Study on Microbial Treatment Technology of Abandoned Drilling Mud in Oil Field

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Abstract

Drilling mud is essential during drilling. It plays the role of carrying drill cuttings, stabilizing the borehole wall, balancing formation pressure, cooling and lubricating the drill bit.[1]. With the depletion of petroleum resources, the depth and difficulty of drilling are constantly increasing. In order to be able to drill safer and faster, the types and quantities of chemical additives added to the drilling fluid are also increasing, resulting in the composition of waste. Also becoming more and more complicated.If it is directly discharged or stacked without treatment, it will be immersed in the surrounding soil or ocean, which will affect the utilization of soil and the growth of animals and plants, destroy the marine ecosystem, and pose a great harm to the environment.[2]At the same time, it poses a great threat to the safety of human life.

Keywords

Microbial treatment; process equipment; abandoned drilling mud.

1. Introduction

The rapid development of the economy is inseparable from the continuous supply of energy. With the development of drilling technology, the increase of water content of oil fields, the maturity of ultra-deep wells and tertiary oil recovery technologies, the pollution of abandoned drilling mud to the environment is becoming more and more serious. Abandoned drilling mud is one of the major pollutants in the petroleum industry, and its treatment is an inevitable problem for the petroleum industry. Based on the treatment status of abandoned drilling mud in China, this paper analyzes the composition and hazard of abandoned drilling mud, and uses microbial treatment technology to treat the waste mud, and innovates a new treatment process to degrade the harmful substances in the mud through biological metabolism. After treatment, it meets national emission standards.

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2. Microbial treatment

The microbial treatment technology is based on the separation, screening and induction culture of microorganisms, and after the selection of suitable strains, comprehensive utilization of microbial metabolites' demulsification performance and microbial degradation performance[3]Biodegradation of various complex pollutants, and the treatment of pollutants through the rapid propagation of the flora.

There are many hydrocarbons in the abandoned drilling mud. The degrading bacteria will proliferate the petroleum hydrocarbons as carbon sources, causing them to assimilate and eventually fully carbonize.[4]Produces harmless products such as carbon dioxide and water. In addition to hydrocarbons, there are a large amount of heavy metals in the waste mud. The adsorption, flocculation and precipitation of bacteria, fungi (yeast), algae and other biological materials, and their metabolic activities can remove or accumulate heavy metals in the waste mud and release metal ions from the

microorganisms by certain methods.[5]. The treatment of heavy metals by microorganisms has the advantages of low cost, wide application range, no secondary pollution, and high treatment efficiency compared with other methods such as chemical precipitation method, reverse osmosis method, and electrolysis method.

3. Status of disposal of waste drilling fluid

Abandoned drilling mud is one of the major pollutants in the petroleum industry, and its production is an inevitable problem for the oil industry. According to the survey of oil pollution sources by China National Petroleum Corporation in 2008, the annual drilling mud produced by drilling in China's oil fields is about 12 million tons, half of which is directly discharged into the surrounding environment.[6]. In foreign countries, terrestrial drilling platforms in Oman, Norway, Canada, Venezuela and other places mainly use heat treatment or surfactant addition method to cure the abandoned drilling mud after initial treatment, and then landfill, build road or open drill Mud use. The Ahwas oil field in Iran reinjects the abandoned drilling mud into the designated formation. Offshore drilling platforms in the Gulf of Mexico and the Norwegian North Sea often use re-injection and heat treatment methods in addition to transporting abandoned drilling mud back to land.[7]. As can be seen from the above examples, the current method for treating abandoned drilling mud in oil fields has strong limitations, and with the increasing number of toxic and harmful types and components in drilling mud, research and development are more efficient and environmentally friendly. The method has become a top priority for the treatment of abandoned drilling mud.

4. Process flow

4.1 Solid-liquid separation

The entire process divides the abandoned drilling mud according to the degree of treatment and can be divided into first, second and third. Primary treatment: It mainly removes the solid pollutants in the suspended state in the sewage. After the primary treatment, the BOD can be removed by about 30%, which can not meet the discharge standard. The abandoned drilling mud passes through the middle grill and the walnut shell filter in order of gravity. The upper part of the solid-liquid separator is provided with a rotating drum type coarse grid with a grid spacing of 50-100 mm, which is used for removing solid particles of large volume such as sediment and debris. The waste drilling mud slurry has a PH value between 8.5 and 12, and the filtered sediment can be used to improve acid soil and industrial desulfurization. The lower part of the separator is a walnut shell filter. The walnut shell filler with small gap is selected to increase the contact area between the filler and the waste drilling fluid slurry, and the suspended matter is fully filtered out. The bottom layer is activated carbon for adsorbing the pigment. (Figure 1 is a schematic diagram of the process flow)

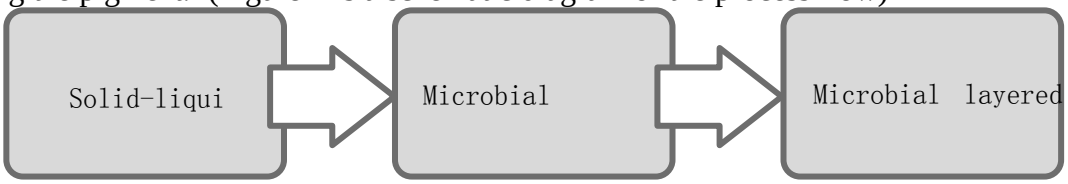

Figure 1 Schematic diagram of the process flow

4.2 Microbial aeration filter treatment

The secondary treatment is a microbial aeration filter. The upper part of the aeration filter has a feed port for the flocculant and the laboratory cultured microorganisms, and the lower part is provided with an aeration port. The effluent from the solid-liquid separator enters the aeration tank, and the aeration tank compresses the air by compression and discharges it from the vent hole at the bottom. The small bubbles rise rapidly, and in the process of ascending, they are in full contact with the colloids and flocs to form an adsorption state, which finally rises and floats on the liquid surface, and the bacteria in the

laboratory screening and culture are biodegraded to achieve the purpose of purification. Two treatment methods are also used: activated sludge method and biofilm method. (The reactor of the activated sludge method has an aeration tank, an oxidation ditch, etc., and the biofilm method includes a biological filter, a biological turntable, and biological contact oxidation. The method and the biological fluidized bed), the effluent of the biological treatment equipment enters the secondary sedimentation tank, and the effluent of the secondary sedimentation tank is disinfected or discharged into the tertiary treatment.

4.3 Microbial layered precipitator

After the secondary treatment, the liquid finally enters the sedimentation tank to further treat bacteria, metal ions and refractory organic substances in the waste mud drilling fluid: soluble inorganic substances such as nitrogen and phosphorus which can cause eutrophication of water bodies. The bio-nanofiltration membrane is arranged at the water outlet between each compartment of the equipment, and the liquid is sequentially pressurized at both ends to pass the liquid through the sedimentation tank and the adsorption tank. Bio-nanofiltration membrane can effectively intercept bacteria, heavy metal elements in your mud drilling fluid, adsorb and degrade it through its own metabolic reaction.

The process operation and equipment maintenance are easy, the automation can be realized, the floor space is small, and the management is suitable for the offshore drilling platform. When the waste drilling fluid passes through the bio-nanofiltration membrane, the pollutants are adsorbed and settled. Bacterial and metal contaminants can be effectively intercepted. It can effectively remove bacteria and metal pollutants from the waste drilling fluid, and the COD removal rate can reach over 90%, meeting the national required emission standards and the water quality requirements of the bottom refill water.

5. Existing problems and research directions

There are still some difficulties in the application of microbial treatment technology. It is highly susceptible to the external environment and takes a long time to process and does not work immediately. The most important thing is that the uncertainty is great. The technology that can be used under laboratory conditions may not be successful due to various uncertain factors in the actual application environment of pollution. Moreover, microorganisms that produce toxic substances (such as trans-diols produced by fungi) and safety problems during the process of pulverizing and degrading pollutants limit the application of microbial remediation technology [8].

6. Conclusion

Oil, a substance known as "industrial blood", promotes the rapid development of the social economy, but a series of environmental problems brought about by the massive exploitation of oil are shocking. With the increasing awareness of environmental protection and the improvement of relevant laws in China, how to make the oilfield waste drilling fluid efficient and harmless has become the focus of petroleum workers' research. The continuous advancement of life sciences has led people to turn their attention to biological treatment technology without secondary pollution, especially the screening and genetic modification of microorganisms, which will make the treatment of pollutants completely in accordance with people's wishes, and it will be a future period. The research direction of the researcher within the time. At the same time, we also catch up with the gap between us and the developed countries. With the continuous development of modern science, we believe that there will be more mature biological treatment technologies, which will make the social economy and environmental protection develop in harmony.

Foundation project

Support for Heilongjiang innovation training project (20170220038).

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