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Characterization of Oils Produced from Jatropha Curcas, Peanut and White Sesame in Burkina Faso for Possible Enable Synthesis of Biofuels

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Abstract

The indispensable role of energy in the correct functioning of economies and the current depletion of fossil fuels which are not renewable, have made the search for alternative energy sources a major point of reflection worldwide. Vegetable oils are increasingly being considered as a possible replacement for fossil fuels in countries of the south and North. In order to vulgarize the use of vegetable oil as fuel, it is essential that analytical protocols and standards are elaborated to assure the quality of oils as fuels. This work aims at developing protocols for the characterization of oilseeds and their resultant oils in a bid to ensure their quality for direct use as Biofuels or better still to serve as raw material in producing Biofuels. These protocols have the advantage of being reproducible, fast, and simple to implement compared to those used in Europe to characterize the oils (very complex and expensive, applied to petroleum products). Cotton, Jatropha curcas, white sesame, and peanut grains were acquired from the Zogona local market, Ouagadougou, and oil extraction was done at the village level. The resultant oils were characterized. Their physicochemical parameters (water content, oil content, acid index, the calorific value, density, and viscosity....) were evaluated at the Biomass Energy and Biofuels Laboratory (LBEB) of the International Institute for Water and Environmental Engineering (2iE) and the Burkinabé National Hydrocarbons Authority (SONABHY) Laboratory. The oilseed grain cakes (moisture, ash rate, rate of volatile matter, and oil content...) were also analysed.

Keywords

Biomass Oleaginous, Physical Parameters, Chemical Parameters Biofuel, Vegetable Oils

1. Introduction

Oilseeds are grown specifically for their seeds or fruits rich in fat, which is extracted from the plant oil for food uses, energy, and industry. The extraction results are usually recycled cake for animal feed. Several oil plants can be targeted for biofuel production. These are mainly the Jatropha curcas or sunflower, palm oil, and other oilseeds.

In this study, the plants studied are Jatropha curcas, peanuts, and white sesame.

Ballerine D *et al.* [1] present their work on the issues of biofuels and provide a comprehensive state of production and consumption in the world, in particular to the availability of use in their manufacturing plant resources. It describes the production sectors and for each, details the technologies used, environmental and economic aspects of the processes, and characteristics of processed products. Looking to the future, it also focuses on the presentation of new courses in development utilizing lignocellulosic biomass (agricultural and forest residues, by-products of wood processing, dedicated crops) as raw material. This book will appeal to the transport industry, refiners, forest, agricultural world, and the food industry, but also the government, students, teachers, and researchers in academia.

Blin J *et al.* [2] study in West African countries are increasingly interested in producing straight vegetable oil (SVO) for direct use as fuel in diesel engines for stationary applications in the fields of agriculture, power generation, and industry. Straight vegetable oil fuel quality, *i.e.* impurities content and physicochemical properties, is a recurring issue that seriously impedes the development of the sector. However, there is still no standard defining the quality characteristics of vegetable oils for fuel purposes in stationary engines. The aim of this study was to propose a quality standard with a set of specifications (parameters, test method, limit value), which SVOs must comply with in order to be used as fuel in stationary diesel engines without causing breakdowns or serious lifetime reductions. After a brief review of SVO production and use techniques, we present a critical review of existing fuel standards (fossil fuels, biodiesel, and European SVO) that must be adapted to the use of SVO for stationary engines, with regard to the requirements of engine manufacturers. Based on this critical analysis and current knowledge of vegetable oil characterization, we propose a simplified, inexpensive, and efficient basic standard of seven specifications. This standard enables easy assessment of SVO quality for fueling a stationary diesel engine.

Vaitilingom G *et al.* [3] study the composition of vegetable oil and has a great influence on its quality as a fuel. Relationships have been established between the major compounds of terrestrial or marine oil, and its behavior as a fuel for engines, allow a prediction of the ignition delay and are related to the evaporation coefficient and its tendency to form carbon deposits in the combustion chambers. The weak influence of minority compounds oils has also been established. Actions on inflammation through a pro-cetane additive revealed that in terms of the formation of carbon deposits, reducing the ignition delay does not improve anything. We found the thermal balance of the quality aspects of the combustion of plant oils. The evaporation characteristics of the study have established the existence of an average temperature of the reaction mixture from which the behavior of the fuel oils are comparable (about 500˚C). The favorable thermal good combustion conditions with no carbon deposits, vegetable oils, or mixtures thereof with the oil, have been defined. The work showed that the overall performance, and the analysis of the rate of heat release and exhaust emissions do not allow a precise comparison of the quality of combustion between a vegetable oil having large droplets in the spray injected and fuel oil having only fine droplets. While the influence of the particle size distribution of the droplets on the polymerization and the formation of deposits in the combustion chambers, always seems to be the most credible hypothesis. It, therefore, appears necessary to improve the mechanisms of vaporization of vegetable oil droplets, in order to achieve a better understanding of physical and chemical processes during the combustion of vegetable oils.

Sidibe Sayon *et al.* [4] studies have been published on vegetable oil used in diesel engines. The different authors unanimously acknowledge the potential and merits of this renewable fuel. Typically, Straight Vegetable Oils (SVOs) produced locally on a small scale, have proven to be easy to produce with very little environmental impact. However, as their physicochemical characteristics differ from those of diesel oil, their use in diesel engines can lead to a certain number of technical problems over time. In the bibliography, there is substantial disagreement between authors regarding the advanced phenomena linked to these problems and their commended solutions. Some of these publications treat options individually without any real comparison between them. Another observation is that the literature rarely tackles problems linked to vegetable oil quality. This paper sets out to review the state of the art for SVO use as fuel in diesel engines, based on a bibliographic study (literature review). The first section of the document examines the influence of the type and quality of vegetable oils for fuel use in diesel engines. The second section discusses the advantages and disadvantages of two options recommended for SVO use in diesel engines: dual fueling and blending with diesel fuel.

Daho T [5] present the physicochemical characteristics, the size of the spray, and evaporation of fuels are fundamental in predicting and optimizing their quality of combustion in engines or burners. In this study, the influence of physicochemical characteristics, size, and evaporation of oil heating oil, various vegetable oils, and their derivatives (mixtures oil) on their combustion in diesel engines or burners was demonstrated. Already established in the case of diesel engines, this study highlights the burners, and the correlations between the physicochemical characteristics of the phenomena before combustion (size and evaporation) and the combustion of vegetable oils. A simple theoretical model for predicting evaporation characteristics of oils (constant evaporation and heating time) gives results in agreement with experimental results. These results allowed us to highlight that there is a temperature at which the behavior of oil and fuel are comparable. Conditions favorable for the good combustion of vegetable oils and their derivatives have been defined. Once these conditions are met, the combustion of the oil is very similar to that of the fuel in terms of emissions of CO and NOx, both for diesel engines and for burners.

Brunschwig C *et al*. [6] present faced with the energy crisis and environmental degradation, due to the massive use of fossil energy sources, biodiesel is an attractive alternative to diesel fuel. With a view to developing local biodiesel production, using bioethanol as a sustainable reactant for biodiesel production, rather than methanol, is leading to increasing interest, notably in emerging countries. Indeed, bioethanol, which is less toxic than methanol, is produced from local and renewable agricultural resources, being more sustainable and providing access to greater energy independence. However, some issues are limiting the process like purification problems, or the presence of water in bioethanol leading to a drop in yield. Although several studies have already been published on ethyl ester production, most of them primarily focus on homogeneous alkaline catalysis, and report various data. Therefore, this paper aims at presenting a review of previous studies on the subject. The aim of this article was to analyze all the literature data available on ethyl ester production, gain a clearer insight into the advances made in the process, and bring out prospects for developing ethyl ester production, along with the limitations. This paper compares the different catalytic pathways that have been investigated for ethyl ester production. It discusses the effect of the main reaction parameters on the yield, the purification issues, and the characteristics and specifications of ethyl esters. This study shows that all authors formerly agreed in saying that ethyl esters separation and purification were a limiting stage. But these limitations can be overcome as high yields of over 90% can be obtained by optimizing all the reaction parameters. Moreover, the negative effect of the water contained in bioethanol remains controversial. Finally, ethyl esters proved to be a viable alternative to diesel fuel being more sustainable than methyl esters. Some aspects of their productions are worth a closer look for shifting the use of bioethanol to large-scale production.

Vaitilingom G [7] study vegetable oils as fuel. Vegetable oils that are primarily industrial and agro-food products have been used as fuel for diesel engines and have a data repository and specific characteristics for this purpose. Very close and diesel fuels, however, they pose a number of problems when using them: the formation of carbonaceous deposits in amounts combustion chambers is the most important. But progress so far to explain the assumptions does not meet the test of experiments with unprocessed vegetable oils. The importance of the nature of the vegetable oils and their fatty acid composition on the quality as fuel has been demonstrated. This study has identified a strong correlation between the ability to auto-ignition and the level of saturated fatty acids in vegetable oils. An experimental model giving the ignition delay depending on the pressure, temperature, and the percentage of saturated fatty acids have been established and verified in a separate engine room.

Vaitilingom G [8] provides the energy use of cottonseed oil. Vegetable oils are the subject of increasing interest as fuels for diesel engines whether for agriculture, power generation, and transportation, whether in the South or in those of North. The recent directive of the European Parliament and of the Council of the European Union clearly expressed the desire to promote the use of biofuels in transport from 2005. You should see the equipment and adapted or designed machines for the use of biofuels including vegetable oils. In a context of high oil prices and rising, one can wonder about the energy opportunities for cottonseed oil whose production per hectare varies from 100 to 300 liters depending on location. Previous work and some applications started in the late 1980s show that cottonseed oil has the same behavior as biofuel as rapeseed or sunflower used more heavily in Europe. Technical constraints are indicated for use as motors for burners. If the equipment is suitable, performance and yields are very close, sometimes better than those obtained with petroleum products. Pollutant emissions are also identical with the advantage that vegetable oils do not emit fossil CO_2 in the atmosphere. Two usage examples, since 1988, oil biofuel cotton in Africa are mentioned.

Azoumah Y *et al.* [9] present the need to decrease the consumption of materials and energy and to promote the use of renewable resources, such as biofuels, stress the importance of evaluating the performance of engines based on the second law of thermodynamics. This paper suggests the use of energy analysis (as an environmental assessment tool to account for wastes and determine the energy efficiency) combined with gas emissions analysis to optimize the performance of a compression ignition (CI) engine using biofuels such as cottonseed and palm oils, pure or blended with diesel for different engine loads. The results show that the combination of energy and gas emissions analyses is a very effective tool for evaluating the optimal loads that can be supplied by CI engines. Taking into account the technical constraints of engines, a tradeoff zone of engine loads (60% and 70% of the maximum load) was established between the gas emissions (NO and CO_2) and the energy efficiency for optimal performance of the CI engine.

In this article we present the physicochemical characteristics of Jatropha curcas, peanut, and white sesame oils. We compared the physicochemical properties of these plant oils as fuel and diesel fuel.

2. Oil Extraction Method

2.1. Extraction of Peanut Oils

Groundnut seeds lightly toasted, cooled and then are separated from their red envelopes. They are comminuted in a mill juice to obtain a homogeneous mixture of peanut paste mixed with two liters of hot water at a temperature between 50˚C - 60˚C in a cauldron. The pasta peanut mixture and hot water are stirred several times for twenty minutes in a bowl, and oil rise to the surface, and is collected and clarified by heating. Twelve kilograms of peanuts used to give two liters of oil which is 2.4 kg and 9.5 kg of cake. This traditional process gives a yield of 20% oil and 79% meal. These cakes are used to prepare the peanut sauce and are valuable in cattle feed.

2.2. Extraction of Jatropha Curcas Oils

Pre-cooked and pressed in presses. Then, the oil is filtered, centrifuged and clarified to obtain a product free of impurities. The cake still contains 8% of oil, which can be extracted with organic solvents, usually hexane.

2.3. Extraction of Oil from White Sesame

The white sesame seeds are crushed and pulped by a rudimentary windmill. Sesame paste is mixed with 2 liters of tap water and stirred for ten minutes, the oil comes out and rises to the surface and is recovered. For extraction was used 12 kg of white sesame, after transformation was obtained 1.5 liters of oil is 1.2 kg and 10 kg of cake.

This transformation method gives a yield of 10% and 83.33% oil cake.

3. Methods of Physical and Chemical Analyses

The methods used for the determination of physicochemical parameters of seeds and oils are following.

3.1. Chemical Analysis Methods

Ash content:

The ground sample is heated in air at the first offset of 250˚C for 50 minutes and (550 ± 10)˚C for 60 minutes. It is maintained at this temperature juice that obtains a constant mass. The ash percentage is calculated from the mass of the residue after incineration. Must repeat the test at least twice.

Humidity:

The crushed sample is dried at a temperature of 105˚C ± 2˚C and kept at this temperature juice to obtain a constant weight. The moisture content is calculated from the sample's lost mass.

Rate of the volatile matter:

The crushed sample is heated at 900˚C for 7 minutes. The percentage of volatile matter is determined by the weight loss of the sample after subtracting the mass due to moisture.

Water Rate: Method Dean-Stark:

The method used for determining the water content is described in the standard NF T60 113 provided for petroleum products. The sample is heated under reflux with an immiscible solvent in water co-distilled with the water contained in the sample. During the reaction, the solvent vapors containing the species to be extracted (water) rise to the condenser and, once liquefied, fall into the graduated cylinder. Inside thereof immiscible liquids separate in phases. In the upper phase (less dense) reaches the level of the arm, it flows into it and back into the reaction flask, while the lower phase (water) remains in the cylinder. The condensed solvent and water are separated in a continuous tube of the recipe and solvent returning into the distillation apparatus.

Oil content: The method used is solvent extraction:

This procedure follows the extraction (solid/liquid) principle, the DIN 12602 standard, but also IEC 60529. Solvent extraction involves passing by solubilizing the substance to be extracted in a solvent. The test sample is heated under reflux with solvent hexane or toluene, the solvent vapor moves an arm distillation, and the tube is filled with a filter paper box or the sample to be extracted. The condenser ensures that all solvent vapors are cooled, and drop down into the filter paper tube. As the tube of filter paper containing solid slowly fills with hot solvent, then some of the desired heat to dissolve in the solvent compound. When the Soxhlet tube is nearly full, the tube is emptied automatically by a siphon side thereof, with the solvent reverse in the distillation flask. In the end to achieve a good extraction of the desired product, after extraction, the solvent is generally removed using a rotary evaporator, yielding the extracted compound. The insoluble solid matter remains in the filter paper tube, and is generally discarded.

Index acid: Method of acid-base titration:

The handling is to determine the acid value of oil by acid-base titration of a known amount of this oil dissolved in ethanol, in the presence of phenolphthalein.

Sediment content:

In an extraction cartridge refractory material, a test portion is extracted with hot toluene juice then the residue reaches a constant mass. The mass of the residue, calculated as a percentage, is denoted as the weight of sediment by extraction.

3.2. Physical Analysis Methods

Viscosity: Method of measuring the flow time by gravity:

The determination of kinematic viscosity was made in the prescribed standard NF EN ISO 3104 provided for petroleum products method.

The principle is to measure the flow time of gravity of a given viscometer placed in a thermostatic bath containing a liquid transparent liquid, all maintained at the test temperature.

Density:

The method used for determining the density is that described in ISO Standard 12185: 1996 Method oscillating U-tube: a small fraction of the test sample is introduced into a U-tube, induced by electronic extraction, changing the oscillation frequency in conjunction with calibration data to determine the density of the sample.

Calorific value: Method slow pyrolysis or flash pyrolysis:

It consists of a test sample mass determined in the presence of oxygen in a bomb calorimeter immersed in a known volume. The upper power calorimetry determined under these conditions that is to say at constant volume is calculated from the measurement of the temperature rise observed, water. The lower calorific value is determined by calculation from the gross calorific value and knowledge of the hydrogen in the fuel tax.

Distillation and Cetane:

When heated to a liquid, it is transformed into vapor. Upon cooling, these vapors condense back into liquid. Products derived from crude oil with hydrocarbon mixtures, are characterized by a distillation curve that starts with an initial point and ends with a final boiling point in this well-defined condition. The cetane number is determined by calculation from density measurements at 15˚C, and distillation points: 50% fused, data obtained by reading the temperature on the thermometer.

4. Results and Discussions

4.1. Results

Each manipulation has been double and triple repeated to ensure the validity of the results.

Chemical parameters of seeds and cakes:

Immediate analyzes of seeds:

The moisture content, volatile matter, and fixed carbon ash seeds were calculated relative to the dry matter. The results are shown in Table 1.

Immediate analysis and oil content of cake:

The oil content of the cake is obtained by solvent extraction. The solvents used are toluene and hexane. The rate of humidity, volatile matter, and fixed carbon ash cake were calculated relative to the dry matter. The results are shown in Table 2 below.

Table 1. Chemical parameters of seeds.

Chemical parameters	Seeds		
	Jatropha curcas	white Sesame	Peanut
Humidity (%DM)	6.16	3.69	3.02
Ash content (%DM)	5.43	5.16	2.04
Rate of volatiles (%DM)	84.19	89.19	81.23
Fixed carbon ratio (%DM)	10.38	5.65	16.73

Oil content of seeds:

The oil content of the seeds is obtained by solvent extraction. The solvents used are toluene and hexane. The results are shown in Table 3 below.

Chemical parameters of vegetable oil and diesel:

Each test for determining the water content (%volume), the sediment content (% mass of the sample) and the acid value (mgKOH /g of oil) were performed in duplicate. We obtain the average values reported in Table 4 below.

Physical parameters of vegetable oils and diesel:

Only the viscosity at 40˚C and diesel oil is contained in the table.

The cetane number is determined by calculation from density measurements at 15˚C and the distillation point of 50% condensed, data obtained by reading the temperature on the thermometer.

Each test for determining the calorific value has been triple manipulations and the average values are reported in Table 5.

Density:

The densitometer shows the value of the density at the temperature of steps (25˚C). This value is reduced to a reference temperature of 15˚C with tables conversion density at 15˚C according to ASTM Standard ISO No. 91/1, applied

Table 2. Chemical parameters of meal.

Chemical parameters	cake		
	Jatropha curcas	white Sesame	Peanut
Humidity (%DM)	6.09	7.39	5.69
Ash content (%DM)	6.77	6.12	5
Rate of volatiles (%DM)	73.49	88.41	94.46
Fixed carbon ratio (%DM)	19.74	5.47	0.84
Oil content (%)	25.87	55.98	21.02

Table 3. Oil content.

Solvents	Peanut	Jatropha curcas	white Sesame
Toluene	55.77	47.18	69.95
Hexane	24.24	35.59	54.54

Table 4. Chemical parameters of oil and diesel.

Chemical parameters	Vegetable oils and Diesel			
	Jatropha curcas	white Sesame	heated peanut	cold peanut
Water content (% volume)	0	3.25	4	11
Sediment content (%pds)	0	0.068	0.024	0.77
Index acid (mg KOH /g)	-	0.66	0.75	0.35

to petroleum products. The results in Table 6 below.

Viscosity:

The kinematic viscosity of diesel fuel and vegetable oil is obtained at different temperatures (40˚C, 50˚C, 60˚C, 70˚C, 80˚C and 100˚C). The kinematic viscosity is the product of the constant flow measured by the viscometer. Prelablement we found that high viscosity oils would be a problem. Since the viscosity is strongly temperature-dependent, see Figure 1 below.

4.2. Discussions

Chemical parameters seed and meal:

Immediate Analysis:

The seed oil is dependent on the maturity of the crop at harvest and the

Table 5. Physical parameters of vegetable oils and diesel.

Physical parameters	Vegetable oils and Diesel				
	Diesel	Jatropha curcas	white Sesame	heated peanut	cold peanut
viscosity (40.4) (mm^2/s)	2.79	35.08	33.24	44.16	37.98
Density (15˚C)	0.844	0.919	0.922	0.920	0.918
Index cetane (50%) (%)	51	37	39	38	38
PCI (KJ/kg)	-	39,981	40,632	40,257	38,581

Table 6. Density vegetable oils and diesel.

	Density (15˚C) (%)
heated Peanut	0.92
Jatropha curcas	0.919
white Sesame	0.922
cold peanut	0.918
Diesel	0.844

The cetane number values of the different vegetable oils are recorded in Table 7.

Table 7. Index cetane by the percentage volume of distilled.

vegetable oils	Index cetane (10%)	Index cetane (50%)	Index cetane (90%)
diesel	32	51	60
white sesame	36	39	-
cold peanut	36	38	40
heated peanut	36	38	40
Jatropha curcas	34	37	41

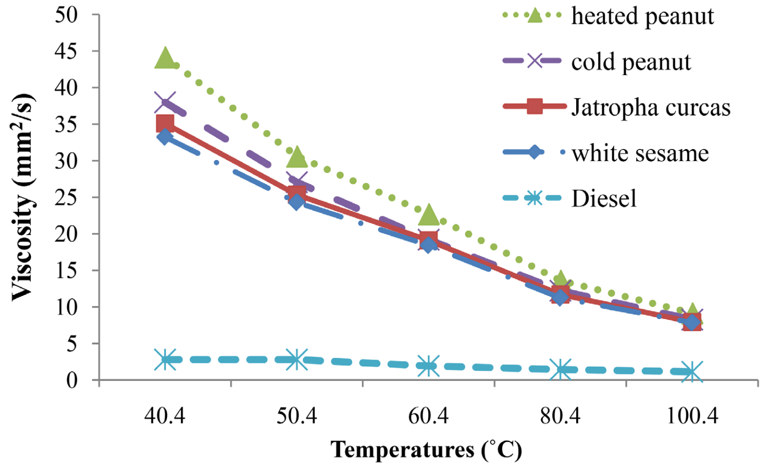

Figure 1. Viscosities depending on the temperature of the gas oil and vegetable oils.

conditions under which it is performed. To ensure good seed conservation, the water content should be as low as possible, that is to say, up to 9% Vaitilingom G *et al.* [3]. The moisture of all seeds studied is less than 9%, that is to say, they have reached maturity and conservation status does not pose a problem. Moisture is an important parameter for crushing seeds. Trituration is optimized with between 5% and 8% S.S. Sidibe *et al.* [4] humidity.

Oil content:

Given the results, it was that the toluene extract is better than hexane. After extracting the separation between the oil and the solvent is very difficult to toluene because its boiling point is 111˚C and for easy Hexane whose boiling point is 69˚C. The contents of Jatropha Curcas oil countries like Brazil, Tanzania, Ethiopia, India, Nigeria and Gambia are respectively 30.9%, 37.8%, 38.8%, 36.8% 32.7% and 33.8% compared to that of Burkina Faso which varies between 35.59 and 47.18% depending on the type of solvent used (hexane and toluene) Beerens P [10]. Whole Sesame seed contains about 49% fat in Agronomist's handbook page 731 of CIRAD [11], the results of experiments in the laboratory showed that the oil content of white sesame varies between 54.54 and 69.85% depending on whether uses Hexane or toluene as solvent. This content shows that Sesame oil has the assets for use in biofuels. In general, the whole cottonseed contains about 20% fats S.S. Sidibe *et al.* [3], based on the results obtained, we have values that are between 38.57 and 66.41% depending on the type of solvent used (Hexane, Toluene). The oil content of peanut seed varies between 24.24 and 55.77% is used as hexane or toluene as compared to that found in the literature which is 50% solvent, it can be concluded that groundnut seeds contain a good oil content. The high oil content of the meal can be explained by the made to contain a lot of oil after extraction.

Physical parameters of oils and diesel:

Viscosity of oil:

The temperature has a great influence on the viscosity decreases with the increase of the oil temperature. A condition for the oils that may be employed as fuel in a diesel engine, will have a viscosity that is close to that of diesel or a maximum of 2.79 mm^2/s limits of 1.11 view mm^2/s (40%) (according to our experiments). At first glance, so we can see it is necessary to heat the oil to a temperature of about 80˚C - 90˚C. Indeed, we found that vegetable oil was quite sensitive to oxidation. The oxidation that is observed at retention of the oil at too high temperature will result in polymerization of the oil. This high viscosity poses particular problems when the engine powered, one solution is to heat the oil to lower its viscosity. In comparison with the viscosity of the oils, we can say that the method (EN ISO 3104) to determine the viscosity remains applicable to vegetable oils.

Density of oil:

The density of oils does not meet the ASTM D 1288 (Standard Oil), the standard Mini specification 0.890. Only the diesel meets this standard. Diesel is less dense than vegetable oils (standards see Appendix).

Index cetane:

The cetane number of white sesame obtained from our experiments is 39% very close to the value found in the literature which is 40.4% (source classification vegetable oils (agreements Born 2002)). We found a peanut cetane number of 38% above the value found in the technical guide for energy use of vegetable oils which is 34.6%. For Jatropha curcas, we find a cetane number of 37% which is lower than that found in the technical guide for energy use of vegetable oils which fluctuates between 40% - 45%. According to SONABHY specifying the minimum value of the cetane number is 45%. We can conclude that ns oils do not meet the specifications of SONABHY.

Calorific Value (PCI):

The net calorific value depends on the experimental conditions and the nature of the oils. In practice, the PCI of a body varies according to the proposals of high humidity. The supplied heat capacity decreases when the oil content of the oil increases. Lower Jatropha curcas and peanuts found in the technical guide for energy use vegetable oils calorific values are respectively 36,920 and 39,330 KJ/kg compared to those found in the result of our experiments are: for 39,981 KJ Jatropha curcas/kg higher than that found in the guide and peanut less than the value found in the guide 38,581 KJ/kg.

Chemical parameters of oil and diesel:

Water content:

The high values of the water content of oils can be explained on the one hand, in that the Dean-Stark method is not exact, this is to say, it is very difficult to distinguish between the solvent and water and also the extraction is based on water. SONABHY fixed specification 0.05 (% volume) for DDO. The specification of the German and Austrian prestandard is 0.075 (% volume). The crude oil does not meet the specifications. Its high water content probably poses problems of corrosion in the tank and the engine.

Index acid:

The acid number is defined directly by the experimental method with potassium hydroxide (KOH). And a good quality vegetable oil sees its acid number between 0 and 2 mgKOH/g [1]. As our oils have a number of less acidity 1 mgKOH/g, we can conclude that peanut oil, white sesame and Jatropha curcas tuck the conditions specified by the standards.

Sediment content:

The results show that crude oils contain many suspended materials. Our oils pose probably more damage to the engine: premature filter clogging, clogging fuel system, abrasive effect on the heterogeneous injection system, and combustion. But every time to avoid any risk of damage to the engine, the oil must be clean and free of particles. Society National Burkinabe hydrocarbon as the fixed specification for DDO is a maximum value of 0.01%. For sediment content, the German pre-standard specification set as the maximum value of 25 mg/kg (or 0.0025 percent of weight). This value from laboratory analysis, using filters with diameters of ports that reach a fineness of 0.8 microns [12], could not be reproducible on an industrial scale below. Thus, a production unit of sediment will always exceed the standard. Thus, to obtain very clean oil for use as fuel, increased vigilance in monitoring the filtration process implemented in the production unit is required. A final safety filter is necessary, for example.

5. Conclusions

We have found that the vegetable oils used in this study can be injected directly into diesel engines. They can also be transformed into biodiesel by the reaction of Transesterification. The physicochemical properties of its oils are close to those of diesel.

As we have seen biofuels in particular vegetable oils offer better prospects from an economic point of view, and therefore deserve special attention from both political authorities and researchers. The production of vegetable oil for fuel production driving force in rural areas and can contribute to rural electrification, water pumping, and running the mills. This technology can use plant oil as a raw material: Jatropha curcas, Peanut, and Sesame white. The locally produced oil is used directly in a diesel engine equipped with a static kit bi. Insofar as access to equipment (press, filter) is available locally, oil and biomass-derived oils are not transported (short circuit). It would be interesting to develop a standard for African specifications for the quality of vegetable oils as fuel. Many work and studies are still needed on the development of this standard.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Nomenclature

DDO: Distillat Diesel Oil
DM: Dry Matte
J/kg: Joule/kilogram
kg: kilogram
KOH: potassium hydroxide
PCI: Calorific value
SONABHY: National Hydrocarbon Company of Burkina Faso