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Dedicated System in Pick-up Truck

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Abstract
This research aimed to study the application of LPG dedicated system which used the process of creating a modified diesel engine combustion chamber with LPG (Liquefied?? Liquid Petroleum Gas) as fuel. The system modified the operation of the diesel injectors with LPG. Then, the researchers designed and installed a diesel engine into the frame and chassis of a pick-up truck with LPG fitted cylinders. Then the researchers identified performance of the system by testing (1) compression of the engine, (2) engine emissions, (3) the rate of fuel consumption, and (4) the engine speed. Exhaust gas of diesel gasoline and LPG was measured at an engine speed of 4,000 Rpm. Diesel pollution was measured: HC = 239 ppm and CO = 3.41%, in contrast with the pollution load measurement of LPG: HC = 147 ppm and CO = 0.9%. The results on the cooling water temperature on LPG was higher than that of diesel gasoline. When gasoline and LPG were used as fuel, their coolant temperature solution was comparatively high. It was also found that the temperature of exhaust gas in LPG temperature sensor was higher than that of diesel. As for the cost, LPG cost less than the diesel gasoline.

***Keywords** : Dedicated engine, modified diesel engines, LPG, pick-up truck*

1. Introduction

Currently, the transportation sector in Thailand is experiencing very high fuel costs. The rising world oil price tendency has prompted the Thai government to find an alternative. There are alternative energy sources available in Thailand including natural gas or liquefied petroleum gas (LPG), ethanol and biodiesel fuel. Natural gas is also an alternative energy to solve the problem. The advantage of using natural gas fuels is to reduce dependence on imported crude oil from abroad as well as air pollution. Many countries are trying to reduce the greenhouse effects on global warming; greenhouse gas emission hampers air quality in the short and long run. This has urged improvement in the exhaust emission standard (Lee, Lee & Kim, 2003). It is important that all countries find clean, safe, cheap and better alternative energy other than oil.

Commercial land transportation in Thailand is currently characterized by the use of pickup trucks, registered under Truck Act, as a bulk cargo vehicle category. Most of the trucks use diesel fuel. Since the fuel price is considered expensive, car users tend to install an alternating fuel system into the original diesel engine using gasoline which is termed a dedicated engine. In practice, many garages import the new fuel engine from abroad to replace the original engine and use only LPG (Liquid Petroleum Gas) or alternate the simultaneous use both gasoline and LPG.

The installation of LPG equipment with gasoline engines is now widely used. However, diesel engine modification for LPG is another way to reduce gasoline consumption. Such modification has become due to the price of second hand diesel engines is affordable to car users and the parts used in adaptation are easily accessible from various sources.

In this regard, the researchers were interested in using natural gas as a substitute for gasoline by modifying the combustion medium-sized diesel engine to use LPG as fuel. In adaptation, fuel consumption and pollution were tested. The researchers also studied engine refinement and engine performance for further development for electronic engines using only natural gas in the future.

2. Research objective

The research objective was to study the effect of a modified LPG diesel engine.

3. The Modified Procedure

The modified procedure for installing LPG on the diesel engine was as follows:

1. Install the engine on the platform,
2. Reduce engine compression ratio by modifying the cylinder head and piston,
3. Install the ignition system using the ignition coil with integrated ignition coil,
4. Control the engine using a butterfly wing, and
5. Install LPG fuel injection system on the engine

4. Expected Results

The researchers expected three results as follows:

1. A guide to diesel engine conversion with LPG to reduce modification costs.
2. How to save fuel costs.
3. Reduction of air pollution in an LPG modified engine in contrast with a diesel engine.

The results of this research were to generate a guideline to refine the timing of the ignition suitable for diesel engines converted into LPG engines and to maximize engine performance. This was to ensure no damage from excessive exhaust temperature and minimal emissions to the atmosphere. All of these were to develop a diesel engine ignition control system adapted to LPG engines.

5. Research Methods

The researchers studied engine data on diesel and LPG fuel for installation on diesel engine combustion modification, using LPG as fuel (Alla & Soliman, 2000; Pagagiannakis & Hountalas, 2003, 2004). The principle of diesel engine conversion and the operation of mixed LPG and mixed LPG equipment were applied to measure diesel and LPG fuel efficiency in specific aspects.

Using the obtained technical information, the researchers used the resources to design and install the LPG gas mixture. Then the researchers worked on modification of the combustion diesel engine with the use of LPG as fuel.

Figure 1: The Cylinder Head and the Modified Wood Burn Chamber Position

Figure 2: The Volume Expansion of the Combustion Chamber

Figure 3: Installation of Thotle Valve

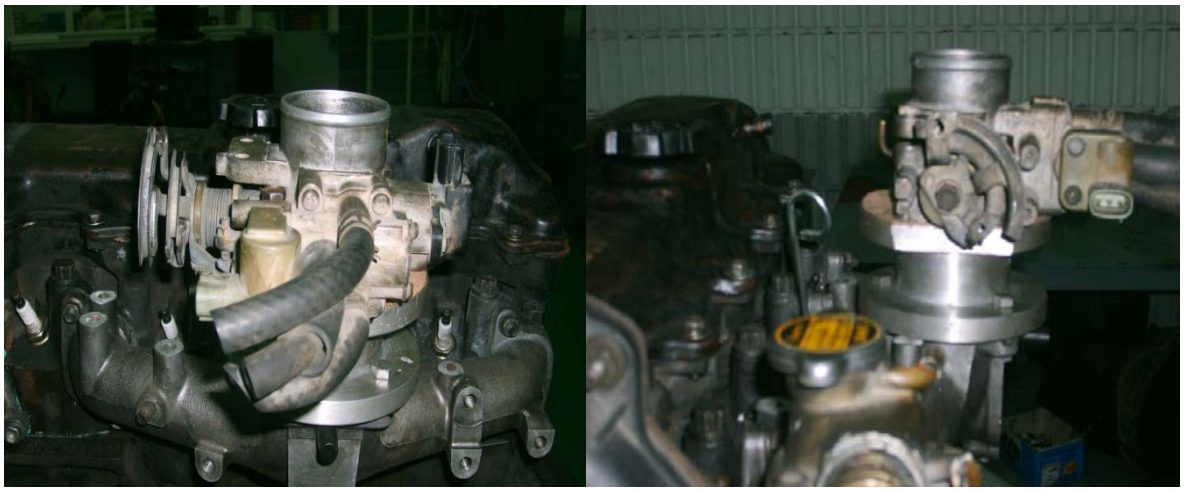
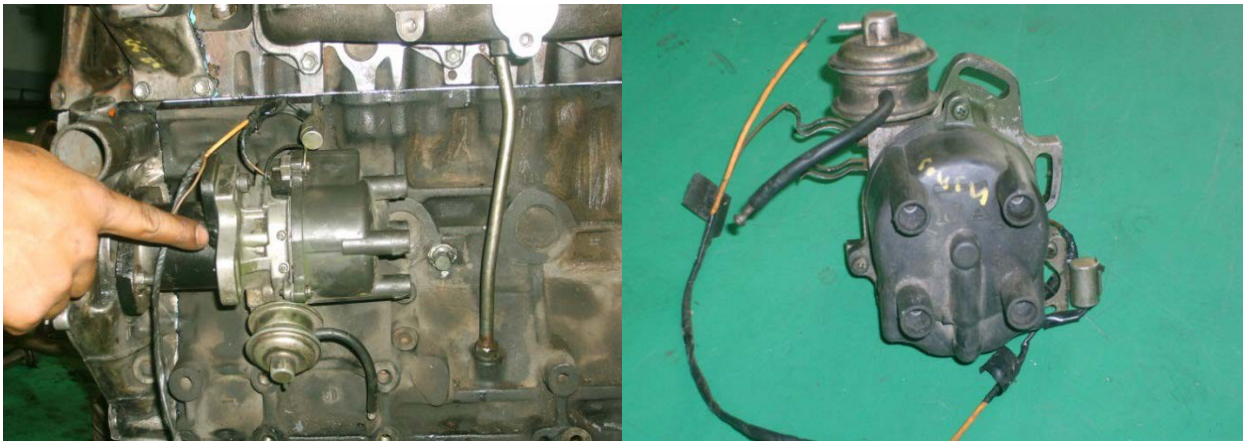


Figure 4: Installation of the Distributor



6. Results of Engine Modification

The results of engine modification are shown in Figures 5-10.

Figure 5: CO Emission

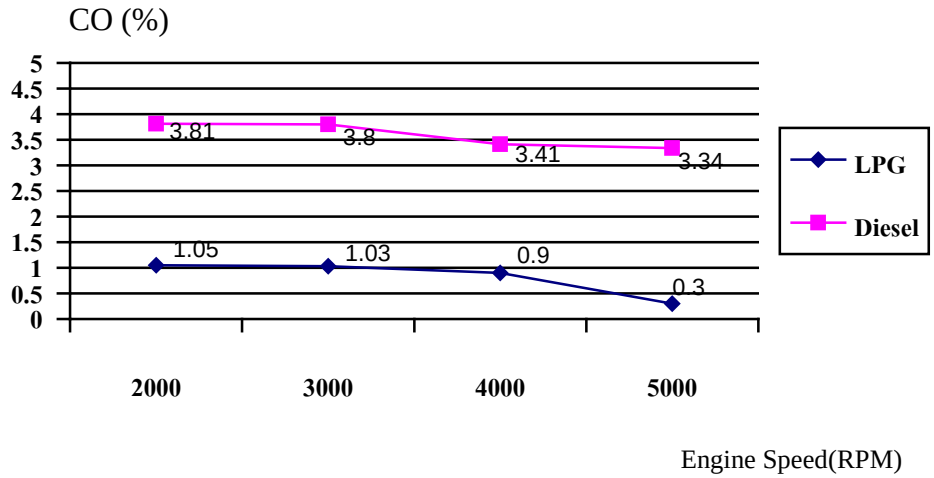


Figure 6: HC Emission Monitoring

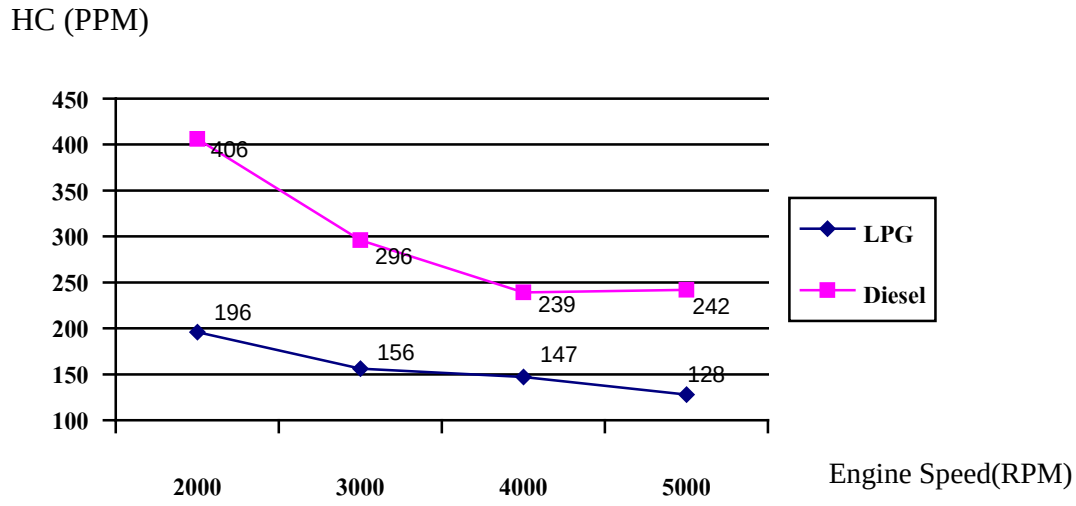


Figure 7: Comparison of Fuel Consumption

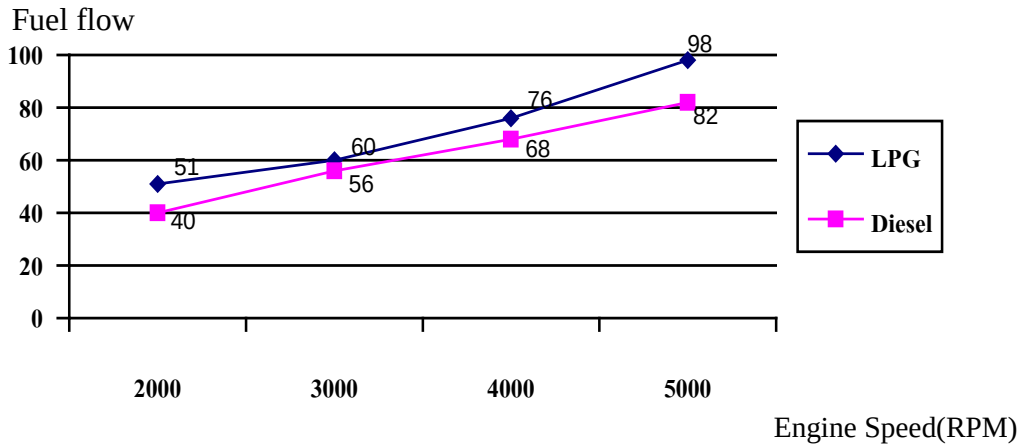


Figure 8: Comparison of the Coolant Temperature

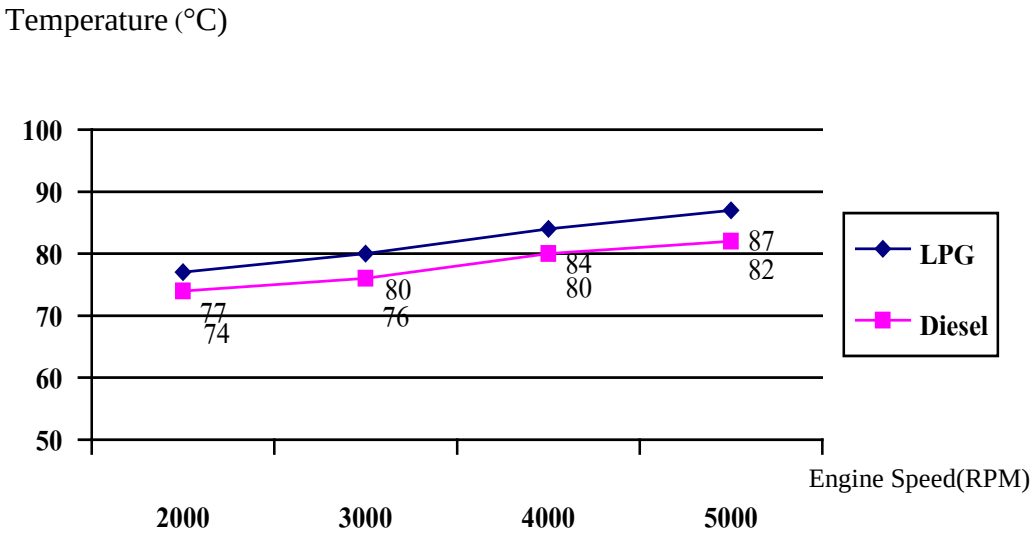


Figure 9: Comparison of the Exhaust Temperature

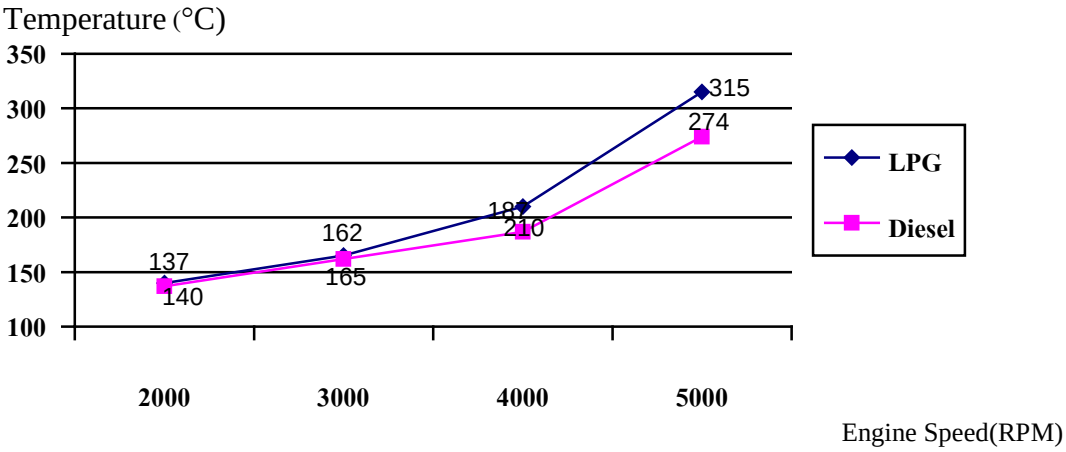
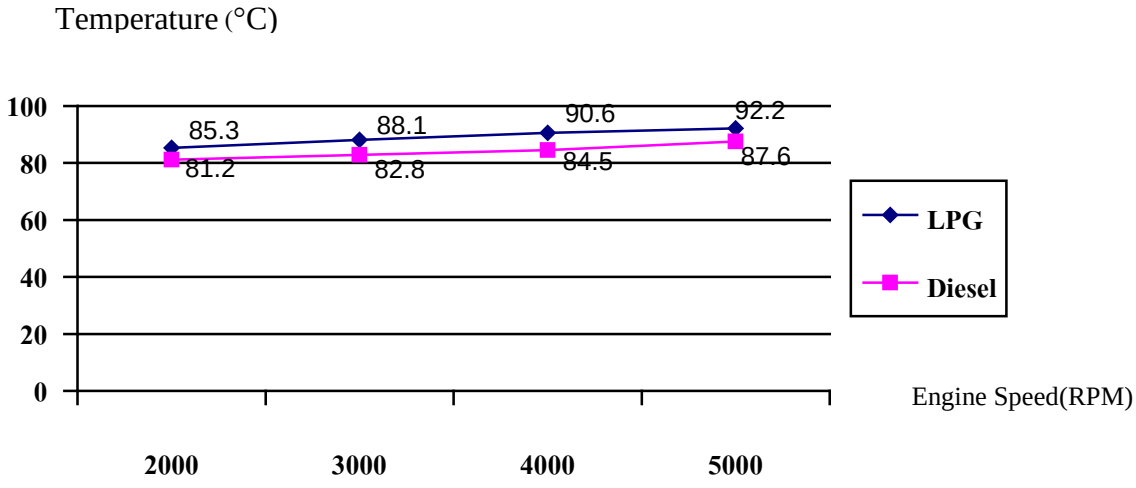


Figure 10: Comparison of Fuel Temperature: LPG and Gasoline



7. Conclusion

From the engine-modified experiments, the combustion engine diesel engine was modified to use LPG as fuel. The researchers measured the amount of exhaust gas CO, HC coolant temperature and exhaust temperature. The costs between diesel and LPG fuels were compared. The results of the experiments shown in Figures 5-10 reveal (1) CO emission and HC emission were higher in diesel than LPG, and (2) fuel consumption, coolant temperature, exhaust temperature, and fuel temperature in LPG were slightly higher than diesel. As for the cost of fuel, LPG consumption was cheaper. It was expected that the information obtained from the study was to improve efficiency of the diesel engine with conversion for LPG as the main fuel.

8. The Authors

Nuntachai loharojwichean, Thawatchai Suksriroj , Veera Kuanliang are working in the Department of Automotive Technology, Siam Technology College, Bangkok, Thailand. Their rrsearch interest is in the areas of automation and automative technology.

9. References

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