International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No. (03), January 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

DISASTER CONTROL MANAGEMENT THROUGH CO-RELATIONAL STUDY OF BS-III AND BS-IV TYPE GASOLINE (PETROL) QUALITY

Mayank Mehta[1], Praveen Jain[1], Apoorva Upadhyay[3]

[1,2]*Department of Chemistry, Barkatullah University Bhopal M.P, (India)*

[3]*Department of Chemistry, Dr. H.S. Gour University, Sagar M.P.(India)*

ABSTRACT

The purpose of this paper is to evaluate physico-chemical properties of BS-III and BS-IV type gasoline and evaluated the disaster control through study. The present study focused on qualitative assessment of gasoline by using Bureau of Indian Standards (BIS) and American Society for Testing and Materials (ASTM) Petro methods and minimize mishandling and problem during transportation. In this study we find out relation between Density@15^{0}C Vs RVP@38^{0}C & VLI or lighter content. Density is increasing with decrease RVP value, decrease VLI value.

Keywords: Gasoline, Octane number, Density, Reid Vapour Pressure, Vapour lock Index.

I. INTRODUCTION

Gasoline is a volatile, flammable liquid procured from the refinement of petroleum, or crude oil. Initial boiling point of gasoline has an at atmospheric pressure of about 30 °C (86 °F) and a final boiling point of about 200 °C (392 °F).[1-4] Primarily it was discarded as a by-product of washing solvent production, but its ability to vaporize at low temperatures made it, as a useful fuel for many machines. Crude Distillation Unit (CDU) and cracked stream from fluidized Catalytic Cracker Unit (FCC) with the overhead boiling range are blended to obtain required motor gasoline. Gasoline became the favored automobile fuel because it releases a great deal of energy when burned. It mixed readily with air in a carburetor. Initially it was cheaper due to large supply, but now its cost increases promptly, except where subsidized. Gasoline was first formed by distillation. A gasoline's octane number indicates its ability to resist knocking (premature combustion) and can be transformed by changing the proportions of certain components.

Variety of additives which can be classified as oxygenated, aromatic, light and heavy aliphatic hydrocarbons, are used in the adulteration of commercial gasoline. The majority of these compounds being natural constituents of gasoline.[5] The addition of solvents changes the original composition of the fuel, affecting the physicochemical properties in different ways.[6] Distillation curves, vapor pressure and octane rating are properties directly related to the fuel composition and the characteristics of its components. [7-9] Simple alcohols and ethers are used as gasoline additives for the reduction of pollutants from vehicle exhaust gases. Proponents of these oxygenates claim several advantages: they are octane enhancers,[10] they have

significant anti-knock properties important for unleaded fuels, they can be formed from renewable agricultural raw materials instead of fossil sources, they not only reduce carbon monoxide emission from vehicle exhaust. But also reducing the emission of carbon monoxide (CO) and unburned hydrocarbons, minimizing the emission of volatile organic compounds.[11-15] Methyl tert-butyl ether (MTBE) is the oxygenate most commonly employed to enhance the octane number of gasoline.[16]

Bharat stage emission standards are emission standards instituted by the Government of India to control the output of air pollutants from internal combustion engine equipment, counting motor vehicles. The standards and the timeline for implementation of BS standards are set by the Central Pollution Control Board under the Ministry of Environment & Forests and climate change.[17] Progressively stringent guidelines have been rolled out since then. All new vehicles manufactured after the implementation of the norms have to be compliant with the regulations.[18] Since October 2010, Bharat stage III norms have been come into force across the country. In 13 major cities, Bharat stage IV emission standards have been in place since April 2010.[19] In 2016, the Indian government publicized that the country would skip the BS V norms altogether and adopt BS VI norms by 2020.[20]

While the norms help in reducing down pollution levels, it invariably results in increased vehicle cost due to the better advanced technology & higher fuel prices. However, this increase in private cost is offset by savings in health costs for the public, as there is lesser amount of harmful particulate matter and pollution in the air. Exposure to air pollution is the root cause of respiratory and cardiovascular diseases, which is estimated to be the cause for 620,000 early deaths in 2010, and the health cost of air pollution in India has been assessed at 3 per cent of its overall GDP.

The significance of gasoline impelled us to evaluate physico chemical properties of BS-III and BS-IV type gasoline and evaluated the relationship between various parameters in different types of petrol. The present study focused on qualitative assessment of gasoline by using Bureau of Indian Standards (BIS) and American Society for Testing and Materials (ASTM) Petro methods and determined their various physico chemical parameters. In this study we used standard IS Specification 2796:2008. This standard made as per previous study on basis of some parameters like air pollution, climate parameters, etc. Nowadays no. of vehicle and temperature was increase, climate parameter was also change due to this problem we required extra precaution for safe our environment.

II. EXPERIMENTAL SECTION

2.1. Materials and methods

The present study carried out by using standard method for Qualitative and Quantitative characterization of gasoline. This study was performed in a Quality Control Lab of Bharat Oman Refinery Limited Bina (BORL). This lab was certified by DGCA, DGAQA, CEMILAC, and NABL accredited. In this study we were used manual & automatic method for determining physico chemical parameter by used BIS standard and ASTM Standard methods.[21-35]This study was divided into four parts. First part of this study is qualitative and quantitative characterization of BS-III type of fuel for 06 samples. Second part of this study is qualitative and

quantitative characterization of BS-IV type of fuel for 05 samples. Each part of study the sample was analyzed 18 parameters by using calibrated instrument.

The physico chemical parameters was used for characterization of gasoline is Colour, Density, Distillation, Anti-knock index, RON (research octane number), MON (motor octane number), Existent Gum, Potential Gum, Sulphur, Lead Content, RVP(Reid vapour pressure), VLI (vapour lock index), Benzene content, Copper Strip Corrosion, Composition, Oxidation Stability, Oxygen Content and Oxygenates. The samples were taken for first part of study TMM-1, TMM-2, TMM-3, TMM-4, TMM-5 and TMM-6, second part of study FMM-1, FMM-2, FMM-3, FMM-4 and FMM-5from BORL (BDT) sample points. The each sample was taken 06 lit in aluminum container (capacity up to the upper surface is 1.0 lit) and preserve into spark proof cooling unit (capacity up to -30^{0}C) for 02 hours. All samples were taken in evening or night hour for minimize lighter evaporation.

At the time of production gasoline (without adding dye) color was yellow. Due to some regulatory requirement and identification purpose dye is added for domestic use. The sample was selected as per different density for complete analysis. The data was tabulated in an increasing manner with respect to the density. The physicochemical parameters of BS-III and BS-IV types' gasoline are summarized in **Table 1 and 2**.

Table 1: Physicochemical parameters of BS-III Type Gasoline

S.No.	PARAMETER		UNIT	OBSERVATION					
				TMM-1	TMM-2	TMM-3	TMM-4	TMM-5	TMM-6
1	**Colour / Visuality**		-	Orange	Orange	Orange	Orange	Orange	Orange
2	**Density**		Kg/M^3	736.7	742	747.8	750.9	754.7	758.8
3	**Distillation**	**A) Recovery up to 70°C**	%v	31.8	28.5	24.5	20.1	19.2	13.7
		B) Recovery up to 100°C	%v	57.8	55.0	49.6	49.8	45.7	42.9
		C) Recovery up to 150°C	%v	92.5	91.7	91.0	92.1	87.6	87.0
		D) FBP	°C	177.0	177.1	177.0	181.8	187.6	190.2
		E) Residue	%v	0.9	1.0	1.1	1.0	0.9	1.0
4	**Anti-knock index**		-	87.4	87.5	87.1	87.2	86.9	86.6
5	**Research Octane Number**		-	91.9	91.9	91.7	91.7	91.8	91.5
6	**Motor Octane Number**		-	82.8	83.1	82.5	82.6	81.9	81.7

International Journal of Advance Research in Science and Engineering
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www.ijarse.com
IJARSE
ISSN: 2319-8354

7	**Existent Gum**	g/m^3	6.9	6.1	6.9	6.2	7.8	7.7
8	**Potential Gum**	g/m^3	7.4	7.0	8.1	6.9	9.2	9.0

Continued……

9	**Total Sulphur**		ppm wt	35	32	38	40	32	34
10	**Lead Content**		gm/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
11	**Reid Vapour Pressure**		kPa	57.6	54.0	56.3	52.8	51.9	45.0
12	**Vapour lock Index**		-	798.6	739.5	734.5	668.7	653.4	545.9
13	**Benzene Content**		%V	0.66	0.41	0.92	0.74	0.68	0.79
14	**Copper Strip Corrosion**		-	1a	1a	1a	1a	1a	1a
15	**Composition**	**A) Olefin Content**	%v	0.88	1.00	1.37	1.19	1.04	1.08
		B) Aromatics Content	%v	33.61	35.22	38.40	38.67	39.80	40.44
16	**Oxidation Stability**		minutes	>360	>360	>360	>360	>360	>360
17	**Oxygen Content**		%wt	Nil	Nil	Nil	Nil	Nil	Nil
18	**Oxygenates Content**	**A) Methanol**	%v	Nil	Nil	Nil	Nil	Nil	Nil
		B) Ethanol	%v	Nil	Nil	Nil	Nil	Nil	Nil
		C) Iso-propyl alcohol	%v	Nil	Nil	Nil	Nil	Nil	Nil
		D) Iso-butyl alcohol	%v	Nil	Nil	Nil	Nil	Nil	Nil
		E) Tertiary-butyl alcohol	%v	Nil	Nil	Nil	Nil	Nil	Nil
		F) Ethers & 5 or more	%v	Nil	Nil	Nil	Nil	Nil	Nil

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IJARSE
ISSN: 2319-8354

		carbon atoms							
		G) other Oxygenates	%v	Nil	Nil	Nil	Nil	Nil	Nil

Table 2: Physicochemical Parameters of BS-IV Type Gasoline

S.No.	**PARAMETER**		**Unit**	**OBSERVATION**				
				FMM-1	**FMM-2**	**FMM-3**	**FMM-4**	**FMM-5**
1	**Colour / Visuality**		-	Orange	Orange	Orange	Orange	Orange
2	**Density**		Kg/M^3	732.5	735.3	737.1	740.4	742.6
3	**Distillation**	**A) Recovery up to 70°C**	%v	34.6	32.3	28.8	29.20	27.7
		B) Recovery up to 100°C	%v	61.9	60.0	58.8	57.2	54.5
		C) Recovery up to 150°C	%v	92.8	91.9	92.7	92.8	89.3
		D) FBP	°C	169.8	178.5	173.6	180.0	185.0
		E) Residue	%v	1.1	0.9	1.0	0.8	1.0
4	**Anti-knock index**		-	87.0	86.6	87.2	87.0	86.6
5	**Research Octane Number**		-	91.8	91.6	91.6	91.6	91.4
6	**Motor Octane Number**		-	82.1	81.6	82.8	82.3	81.7
7	**Existent Gum**		g/m^3	4.6	7.2	4.6	6.0	7.5
8	**Potential Gum**		g/m^3	5.4	7.8	5.4	7.9	8.5
9	**Total Sulphur**		ppm wt	12	15	16	20	11
10	**Lead Content**		gm/l	<0.005	<0.005	<0.005	<0.005	<0.005
11	**Reid Vapour Pressure**		kPa	54.7	52.2	51.5	50.2	48.2
12	**Vapour lock Index**		-	789.2	748.1	716.6	706.4	675.9

13	**Benzene Content**	%V	0.45	0.76	0.73	0.76	0.68

Continued….

14	**Copper Strip Corrosion**	-	1a	1a	1a	1a	1a
15	**Composition** **A) Olefin Content**	%v	0.98	1.06	1.05	1.31	0.96
	B) Aromatics Content	%v	30.4	31	32.4	32.1	33.5
16	**Oxidation Stability**	minutes	>360	>360	>360	>360	>360
17	**Oxygen Content**	%wt	Nil	Nil	Nil	Nil	Nil
18	**Oxygenates Content** **A) Methanol**	%v	Nil	Nil	Nil	Nil	Nil
	B) Ethanol	%v	Nil	Nil	Nil	Nil	Nil
	C) Iso-propyl alcohol	%v	Nil	Nil	Nil	Nil	Nil
	D) Iso-butyl alcohol	%v	Nil	Nil	Nil	Nil	Nil
	E) Tertiary-butyl alcohol	%v	Nil	Nil	Nil	Nil	Nil
	F) Ethers & 5 or more carbon atoms	%v	Nil	Nil	Nil	Nil	Nil
	G) other Oxygenates	%v	Nil	Nil	Nil	Nil	Nil

III. RESULTS AND DISCUSSION

The present studies find out some relation between Density Vs RVP (Reid Vapors Pressure), and Density Vs VLI (Vapors Lock Index). On the basis of characterization data of the BS Type Fuel the following conclusions have been drawn:

(i) The present study find out relation between Density@15^{0}C (unit is Kg/M^3) and RVP@38^{0}C (Unit is KPa). Density is increasing with decrease RVP value its mean your lighter part of product are decrease with

decreasing your RVP value. This relation presented by **Fig 1** and **2**. The graph was sketched between density and RVP. The Graph was find approximate linear relation for BS-III & BS-IV.

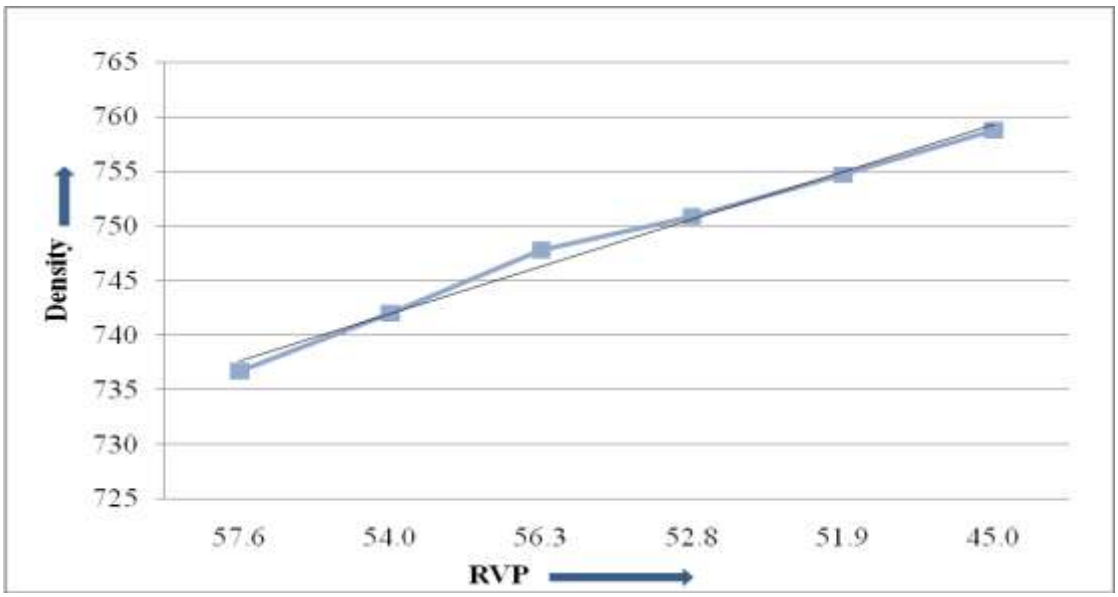

Fig 1 Graphical representation BS-III type Gasoline Density@15^{0}C Vs RVP@38^{0}C

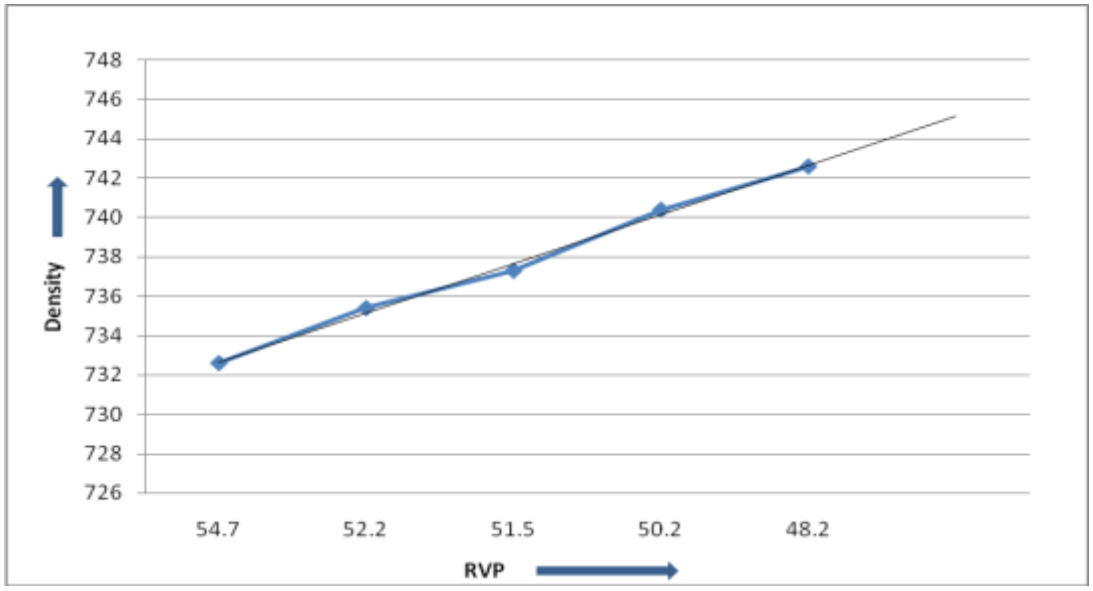

Fig-2 Graphical representation BS-IV type Gasoline Density@15^{0}C Vs RVP@38^{0}C

(ii) The present study find relation between Density@15^{0}C (unit is Kg/M3) and VLI (Vapors Lock Index). Density is decrease with increase VLI value. VLI (7x70^{0}C dist.+10xRVP) is a joint product of RVP and Distillation Value (Rec@70^{0}C). Its mean lighter part of product gives maximum VLI. This relation presented by **Fig 3** and **4**. The graph was sketched between density and VLI. The graph was find approximant linear relation for BS-III & BS-IV.

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Volume No.07, Special Issue No. (03), January 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

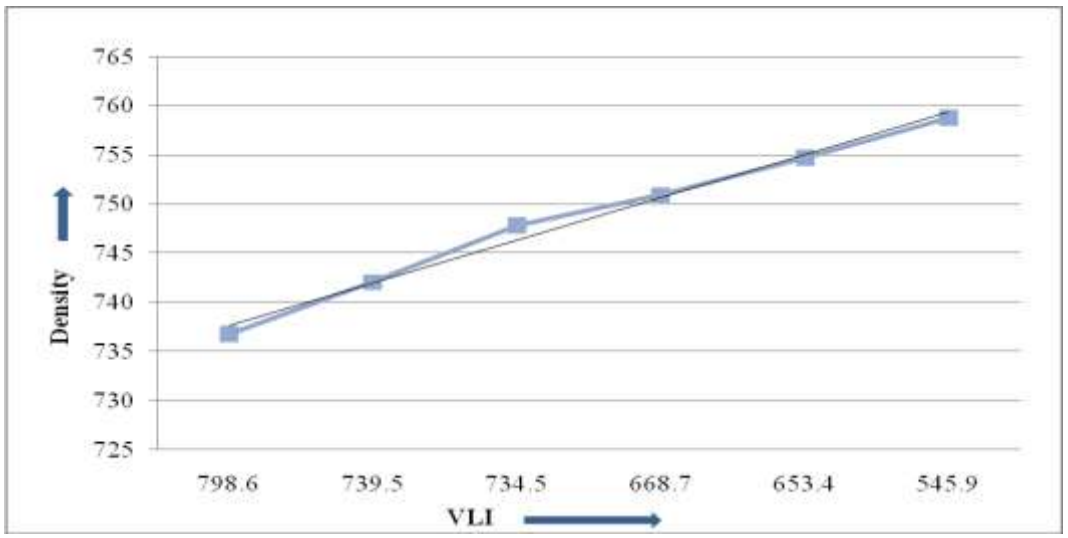

Fig-3 Graphical representation BS-III type Gasoline Density@15^{0}C Vs VLI

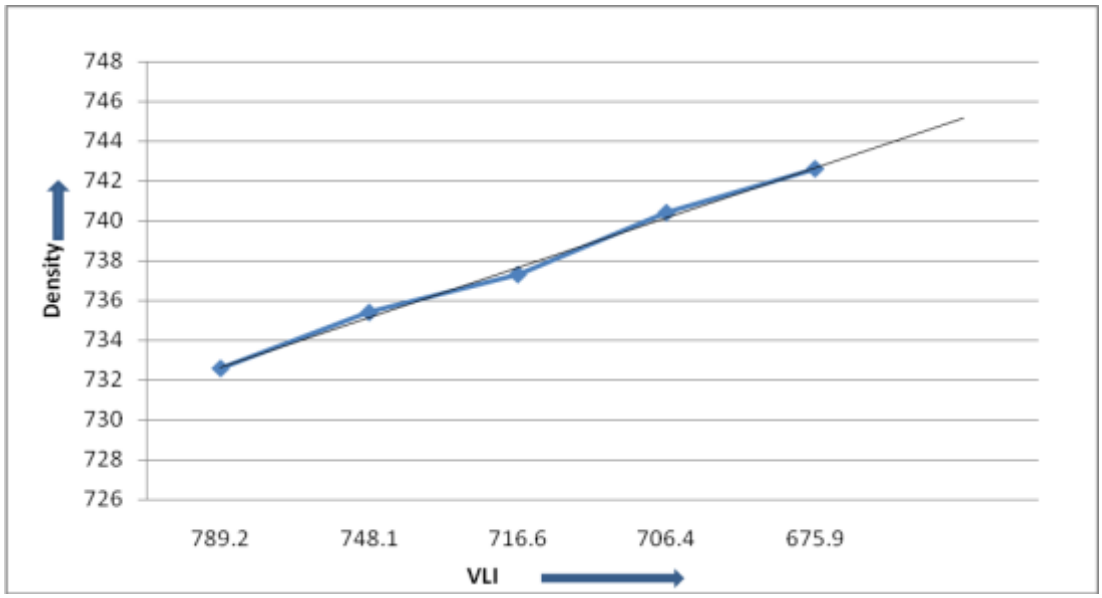

Fig-4 Graphical Representation BS-IV type Gasoline Density@15^{0}C VS VLI

(ii) The gasoline products were made by blending of isomerate and reformate product by the fluidized Catalytic Cracking process. Isomerate part of product is lighter (C5 or lighter carbon) compare with reformate (C6 or C6+ carbon Content). Lighter part of gasoline product is directly related to IBP, VLI and RVP Value. Lighter part (volume) of product is increase with increasing RVP Value, VLI and decreasing IBP Value. The gasoline standard (IS 2796:2008) was made as per standard condition on 2008. Nowadays climate temperature (>47^{0}C) is increasing due to pollution. In this condition we need take extra precaution in handling, transportation & storage of gasoline.

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