COMPARATIVE ANALYSIS OF INTENSIVE PROPERTIES BETWEEN CASHEW NUTS OIL WITH SAE 15W40 OIL

Rodrigues, Luanda Kívia de Oliveira; luandakivia@gmail.com[1]
Cavalcanti, Synara Lucien de Lima, synara2004@hotmail.com. [1]
Mendes, José Ubiragi de Lima; ubiragi@ct.ufrn. br[1]

[1] Universidade Federal do Rio Grande do Norte; Campus Universitário Lagoa Nova CEP 59072-970 Natal - RN - Brasil.

Abstract: *This article is a subsequent step to studies already conducted and published in COBEM 2009 and CONEM 2010. The same tests performed in the Oil of Cashew Nut (OCC) in the work already published were performed in the lubricating oil SAE 15W40. The tests mentioned have been redone in order to increase the reliability of the data presented here. This increases reliability because the two oils were subjected to the same conditions, measured on the same equipment, not may so, have error by difference between methods of measurement or calibration of equipment. Besides the comparative analysis, the research advances to examine the acidity due to the importance of knowing this property to a fluid that aims to lubricate a mechanical system. The working fluid remains the oil product of a merger between the oil of almond and cashew nut shell, in-nature, because it showed satisfactory results in past research. When analyzing the data obtained in the tests, we found that there are positive results with viscosity and flash point, but there are points that need to be further worked out, perhaps with the presence of some additive to oil. In condition of in-natura, when necessary, in other words, when the data presented did not prove satisfactory, the oil can be worked in order to provide desirable the results. The search for improvement of data is due to the fact of working with what is believed to be a source of lubricating oil economically viable, since it refers to a product abundant in our region, low cost, beyond encourage the clean engineering and the exploration local potential. So will be proposed for future work, redo these analysis with the presence of a chemical additive that can reduce its acidity, since because of the high level of acidity the use this oil as a lubricant in natura is not feasible.*

Keywords*: Cashew Oil, SAE 15W40, Flash point, Lubrificant, Viscosity.*

1. INTRODUCTION

For a mechanical system a factor important is the lubrificant oil, your lack, misuse, or bad quality, can cause serious damage to system. For this reason is wich advances research in this line, seeking improvement wich of what has or other sources of raw materials for the product. The lubrificant oils found on the market currently are derived from petroleum or synthesized; nevertheless companies concerned with environmental issues, come sought to develop a lubricant plant quality.

The sources of raw materials are several, the extraction can be from so soybean seeds, sunflower, corn, cotton, rice, among other. However an option to the northeast, as well as the state Rio Grande do Norte is the oil of cashew nut. The cashew is a fruit that resists drought in the region and therefore can be grown all year, apart from being cheap. Using the method of pressing for the extraction of oil with the chestnuts pre-heated up to 60 º C, the average yield of nut oil is about 45.7%, according to (Lima, et al 2004).

Exploring, an alternative source of raw material for production of a lubricant, and this renewable, biodegradable, chestnut oil has, also a great potential for exploitation and is economically viable because of low added value which the fruit is extracted.

2. THEORETICAL FOUNDATION

The main contribution of the lubricant is to separate surfaces when in motion, so as to reduce friction between them and dissipate the heat produced by the same. A large amount of fluids in some way, may play this role, however, this fluid must possess some degree of stability, for security reasons, to qualify as a lubricant. Thereby, lubricants receive a classification according to its viscosity and additives. Thereby, lubricants receive a classification according to its viscosity and additives.

The SAE (Society of Automotive Engineers) ranks as the oil viscosity, for which each application has a different viscosity, and level API (American Petroleum Institute), which ranks as the additive. This classification is indicated by two letters, where the first S, the letter S stands for Service Station, the second defines the performance, when more distant from the beginning alphabet is but modern is the product. For example, the SJ is more modern than the SG and SH and can replace anyone who is below him.

The physicochemical properties of a lubricant are important to define the application. Besides the viscosity, there is the flashpoint that says until temperature the fluid can work, in case of maximum temperature and pour point of the lows.

Are points important to analyze, the density, viscosity, flash point, pour point and total acid number, and all they will be done in both fluids that will be worked out: the oil of cashew nut and a commercial lubricant. It is known that temperature influences the results of all these tests, so the method used to extract oil from the nut is different than mentioned in the introduction. The vegetable oil extracted by pressing, without pre-heating remains *in nature*, which, depending on the results, allows it to be manipulated.

The two fluids are studied: the oil extracted from cashew nut and lubricant SAE15W40 SL. The viscosity of vegetable oil analyzed, published in (Rodrigues, et al, 2010), proved to be next, according to tables provided by manufacturers from refered lubricant.

Metrology, it is known that the same equipment, due different ways of handling may produce different results, therefore, to ensure the legitimacy of the data presented here, the two oils have undergone the same tests, performed on the same equipment and glassware all calibrated.

3. METHODOLOGY

The density test was conducted by the pycnometer method. Unlike other tests, this temperature did not participate in the process, will be compared only at room temperature, in this case 26 ° C.

The kinematic viscosity was performed according to ASTM D445 "Viscosity of Transparent and opaque liquids. Was used a bath temperature constant ISL brand, model TVB - 445 and Fluid to glycerin bath. For measurement at 40 ° C, we used the viscometric tube type Cannon-Fenske reverse flow, 300 series, with the following constants: A (lower) = 0.2723 mm ² / s ² and B (upper) = 0, 1966 mm ² / s ². For the temperature to 100 ° C the tube was used viscometric same make and model mentioned above, with series equal to 150 and constant = 0.03857 mm ² / s ².

O test acid index was conducted in Automatic Potentiometric Titrator, model AT - 500N-2 KEM brand. The solution padroniada was alcoholic KOH and the titrant used was bifilitato potassium, according to ASTM D664-09a.

The equipment used to measure the flash point (PF) was the semi-auto MP-4, PETROTEST, measurement closed vase of Nucleus Research in Oil and Gas - NUPPEG - Department of Chemical Engineering UFRN.

Figure 1. Image of Petrotest PM4. Equipment used for measuring flashpoint.

4. RESULTS AND DISCUSSION

The data about the densities obtained by the tests, using the ratio of mass over volume 26 ° C, are given in Tab.1.

Table 1. DENSITIES

OIL TYPE	DENSITIES	STANDARD DEVIATION
Cashew Nuts	0,98564	0,005601
SAE 15W50	0,85867	0,006686

Analyzing the results, realize if that the value of 15W40 is within an acceptable range, because second tables provided by manufacturers is the value 0.8845. All due diligence necessary to ensure the legitimacy of the data presented here, as the calibration of glassware and the separation by the method of settling the possible solid particles existing in the, fluid were performed but this values found was higher than that found in the literature. A company that works with the processing of cashewnuts oil shows a variation being 0.94 to 0.97, however the temperature not reported.

By measuring the Flashpoint:

Table 2. Flashpoint closed vase

OIL TYPE	**FLASHPOINT** Closed Vase **(ºC)**	**DESVIO PADRÃO**
Cashew nuts	166,6	1,247219
SAE15W40	193	0,816497

With over this parameter, if can reaffirm that the viscosity found are in an acceptable range, because the viscosity index are also nearby, and the value of SAE15W40 check with the manufacturer-supplied what, in my view, further validates the results presented here.

Observing Index Acidity:

Table 4. Index Acidity

OIL TYPE	Index Acidity **(mg/g KOH)**
CASHEW NUTS	129, 42
SAE 15W50	3,84

To analyze the viscosity at distinct temperatures, we used two types of viscometric tube, this because of the capillary diameters are different, therefore the time that a fluid under the same conditions leads to if move is different. Thus the value of viscosity is obtained by multiplying between the time wich took to the fluid drain and constant tube. So it can be seen in Table 2:

Table 2. Kinematics Viscosity **à 40ºC**

OIL TYPE	Viscosity (Cst)	STANDARD DEVIATION
CASHEW NUTS	127,3105	2,902673
SAE 15W50	108, 237	0, 960251

Analyzing now at 100 º C:

Table 3. Kinematics Viscosity **à 100ºC**

OIL TYPE	Viscosity (Cst)	STANDARD DEVIATION
CASHEW NUTS	14, 4445	0, 627204
SAE 15W50	15, 582	0, 11571

It can be observed in the values shown above that there is not a considerable difference between the viscosities of oils at 40 ° C and 100 º C. Calculating Viscosity Index of the two fluids, which was not proposed by the work, but now becomes necessary, to be a parameter that enriches the search by to be one more tool to be evaluated in completion.

The viscosity index was calculated based on ASTM 2270, where the default values used in the equation were removed from tables from the viscosity at 100 ° C for each oil studied.

$$IV = \frac{L-U}{L-H} * 100 \quad (1)$$

In Equation (1), L and H are reference values and the U the value of the viscosity at 40 °C of the fluid to be evaluated.

Applying Equation (1), For the cashew nut oil:

$$IV = \frac{286,4-127,3}{286,4-149,7} * 100 \; ; \; IV = 116,4$$

To oil SAE15W40:

$$IV = \frac{317,5-108,2}{317,5-158,6} * 100 ; \; IV = 131,7$$

With over this parameter, if can reaffirm that the viscosity found are in an acceptable range, because the viscosity index from , are also nearby, and the value of SAE15W40 gives with the manufacturer-supplied what, to my view, further validates the results presented here.

5. CONCLUSION

From the results obtained from analyzes of Viscosity, Flash Point and acidity index in the two oils, cashew nut and SAE15W40, one can observe some important points for the outcome of the paper.

The first analysis presented, the density, showed a satisfactory result, as well as viscosity. The kinematic viscosity of oil SAE15W40 showed a result compatible with provided by manufacturer, while the oil of cashew nut showed a better result than that already found, however the methodology applied differs from that found in the literature. Because of this result has realized the importance of calculating the viscosity index, a parameter that measures the stability of the lubricant. As this parameter the result was satisfactory, if can conclude that from the standpoint of viscosity, not only for presenting a value close to the mineral oil, but to have a stability in the same range of values.

The flash point has already shown results in a range more distant of SAE15W40, a difference of about 30 degrees, that depending on the mechanical system may not be relevant. Anyway, the measures, although different measures in the literature, because the system used was closed vessel, shows that the fluid is not self-igniting at low temperatures.

Despite all the other tests submit good results, only one was essential for completion of paper, index of acidity. In this test the oil of cashew nut obtained an unfavorable outcome. The value as shown gave very high and therefore the oil of cashew nut, provided in nature, can not be used as a lubricant.

To continue research in this line if had to remove this acidity in some way, such as applying a chemical additive, for example. The lubricant was no longer in natura, for it would begin to be worked, but could have a better outcome without the other physico-chemical properties be changed and the focus diverted from paper.

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