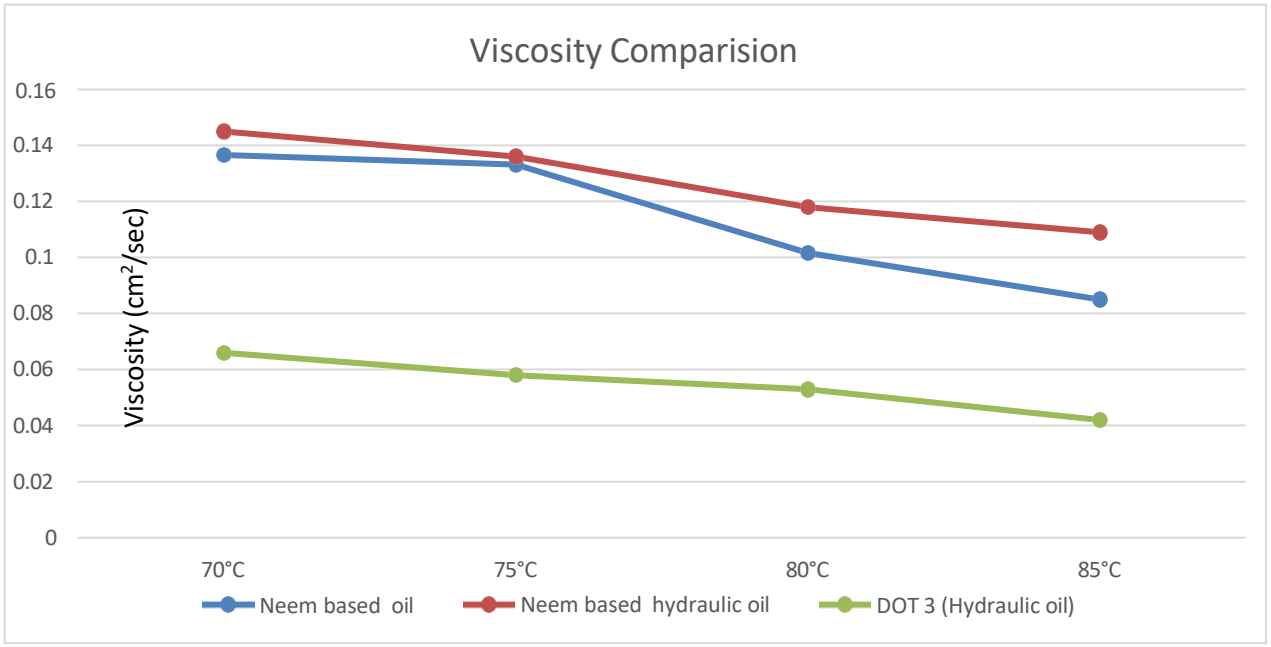
Table – 03 Comparison of boiling and freezing point

As Table 02 shows the comparison of the viscosity of Neem based hydraulic oil, neem base oil and hydraulic oil (DOT 3).

Monoethylene glycol acts as both an antifreeze and a coolant. A solid or block substance cannot be employed as a fluid, and extremely high temperatures are hazardous in fluid operations because they generate unwanted moisture in fluid pipes and lines.

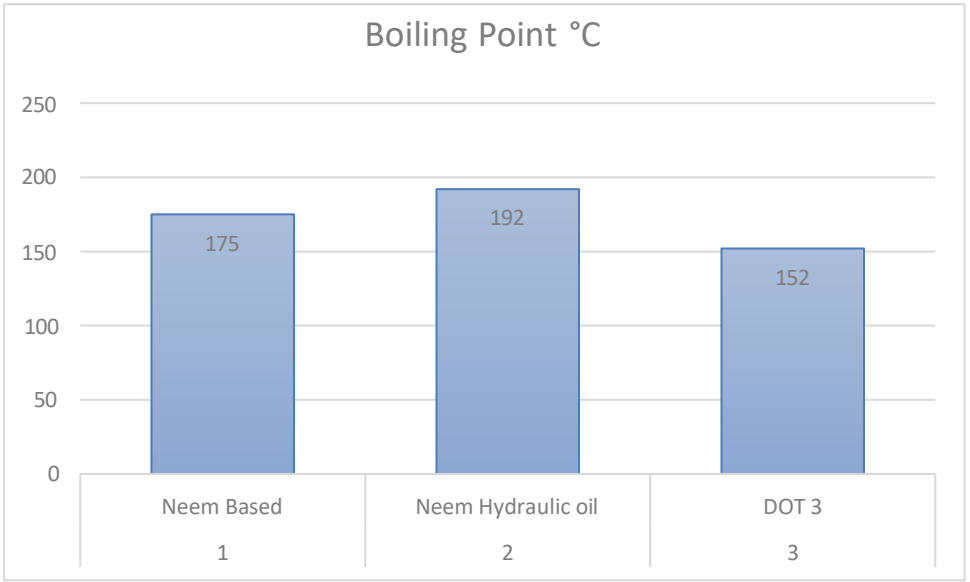
Neem seed oil is less likely to harm system components and has better freezing and saponification capabilities. Within the allowable range of viscosity. Furthermore, the qualities of the neem seed oil provided in table 3 and compared with other values from literature, which are in close agreement, indicate that the extracted neem seed oil is a true sample representation.

It may show that, Lubricants and additives give fluids performance characteristics Detergent oils emulsify water while also dispersing and suspending pollutants like varnish and sludge. This prevents deposits on components, but it also means that pollutants do not settle out and must be filtered away. These can be desirable qualities in mobile hydraulic systems, which, unlike industrial systems, have minimal opportunity for contaminants to settle and precipitate at the reservoir due to its tiny volume. The fundamental issue with these fluids is that they have great water emulsifying capacity, which means that water is not separated out of the fluid if it is present.



Temperature (°C)

Graph 01: Comparison of viscosity between oils.



Conclusion:

Graph 02: Comparison of temperature between oils.

Hydraulic braking fluid derived from neem seed oil has demonstrated satisfactory performance in terms

of its qualities. The results demonstrate that the it will improve its applicability and appropriateness for use as braking fluid. The neem seed oil brake fluid is recommended for usage in automobiles to test its efficiency, and further research is also advised in order to improve on its properties by producing a better brake formulation, which will increase its application. Primary parameters that determine the appropriateness of any hydraulic fluid. The combustion of bio- based substances generates fewer greenhouse emissions than petroleum- based compounds. This outcome safeguards our ecosystem against pollution and its negative consequences.

From our project we have concluded that, boiling point and the viscosity of neem based hydraulic oil is more than DOT 3 hydraulic oil.

The study presented in this paper explores the potential of neem oil as a sustainable alternative to mineral-based hydraulic fluids. The researchers formulated a neem-based hydraulic oil by adding various additives to achieve the desired fluid characteristics. The use of neem oil as a base substance for hydraulic fluids could help reduce the environmental impact of hydraulic fluids, which can have a significant impact on the environment. The findings of this study contribute to the ongoing exploration of eco- friendly hydraulic oil for industrial applications. Further research is needed to explore the full potential of neem oil as a sustainable alternative to mineral-based hydraulic fluids.

Reference:

1. C.C.CZE. 2016.*Formulation and production of bio-hydraulic fluid as alternative to Mineral fluids for Automobile.* American journal of engineering research (AJER).
2. I.S. Aji, S.A. Abdulrahman and O.V. Odigwe.2015. *Assessment of neem seed oil for use as brake fluid.*
3. George E. Totten, Jurgen Reichel and Gary H. Kliflg. *Biodegradable Hydraulic Fluids: A Review.*
4. George E. Totten' and John V. Sherman. *Current needs and developments in hydraulic fluid technologies.*
5. 1Sohan Kamble, 2Vedant Kale,3Kaustubh Nilakhe,4Omkar Kedari, 5Sanket Khade, 6Dr.Satish Inamdar.2022. *Extraction of neem oil with different methods and applications in different fields*. International journal of creative research thoughts (IJCRT).
6. Zdenko TKÁČ, Štefan ČORŇÁK, Vladimír CVIKLOVIČ, Ján KOSIBA, Josef GLOS, Juraj JABLONICKÝ, Rastislav BERNÁT1.2017. *Research of Biodegradable Fluid Impacts on Operation of Tractor Hydraulic System*. Acta Technologica Agriculturae 2Nitra, Slovaca Universitas Agriculturae Nitriae, 2017, pp. 42–45.
7. Kodanda Rama Rao Chebattina, CH Uma Chaitanya, Dharmala Venkata Padmaja. *SYNTHESIS OF NEEM OIL ESTERS AS BIOLUBRICANT BASE STOCK*. International Journal of Management, Technology and Engineering (IJMTE).
8. Mu-Jung Kao, Der-Chi Tien, Chen-Ching Ting, and Tsing-Tshih Tsung.2006. *Hydrophilic Characterization of Automotive Brake Fluid*. Journal of Testing and Evaluation, Vol. 34, No. 5 Paper ID JTE14254.
9. *Bio-based hydraulic fluids and the influence of Hydraulic oil Viscosity on the efficiency of Mobile Machinery.*
10. https://en.wikipedia.org/wiki/Brake_fluid.