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Research Article

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QUALITATIVE ANALYSIS OF PETROL IN LOCAL PETROL FILLING STATION BY USING GAS CHROMATOGRAPHY

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ABSTRACT

In order to our academic training projects we did analysis of petrol sample from our Narasaraopet city. We are collected petrol samples from different Petrol bunks. With Optima G.C instrument, FID Detector we analyzed the sample in our laboratory. Nitrogen is used as carrier gas. From pur reports we concluded few of petrol sellers selling impure petrol.

Key words: Gas Chromatography, F.I.D Detector, Packked Column, N2 Gas, Narasaraopet Town.

INTRODUCTION

The term petroleum was found (in the spelling "petraoleum") in 10th-century Old English sources.[6] It was used in the treatise De Natura Fossilium, published in 1546 by the German mineralogist Georg Bauer, also known as Georgius Agricola.[7] In the 19th century, the term petroleum was frequently used to refer to mineral oils produced by distillation from mined organic solids such as cannel coal (and later oil shale), and refined oils produced from them; in the United Kingdom, storage (and later transport) of these oils were regulated by a series of Petroleum Acts, from the Petroleum Act 1862 c. 66 onward.

In its strictest sense, petroleum includes only crude oil, but in common usage it includes all liquid, gaseous, and solid (e.g., paraffin) hydrocarbons. Under surface pressure and temperature conditions, lighter hydrocarbons methane, ethane, propane and butane occur as gases, while pentane and heavier ones are in the form of liquids or solids. However, in an underground oil reservoir the proportions of gas, liquid, and solid depend on subsurface conditions and on the phase diagram of the petroleum mixture.[8]

An oil well produces predominantly crude oil, with some natural gas dissolved in it. Because the pressure is lower at the surface than underground, some of the gas will come out of solution and be recovered (or burned) as associated gas or solution gas. A gas well produces predominantly natural gas. However, because the underground temperature and pressure are higher than at the surface, the gas may contain heavier hydrocarbons such as pentane, hexane, and heptane in the gaseous state. At surface conditions these will condense out of the gas to form natural gas condensate, often shortened to condensate. Condensate resembles petrol in appearance and is similar in composition to some volatile light crude oils.

The proportion of light hydrocarbons in the petroleum mixture varies greatly among different oil fields, ranging from as much as 97% by weight in the lighter oils to as little as 50% in the heavier oils and bitumens.

The hydrocarbons in crude oil are mostly alkanes, cycloalkanes and various aromatic hydrocarbons while the other organic compounds contain nitrogen, oxygen and sulfur, and trace amounts of metals such as iron, nickel, copper and vanadium. The exact molecular composition varies

widely from formation to formation but the proportion of chemical elements vary over fairly narrow limits as follows:[9]

Composition by weight

Element	Percent range
Carbon	83 to 87%
Hydrogen	10 to 14%
Nitrogen	0.1 to 2%
Oxygen	0.05 to 1.5%
Sulfur	0.05 to 6.0%
Metals	< 0.1%

Four different types of hydrocarbon molecules appear in crude oil. The relative percentage of each varies from oil to oil, determining the properties of each oil.[8] Composition by weight Hydrocarbon Average Range Paraffins 30% 15 to 60% Naphthenes 49% 30 to 60% Aromatics 15% 3 to 30% Asphaltics 6% remainder. Crude oil varies greatly in appearance depending on its composition. It is usually black or dark brown (although it may be yellowish, reddish, or even greenish). In the reservoir it is usually found in association with natural gas, which being lighter forms a gas cap over the petroleum, and saline water which, being heavier than most forms of crude oil, generally sinks beneath it. Crude oil may also be found in semi-solid form mixed with sand and water, as in the Athabasca oil sands in Canada, where it is usually referred to as crude bitumen. In Canada, bitumen is considered a sticky, black, tar-like form of crude oil which is so thick and heavy that it must be heated or diluted before it will flow.[11] Venezuela also has large amounts of oil in the Orinoco oil sands, although the hydrocarbons trapped in them are more fluid than in Canada and are usually called extra heavy oil. These oil sands resources are called unconventional oil to distinguish them from oil which can be extracted using traditional oil well methods. Between them, Canada and Venezuela contain an estimated 3.6 trillion barrels (570×10^9 m^3) of bitumen and extra-heavy oil, about twice the volume of the world's reserves of conventional oil.[12]

Petroleum is used mostly, by volume, for producing fuel oil and petrol, both important *"primary energy"* sources.[13] 84% by volume of the hydrocarbons present in petroleum is converted into energy-rich fuels (petroleum-based fuels), including petrol, diesel, jet, heating, and other fuel oils, and liquefied petroleum gas.[14] The lighter grades of crude oil produce the best yields of these products, but as the world's reserves of light and medium oil are depleted, oil refineries are increasingly having to process

heavy oil and bitumen, and use more complex and expensive methods to produce the products required. Because heavier crude oils have too much carbon and not enough hydrogen, these processes generally involve removing carbon from or adding hydrogen to the molecules, and using fluid catalytic cracking to convert the longer, more complex molecules in the oil to the shorter, simpler ones in the fuels.

Due to its high energy density, easy transportability and relative abundance, oil has become the world's most important source of energy since the mid-1950s. Petroleum is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilizers, pesticides, and plastics; the 16% not used for energy production is converted into these other materials. Petroleum is found in porous rock formations in the upper strata of some areas of the Earth's crust. There is also petroleum in oil sands (tar sands). Known oil reserves are typically estimated at around 190 km^3 (1.2 trillion (short scale) barrels) without oil sands,[15] or 595 km^3 (3.74 trillion barrels) with oil sands.[16] Consumption is currently around 84 million barrels (13.4×10^6 m^3) per day, or 4.9 km^3 per year. Which in turn yields a remaining oil supply of only about 120 years, if current demand remain static.

Petroleum is a mixture of a very large number of different hydrocarbons; the most commonly found molecules are alkanes (linear or branched), cycloalkanes, aromatic hydrocarbons, or more complicated chemicals like asphaltenes. Each petroleum variety has a unique mix of molecules, which define its physical and chemical properties, like color and viscosity.

The *alkanes*, also known as *paraffins*, are saturated hydrocarbons with straight or branched chains which contain only carbon and hydrogen and have the general formula C_nH_{2n+2}. They generally have from 5 to 40 carbon atoms per molecule, although trace amounts of shorter or longer molecules may be present in the mixture.

The alkanes from pentane (C_5H_{12}) to octane (C_8H_{18}) are refined into petrol, the ones from nonane (C_9H_{20}) to hexadecane ($C_{16}H_{34}$) into diesel fuel, kerosene and jet fuel). Alkanes with more than 16 carbon atoms can be refined into fuel oil and lubricating oil. At the heavier end of the range, paraffin wax is an alkane with approximately 25 carbon atoms, while asphalt has 35 and up, although these are usually cracked by modern refineries into more valuable products. The shortest molecules, those with four or fewer carbon atoms, are in a gaseous state at room temperature. They are the petroleum gases. Depending on demand and the cost of recovery, these gases are either flared off, sold as liquified petroleum gas under pressure, or used to power the refinery's own burners. During the winter, Butane (C_4H_{10}), is blended into the petrol pool at high rates, because butane's high vapor pressure assists with

cold starts. Liquified under pressure slightly above atmospheric, it is best known for powering cigarette lighters, but it is also a main fuel source for many developing countries. Propane can be liquified under modest pressure, and is consumed for just about every application relying on petroleum for energy, from cooking to heating to transportation.

The *cycloalkanes*, also known as *naphthenes*, are saturated hydrocarbons which have one or more carbon rings to which hydrogen atoms are attached according to the formula C_nH_{2n}. Cycloalkanes have similar properties to alkanes but have higher boiling points.

The *aromatic hydrocarbons* are unsaturated hydrocarbons which have one or more planar six-carbon rings called benzene rings, to which hydrogen atoms are attached with the formula C_nH_n. They tend to burn with a sooty flame, and many have a sweet aroma. Some are carcinogenic.

These different molecules are separated by fractional distillation at an oil refinery to produce petrol, jet fuel, kerosene, and other hydrocarbons. For example, 2,2,4-Trimethylpentane (isooctane), widely used in petrol, has a chemical formula of C_8H_{18} and it reacts with oxygen exothermically:[17]

$$2\ C_8H_{18(l)} + 25\ O_{2(g)} \rightarrow 16\ CO_{2(g)} + 18\ H_2O_{(g)} + 10.86\ \text{MJ/mol (of octane)}$$

The amount of various molecules in an oil sample can be determined in laboratory. The molecules are typically extracted in a solvent, then separated in a gas chromatograph, and finally determined with a suitable detector, such as a flame ionization detector or a mass spectrometer.[18] Due to the large number of co-eluted hydrocarbons within oil, many cannot be resolved by traditional gas chromatography and typically appear as a hump in the chromatogram. This unresolved complex mixture (UCM) of hydrocarbons is particularly apparent when analysing weathered oils and extracts from tissues of organisms exposed to oil.

Incomplete combustion of petroleum or petrol results in production of toxic byproducts. Too little oxygen results in carbon monoxide. Due to the high temperatures and high pressures involved, exhaust gases from petrol combustion in car engines usually include nitrogen oxides which are responsible for creation of photochemical smog.

MATERIALS AND METHODS

For analysis of different petrol samples in Narasaraopet town, we collected petrol sample from different petrol bunks.

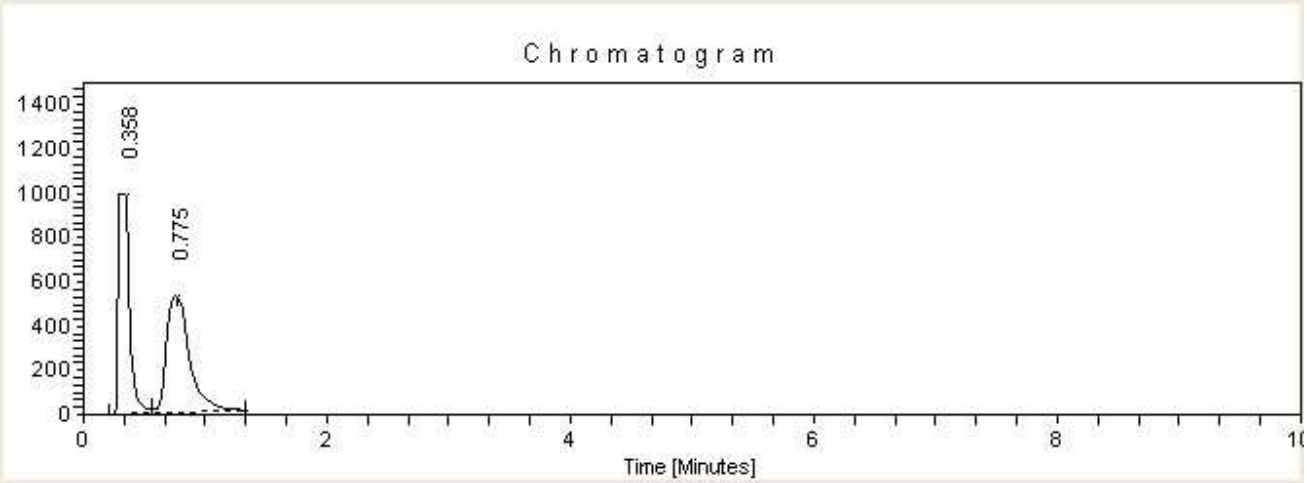
TABLE.1

1	G.V	OPTIMA 2800
2	DETECTOR	F.I.D
3	COLUMN	PACKKED
4	CARRIER GAS	N_2
5	TEMPARATURE PROGRAMMING	Inject port :45 c Column : 39 c Detector: 50 c
6	Runtime	10 min

RESULTS AND DISCUSSION

G.C WORK

File Name	:	Petrole
Print Date	:	18/12/2010
Print Time	:	3:44:39 PM



Result-A Table

Peak No	Retn.Time	Area	Height	Area %	Height %	Width@50%
1	0.358	6456.527	996.201	48.626	65.208	0.117
2	0.775	6821.396	531.538	51.374	34.792	0.184
Total		**13277.923**	**1527.739**	**100**	**100**	

S.NO	SAMPLE	PURITY IN %
1	PETROLE BUNK - 1	99.2
2	PETROLE BUNK – 2	99.5

3	PETROLE BUNK – 3	98.3
4	PETROLE BUNK – 4	99.1
5	PETROLE BUNK – 5	95.3
6	PETROLE BUNK - 6	97.3

TABLE.2

The analysis of petrol sample in our Narasarao pet town, tells that few of petrole bunks selling impure petrole. We clearly found that the petrol bunks where nearby vehicle rush, those bunks are adding some another oils. Due to legal problems we are not mentioned names of Petrol bunks.

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