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Purification of Drilling Waters with Simultaneous Disposal of Sediment

Gaffar Avalbaev
Senior Lecturer, Jizzakh Polytechnic Institute Uzbekistan

ABSTRACT: The possibilities of drilling wastewater treatment and sediment neutralization by the introduction of Portland cement are given, when the formed hydrosilicates bind pollutants, which prevents them from entering the environment. The cleaning efficiency is estimated by the degree of cleaning by polluting components.

KEYWORD: Drilling wastewater, coagulant, storage pit. purification degree, sludge neutralization.

The largest volume of drilling waste is drilling wastewater (DWW), which, as a result of filtration, breakage of barn embankments, can enter the soil and water bodies, polluting them. Therefore, the environmentally and economically justified direction of DWW disposal is their reuse for the technical needs of the drilling rig.

DWW - high-turbidity, heterophase systems containing significant amounts of fine impurities, oil, oil products, causing high aggregative stability.

The process of purification of such waters is accompanied by the formation of a significant amount of sediment containing pollutants in its composition, which must be localized and neutralized. For this purpose, when cleaning the DWW, simultaneously with the coagulant, (Portland cement) is introduced into the mixing chamber in an amount of 2 ... 8% of the mass of the DWW.

Until now, the process of sediment consolidation was carried out in several stages. First, it was separated from purified water, and then treated with a consolidant, followed by hardening.

The possibility of simultaneous purification of the DWW and neutralization of the resulting precipitate was tested due to the precipitation of the binder together with suspended solids and coagulant hydroxide, as well as their joint hydration. The resulting hydrosilicates bind the polluting ingredients into the structure and do not allow them to migrate into the environment.

And since the DWW settle in storage pits, the hydroxide of the coagulant metal, adsorbing suspended solids and Portland cement, precipitates them to the bottom. Thus, the mass is hydrolyzed as a result of the subsequent hydration of Portland cement. Consequently, when the spent DWW are fed into the storage pit, along with their cleaning, the organic substances that precipitated are neutralized and the bottom and walls of the storage pit are waterproofed, which prevents their further penetration into the environment. It is also possible to waterproof barns already filled with water. i.e. feed a mixture of coagulant and Portland cement into them.

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Wastewater was used in the experiments, taken from the settling pit of well 4 of the Production Association “Fergananeft” with the following initial parameters: chemical oxygen demand (COD) - 1.72 and 10.275 g O_2/l; suspended solids (SS) - 5.305 and 5.012 g/l; oil products (OP) - 0.664 and 0.640 g/l; pH-7.9 and 7.6, respectively. Dry residue DWW SKV.4. is 30.188g/l; calcined - 26.388g / l.

The method of work was as follows. At the same time, DWW was fed into the mixing chamber at a speed of 25 m/s, 5% solution of aluminum sulfate Portland cement. Their joint hydraulic mixing took place in the mixer, and then the suspension was transported to a sump (barn), where it was clarified and consolidated. The selected speed made it possible to evenly distribute the particles of Portland cement in the DWW and prevented its sedimentation during processing.

The parameters of the composition and properties of the original and purified DWW were determined according to standard methods generally accepted in water treatment.

For analysis, purified water was taken from the clarified part after 30 min of settling by decanting.

The indicator of the efficiency of the process was the degree of purification ... for the main pollutants (suspended substances, chemical oxygen demand, oil products), which was calculated according to the well-known formula (Handbook on properties, methods of analysis and water purification / L.A. Kulchinsky et al. - Naukova Dumka, 2009).

The cleaning results are shown in Tables 1 (DWW well-4) and 2 (DWW well-34).

Compressive strength () served as an evaluation indicator of the curing process. To determine the stability of the cured composition and the leaching of organic components from it, the COD of the aqueous extract was determined after 7,14,21 days of curing. The COD of the extraction water practically does not increase, which indicates a reliable neutralization of the polluting components in the DWW.

Table 1

Degree of purification α	1,2 g/l $Al_2(SO_4)_3$		
	20 g/l PC	40 g/l PC	80 g/l PC
α_{COD}.	88	92	97
α_{SS}.	94	96	98
α_{OP}.	100	100	100
pH.	8,0	8,9	9,6

Table 2

Degree of purification α	1,2 g/l $Al_2(SO_4)_3$		
	20 g/l PC+ 0,08 g/l SAA(surface active anions)	40 g/l PC + 0,01 g/l SAA(surface active anions)	80 g/l PC+ 0,012 g/l SAA(surface active anions)
α_{COD}.	88	91	95
α_{SS}.	93	95	97
α_{OP}.	100	100	100
pH.	8,0	8,6	8,9

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Table 3

Sediment parameters after hardening for 7 days in pure water	1,2 g/l $Al_2(SO_4)_3$		
	20 g/l PC	40 g/l PC	80 g/l PC
Compressive strength σ ¸MPa	0,05	0,11	0,21
Change in COD of extraction water, %	0	0	0

The results of sediment neutralization during the cleaning process are summarized in table.3.

On the basis of the results obtained, it can be concluded that this method allows achieving high purification of the DWW. reliably consolidate and neutralize sediment, eliminates the process of additional alkalization of purified water. Four technological operations: separation of the sludge from the treated water; introducing a binder into the sediment; uniform distribution of the binder in the mass and transportation of the spent mass to the place of hardening are caused by one thing - the introduction of Portland cement simultaneously with the coagulant into the flow of the DWW.

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