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# New Drilling Liquid Waste Harmless Treatment Technology of Research

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**Abstract.** This paper briefly introduces the current status of drilling fluid waste and its impact on the surrounding environment. Based on the analysis of the current situation of drilling fluid waste in the oilfield, the evaluation criteria of drilling waste are clarified, and a new technology for the harmless treatment of water-based drilling fluid waste is proposed, which includes a new type of environmental protection agent and armored modularization. Design, automation and intelligent control, etc., hope to provide reference for the later drilling fluid waste treatment.

## 1. Drilling fluid waste status

Drilling fluid is divided into water-based drilling fluid and oil-based drilling fluid.

- Clean the bottom of the well, carry the debris and sink it on the ground.
- Cooling and lubricating drill bits and drills.
- Equilibrium formation pressure, formation of filter cake in the well wall, sealing stable well wall.
- The drilling fluid can be used to obtain data from point logging and rock logging.

After the completion of the drilling, all mud stored in the mud pool of the well site is waste drilling fluid. Drilling waste is one of the main pollutants in petroleum industry. Drilling waste mainly contains rock debris, aggravating material, polymer and waste drilling fluid formed by various chemical additives. The main pollution components are hydrocarbon, salt, various polymers and heavy metal ions. The amount of waste of drilling fluid in oil and gas fields in China is huge, so it is urgent to deal with the waste of drilling fluid to reduce quantity, harmless and resource.

## 2. Influence of Drilling Fluid Waste on Environment

### 2.1 Effects and hazards on water bodies

Drilling fluid waste enters the water body, makes the water body polluted by oil, heavy metal and salt ions, thus destroys the drinking water source, affects and endangers the normal growth of fish and other aquatic organisms in the surface water, and can finally affect and harm human health by the action of food chain.

### 2.2 Soil hazards and impacts

Drilling fluid waste is incorporated into the soil, which is polluted by oil, heavy metal ions and salts. Soluble salts in drilling waste can make the water absorption process of plant difficult. Oil products (such as diesel oil) can inhibit plant germination, kill seeds and reduce soil wettability; Some plants



absorb heavy metal ions; High salinity can cause salinization of soil and affect plant cover, seed germination and crop yield.

### *2.3 Atmosphere Pollution and Effects*

Because the waste of drilling fluid contains a great deal of organic and inorganic matter, on the one hand, the smell of medicament and oil from the waste; On the other hand, the scent of hydrogen sulfide released in the process of bacteria, such as sulphur bacteria, iron bacteria and saprophyte, growth and propagation under natural conditions and pollutant decomposition not only pollutes the atmospheric environment, but also affects the safety of personal property in the process of oilfield operation, and endangers the growth of environment and plant.

## **3. New and harmless treatment technology of drilling fluid waste**

### *3.1 technological process*

The new harmless process of drilling fluid waste is composed of three units:

- Harmless treatment unit, equipment and equipment are mainly: Mud settling tank, stirring reaction tank, concentration settling tank. The main function is to collect the mud produced by vibrating sieve, sand remover and centrifuge in the drilling platform by mud depositing tank, and then pump it into the mixing tank by mud pump, then add medicament A (pH regulator) and medicament B (innocuous reducing agent) in the mixing tank, and then flow into the concentration settling tank to realize harmless and solid-liquid separation of harmful substances in mud.
- Water treatment unit, equipment equipment mainly includes: Filtrate water tank, filtration tank, medicine adding device. The main function is to add medicament C, medicament D and medicament E to the liquid phase produced by the harmless unit and the dehydrating unit to realize the deodorization, oxidation, pH regulation and precipitation of the liquid phase. After filtration with active filter, the final liquid phase can meet the local reuse requirement or reach the discharge standard.
- Dewatering unit, equipment is composed of two ultra-high pressure plate-frame filter presses, two sets of ultra-high pressure filter presses, ensuring the solid moisture content below 70%, reducing the transportation cost of solid phase and the risk of leakage of waste along the road.

### *3.2 Indicator evaluation*

According to the actual operation of the site and the final location of solid phase and liquid phase after treatment, the evaluation results are as follows.

- Repreparation of mud by liquid phase: COD  $\leq$  150mg/L, petroleum  $\leq$  10mg/L;
- After treatment, the solid-phase indexes are as follows: Oil content  $\leq$  0.3%, heavy metal ion content meets the requirements of "Comprehensive Utilization Pollution Control Standard of Oil-bearing Sludge in Oilfield" (DB23/T1413)..
- The volume of solid phase reduce by 20% compared with the existing curing process.

### *3.3 Process and equipment advantages*

- The process is simple and the process is short;.

The new type of drilling fluid waste harmless treatment equipment is simple in technology, without complex equipment, simple in operation, greatly reducing the burden of personnel.

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During the operation of the harmless treatment equipment, five kinds of medicament A, B, C, D and E were added according to the actual conditions on the spot. Medicament A had the function of oxidation, glue breaking and pH adjustment. Medicament B cation precipitator is a kind of inorganic substance containing ferrous ion phosphate, precipitating heavy metal ion, reducing its activity, mainly reducing heavy metal ion of drilling fluid waste from high valence state to low valence state, reducing toxicity, forming complex and precipitating from water. Medicament C is deodorant, reducing harmful gas

diffusion in mud, preventing harm to human body; Medicament D is an oxidizing agent, which can change the soluble anionic organic pollutant into insoluble substance, reduce its toxicity, adjust the pH value of waste, and cooperate with cation precipitator to break milk. Agent E is a curing agent, which can form a solid structure inorganic polymer wrapping and fixing pollutant by chemical reaction, so that it can not be free under the action of external force and its migration ability can be reduced to improve the cleaning effect.

- Unit module design, easy to move and transport;

A new type of harmless treatment equipment for drilling fluid waste is an industrialized combination of waste harmless treatment technology and waste unlanding technology. This technology combines the new type of environmental protection agent oxidation breaker, catching and complexing heavy metal ions and oxidizing organic matter by physical and chemical methods on the basis of flocculating and settling. In view of the increase of drilling and production in single well in oilfield at present, we design each unit by prying and assembling modular design, which is convenient for moving and arranging in narrow well.

#### 4. Field application and Related benefit assessment

##### 4.1 field application



Figure 1. field application a



Figure 2. field application b

##### 4.2 Related benefit assessment

- Economic benefits.

The solid-phase non-curing treatment technology can eliminate the polluted matter in the waste, reduce the solid-phase volume after treatment by 20%, reuse the liquid phase, and realize zero pollutant emission.

- Environmental benefits.

From the source, the disposal of mud and harmless treatment are solved, the harm to environment is reduced, the waste water after treatment can be reused and discharged, the water resources are saved, and the worry of drilling industry is solved.

- Social benefits

It has effectively protected ecological health, realized energy saving and emission reduction, and promoted the image of enterprises.

## 5. Prospects

Compared with the traditional waste treatment equipment, the new type of waste treatment equipment of water-based drilling fluid greatly improves the harmless treatment effect of waste and reduces the staff load.

- The development and evaluation of environmental-friendly desorption and leaching agent and the enrichment of the types of environmental-friendly agent can not only reduce the dosage of the agent but also adapt to the treatment of the waste of water-based and oil-based drilling fluid.;
- The compatibility of liquid phase and drilling fluid after treatment is studied, and the compatibility of liquid phase and drilling fluid after treatment is more stable, which ensures the continuous process of treatment;
- To optimize the performance parameters of solid-liquid separation equipment and filtration equipment and improve the application effect of drilling waste treatment.

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