Research on the New Path of Oilfield Oily Wastewater Treatment and Resource Utilization Based on Big Data of Internet of Things

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Abstract. In oil exploitation, we often improve oil recovery by water injection, which is also the main reason to increase the water content of crude oil. At present, the most important artificial water injection technology in China is based on reservoir geological data, which is a way of injecting high-pressure water or polymer to improve formation pressure. At the same time, water or polymer will be injected into the ground, and water and crude oil will be produced from the ground together, which requires us to separate oil and water. At the same time, oil-water separation will produce a large amount of Oily Wastewater (hereinafter referred to as OW), which requires enterprises to treat OW quickly and effectively. Therefore, this paper first analyzes the classification of OW. In view of the common treatment methods, this paper carries out the treatment method of oil slick wastewater, which is also the main technology of water flooding to achieve large-scale oil production. With the popularity of computers, IOT has been applied to many fields, which is also applied to the treatment of oilfield OW. Through the various monitoring data, we can monitor the processing effect. This paper also analyzes the treatment process.

Keywords: Iot, Big Data, Oilfield Ow Treatment, Resource Utilization

1. Introduction
Oilfield wastewater is a mixture of very complex components, including crude oil composition, inorganic ions, bacteria, solid particles, sulfide and so on [1]. Therefore, we need to add a variety of chemicals, such as demulsifiers, flocculants and fungicides. Therefore, oil companies must adopt OW treatment technology, which will be better for the effective treatment of OW [2]. By removing the oil, suspended solids and other impurities in the sewage, we can recover the oil in the sewage. With the application of IOT, the traditional sewage treatment methods are not suitable for the current high environmental requirements [4-7]. Through the IOT, enterprises can better detect OW treatment indicators, which will standardize the detection of effluent quality. Through standardization, we can
make better use of the treated water resources, which is also the main procedure requirement to reduce pollution [8].

2. Basic situation of oilfield OW

2.1. Characteristics of oilfield OW

There are many pollutants in oilfield sewage, including various microorganisms, inorganic matter, organic matter and various salts. Sewage mainly has the following characteristics. First, oily sewage generally has higher water temperature [9]. Second, OW has a high degree of mineralization; third, the wastewater is contaminated by many bacteria, especially TGB or SRB; fourth, there is a lot of tension on the surface of the wastewater, and there are residual chemicals or other impurities. The discharge standards of main pollutants in sewage are also different [10].

2.2. Classification of oilfield OW

Crude oil in oilfield produced water is dispersed in water with different sizes of oil beads. The water content is high in the later stage of oil recovery. Under the microscope, we can analyze that the produced liquid is "oil in water" emulsion [11]. According to the size of oil particles dispersed in water, we can divide oil substances into four forms, as shown in Table 1.

| NO. | Type              | Particle size | State                                                                 |
|-----|-------------------|---------------|----------------------------------------------------------------------|
| 1   | Oil slick         | >100 μm       | About 65% - 70%. It is easy to float on the water surface and form oil layer or oil film. The dispersed oil is unstable when it is dispersed in water in suspension state. After standing for a period of time, the oil droplets naturally gather into larger diameter particles and float to the water surface, which will form an oil film. |
| 2   | Disperse oil:     | 10-100μm      | About 5% - 8%. Surfactants can be stably dispersed in water, which is not easy to surface. It is difficult to separate it from water only by standing. |
| 3   | Emulsified oil    | <10 μm        | About 2% - 5%. Dispersed in water, invisible to the naked eye, very stable. It is difficult to remove it by common methods. |
| 4   | Dissolved oil     | <0. 1 μm      |                                                                      |

3. Application of OW treatment technology and reuse technology

3.1. Application of membrane separation technology

Membrane separation technology is a new type of oil filtration technology, which combines modern computer technology and chemical separation technology. When membrane separation and filtration technology is used, the oil will go through three processes: ultrafiltration, microfiltration and reverse osmosis, which will realize the comprehensive filtration of oil. In this way, we can ensure that the oil filtration effect is the best. Ultrafiltration can separate large volume substances contained in oil. Microfiltration is the treatment of micro suspended solids contained in oil. Reverse osmosis is the use of electrolysis technology to completely separate oil and water. At present, membrane separation technology is one of the main application technologies of sewage treatment in modern oil exploitation [12].

3.2. Application of magnetic adsorption separation technology

Magnetic adsorption separation technology breaks the traditional oil wastewater treatment technology, which makes full use of the movement concept of physical molecules and magnetic adsorption capacity.
In oil exploitation, enterprises can use a large number of materials with magnetic adsorption capacity for exploitation. Under the action of magnetic force, the equipment can separate some substances in oil, which will improve the separation effect of oil exploitation. In addition, the magnetic adsorption separation technology can also greatly reduce the consumption of various resources in oil exploitation, which can achieve the best effect in the treatment and reuse of open water. Therefore, magnetic adsorption separation technology has good technical performance, which can gradually improve the application process. Therefore, magnetic adsorption separation technology is widely used in China's oil production industry.

3.3. Application of high oxidation technology
High oxidation technology is a kind of OW treatment technology based on water separation principle, which has been widely used in China's oil exploitation industry. High oxidation technology requires the use of high temperature oxides, which will be used as catalysts in the treatment process. Through the automatic sewage treatment process, we can control the catalyst delivery. After entering the sewage, the catalyst will quickly release a lot of heat to evaporate the water molecules, which will complete the separation of oil and water. At the same time, the high temperature oxidation reaction can also transform the floating materials on the oil surface into useful materials, which will improve the utilization rate of oil exploitation.

3.4. Application of Biotechnology
The treatment of OW by biotechnology mainly uses the metabolism of microorganisms, which can degrade or decompose the organic pollutants in OW. Through biotechnology treatment, we can make the purification effect of toxic substances in OW reach the discharge standard. Biotechnology mainly includes aerobic degradation and anaerobic degradation. The investment scale of biotechnology is relatively small, which can ensure good sewage treatment effect. Therefore, biotechnology has a good application prospect in OW treatment.

3.5. Air flotation treatment
Air flotation treatment is to produce many tiny bubbles in sewage by various means. When the tiny bubbles float up, the suspended particles of crude oil will be fully contacted, which will produce adsorption. Flotation treatment can separate the liquid and solid phases in sewage. Solid objects will precipitate or float to the surface of sewage, which can achieve the purpose of sewage purification. The air flotation process is complex, which is very difficult. Therefore, we need to have high requirements for maintenance personnel. The air flotation tank has a good effect on the low turbidity water which is difficult to be treated. Gravity settling tank is universal, which can reduce the investment cost of construction. Air flotation process will also dissolve a lot of oxygen, which also has a great role in the follow-up treatment of sewage. The requirement of coagulation reaction is relatively low, which can effectively shorten the time of solid-liquid separation. According to the research, the diameter of bubbles produced by air flotation is about 20-100 microns. When the diameter of suspended particles is close to the bubble produced by air flotation, the effect of sewage treatment is the best.

4. Oilfield OW treatment process based on big data of IOT

4.1. Selection of OW treatment equipment in Oilfield
With the improvement of environmental requirements in China, there are higher requirements for low permeability and water injection quality. Based on the IOT technology, we can better build ceramic membrane filtration process, which will have a variety of equipment, as shown in Table 2.
Table 2. Statistics of main equipment

| NO. | Name and specification                                      | Number |
|-----|-------------------------------------------------------------|--------|
| 1   | Ceramic membrane ultrafiltration unit hyqtcmglzz-7500       | 12     |
| 2   | Ceramic membrane ultrafiltration equipment hyqtcmglzz-7500  | 1      |
| 3   | Export pump 250565 q = 350m3 H = 65m P = 132kw            | 3      |
| 4   | Recovery water pump xg085bo1z                               | 2      |
| 5   | Circulating water pump sls50-125a                          | 2      |
| 6   | Flowmeter                                                   | 12     |
| 7   | Flowmeter                                                   | 12     |
| 8   | Flowmeter                                                   | 12     |
| 9   | Effluent tester                                             | 12     |
| 10  | Pressure sensor                                             | 72     |
| 11  | Temperature change sensor                                   | 12     |

OW treatment process in Oilfield:
Coagulant and bactericide are mainly added to raw water in OW treatment process. After entering the crossflow coalescer, we can enter the walnut shell filter. After walnut shell is considered, we can add bactericide into the membrane. After the pump pressurization, we can enter the ceramic membrane filtration system. Through the ceramic membrane, we can produce qualified water, which will go into the backwash tank and purification tank. After a small amount of purified water enters the backwashing tank, it can be reused for backwashing of ceramic membrane system. The process flow of OW treatment is shown in Figure 1.

![Neutralization tank](image)

**Figure 1.** Process flow of oilfield OW treatment

5. Conclusion
With the continuous improvement of the requirements of green ecological civilization, the technical requirements of OW treatment are also increasing. With the rapid development of IOT technology, we can strengthen the protection of the ecological environment. This paper establishes an OW treatment technology based on IOT technology, which can make better use of the new path.
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