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EXPERIMENTAL ANALYSIS OF GASOLINE - ADULTERATED WITH KEROSENE

AMEET P. GAWANDE[1*], JAYANT P. KAWARE[2]

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Abstract

Petroleum products, especially automotive fuels are the most extensively used source of energy, everywhere in the world. The same international trend is true in India as well. Petrol, Diesel and kerosene are used in transportation, construction, industries, power generation, agriculture, household cooking and lighting in rural areas.

It is generally believed that a major portion of kerosene is bypassed for adulterating other fuel products such as Gasoline and Diesel. Fuel adulteration is common everywhere including India. The fuel adulteration problem is the case in India as explained by, Shenoy (2010) referring to The National Council of Applied Economic Research (NCAER, 2005) estimated that around 38 % of kerosene diverted from its intended use, was associated with environmental pollution, problems with engine performance, and tax losses. Current paper investigates the effects of adulteration of Gasoline with kerosene on the performance characteristics of gasoline.

Keywords- Adulteration, Gasoline, Kerosene, Pollution, Emissions

1. INTRODUCTION

The practice of fuel adulteration is not rare. Illegitimate practices while trading is a universal occurrence. Adulteration is significant along with less distribution of fuel to clienteles. These manipulations result in damaged engines and aggravating air quality along with escaping fuel taxes, sinking government income. Under-distribution supplies to buyers contribute to customer losses. Mixing kerosene with gasoline may have damaging deposits in engines. In India; it is mainly due to the substantial price variance amongst products, and also various products of analogous properties have diverse prices or common people don't have any effective tool to distinguish between clean fuel and adulterated, devious operatives will constantly try to feat the condition for monitory gains.

India consumed 4,443,000 barrels of fuel per day in 2016. Given this level of fuel consumption size, analyzing the level of adulteration and shading light on what is at stake will be of significant interest. Even then the data comprising of the harmful effects of fuel adulteration is unavailable. In India, Gasoline contributes as a main automotive fuel. Mixing of kerosene with the same at the point of purchase, during conveyance, and by the end-user such as drivers of Intermediate public transport (Auto Rickshaws), which function on the Indian streets in great records, has developed a critical problem across the country. We don't see the above problem in the economies which allow the capability of fuel manufacturers to update or keep pricing, built on market demand. In the current paper, we investigate the settled techniques for gasoline adulteration with kerosene causing deviations in the qualities of gasoline.

2. OBJECTIVE

The study intended to evaluate the effect of adulteration of gasoline with kerosene on some specific properties of gasoline such as Aromatic hydrocarbon content, sulfur content, and BTEX components, applied to different proportional mixtures of fuel & adulterant.

Special emphasis was given to BTEX compound as Benzene was classified as class-I carcinogen marked by the World Health Organization, which is prominently used as octane booster by most of the fuel refineries.

3. SCOPE

Right to Breath is inevitably Right to Clean Air. A clean and eco-friendly realm is a necessity nowadays. For this, we should reflect and deed as an ecologist. The type of transportation, particularly private conveyance indicates the spread of society, adding furthermore automotive to streets, contributing to the release of an enormous volume of contaminants from the tailpipe of these engines, ride on fossil fuels.

4. LIMITATIONS

This study is dealing with one of the few areas covered by others and naturally was not without challenge and

[1]Department of Chemical Engineering, College of Engineering & Technology, Akola , India
[2]Principal, Rajrshi Shahu College of Engineering Buldhana , India
*Corresponding author email-apg.coeta@gmail.com

limitations. Because fuel quality and standards and compliance are relatively complex matters, as far as possible, much care and attention were given to ensure the study was relatively adequately structured to accomplish its goal. Considering the size of the malpractices of adulteration in India and various possible combinations of automotive fuel with lots of adulterants available, which would require huge resources, time, manpower, and funds set the primary boundary of limitations.

Secondly, the study could not assess other adulteration combinations for eg. Diesel mixed with kerosene. It could not also accommodate all aspects of the fuel adulteration checking mechanism, however, most of the test methods of the international standard on fuel quality were carried out.

5. EXPERIMENTATION (MATERIALS & METHODS)

To assess the variations in the range of parameters applied to different proportional mixtures of fuel and adulterant according to the degree of adulteration in the fuel (Gasoline), various blends of base fuel (Gasoline), and additive (Kerosene) were prepared.

5.1 Materials

The raw material for study i.e. base fuel and the adulterant were locally available petrol and kerosene. Stages involved were a) Procurement of materials: Gasoline (07 liters) was bought from a local HPCL petrol pump. The contaminant fuel used was kerosene (07 liters), obtained from indigenous sources. b) Preparation of blends: 11 specimens of 500 ml each, Gasoline-kerosene combinations were arranged at room temperature for diverse volume portions, to ensure the complete composition array, and kept in different bottles. Gasoline and kerosene blended in 10:00, 9:1, 8:2, 7:3, 6:4, 5:5, 4:6, 3:7, 2:8, 1:9, and 00:10 ratios respectively, used to assess variations in the number of parameters, according to the degree of adulteration.

5.2 Methods

To check the properties of blended fuel & compare it with standard literature available for clean fuels, we assessed some parameters of each blend & pure sample of Gasoline & kerosene. The parameters used to assess the variations in the properties of base fuel with adulteration are Aromatic hydrocarbon composition, Sulphur content & BTEX composition. Appropriate test procedures were used to assess the variations in the above parameters.

6. RESULTS AND DISCUSSION

6.1 Aromatic Hydrocarbons

Generally, aromatic hydrocarbons do not affect the quality of fuel & efficiency of combustion. But at the same time, increased amount of aromatics in fuel has a bad impact on the environment in terms of high pollutant by vehicle exhausts. Results below in the figure unveiled the odd fact that an increased amount of kerosene in the gasoline significantly reduces the aromatic content from various mixture combinations. This test also revealed the fact that the gasoline (petrol) that is available at the petrol pumps (Gas stations) contains nearly twice (65.25 vol. %) the maximum permissible aromatic hydrocarbons as per standards (35 vol. %).

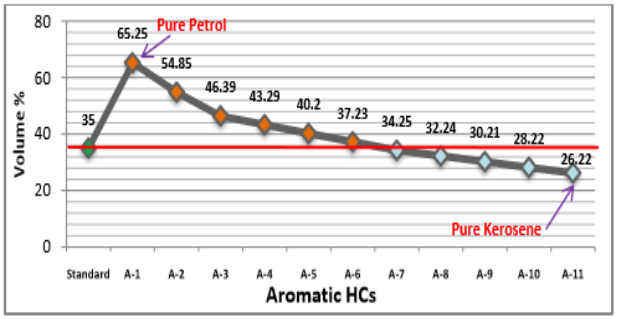

Figure 1 Results for Aromatic Hydrocarbons

6.2 Sulphur (as S)

Sulphur as a whole, whether as a liquid component or as an air pollutant, proved to be damaging to the engine & pollution reduction system of the vehicle as well as on the environment. The high content of sulphur in gasoline may initiate a pronounced effect on cylinder and ring wear as well as the degradation of the catalyst in the emission control system.

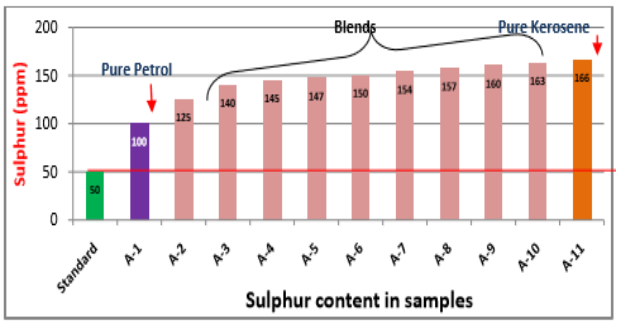

Figure 2 Sulphur composition in fuel samples

All the Gasoline- kerosene mixtures containing 10-90% kerosene (Samples A-2 to A-10) confirm the well-established fact that kerosene being a sulphur dominant fuel, its addition to gasoline, surely increases sulfur content in the gasoline. The most horrible thing found out in this test is that whether the limit of sulfur content in the gasoline as specified by the regulatory authority of India is limited to 50 ppm maximum, the fuel being sold out in class III cities is containing 100 ppm sulfur, nearly two times the standard specifications.

6.3 BTEX Compound

The compound is made up of Benzene, Toluene, Ethyl-benzene, and Xylenes, abbreviated as BTEX, which is found in a wide range of petroleum products including coal tar, crude petroleum. When emitted to the atmosphere, BTEX compounds disperse quickly into the air and are water-soluble also.

After the phasing out of lead from gasoline, the BTEX compound is used to achieve higher octane ratings of gasoline. As we substitute lead from gasoline with BTEX compound, being lead a heavy metal causing damage to the central nervous system and impairing neurological development in children, we eventually forgot that BTEX is more dangerous than lead itself and notified as a class-I carcinogen by the world health organization.

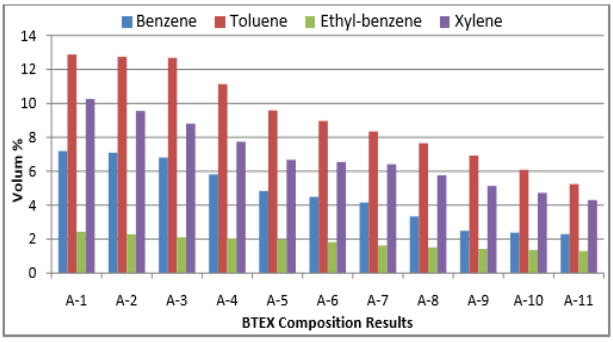

Figure 3 The BTEX Composition findings

The composition of all four components in the BTEX complex was found to be elevated in the sample of pure gasoline. However, the addition of kerosene to gasoline significantly decreases the elevated fraction of BTEX compound from the gasoline. It was observed that for pure gasoline to pure kerosene; benzene ranges from 7.19-2.3 %, toluene shows values between 12.88 – 5.25%, while ethyl-benzene records the lowest composition of all four, from 2.43 – 1.30%, xylene fraction declined from 10.25 to 4.30 volume %. During the combustion of fuel in an engine, all these elements are released to the environment through tailpipe exhaust. The benzene being converted to toluene, due to a photochemical reaction with methyl free radical, the toluene concentration in samples was found to be higher than that of benzene and this phenomenon clarifies why benzene has a lesser concentration when gasoline is mixed with kerosene.

7. CONCLUSION

The fact that difficulty in onsite, real-time detection of fuel adulteration shared with the variance duty structure makes such illegal practices monetarily appealing, even though it is punishable. Blending of adulterants such as kerosene with gasoline, leads to an increase in tailpipe emission, bringing down the availability of PDS kerosene due to its diversion to the black market, to the underprivileged, and forcing them to use crop waste and other biomass for cooking. This causes an escalation in indoor air pollution and subsequent adverse effects on healthiness. Our study reveals that for the avoidance of deliberated contamination, continuous quality monitoring of petroleum products at the dispersal point as well as at the end-users, therefore, is highly essential. The results of fuel quality on various parameters suggest that even pure fuel, the oil marketing companies are selling to us are not fulfilling the prerequisite of fuel quality, let adulteration. They are loaded with high concentrations of BTEX complex, which are notified as a threat to human health. Sulphur and aromatic content were found to be nearly double which makes the scenario further worse.

Clear scientific shreds of evidence emerged from the results showed that higher concentrations of aromatic hydrocarbons in gasoline due to the addition of kerosene, pollutants particularly gases and particulate matter, increases. High concentrations of aromatics, regularly combined to boost the anti-knock property of the fuel, are found to be forerunners of particulate pollutants. An increased sulphur content due to adulteration results in premature wear of engine components and deactivation of the catalyst in the emission control system. To decrease fuel sulfur concentrations for lowering the vehicle emissions, it is necessary to modify lubricants without compromising fuel economy, or decreasing the oil change frequency. This could be accomplished by using lubricants with sulphur-free detergents, using a higher quality base stock, and increasing the use of antioxidants.Increased hydrocarbon content in the petrol is a result of the addition of heavier fuel to the petrol which aggravates particulate emissions from the exhaust. On the contrary, kerosene blended with petrol decreases the harmful and deadly air toxins- the BTEX complex, with the increasing fraction. However, due to partial burning of the BTEX compound from gasoline, very tiny particulate matter and aromatic hydrocarbons are formed, which have severe health impressions even at low intensities. These are cancer-causing and genotoxic. They are also linked to progressive disorders and degeneration of nervous tissues, malignancies (Cancer), and weakening of the heart and lungs.

The establishment of unleaded gasoline in India has reduced the threat imposed due lead but exchanged it with benzene and toluene from the BTEX component, both terminal cancer-causing agents. These chemicals are added to unleaded petrol to raise the octane level, and they should be trapped by catalytic converters; however, they lose their efficiency due to adulterated fuel. Also, most of our vehicle fleet is does not equipped with catalytic converters. Threats from contaminated fuel are real; it is not some hypothesis. It affects equally to all, who are on our roads. It will distress us at present; it will disturb us in the future. The hazards add up and are disastrous.

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