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Changes of Physico - Chemical Properties of Gummry Crude oil on Dar blend

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Abstract: ***This study was conducted on Dar crude oil physical, chemical, Rheological properties and operational parameters for the purpose to give an idea about Dar fluid properties after the new oil field Gummry started the production with the oil properties different from the previous Crude Oil. Data were collected from Dar crude oil Daily reports, including Specific gravity, API, Water and sediment, Viscosity and total acid number. The result showed that The new Dar blend which include Gummry Oil field affected the physical and chemical properties of Dar blend especially in the API which increased up to 26.11from 24.37(average), there is no change in the pour point. The change in the Rheological Properties is very sharp which shows Viscosity of the new blend decreased. This change affects the Water separation performance. Chemical properties of Dar crude change because TAN content in Dar blend was decrease to 2.90 from 3.43 mgKOH/g.***

Keywords: Specific gravity, API, Water and sediment, Viscosity, Gummry and Dar blend

1. Introduction

Crude oil is a complex mixture doesn't a uniform material consisting of 200 or more different hydrocarbon organic compounds, where its quality based on American Petroleum Institute (API) gravity, specific gravity (SG) and sulfur content (S %) (Dickson and Udoessien, 2012).

The most important of commercial parameters is a specific gravity, which is used for measuring the quality of crude oils. Low specific gravity indicates good quality of crude oil having lighter fractions and vice versa. Crude oil is classified as light, medium or heavy, according to its measured API gravity.

The API gravity of less than 10 defines bitumen and extra heavy oil; asphalt on average has an API gravity of 8°, which sink in fresh water, while oil floats; API gravity less than 10° generally considered natural bitumen (Danyluk and others, 1984).Generally, API from 10° to22.3° defines heavy oil, from 22.3° to 31.1° was considered as medium oil, higher than 31.1° defines the light oil(dnr.louisiana.gov, 1989). The specific gravity of the crude oil is inversely related to the API values and provides a preliminary estimation of the amount of type (heavy or light) of hydrocarbons present. The lower the specific gravity and higher API gravity are characterized the high quality crude oil. Therefore, higher API gravity crude oil has a higher price and is of good quality. The total sulfur content in the crude oil is represented by sulfur compounds such as thiols, sulfides, disulfides and thiophenes, where sour and sweet oil classes are based on S% in the crude oil (Wang and Huang, 1992). The oil classification on the basis of physical characteristics is commercially important (Sun et al., 2009; Odebunmi et al., 2002).

Dar blend is considered as sweet acidic crude for low sulpher content and high TAN content has an average American Petroleum Institute (API) degree of 32.

The paraffinic nature of the crude makes it a good feed stock for lubricating oils and petrochemical industries.

Dar petroleum operating company Ltd (DPOC) holds right, for exploration and development of the contract area block 3 and 7 located in the north east of the republic of South Sudan, between longitudes 31 and 34 and latitude 8 and 10 with a total area of about 72,000Km2. DPOC is currently develop the oil reserves in block 3 and 7 which hereinafter refer to Melut basin oil development which consists of Palouge oilfield, Adar- yale oil field, Gummry oilfield and Moleeta oilfield. The oil produced from different fields is blended to constitute Dar Blend which are paraffinic and asphaltinic in nature. The main features of the blend mixture are medium density, low sulfur content (sweet), high pour point (42°C) (Elhassan,S. and Dfaallah, A.2014).

Gummry Oilfield located 35 km southeast of Palouge Oilfield and 33km from Adar- Yale. The production started of this oilfield in 29thAugust.2008 with approximately 40,000 barrels per day (http://www.petrdar/content.pht.(2011)).

2. Materials and Methods

Materials

This study was carried out on data that have been collected from Laboratory daily reports regarding the crude oil physical, chemical, Rheological properties and operational parameters for Month of August 2008 were gathered and consider as the previous Dar Crude Oil properties and compare it with the average data for month of September 2008 which consider as the new blend. It aims to discuss the Dar fluid properties after the new field Gummry started the production with the oil properties different from the previous Crude Oil.

Methods

Density, API, Specific gravity, Pour point, Water and Sediment content, kinematic Viscosity and TAN of Dar blends were measured using standard methods according to the American Society for Testing and Materials (ASTM) and

the American Petroleum Institute API (ASTM D5002 ; Waruquier, J. 1995).

3. Results and Discussion

Crude oils are not uniform materials. Classification on the basis of physical and chemical characteristics, which are commonly called as "commercial parameters" and have remained with the oil industry for the quality evaluation and pricing purposes of the crude oil (Odebunmi et al., 2002 ; Sun et al., 2009).

Specific gravity is an important parameter to measure the quality of crude oils and also gives a rough measure of the amount of lighter hydrocarbons present. Lower the specific gravity and higher API gravity indicates good quality, higher price of crude oil having lighter fractions and vice versa.

The Specific gravity range of New Dar (Adar12%, Gummry 13% and Palouge 75%) crude oils which is (0.8994) compared with old Dar (Adar 15% and Palouge 85%) crude oils is (0.9070). this indicate that new Dar (Adar, Gummry and Palouge) crude oils are better quality than (Adar and Palouge) crude oils. Fig (1)

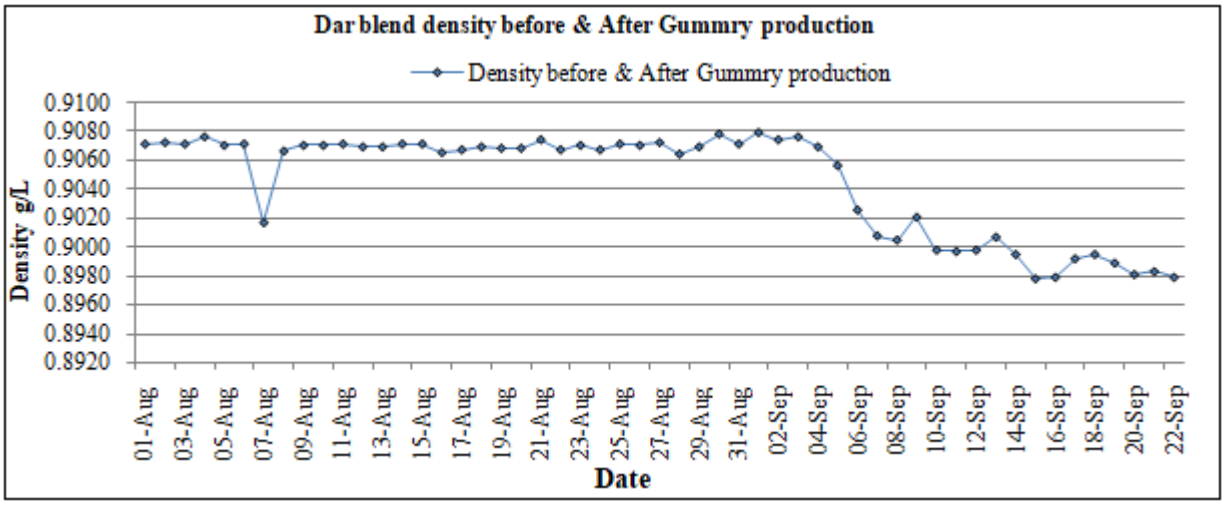

Figure 1: is the Dar blend density before and after Gummry production

API gravity is a special function of Relative density (Specific gravity) and also is a factor indicating the quality of crude oils. Generally, the heavier (lower the API gravity) the crude oil the greater the quantity of heavier components that may be more refractory and require greater upgrading or more severe cracking to produce salable products. Conversely, the lighter the crude oil the greater the quantity of easily distillable products. Crude oil prices are frequently posted against values in kilograms per cubic meter (kg/m3) or in degrees API.

Crude oil with API gravity between 40 and 45 commands the highest prices. Above 45° the molecular chains become shorter and less valuable to refineries.

Crude oil is classified as light, medium or heavy, according to its measured API gravity. Light crude oil is defined as having API gravity higher than 31.1° API. Medium oil is defined as having API gravity between 22.3° API and 31.1° API. Heavy oil is defined as having API gravity below 22.3° API. Heavy crude oil has been defined as any liquid petroleum with API gravity less than 20° (ASTM D664).

New Dar blend (Adar, Gummry and Palouge) crude oils vary widely in ranging from (25.70) API gravity. Whereas old Dar blend (Adar and Palouge) crude oils have API gravity ranges (24.40). It means that the new Dar blend which including gummry oilfield (Adar, Gummry and Palouge) are better in quality than old Dar blend (Adar and Palouge) crude oils. Basis of API gravity, the new Dar crude is classified as a medium crude oil having API gravity25.70 API. Fig (2)

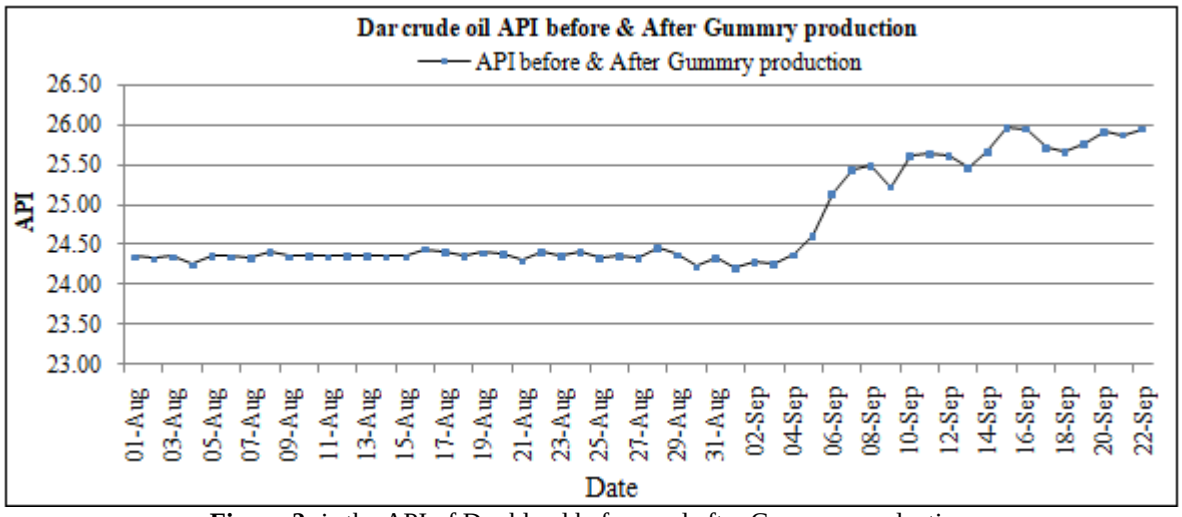

Figure 2: is the API of Dar blend before and after Gummry production

Total Acid Number (TAN) is the amount of potassium hydroxide in milligrams that is needed to neutralize the acids in one gram of oil. The acids present in crude oil contribute to increased rates of corrosion in the refinery and can contribute to instability in refined products. Surface activity imparted by acids can also make for difficulty in desalting of crude oils. Knowledge of the acid number is important in planning for injection of neutralizing agents in refinery streams or reducing the acid content to an acceptable level by other means such as dilution with lower acid streams. Acid number data can also be useful when selecting metallurgy for new or replacement units. Historically, crude oils with an acid number of less than 0.5 mg potassium hydroxide (KOH)/g have been considered acceptable for processing by most refineries without the use of a neutralizing agent. Some refineries have the metallurgy that allows them to process streams with an acid number of up to approximately 1.0 mg KOH/g. Several crude oils being produced today have acid numbers well above 1.0 mg KOH/g. These high-acid crudes, which are generally heavy, may be traded at a discount price relative to other similar quality crude oils or may be difficult to market.

Crude with a Total Acid Number (TAN) >1.0mg KOH/g conventionally labeled as High TAN which indicates to the potential of corrosion problems when temperature range between (220-420) Co(Fuhr et al., 2007).That mean Dar blend is considering as acidic crude for high TAN content. After the Gummry production started the TAN content in Dar blend was decrease to 2.90 mgKOH/g from 3.43 mgKOH/g. Fig (3)

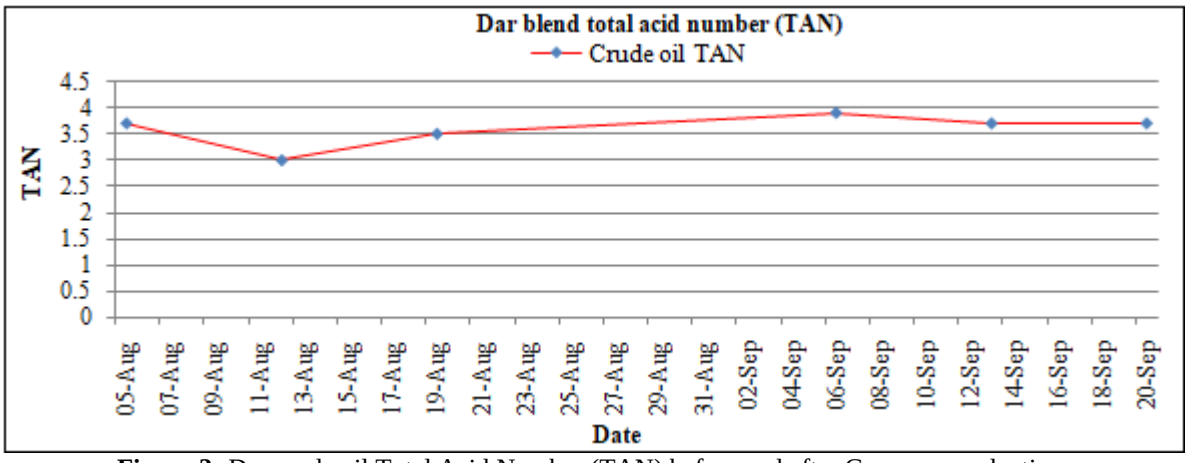

Figure 3: Dar crude oil Total Acid Number (TAN) before and after Gummry production

Water and Sediment content of crude oil results principally from production and transportation practices. Water in crude oil is either in the form of emulsion or in large droplets. Emulsified water in heavy asphaltic crude is difficult to separate. Water and sediment can foul heaters, distillation towers, and exchangers and can contribute to corrosion and to deleterious product quality.Knowledge of the water and sediment content is also important in accurately determining net volumes of crude oil iAn sales, taxation, exchanges, and custody transfers (Gurwitch, L. and Moor, H. 1932).

The new Commingling blends which include Gummry Oil field improve the water separation performance of Dar crude from 0.8% to 0.4 water cut, which showing better quality than old Dar fluid basis of water contents.

It is clear that Dar crude oils have more water (0, 4 - 0.8Vol %) contents than international crude oils (trace). On the basis of water contents Dar crude oils are poor quality. Fig (4 & 5)

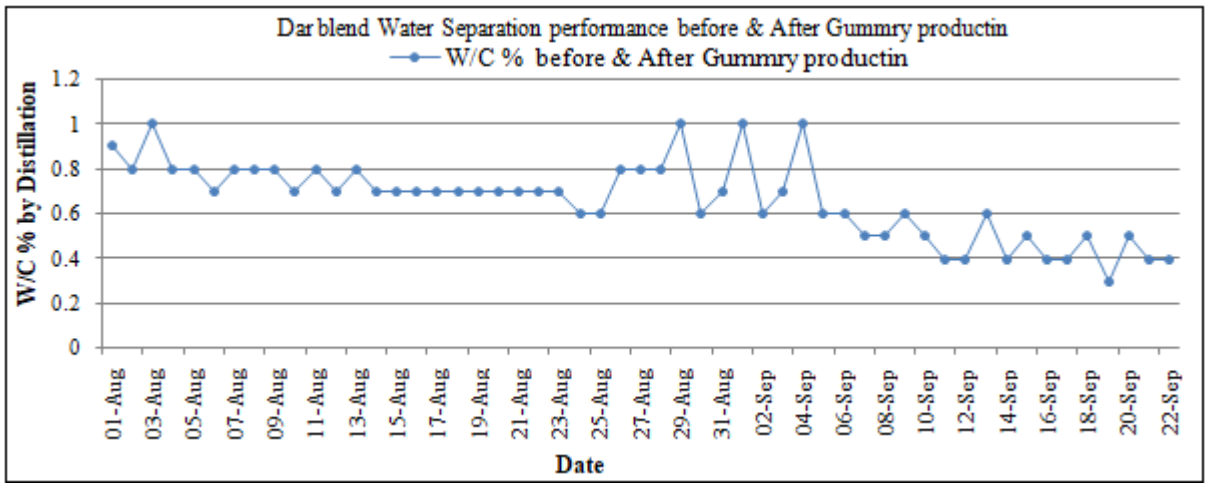

Figure 4: Electrostatic Dehydrators Water Separation Performance Before& After Gummry Production

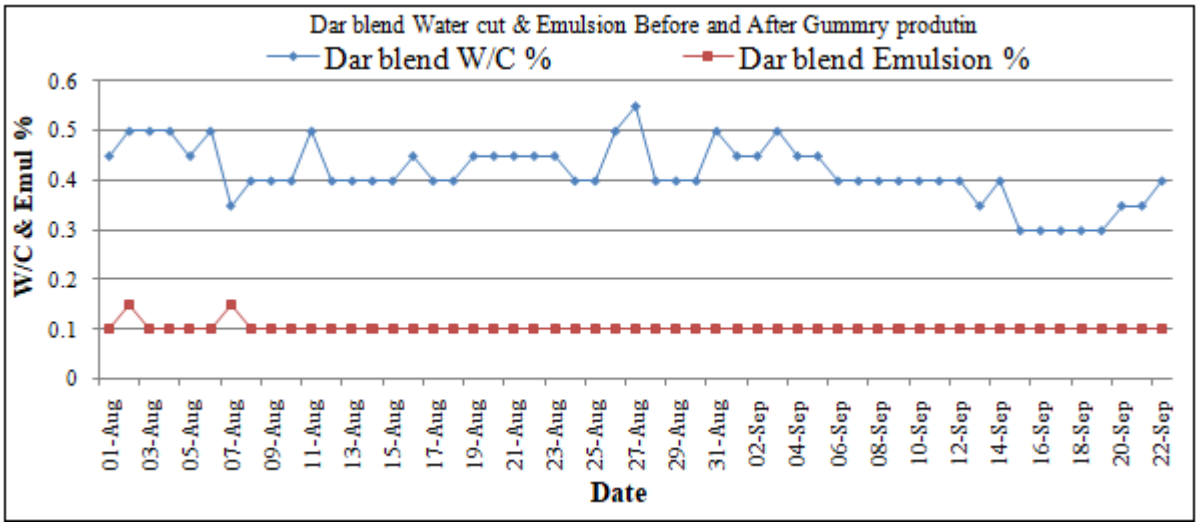

Figure 5: Water Separation Performance Before and After Gummry Production

The viscosity of oil is its resistance to flow. The viscosity of a crude oil is very important from the technical point of view. Viscosity plays an important part of the calculation of pipelines and pumps, and design of furnaces and heat exchanger; it is also one of the principle properties in lubrication.

The viscosity is highly dependent on the type of components and the temperature. The viscosity of Paraffins is approximately a function of the density. Aromatic of low molecular weight often have lower viscosity than the corresponding Paraffins, whereas the high – molecular aromatics in oil are more viscous than the Paraffins. (Halliday, D et al 1996)

Viscosity data at both temperature 40 and 50°C indicate variation in the Rheological Properties of Dar blend. New Dar blend crude oils have low viscosity than old Dar blend (Adar and Palouge) crude oils .The new data of Dar blend (Adar, Gummry and Palouge) crude oils show lighter contents than old Dar blend (Adar and Palouge) crude oils. These types of crudes are very good in feedstock for the production of asphalt.

New Dar blend (Adar, Gummry and Palouge) crude oils are better quality than old Dar blend (Adar and Palouge) crude oils.

There is a direct relationship between the specific gravity and the kinematic viscosity, as the specific gravity increases, the kinematic viscosity also increases and vice versa. Fig (6)

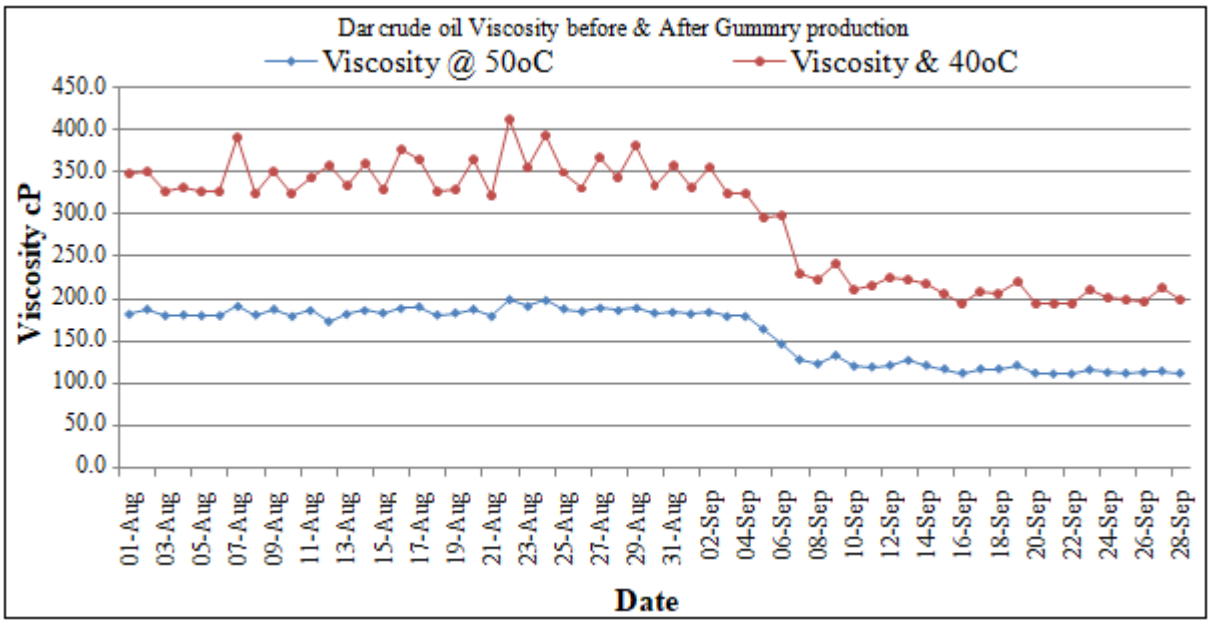

Figure (6) is the Dar blend Viscosity @ 40oC & 50oC performance After Gummry Production

4. Conclusion

Basis of the above statistical study, it concludes that:

- New Dar blend which include Gummry Oil field affected the physical and chemical properties especially in the API which increased up to 25.70 from 24.40(average), and Specific gravity which decreased from 0.9070 to 0.8994 g/ml
- There is no change in the pour point.
- The effect in the Rheological Properties is very sharp which shows Viscosity of the new blend decreased, this change affecting the Water separation performance.
- After the production from Gummry started the chemical properties of Dar crude has change because TAN content in Dar blend was decrease to 2.90 from 3.43 mgKOH/g.
- New Dar blend which include Gummry crude oil are better in quality than the old Dar blend (Adar and Palouge) crude oils.
- Dar blend is considered as acidic crude for high TAN content.
- Generally,Gummry Crude Oil improves the Dar blend characteristic and this will evaluate the new blend in the marketing.

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