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A Review on Effect of Blends of Higer Alcohol on Emission of Si Engine

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ABSTRACT

The world in the 21st century presents many critical challenges. One of the most important challenges is the environment. As population increases and the standard of living improve, there is a growing concern that there will be a shortage of energy to heat our homes and power the vehicles on which we so heavily depend. We must also remember the need for clean air, clean water, cleaner burning fuels, and biodegradable, renewable materials. Advances in technology have allowed development of alternative energy sources. Alternative energy sources are renewable, cleaner, and more dependable than traditional fuels.Presently ethanol is found to be best alternative fuel blended with gasoline. Many researches have been made on higher alcohol blend with petrol which can reduce the emissions characteristics of SI engine. The objective of this paper is to provide a thorough literature review on the current status of higher alcohol blends on emission in SI engine and to guide the continuity study of reduction emission using higher alcohol blends with petrol.

INTRODUCTION

Internal combustion engines have been in use for more than a century and have undergone tremendous changes in design, materials used and operating characteristics. Never ones during their long history of development have they lost their importance as the planet most widely used prime movers. In the past few decades, research efforts have been focused largely on better spark ignition engine, from the perspective of reducing the pollutant emissions without sacrificing performance and fuel economy. Another driving force behind the need to design engines amenable to operate on non-conventional fuels is the rapid depletion rate of currently used fossil fuels. The importance of environment and energy is emphasized in various sectors. Increase in stringent emission regulations and anticipated depletion of worldwide petroleum reserves in future provide a strong encouragement to carry out research on alternate fuels. In view of heavy consumption of gasoline due to individual transport, the search for alternative fuels has become compulsory. The alcohol as a alternative fuel has been suggested for automobiles. The alcohol used to change/modify the attitude toward the present fuel, i.e., gasoline and Search for New alternatives. Alcohol is a good substitute as alternative fuel for use in SI engine. It has good compatible property with gasoline fuels. Their octane rating is also more than 100.if alcohols are added in a small amount with gasoline in SI engine then there is no need to make any modification in engine. As we all know that modification in engine and change in composition of fuel are two methods by which we can improve the performance of an engine and can reduce the environmental pollution.

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.

H S Farkade and A P Pathre [1] 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.

Renhua Feng, Jing Yang, Daming Zhang, Banglin Deng, Jianqin Fu, Jingping Liu, Xiaoqiang Liu [2] 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.

Wei Yanju, Liu Shenghua, Li Hongsong, Yang Rui, Liu Jie, and Wang Ying [3] investigated Three typical methanol-gasoline blends M10, M20, and M85 containing 10%, 20%, and 85% of methanol by volume, respectively. Experimental results show that the engine power/torque ratio under the wide open throttle condition mainly depends on the amount of heat delivered to the engine. The addition of methanol significantly improves the brake thermal efficiency, while the methanol/gasoline ratio has a slight effect on it. Engine out CO and NOx emissions decrease with the increase of the methanol/gasoline ratio. The use of M85 leads to a reduction of CO and NOx by about 25% and 80%, respectively.

Sahib Shihab Ahmed [4] has discussed the performance and exhaust emissions of a vehicle fueled with low content alcohol (methanol) blends and pure gasoline. In this study, experiments have been done to measure the performance and emissions of a 4-stroke S.I. Engine, one by using the commercial imported gasoline, another by using the gasoline-methanol blends. The engine is run at different loads and methanol blending percentages . It is found that increasing the blending percentage reduces the emitted concentration of carbon oxides and HC . However it is found that break power and break thermal efficiency are increased with increasing methanol blending percentage due to higher cylinder temperatures.

Mridul Gautam and Daniel W. Martin II [5]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) [6] 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) [7] 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.

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.

Alvydas Pikūnas, Saugirdas Pukalskas and Juozas Grabys[12]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 [13] 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%.

Liangjie Wei, C.S. Cheung, Zuohua Huang [14], In this study, experiments were conducted to examine the effect of using a mixture of diesel and n pentanol,which is one of the second-generation biofuels with comparable properties to diesel fuel, as fuel on the combustion, performance, and gaseous and particulate emissions of a naturally-aspirated, four-cylinder, direct-injection diesel engine. Three n-pentanol fractions in the fuel mixture were selected: 10, 20 and 30% by volume. Results show that, the addition of n-pentanol leads to longer ignition delay and increases the peak heat release rate in the premixed combustion phase. The brake specific fuel consumption increases with increase of n-pentanol, while the brake thermal efficiency is not affected. Regarding the gaseous emissions, n-pentanol addition results in the following consequence: (a) HC (hydrocarbon) and CO (carbon monoxide) emissions increase for 30% n-pentanol in the blended fuel at low engine load but decrease at high engine load; (b) a slight increase (maximum 8%) in NOx emissions but noticeable increase in NO2 emissions. Regarding the particulate emissions, n-pentanol is found to be very promising in terms of reducing both the mass concentration and the particulate number concentration simultaneously.

CONCLUSION

From the literature review it is concluded that exhaust emission (CO, HC and NOx) of SI engine can be reduced by blending higher alcohol with gasoline. A research study can be done on higher alcohol/gasoline blends on variable compression ratio at different torque.

REFERENCES

[1] H S Farkade and A P Pathre, Experimental investigation of methanol, ethanol and butanol blends with gasoline on SI engine, International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 4, April 2012)

[2] Renhua Feng, Jing Yang, Daming Zhang, Banglin Deng, Jianqin Fu, Jingping Liu, Xiaoqiang Liu, Experimental study on SI engine fuelled with butanol–gasoline blend and H2O addition, Energy Conversion and Management 74 (2013) 192–200.

[3] Wei Yanju, Liu Shenghua, Li Hongsong, Yang Rui, Liu Jie, and Wang Ying, Effects of Methanol/Gasoline Blends on a Spark Ignition Engine Performance and Emissions, School of Energy and Power Engineering, Xi′an JiaotongUniVersity, Xi′an 710049, ChinaReceived July 2, 2007. ReVised Manuscript ReceiVedNoVember 20, 2007.

[4] Sahib Shihab Ahmed , Effect of Methanol – Gasoline Blends on S.I. Engines Performance and Pollution, International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS Vol:13 No:05.

[5]MridulGautam And Daniel W. Martin II, Chapter 20, EMISSIONS CHARACTERISTICS OF HIGHER ALCOHOL/GASOLINE BLENDS.

[6] Furey, Robert L., "Volatility Characteristics of Gasoline-Alcohol and Gasoline-Ether Fuel Blends," SAE Paper No. 852116, 1985.

[7]Reddy, S. R., "Evaporative Emissions from Gasolines and Alcohol-Containing Gasolines with Closely Matched Volatilities," SAE Paper No. 861556, 1986.

[8] Mrs. RupaliS.Tupkar, Mrs. Manisha S. Lande, Ms. PrernaS.Borkar, Mr.V.S.Shende "Experimental Investigation of four stroke spark ignition engine using alcohol petrol blends" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 33-37.

[9] Renhua Feng, Jing Yang, Daming Zhang, Banglin Deng, Jianqin Fu, Jingping Liu, Xiaoqiang Liu, Experimental study on SI engine fuelled with butanol–gasoline blend and H2O addition, Energy Conversion and Management 74 (2013) 192–200.

[10] P. Xyradakis, Th. Gialamas, I. Gravalos, D. Moshou, D. Kateris, Z. Tsiropoulos, A. Augusti, K.

Tsatsarelis Emissions characteristics of spark ignition engine operating on pure and high alcohol blended gasoline fuels, Efficient and safe production processes in sustainable agriculture and forestry XXXIV CIOSTA CIGR V Conference 2011.

[11] Jing GONG, Yingjia ZHANG, Chenglong TANG, and Zuohua HUANG, Emission Characteristics of Iso-Propanol/Gasoline Blends in a Spark-Ignition Engine Combined With Exhaust Gas Re-Circulation, THERMAL SCIENCE: Year 2014, Vol. 18, No. 1, pp. 269-277

[12] AlvydasPikūnas,SaugirdasPukalskas and JuozasGrabys,influence of composition of gasoline – ethanol blends on parameters of internal combustion engines, Journal of KONES Internal Combustion Engines 2003, vol. 10, 3-4.

[13]Palmer, F.H., 1986. Vehicle performance of gasoline containing oxygenates. International conference on petroleum based and automotive applications. Institution of Mechanical Engineers Conference Publications, MEP, London, UK, pp. 33–46.

[14] Liangjie Wei, C.S. Cheung, Zuohua Huang, Effect of n-pentanol addition on the combustion, performance and emission characteristics of a direct-injection diesel engine, Energy 70 (2014) 172-180.