# Experimental Investigation of Sae Grade Engine Oil Vs Non Edibe Oil

[1.] B. Mathivannan
P.G, Department of mechanical engg, C.M.S College of engineering,Namakkal

[3] G. Kumaresan
Asso.prof/ Department of mechanical engg C.M.S College of engineering,Namakkal

[2.] Vignesh.M
P.G, Department of mechanical engg C.M.S College of engineering,Namakkal

[4.] Dr. K. G. Muthuraja
Sr.prof, Department of mechanical Engg V.M.K.V Engineering college,Salem

*Abstract*— **Engine oil are made from non edible oil and its derivatives by mixing of certain other non edible oil for improving their certain properties. Lubricating oil is used to lubricate moving parts of engine, reducing friction, protecting against wear, and removing contaminants from the engine, act as a cleaning agent, and act as an anticorrosion and cooling agent. This research effort focuses on comparative study of re-refined non edible oil by extraction of composite solvent, single solvent, Composite solvent was made up of Different properties of refined oil were analyzed, such as cloud and pour point, flash point, specific gravity, viscosity, moisture ratio and acid value. On the basis of experimental work, Results from the flash point, pour point, viscosity, specific gravity, and percentage were improved at different degrees, but the best results were seen by using the composite solvent with having drawback of expensiveness.**

## I. INTRODUCTION

Today the world is facing two major challenges which include the energy (fuel) crisis and environment degradation. The costs of crude oil products depend on international markets and petroleum reserves are limited to nearly 40 years with current consumption rate. The idea of using vegetable oil as a substitute for non edible oil was demonstrated by the inventor of the diesel engine, Rudolph Diesel, around the year 1900, when vegetable oil was proposed as fuel for engines. The oil use as non edible oil was limited due to its high viscosity (near 10 times of the gas oil). In order to adapt the fuel to the existing engines the properties of vegetable oil had to be modified. Various products derived from vegetable oils have been proposed as an alternative fuel for diesel engines.

## II. BACKGROUND AND HISTORY

Many developed countries have activenon edible oilprograms. Currentlynon edible oilis produced mainly from field crop oil like rapeseed, sunflower etc. in Europe and soybean in US. Malaysia utilizes palm oil fornon edible oilproduction while in Nicaragua it is jatropha oil. At present the country is relying on imported technology, which is extremely expensive and is also proven for edible oil as feedstock. There are risks associated with the technology for its costs and compatibility.

| OIL | MT | OIL | MT | OIL | MT |
|---|---|---|---|---|---|
| SOYA BEAN | 27.8 | PALM KERNEL | 2.9 | SESAME | 0.26 |
| RAPES EED | 13.7 | OLIVE | 2.7 | CASTOR | 0.25 |
| COTTO NSEED | 4 | CORN | 2 | NIGER | 0.03 |
| SUNFL OWER | 8.2 | CASTOR | 0.5 | COCOCN UT | 0.55 |
| PEANU T | 5.1 | GROUN DNUT | 1.4 | RICE BRAN | 0.55 |

## III. METHODOLOGY

About 30 g of finely grounded seed of the test plant were used to extract the essential oil in 250 mL of n-hexane by using soxhlet extraction for about three hour. Then, the solvent was separated from the oil by using Rota evaporator and suction pump. The extracted phase was distilled to separate the oil from the solvent and the distillate were collected and stored in a refrigerator for further experiment.

### *A. OIL MIXING PROCESS*

Magnetic stirrers are one of the most useful instruments in research and product development laboratories because they work tirelessly in performing mundane tasks without being paid or collecting benefits. These compact bench top units are used in a variety of applications to stir or mix fluid samples in industries including food processing, chemical production, and biotechnology.

### *B. THE ROLE OF THE TEMPERATURE PROBE*

Pt100 temperature probes serve multiple functions, chief of which is monitoring the operation of the magnetic stirrer. They are electronically connected to the stirrer's microprocessor control and provide control of and feedback on sample temperature. They also perform a vital safety function in that should the temperature drop quickly (which can be caused by a broken container) the probe will shut down the equipment.

### *C. INTUITIVE MAGNETIC STIRRER CONTROL PANEL*

Magnetic stirrer control panels vary depending on model. Continuing with the CAT MC S66 as an

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example, by using up and down keys the LED display keypad controls functions including:

- Power off/on
- Heating plate off/on
- Magnet motor off/on
- Plate temperature
- Motor RPM
- Probe temperature (set and actual will be displayed)
- Safety temperature (to shut the unit down if it exceeds the set probe temperature)
- Ramp (controlling application of heat)
- Operation timer in days/hours/minutes

## IV. RESULTS AND DISCUSSION

The following points explain the major differences between vegetable oils and non edible oil:

1) Viscosities of the vegetable oils are significantly higher and densities are slightly higher.
2) Heating values of vegetable oils are about 10% lower (on mass basis).
3) The presence of molecular oxygen in vegetable oils raises the stochiometric fuel/air ratio.
4) Vegetable oils could experience thermal cracking by the fuel spray in naturally aspirated engines [28].
5) The cetane number of vegetable oils is 32-40% lower than diesel, while the sulphur content is negligible in vegetable oils compared to 0.45% in diesel

| PROPERTIES | LINSEED OIL |
|---|---|
| Density (kg/m3) | 911.5 |
| Calorific value (kJ/kg) | 39700 |
| Cetane number | 41.3 |
| Viscosity@40 oC | 37 |
| Oil content wt% | 25-35 |
| Flash point oC | 246 |
| Fire point oC | 257 |
| Pour point oC | -31.7 |

| PROPERTIES | MAHUA OIL |
|---|---|
| Density (kg/m3) | 924 |
| Calorific value (kJ/kg) | 37614 |
| Cetane number | 40 |
| Viscosity@40 oC | 39.45 |
| Oil content wt% | 35-50 |
| Flash point oC | 276 |
| Fire point oC | 282 |
| Pour point oC | 14 |

| PROPERTIES | COTTONSEED OIL |
|---|---|
| Density (kg/m3) | 907 |
| Calorific value (kJ/kg) | 39500 |
| Cetane number | 41.8 |
| Viscosity@40 oC | 33.5 |
| Oil content wt% | 17-25 |
| Flash point oC | 232 |
| Fire point oC | 240 |
| Pour point oC | -4 |

| PROPERTIES | KARANJA OIL |
|---|---|
| Calorific value (kJ/kg) | 388879 |
| Viscosity@40 oC | 35.98 |
| Oil content wt% | 25-50 |
| Pour point oC | 3 |

| PROPERTIES | JATROPHA OIL |
|---|---|
| Density (kg/m3) | 917 |
| Calorific value (kJ/kg) | 39071 |
| Cetane number | 23 |
| Viscosity@40 oC | 35.98 |
| Oil content wt% | 20.6 |
| Flash point oC | 229 |
| Fire point oC | 240 |
| Pour point oC | 4 |

| PROPERTIES | KUSUM OIL |
|---|---|
| Density (kg/m3) | 860 |
| Calorific value (kJ/kg) | 38140 |
| Cetane number | 40 |
| Viscosity@40 °C | 40.36 |
| Oil content wt% | 25-36 |
| Flash point °C | 225 |
| Fire point °C | 234 |
| Pour point °C | -11 |

| PROPERTIES | JULIFLORA OIL |
|---|---|
| Density (kg/m3) | 1060 |
| Calorific value (kJ/kg) | 22.6 |
| PH value | 4.9 |
| Viscosity@40 oC | 8 |
| water content wt% | 27.5 |
| Flash point oC | 272 |
| Fire point oC | 282 |

| PROPERTIES | PONGAMIA OIL |
|---|---|
| Density (kg/m3) | 924 |
| Calorific value (kJ/kg) | 36576.53 |
| Cetane number | 42 |
| Viscosity@40 °C | 40.2 |
| Oil content wt% | 26-35 |
| Flash point °C | 272 |
| Fire point °C | 288 |
| Pour point °C | -3 |

| PROPERTIES | NEEM OIL |
|---|---|
| Calorifi value (kJ/kg) | 29.97 |
| Cetane number | 31 |
| Viscosity@40 oC | 72.4 |
| Oil content wt% | 20-31 |
| Flash point oC | 252 |
| Fire point oC | 268 |
| Pour point oC | 11 |

## *A. OPERATIONAL PROBLEMS*

1) Fuel Filter Plugging: Crude vegetable oil when used for long hours chokes the fuel filter because of high viscosity of crude oil. To avoid this, the oil must be filtered and then re-filtered. Within 3-12 hours the filter usually gets choked.
2) Cold Starting: Starting ability of engine gets impaired due to high viscosity and low cetane number in certain cases
3). Injector Coking: In long run tests carbon deposits build up in and around the nozzle between 70-150 hours. Carbon build up interferes with the fuel flow and can ultimately stop it.
4)Carbon Deposition in Combustion Chamber: - Very hard carbon deposits of 3-4 mm thickness have been found in the vicinity of exhaust area
5) Piston Ring Sticking: - Top or fine ring sticks to the groove due to gum formation and this makes the other ring to suffer more.
6).Lubricating Oil Contamination: Lubricating oil has been found contaminated with reasonably high percentage of iron, zinc etc., along with nominal increase in viscosity after 100-200 hrs.
7).Effect on Performance Parameters: Fuel consumption increases sharply, power developed reduces, thermal efficiency reduces, blow-by losses reduce and exhaust temperature rises sharply.

## *B. DURABILITY PROBLEMS*

1.The high viscosity of the vegetable oils results in degraded fuel atomization, which in turn results in the observed durability problems.
2.The durability problems associated with the use of vegetable oils as fuels result directly from the chemical structure of the oils and the affect of these structures on the combustion chemistry.
3.The durability problems are a result of incomplete combustion of the fuels (either spray or chemically induced) and the subsequent reaction of the fuels and/or partial combustion products on the metal surface and in the lube oil.
4. Fuel filter pressure drop can increase ten times faster than on Non edible oil due to starch particles in the vegetable oil. Crude degummed oils are typically filtered to 12 μ level.
5. The fuel supply should not have fuel exposed to surface temperature greater than 90°C. Local oxidation will generate gums that will plug lines & filters

## *C. REMEDIAL MEASURES*

At least three major proposals have been made to alleviate the problems associated with the use of vegetable oils as fuels.
1. Heating the fuel to temperatures sufficient to bring the viscosity to near specification range. At 145oC, the viscosity of vegetable oil is about 4.0 Cst.
2. Conversion of the vegetable oils to the simple esters of Methyl, Ethyl or Butyl type. Results till date indicate that the esters are superior fuels for D.I. engine
3. Dilution of vegetable oils with other materials to bring the viscosity to near specification e.g. mixture (50/50) of these oils with non edible oil have viscosities in the range of 4-8 times that of non edible oil.

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