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Ratnakiran D Wankhade
Ph.D. Scholar, Department of Farm Machinery and Power Engineering, College of Technology, G.B.P.U.A & T., Pantnagar, Uttarakhand, India

TK Bhattacharya
Professor and Head, Department of Farm Machinery and Power Engineering, College of Technology, G.B.P.U.A & T., Pantnagar, Uttarakhand, India

Corresponding Author:
Ratnakiran D Wankhade
Ph.D. Scholar, Department of Farm Machinery and Power Engineering, College of Technology, G.B.P.U.A & T., Pantnagar, Uttarakhand, India

Comparative study on fuel properties of raw Tyre Pyrolysis oil with HSD

Ratnakiran D Wankhade and TK Bhattacharya

Abstract
Prices of the fuel are going up and up with very high rate and also there is shortage of international crude oil supply due to many reasons. There is an urgent need to find out the substitute for crude petroleum oil to fulfill the highly increasing fuel demand. Taking in to consideration the above points the research was carried out in the bioenergy lab of Department of Farm Machinery and Power Engineering., College of Technology, G.B. Pant University Pantnagar. The two different raw tyre pyrolysis oil samples obtained from waste scrap tyre from different location was selected to compare its fuel properties with high speed diesel oil for its use in the CI Engine. The fuel properties raw tyre pyrolysis and high speed diesel oil like moisture content, relative density, kinematic viscosity, high heat value, ash content, carbon residue, flash point, fire point, pH, copper strip corrosion were determined to check the compatibility with high speed diesel. Result shows that there was much variation in the fuel properties of raw tyre pyrolysis oil as compare to high speed diesel. Hence its requires further purification to bring nearly close the fuel properties of raw tyre pyrolysis oil to high speed diesel (HSD).

Keywords: Pyrolysis, raw tyre oil, fuel properties, high speed Diesel

Introduction
The conventional fuel resources are decreasing day by day opposite to that the fuel prices and its demand is increasing with very high rate. So, it has become the burning issue to find the new renewable sources to fulfill the increasing fuel demand. Also, it is necessary that the obtained alternate solution for the crude oil must be pollution free and ecofriendly in all manners. Hence, keeping the above point in view research was carried out at bioenergy lab of farm machinery department of G.B. Pant University to find the alternative fuel to high speed diesel for engine use. On other hand, every year numbers of waste scrap tyre obtained from automobile sector are buried in the soil or burned openly which create soil as well as air pollution. So, degradation of this has become major issue. Taking in to consideration the all above points in view, the two different raw tyre pyrolysis oil samples were selected to check their compatibility with high speed diesel as fuel for compression ignition engine (CI) based on fuel properties.

Material methods
Sample selection
The two different raw tyre pyrolysis oil sample were collected from two different location, one (RTPO1) from tyre pyrolysis oil plant Sitarganj, District Uddham Singh Nagar (Uttarakhand) and other (RTPO2) from tyre pyrolysis oil plant Shahjahanpur (Utter Pradesh). The HSD was collected from the nearest fuel station of Pantnagar.

Fuel properties
The fuel properties of the oil samples were determined using the BIS standard shown in Table 1.

Table 1: IS standard used for properties determination

S.N.	Fuel Properties	IS
1.	Moisture Content, %	IS 1448 [P: 18]: 1991
2.	Relative Density	IS: 1448[P: 32]: 1992.
3.	Kinematic Viscosity, cSt	IS: 1448 [P: 25]: 1976
4.	High Heat Value, kCal/kg	IS: 1448 [P: 6]: 1984
5.	Ash Content, %	IS: 1448 [P: 4]: 1984
6.	Carbon Residue, %	IS: 1448 [P: 122]
7.	Flash Point, ^{0}C	IS: 1448 [P: 21]: 1992
8.	Fire Point,^{0}C	
9.	pH	IS: [4309-1979]
10.	Copper Strip Corrosion	IS 1448 [P: 15]:2004

Results and Discussion

The result (**Table 2**) shows that there is very minute variation between fuel properties of RTPO1 and RTPO2 between each other except moisture content but both this samples when compare to HSD has significant differences except the copper strip corrosion. It is clear from the result that RTPO2 has more moisture than RTPO1. It is also observed that RTPO1 and RTPO2 have 11.2 and 11.4% more relative density than HSD respectively.

Kinematic viscosity of RTPO1 is 6.28cSt which is 78.9% more than HSD while in case of RTPO2 its 103.7% more. It was also observed that RTPO1 has more high heat value than RTPO2 and it is 9.6% more than HSD while in case of RTPO2 it is 7.2% more than HSD. Also, it is clear from the result that RTPO1 has 793.8 and 5708.3% more ash and carbon content than HSD respectively while it is observed 1068.8 and 6379.2% more in RTPO2 than HSD respectively. The flash and fire point of TPO1 was observed as 4.6 and 3.9^0 C more than HSD while in case of TPO2 it was 7.6 and 7.5^0 C more than HSD respectively. It was also found that pH value for both TPO1 and TPO2 was higher than HSD while in case of copper corrosion test all the samples has shown the same results.

Table 2: Variability in fuel properties of raw tyre pyrolysis oil samples with HSD

Fuel Properties	HSD	RTPO1	Different than Diesel (%)	RTPO2	Different than Diesel (%)
Moisture Content, %	-	10	-	14	-
Relative Density	0.830	0.923	11.2	0.925	11.4
Kinematic Viscosity, cSt	3.51	6.28	78.9	7.15	103.7
High Heat Value, kCal/kg	10003.4	10965.3	9.6	10724.4	7.2
Ash Content, %	0.016	0.143	793.8	0.187	1068.8
Carbon Residue, %	0.024	1.394	5708.3	1.555	6379.2
Flash Point, ^{0}C	51.8	56.4	-	59.4	-
Fire Point,^{0}C	55.7	59.6	-	63.2	-
pH	5.61	6.95	-	6.68	-
Copper Strip Corrosion	1b	1b	same	1b	same

The variation in the fuel properties of TOP1 and TPO2 may be due to the different weather condition or pyrolysis plants condition like shape size and material used. Also, the large amount of variation in the fuels properties of TPO1 and TPO2 as compare to diesel may be because of large amount sediments and contamination present in the raw oil. In case of copper strip corrosion, the grade 1b shows that the strips were slightly tarnish having dark orange colour indicating that oil samples are less corrosive. The high pH value in case of TPO1 and TPO2 than HSD may be due to the high moisture content of both samples than HSD.

Conclusion

It is clear from the result that there much variation in the fuel properties in the raw oil samples of tyre pyrolysis oil so it can't be use as it is as a fuel. It must be necessary to purify raw oil by a suitable purification technology and further the fuel properties determination is necessary until bring the raw oil properties non-significant differences with the HSD.

References

1. Methods of test for petroleum and its products. Method of measurement on direct reading pH meters, Bureau of Indian Standards, New Delhi. IS: [4309], 1979.
2. Methods of test for petroleum and its products. Determination of carbon residue, Bureau of Indian Standards, New Delhi. IS: 1448 [P: 122], 2013.
3. Methods of test for petroleum and its products. Determination of corrosiveness to copper- copper strips test, Bureau of Indian Standards, New Delhi IS: 1448 [P: 15], 2004.
4. Methods of test for petroleum and its products. Distillation of petroleum product, Bureau of Indian Standards, New Delhi. IS: 1448 [P: 18], 1991.
5. Methods of test for petroleum and its products. Determination of flash point and fire point, Bureau of Indian Standards, New Delhi. IS: 1448 [P: 21], 1992.
6. Methods of test for petroleum and its products. Determination of Kinematic and Dynamic Viscosity, Bureau of Indian Standards, New Delhi IS: 1448 [P: 25], 1976.
7. Methods of test for petroleum and its products. Methods of test density and relative density, Bureau of Indian Standards, New Delhi. IS: 1448 [P: 32], 1992.
8. Methods of test for petroleum and its products. Determination of ash, sulphated ash and water soluble ash, Bureau of Indian Standards, New Delhi. IS: 1448 [P: 4], 1984.
9. Methods of test for petroleum and its products. Heat of combustion of liquid hydrocarbon fuels by bomb calorimeter method, Bureau of Indian Standards, New Delhi. IS: 1448 [P: 6], 1984.