

Analysis of Smoke of Diesel Engine by Using Biodiesel as Fuel

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Abstract- This study represents the analysis of smoke of biodiesel by using smoke tester. In this article biodiesel is taken as a fuel instead of diesel and quantity of emitted pollutants HC and CO is evaluated by taking different quantity of biodiesel at different load. This work shows how use of biodiesel will affect the emission of pollutants. Diesel Engine is compression ignition engine and use diesel as fuel, in this engine alternative fuel can be used. One alternate fuel is biodiesel. Biodiesel can be used in pure form or may be blended with petroleum diesel at any concentration in most injection pump diesel engines and also can be used in Vehicle, Railway, and Aircraft as heating oil.

Index Terms- Biodiesel, Diesel Engine, CO, HC, Smoke, Smoke Tester.

I. INTRODUCTION

Bio diesel is the ester based variety oxygenated fuels derived from natural renewable biological sources such as vegetable oils. Biodiesel fuel can be made from new or used vegetable oil and animal fats. Biodiesel is high quality fuel made through a chemical process called Trans esterification. Needed ingredients are vegetable oil, Methanol and Lye (NaOH).

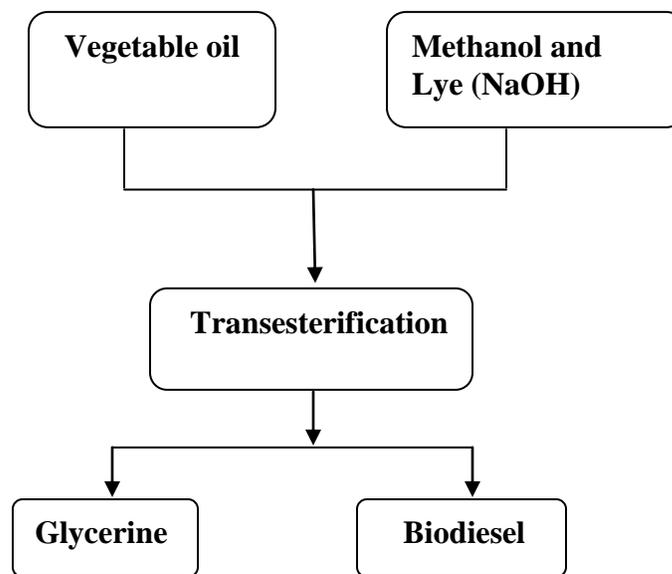


Fig. 1 Process of making Biodiesel

The chemical reaction that occurs through this process breaks down the oil into a layer of biodiesel which rises to the top of the reactor, and a layer of Glycerine which falls to the bottom. The Glycerine is drained is drained off and used for other purposes, composted or otherwise disposed off. The biodiesel is then washed, dried and filtered to remove any extra impurities and its ready to be used as a fuel in diesel engines without any modifications to the engine.

Biodiesel is just twice as viscous as diesel having better lubricating properties and much higher cetane ratings than today's lower sulphur diesel fuels. Biodiesel addition reduces fuel system wear and in low levels in high pressure systems increases the life of the fuel injection equipment that relies on the fuel for its lubrication. Depending on the engine, this might include high pressure injection pumps, pump injectors (also called unit injectors) and fuel injectors.

II. ANALYSIS & FINDINGS

In this study *castor oil* is taken as vegetable oil mixed with and forms biodiesel used in different quantity at different load to take observations about emitted pollutants HC and CO.

TABLE I : Quantity of HC in ppm

Load (lbs)	Biodiesel	Fuel consumption (ml)	Time of consumption	HC (ppm)
20	20%	40	4 min 30 sec	1700
	50%	60	4 min 30 sec	1500
	80%	40	4 min	1400
	100%	50	4 min 15 sec	1340
40	20%	30	3 min 15 sec	1800
	50%	60	4 min 30 sec	1580
	80%	40	3 min 45 sec	1450
	100%	40	3 min 45 sec	1400
60	20%	40	3 min 30 sec	1800
	50%	40	4 min 30 sec	1650
	80%	60	3 min 45 sec	1560
	100%	60	4 min	1500

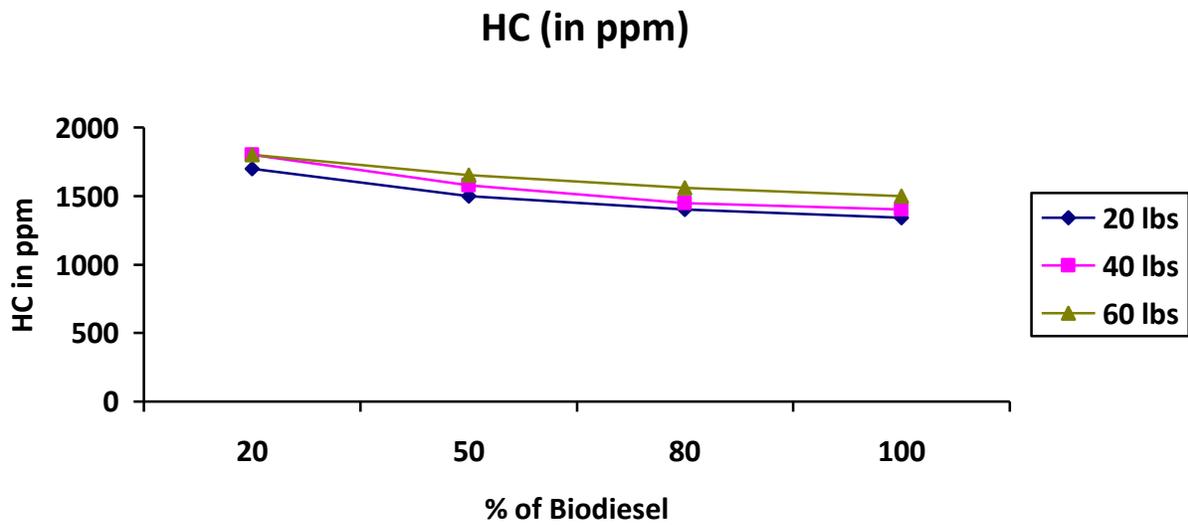


Fig. 2 Graph between quantity of HC & Biodiesel %

TABLE II : Quantity of CO in %

Load (lbs)	Biodiesel	Fuel consumption (ml)	Time of consumption	CO (%)
20	20%	40	4 min 30 sec	2.7
	50%	60	4 min 30 sec	2.5
	80%	40	4 min	2.3
	100%	50	4 min 15 sec	2.1
40	20%	30	3 min 15 sec	2.8
	50%	60	4 min 30 sec	2.6
	80%	40	3 min 45 sec	2.4
	100%	40	3 min 45 sec	2.1
60	20%	40	3 min 30 sec	2.8
	50%	40	4 min 30 sec	2.7
	80%	60	3 min 45 sec	2.5
	100%	60	4 min	2.3

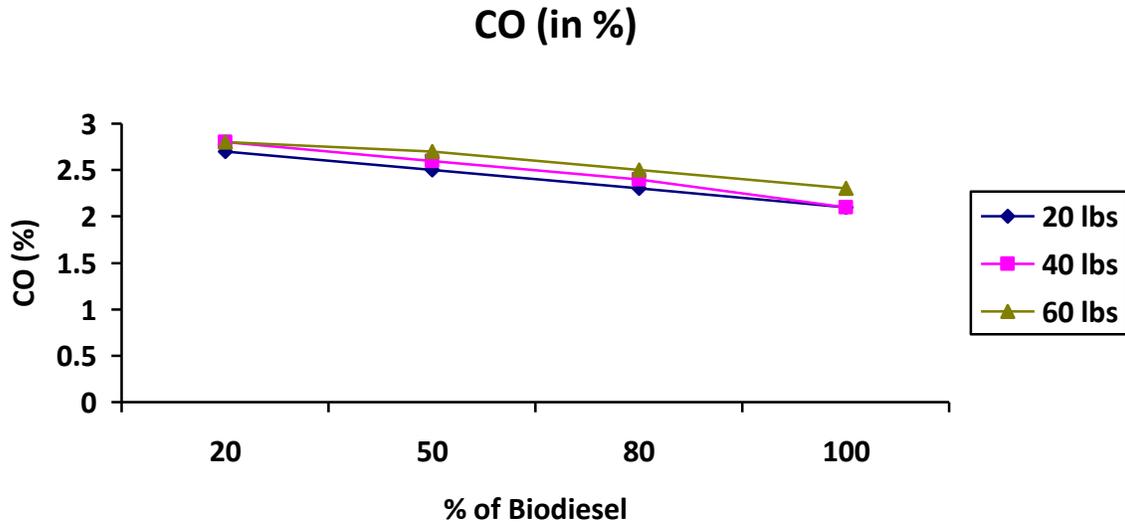


Fig. 3 Graph between quantity of CO % & Biodiesel %

III. RESULTS AND DISCUSSIONS

After experiment we find that hydrocarbons (HC) in ppm decreases with increasing of biodiesel percentage as shown in graph in fig 2.

Order of impact by HC –

Pure diesel > 20% biodiesel mixed diesel > 50% biodiesel mixed Diesel > 80% biodiesel mixed diesel > 100% pure biodiesel

At 20 lbs load –

20 % biodiesel emitted 1700 ppm HC
50 % biodiesel emitted 1500 ppm HC
80 % biodiesel emitted 1400 ppm HC
100 % biodiesel emitted 1340 ppm HC

At 40 lbs load –

20 % biodiesel emitted 1800 ppm HC
50 % biodiesel emitted 1580 ppm HC
80 % biodiesel emitted 1450 ppm HC
100 % biodiesel emitted 1400 ppm HC

At 60 lbs load –

20 % biodiesel emitted 1800 ppm HC
50 % biodiesel emitted 1650 ppm HC
80 % biodiesel emitted 1560 ppm HC
100 % biodiesel emitted 1500 ppm HC

Hence, load increasing also affects the pollutants emission, % of HC increases with load increasing.

And, carbon monoxide (CO) percentage also decreases with increasing biodiesel percentage as shown in graph in fig.3

Order of impact by CO –

Pure diesel > 20% biodiesel mixed diesel > 50% biodiesel mixed Diesel > 80% biodiesel mixed diesel > 100% pure biodiesel

At 20 lbs load –

20 % biodiesel emitted 2.7 % CO
50 % biodiesel emitted 2.5 % CO
80 % biodiesel emitted 2.3 % CO
100 % biodiesel emitted 2.1 % CO

At 40 lbs load –

20 % biodiesel emitted 2.8 % CO
50 % biodiesel emitted 2.6 % CO
80 % biodiesel emitted 2.4 % CO
100 % biodiesel emitted 2.1 % CO

At 60 lbs load –

20 % biodiesel emitted 2.8 % CO
50 % biodiesel emitted 2.7 % CO
80 % biodiesel emitted 2.5 % CO
100 % biodiesel emitted 2.3 % CO

IV. CONCLUSION

During this study we find that use of Biodiesel in diesel engine reduces the percentage of emitted pollutants, hence with increasing quantity of biodiesel Emission of HC and CO decreases. In this experiment castor oil is taken as vegetable oil and mixed with methanol makes Biodiesel, and this biodiesel used in diesel engine instead of diesel to get the results about emission of HC (hydrocarbons) & CO (carbon monoxide). So we find quantity of HC & CO reduced with increasing quantity of biodiesel. But this quantity of pollutants increases with load increasing.

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