

Investigation on the Performance of Fuel Stick Fuel Conditioner in Diesel Vehicle

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Abstract: *In the present scenario of worldwide hype about the usage of fuel stick fuel conditioner in various types of vehicles, stationery engines and its associated benefits related to power output, fuel cost, pollution, durability of engine parts etc. the fuel industry of Ethiopia is preparing grounds to adopt such fuel conditioner in anticipation of better benefits. It is very much misleading in the absence of authoritative and extensive validation of the performance of such fuel conditioner in vehicles and engines. In this context to bring out the reality and to make it clear to the automotive industry and society of the country as a whole, a team from Mechanical and vehicle engineering department carried out a series of laboratory experiments to estimate the performance of the fuel stick conditioner in various types of vehicles and engine test rigs. The performance parameters like wheel power, wheel force and fuel consumption were measured under various operating conditions. This paper discusses the procedure and the results obtained in one of such experimentation done on Diesel vehicle using chassis dynamometer. The experiments were conducted with both pure diesel and diesel added with fuel stick conditioner under similar conditions. Comparison was made to understand the pros and cons of fuel stick conditioner. From this exhaustive experimentation it was found that the usage of fuel stick definitely helps in increasing wheel power and wheel force of diesel vehicles. Increase in fuel consumption was also observed which might be the result of cleaning effect of fuel stick on fuel lines. So it is recommended proper tune up of the vehicle is to be done before using diesel with fuel stick.*

Keywords: Fuel-stick fuel conditioner, Chassis Dynamometer, Wheel Power, wheel force, fuel consumption.

1. Introduction

For the country like Ethiopia which is totally dependent on the importation of petroleum fuels cost saving on fuel consumption is very much necessary to have a sustainable economical growth. There are a great number of products in the world market that claim to lower fuel costs when mixed with petro-fuels but only a few really work. A recent product known as Fuel Stick is reported to be one of the better ones which help in reducing the fuel costs and tail pipe emissions as well. Fuel-stick is receiving testimonials in its favor from various customers from different corners of the world [1]. Trustworthiness of which is under question.

Fuel stick is a product invented by a New Zealand company called Bio Marine Solutions which is currently being produced from natural resources in Malaysia. Fuel Stick has been sold around the world since 2006 and is available in numerous countries including India, China, New Zealand, Malaysia, Australia and many more. Fuel Stick has been available in Canada since 2009 [2].

It is understood that the fuel stick which is available in the form of tablets, is an extract of palm tree. It is reported that due to its bio-origin, it is environmental friendly and biodegradable. Each 20 liters of either diesel or gasoline needs one tablet of fuel stick.

As the characteristics of fuel stick appear to be matching with the interest of Ethiopia, the industry is preparing grounds to import fuel stick without having authoritative validation of its behavior. For example, A.J Simony Merchandise, Addis Ababa based company was preparing to import fuel stick at the time of conducting this research work.

In this context this work is taken up to enlighten the society about the real behavior of fuel stick when used with petro fuel.

The main objective of this work is to compare the performance of fuel without fuel stick and fuel with fuel stick in the vehicle running under similar conditions on chassis dynamometer. For comparison, the power and force at the wheels were measured at different speeds in different gears. The fuel consumption also measured at idle and fast idle speeds of the vehicles in 1st and 2nd gears. Diesel vehicle was run both with pure diesel and diesel added with fuel stick fuel conditioner using chassis dynamometer.

2. Materials and Methods

2.1 Materials

The list of the materials used for this experimental study is as follows:

- Twin Roller Chassis Dynamometer (RAM XII)
- Diesel Vehicle (Toyota Hilux 2.8D, Diesel Pickup)
- Measuring Jar
- Digital Weighing Machine
- Stop Watch
- Fuel Stick Fuel Conditioner
- Diesel Fuel

To maintain uniform characteristics, the fuel was purchased from the same fuel station in cans of 20 liters capacity for conducting the test. The fuel in one can with addition of fuel stick and one without fuel stick are used for testing. The cans

were labeled to avoid the mixing of the fuel with stick and the fuel without stick.

Comparative performance evaluation of fuels with stick and without stick was done on same diesel vehicle under uniform conditions. The tests were repeated several times to obtain reliable data.

2.2 Methods and Procedures

2.2.1 Chassis Dynamometer

The twin roller eddy current absorption chassis dynamometer (RAM XII) available in automotive work shop has the capabilities of testing the vehicle in constant speed and constant load test mode. The constant speed test mode is used in this work to measure wheel power and force at different speeds and gears [3].



Figure 1: Twin roller chassis dynamometer

The test procedure is as follows

- Run the vehicle for about half an hour to see the complete replacement of the fuel used previously with the fuel under test
- set the measurement mode to power (kW) and the speed coarse control to the required speed say 25 km/hr
- Drive away the vehicle normally as on the road and engage gear convenient for the vehicle at the speed
- Accelerate till the acceleration ceases after approximately reaching the set speed
- Set the speed precisely using fine speed control
- Accelerate the vehicle at full throttle
- Record power and speed after stabilizing
- Turn hand control switch to Force (F) while speed is more than 20 kmph and record force (kN).

Following the procedure given above the tests were conducted at 25, 50, 75 and 100 kmph engaging different gears convenient to the vehicle.

As there is no set instrumentation to measure fuel consumption, it was observed inconvenient to measure the fuel consumption during the above test. Fuel consumption was measured using unloaded steady state test at idle and fast idle. These tests were also observed to be useful to see the cleaning effect of the fuel stick.

3. Results and Discussion

Vehicle used for testing: TOYOTA Hilux 2.8D, Diesel Pickup

Test used: *Constant speed mode test*

The tests were conducted at 25, 50, 75 and 100 kmph with pure diesel and diesel with fuel stick and the results are shown in the graphs given below.

3.1 Wheel Power and Wheel Force

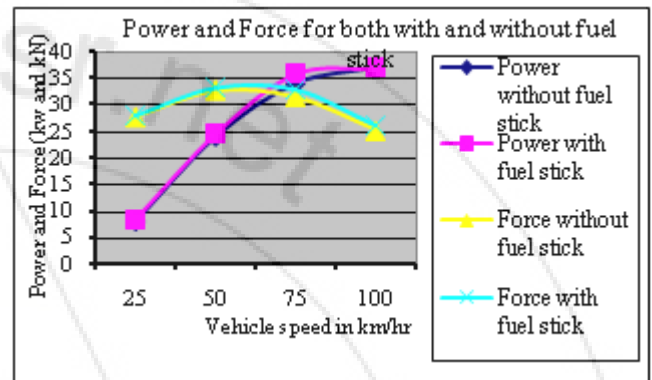


Figure 2: Power and force for diesel vehicle (Scale: power 1:1, Force 1:20)

Figure 2 shows:

- The power and force produced by fuel with stick is higher than the fuel without stick
- On an average in the speed range of 25 to 100 kmph the power produced by the fuel with stick is 2.5% higher than the fuel without stick and force is 2.6 % higher than the fuel without stick.
- With increase in the speed the difference is observed to be increasing. So the fuel with stick is performing better in high power zone.
- In 4th gear at 75 km/hr speed, the difference is higher which is about 5.6% higher in case of power and 4.44 % higher in case of force.

Figure 3 shows:

- The power and force produced by fuel with stick is higher than the fuel without stick
- On an average in the speed range of 25 to 100 kmph the power produced by the fuel with stick is 4.5% higher than the fuel without stick and force is 2.36 % higher than fuel without stick.
- With increase in the speed the difference is observed to be increasing. So the fuel with stick is performing better at high power zone.

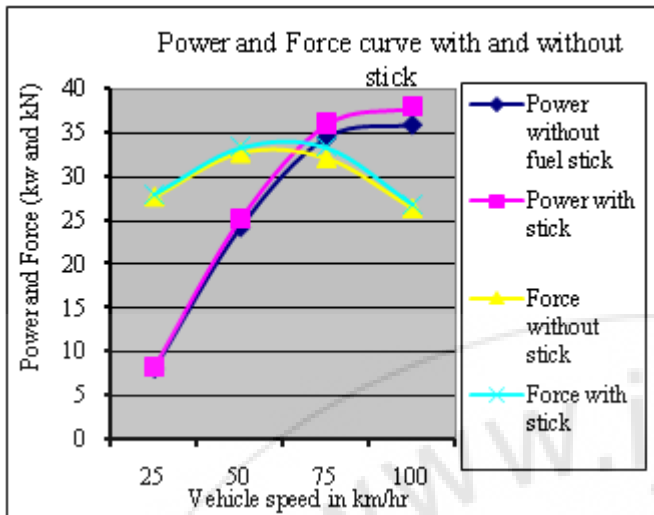


Figure 3: Force and power for diesel vehicle

- In 4th gear at 100 km/hr vehicle speed the difference is higher which is about 5.47% .
- On an average from two trials the power produced by the diesel with stick is 3.5% higher than the diesel without stick. Similarly the average force produced by diesel with stick is 2.48% higher than the diesel without stick

The difference of the power is highest in 4th gear at 100kmph which is 5.47 % and the difference of the force is highest in 4th gear at 75kmph which is 4.44%

3.2 Fuel Consumption

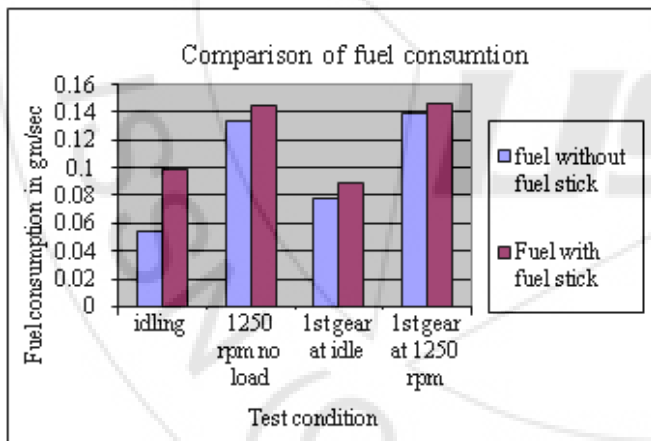


Figure 4: Fuel consumption

Figure 4 shows:

- Even though the fuel consumption of the fuel with stick is higher at lower speeds, it is gradually reducing with increase in the speed, indicating the better performance of the fuel with stick at higher speeds.
- The higher fuel consumption of fuel with stick may be due to increase in the rate of fuel flow into the engine through the cleaned fuel systems.
- Increase in the idling speed observed clearly, showing increase in the power of the engine when fuel with stick is used. Engine tune up may be required for deriving the benefit of the fuel stick.

Figure 5 shows:

- It is observed that the fuel consumption of fuel with stick is higher at idling speed. This might be due to increase in idle speed and cleaning effect of the stick. Increase in idle speed is also observed when fuel with stick is used with the existing engine setting though it was difficult to register the exact increase in speed due to wider scale of the engine tachometer.

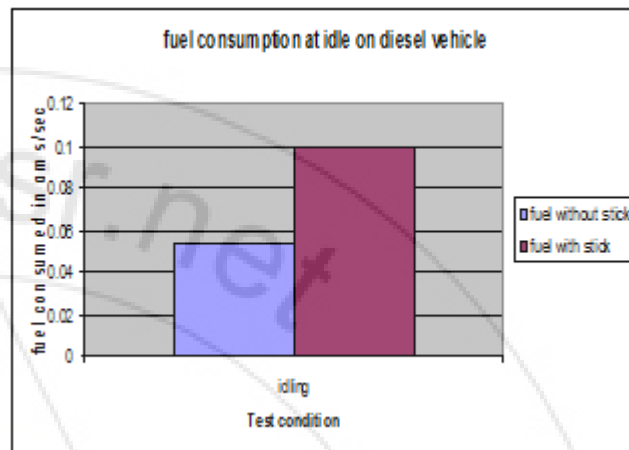


Figure 5: Fuel Consumption at idling condition

4. Conclusions and Recommendations

4.1 Conclusions

- It is observed that on an average from two trials conducted the power produced by the diesel with stick is 3.5% higher than the diesel without stick. Similarly the average force produced by diesel with stick is 2.48% higher than the diesel without stick, indicating that there is better torque and power if the fuel with stick is used.
- The difference of the power is highest in 4th gear at 100kmph which is 5.47 % and the difference of the force is highest in 4th gear at 75kmph which is 4.44%
- Even though the fuel consumption of the fuel with stick is higher at lower speeds, it is gradually reducing with increase in the speed, indicating the better performance of the fuel with stick at higher speeds.
- The higher fuel consumption of fuel with stick may be due to increase in the rate of fuel flow into the engine through the cleaned fuel systems.
- Increase in the idling speed observed clearly, showing increase in the power of the engine when fuel with stick is used. Engine tune up may be required for deriving the benefit of the fuel stick.

4.2 Recommendations

- The results may be quite specific to the type of engine, vehicle and their condition. So wide range experimentation is required further to come up with an overall conclusions which give clear picture of the fuel stick.
- Conduction of experiments on different types of vehicles on real road conditions for long time is necessary to estimate fuel consumption and emissions.
- Stationary machines which are operating at a known load condition like generators are to be used for

exhaustive experimentation to understand clearly the effect of fuel stick conditioner on the performance of the engine.

5. Acknowledgements

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Author Profile



N. Ramesh Babu received the M.Tech degree in design and production of IC Engines from REC Warangal in 1991. He has 22 years of teaching experience. Worked in USA for 1 year as software consultant. Published around 20 national and international papers. Areas of his research interest are biofuel applications in IC engines, combustion analysis, renewable sources of energy, hybrid vehicles, vehicle design etc. Presently working as Associate Professor, Mechanical and Vehicle Engineering Department, Adama Science and Technology University, Adama, PoBox: 5116, Ethiopia.



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