Evaluation and Comparison between Crude Oil Straight Run Fractions and Its Commercial Fractions (Gasoline, Kerosene and Gas Oil) at Dura Oil Refinery

Wedad H. Al-Dahhan
Department of Chemistry, College of Science, Al-Nahrain University, Baghdad-Iraq.

Abstract

Atmospheric distillation according to ASTM-D 2892 and ASTM-D 86 distillation methods was carried out to one selected crude oil at Dura oil refinery. Its straight run fractions (Gasoline, Kerosene and Gas Oil) were tested using the physical properties: Boiling point, Density, Pour point, Surface tension and Aniline point in addition to the calculated results: API gravity, Kw factor and Correlation index to make a comparison with commercial fractions (refinery final products): Gasoline, Kerosene and Gas Oil. A special distillation curves were obtained for crude oil to determine the straight run fractions and for the commercial fractions to establish their characteristics and support the preliminary results of the physical properties with valuable data which enhanced the comparison. Distillation of commercial gasoline shows that it is heavier than straight run ones, while there were matching in the characteristics for kerosene. Commercial gas oil was lighter than straight run due to the presence of kerosene.

Keywords: Crude oil, Crude Oil Fractions, Distillation curve, Gasoline, Kerosene, Gas Oil.

1-Introduction

Petroleum from a chemical standpoint is an extremely complex mixture of hydrocarbon compounds, usually with minor amounts of nitrogen, oxygen, and sulfur containing compounds as well as trace amounts of metal-containing compounds [1]. Gasoline is a mixture of hydrocarbons that usually boil below 180 ^{o}C. The hydrocarbon constituents in this boiling range are those that have 4 to 12 carbon atoms in their molecular structure and fall in to three general types: paraffins (including the cycloparaffins and branched materials), olefins, and aromatics [2]. Naphtha is a general term used for low boiling hydrocarbon fractions that are a major component of gasoline. Aliphatic naphtha refers to those naphthas containing less than 0.1% benzene and with carbon numbers from C3 through C16. Aromatic naphthas have carbon numbers from C6 through C16 and contain significant quantities of aromatic hydrocarbons such as benzene (>0.1%), toluene, and xylene [3]. Kerosene, also called paraffin or paraffin oil, is a flammable pale-yellow or colorless oily liquid with a characteristic odor. Kerosene originated as a straight-run petroleum fraction that boiled between approximately 157 OC and 232 ^{o}C [4]. Gas oil is a heavier petroleum fraction than kerosene. It can be obtained from the atmospheric distillation of crude oils (atmospheric gas oil, AGO), from vacuum distillation of topped crudes (vacuum gas oil, VGO), or from cracking and hydrocracking units. Atmospheric gas oil has a relatively lower density and sulfur content than vacuum gas oil produced from the same crude. The aromatic content of gas oils varies appreciably, depending mainly on the crude type and the process to which it has been subjected. For example, the aromatic content is approximately 10% for light gas oil and may reach up to 50% for vacuum and cracked gas oil. Table (1) is a typical analysis of atmospheric and vacuum gas oils [5].

Table (1)
Characteristics of typical atmospheric gas oil (AGO) and vacuum gas oil (VGO) [5]

Properties	**Gas Oil**	
	Atmospheric gas oil	**Vacuum gas oil**
Specific gravity, °API	38.6	30.0
Specific gravity, 15/15°C	0.832	0.876
Boiling range, °C	232-327	299-538
Hydrogen, wt %	13.7	13.0
Aromatics, wt %	24.0	28.0

The test method for the distillation of petroleum products at atmospheric pressure, ASTM-D 86, provides the approach to measurement [6]. The method often used for measuring the distillation of crude petroleum is ASTM D 2892 [7]. E.O. Odebunmi adapt a methods for the characterization of crude oils and petroleum product fractions using elution liquid chromatography and then to analyze the fractions using ultraviolet and infrared spectroscopic techniques [8]. In an earlier study, E.O. Odebunmi have presented the results of the characterization of crude oils and petroleum products by fractional distillation and elution liquid chromatography and the analysis of the fractions by gas chromatography [9] Angel Nedelchev, adapt thirty three crude oil samples were characterized by means of TBP distillation and ASTM D-86. The paper presents an attempt to test the applicability of the major methods available for converting ASTM D-86 to TBP for the whole range of the distillation curve [10]. Waples, adopted the major groups of compounds found in petroleum are saturated hydrocarbons, including straight chained, branched and cyclic hydrocarbons, simple aromatic hydrocarbons, small sulphur bearing compounds, resins and very large aromatic asphaltene compounds [11].

The aim of this work is to compare between crude oil straight run fractions and its commercial fractions (Gasoline, Kerosene and Gas Oil) form Dura oil refinery.

2-Experimental

2.1. Crude Oil Classification

2.1.1. Light/Heavy Crude Oils

The designation of “light” or “heavy” for crude oils is based on their density. API gravity is the common measure of crude oil density and is calculated as °API = 141.5/Sp. Gr.–131.5; the higher the API gravity, the lower the specific gravity. Crude oils with lower densities and viscosities, and thus higher API gravities, usually contain higher levels of naphtha (gasoline-range hydrocarbons) with predominately volatile paraffinic hydrocarbons, which can be processed readily to produce gasoline and are considered “light” crude. Heavy crude oils are more viscous, have higher boiling ranges and higher densities, and thus have lower API gravities. Heavy crude oils are usually rich in aromatics and tend to contain more residual material, e.g. asphaltenes, and heterocyclics, e.g. sulfur, nitrogen, oxygen-containing hydrocarbon analogs. Crude oils with gravity > 33°API are considered as light. Heavy crudes, i.e. those with gravity < 28°API tend and are usually rich in aromatics [2].

2.1.2. Paraffinic/Naphthenic Crude Oils

Crude oils are composed of paraffinic, naphthenic (cycloparaffinic) and aromatic hydrocarbons, and may be described as either paraffinic or naphthenic depending on the predominant proportion of hydrocarbon type present [12]. Paraffinic crude oils are rich in straight chain and branched saturated hydrocarbons while naphthenic or asphaltic crude oils contain mainly cycloparaffinic, saturated-ring hydrocarbons and aromatic, unsaturated ring hydrocarbons with at least one benzene ring [13]. The aromatic fraction of crude oil include such compounds as the BTEX group (benzene, toluene, ethylbenze and the three xylene isomers), polycyclic aromatic hydrocarbons (PAHs, such as naphthalene), and some heterocyclic aromatics such as the di-benzothiophenes [14].There are several correlation between yield and the aromaticity and paraffinicity of crude oils, but the two most widely used are UOP or Watson “characterization factor” (Kw) and the Bureau of Mines correlation index (CI).

$$Kw = (TB)^{1/3} / G$$

$$CI = 87552/TB + 473.7\,G - 456.8$$

Where (TB) is the average boiling point in degrees Rankine (^{o}F+ 460) and (G) is the specific gravity 60^{o}/60^{o}F [15]. Characterization factor has been shown to be additive on a weight basis. It was originally devised to show the thermal cracking characteristics of heavy oils, thus highly paraffin oils have Kw in the range 12.5 to 13.0 and cyclic (naphthene) oils have Kw in the range 10.5 to 12.5 [16]. The CI scale is based upon straight-chain paraffins having a CI value of (0) and benzene having a CI value of (100). The CI values are not quantitative, but the lower the CI value, the greater the concentration of paraffin hydrocarbons in the fraction, and higher the CI value, the greater the concentration of naphthenes and aromatics [15]. Density, specific gravity at 20^{o}C has been determined according to ASTM 1217. The surface tension has been analyzed according to ASTM 1331. The viscosity has been measured according to ASTM-D 445.

The pour point has been analyzed according to ASTM D 5853-11. The aniline point has been measured according to ASTM-D 611.

2.2. Distillation

2.2.1. Distillation Process

The distillation tests give an indication of the types of products and the quality of the products that can be obtained from petroleum, and the tests are used to compare different petroleum types through the yield and quality of the 300°C residuum fraction. The basic method of distillation (ASTM D-86) is one of the oldest methods in use because the distillation characteristics of hydrocarbons have an important effect on safety and performance, especially in the case of fuels and solvents. Usually seven fractions provide the basis for a reasonably thorough evaluation of the distillation properties of the feedstock: [17].

1. Gas, boiling range: < 15.5 °C
2. Gasoline (light naphtha), boiling range: l5.5–149 °C
3. Kerosene (medium naphtha), boiling range:149–232 °C
4. Gas oil, boiling range: 232–343 °C
5. Light vacuum gas oil, boiling range: 343–371°C
6. Heavy vacuum gas oil, boiling range: 371–566 °C
7. Residue, boiling range: > 566 °C

The boiling range gives information on the composition, the properties, and the behavior of petroleum and derived products during storage and use Fig.(1)[18]. Crude oil fractions (Kerosene and Gas Oil) can be classified with more details Fig.(2) [19].

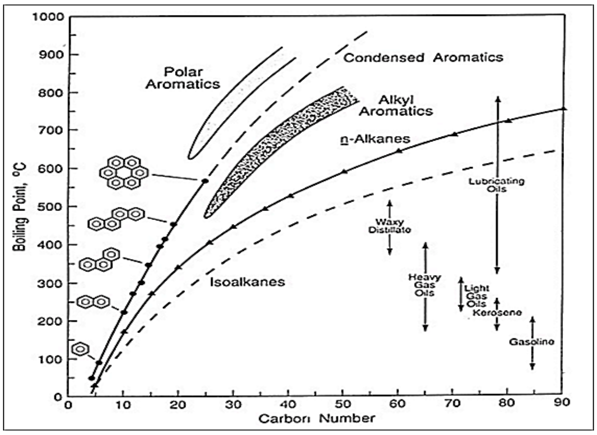

Fig.(1): Boiling point and carbon number for various hydrocarbons and petroleum products [18].

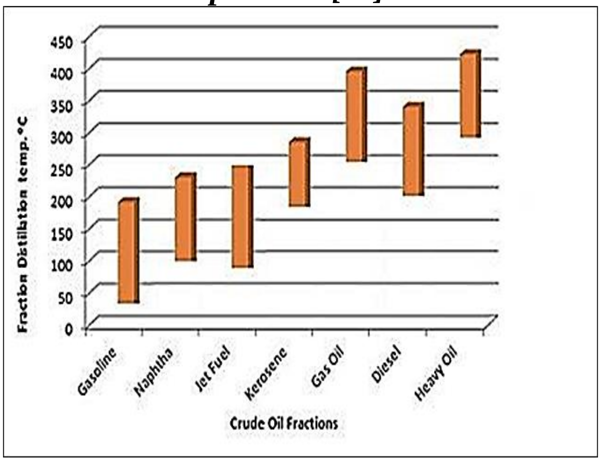

Fig.(2): Crude oil fractions [19].

The atmospheric distillation of crude oil commercial fractions (Gasoline, Kerosene and Gas Oil) has been carried out in distillation apparatus according to ASTM-D 86 and for crude oil according to ASTM-D 2892.

2.2.2. Distillation Curve

When a refining company evaluates its own crude oils to determine the most desirable processing sequence to obtain the required products, its own laboratories will provide data concerning the distillation and processing of the oil and its fractions [20].

The distillation curve is a graphical depiction of the boiling temperature of a fluid (or fluid mixture) plotted against the volume fraction distilled [21]. The ASTM-D2892 method is designated for any petroleum mixture with an initial boiling point below 400^{o}C, and specifies that the atmospheric pressure section of the four-part distillation procedure be discontinued at 310^{o}C to avoid ‘‘significant cracking”. Table (2) illustrates the common cut points from atmospheric distillation [22].

Table (2)
Some common cut points [22].

Temperature Range	Under (32.2 ºC)	(32.2-104.4) ºC	(104.4-157.0) ºC	(157.0-232.0) ºC	(232.0-426.0) ºC	(426.0 ºC) and up
Fraction Type	Butane and lighter	Gasoline	Naphtha	Kerosene	Gas oil	Residue (including asphalt)

3. Results and Discussion

3.1.Characterization of crude oil

The characterization of tested crude oil in Table (3) and its distillation results Table (4) illustrates that the crude oil as light according to API gravity value and contain naphthenic more than aromatic hydrocarbons. These data effect on straight run crude oil fractions quality and quantity, see Fig.(3) and Table (5).

Table (3)
Characterization of tested crude oil.

Density g/cm^3 (20 ºC)	Density g/cm^3 (15.6 ºC)	Specific gravity (15.6 ºC)	API gravity	Pour Point (ºC)	Dynamic Viscosity (cp)	Surface Tension at 20ºC (mNm^{-1})	Kw Factor (ºR)	Correl-ation Index (CI)
0.83	0.85	0.85	34.97	-23	13.32	21.23	11.41	41.58

3.2. Distillation results for crude oil

Calculate the percentage or quantities of crude oil derivatives (Gasoline, Naphtha, Kerosene and Gas oil) based on the data presented in Table (1) crude oil gave straight run products within the limits of atmospheric distillation a quantities shown in Fig.(3) and Table (5) which is clearly refers to the abundance of light products within a maximum temperature of 332ºC.

Table (4)
Distillation results for tested crude oil.

Cumulative Volume (%)	Boiling Point (ºC)	Density g/cm^3 (20 ºC)	Density g/cm3 (15.6 ºC)	Specific gravity (15.6 ºC)	API gravity	Aniline point (ºC)	Pour point (ºC)	Kw Factor (ºR)	Correlat-ion Index (CI)
First drop	43	-	-	-	-	-	-	-	-
5	83	0.64	0.66	0.66	82.89	70.2	-	14.70	-
10	133	0.68	0.70	0.70	70.64	68.3	-50.9	13.86	-
15	186	0.76	0.78	0.78	49.91	65.3	-	12.44	8.42
20	213	0.78	0.80	0.80	45.38	60.0	-45.3	12.13	17.89
25	232	0.80	0.83	0.83	38.98	58.2	-	11.69	32.10
30	265	0.82	0.84	0.84	36.95	52.2	-41.6	11.55	36.84
35	286	0.83	0.85	0.85	34.97	48.1	-	11.41	41.58
40	301	0.85	0.87	0.87	31.14	43.3	-27.3	11.15	51.05
45	317	0.85	0.88	0.88	29.29	40.7	-	11.02	55.79
50	332	0.87	0.91	0.91	23.99	35.8	-16.0	10.66	70.00

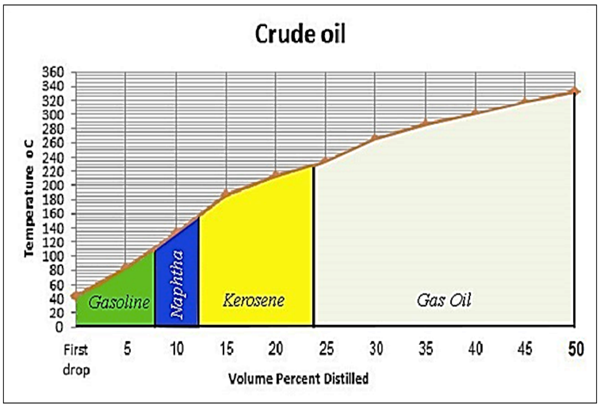

Fig.(3): Straight run crude oil fractions distribution on crude oils distillation curve.

Table (5)
Straight run crude oil fractions from crude oil distillation curve.

Gasoline	Naphtha	Kerosene	Gas oil
Volume Percent Distilled			
8	4	12	26
The approximate volume (liter) distilled from one barrel			
12.72	6.36	19.08	41.34

3.3. Distillation results for commercial fractions

Crude oil commercial fractions (Gasoline, Kerosene and Gas Oil) were distilled according to ASTM -D 86 separately from each other, the distillation results illustrates in Table (6).

Table (6)
Distillation results for commercial fractions (Gasoline, Kerosene and Gas Oil).

Cumulative Volume (%)	Boiling Point (ºC)		
	Gasoline	Kerosene	Gas Oil
First drop	35	135	140
5	55	165	180
10	59	168	185
15	63	169	190
20	68	170	194
25	70	173	197
30	75	176	200
35	79	179	208
40	85	180	210
45	89	184	214
50	90	187	217
55	96	190	220
60	100	194	223
65	108	198	228
70	112	201	234
75	118	203	239
80	120	206	241
85	123	208	248
90	126	211	257
95	128	216	261
100	130	220	265

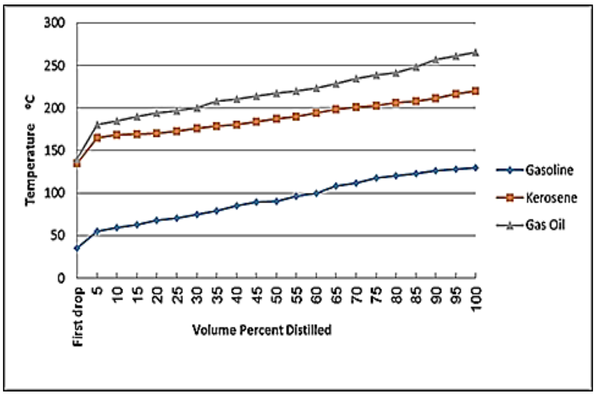

Fig.(4): Commercial fractions (Gasoline, Kerosene and Gas Oil) distillation curves.

3.4. Physical properties for some cuts from commercial fractions (Gasoline, Kerosene and Gas Oil) distillation

The percentage volumes (20, 40, 60, 80 and 100 %) see Table (6) were selected only to test the physical properties which is quite enough to study the possible differences in the produced cuts specifications which will discusses separately in sec.(3.4.1) for gasoline, see Table (7), sec. (3.4.2) for kerosene, see Table (8) and sec. (3.4.3) for gas oil see Table (9).

Table (7)
Physical properties for some cuts from gasoline commercial fraction distillation.

Cumulative Volume (%)	Boiling Point (ºC)	Density g/cm³ (20 ºC)	Density g/cm³ (15.6 ºC)	Specific gravity (15.6 ºC)	API gravity	Aniline point (ºC)	Pour Point (ºC)	Kw Factor (ºR)	Correlation Index (CI)
First drop	35	-	-	-	-		-	-	-
20	68	0.70	0.72	0.72	65.03	72.2	- 43.1	12.17	14.26
40	85	0.71	0.73	0.73	62.34	65.0	- 40.3	12.00	19.00
60	100	0.72	0.76	0.76	54.68	59.3	- 38.2	11.53	33.21
80	120	0.73	0.77	0.77	52.27	51.6	-36.2	11.38	37.95
100	130	0.75	0.78	0.78	49.91	46.9	- 33.7	11.23	42.69

3.4.1. Physical properties for some cuts from gasoline commercial fraction distillation

The results of gasoline distillation see Fig.(5) refer to the presence of a heavy cut with boiling range (104.4-130)ºC compared with the limits of straight run gasoline (32.2-104.4)ºC. This can be explained through:

1. At refinery blending process they add gasoline octane number boosters (branched chain paraffinic hydrocarbons and light naphthenes and aromatics) which consider as heavy cuts compared with straight run gasoline.
2. This cut (104.4-130)ºC lies in straight run naphtha boiling point limit (104.4-157) ºC Table (1) which is heavier than straight run gasoline and often they are added to commercial gasoline.

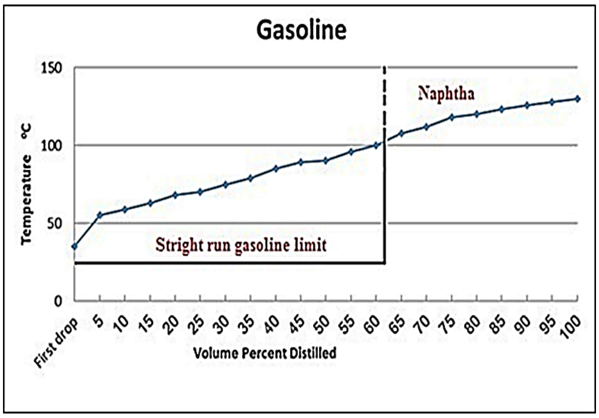

Fig.(5): Gasoline commercial fraction distillation curve with straight run limit selection.

Table (8)
Physical properties for some cuts from kerosene commercial fraction distillation.

Cumulative Volume (%)	Boiling Point (ºC)	Density g/cm³ (20 ºC)	Density g/cm³ (15.6ºC)	Specific gravity (15.6ºC)	API gravity	Aniline point (ºC)	Pour Point (ºC)	Kw Factor (ºR)	Correlation Index (CI)
First drop	135	-	-	-	-	-	-	-	-
20	170	0.77	0.79	0.79	47.61	50.0	-26.2	11.95	21.52
40	180	0.78	0.80	0.80	45.38	41.3	-24.1	11.80	26.26
60	194	0.80	0.83	0.83	38.98	34.3	-23.3	11.37	40.47
80	206	0.81	0.84	0.84	36.95	29.9	-20.5	11.24	45.21
100	220	0.83	0.86	0.86	33.03	28.0	-17.8	10.98	54.68

3.4.2. Physical properties for some cuts from kerosene commercial fraction distillation

Fig.(6) illustrates that straight run kerosene (157-232)ºC match the characteristics of commercial kerosene for domestic uses. This is logical result due to straight run kerosene is not subject to any complementary operations and additives compared with kerosene (Jet Fuel) (82.2-232.2)ºC see Fig.(2).

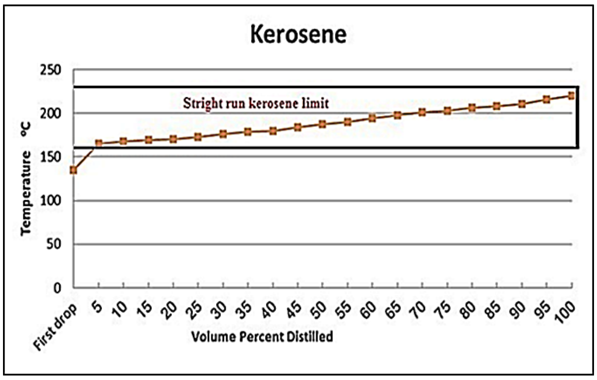

Fig.(6): Kerosene commercial fraction distillation curve with straight run limit selection.

Table (9)
Physical properties for some cuts from gas oil commercial fraction distillation.

Cumulative Volume %	Boiling Point ºC	Density g/cm^3 (20 ºC)	Density g/cm^3 (15.6ºC)	Specific gravity (15.6ºC)	API gravity	Aniline point (ºC)	Pour Point ºC	Kw Factor (ºR)	Correlation Index (CI)
First drop	140	-	-	-	-	-	-	-	-
20	194	0.81	0.83	0.83	38.98	45.6	-24.7	11.62	33.67
40	210	0.82	0.85	0.85	34.97	36.1	-20.3	11.35	43.15
60	223	0.84	0.86	0.86	33.03	28.9	-17.6	11.22	47.88
80	241	0.86	0.89	0.89	27.49	22.1	-13.8	10.84	62.09
100	265	0.88	0.91	0.91	23.99	19.7	-15.8	10.60	71.57

3.4.3. Physical properties for some cuts from gas oil commercial fraction distillation

The atmospheric gas oil with boiling range (232.2-343.0)ºC is lighter than the tested commercial gas oil due to the later consist of vacuum gas oil (VGO) which is heavy fraction with end boiling point 426ºC Table (1) but Fig.(7) shows the distillation range for commercial product (140-265)ºC which means that it consists of light cut (140-232)ºC belongs to kerosene fraction.

3.5. Density, API, Aniline point, Pour point, Kw and CI data with respect to volume percent distilled

Density, API, Aniline point and Pour point results, see Tables (7, 8 and 9) illustrate a logical differences between the petroleum products, see Fig.(8, 9, 10 and 11), but there is substantial convergence between the observed properties of kerosene and gas oil in all physical properties tested and this is what was referred to analyze the results for Fig.(7).

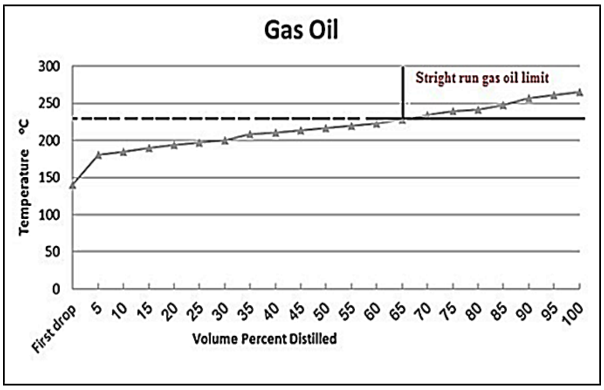

Fig.(7): Gas Oil commercial fraction distillation curve with straight run limit selection.

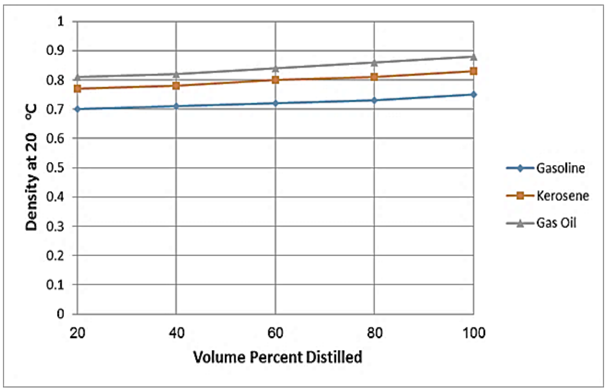

Fig.(8): Gasoline, Kerosene and Gas Oil densities with respect to volume percent distilled.

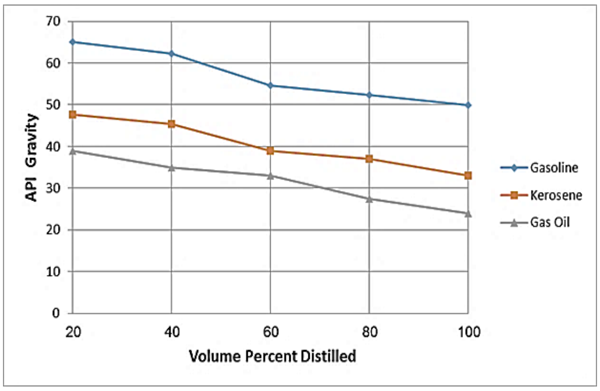

Fig.(9): Gasoline, Kerosene and Gas Oil API gravities with respect to volume percent distilled.

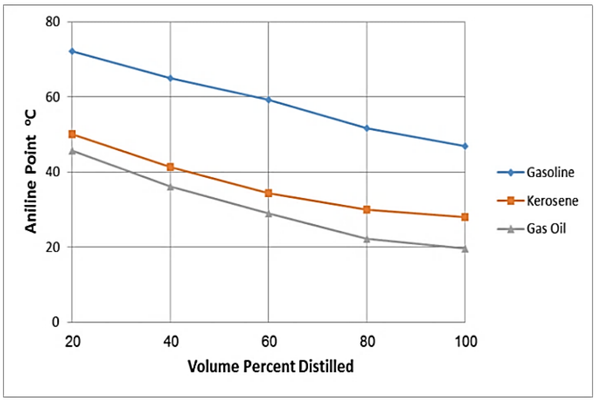

Fig.(10): Gasoline, Kerosene and Gas Oil aniline points with respect to volume percent distilled.

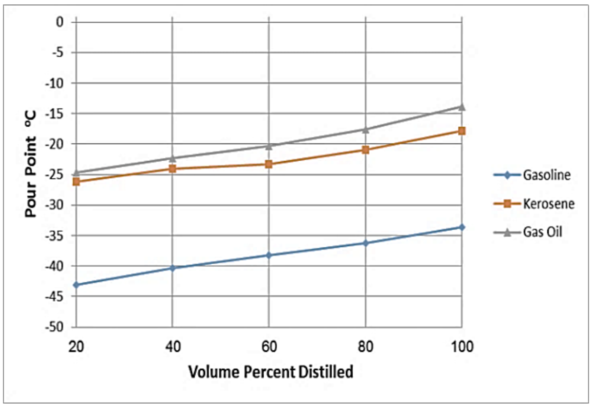

Fig.(11): Gasoline, Kerosene and Gas Oil pour points with respect to volume percent distilled.

Commercial gas oil distillation temperature in the range of (140-228)°C Table (6) refers to distillation cut with lower temperature range than straight run gas oil (232-426)°C Table (1). Distillation temperature drop from initial boiling point at 140°C to 65% distilled product at 228°C see Table (6) caused to decrease (TB) value and this led to decrease (Kw) and increase (CI) values. This justifies the apparent difference between the kerosene and gas oil curves see Fig.(12, 13) while we noticed the presence of convergence between them in the Figs.(8, 9, 10 and 11).

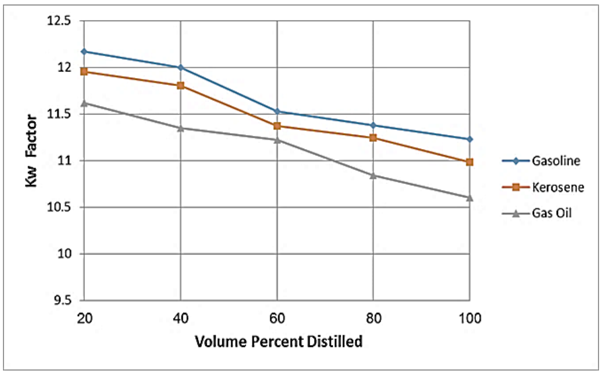

Fig.(12): Gasoline, Kerosene and Gas Oil (K) factor results with respect to volume percent distilled.

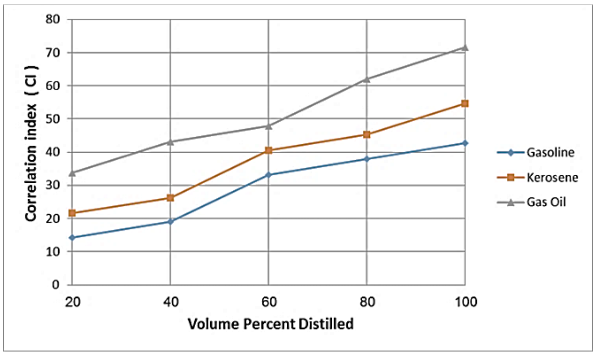

Fig.(13): Gasoline, Kerosene and Gas Oil (CI) results with respect to volume percent distilled.

4. Conclusion

The characterization of tested crude oil illustrates that the crude oil consider as light and contain naphthenic more than aromatic hydrocarbons. This effect clearly on straight run crude oil fractions quality and quantity.

Distillation of commercial gasoline shows that it is heavier than straight run ones, while there were matching in the characteristics for kerosene. Commercial gas oil was lighter than straight run due to the presence of kerosene. Density, API, Aniline point and Pour point results illustrate logical differences between the petroleum products, while (Kw) and (CI) values shows that there were differences between the kerosene and gas oil curves due to decrease in (TB) value.

5. Acknowledgements

The authors acknowledge the Department of Chemistry, College of Science, Al-Nahrain University for their encouragement.

References

[1] Algelt K.H. and Bodieszynski M.M., "Comparison and Analysis of Heavy Petroleum Fractions". Chapters 2, 4 &10 (Eds.) Marcel Dekker, Inc. New York, 1994.

[2] Crude Oil Category, Category Assessment Document, The American Petroleum Institute, Petroleum HPV Testing Group, January 14, 2011.

[3] US OSHA, Technical Manual, Section IV: Chapter 2 "Petroleum Refining Processes" 2011.

[4] Walmsley A.G., "Modern Petroleum Technology". Applied Science Publishers Inc., Barking, Essex, UK. Chapter 17. 1973.

[5] Sami Matar, "Chemistry of Petrochemical Processes" Second edition, Houston, Texas, 2000.

[6] Standard test method for distillation of petroleum products at atmospheric pressure. ASTM Standard D 86-04b, Book of Standards Volume: 05.01. West Conshohocken (PA): American Society for Testing and Materials; 2004.

[7] Standard test method for distillation of crude petroleum. ASTM Test Method D-2892. West Conshocken (PA): ASTM Book of Standards; 2003.

[8] Odebunmi E. O., "Infrared and Ultraviolet Spectrophotometric Analyses of Chromatographic Fractions of Crude Oils and Petroleum products" Bull. Chem. Soc. Ethiop., 21(1), 2007.

[9] Odebunmi, E.O., "Characterization of Crude Oils and Petroleum Products by Fractional Distillation" Bull. Chem. Soc. Ethiop., 16 (1), 2002.

[10] Angel Nedelchev, "Boiling Point Distribution of Crude Oils Based on TBP and ASTM D-86 Distillation Data" Petroleum & Coal 53 (4), 2011.

[11] Waples D.W., "Geochemistry in Petroleum Exploration" D. Reidel Publishing Company, Dordrecht, Holland. 1985.

[12] Shell, "The Petroleum Handbook" (6th Edition) Hardcover, 1983.

[13] Test Plan, Crude Oil Category, the American Petroleum Institute, Petroleum HPV Testing Group, November 21, 2003

[14] Zhendi Wang, "Characteristics of Spilled Oils, Fuels, and Petroleum Products: 1. Composition and Properties of Selected Oils", Emergencies Science and Technology Division, Environmental Technology Centre Environment Canada. 2012.

[15] G lean E., James H. Gary "Petrochemical Refining Technology and Economics" Fifth Edition 2010.

[16] James G. Speight "The Chemistry and Technology of Petroleum" Fourth Edition, 2011.

[17] Ashraf Yehia El-Naggar "Petroleum in View of its Classification, Assay and Analysis" International E–Publication, 2014.

[18] James G. Speight "Handbook of Petroleum Product Analysis" Handbook of Petroleum, John Wiley & Sons, Inc., Publications, 2002.

[19] Georgius A. Adam, "Industrial Chemistry" Basrah University, Table (1) (Arabic) 1985.

[20] James H. Gary, "Petroleum Refining Technology and Economics", Fourth Edition, 2001.

[21] Leffler WL., "Petroleum refining in nontechnical language" Tulsa, Oklahoma, Penn Well, 2000.

[22] Standard test method for distillation of crude petroleum. ASTM Test Method D-2892. West Conshocken (PA): ASTM Book of Standards, 2003.

الخلاصة

تم اختيار احد النفوط الخام من مصفى الدورة واجراء التقطير عليه بموجب الطريقة (ASTM-D2892) للحصول على المشتقات النفطية الرئيسية محور البحث (كازولين، كيروسين وكاز اويل).

اجريت عمليات تقطير على نماذج من المشتقات النفطية التجارية (منتج نهائي من مصفى الدورة) بموجب الطريقة (ASTM-D86).

المشتقات النفطية المستحصلة من تقطير النفط الخام مع المشتقات التجارية اجريت عليها الفحوصات الفيزيائية: درجة الغليان، الكثافة، درجة الانسكاب، الشد السطحي ودرجة الانلين اضافة الى الخواص التي تم حسابها (Kw,API,CI) للوقوف على نقاط الاختلاف والمقارنة بينهما.

تمت الاستعانة بمنحنيات التقطير للنفط الخام والمشتقات النفطية لدعم النتائج المستحصلة من الخواص الفيزيائية.

تبين من خلال المقارنه بين المشتقات التجارية طي البحث والمنتجات المستحصلة مباشرة من عملية التقطير ان الكازولين التجاري اثقل من المقطر بينما تطابقت النتائج بالنسبة للكيروسين وعلى عكس الكازولين فان الكاز اويل التجاري كان اخف من الكاز اويل المنتج مباشرة من عملية التقطير.