Journal of Chemical, Biological and Physical Sciences

An International Peer Review E-3 Journal of Sciences

*Available online at*www.jcbsc.org

Section A: Chemical Sciences

CODEN (USA): JCBPAT Research Article

Physical Studies of Crude Oil and Comparative Analysis of the Different Kurdistan-IRAQ Crude Oil Fields

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Received: 28 May 2016**; Revised:** 21 June 2016**; Accepted:** 24 June 2016

Abstract: Physical analysis of crude oil samples in different fields of Kurdistan region has been evaluated and is reported in this project. Four different Kurdistan crude oils produced in various fields namely (Khormala, Tawki, Ain zala and Taqtaq) were analyzed. All crude oil samples were evaluated using ASTM standard methods of testing, and compared to Iraqi specification of crude oils. The results showed that all fuel oils are within the Iraqi specification except that produced from Ain zala and Taqtaq which are higher in sulphur content (4.2632% w/w and 0.7818% w/w) respectively.

Keywords: Physical study, Sulphur content, Analysis, Carbon residue

INTRODUCTION

Nowadays, the argument about the most effective manner of award of rights to explore for and exploit petroleum has led to the use of one, two and sometimes three legal instruments of award within the regional boundaries of some oil-producing nations[1]. However continuing to utilize concession-style arrangements since the 1960s, Kurdistan region also makes use of the production sharing legal framework in awarding rights for petroleum profiteering. In Iraq today, the Kurdistan Regional Government chooses to employ production sharing contracts for petroleum exploitation within its regional boundaries while the Federal Government of Iraq favors the risk service contract regime[2]. This has led to both parties nursing conflicting views as to which manner of award rights is in the best interest

of the entire Iraqi Republic with the ultimate goal of achieving optimized petroleum production within the shortest possible time[3]. Against this backdrop, this study seeks to determine which manner of award rights to explore for and exploit for petroleum would be better suited for the entire Iraqi Republic. Bearing in mind the "nationalistic" concerns among the Iraqi peoples and religious bearings on the Iraqi Constitution as well as the economic interests of international oil companies, this paper ultimately concludes that the concession-style arrangement is not the best-suited legal instrument for the nation[4]. In other hand, in order to attract foreign investment and ensure sustainable growth in Iraqi oil production while at the same time guaranteeing "suitable" revenues to the state and returns to the investor, the production sharing legal arrangement is highly recommended[5]. This is based on its structural characteristics and its adaptability to fiscal and economic variations. Despite this, the policy framework that will eventually be adopted for Iraq a whole will depend on political solutions to the current rift between the KRG and FGI over oil licenses and the constitutional powers of Iraqi regions and governorates. In addition the long-term implications of the KRG-FGI rift is not the focal point of this study, this research will compare the ASTM standard method and analyzed four type of crude oil in different field[6,7].

MATERIAL AND METHODS

Analytical grade chemicals and deionized water was used. Calibrated Pyrex glassware's and equipments such as Viscometer Baths VHC-220 (Giuleukamn, England). Muffle furnace FSE-621 (Gallcnkamp, England) and crude oils were sampled using standard sampling procedure (ASTM D-270) from different oil fields of KR. Physico-chemical characteristics such as API (American Petroleum Institute) gravity, specific gravity, flash point, kinematic viscosity, carbon residue, water and sediments, total sulphur were determined.

Sampling of crude oils: For the sampling of crude oil ASTM D 4057 method was used. This method provides procedures for manually obtaining samples of petroleum and petroleum products of a liquid and semi liquid. A sampling pot made of copper was used. It was cleaned with detergent and rinsed with distilled water many time to make it contamination free. Sample container (plastic cans) having volume capacity 5 L was used. These can were also cleaned with detergent and rinsed with distilled water to make these dust free. Three samples top, middle and bottom were taken from storage tank of every well with the help of sampling pot and mixed in 5 L plastic cans. Sample containers were sealed and screwed to make it air tight.

RESULTS AND DISCUSSION

1.Crude Oils Analysis: Evaluation of crude petroleum according to IP-methods (Appendix D) requires introductory distillation to determine the distillation characteristics of small quantities of crude petroleum by IP-24 method, in which the volume of distilled fractions obtained at each multiple of 25 ^{o}C were recorded, up to maximum of 300^{o}C, at which the distillation was stopped[8,9]. The results of all crude oils according to the IP-24 are shown in **Table (1).**

Table 1: Distillation of crude oils according to IP 24

Tests	Khormala	Tawke	Ain Zala	Taq taq
ASTM Dist.	V/V	V/V	V/V	V/V
I.B.P.	70	60	46	35
25	-	-	-	-
50	-	-	Few dp.	2
75	0.3	1	2	8.1
100	2	4.5	5	16
125	4	9	11	23
150	11	14	16	33
175	16	19	23	42
200	21	24	28	50
225	26	30	35	56
250	33	36	41	62
275	39	43	49	67
300	47	50	56	74

2. Evaluation of crude oils produced according to the ASTM standards: Essentially crude oils are complex mixtures containing many different hydrocarbon compounds that vary in appearance and composition from one oil field to another. Crude oils range in consistency from water to tar-like solids, and in color from clear to black. An "average" crude oil contains about 84% carbon, 14% hydrogen, 1%-3% sulfur, and less than 1% each of nitrogen, oxygen, metals, and salts[10-12]. Refinery crude base stocks usually consist of mixtures of two or more different crude oils. Crude oils are also defined in terms of API (American Petroleum Institute) gravity. Crude with a high API gravity are usually rich in paraffin's and tend to yield greater proportions of gasoline and light petroleum products. Crude oils that contain appreciable quantities of hydrogen sulfide or other reactive sulfur compounds are called "sour." Those with less sulfur are called "sweet." All crude oils are assayed and values depending on their potential yield. Crude Oil with low assay numbers is referred to as "Opportunity Crude". This type of oil will be more difficult to process due to higher levels of contaminants and water. This type of crude will typically give desalter equipment the most trouble and require the greatest skill of the operator[9].

3. Evaluating viscosities: The viscosities of the crude oils and their emulsions were determined by using a Brookfield digital rheometer. **Table 2** illustrates the viscosity of the starting oil and the change in viscosity due to evaporation and emulsification, respectively.

Table 2: Viscosities of the evaporated crude oils

Oil Type	Evaporation (%)	Viscosity (cp)	Oil Type	Evaporation (%)	Viscosity (cp)
Khormala	0	11.9	Tawke	0	5.27
Khormala	10	18.1	Tawke	10	14.6
Khormala	20	39.0	Tawke	20	39.6
Khormala	30	147.0	Tawke	30	190.8
Ain zala	0	11.9	Taq taq	0	3.6
Ain zala	10	18.1	Taq taq	10	5.8
Ain zala	20	39.0	Taq taq	20	9.85
Ain zala	30	147.0	Taq taq	30	14.8

Test analysis conducted for all sample in different fields in Kurdistan region, table 3 showed significant changes on different parameters, and specifications of quality requirements such as: density (specific gravity), flash point, pour point, metal content, calorific value, water content and sulfur content may be required for any given application. Table 4 shows these properties and specification in comparison to Iraqi requirements for marketing specification for crude oil. Density or specific gravity is used whenever conversion must be made between mass and volume measurements, and it is used also in combination with other test results to predict oil quality. Flash point, as for all petroleum products, considerations of safety in storage and transportation and contamination by more volatile products are required. The pour point is indication of the lowest temperature at which the oil can be transferred from one place to another. The calorific value of residual fuel oil is lower than that of lower-boiling fuel oil, because of the lower atomic hydrogen to carbon ratio and the incidence of greater amounts of less combustible material, such as water and sediment, and higher levels of sulfur.

Table 3: Sample tests of crude oil collected from different fields in Kurdistn region

Tests	Unit	Khormala	Tawke	Ain Zala	Taq taq
API	Gravity	29	26	23	52
Flashpoint	°C	48	66	72	53
CR	gm %	4.25	6.2	8.25	0.267
Sulphur content	Mass %	1.8574	2.0712	4.2632	0.7818

Table 4: Specification of Iraqi requirements for marketing of crude oil according to Baraheen Company

Tests	Unit	Khormala	Tawke	Ain Zala	Taq taq
API	Gravity	16.59	15.6	14.2	28.58
Flashpoint	°C	↓15	↓15	↓20	↓15
CR	gm %	-	-	-	-
Sulphur content	Mass %	2.39	2.91	3.96	0.61

CONCLUSION

The main idea of this project was to evaluate and measured various physical parameters of the crude oil samples taken from different fields in KR, parameters were studied according to ASTM standard and compared with Iraqi specification of crude oil reported by Baraheen Company at 2015, all measurement are summarized in table 2, 3 and 4.

ACKNOWLEDGEMENT

The author is thankful to the Technical Institute and Department of Chemical Analyzing of KOYA for their technician support.

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