HIGHER ALCOHOL BLEND WITH PETROL: ALTERNATIVE FUEL FOR SI ENGINE A REVIEW

Mr.Sachin Dinkar Fulzele[1], Prof. C. B. Kothare[2], Prof. K.S. Raizada[3]

[1] *Mtech student, Mechanical Engineering Department, Shri shankarprasad Agnihotri college of Engineering, Wardha,Maharashtra,India*
[2] *Principal, Mechanical Engineering Department, Agnihotri School of technology, Wardha, Maharashtra, India*
[3] *Principal, Mechanical Engineering Department, Agnihotri college of Engineering, Maharashtra, India*

ABSTRACT

Internal combustion engine are the most preferred prime mover across the world. Spark ignition engine is preferred locomotive prime mover due to its smooth operation and low maintains. The gasoline is fossil fuel which is limited in reservoirs causes varieties of study in search of alternative fuel for SI engine, where alcohol promises best alternative fuel. Considering the energy crises and pollution problems today, investigations have concentrated on decreasing fuel consumption by using renewable alternative fuels and on lowering the concentration of toxic components in combustion product. An experimental investigation was conducted to determine the emission characteristics of higher alcohols and gasoline blends. While lower alcohols (methanol and ethanol) have been used in blends with gasoline, very little work has been reported on higher alcohols (propanol, butanol, and pentanol). The objective of this paper is to provide a thorough literature review on the current status of higher alcohol blends on performance characteristics and emission in SI engine and to guide the continuity study of improving performance characteristics and reduction emission using higher alcohol blends with petrol.

Keyword:-*Higher alcohol, gasoline, SI engine, emission characteristic, performance characteristics.*

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1. INTRODUCTION

The consumption of energy has ever-increasing trend mainly due to two reasons: (1) changes in lifestyles and (2) the significant growth of the population. Petroleum-based fossil fuels presently provide the major portion of the energy supply; however, their sources are limited on this Earth. In the twentieth century, the research emphasis was on the development of fossil crude oil, coal, and natural gas based refinery to exploit the cheaply available fossil feed stock to meet the growing demand of the population. In the 21st century, the adverse effect of greenhouse gas emissions on the environment, together with declining petroleum reserves and future energy security, is pronounced well. The combustion of fossil fuels is a big contributor to carbon dioxide (CO_2) emission, which is a direct contributor to global warming. Every year about 25 billion ton of CO_2 are generated worldwide by anthropogenic activities. Therefore, the present research is focused on alternative energy sources for sustainable development of the economy and society. Fossil fuels still represent 80% of total energy supply whereas biofuel contribute only 1%. The main alternative fuels utilized so far are oxygenates (alcohol, ether etc.), vegetable oils and their esters, gaseous fuel (hydrogen, liquefied petroleum gas etc.), gas to liquids (GTL) and coal derivatives. Ethanol has attracted attention worldwide because of its potential use as an alternative automotive fuel. Use of ethanol as a fuel is not a new concept. In 1826, Samuel Morey developed an engine that ran on ethanol. The use of ethanol blended with diesel was a subject of research in the 1980s. At that time, it was shown that ethanol blends were technically acceptable as a fuel for existing engines. However, the relatively high production cost of ethanol at that time hindered its regular use and made it a backup fuel in cases of fuel shortages. However, the economics have become much more favorable for the production of ethanol and it is now able to compete with standard petroleum-based fuel.

2. LITERATURE REVIEW

Literature review is a body of text that aims to review the critical points of current knowledge and or scientific methodological approaches on the topic related to the study. In this chapter, literature will give information about the background knowledge in internal combustion engine field and other technologies that being used as references to generate idea to conduct this study.

Mridul Gautam and Daniel W. Martin II [1] conducted experiment to determine the of emission characteristics of higher alcohols and gasoline (UTG96) blends. The cycle emissions (mass per unit time) of CO, CO2, and organic matter hydrocarbon equivalent (OMHCE) from the higher alcohol/gasoline blends are all within 5% of those emissions from neat gasoline. Cycle emissions of NOx from the blends were 15% - 18% higher than those from neat gasoline. However, for all the emissions species considered, the brake specific emissions (mass per unit time per unit power output) were significantly lower for the higher alcohol/gasoline blends than for neat gasoline. Cycle fuel consumption (mass per unit time) of higher alcohol/gasoline blends ranged from 3% to 5% higher than neat gasoline. The brake specific fuel consumption (BSFC) (mass per unit time per unit power output) for the blends ranged from 15% - 19% lower than the BSFC of neat gasoline.

Furey (1985) [2] investigated RVP changes in gasoline when methanol, ethanol, and higher alcohols were added. His findings showed that very small amounts of alcohol in the blend drastically increased the RVP, and methanol seemed to have a more dramatic effect on RVP than higher alcohols. Hence, using higher alcohols as co-solvents in alcohol/gasoline blends seems to be a viable option for controlling RVP and, consequently, for controlling evaporative emissions.

Reddy (1986) [3] compared the evaporative emissions of blends containing three levels of methanol and tertiary butyl alcohol (TBA) with gasoline of closely matched RVP. Three different fuel metering systems were tested: carburetor, throttle body injection (TBI), and multiport fuel injection (MFI). The alcohol blends generated the same vapor levels as gasoline matched to the same ASTM D 439 volatility.

H S Farkade and A P Pathre [4] has investigated three alcohols in two parts. Comparative study of methanol, ethanol and butanol on the basis of blending percentage is first part, followed by investigation of oxygen role on the basis of oxygen percentage in the blend. The result shows highest replacement of gasoline by butanol at 5 % of oxygen content, the performance of same oxygen percentage for other two alcohols are also better. Presence of oxygen gives you more desirable combustion resulting into low emission of CO, HC and higher emission of CO_2 as a result of complete combustion, higher temperature is also favorable for NOx emission resulting higher emissions for it.

Alvydas Pikūnas, Saugirdas Pukalskas and Juozas Grabys [5] has investigated experimentally and compare the engine performance and pollutant emission of a SI engine using ethanol–gasoline blended fuel and pure gasoline. The results showed that when ethanol is added, the heating value of the blended fuel decreases, while the octane number of the blended fuel increases, the engine power and specific fuel consumption of the engine slightly increase; CO emission decreases, HC emission decreases in some engine working conditions; and CO2 emission increases.

Palmer [6] used various blend rates of ethanol–gasoline fuels in engine tests. Results indicated that 10% ethanol addition increases the engine power output by 5%, and the octane number can be increased by 5% for each 10% ethanol added. He also indicated that 10% of ethanol addition to gasoline could reduce the concentration of CO emission up to 30%.

A Y F Bokhary, Majed Alhazmy, Nafis Ahmad and Abdulrahman Albahkali [7] explored the effects of using ethanol- unleaded gasoline fuel blends on engine performance and exhaust gas emissions in a spark ignition engine. The results showed that blending of unleaded gasoline with ethanol increases the brake torque, brake power, brake mean effective pressure, volumetric and brake thermal efficiencies and reduce the brake specific fuel consumption. Also the results showed that when ethanol is added, the carbon monoxide (CO) and carbon dioxide (CO_2) emission concentrations in the engine exhaust decrease, while the nitric oxide (NO) concentration increases.

Rupali S.Tupkar et.al [8] work on Experimental Investigation of four stroke spark ignition engine using alcohol petrol blends was studied by In his work he prepared different alcohol petrol blends and find out optimum petrol blend for S.I. Engine and he conclude that ethanol -gasoline blended fuels, the power output, fuel consumption, thermal and volumetric efficiency of the engine increase.CO and HC emissions decrease dramatically as a result of the leaning effect caused by the ethanol addition; and CO2 emission increases because of the improvement of combustion. It shows that ethanol can be used as a supplementary fuel to gasoline in modern spark ignition engines without major changes, and it can help to save our environment from toxic pollutants and to save a considerable part of the available oil.

Renhua Feng, Jing Yang, Daming Zhang, Banglin Deng, Jianqin Fu, Jingping Liu, Xiaoqiang Liu [9] conducted experiment on a single cylinder motorcycle engine for two operating modes of full load and partial load at 6500 rpm and 8500 rpm with pure gasoline and 35% volume butanol–gasoline blend. The experimental results showed that engine torque, BSFC, CO emissions and HC emissions are better than that of pure gasoline at both full load and partial load with 35% volume butanol and 1% H2O addition, combined with the modified ignition timing. But NOx and CO2 emissions are worse than that of the original level of pure gasoline.

P. Xyradakis, Th. Gialamas, I. Gravalos, D. Moshou, D. Kateris, Z. Tsiropoulos, A. Augusti, K. Tsatsarelis [10] experimentally conducted investigation of emissions characteristics of pure and high alcohol/gasoline fuel Blends. The exhaust emissions of CO and HC from the pure-high alcohol/gasoline blends are lower than those emissions from neat gasoline, with the reduction being higher the higher the percentage of ethanol in the blend. The CO_2 exhaust emissions have an opposite behavior when compared to the CO exhaust emissions. Emissions of NO from the pure and high alcohol/gasoline fuel blends were higher than those from neat gasoline. The comparative results of CO, CO_2, HC and NO exhaust emissions between pure-high alcohol/gasoline and pure alcohol/gasoline fuel blends indicate that addition of longer-chain alcohols cause higher emissions except CO.

Jing GONG, Yingjia ZHANG, Chenglong TANG and Zuohua HUANG [11] studied various emission characteristics of the engine, including NOx, CO, CO2, and particulate matter emissions in a spark-ignition engine fueled with various iso-propanol/gasoline blends. The main results are NOx emission gives the highest value at full load. The introduction of EGR reduces NOx emission. HC and CO emissions show inconspicuous variations at all the loads except L = 10. HC emission indicates no obvious difference in all the blending ratios except pure propanol while CO emission gives the lowest value at x = 40%. There exists critical spark timing, lager than MBT timing, generating the highest PM number concentration for all the blending ratios.

3. CONCLUSION

From the literature review it is concluded that higher alcohol blend with gasoline improves brake thermal efficiency and brake specific fuel consumptions (performance characteristics). Also emission characteristics of higher alcohol blend with gasoline are also improved. A research study can be done on higher alcohol/gasoline blends on variable compression ratio at different torque.

4. REFERENCES

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