A Review Paper on "Performance of Different Fuels inInternal Combustion Engine"

[1] Dr.Dipesh Patel, [2] Mr. Priyank Machhi, [3] Patel Bhupendra, [4]Amin Bhargav, [5]Shrotriya Shrey, [6] Vanzara Rajesh

[1]Head of the institute [2]Assistant Professor in Mechanical Engineering Department,
[3,4,5,6]Students of D. A. Degree Engineering & Technology, Mahemdabad-Gujarat

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Abstract - *This review is focused on performance of various fuels used in internal combustion engine. The Conventional fuels used are Petrol, CNG and Diesel, while new alternative fuels for petrol, CNG and diesel are Bio-diesel, ethanol, hydrogen, ethanol blended with petrol and diesel. Each of these alternative have different effect on performance on internal combustion engine. The use of these alternatives is due to limited amount of petroleum available. These alternative fuels can help petroleum last longer, because fuels like hydrogen are very much in abundant quantity, while fuels like ethanol can be produced as per needs and requirements. Effectiveness of petrol machine is substantially related to contraction rate of the machine. Typically contraction rate of petrol machine ranges around 6 to 9 when contraction rate is increased beyond 9.3 possibility of eruption will be increased. Applying the affair value from the trials and with the help of fine formulas brake power, specific energy consumption, energy mass inflow rate, and brake thermal effectiveness were measured.*

Keywords: Internal Combustion Engine, Bio- diesel, hydrogen, Petrol, Diesel, CNG.

Introduction

An internal combustion machine (ICE or IC machine) is a heat machine in which the combustion of an energy occurs with an oxidizer (generally air) in a combustion chamber that's an integral part of the working fluid inflow circuit. In an internal combustion machine, the expansion of the high- temperature and high- pressure feasts produced by combustion applies direct force to some element of the machine. The force is generally applied to pistons (piston machine), turbine blades (gas turbine), a rotor (Wankel machine), or a snoot (spurt machine).

This force moves the element over a distance, transubstantiating chemical energy into kinetic energy which is used to propel, move or power whatever the machine is attached to. This replaced the external combustion machine for operations where the weight or size of a machine was more important. Energies used in ICE are generally produced from primary coffers. To convert a source to an energy and bring this energy to a vehicle, well to tank (WTT) analyzes are made in terms of energy consumption and hothouse gas emigrations

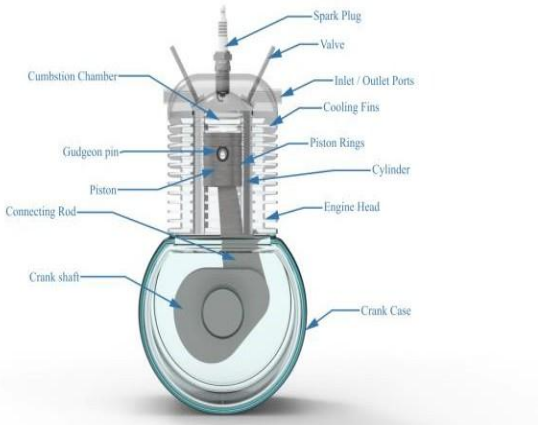

Fig1 Components of IC Engine

Different Alternative fuels used in Engine

1) Petrol/Gasoline

Gasoline or petrol is a transparent, petroleum- deduced ignitable liquid that's used primarily as an energy in utmost spark- ignition internal combustion machines (also known as petrol machines). It consists substantially of organic composites attained by the fractional distillation of petroleum, enhanced with a variety of complements. [5]

2) Bio-Ethanol

Ethanol can be produced from any substance that is convertible either to molasses or synthesis gas (which has CO and H2). [8] Ethanol is largely sharp. But change in machine set up isn't required as manufacturers allow mixing of small amount of ethanol with petrol directly. [4] Worldwide bio- ethanol production was increased from 50 billion liters in 2007 to approximately 97 billion liters in 2015. [9] Ethanol fuel has a "gasoline gallon equivalency" (GGE) value of 1.5 US gallons (5.7 L), which means 1.5 gallons of ethanol produces the energy of one gallon of gasoline. [10]

3) CNG

Natural gas is also gained from fossil fuel, which is similar to liquid fuel and diesel. Here natural gas can be recycled as it is essentially methane.

[11] Natural gas consists mainly of methane with small amount of ethane, propane, and butane. Very small concentrations of inert gases such as N2 and CO2 are also present. [12]

4) Biodiesel

Vegetable canvases are chemically complex esters of adipose acids. These are the fats naturally present in oil painting seeds, and known astri-glycerides of adipose acids. Because of their high molecular weights these fats have high density causing major problems in their use as energies in CI machines. These motes have to be resolve into simpler motes so that they've density and other parcels similar to standard diesel canvases. Modifying the vegetable canvases (to make them lighter) can be achieved in numerous ways, including; Pyrolysis, Micro emulsification, Dilution and Transesterification. Among these, Transesterification is the most generally used marketable process to produce clean and environmentally friendly light vegetable oil painting energy i.e. biodiesel. [3]

5) Hydrogen

Although hydrogen the most common element in the world and it doesn't live in nature in its pure state, so it has to be produced from sources like water and natural gas. The environmental impact and energy effectiveness of hydrogen depends on how it's yield. Hydrogen has been studied as an indispensable gas energy for a long time. Hydrogen has not some problems associated with liquid energies, similar as vapor cinch, cold wall quenching, shy vaporization and spare mixing. Hydrogen has clean burning actions. As hydrogen is burned, it products substantially water. The combustion of hydrogen doesn't bring out poisonous products similar as hydrocarbons, carbon monoxide and carbon dioxide. The most important advantage of hydrogen is that it does not produce CO gas, which is one of the most important sources of global warming. In addition, hydrogen has a wider limit of flammability than gasoline, diesel and natural gas. (2) Hydrogen always sounded seductive from several points of view it mixes fluently with air, the performing admixture has wide flammability limits, is fluently burned and has a large honey speed. (7)

6) LPG/Propane

The chemical formula for propane energy is C3H8.Propane is extensively known as Deiced petroleum gas (LPG) or bus gas in Europe. Propane is a gas at normal temperatures and pressures. It's stored onboard a vehicle in a tank pressurized to around 300 pounds per square inch about twice the pressure as in an exaggerated truck tire. Under this pressure, propane becomes a liquid with an energy viscosity 270 times lesser than the gassy form. Agallon of propane has about 25 lower energy than a gallon of gasoline. In liquid form propane turns into a tint-less & odorless liquid. As pressure is released, the liquid propane vaporizes and turns into gas that's used for combustion. An odorant, ethyl mercaptan, is added for leak discovery. In liquid state, propane are fast to cache & the tank to store liquid propane is affordable but the avail of propane is less compared to gasoline LPG and other gassy energies have common parcels that give them some advantages and disadvantages relative to gasoline. Propane has lower viscosity and stoichiometric energy – air rate than gasoline, therefore it could reduce the specific energy consumption(sfc). propane can be used at advanced contraction rates due to advanced octane number as a consequence of this property, machine performance, power and thermal effectiveness would be bettered. [1] There are also disadvantages of LPG fuel application to internal combustion engines. Major issues might include a higher thermal load of the combustion chamber due to a higher combustion temperature of light hydrocarbons and virtually no lubricity of gaseous fuels. [13]

Octane Number of Different Fuels [14]

Fuel Type	Octane Number
Petrol/Gasoline	91-93
Bio-Ethanol	108
CNG	135
Bio-Diesel	45-67
Hydrogen	130
LPG/Propane	112

Table 1 for Octane Number

Literature Review

1. Review of energies for internal combustion machines in the aspect of frugality, performance, terrain and sustainability. Advantages and disadvantages of each type of energies in terms of economics, performances, and surroundings were bandied. Reviews of colorful types of energies including reactionary energies like gasoline and diesel and indispensable energies like LPG, CNG, Alcohol, Bio-diesel and P- series energies. The hunt for indispensable energies which promise a harmonious correlation with sustainable development, energy conservation, effectiveness and terrain preservation has come largely important. Developed and developing countries which warrant of crude oil painting reserve

countries spend huge quantum of plutocrat to buy crude petroleum oil painting. (1)

2 Hydrogen increases the effectiveness of combustion, reduces emigrations and gives high performance, when is added as 20 to energies. Ethanol can be used as pure energy or mixed with different energies in internal combustion machines. Indispensable energies for new ICEoperations. (2)

3. A review of the machine performance using indispensable energies for internal combustion machines has been published in the journal Accoutrements moment. The study was conducted by Dr Venkata Sundar Rao, a professor at the Basaveshwar Engineering College, Bagalkot- 587102, India. (3)

4. The author(s) of this publication are Faisal Kader, Abdullah Noor- e- Mostofa and Mohammad Reyad Arefin Shuvo at the Islamic University of Technology in Dhaka and the Military Institute of Science and Technology in Chittagong ,Bangladesh independently. Compressed Natural Gas (CNG) has lower exhaust temperature (300 °C) and advanced boscage thermal effectiveness (24) compared to petrol. CNG is cost-effective and good for terrain, but it also has the loftiest affair necklace (5.8 N-m) and boscage power (1.98 kW).[4]

5. Hydrogen as an energy in Internal Combustion machines is a result for the near future to realize zero CO 2 emigrations. The paper gives an overview of the development of hydrogen fueled IC machines by the most important auto manufactures (Ford, Bewitch.). Hydrogen can be used as an energy for business by replacing reactionary energy machines with hydrogen- powered bones. There are several reasons to consider converting gasoline, diesel or natural gas machines into hydrogen powered bones. There are four generations in development of hydrogen powered machines for electric vehicles. (5)

6. The trouble posed by climate change and the seeking for security of energy force are issues high on the political docket. A number of manufacturers are now leasing demonstration vehicles to consumers using hydrogen- fueled internal combustion machines (H 2 ICEs) as wellas energy cell vehicles. (6)

7. Journal of Hydrogen Energy, Vol 1, pp. 153- 172. published in Northern Ireland. A detailed discussion is given of the thermal effectiveness of hydrogen machines. No emigrations are slightly small for energy- air parity rates below0.55. (7)

8. Ethanol has been the most extensively delved alcoholic energy in IC machine. They've brought into light the parcels of ethanol and the effect of colorful ethanol blends on the performance of. spark- ignition machines. It also examines the parameters concentrated for this study, including the machine boscage necklace, machine volumetric effectiveness, thermal effectiveness and thermal effectiveness. (8)

9. Ethanol(C2H5OH) are favorable for IC Machines due to their high- octane standing, burning rapidity, and wider flammability limits. When alcohol- gasoline energy composites were used the boscage power dropped and the boscage specific energy consumption increased as compared to those of gasoline energy. The energy that's used in internal combustion machines will fulfill all the musts of cost effectiveness, maximum thermal effectiveness, excellent machine performance and still remain clean sufficient to cover the terrain. (9)

10. Study of Modified Internal Combustion Engine to Run with' Ethanol' August 2017. Ethanol can replace conventional gasoline to be used as an energy for automotive. The optimal application of ethanol in the modified gasoline machine was done by changing the contraction rate of the machine. Study of Modified Internal Combustion Engine to Run with' Ethanol' is published in the International Journal of Engineering and Applied lore's (IJEAS) ISSN 2394- 3661, Volume- 4, Issue- 8 August 2017. Ethanol can replace conventional gasoline to be used as an energy for automotive machines. Carburetor of IC machine was modified so as to maintain proper stoichiometric rate which bettered energy effectiveness and avail. (10)

11. The author(s) are Musthafah Mohd. Tahir, M.A. Salim, RosliA. Bakar, M.Z. Hassan, Abdul MuhaiminM.S. Khatib, Hang Tuah Jaya, 76100 Durian Tunggal Melaka, Malaysia. It was presented at the 2nd International Conference on Sustainable Energy Engineering and Application. Peer- review under responsibility of Scientific Committee of ICSEEA 2014 356. Musthafah Mohd Tahir etal. / Energy Procedia 68(2015) 355 – 362. The main dangerous emigration from liquid energy are CO and NOx emigration (11).

12. Compressed Natural Gas (CNG) has the implicit to give a good concession in effectiveness, cost, and emigration. Due to its advanced octane number, machine effectiveness can be increased through advanced contraction rates. It has lower product of adulterants when burned and is cornucopia in nature. Natural gas has an important position among indispensable energies and an eventuality for low emigration of adulterants when used IC machines. In gassy state it's lighter than air, tintless, and odor free. (12)

13. Performance of Internal Combustion Engine Fueled by Liquefied Petroleum Energy with Water Addition. The results of empirical exploration have been presented, i.e., the energy consumption and contaminant emigration. An attempt has been made to dissect water additionin colorful forms to the operating medium of an LPG fueled machine. It's estimated that the addition of water has a salutary

effect on the thermal effectiveness of rotation, and the reduction of carbon monoxide, hydrocarbons and nitrogen oxides emigration. (13)

14. Maejo International Journal of Science and Technology- May 2019 Composition Enzymatic hydrolysis of small- unfolded nuts edge (Cyperus difformis) with alkaline pretreatment for bioethanol product. Author(s) Rameshprabu Ramaraj Maejo University, Chiang Mai 50290, Thailand and Yuwalee Unpaprom, Mijst. Bioethanol is a good cover for gasoline due to its renewable nature, high octane number and high energy content. It can be produced from different kinds of biomass similar as sugar- and bounce- grounded crops, lignocelluloses biomass and algal biomass. (14)

Various Charts of Comparison of Various Fuels [4]

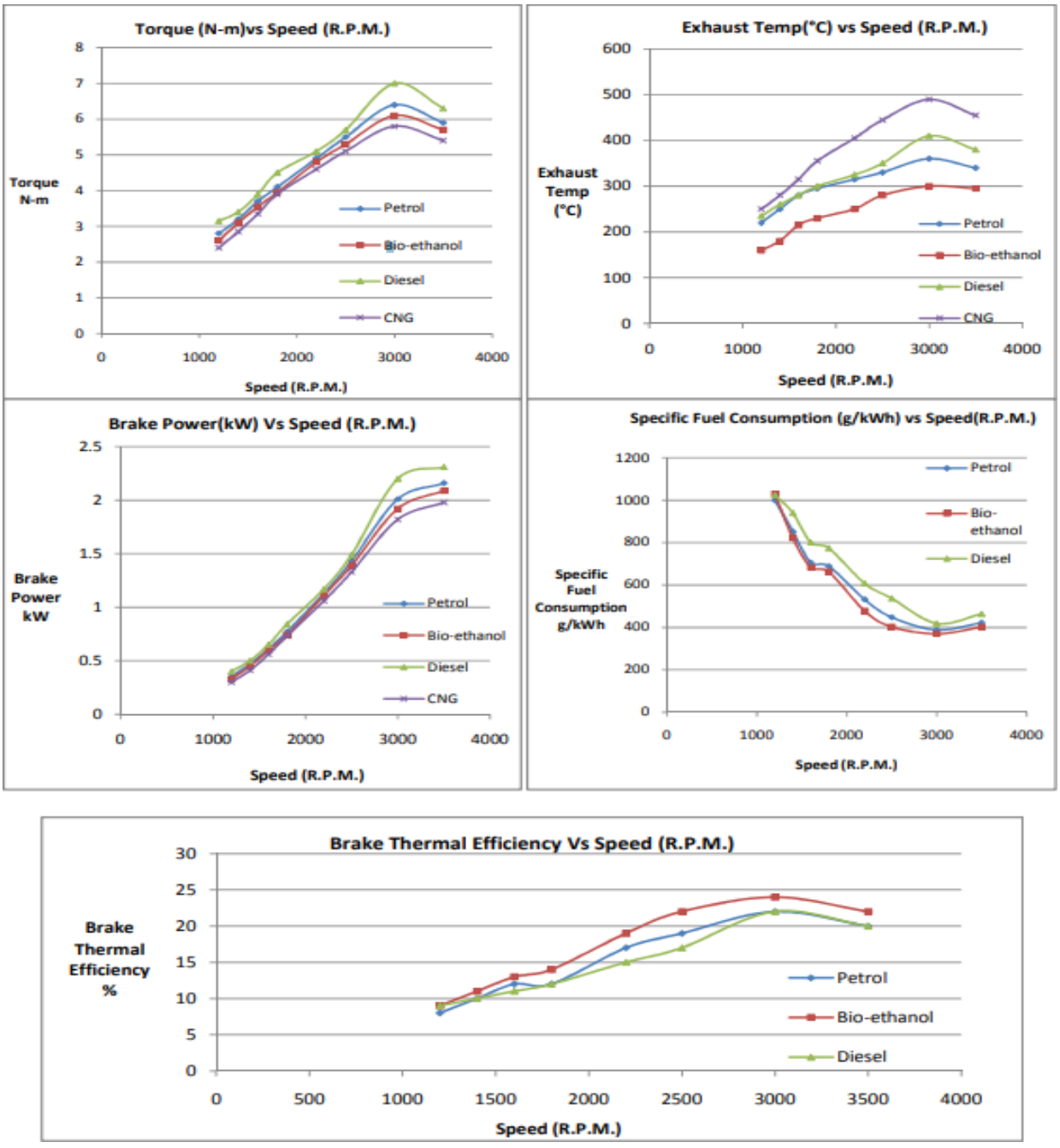

Fig. 2 Performance of different fuel

Comparison of alternative Fuels with Petrol and Diesel [4]

R.P.M. (Rev/min)	Fuels	Torque (Nm)	Temperature °C	Brake Power (kW)	Time for 8ml(s)	Brake Power Rate(kg/hr)	Brake Power (g/kWh)	BrakePower%
1200	Petrol	2.80	220	0.35	61.45	0.35	1000	8
	Bio-ethanol	2.60	160	0.33	63.3	0.34	1030.3	9
	Diesel	3.15	235	0.40	58.45	0.41	1025	9
	CNG	2.40	250	0.30	-	-	-	-
1400	Petrol	3.20	250	0.47	53.76	0.4	851.06	10
	Bio-ethanol	3.10	180	0.45	57.87	0.37	822.22	11
	Diesel	3.40	260	0.50	51.12	0.47	940	10
	CNG	2.85	280	0.41	-	-	-	-
1600	Petrol	3.70	280	0.61	49.5	0.43	704.91	12
	Bio-ethanol	3.55	215	0.60	52.44	0.41	683.33	13
	Diesel	3.90	280	0.65	46.45	0.52	800	11
	CNG	3.35	315	0.56	-	-	-	-
1800	Petrol	4.10	295	0.77	39.87	0.53	688.31	12
	Bio-ethanol	3.95	230	0.74	44.12	0.49	662.16	14
	Diesel	4.50	300	0.84	37.22	0.65	773.8	12
	CNG	3.90	355	0.73	-	-	-	-
2200	Petrol	4.90	315	1.13	36.9	0.58	531.27	17
	Bio-ethanol	4.80	250	1.11	40.18	0.53	477.48	19
	Diesel	5.10	325	1.17	34.15	0.71	606.84	15
	CNG	4.60	405	1.06	-	-	-	-
2500	Petrol	5.50	330	1.43	33.25	0.64	447.53	19
	Bio-ethanol	5.30	280	1.39	38.21	0.56	402.88	22
	Diesel	5.70	350	1.49	30.18	0.8	536.91	17
	CNG	5.10	445	1.33	-	-	-	-
3000	Petrol	6.40	360	2.01	27.45	0.78	388.06	22
	Bio-ethanol	6.10	300	1.92	30.14	0.71	369.79	24
	Diesel	7.00	410	2.20	26.11	0.92	418.18	22
	CNG	5.80	490	1.82	-	-	-	-
3500	Petrol	5.90	340	2.16	23.3	0.91	421.3	20
	Bio-ethanol	5.70	295	2.09	25.66	0.84	401.91	22
	Diesel	6.30	380	2.31	22.45	1.07	463.2	20
	CNG	5.40	455	1.98	-	-	-	-

Table 1. Different fuels in different parameters

Limitation

1. Ethanol is still far from being economically competitive when compared to energies deduced from fossil energies.

2. Biodiesel can achieve an energy rate as low as three to one. The product of biodiesel from crops, similar as soybean, can affect in adverse environmental goods.

3. Hydrogen is a largely ignitable substance and explosive in nature; it cannot be fluently transported from one place to another and it can be generated by the hydrolysis of water but it'sa veritably precious process.

4. Petroleum is unfriendly to the terrain. The transportation of petroleum tumbles. Petroleum is a skimp resource. Petroleum releases dangerous poisons. Petroleum contributes to acid rain

Conclusion

In the overall concept we came to understand that these various fuels have different efficiencies in internal combustion engine. While diesel gives more torque and brake power, bio- ethanol has least exhaust temperature and specific fuel consumption and hydrogen is least harmful to environment in these various fuels.

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Biographies

1) Name: Asst. professor, Mr. Priyank Machhi
Educational Qualification: ME In Thermal Engineering.

2) Name: Patel Bhupendra .R
Educational Qualification: Diploma in Tool and design engineering (IGTR)
BE Mechanical Engineering. (GTU)
Skills: Solid Works Mechanical

3) Name: Amin Bhargav .D
Educational Qualification: BE MechanicalEngineering. (GTU)
Skill: Basic Solid Works Mechanical &FDM

4) Name: Shrotriya Shrey .J
Educational Qualification: BE MechanicalEngineering. (GTU)
Skill: Basic Solid Works Mechanical & 3D Printer

5) Name: Vanzara Rajesh .N
Educational Qualification: BE Mechanical Engineering.(GTU)
Skill: Basic Solid Works Mechanical & Autocad