

ANALYSIS OF ETHANOL-GASOLINE-BUTANOL BLENDS IN SI ENGINES: A REVIEW

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ABSTRACT

Three different compositions of alcohol-gasoline blends are used and analyzed on the basis of developments made after going through the earlier researches and papers. These blends are compared with pure gasoline and readings are concluded into result which shows composition having butanol and ethanol in 10 and 15 percentages respectively showed satisfactory results in terms of engine performance and emissions.

Keywords: Alcohols; SI Engines; Emissions; Exhaust Gas Analyzer.

1. INTRODUCTION

Earlier researches have showed the positive impact of different alcohols including methanol, ethanol, propanol hexanol and butanol. The effects on performance like efficiency, power were different based on the use of particular alcohol composition and were different for emissions too. Mainly effect of ethanol alone was most positive and now using butanol with it gave more satisfactory result.

2. BIOFUELS

Ethanol, due to its unique and typical attributes like highvalue of octane number, higher evaporation heat and properties in basic form like low emissions, anti-knocking and oxygenating makes it more utilizable in the blends of gasoline-ethanol. Being a bio-renewable and bio-

degradable alcohol cum fuel, ethanol can be employed in SI engines while mixing with gasoline. Many researchers earlier investigated about ethanol utilization efficiently but still some improvement is always there for others also and for them too.



Figure 1.1 Bio-Ethanol

A no. of ethanol-gasoline mixtures containing diverse volume percentage of ethanol are taken into account. From the analysis, the result achieved was increased torque and enhanced combustion efficiency but the fuel consumption also increased. As a result of leaning effect emission of gases like NO_x, CO and HC declined and the increased heat of evaporation also contributed in it, also the carcinogenic or cancer causing pollutants and particulate matter also decreased by the use of ethanol-gasoline blends. [26]

3. SCARCITY OF FUEL IN NEAR FUTURE

Soon we will be seeing fossil gone extinct from the world as people are consuming it in an extensive manner, environment is getting contaminated and energy crisis is not far enough. An earlier research contains experimental investigation and analysis part of ethanol-gasoline blends and also the use of it. Due to low calorific value, the fuel consumption found to be high with increasing percentage to around 20% to 30% of alcohol and temperature of exhaust gases decreased, while volumetric efficiency and thermal efficiency increased.

Increasing requirements and today's condition clearly indicates that the no. of vehicles will jump and the transport segment will harm globally the most. Thus, some strict political decisions and amendments should be made to cope up with this alarming situation. There is a need of the hour to search for alternative to the conventional fuel as its supply could lean soon.[3]



Figure 2.1 Bus running on ethanol

4. THE EMISSIONS

4.1 The Regulated Emissions

To fix the regulated pollutants emission and to update them so that they and their limits are implemented to the conventional fuels – diesel and gasoline, certain methods are employed. The methods are- 1.Flame Ionization detection of unburnt hydrocarbon 2.Non Dispersive Infrared Detection 3. Gravimetric analysis of particulates.



Figure 3.1 Smoke from a truck

4.2 The Unregulated Emissions

When, for an example, methanol is burnt with gasoline, the amount of unburnt aldehydes and methanol decreases. Emissions that are unregulated are influenced by the alcohol usage with the gasoline.

Whereas, when parallel addition of ethanol is made, unburnt ethanol and methanol elevates and release from the exhaust with increased nitrite. And the emissions released are consists of approx. 90% of unidentified emissions with their health effects unknown.

Table 1.1 Properties of alcohols- Butanol, Ethanol and Gasoline

Butanol	Ethanol	Gasoline
Chemical formula	C_4H_9O	C_2H_5OH
	C_4-C_{12}	
Lower heating value (MJ/KG)	33.026.8	42.9
Density (kg/m ³)	810790	736
Octane Number	89 100	97(R + M)/2
Latent heat of vaporization	716904380-500	
Stoichiometric Air/Fuel ratio	11.2	9.0 14.7
Stoichiometric Calorific Value(MJ/KG)	2.70	2.68 2.73

Those emissions are considered which harm both humans and animals and have higher tendency to increase greenhouse gases and forming haze.[3]These are accepted as potent carcinogen, irritating and highly allergic having two most common forms- acetaldehyde and formaldehyde. [17]

5.CALCULATION OF PARTICULATE EMISSIONS

The particulate matter determination is performed through a different process based on weight commonly known as Gravimetric Analysis and implemented at temperatures not more than 52°C.The researches reports have shown and awareness has been widespread that the rats are prone to lung cancer and tumor and majorly due to TiO_2 and carbon black from the diesel exhausts.

As concluded by the studies, amount, surface area and particle size are the important aspects and unit constraints of particles. So, as a result,for emissions scrutiny and observation should be performed on the basis of particle size and quantity.



Figure 4.1 Exhaust coming out from a vehicle

6.NITROGEN DIOXIDE

The higher temperature of the exhaust leads to more release of the Nitrogen Oxide as the combustion

temperature increases, Nitrogen Oxide emissions also increases. Oxidation of Nitrogen is caused by air and then it forms Nitrogen Oxides-Nitrogen oxide and Nitric oxide.

Asthma patients and kids are affected more as it increases the respiratory diseases in them and causes acid rain when NO_x reacts with air. Being legalized pollutant, NO and NO₂ are not considered singular or individually also it pollutes coastal waters. It is also responsible for polluting coastal waters. NO_x is a joint sum of both NO and NO₂ and not considered individually and is a legalized pollutant.

7. PRESENT PICTURE OF OTHER COUNTRIES

A topic for discussion is still there on the use percentage of ethanol that can be used with gasoline such that it doesn't impact the engine material and parts. It should not let wear the engine, so that it does not require much service as compared to gasoline.

Still, in U.S.A, it has been approved that gasoline can be used with 10% ethanol and will not influence and effect the service bond/contract of automobile. .

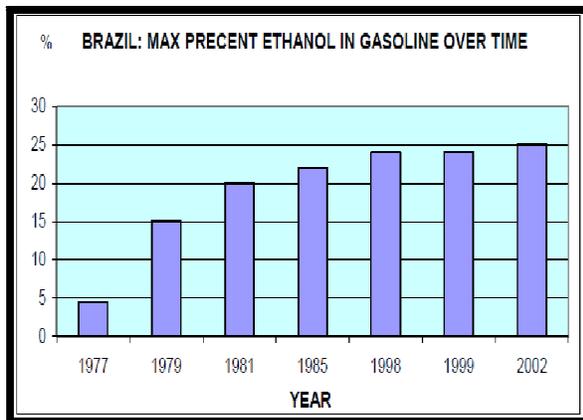


Figure 6.1 Use of ethanol over time in Brazil

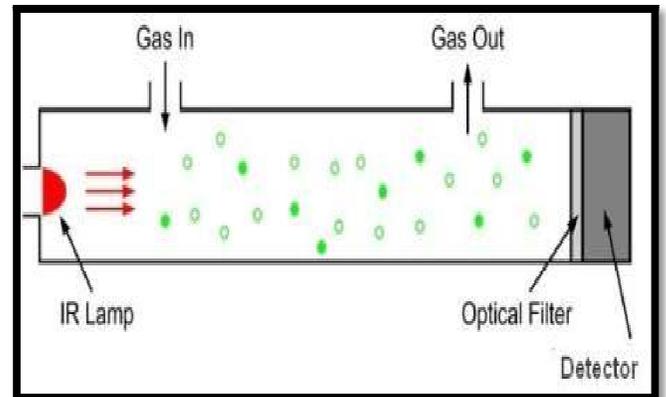
7.1 Scenario of India

In 70's much like other countries India too faced price hike of crude oil and then the interest in butanol arouse. After that many plans were made so that an alternative is found to replace crude oil. Around 94 vehicles including jeep, vans and cars etc. were employed so that tests are carried out on them in which 5 and 10 % ethanol was employed with gasoline. Abrupt rise was noted in the blends of gasoline-ethanol when agriculture sector wanted improved and better air quality.

8. ANALYZER USED- NDIR

We have used a four gas analyzer which can detect the amount of 1. unburned hydrocarbons (HC) 2. oxygen (O₂) 3. carbon dioxide (CO₂), and 4. carbon monoxide (CO).

This is how it works -



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