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Application of waste of treatment facilities to improve barrier reclamation

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Abstract

Our work is devoted to the development of an effective method of reclamation of areas involved in oil and gas production. In particular, those areas that are allocated for the placement of barns and are one of the most polluted at the end of mining. The solution to the problem is achieved through the use of a modified barn design, as well as the use of sorbent from the wastewater treatment plants. Reduction of soil contamination on the site allows further use of the oil sludge barn, including agricultural activities. The developed method can be used in any drilling operations, as well as in activities involving the reclamation of areas exposed to pollution due to oil spills, as well as those soils that have degraded due to the migration of pollutants associated with in the process of drilling.

Key words: soil, reclamation, sorbent, oil products, barn, construction

Анотація

Наша робота присвячена розробці ефективного методу рекультивації територій які задіяні у процесі видобутку нафти і газу. Зокрема тих ділянок які відводяться під розміщення амбарів і є одними із найзабрудненіших по закінченню видобутку корисних копалин. Розв'язання проблеми досягається за допомогою використання зміненої конструкції амбару, а також застосування сорбенту із відходів водоочисних підприємств. Зменшення забруднення ґрунтового покриву, на території об'єкту дає можливість подальшого використання території нафтошламового амбару включаючи сільськогосподарську діяльність. Розроблений спосіб може використовуватись при веденні будь-яких бурових робіт, а також у діяльності, що передбачає рекультивацію територій, які піддались впливу забруднення через аварійні ситуації, що проявляються розливами нафти, а також ті ґрунти, які деградували через міграцію забруднюючих речовин, що є супутніми в процесі буріння.

Ключові слова: ґрунт, рекультивація, сорбент, нафтопродукти, амбар, конструкція

Introduction

The main purpose of the work is to determine the level of reclamation of the territory of oil and gas production activities. The subject of the study is the quantitative and qualitative indicators of reclamation of the study area. An experimental site of a drilling barn was selected for the study.

Today there are many promising methods of cleaning oil-contaminated soils, both economically and practically, there is a biotechnological approach based on the use of different groups of microorganisms and increases the ability to biodegrade components of oil and petroleum products.

The main mechanism for the spread of oil pollution in soils - gravitational movement on the surface towards the slope (surface runoff), penetration into soil horizons and loose sediments. In the course of the research the existing constructions of drilling barns and methods aimed at reducing the level of soil pollution and degeneration of vegetation were analyzed. Currently, the following methods are used: the use of soil-cement, waterproofing, biological utilization and the use of a combination of protective wal

Results of the research

In order to solve the problem of effective reclamation of drilling barns, we have developed an effective version of the drive design. But to achieve the effect of complete reclamation used sludge (waste from treatment plants). The used sorbent in the dry state effectively interacted with the contents of the barn, which was the reason to stop there because other types of sorbents used by us showed quite low levels of efficiency. A feature of our development is the use of shock-absorbing walls and a special structure of the barn lid in the process of creating an oil sludge barn. The walls will consist of a three-layer protective block, the inner layer of which is a kind of shock absorber, and the cover provides for the use of agrofiber. Also, to enhance the biologically renewable processes of pollutants during the filling of the oil sludge barn, a filler (sludge) is gradually added in a ratio of 2.5: 1.

With the help of the above methods it is impossible to completely rehabilitate drilling barns or sludge storages in such a way as to restore full human activity in the burial area. However, it is possible to approach the solution of the problem that is raised in the article by implementing our development from the experimental stage into real use.

As for the advantages of the proposed method of reclamation, there are several key ones, namely: the ability to use in any climatic conditions; economic advantage, the cost of the proposed method is relatively lower than in existing analogues; the possibility of further use of the surface of the oil sludge barn; use of waste from other industries that reduce the burden on the environment.

The study is based on the task of creating a design of oil sludge barn, which would reduce the impact on vegetation, which leads to degeneration of the phytosphere and prevents further use of the surface for the development of organic components of the environment.

An important advantage of this method is the ability to use the development in any parametric and time variations required by the designer. The size of oil sludge barns, their volume, profile and depth and height of the embankment are determined at the stage of working design, according to the specific site of well construction, taking into account the soil category, depth of groundwater and other characteristics.

Construction of a drilling mud barn begins with the removal of the fertile layer of soil and its storage in temporary dumps; then digging an earthen pit and storing clay soil. The next stage is the construction of anti-filtration walls. When creating an oil sludge barn, it is necessary to use shock-absorbing walls, which will consist of three types of soil. In the proposed embodiment, it is necessary to use types of bends that have different throughput properties, ranging from dense to the next least dense and ending with medium density [2-6].

The offered model of a design of construction of a drilling barn will allow to slow down as much as possible processes of distribution of hydrocarbon pollution of a vegetative cover. At the same time, the soil layers that will be used for the sides of the structure will contain hydrocarbon pollutants and related chemicals, gradually reducing the level of distribution of substances to unpolluted areas not involved in technogenic activity.

For external walls that need to use medium-density soils such as scaffolding, loess and carbonate loams and sands, to create intermediate walls of different, different types of sand, or soil types with a sand content of 37%, to create the most active layer of isolate must use the densest clay types soils [1, 2].

The next step in the creation and reclamation of barns, while filling it with an important element to reduce the level of impact on the biosphere is the gradual addition of sorbent [1].

In this case, waste treatment plants play the role of a natural sorbent. The optimal proportion of 2.5: 1 volume relative to the content of the contaminant, this amount will act as a binder, absorbent (the amount relative to the filler of the barn is determined experimentally and determined its highest efficiency). When less absorbent was added, an increase in unbound hydrocarbon fractions and direct drilling waste (drilling fluids and various types of chemical softeners) was observed in the experimental model. If more sorbent is added, oil sludge overload is recorded and a significant loss of working volume is detected, which leads to an increase in the initial size of the structure, which is an important negative factor not only from an ecological point of view, but also from an economic point of view. It is these results of studies with an experimental model that led to the conclusion that 2.5: 1 is the optimal amount of sorbent to achieve maximum environmental and economic effect.

Physico-chemical properties of the sorbent will stimulate reclamation and increase the level of potential use of the territory in the future, reduce the risk of leakage, prevent subsidence of the surface of reclaimed barns (maximum possible level of subsidence caused by active use of the barn will not exceed 15 cm). use the barn area as an agricultural facility. The principle of arrangement of the developed ecological modification of an oil sludge barn. Feature of modification consists in the following constructive elements: 7 - an external wall; 6 - intermediate wall; 3 - inner wall; 1 - board of the oil sludge barn; 2 - absorbent with drilling waste; 5 - inner wall (barn lids); 8 - removed soils outer part of the cover (in the process of creating the pit); 4 - stabilizing embankments; 9 - agrofiber.

To effectively apply our development and achieve the effect of reclamation, we have the following recommendations. For external walls (7) use soils with medium density, for example, woods, loess and carbonate loams and sands. Intermediate walls (6) of different sand, different types of sand, or soil types with a sand content of not less than 37%. Inner wall (3 and 5) of clay soil types. For stabilizing embankments (4) use dense types of soils or certain rocks that can maintain the pressure balance and shift the center of maximum pressure of the barn filling (1 m - width, thickness not less than 30 cm). Agrofiber (9) with a density of

100 g / sq.m. Each wall of the developed modification is expected to be at least 30 cm thick and will increase accordingly if a longer operation process is required. Each layer of the cover must be at least 40 cm and the thickness of the agrofiber.

The study found that the sorbent contained in the waste storage facilities has high binding properties and also promotes reclamation processes, as the top layer of soil, which will act as a barn lid, will be suitable for further use.

It is important to note that oil sludge barns are a major environmental problem, as large areas set aside for their placement lose their functional properties. It should be noted that sludges formed in the process of wastewater treatment have good properties, but are not currently actively used, but mostly accumulate in (sludge dump), which is not effective in terms of sustainable development and sustainable use of nature. This aspect became one of the reasons for the use of waste from treatment facilities to restore the area set aside for the oil sludge barn.

The use of silt will not only rehabilitate barns, but also reduce the area used for (sludge dump), which is a direct economic benefit for both treatment companies in any locality and for the extractive industry. That is, this method / method has a specific environmental effect, which creates a direct impact on the level of environmental safety of oil-producing areas.

The conducted research leads to the conclusion that by reducing the area involved in waste storage and use of our proposed sludge sorbent, it will promote gradual reclamation. On the other hand, the introduction of effective reclamation of oil sludge barns will not only reduce the migration of hydrocarbons, but will also allow further exploitation of areas that were allocated for the construction of this type of structures. A special effect for the use of the barn surface is brought by the use of agrofiber which will work as a two-stage filter. The versatility and ease of use of the developed design makes it possible to use it in different climatic conditions. This will undoubtedly improve the environment and raise the level of environmental safety in areas of active oil and gas production.

Conclusions

The conducted research solves the problem of migration of oil products from potential sources of pollution (drilling barns) into the soil profile, and, consequently, to increase the level of environmental safety, as well as to develop a way of further use of reclaimed areas. We achieved this result by developing a new design of the drilling barn and the use of sorbent, which is the waste of water treatment plants. The design of the drilling barn with the addition of sorbent (sludge) allowed to solve the problem of primary contamination of the soil cover, which occurs due to the migration of oil, oil products and drilling waste from the drilling barn into the soil profile.

REFERENCES

1. Kachala, Taras Bohdanovych. Udoskonalennya system ekolohichnoho monitorynhu gruntovoho pokryvu vysnazhenykh naftohazovykh rodovyshch Prykarpattya (na prykladi Bytkiv - Babchens′koho nafto hazokondensatnoho rodovyshcha) : dysertatsiya. 2018.
2. Handbook management of the contaminated sites with oil products depollution and fertilization technologies Romania-Ukraine cross border area area edtiura risoprint cluj-napoca 2015−100 c.
3. Kachala T. B. Bezpechnyy rozvytok pryrodnykh i antropohenno-modyfikovanykh heosystem / Kachala T.B. // Ekolohichna bezpeka ta zbalansovane resursokorystuvannya : naukovo-tekhnichnyy zhurnal. — Ivano-Frankivs′k : Holiney. — 2014. — №2. — S. 162–163
4. Kachala T. B. Sposib stvorennya ekolohichnoyi modyfikatsiyi nafto shlamovoho ambaru / T. B. Kachala // Ekolohichna bezpeka ta zbalansovane resursokorystuvannya : naukovo-tekhnichnyy zhurnal. — Ivano-Frankivs′k : Holiney, 2016. — №1. — S. 52–57.
5. Kamenshchikov F. A. Neftyanyye sorbenty / F. A. Kamenshchikov, Ye. I. Bogomol'nyy. — Moskva–Izhevsk : NITS «Regulyarnaya i khaoticheskaya dinamika», 2005. — 268 s.
6. Preparat «Ekolan» dlya ochyshchennya seredovyshch vid nafty ta naftoproduktiv : TU U 24.6- 30572733-005-2004. — [Chynnyy vid 2004-07-21]. — K., 2004. — 18 s.

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