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INVESTIGATION OF THE MIXTURE OF USED ENGINE OIL AND KEROSINE AS AN ALTERNATIVE SOURCE OF FUEL

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ABSTRACT
Domestic fuel like kerosene has become an expensive commodity today for use as fuel energy, but used Engine oil is more available than kerosine. Therefore, a mixture of used engine oil and kerosene at various ratios were subjected to an experimental test in order to determine their physical properties. This is to ascertain the viability of the mixture as domestic fuel. This paper will present some preliminary results of the ratio 1:4 mixture which indicates its efficiency over 1:5 and 1:6 ratio.
Keyword: *Used Engine oil and Kerosine.*

INTRODUCTION
A lubricant (engine oil) can be defined as an oil product that separates the metal parts of an engine, reduce friction and keep it clean. Lubricant deals with the application of lubricating oil to machine and were at one time exclusively animal or vegetable oils or fats, but modern requirement in both nature and volume have petroleum as the main source of supply. Lubricating oil can be produced by modern method of refining from crude and this ranges from thin easily flowing spindle oils to tank cylinder oils. The lubrication system of an engine is intended to avoid the increase of wear, overheating and seizure of rubbing surfaces so as to reduce the expenditure of indicated power on overcoming mechanical losses in the engine and also to remove wear products of a machine.(Ogbeide,2010)
Kerosene, in scientific and industrial usage, also known as paraffin, is a combustible hydrocarbon liquid. The name is derived from Greek *keros* (wax). The word *Kerosene* was registered as a trademark by Abraham Gesner in 1854 and for several years only the North American Gas Light Company and the Downer Company (to which Gesner had granted the right) were allowed to call their lamp oil *kerosene(Ogbeide,2010)*. It eventually became a generalized trademark. It is usually called paraffin (sometimes paraffin oil) in the UK, South East Asia and South Africa (not to be confused with the much more viscous paraffin oil used as laxative, or the waxy solid also called paraffin wax or just paraffin).The term *kerosene* is usual in much of Canada, the United States, Australia (where it is usually referred to colloquially as *kero*) and New Zealand . Kerosene is widely used to power jet-engine aircraft (jet fuel) and some rockets, but is also commonly used as a heating fuel and for fire toys such as poi. (Wikipedia, 2010).

PROPERTIES
1.1.1 Engine Oil
here are four major types of lubricant, namely – liquid, solid, gaseous and plastics lubricant. Example of lubricants include oil, grease, air and graphite. Liquid and plastic lubricant are the most commonly used lubricant in industries because they are inexpensive, easily applied and

good coolants while gaseous and solid lubricant are recommended only in some special applications. In view of the problems encountered, lubricating oil is designed to impact varieties of properties and to protect engine in so many ways. Lubricating oil is highly specialized product carefully developed to perform many essential functions among which are the following. Permit easy starting of engine, reduced friction, protecting machine against rust and corrosion, lubricating of engine parts etc.(Ogbeide, 2010.)

Kerosene

Kerosene is a thin, clear liquid formed from hydrocarbons, with density of 0.78–0.81 g/cm^3. It is obtained from the fractional distillation of petroleum between 150 °C and 275 °C, resulting in a mixture of carbon chains that typically contain between 6 and 16 carbon atoms per molecule. The flash point of kerosene is between 37 and 65 °C (100 and 150 °F) and its auto-ignition temperature is 220 °C (428 °F).The heat of combustion of kerosene is similar to that of diesel: its lower heating value is around 18,500 Bt/lb, or 43.1 MJ/kg, and its higher heating value is 46.2 MJ/kg. Kerosene is immiscible in water (cold or hot), but miscible in petroleum solvents.(Wikipedia,2010)

THEORITICAL ANALYSIS

Informally, viscosity is the quantity that describes a fluid's resistance to flow. Fluids resist the relative motion of immersed objects through them as well as to the motion of layers with differing velocities within them.

Formally, viscosity (represented by the symbol η "eta") is the ratio of the shearing stress (F/A) to the velocity gradient ($\Delta v_x/\Delta z$ or dv_x/dz) in a fluid.

$$\eta(F/A) \div (\Delta v_x/\Delta z) \text{ or } \eta(F/A) \div (dv_X/Dz) \quad \text{.. 2.0}$$

The more usual form of this relationship, called Newton's equation, states that the resulting shear of a fluid is directly proportional to the force applied and inversely proportional to its viscosity. The similarity to Newton's second law of motion ($F = ma$) should be apparent.

$$F/A=\eta\Delta v_X/\Delta z \text{ or } F/A=\eta d\times/dz \quad \text{.................................. 2.1}$$

LAMINAR FLOW

The resistance to flow in a liquid can be characterized in terms of the viscosity of the fluid if the flow is smooth. In the case of a moving plate in a liquid, it is found that there is a layer or lamina which moves with the plate, and a layer which is essentially stationary if it is next to a stationary plate. There is a gradient of velocity as one moves from the stationary to the moving plate, and the liquid tends to move in layers with successively higher speed. This is called laminar flow, or sometimes "streamlined" flow. Viscous resistance to flow can be modeled for laminar flow, but if the lamina break up into turbulence, it is very difficult to characterize the fluid flow. (Elert, 1998)

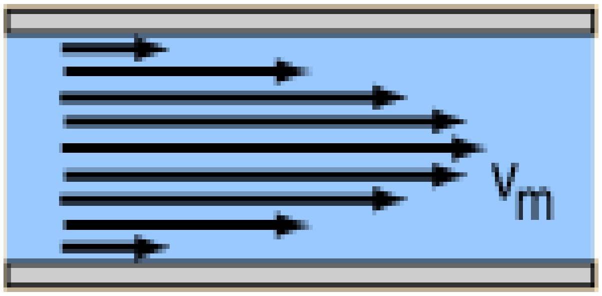


Figure 2.0 laminar flow

The common application of laminar flow would be in the smooth flow of a viscous liquid through a tube or pipe. In that case, the velocity of flow varies from zero at the walls to a maximum along the centerline of the vessel. The flow profile of laminar flow in a tube can be calculated by dividing the flow into thin cylindrical elements and applying the viscous force to them.(Elert,1998.)

VISCOSITY

The resistance to flow of a fluid and the resistance to the movement of an object through a fluid are usually stated in terms of the viscosity of the fluid. Experimentally, under conditions of laminar flow, the force required to move a plate at constant speed against the resistance of a fluid is proportional to the area of the plate and to the velocity gradient perpendicular to the plate. The constant of proportionality is called the viscosity . (Elert,1998,)

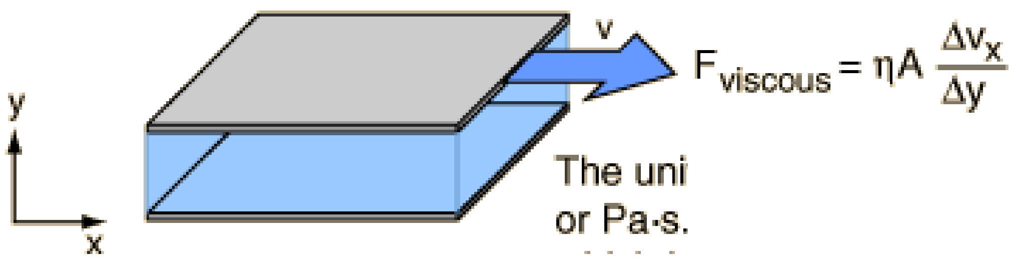


Fig. 2.1: Viscosity of fluid

2.4 FLOW RESISTANCE FOR A TUBE

The flow resistance of a tube is defined from the relationship

$$\mathcal{F} = \frac{P_1 - P_2}{\mathcal{R}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \quad 2.2$$

where the script F is the volume flowrate through the tube. This volume flowrate can also be expressed by

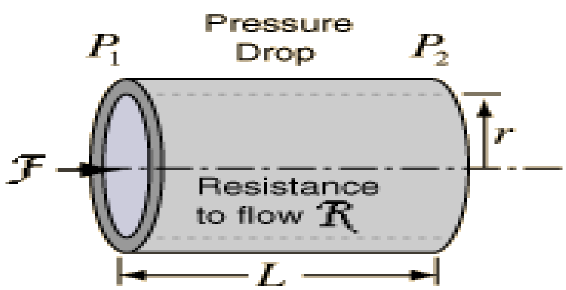


Fig. 2.2: Flow rate through a tube

$$\mathcal{F} = Av_{effective} = A\frac{v_m}{2} = \frac{A}{8\eta}\frac{(P_1 - P_2)r^2}{L}$$ ………………………………. 2.3

where v_m is the maximum flow velocity at the center of the tube. The resistance denoted by the script *R* can be calculated from:

$$\mathcal{R} = \frac{8\eta L}{Ar^2} = \frac{8\eta L}{\pi r^4}$$ ……………………………………… 2.4

Stated in terms of a viscous resistance force, (Elert, 1998)

$$F_{viscous} = (P_1 - P_2)A = \mathcal{F}\mathcal{R}A = \left(\frac{Av_m}{2}\right)\left(\frac{8\eta L}{\pi r^4}\right)A = 4\pi\eta L v_m$$ …………………… 2.5

FLUID VELOCITY PROFILE

Under conditions of laminar flow in a viscous fluid, the velocity increases toward the center of a tube.

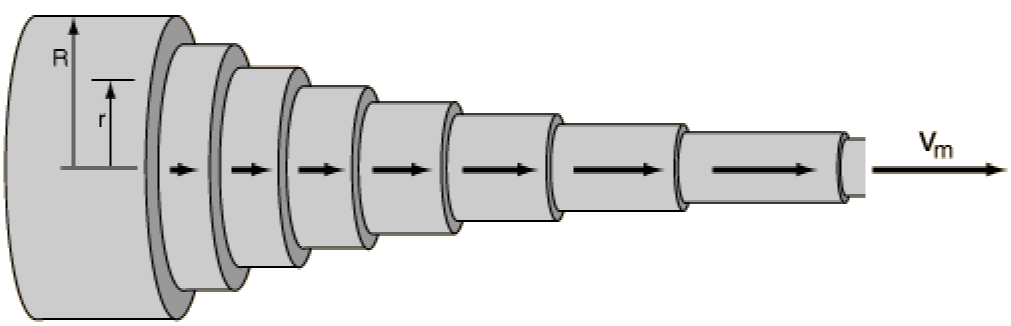


Fig.2.3: Fluid velocity profile

The velocity profile as a function of radius is

$$v(r) = \frac{\Delta P}{4\eta\Delta L}(R^2 - r^2) = v_m\left(1 - \frac{r^2}{R^2}\right)$$ 2.5

.

The fluid transported by each lamina is given by $\Delta\mathcal{F} = v(r)2\pi r\Delta r$

and the summing of the contributions gives flow (Elert, 1998)

$$\mathcal{F} = A\frac{v_m}{2}$$ 2.7

EFFECTIVE FLUID SPEED IN A TUBE

In order to get the net resistance to flow for laminar fluid flow through a tube, one must account for the fact that different lamina of the flow travel at different speeds and encounter different resistances.

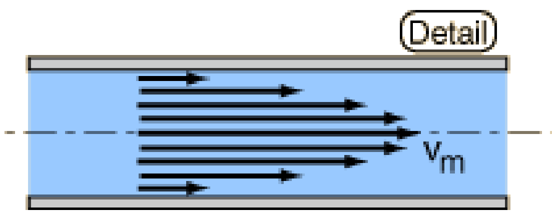


Fig.2.4(a): Fluid speed in a tube

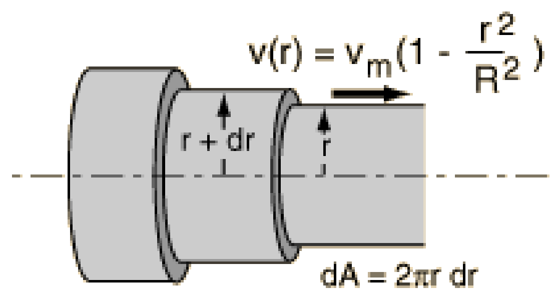


Fig. 2.4 (b)

The volume flowrate can be generally expressed by

$$\mathcal{F} = Av_{effective}$$ 2.8

but the effective velocity is not a simple average because of the nonlinear velocity profile. The total volume flowrate can be calculated by integration of the flow of the successive.(Elert,1998.) l

$$\mathcal{F} = \int v dA = \int_0^R v_m\left(1 - \frac{r^2}{R^2}\right)2\pi r dr = 2\pi v_m\left[\frac{r^2}{2} - \frac{r^4}{4R^2}\right]_0^R = \frac{v_m}{2}A$$

$$\therefore v_{effective} = \frac{v_m}{2}$$ 2.9

MATERIALS AND METHODS

Used engine oil was mixed in different ratios of 1:4, 1:5 and 1:6 and then at the measurement of 400ml, 500ml and 600ml to be mixed with the kerosine in volume of ratio 250ml, 200ml and 165ml respectively. A burette glass tube clamped vertically on a pivoted retort stand with oil specimen of ratio 1:4 in it with a steel ball bearing which was dropped and time is noted with a stop watch until it reach mark at the bottom of the tube, which the terminal velocity is recorded by the method of falling – sphere. The process was carried out on the other specimen of ratios 1:5 and 1:6. For the logarithmic value the same method was carried out but with a different size of ball bearings.

RESULTS AND DISCUSSION

Table 4.0: Viscosity of used Engine Oil and Kerosine in ratio 1:4

S/N	**Temperature in ^{0}C**	**Time in Seconds**	**Velocity (cm s^{-1})**
1.	26	3.30	22.7
2.	40	2.0	37.2
3.	50	1.7	42.6
4.	60	1.60	46.9
5.	70	1.40	53.6
6.	80	1.23	61
7.	90	1.13	66.4
8.	100	1.03	72.8

Source: Experimental values Fig. 4.0 Velocity against temperature for used engine oil and kerosene at ratio of 1:4.

Table 4.1: Logarithmic Ratio 1:4

S/N	**Diameter of ball (cm)**	**Time in Seconds**	**Velocity (cm s^{-1})**	**Log v (cm s^{-1})**	**Log d (cm)**
1.	0.380	2.40	20.80	1.32	-0.42
2.	0.459	2.15	23.3	1.37	-0.34
3.	0.519	2.05	24.4	1.39	-0.28
4.	0.858	2.5	9.10	0.96	-0.07

Source: Experimental values

Fig. 4.0: Viscosity of used Engine Oil and Kerosine in ratio 1:4

Figure 4.1 shows logarithmic graph of velocity against Diameter of steel ball bearings at ratio 1:4

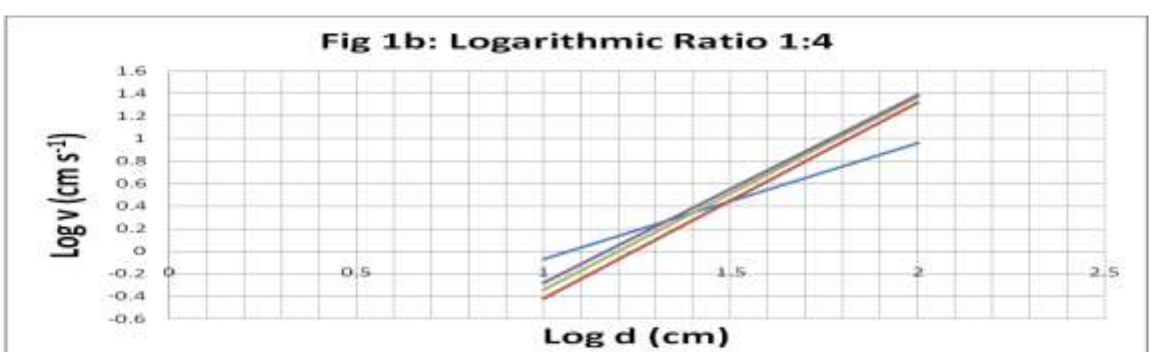
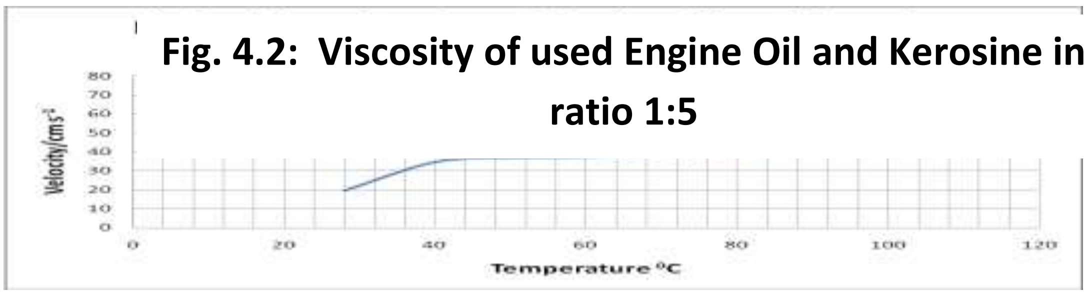


Fig. 4.1: Logarithmic in ratio 1:4

Table 4.2: Viscosity of used Engine Oil and Kerosine in Ratio 1:5

S/N	Temperature in ^0C	Time in Seconds	Velocity (cm s^{-1})
1.	28	3.83	19.6
2.	40	2.16	34.7
3.	50	2.03	36.9
4.	60	2.0	37.5
5.	70	1.9	39.5
6.	80	1.73	43.4
7.	90	1.17	64.1
8.	100	1.0	75

Source: Experimental values

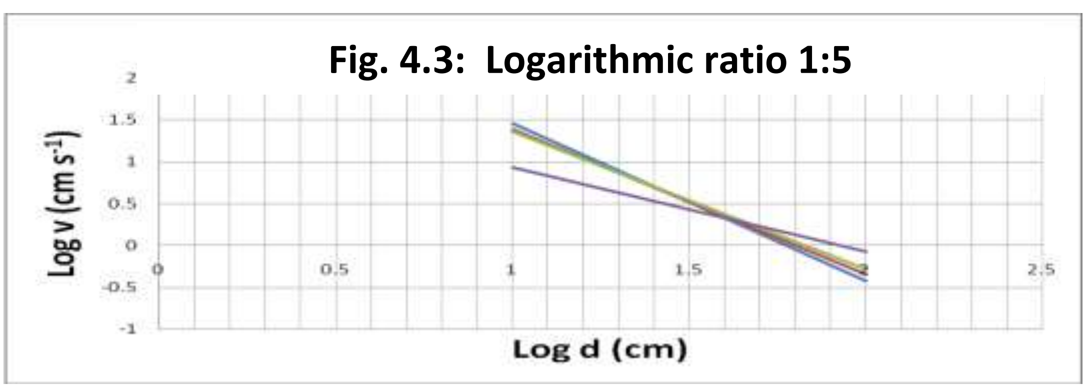


In Fig. 4.2 graph shows that the velocity against temperature in ratio 1:5.

Table 4.3: Logarithmic Ratio 1:5

S/N	Diameter of ball (cm)	Time in Seconds	Velocity (cm s^{-1})	Log v (cm s^{-1})	Log d (cm)
1.	0.380	1.75	28.4	1.46	-0.42
2.	0.459	2.05	24.4	1.39	-0.34
3.	0.519	2.2	22.7	1.36	-0.25
4.	0.858	5.9	8.47	0.93	-0.07

Source: Experimental values



In figure 4.3, Shows the logarithmic graph of velocity against diameter of steel ball bearing at ratio 1:5.

Table 4.4: Viscosity of used Engine Oil and Kerosine in Ratio 1:6

S/N	Temperature in ^{0}C	Time in Seconds	Velocity (cm s^{-1})
1.	28	4.03	18.6
2.	40	3.0	25
3.	50	2.37	31.6
4.	60	2.17	34.6
5.	70	2.23	33.6
6.	80	1.73	43.4
7.	90	1.53	49
8.	100	1.33	56.4

Source: Experimental values

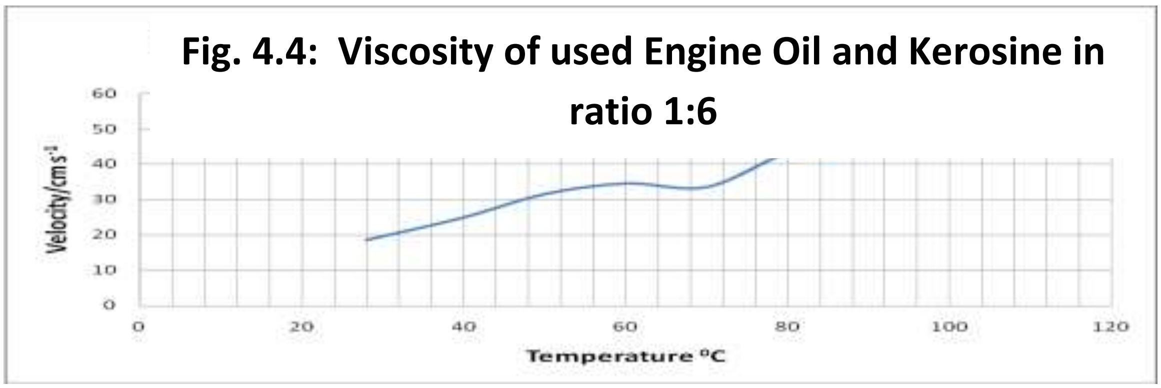


Fig. 4.4: Viscosity of used Engine Oil and Kerosine in ratio 1:6

Fig. 4.4: Shows the graph of velocity against temperature at ratio 1:6.

Table 4.5: Logarithmic Ratio 1:6

S/N	Diameter of ball (cm)	Time in Seconds	Velocity (cm s^{-1})	Log v (cm s^{-1})	Log d (cm)
1.	0.380	2.10	23.8	1.38	-0.42
2.	0.459	7.3	6.85	0.84	-0.34
3.	0.519	2.95	16.9	1.23	-0.28
4.	0.858	2.25	22.2	1.35	-0.07

Source: Experimental values

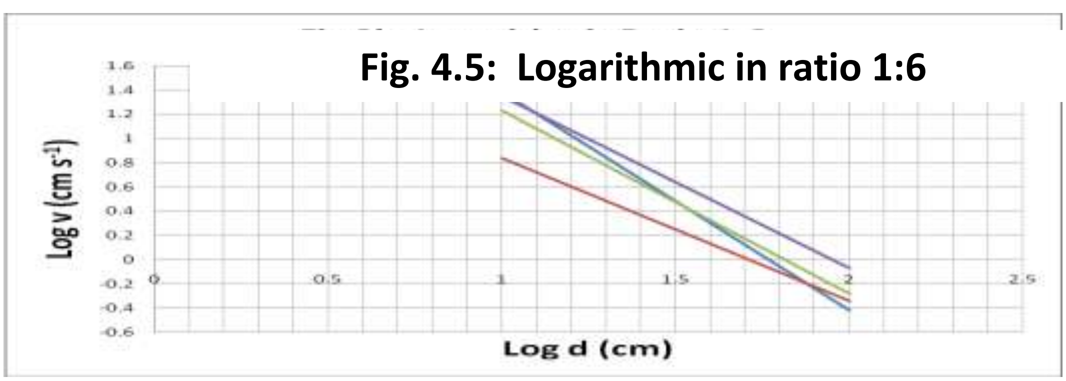


Fig. 4.5: Logarithmic in ratio 1:6

Fig. 4.5: Shows the logarithmic graph of velocity against diameter of steel ball bearing at ratio 1:6.

CONCLUSION

From the research carried out the preliminary test, the results indicates that from the three specimen tested, the specimen of ratio 1:4 provided a good and clear working specimen, the flow rate of capillarity rising is uniform which shows the suitability in constant flow, for use in heating that is, used as domestic fuel ordinarily. Because viscosity rate in the mixture of 1:4 moderate the flow rate to a proportional constant than the mixture of the ratio 1:5 and 1:6 which where assume to have slightly a high content of some immisable proportion of some particles the used engine oil from the accumulation of dirt due to either abrasion in the engine, which can not be easily dissolve with the kerosene, that will bw eble to regulate the flow of the mixed in the working fluid through the wick to support a good combustion.

RECOMMENDATION

Economically it is accessible to a common man for easy domestic energy usage e.g. for cooking burning in our houses. Secondly the risk hazard is much less compare to other conventional fuels. It is therefore recommended for usage domestically.

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