Scholars Journal of Engineering and Technology
OPEN ACCESS
Abbreviated Key Title: Sch J Eng Tech
ISSN 2347-9523 (Print) | ISSN 2321-435X (Online)
Journal homepage: https://saspublishers.com/journal/sjet/home

Research and Status Quo Analysis of Light Hydrocarbon Recovery Technology in Gas Field

Yuan Xiaoyun; Li Changjun; Ban Jiuqing

Southwest Petroleum University, Sichuan Province, China

***Corresponding author:** Yuan Xiaoyun
| **Received:** 02.03.2019 | **Accepted:** 10.03.2019 | **Published:** 30.03.2019
DOI: 10.36347/sjet.2019.v07i03.001

Abstract | **Original Research Article**

The separation of light hydrocarbon components in natural gas is a necessary step in natural gas transportation. This paper summarizes and analyzes the existing technology of light hydrocarbon recovery techniques, and the future direction of the development of the technology of light hydrocarbon recovery prospects, put forward ideas for future research of recycling technology, provide a reference for oil workers.
Keywords: light hydrocarbon recovery; natural gas transportation; separation of natural gas.

INTRODUCTION

At present, the consumption of natural gas and the chemical application demand of light hydrocarbon components are increasing year by year, but the natural gas components produced from the gas field are complex and cannot be directly used, and need to be processed[1, 2], such as dehydration, desulfurization and other processes. In addition, light hydrocarbon recovery (ie, condensate recovery) is also one of the important processes. The separated natural gas is more pure and can be transported to the next step, and the obtained light oil or other light hydrocarbon components can be chemically processed or directly blended [3, 4]. The use of ethylene in China in recent years is shown in the figure 1. It can be seen from the figure that the demand for light hydrocarbon components in China far exceeds the current supply. Therefore, strengthening research on light hydrocarbon recovery process and improving condensate recovery efficiency are important research directions at present [5].

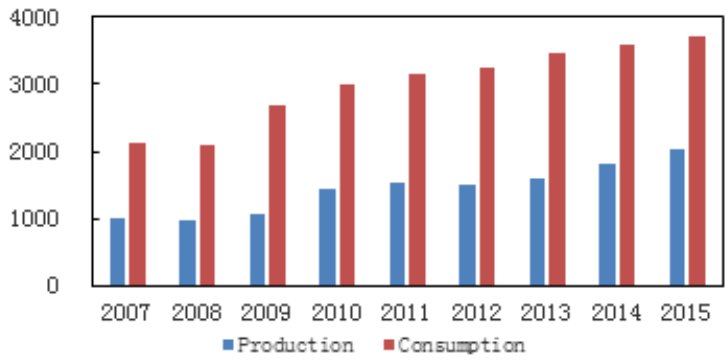

Fig-1: Domestic ethylene supply and demand structure change chart in different years

Light hydrocarbon recovery process

In the oil and gas field production process, with the development and application of new light hydrocarbon recovery technology, there are several major hydrocarbon recovery method in the field of production process [6].

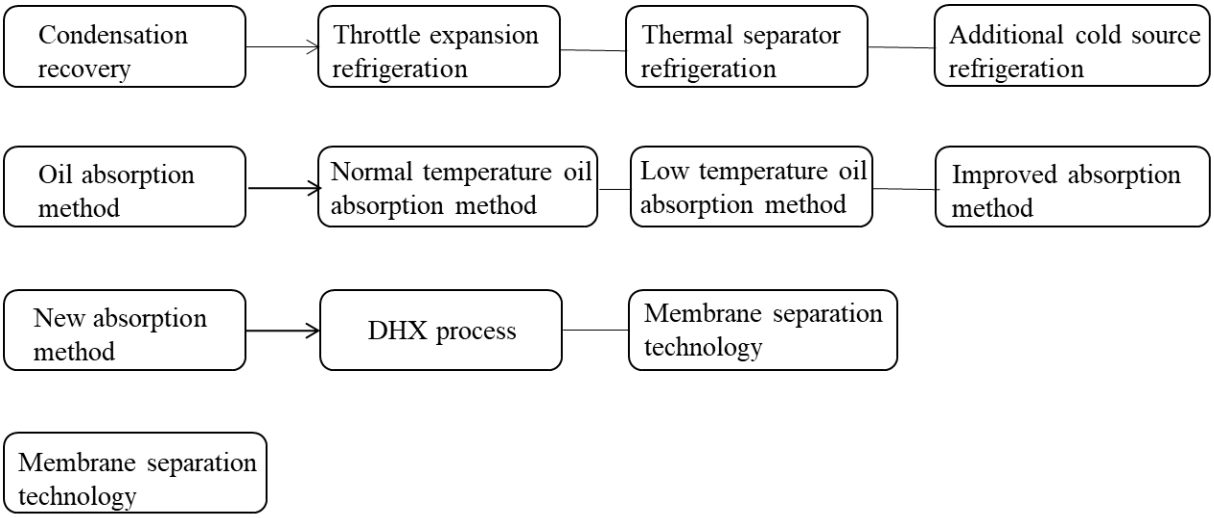

Fig-2: Different light hydrocarbon recovery technology classification

Oil absorption method condensate recovery process

When using the oil absorption method for condensate recovery, the main principle is that hydrocarbons of different molecular weights have certain selective absorption capacity for transporting impurities in natural gas (C_2 and above component alkanes), and different alkane groups can be separately removed according to requirements. The most commonly used in oil absorption is chemical light oil (also known as naphtha) [7, 8]. Generally, the classification of the oil absorption process technology is mainly based on the temperature selection during the absorption treatment. It is generally believed that as long as the operating temperature is below minus 18 ℃ attributable to the low temperature oil absorption. The normal temperature oil absorption method has high economic cost and relatively low absorption rate for the corresponding light hydrocarbon component, and the applied device is relatively limited. Therefore, the normal temperature oil absorption method has gradually faded out the optional process range for condensate recovery. At present, the application of low temperature oil absorption method is relatively more. Figure 3 is the basic process flow chart of the low temperature method:

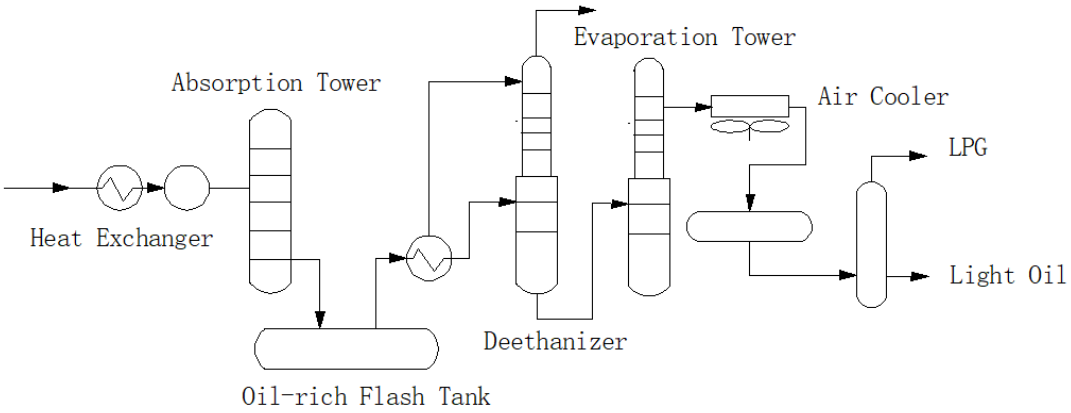

Fig-3: Schematic diagram of the basic process of low temperature absorption

Although the low-temperature oil absorption method is much more mature than the normal temperature oil absorption method in the process technology and the recovery rate of the light hydrocarbon component can be significantly improved, but both of them have the problems of complicated process and high economic cost. As the recovery of light hydrocarbon components increases, the more the adsorption solution (eg, naphtha) used is lost. China is a scarce country for chemical light oil, and it has more heavy oil. Therefore, the large consumption of naphtha has a certain impact on the development of gas fields. The requirements for light hydrocarbon recovery rate in the gas field production site are increasing year by year, and both the normal temperature and low temperature oil absorption methods are gradually replaced by the freezing separation method.

Frozen condensate separation recovery process

When using the cryogenic separation method to recover natural gas condensate, the main working principle is: different components are different in

physical properties. When the natural gas temperature is gradually reduced, different components will be volatilized in order to achieve the purpose of condensate recovery [9]. Throughout the process, due to the differences in the different components of the natural gas, the separation temperature will be adjusted. The freezing method is generally classified as [10]:

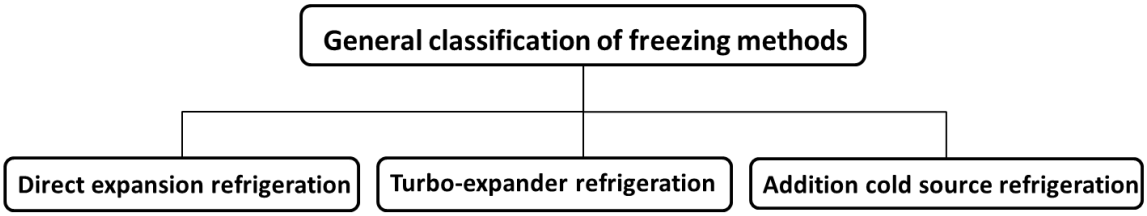

Fig-4: Freezing method

In addition, freeze separation includes methods such as mixing refrigeration. The main difference between these methods is that the temperature provided by the cold source is different and can achieve different levels of separation. The direct expansion refrigeration method is suitable for separation tasks with low cold demand, and the main energy comes from the work of gas self-expansion [11]. The addition of cold source refrigeration can provide additional pressure for the separation system or use the reagent to cool, so it is mainly suitable for the low-pressure production of oilfield associated gas condensate recovery process to achieve component separation. The difference between turboexpansion method and direct expansion is mainly due to the different sources of energy utilized. The turbine energy source is the work of the turbine. If the cold source provides insufficient cooling capacity, it will generally choose to use a mixing method to increase the cooling capacity, thus ensuring a higher recovery rate of light hydrocarbons. In addition, the equipment used for mixed cooling is generally large-scale equipment [12]. In the current gas field production process, the turbine method is generally selected for condensate separation, and the recovery rate is also considerable [13].

Future development of condensate recovery technology

Overall, increasing the recovery rate of condensate has always been the top priority in the entire process, and further improvement of recycling efficiency is the focus of work [14]. In addition, due to the increasing emphasis on energy consumption in the industrial industry, chillers are more energy-intensive. Starting from the direction of reducing energy consumption can greatly reduce the pressure on economic input and raw material supply. Saving energy is also improving efficiency in disguise. It is worth noting that in the past production, the importance of industrial pollution is not enough. The pollution problem in the current industrial environment is also to attract the attention of workers. For condensate recovery, because it includes exhaust gas treatment, cold machine refrigeration and other links, it is necessary to strengthen research on pollution issues to achieve an ideal process for environmental protection and efficiency. In order to further develop the condensate recovery process technology, it can be studied from the following aspects: (1) Optimize various parameter factors affecting the recovery rate of light hydrocarbons, such as separation temperature, separation pressure, processing parameters of gas before separation, and the like. (2) Appropriately change the cooling method. Although the turbine method is more efficient, in accordance with economic requirements, the separation method should also be refined, and various methods should be used in combination. (3) Constantly innovating technology, recycling technology is the decisive factor for the recovery rate. Therefore, the breakthrough in recycling technology can directly help the improvement of recovery rate. At present, there are new process technologies for research and utilization in China and abroad. DHX technology and membrane separation technology are promising separation technologies.

CONCLUSION

With the gradual exploitation of petroleum energy and its non-renewability, the use of natural gas will greatly affect people's lives in the future. Dealing with light hydrocarbon recovery is a very important step in the natural gas production process. In addition to protecting the environment and ensuring the safety and efficiency of pipeline transportation, the recovered light hydrocarbon components are also of great help to industrial production.

REFERENCES

1. Li H, Misra S. Assessment of miscible light-hydrocarbon-injection recovery efficiency in Bakken shale formation using wireline-log-derived indices. Marine and Petroleum Geology. 2018 Jan 1;89:585-93.
2. Varga Z, Csaba T. Techno-economic evaluation of waste heat recovery by organic Rankine cycle using pure light hydrocarbons and their mixtures as working fluid in a crude oil refinery. Energy Conversion and Management. 2018 Oct 15;174:793-801.
3. Deng J, Hong YJ, Zhai JY, WANG H, FAN MG. Characteristics and Prediction of Production

Performance of Yaha 2-3 Gas Condensate Fields. Natural Gas Industry. 2007;27(2):87.
4. Chen B, Ruan X, Xiao W, Jiang X, He G. Synergy of CO2 removal and light hydrocarbon recovery from oil-field associated gas by dual-membrane process. Journal of Natural Gas Science and Engineering. 2015 Sep 1;26:1254-63.
5. Bi H, Wang H, Chen J, Zhang X, Hu D. Analysis of the light hydrocarbon recovery rate in the negative pressure crude stabilization system. Electromechanical Control Technology and Transportation. 2017 May 12.
6. Li H, Misra S. In-situ wireline-log-derived indices for miscible light-hydrocarbon-injection recovery in Bakken petroleum system. InSEG Technical Program Expanded Abstracts 2017 2017 Aug 17 (pp. 3453-3457). Society of Exploration Geophysicists.
7. Li Yu-dong, Ding Jian-cheng, Dai Yong, Wang Yan-Juan, Zhang Shu-Juan. Study on light hydrocarbon recovery from incondensable gas[J].Journal of North China Electric Power University. 2007, 34(2): 116-117
8. Lean LNG plant study and issues like recovery of light hydrocarbons and refrigerant make-up[J].Latest News. 2015.
9. Hung-Kl Yen, Ni-Bin Chang. Bioslurping Model for Assessing Light Hyd-rocarbon Recovery in Contaminated Unconfined Aquifer. II: Optimization Analysis[J].Journal of Hazardous, Toxic, and Radioactive Waste. 2003, 7(2): 131-138.
10. Hung-Kl Yen, Ni-Bin Chang, Tsair-Fuh Lin. Bioslurping Model for Asse-ssing Light Hydrocarbon Recovery in Contaminated Unconfined Aquifer. I: Simulation Analysis [J].Journal of Hazardous, Toxic, and Radioactive Waste. 2003;7(2): 114-130
11. Cooper Jr GS, Peralta RC, Kaluarachchi JJ. Stepwise pumping approach to improve free phase light hydrocarbon recovery from unconfined aquifers. Journal of contaminant hydrology. 1995 Apr 1;18(2):141-59.
12. Cooper Jr GS, Peralta RC, Kaluarachchi JJ. Stepwise pumping approach to improve free phase light hydrocarbon recovery from unconfined aquifers. Journal of contaminant hydrology. 1995 Apr 1;18(2):141-59.
13. Cooper Jr GS, Peralta RC, Kaluarachchi JJ. Stepwise pumping approach to improve free phase light hydrocarbon recovery from unconfined aquifers. Journal of contaminant hydrology. 1995 Apr 1;18(2):141-59.
14. Chen B, Ruan X, Xiao W, Jiang X, He G. Synergy of CO2 removal and light hydrocarbon recovery from oil-field associated gas by dual-membrane process. Journal of Natural Gas Science and Engineering. 2015 Sep 1;26:1254-63.