

## Identification of Oil and Water Layer Method for Light Hydrocarbon in Liaohe Depression

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**Abstract:** The status of oil in the world energy structure in the short term. In recent years, with the development of Chinese economy, there is an increasing demand for oil and oil exploration into the bottleneck of further development. Oil exploration in addition to the constrained by geological factors, also affected by exploration theory and exploration technique. As a result of the geological factors immutability, exploration technology and breakthrough of the theory of become the important premise of oil company found oil and gas breakthrough. And oil and gas layer identification and evaluation technique is an important link in oil and gas exploration. In this paper, we study in the process, the characteristics of petroleum geology in the study area, on the basis of in-depth understanding, optimization can accurately reflect reservoir rock hydrocarbon content and light hydrocarbon analysis of nature of the fluid (oil) as the main geochemical logging technology.

**Keywords:** Oil exploration; gas layer identification; light hydrocarbon analysis.

### THE DEVELOPMENT SITUATION AT HOME AND ABROAD

Light hydrocarbon analysis technique in foreign countries in 1970, has been widely used western oil companies, and successfully used for single well oil and gas evaluation. Jiangnan petroleum institute in 1983, for the first time in China to create a light hydrocarbon analysis method [1]. In 1985, the ministry of petroleum industry will light hydrocarbon analysis technique into a focus to promote new technology of oil and gas exploration. Branch of Henan oilfield exploration and development research institute, 2005 light hydrocarbon analysis technique is discussed in the application of exploration. In 2007, the Yangtze university Jia Shiliang further discusses the application of light hydrocarbon analysis technique in oil and gas exploration [2]. To discriminate the light hydrocarbon analysis technique applied in oil and gas layer technology is domestic emerging technology in recent years, is not mature.

### LIGHT HYDROCARBON ANALYSIS METHOD

Light hydrocarbon analysis technique principle and process. Through sealed the oil-bearing sandstone in small bottle, hydrocarbon component of crude oil to evaporate into the small bottle at the top of the air, the formation of multi-component gas mixture, due to the different physical properties and the relative content of components is different, have a certain points in the mixed gas pressure and saturation vapor pressure under a certain temperature, and most of the crude oil and heavy components still exist as a liquid in sandstone, so

to evaporate into the air in the light component characterization of light hydrocarbons in crude oil. Take a certain amount of mixed gas injection port into the gas chromatograph, under the carrier gas to carry into the chromatographic column, speaking on mobile phase and the distribution of the fixed liquid two phases for repeatedly, due to the adsorption of each composition was fixed or dissolving ability is different, therefore, every component in the chromatographic column speed is different, after a certain long column, then separated from each other, order leave chromatographic column into the detector, the ion current signal after amplification by a computer automatically record chromatographic peaks and their relative content of each composition. Including a, b, c, d, e, f, g, essien, nonyl straight-chain alkanes isomerization alkane, cyclanes and benzene, toluene, ethylbenzene and xylene aromatic hydrocarbon and so on more than 100 monomer hydrocarbon, the monomer hydrocarbon content in the reservoir nature and characteristics of the hydrocarbon source rocks, reservoir oil alteration factors such as control [3]. In hydrocarbon source rock organic matter type, degree of thermal evolution, under the premise of consistent, mainly on the basis of light hydrocarbon compounds biodegradation degree and the solubility in water is used to identify the reservoir property of the differences.

Generally refers to light hydrocarbon source rocks or carbon number is less than 15 of hydrocarbon compounds in oil and gas, is an important part of oil and gas, are an important and extremely rich

geochemical information. Light hydrocarbon analysis is a kind of gas chromatographic analysis technique, chromatography early in the development of applied to C<sub>1</sub> - C<sub>5</sub> gas analysis, in the 1990s, and generally the C<sub>10</sub> in crude oil [4]. After qualitative quantitative analysis of saturated hydrocarbon, used for source rock and reservoir rock evaluation. The highest content in crude oil, one of the most abundant components, change is the biggest C<sub>6</sub> ~ C<sub>9</sub> is failed to be light hydrocarbon analysis and application of the main reason is that technical problems, sampling difficulty, light hydrocarbon separation hard times, the component qualitative analysis and data processing difficulties.

In actual exploration, light hydrocarbon analysis is an economic, rapid and effective method of reservoir evaluation, according to stratigraphic characteristics of a kind of important means. And organic carbon analysis, rock evaluation instrument analysis, pyrolysis gas chromatography analysis, as in the process of oil exploration geochemical analysis of regular issue. At present the technology in abnormal display layer of oil, gas, water quality qualitative, criterion and the development of reservoir water, water flooded condition recognition has uniqueness.

Light hydrocarbon generation in source rock, migration to gather in the reservoir, and through further evolution. Therefore, light hydrocarbon compounds in crude oil is the inevitable outcome of the organic matter maturation. Light hydrocarbon geochemical characteristics, in order to comprehensively understand there is necessary to discuss the physical properties of light hydrocarbon in crude oil

#### **LIGHT HYDROCARBON ANALYSIS PARAMETERS AND CALCULATION**

Before the C<sub>9</sub>, can divided detection and characterization of 103 group, of which six monocyclic aromatics, 34 naphthenic, nine corresponding normal alkanes, 54 isomerization alkane. These parameters cannot be directly applied, the reasons: one is the parameter, the two is the size of these parameters only reflect the abundance of each component. Therefore, it is necessary to summarize and extract useful information from a large amount of information according to the demand [5]. At present, the application of light hydrocarbon analysis data to solve different problems, different parameters are defined, to solve the same problem, such as oil and water layer identification, there is no uniform standard, each parameter defines the content of a hundred schools of thought, this is the light of the difficulty in the application of hydrocarbon data. Asked to take advantages and choose effective oil-water layer evaluation parameters, first make clear these compounds of the physical and chemical properties and main control and influence factors. Otherwise, oil and water layer evaluation is difficult to achieve targeted, effective evaluation.

Light hydrocarbon analysis components are alkanes, paraffin and naphthene, a total of 103 aromatic hydrocarbon monomer. Light hydrocarbon parameters are used to identify oil and water layers, mainly based on the water content of the reservoir, and the content of some components is changed due to the action of biodegradation and water washing. Evaluation parameters are obtained from a large number of data, reflecting the changes [6]. One is the physical and chemical characteristics of the light hydrocarbon component, and the two is the main control factor and the influencing factor of the hydrocarbon characteristics of the reservoir.

#### **LIGHT HYDROCARBON ANALYSIS TECHNOLOGY TO IDENTIFY OIL AND WATER LAYERS**

The content and distribution of light hydrocarbon compounds in oil layer and crude oil not only depend on the genetic type of crude oil, but also depend on the thermal evolution degree and the intensity of alteration. In the same oil source, lithology and physical properties, the thermal evolution degree and secondary evolution intensity are the same, and the difference of light hydrocarbon parameters is related to the water content in the reservoir. When the reservoir for oil-water miscible, the water contains a certain amount of oxygen and various types of bacteria, groundwater dynamic effect is strong, the oxygen content is higher, with oxygen to the survival of the bacteria were more developed, the bacteria in the water is and soluble in water hydrocarbon occurrence of bacteria solution and oxidation, resulting in aromatics with high solubility in water content decreased, suffered biodegradation ability of normal paraffin alkane content reduced, and naphthenic hydrocarbons solubility in water is low, anti biodegradation ability strong in relatively stable, according to the change of oil and water layer identification, to establish the criterion of oil and water.

In the process of evaluating the oil content of the reservoir with light hydrocarbon parameters, the ratio parameters are generally used in a large amount, and the variation law of different reservoir conditions is found out by using the ratio of light hydrocarbon to different compounds [7]. Select the carbon number range similar or the same, close boiling hydrocarbon fractions compared to the, can avoid the effects of temperature and light hydrocarbon loss; choose the physical and chemical properties of them are larger parameters were compared, in order to fully reflect the parameter changes; such as in the water solubility of benzene and alkyl ratio, chemically unstable containing quaternary carbon molecules and cyclohexane ratio.

Poor stability of different layers for, due to the reservoir layer is not affected by water transformation

and water, the light hydrocarbon component distribution is complete, the peak number more, lighter hydrocarbon component content has the absolute advantage, compared with the weight of the light hydrocarbon component in the spectrum of light "heavy hydrocarbon component distribution showed a right angle trapezoid", with the water content increasing, the reservoir by water transformation, the peak number of intensive degree is reduced, the light hydrocarbon component content decreased significantly, which is relatively heavy hydrocarbon component was reconstructed and the degree of strong, and the peak value is low, making the oil-water layer sample spectra showed a right angled triangle ; and water sample spectrum is approximate to a straight line shape.

### Oil layer

Reservoir has the characteristics: chromatographic elution curve of high peak, peak a multiple, peak in

more than 60, peak area is larger, can detect benzene, toluene, Bz/CYC6 greater than 0.06, TOL/MCYC6 greater than 0.2 (Figure 1-a).

### Oil and water with the same layer

Oil-water layer has the characteristics: low relative to that of the pure oil peak, peak a few, general between 40 and 60, peak area is medium to large, detected benzene, toluene, but lower peak, or only detected in toluene, BZ/CYC6 between 0.04-0.06, TOL/MCYC6 in between 0.1-0.2 etc., (Figure 1-b).

### Water

Light hydrocarbon chromatogram peak value of the curve is low, the number of the peak is less, generally not more than 40 peaks, the peak area is smaller, less than 0.04 of benzene, toluene, BZ/CYC6 less than, TOL/MCYC6 less than 0.1, etc., (Figure 1-c).

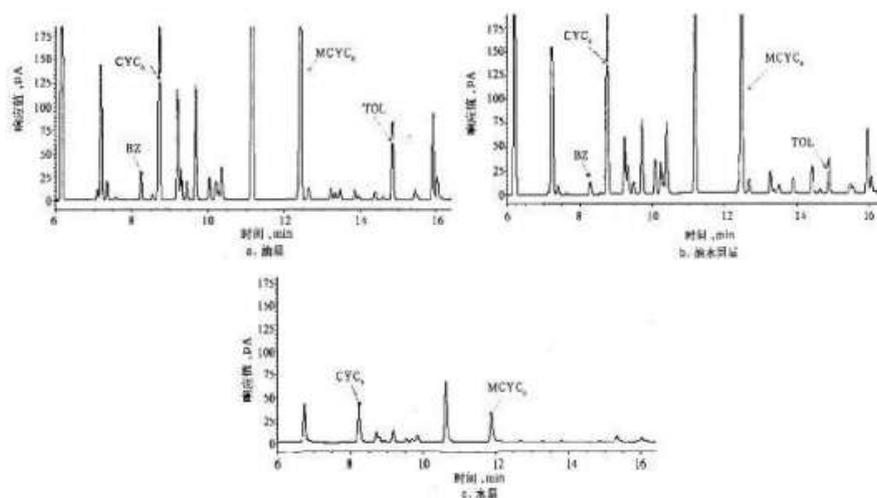


Fig-1: Typical light hydrocarbon characteristic spectra of oil and water layers

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