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Determination of Saturated Hydrocarbon from Nigerian Crude Oil from Selected Oil Wells: A Comparative Study

*Idris; S. U[1], B. B; Usman[2], A.B; Muhammad[2], Atiku; F.A[3], N; Tijjani[4] and I. Muhammad[5]
[1]National Biotechnology Development Agency, (BIODEC) Katsina State.
[2]Department of Pure and Applied Chemistry, Usmanu Danfodiyo University, Sokoto.
[3]Department of Pure and Applied Chemistry, Kebbi State University of Science and Technology, Aleiro.
[4]Energy Commission of Nigeria, Plot 701C Central Business District, PMB 358, Abuja.
[5]Department of Chemistry, Zamfara State Collage of Education, Maru, PMB 1002, Zamfara State.
*Corresponding Author mails: abuameerat@gmail.com ,+2347031111114

Abstract

The saturated hydrocarbons were isolated from the crude oil samples by the use of SARA separation and column chromatography methods. The fractions obtained were identified using GC-MS. The result shows that the saturated hydrocarbons presence in the samples indicate that all the samples spectra indicated the presence of Trans-decalin-2-methyl, Dodecane, Tridecane, Tetradecane, Pentadecane, Hexadecane, Octadecane, Nonadecane and Eicosane, all at a minimum quality of correlation of 70%. The result of the GC-MS indicated that sample D has the highest number of saturated hydrocarbons presence in a minimum quality of % correlation of 70% and sample E has the lowest amount of saturated hydrocarbons.

Keywords: Crude oil drilling, GC-MS, Sara analysis, Saturated hydrocarbons, Trans-decalin-2-methyl

Introduction

Due to the complex composition of crude oils, characterizations of the individual molecular types is not possible, and elemental analysis is unattractive because it gives only limited information about the constitution of petroleum due to the
consistency of elemental composition. Instead, hydrocarbon group analysis is employed (). Knowledge of the distribution of major structural classes of hydrocarbons in crude oils is needed in various fields in the petroleum industry (). Studies related to reservoir evaluation, migration and maturity, degradation processes and environmental effects are few**[1]**.

The SARA analysis involves fractioning the crude oil components based on their polarity. This type of analysis is very simple to perform and has found wide application in the petroleum industry [2]. As the physical and chemical characteristics of crude oils and refined products differ significantly, several methods have been developed and standardized to study their SARA composition. Several SARA analysis methods based on open column, low pressure liquid chromatographic separation using polar stationary phases such as alumina, silica and fluorosil are reported [3]. Saturates are usually eluted with n-alkanes solvents, this is followed by the elution of aromatics, resins and asphaltenes with solvents of increasing polarity. (eg. Toluene). The solvent strength can be fine-tuned by mixing more than one solvent to get improved separation between compounds classes. Silica gel is the preferred stationary phase for the separation due to its good stability, although alumina can better separate the aromatic fractions based on the number of aromatic rings **[1]**.

In recent times, these open column methods have been substituted by normal phase HPLC methods due to the simplicity and reproducibility of the later technique **[4].** In addition to traditional polar HPLC stationary phases such as silica, different types of bonded stationary phases such as cyano, nitro and amino prophyl silica were applied to improve the separation of aromatic and polar compounds **[5, 6]**. In addition to the HPLC methods, other chromatographic techniques such as supercritical fluid chromatography and thin-layer chromatography's have also been developed for the analysis of group composition of crude oils **[7, 8].**

Experimental

Sample Collection

Two of the samples were collected from oil movement unit of Kaduna Refining and Petrochemical Company (KRPC), a subsidiary of NNPC. One of the samples from Shell Petroleum Development Company, Port Harcourt, while the remaining two were obtained from Nigerian Petroleum Development Company (NPDC) Benin City. All the samples were put in clean sample bottle and kept away from sunlight. The samples were labeled as **A** for Escravos blend (50-01B),**B** for Escravos blend (50-O1C) all obtained from KRPC. **C** for Forcados blend, **D** for

Okonno and **E** for Oredo oil.

Chemicals and Reagents

All the chemicals and reagents used in this study were of analytical grades, the glass wares used were cleansed, rinsed with distilled water and air dried. Physicochemical parameters of petroleum products understudy.

Method of Crude oil Fractionation

The sequential leaching method was used to separate the crude oil into distinct fractions. The method is based on leaching of crude oil with different organic solvents and their mixtures. Sequential leaching allows the separation of four hydrocarbons fractions. Silica gel of smaller particles was introduced into the column and homogenized with hexane. 80mg of each of the sample was introduced into the glass column and eluted with hexane: cyclohexane (1:1) pale yellow band (saturated fraction) was collected in a sample bottle. The column was then eluted with hexane: toluene (7:3), a yellow band (aromatic fraction) was collected [2]

Result:

Figure 1

Figure2

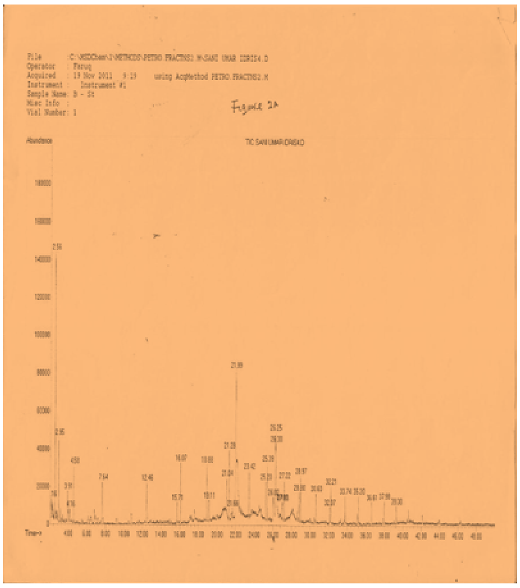


Figure 2

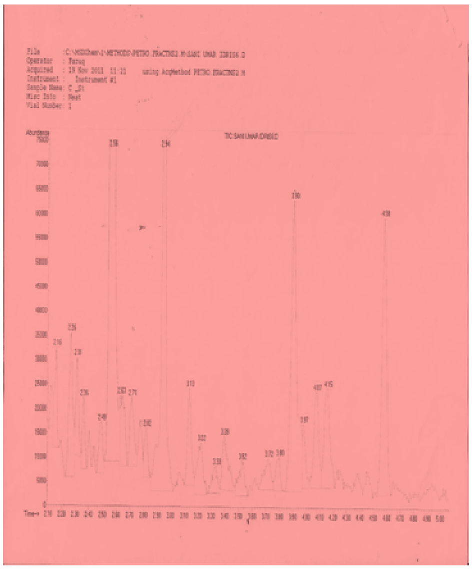


Figure 4

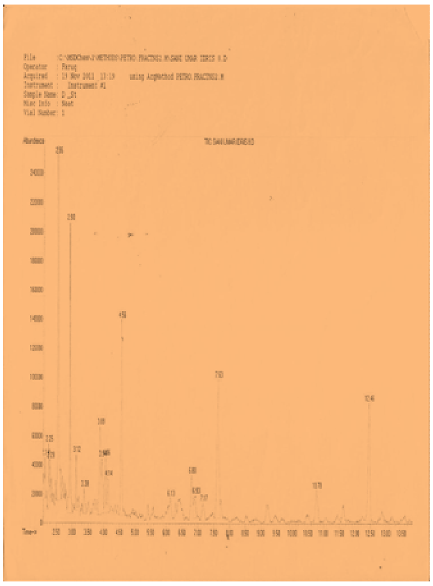
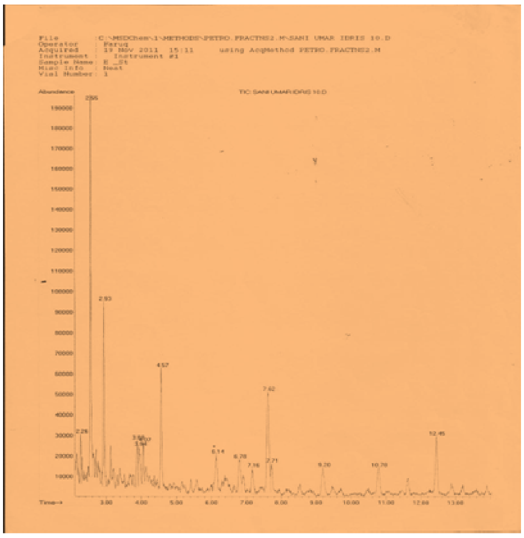


Figure 3



DiscussionFrom the table:1, the result of the saturated hydrocarbons presence in the samples indicate that all the samples spectra indicate the presence of Trans-decalin-2-methyl, Dodecane, Tridecane, tetradecane, pentadecane, hexadecane, octadecane, nonadecane and eicosane, all at a minimum quality of correlation of 70. Also from the table both sample A,B,C and D with exception of E indicated the presence of tetratricontane, tetratetracontane and Heneicosane. Sample A,B, and C contain tritetracontane but found in sample D and E. Also from the table pentadecane-2,6,10,14-tetramethyl was only found in sample A,C and D but not present in samples B and E. Hexacosane was only presence in sample D and E but not present in either A,B, or C at minimum quality of % correlation of 70. Also tetracosane was only present in sample B and D and not present in A, C and E. Cyclohexane, (4-methylpentyl), nonane-3-methyl were only present in sample C but not found in the samples. From the results, Cyclohexane, hexyl, nonane-3-methyl, pentadecane-2-6, 10-trimethyl and docosane were only present in sample A and not present in B,C,D and E. Also the table indicated that only sample D indicate the presence of tetracosane. Finally, sample D shows the highest number of hydrocarbons not common to all other samples having pentaconsane, heptadecane, triacosane, cyclododecane, cyclohexane-(4-methylpentyl), dodecane-4-methyl.

The table, also reveal that sample D has the highest number of saturated hydrocarbons compound than any of the A,B,C and E at a minimum quality of correlation 70%. Indicating twenty eight compound (28), followed by C and D each having seventeen (17) compounds. Then sample B with 15 compound and E sample with least number of saturated hydrocarbons at minimum quality of % correlation, with only eleven (11) compounds. As stated before many saturated hydrocarbons were present in the spectrum, but only those with % correlation of not less than 70 were recorded as required by the standard.

Conclusion

The result of the GC-MS indicated that sample D has the highest number of Saturated hydrocarbons present in a minimum quality correlation of 70% and sample E has the lowest amount of saturated hydrocarbons. Also that saturated hydrocarbons are in greater quality in the remaining samples. And among the crude oil samples, sample D will be more preferable source of saturated hydrocarbons. Furthermore it was also fund that saturated hydrocarbons were present in the spectrum, but only those with % correlation of not less than 70 were recorded.

References

1) Ahmad, H., Tsafe, A.I., Zuru, A.A., Shehu R.A., Atiku, F.A. and Itodo A.U. (2010) Physicochemical and Heavy Metals Values of Nigerian Crude Oil Samples. *International Journal of Natural and Applied Sciences*, **6**(1):10-15.
2) Barman, B.N., Cebolla, V.L and L. Membrado(2000) Chromatographic Techniques for Petroleum and Related Products. Critical Reviews in Analytical Chemistry, 30(2-3).

3) Simoneit B.R.T. (1096) High Molecular Weight Polycyclic Aromatic Hydrocarbons in Hydrothermal Petroleum from the Gulf of California and Northeast Pacific Ocean.*Organic Geochemistry,* 24: 65-77.
4) Kaminski, M., R. kartanowicz, E. Gilgenast and J. Namiesnik (2005) HPLC in Group-Type Separation and Technical or Process Analytics of Petroleum Products.*Critical Review in Analytical Chemistry* 35(3): 193-216.
5) Grizzle, P.L. and D.M. Salblotny (1986) Automated Liquid Chromatographic Compound Class Group type Separation of Crude Oil and Bituments using Chemically Bonded Aminosilane.*Analytical Chemistry,* **58(12):** 2389-2396.
6) Leontaris, K.J and G.A Mansoori (1989) Fast Crude-Oil Heavy Component Characterization using Combination of ASTM, HPLC and GPC Methods.*international Journal of Petroleum Science and Technology,* 2: 1-12.
7) Sharma B.K., S.L.S Sarowha, S.D. Bhagat, R.K. Tiwari, S.K. Gupta and P.S. Venkatataramani (1998) Hydrocarbon Group Analysis of Petroleum Heavy Fractions using TLC-FID Technique. *Fresenius Journal of Analytical Chemistry,* 360(5): 525-544.
8) Dixon Corporation (1996) *Encyclopedia for the Users of Petroleum Products.*1:11.
9) Garrigues, P., Connan, J., Parlanti, E., Belloco, J., and Ewald, M. (1988) Relationship between Rank and Distribution of Methyl Aromatic Hydrocarbons from Condensates of Different Origin. In: MattaVelli and L. Novelli, Editors, Advances in Organic Geochemistry 1987. *Organic Geochemistry,* 13: 1115-1121.