Experimentation On Bio-kerosene Stove Using Organic Additive

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Abstract: One of the basic worthy item used in most of the villages even now a day's also is the kerosene stove. But in the current scenario, the petroleum products are been replenished. So an alternate fuel should be found in order delve. This work is to check the contingency of blending pongamia oil and kerosene in which is used as an additive. Pongamia is one of the forest based fast growing evergreen tree which is capable of yielding 9 - 90 kg seeds from which 25% of oil can be extracted. Distilled cow urine is to be used so that the fuel can be stored for longer time and is odorless. Blends of 10% to 70% neat pongamia oil - kerosene(KEP) and pongamia oil - kerosene with additive(KEPWA) are prepared. The properties such as flash point, fire point and viscosity are determined. The blends are been compared by doing emission test. The blends with additive showed better properties and reducing in emission characteristics compared to neat blends. It is also observed that emission of CO is decreasing with increasing blends.

INTRODUCTION

Kerosene is a combustible hydrocarbon liquid derived from petroleum, which widely used in industry as well as households. Still many places in India doesn't have proper electricity facility and kerosene is the fuel used as an alternate. It has been estimated that nearly 910 million people use 10.546 MT of kerosene for cooking[1]. Kerosene consumption getting reduced is trending and bielding in finding a alternate fuel [3,8]. Pongamia oil also known as karanja is a fast growing medium sized plant which is grown in wide range climatic conditions. About 30 - 40% oil can be yielded from 8 - 4 kg of kernels. The kernels are constituted of moisture(19%), oil(27.5%), protein (17.4%), starch(6.6%), ash(2.3%) and crude fiber(7.3%) [5]. Any proportion of blends can be used as fuel in kerosene pump stove to the higher proportions without losing much efficiency [4,7,9].

The mixture of kerosene and vegetable oil is known as the bio-kerosene. In this work neat pongamia oil and kerosene is used for blend preparation and also cow urine is used as additive. The vegetable oil is not advised to use in the neat form because of higher viscosity. Organic additive which is being added in this will reduce the viscosity of vegetable oil. The raw materials are purchased from local store in Bangalore. Blends are prepared in proportions of 10, 30, 50

and 70% as neat pongamia oil - kerosene blends and pongamia oil - kerosene blends with additive. The additive which is added in this work will help to reduce the viscosity and not taking any part in the combustion process. After the preparation of blends, their properties such as viscosity, flash point and fire point have been determined. Viscosity is determined by using Saybolt viscometer at a temperature of 40^{o}C. By using a Cleave land open cup tester the flash point and fire point are found. Then the blends are used as fuel in kerosene pump stove and the emission characteristics are determined.

The comparative study is done for blends with and without organic additive is carried out. The experimental results shows better results for blends with additive than the other one. The property values of blends with additive are less than the blends without additive. The emission characteristics have also been found to be less than the blends without additive. As the CO_2 emission increased the CO emission decreased. CO emission decreases in increasing blends.

EXPERIMENTAL PROCEDURE

Blend Preparation

The blends are prepared by mixing neat kerosene and pongamia oil in 10, 30, 50 and 70 % by adding organic additive of 5ml, 7ml, 9ml and 11ml respectively. For 4 hours the mixture is stirred and separated from forth by cooling down to room temperature.

Stove Specification

Without any modification a commercial pump stove has been used. The specification is given below in TABLE 1 and the schematic diagram is as shown in fig.1. For this work pump stove is chosen since it working on pressure build up in a fuel tank. By increasing pressure inside the fuel tank it allows the fuel to flow freely through the nozzle. Experimental study on pump stove is carried out at all proportions of blend. It is approximated that, there is pressure build up of 1.5 bar by pumping 5 times. There was 5 minutes time gap maintained for all blends from beginning of heating process and actual start of flame. The entire range of experiments was conducted with kerosene and neat pongamia oil and kerosene & pongamia oil blends with additive.

Tank size	2 L
Number burners	1
Total height	160mm
Mantle height	25mm

TABLE 1: Specification of the pump stove

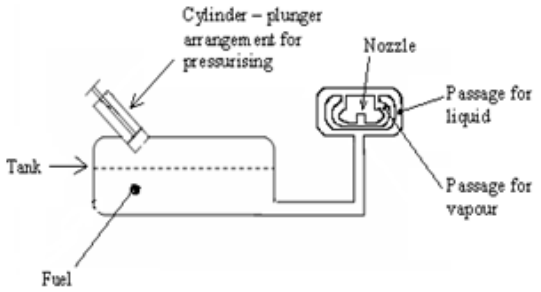

FIGURE 1: Schematic of a pump stove

RESULTS AND DISCUSSIONS

The variation of flash point and fire point (fig. 2) for both KEP and KEPWA are drawn with respect to kerosene. The blends with organic additives shows lower flash point and fire point compared to blends without additive. The improvement in flash point and fire point can be considered by decreasing the viscosity of the blends by adding organic additive. By adding an additive the flash point and fire point improved approximately 5 - 6 %.

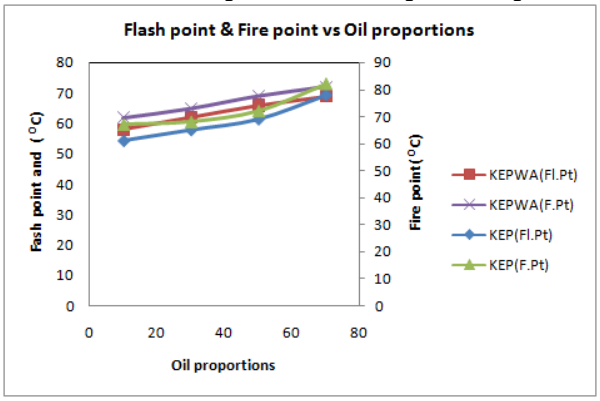

Fig.2

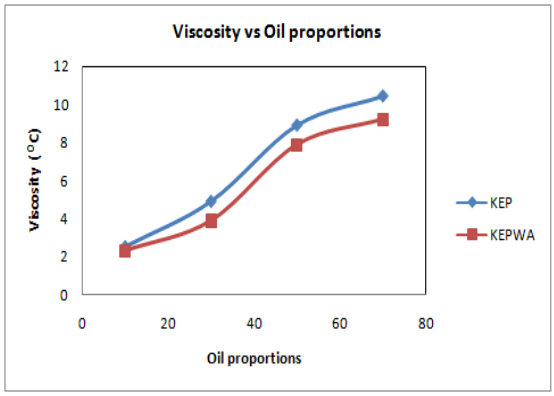

Fig.3

FIGURE 2: Variation of flash point and fire point
FIGURE 3: Variation of viscosity

It is observed from fig.3, the viscosity is slightly decreasing by increasing the percentage of additives in the blends. The reason for decreasing the viscosity is due to removal of glycerol contents from the vegetable oil. Since the cow urine has the ability to remove the glycerol content by reacting with vegetable oil.

It is observed from fig. 4 that the time consumed for increasing water temperature by 20^{o} C is reduced for blends with additive. There is almost 8-11% reduction in time consumption for all blends with organic additive. The reason for decreasing the time consumption is due to reduction in viscous property of the fuel. By decreasing the viscosity the fuel is easily allowed to flow through the nozzle which will help in better combustion and heating value. The oil with better flash point and fire point has been obtained.

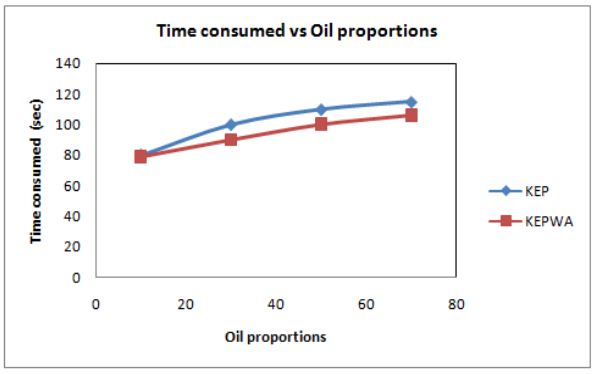

Fig.4

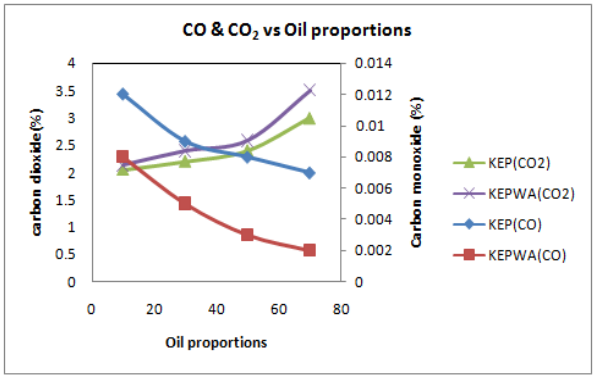

Fig.5

FIGURE 4: Time consumed for increasing water temperature by 20^{O}C

FIGURE 5: Variation of carbon monoxide and carbon dioxide

The variation of carbon monoxide with additive and without additive is plotted for all blend in fig.5 The chart shows decreasing trend for blends with additive compared to blends without additive. Since cow urine which is used as additive in blends has oxygen content will helps in decreasing the CO content after combustion. It shows that CO_2 content for blends with additive slightly higher than blends without organic additive. The reason for increasing carbon dioxide is due to proper combustion with the presence of oxygen in additive.

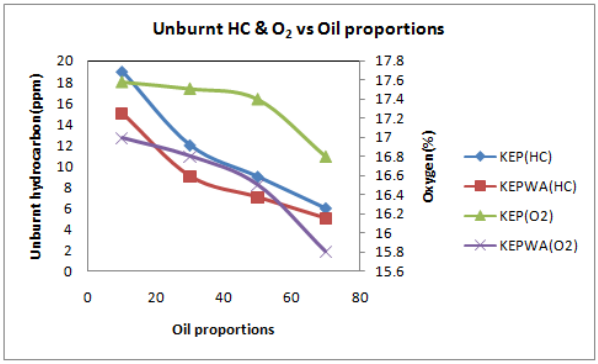

FIGURE 6: Variation of unburnt hydrocarbon and oxygen

In fig.6 graph the hydrocarbon and oxygen emission variation is been observed. Since kerosene is a hydrocarbon liquid, when the blends are prepared the hydrocarbon linkage cracks with respect to the pongamia oil content, so the hydrocarbons arrive at decreased esteem in rise of blends percentage. But the blends with additive pose superior results as the linkage cracks are survived by the additive action.

The flame produced by the pump stove is shown in fig.7(a) and fig.7(b). Generally for all proportions of biokerosene, the good blue flame is visible.

Fig.7(a)

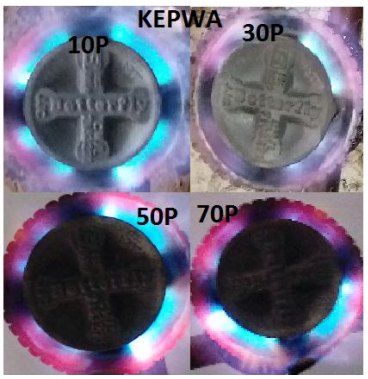

Fig.7(b)

FIGURE 7 (a): Comparison of flames produced by neat kerosene and pongamia oil(KEP).
(b): Comparison of flames produced by kerosene and pongamia oil with additive(KEPWA).

CONCLUSION

The operation of the stove using kerosene - pongamia oil blends with additive showed better performance compared to that of kerosene - pongamia oil blends without additive. The percentage variation of time consumed for increasing water temperature by 20^{o}C was less in blends with additive than that of blends without additive. Flash point and fire point are less in percentage variation for blends with additive. This may be due the basic property of the cow urine which is removing the glycerin content in the vegetable oil. The carbon monoxide content is slightly reducing for all proportions of kerosene - pongamia oil blends with additive. The reason is due the high oxygen content which will produced carbon dioxide instead of carbon monoxide. So easily it can be understood that the carbon dioxide is increasing and hydrocarbons are decreasing with respect to kerosene - pongamia oil blends. By observing the results obtained by blends with additive, it can be recommended higher quantity of cow urine can be tried in future work as additive.

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