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Characterization of Crude Oil from Various oilfields in Albania through the Instrumental Analysis

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Abstract: The characterization of the crude oils is depended on the evaluation of chemical and physical properties of pure oil by-products. Characteristics of crude oil are very important in the designing and operation of the almost every equipment in the refining petroleum industry. A petroleum fluid is defined by its thermodynamic and volumetric properties as well as by its physicochemical properties. Their behavior is modeled from experimental data in order to properly simulate the processing of these fluids during their industrial production. To achieve optimal crude selection and processing decisions is very important to have information refer to crude oil quality. This includes: the characteristics of crude oil fractions, density, the octane number, sulfur content, viscosity, *etc*. The aim of this study was quality evaluation of some specific crude oils extracted in Albania, by the classification range of obtained fractions during the crude oil distillation. It was indicated from our experiments that main physical properties of crude oils has been found in a close range, except the water content which has shown a fluctuation for different oilfields included in our study.

Keywords: *crude oil, characterization, refinery processes, physical properties*

Introduction

Crude oil is a naturally generated material comprising a very complex mixture of coexisting hydrocarbons and polar organic compounds. It is found in geologic formations below the earth's surface and recovered mostly through oil drilling. It is refined and separated by distillation according to the various boiling points of the components resulting in a number of products, such as petrol, kerosene, and numerous chemical reagents. Due to the extreme complexity of the components of crude oil samples, the characterization of these constituents of their product has been challenging research topic for analytical chemists. This aim introduces the common methods for characterizing crude oil and for their thermo physical properties. Crude oils and petroleum fractions are the most important feedstock for refining processes. To properly simulate the refining processes, we must have good understanding of the compositional information and thermo physical properties of crude oils. Albania has seven major oilfields. After leaving the oil wells the crude oil passes to reservoirs collection and then to the plant decantation.

In this study we have present the physical characteristics of crude oil from various natural resources in Albania using instrumental analysis, specifically the water content, specific gravity and sediment content. Sampling of crude oil is done directly in the source, about 20 samples. Sampling points are taken from groups and decantation oil plants. From our experiments the most physical properties of crude oils has not been varied wide range of their values. Petroleum refining involves separating crude oil into its constituents and converting and treating them into marketable products. Processed crude compositions have the greatest influence on refinery margins (Chandra, *et al*., 2004). Therefore is very important the study of crude oil properties. Most of the oil fields around the globe are producing oil that is often accompanied by significant amounts of water, sediment, clay, etc. So is very important the study of water and sediment in crude oil. To remove these compounds from crude oil is necessary the preliminary treatment, for example desalting.

One main reason of installing desalting plants is to decreases the flow of salt content to refinery required for pumping and transportation (Musleh, *et al*., 2005). Among the important reasons for treating water-in-oil emulsions are scale accumulations, corrosion, and lowering of activity of catalyst.

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The main objective of an oil desalting and dehydration plant is to remove water-soluble salts and entrained water. Principally, water normally contains chlorides of sodium, calcium and magnesium. During the designing of a desalter unit, its type and size are all depended on a number of operational factors such as required pressure, temperature, viscosity, and flow rate, as well as user specification relating to maximum salt amount allowed in the product oil stream.

Materials and Methods

Samples collection and analysis of oil samples were carried out in line with recommended procedures of the American Society of Testing and Materials – (ASTM) A.P. I., *et al*., 2011). A total of twenty crude oil samples were collected from various natural Albania resources (ASTM D4057-95, *et al*., 2011). Sample collection was done out in collaboration with field technicians from the wellheads of the various producing wells. The crude oil sampling included the Patos-Marinez Oilfield: Marinza, Belina, Sheqishte, Kallmi . Samples were obtained in duplicates. The samples were taken at group and decantation oil plant. Specific gravity was determined with SVM-3000 device (ASTM D5002-99, *et al*., 2011). Water and sediment in crude oil are determining by the centrifuge method (ASTM 4007-82, *et al*., 2011). Table 1 presents details of the instrument used in analysis.

The water and sediment content of crude oil is significant because it can cause corrosion of equipment and problems in processing. A determination of water and sediment content is required to measure accurately net volumes of actual oil in sales, taxation, exchanges, and custody transfers. For this test we used a centrifuge capable of spinning two or more filled cone-shaped, centrifuge tubes (each centrifuge tubes shall be a 203 mm cone – shaped tube, and a solvent (toluene). The specific gravity was determined by SVM 3000 Anton Paar automatic equipment. The API gravity it is calculated by specific gravity, with a inverse function.

Table 1. Details of the instruments

Instrument	Instrument make and model	Purpose of the instrument
Centrifuge SVM-3000	Model Z 510, manufacturer Bethold Hermle AG, type Z 510	Read basic sediment and water or water cut by weight percentage through small graduated tubes, ASTM 4007-02

Results and Discussions

The details of the experiment are presents below.

Table 2. Characteristics of the crude oil samples.

Property	**Average value after treatment**
Specific gravity (15/15)	1.000
API gravity to 15 ◦C	Less then 15
Water content (%)	0.1
Sediment content (%)	0.2445

Table 2 present the average value after treatment for sample taken in studies. The most important samples for study are samples taken from plants decantation, which are then sent to refineries. The following measurements have been made in treated samples. Marinze resources include some small groups that may accumulate from 3 to over 10 wells, two major groups (D - Pad, H - Pad) and the central decantation plant.

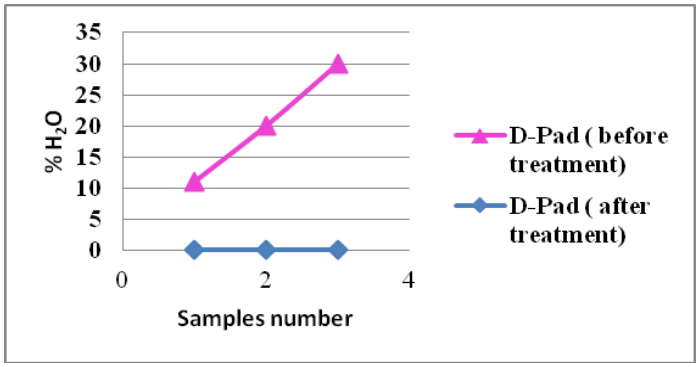

Figure 1. The percentage of water in the D- Pad before and after treatment.

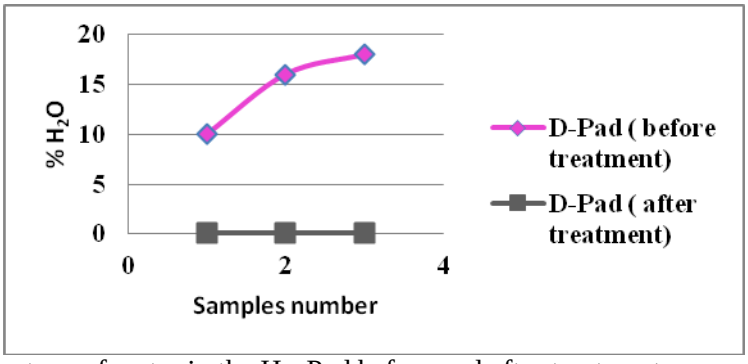

Figure 2. The percentage of water in the H - Pad before and after treatment.

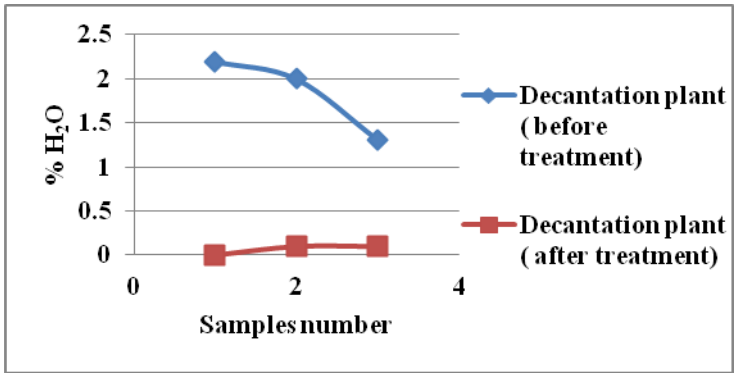

Figure 3. The percentage of water in the decantation plant before and after treatment.

From experiment carried in D,H-Pad and in central plant decantation, we see that the crude oil after treatment reaches a percentage 0.1% water, so its ready for sale.

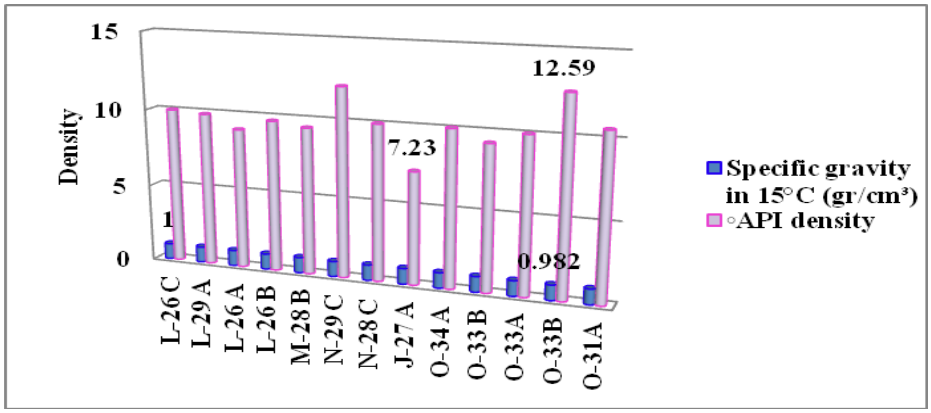

Figura 4. Specific gravity and density in ◦API for small groups and decantation plant after treatment

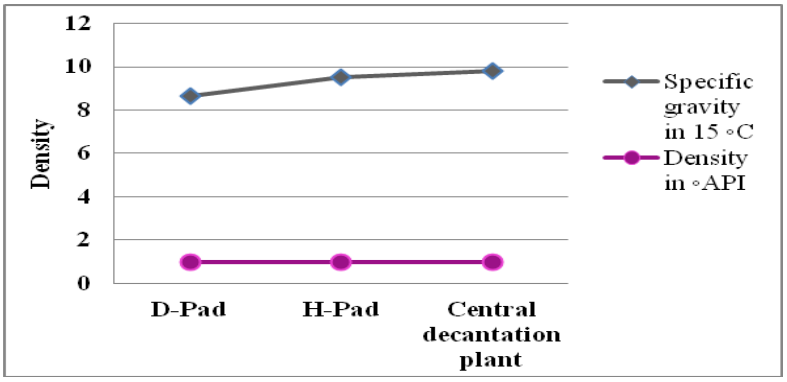

Figure 5. Comparison of the relative density ($d_{15,56}^{15,56}$) and ° API density in D, H-Pad and decantation plant.

Gravity specific is in inversely proportion to the density in API. Almost densities in D, H -Pad are the same while the density in API is lower than 31.

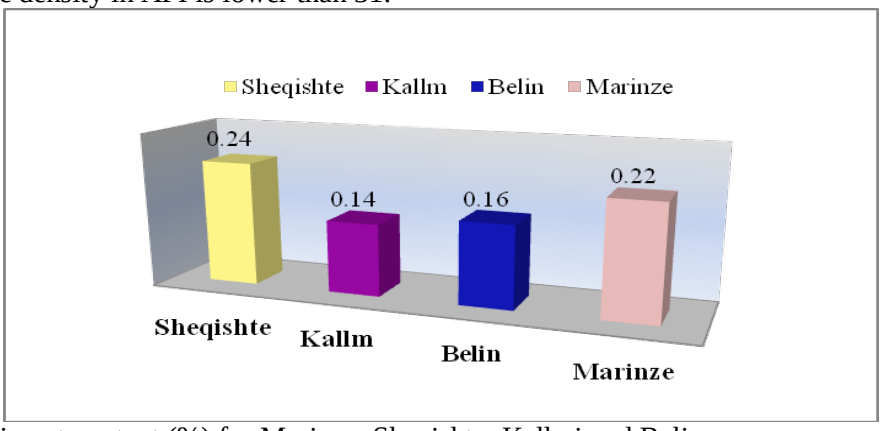

Figure 6. Sediment content (%) for Marinza, Sheqishte, Kallmi and Belina resources.

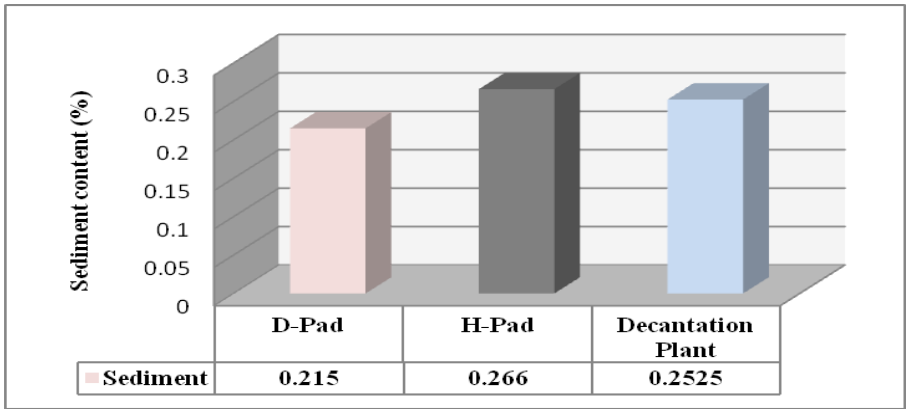

Figure 7. Sediment content at groups (D,H-Pad) and decantation plant

The water content

Crude oil cannot be processed in refineries before treatment, because the presence of water, clay, salts, etc increasing pressure, and cause lowers productivity, costs heat, etc. Water content in crude oil ranging from 10-90% and after processing it in groups and decantation plant it amounts to 1-2% water. From the studies it is known that the proportion of water is greater than the amount of oil that produces a well (Cani, et al., 2015). In D-pad (figure.1), from the analysis performed we see that entered oil with high percentage of water up to 30% and after cleaning with 0.2% of water. This tells us that water separation technology is highly sophisticated; hence the crude oil can flow directly into distribution chain end-point consumers with a very good quality. In H- Pad (figure.2) on different

days its treated crude oil with different water percent. In the analyzed samples we can see that before treatment enters oil with high percent of water, after treatment the percent of water is lower.

Density

Density is very important indicators used in the study of oil and its derivatives. The resources which is under study consists of several small crude oil groups, where the crude oil is collected before to go to the central plant of decantation in small groups entering 5-20 different wells.

In figure 4, O-30B group at the Beline area has the greater ◦API gravity (◦API =12.59). The small value ◦API belongs J-27 A in Sheqishte area (◦API= 7.23). While the specific gravity is about 1 gr/cm^3 (figure 4,5). So these crude oil classified as heavy crude oil.

If we make a comparison between the output density of wells and small groups, note that after the treatment the density decreases. This occurs as a result of treatment especially for dewatering.

Sediment content

Marinza and Sheqishta (Figure 6) source have the largest amount of sediment content (0.24 and 0.22%). Lowest contents of sediment have Kallmi and Belina source (0.14 and 0.16%). This variation in value is a result of oil-producing layers. The amount depends on the layer of sediments derived from it, the kind of pump used and also the method used to extract crude oil.

Different from water content which reduced water after treatment, the amount of sediment does not change after the crude oil treatment, so does not affect the organic composition of crude oil.

The presence of the sediments is very important in crude oil related to their quality, due to the cost elevationon the transport, their deposition in transport pipelines, deposition in the inner walls of the heat exchangers, by causing increased pressure, reduced capacity and temperature rise. Also their presence may result in the complete blocking of the main operations system and tray of rectification columns and corrosion.

Conclusions

The oil cannot be processed at facilities without preliminary treatment because the non oil compounds cause disturbed as increasing pressure, reduction of production costs of heat. Therefore before processed crude oil must be separated from the water and salts, which are in the form of unstable and stable emulsions?

Water in crude oil can be removed from the oil before it is processed, after treatment the crude oil contains about 0.1 ÷ 0.2% water.

After the treatment process, specific gravity and API density have changes of their values. If we make a comparison before and after treatment we note density decrease. This occurs as a result of treatment especially for dewatering.

The Crude oil in Sheqishta, Kallmi, Belina and Marinza area are classified as heavy crude oil. In the figure 4, O-30B group at the Belina area has the greater API gravity (API =12.59). The small value API belongs J-27 A in Sheqishte area (API= 7.23). While the specific gravity is about 1 gr/cm^3

Marinza and Sheqishte resource have the largest amount of sediment content (0.24 and 0.22%). Kallmi and Belina resource (0.14 and 0.16%) have lower contents of sediment.

This variation in value is a result of oil-producing layers. The amount depends on the layer of sediments derived from it, the kind of pump used and also the method used to extract crude oil.

The study of crude oil is very important, because their content, Increasing the cost of transport, they deposited in transport lines, in inner walls of the heat exchangers causing increased pressure, reduced capacity and temperature increase.

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