

The Adulteration of Gasoline and it's Harmful Effects on the Environment in Islamabad

Shazeen Khan and Amal Sadozai, Brent R. Loken

The International School of Islamabad

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Abstract

Gasoline adulteration is the addition of pollutants in pure gasoline for the cause of gaining profit. We focused on the gasoline adulteration in Islamabad's urban and rural areas and found out about The Hydrocarbon Carbon Development Institute of Pakistan (HDIP) and its work in Gasoline adulteration. We collected an interview in HDIP, which helped us to gain more information about the status of gasoline adulteration in Pakistan since the past few years. We also learnt about the harmful effects of gasoline on car engines and the environment. We conducted experiments to test for adulteration in both the urban and rural regions of the city. We collected samples from the three major oil companies in Pakistan and then went to two villages. The experiments we conducted consisted of distillation, gravity and fuel efficiency test. All these three tests showed us if the gasoline was adulterated and did not meet the American Standard Methods for Testing. Our results showed that the level of gasoline adulteration in cities like Islamabad has decreased since the past few years but still exists in some rural areas. We also learnt that this problem could further be helped if companies like HDIP carry on regular tests and the Ministry of Petroleum supports the tests and works forward towards an adulterant free gasoline and a pollutant free environment.

Keywords

Organic Chemistry, Gasoline Adulteration, Distillation, Hydrocarbon, Physical Properties, Pollutants

Hypothesis

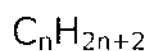
We hypothesize that gasoline in Islamabad is not as adulterated as before but some Adulteration still exists that is harmful for both the engine of the car and the environment.

Introduction

“High pollution accompanies the adulteration of gasoline and diesel with lower-priced materials throughout South Asia,” said Jitendra Shah, senior environment engineer with the World Bank in Washington” (Shawal, 2004). This report was stated in a newspaper article in THE NEWS in 2004. Adulteration of gasoline and diesel is very common in South Asia than compared to other countries in the world. One of the countries facing this problem is Pakistan. The newspaper article also stated that “Nearly 95 percent of the random samples of T2 engine oil that we ran a check on in Lahore and other Pakistani cities like Islamabad was adulterated,” said a spokesman for GSDN(Global Sustainable Development Network)” (Shawal, 2004). After some research we realized that gasoline adulteration was a problem in cities of Pakistan and wanted to explore the causes and effects of gasoline adulteration in Islamabad. We hypothesized that gasoline in Islamabad is not as adulterated as before but some adulteration still exists that is harmful for both the engine of the car and the environment.

Gasoline adulteration is when pollutants are added to pure gasoline merely for profit (Burgess, 2004). Gasoline is a complex mixture of hundreds of hydrocarbons. The

hydrocarbons vary by classes starting from paraffins, olefins, naphthenes, and aromatics and, within each class, by size. This mixture of hydrocarbons (and oxygenates) in a gasoline determines its physical property and engine performance characteristics. Gasoline is an alkane, a compound that is found in basic organic chemistry (Schuetzle, 1994). In chemistry organic means anything that consists of a carbon atom and thus organic chemistry deals with molecules consisting of carbon atoms. The simplest organic compounds consist of carbons and hydrogen atoms that are known as hydrocarbons which alone run into millions. The simplest members of this series of alkane hydrocarbons are methane and every member after that has more carbon atoms than the previous one (Hamilton, 2004). All of the bonds are single bonds (-C-H-, and -C-C-). The chains can be either straight or branched. The lighter members of the series are fuels and gasses while the middle ones range from 7 to 12 carbons include liquids like gasoline that are used in petrol . (Katsiavriades, 1998) A general formula for these series of compounds is:



Gasoline does not have a definite formula as it consists of many hydrocarbon atoms. It has a boiling point of 35°C to 205°C. Gasoline adulteration has been a problem in Islamabad for many years now. Most of the gasoline in Pakistan is imported from countries such as Iran and Saudi Arabia. Provinces in Pakistan such as Sindh and Balochistan supply the rest (ESMAP). The same company supplies Shell, PSO, and Caltex. Usually the suppliers adulterate their product because it increases the profit immensely. Adulterants such as kerosene and solvent oils are much cheaper than gasoline

therefore they are cheaper for suppliers. If the suppliers get cheaper materials they make a bigger profit.

The adulterants are added into gasoline by mixing small amounts of distilled fuels such as diesel, kerosene and solvent oils into automotive gasoline, adding industrial solvents into automotive gasoline, adding lubricants into automotive gasoline and adding heavier fuel into automotive gasoline. One of most commonly used adulterant in Islamabad is Kerosene as it is very cheap. Kerosene is a complex mixture of hydrocarbons from a variety of chemical processes, which is blended to meet standardized product specifications (Brown, 1997). The composition of it varies from hydrocarbons of C-9 to C-16 and has a boiling range of 180°C to 235°C. It has stronger chemical bonds than gasoline and thus when it is added to gasoline it changes its physical property. This is because when added it increases the boiling point of gasoline as it has a higher boiling point (Chevron, 2002)

Due to it having a higher boiling point Kerosene also damages the engine of the car and releases harmful pollutants for the environment. The pollutants led out during the combustion of kerosene include carbon dioxide and carbon monoxide. Due to the addition of the other adulterants tailpipe emissions also include hydrocarbons (HC), carbon monoxide (CO), and nitrogen oxides (NO_x), which contribute to air quality problems in some urban areas. Some other non regulated emissions such as benzene, 1,3-butadiene, and polycyclic organic material (POM) are considered toxic to humans (Schuetzle 1994) . Adulterants vary greatly they can be derived from crude oil or even lubricants. There are many ways to test for adulterants such as density, evaporation, distillation, gas chromatography, ash content determination and markers. Gas

chromatography is a tool used to separate different compounds that are derived from crude oil such as gasoline. However it is not used in Pakistan for separating gasoline.

The adulterants that are added into the gasoline also harm the engine of the cars. The engines are harmed as during the process of combustion many of the adulterants leave the pollutants that are formed during this process in the engine of the car, thus polluting the engine or causing the stalling or knocking of the engine. Another way they harm the engine is because they require a much higher combustion level and because they are not as efficient and pure as gasoline,



Fig-14- Our interview with Mrs. Shahnaz Alam, the principal chemist at HDIP.

they decrease the efficiency of the engine.

Due to these harmful affects of gasoline on the car the owners have a lot of complaints. They take their samples to The Hydrocarbon Development Institute of Pakistan or HDIP. Along with other tests, HDIP tests for adulteration in different fuels such as gasoline. When we found out about HDIP and its work in gasoline adulteration we decided to go and interview the principal chemist who is in charge of the Geochemistry Section. Her name was Shahnaz Alam and we asked her questions relating gasoline and their work in the field of gasoline adulteration. We found out that they used the American standard testing method (ASTM) for conducting their experiments. She