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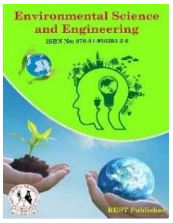

Experimental Study on the Effects of Shale Gas-LPG Blend on 4-Stroke SI Engine Performance

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Abstract: In today's world, as our supply of fossil fuels dwindles, we are constantly on the lookout for alternative energy sources that can power our IC engines. The primary goal of this investigation is to investigate the feasibility of using shale gas as a fuel by experimenting with different mixtures of shale gas and LPG gas in automobiles. Many operations have demonstrated that extracting natural gas from North America's shale gas reserves is possible, but many obstacles remain in the way of fully exploiting these unconventional reservoirs. Because shale gas reservoir rocks are so impermeable, production must be stimulated via hydraulic fracturing.
Keywords: *Shalegas, petrol Engines, Engine Performance, BSFC – Brake specific fuel consumption, UHC-Unburnedhy drocarbons, CO–Carbon monoxide, NOX emissions.*

1. INTRODUCTION

The extraction of natural gas from oil and gas-bearing organic-rich mudstone strata, commonly referred to as "shale gas," is a rapidly growing trend in onshore oil and gas exploration and production today. Some of these places have previously witnessed little to no activity, but now have drilling and production operations. Especially in regions where gas production is novel, new oil and gas developments alter the local ecological and socioeconomic landscape. Concerns have been raised over whether or not the current regulatory system can keep up with shale gas extraction, its possible environmental implications, and the nature of the industry itself. The public, regulators, and policymakers all want a neutral, unbiased source of data on which to base choices about how to handle the potential risks associated with shale gas development and the answers to the aforementioned issues. In the last decade, three developments have combined to make shale gas production cost-effective. Improvements in horizontal drilling, Hydraulic fracturing technology improvements, Natural gas prices have soared in recent years due to intense market competition.

- Shale is a sedimentary rock composed of mud and was formed in placid lakes and oceans.
- Black shale Rich in organic substances produced from bacterial, plant, and animal waste, black shale is shale that was set down under particularly anoxic conditions on the floors of stagnant oceans.
- Conventional gas Gas that has migrated from shale to more permeable reservoirs, typically sandstone, is referred to as "conventional gas.
- Shale gas is methane-dominated, but also contains ethane, propane, butane, and other organic compounds--gas that has been permanently trapped in shale. Black shale is heated and compressed for millions of years at depths of 5,000 to 15,000 feet to create this rock.
- Coal-bed Gas trapped in coal seams is known as coal-bed methane, and it can be extracted using the same techniques as shale gas.
- Tights and gas is gas trapped in unusually impermeable sandstone aquifers and is retrieved by hydraulically fracturing

2. WHATISASHALEGAS

Shale gas is the same as regular natural gas and can be used for the same purposes, such as house heating, cooking, and electricity production. Natural shale gas is found in mudstone and other fine-grained sedimentary rocks. Plant and animal remains were commonly found in the muck and silt that settled at the bottom of prehistoric lakes and oceans. Shale and mudstone were produced when organic-rich sediments were buried for long periods of time and subjected to high temperatures and pressures. Conventional oil and gas reservoirs are formed when oil and gas produced by the decomposition of organic matter migrate into different rock types, such as sandstone and limestone. Shale gas refers to the natural gas that is trapped in shale. We have finally figured out how to successfully extract this hydrocarbon.

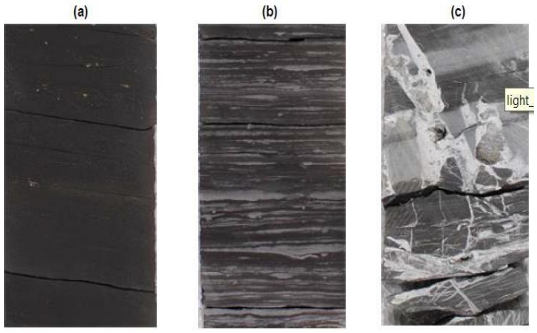


FIGURE 1. Shale rocks

Shalegasre sources a deserves: Since burning coal releases more carbon dioxide than burning natural gas, the increase in oil and gas production from shale rock has transformed energy in the United States, reversing declines in oil production and prompting a massive shift from coal to natural gas electricity production, resulting in a drop in carbon dioxide emissions. According to the results of a recent study (EIA, 2013). The Energy Information Administration agrees that a transition like this is possible in countries other than the United States (Bullis, 10 June 2013). From that study, we get this map (Figure) depicting the distribution of shale gas and oil over the world. This map provides a considering how pervasive the resources for shale gas and oil are. Shale gas is more abundant in China, Argentina, and Algeria than in the United States. The global distribution of shale gas resources is depicted in the figure below, which features a map of shale gas fields in the United States. There are countries with more of these resources than the United States, but that doesn't mean they'll have the same impact or move as rapidly. Because the geology is different in other nations, resource development could take a long time. The methods that are successful in the United States might not be applicable in other countries. Many nations also lack the skilled technologists essential to solve these problems.

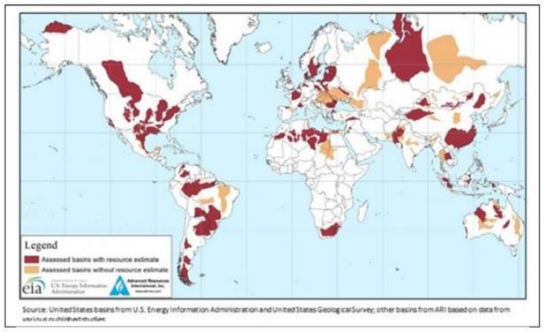


FIGURE 2. Assessed shale oil and shale gas formations

Shalegas Composition: Methane and other hydrocarbon gases, carbon dioxide and sulfide compounds, nitrogen and other inert gases, water vapor, condensed higher hydrocarbons, and entrained particles are all possible components of the gas in the shale formation. The table below displays the differences in gas composition across different formations and wells within the same formation. United States shale deposits. The percentage by volume of the various components of raw shale gas

TABLE 1. Raw shale gas composition as a percentage by volume

	Bar-nett	Marcel-lus	Fayette-ville	New Albany	Antrim	Haynes ville	Mean
Methane (%)	87	85	97	90	62	95	86
Ethane (%)	7	11	1	1	4	0	4
Propane (%)	2	3	0	1	1	0	1
CO_2 (%)	2	0	1	8	4	5	3
N_2 (%)	3	0	1	-	29	0	7

3. METHODOLOGY

There must be supplementary equipment for this experimental performance. Since gas injection was included in the system, extra precautions were required to ensure they were followed. The SI engine underwent a number of fundamental changes, including:

1. Performance testing framework fabrication
2. Nozzle installation on air intake manifold
3. The solenoid valve is used to regulate the flow of liquid.
4. Gasoline set-up and operation.
5. Parameters of the Engine

TABLE 2. Engines pacifications

Displacement	92.2cc
Bore*Stroke	50 mm*56.9 mm
Power	7.4bhp (5.4kw)
Torque	7.85Nm
Engine type	Bajaj
Cooling system	Air cooled
Rpm	5800
Stroke	4T
No of cylinder	Single

Test Engine and Fuel Properties:

The tests were conducted on a water-cooled, single-cylinder, direct-injection, naturally aspirated, gasoline engine. Table Properties details the engine's specs. Ares hown Table Properties.

TABLE 3. Engine Equipment

Properties	petrol	LPG	Shale gas	B20
Density(Kg/M^3)	716	495	430	425-448
Calorific Value(K J/Kg)	47100	46100	40455	42100
Octane Number	80-100	135	110	115

Fabrication of frame for per for mince testing: The structure was constructed so that the engine's performance could be tested by mounting it at an angle and then welding together a series of angle sections. The injection nozzle and solenoid assembly were cast into the intake manifold. This will allow the fuel to flow freely into the intake manifold, which will boost performance. Drilling into the carburetor's top allowed for the nozzle's installation. As far as flow processing goes, the installed solenoid valve does the job. It controls the flow rate and, in response to signals from the engine, adjusts the opening and closing of the inlet and output valve. The installation of the gas kit, which included an LPG gas cylinder, vaporizer, regulator, and solenoid valve, went smoothly, and the trial was successful. Vaporizer, solenoid valve, and regulator explanations. A vaporizer, also known as a converter, is a machine used to change fuel from its liquid condition into its vaporized form. Since it lowers the pressure of fuel in its highly pressured liquid condition, it is sometimes referred to as a reducer. This item is a shutoff valve designed for the LPG gas lines in automobiles. This valve, which has a built-in filter to eliminate impurities from the LPG, opens automatically when the vehicle requires LPG consumption to guarantee a steady gas flow and meet the vehicle's LPG combustion requirements. The solenoid and the valve are the two primary components of a solenoid valve. The gas pressure is controlled by the solenoid, which receives electrical energy and converts it into mechanical energy by opening and closing the valve. Liquid petroleum gas (LPG) is held at 200 bar and in a liquefied condition in the cylinder; a solenoid controls the pressure to maintain a steady 1.5 bar.

Fitting of nozzleoninta kemani fold: The injection nozzle and solenoid assembly were cast into the intake manifold. This will allow the fuel to flow freely into the intake manifold, which will boost performance. Drilling into the carburetor's top allowed for the nozzle's installation.

Solenoid valves are used to regulate flow: As far as flow processing goes, the installed solenoid valve does the job. It controls the flow rate and, in response to signals from the engine, adjusts the opening and closing of the inlet and output valve.

Implementation of gasket: After properly installing an LPG gas cylinder, vaporizer, regulator, and solenoid valve, the experiment proceeded as planned. Vaporizer, solenoid valve, and regulator explanations

Vaporizer: The term "vaporizer" refers to any apparatus that takes a fuel in liquid form and transforms it into a gaseous or vaporous one. Since it lowers the pressure of fuel in its highly pressured liquid condition, it is sometimes referred to as a reducer. Vaporizers have a metal main body that has been pressure die cast, vacuum impregnated, shot blasted, and hard anodized. Pressure regulation and flow maintenance are typically accomplished in three or two phases, respectively, using diaphragms and a lever arrangement within the main body. The port diameter of the fine precision jet and the volume encompassed by the diaphragms determine the fuel flow rate and quality. Here, the performance of the vaporizer is controlled by jet seat machining, a matching rubber pad made from high-quality, long-lasting material, and diaphragms with the suitable design.

Solenoid Valve: This item is a shutoff valve designed for the LPG gas lines in automobiles. This valve opens automatically when the vehicle uses LPG, allowing gas to flow freely and meeting the car's LPG combustion needs while also filtering out any contaminants. Solenoid valves consist of a solenoid and a valve. In order to open or close the valve mechanically, electrical energy is converted by the solenoid into mechanical energy. The flow circuit is minimal in a direct acting valve. A diaphragm piloted valve uses this minimal flow to regulate a much bigger aperture, thereby amplifying it.

Pressure Regulator: The gas pressure is controlled by it. Since the liquefied petroleum gas (LPG) in the cylinder is held at a pressure of 200 bar, a solenoid is used to reduce the pressure to a safe level, typically 1.5 bar.

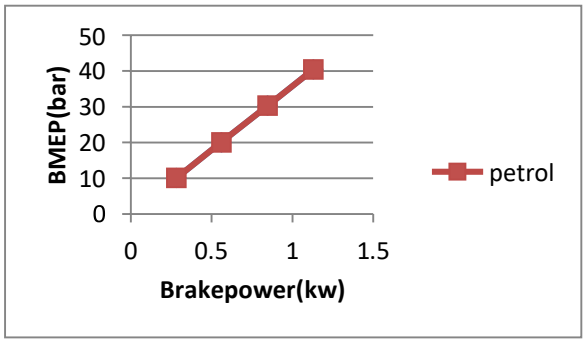
FIGURE 3. Pressure Regulator

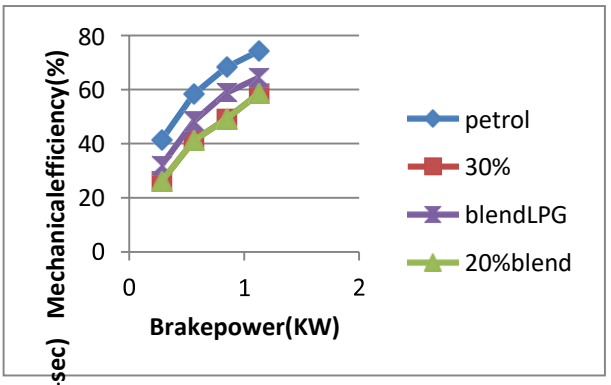
Precautions: Check the engine's lubricating oil level and make sure the panel has the proper electrical connections. See if there's enough gas in the tank.

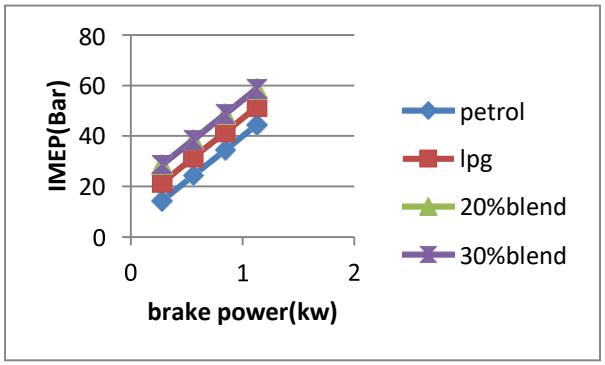
Procedure of Experiment: Turn on the water supply and set the flow rates to 6 gallons per minute (gpm) for the engine and 3 gpm for the calorimeter. If there is weight on the dynamometer, remove it. To allow fuel to enter the engine, release the three-way cock. Turn the crank to start the car. To go into a state of study, please let. Turn on the loading switches to begin loading the engine. Please take the following measurements into account. Manometer readings, in cm of water Temperature sat differently cations Readings of Voltmeter and Ammeter Note pollution values from the pollutionsetupi.e., multitask analyzer system After the completion, releasetheload and the switch of the engine. Allow the water to flow for few minutes and thenturnit off

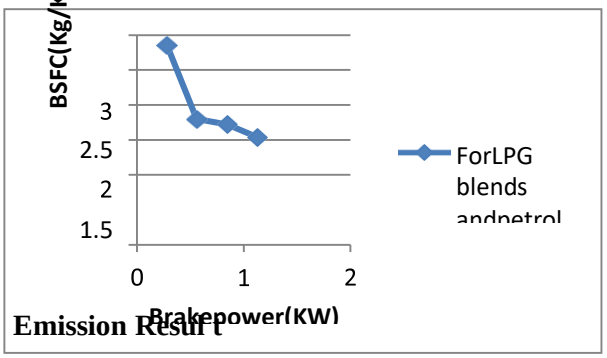
4. RESULTSANDDISCUSSIONS

Diesel engines are used to conduct visual experiments with varied fuel injection pressures of 180, 190, and 200 bars. This section discusses the finding.

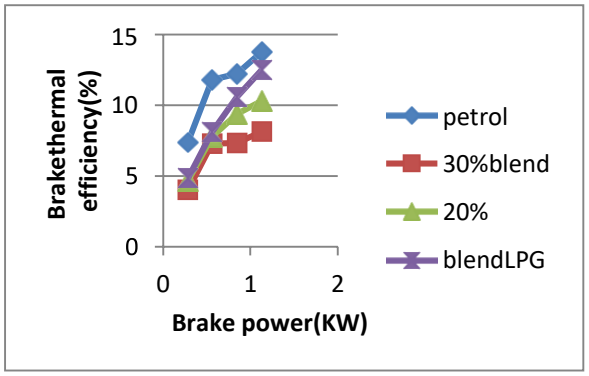


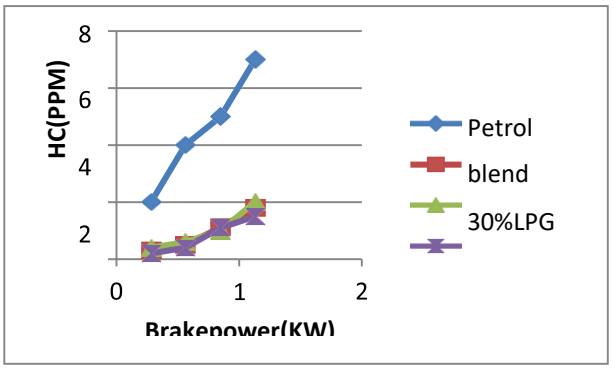


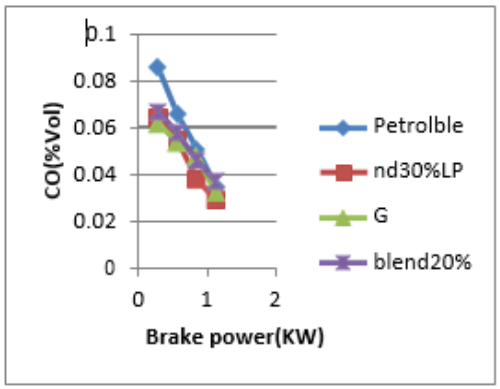


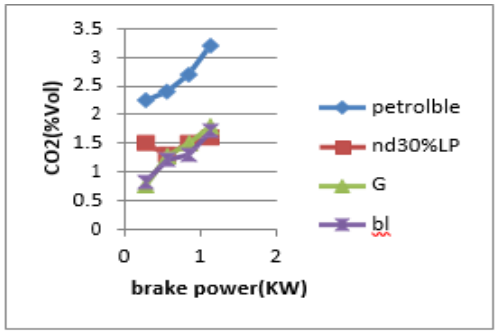


Emission Result









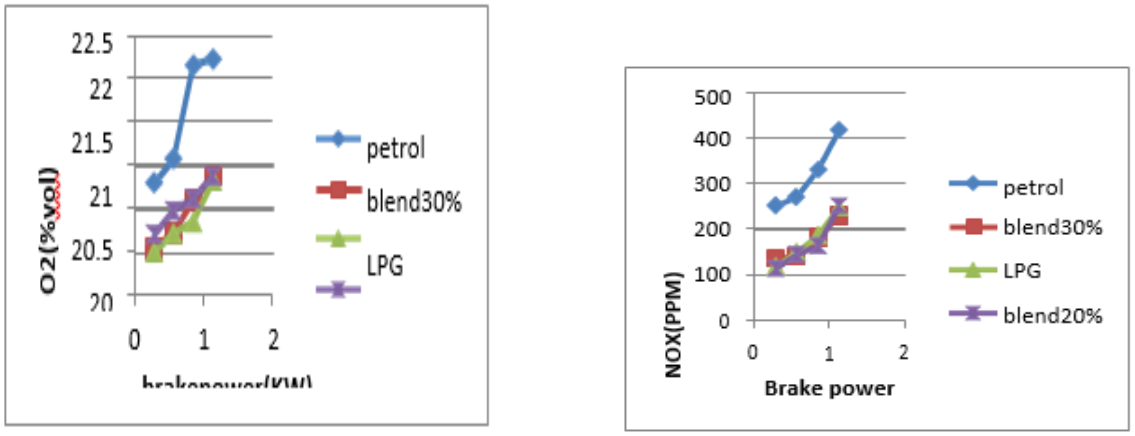


FIGURE 4. Diesel engines

5. CONCLUSION

Despite significant production challenges, its qualities make it an effective replacement fuel for modern automobiles. The extraction of natural gas from oil and gas-bearing organic-rich mudstone strata, commonly referred to as "shale gas," is a rapidly growing trend in onshore oil and gas exploration and production today. Some of these places have previously witnessed little to no activity, but now have drilling and production operations. Especially in regions where gas production is novel, new oil and gas developments alter the local ecological and socioeconomic landscape. Concerns have been raised over whether or not the current regulatory system can keep up with shale gas extraction, its possible environmental implications, and the nature of the industry itself.

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