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DEVELOPMENT OF TECHNICAL MEANS FOR COLLECTING OIL AND OIL PRODUCTS FROM THE WATER SURFACE

Abstract

The article considers the problems of water surface pollution with oil and oil products. Proposed the design of a new device that allows to eliminate emergency spills of oil products from the surface of natural water areas, as well as significantly improve the environmental situation in the places of storage and collection of wastewater containing oil products.

Key words: oil, oil products, wastewater, storage device, storage, sorbents, oil skimmers.

Introduction

In the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, the most harmful chemical pollutants are oil and oil products. Into the environment, including the water environment, oil and its products are introduced as a result of economic and production activities by oil producers, pumping and transportation systems, oil terminals, oil depots, oil product storage facilities, railway transport, river and sea oil tankers, refueling complexes and stations.

Accumulated volumes of waste products of oil products and oil pollutants on separate storage tanks reach tens and hundreds of thousands of cubic meters, which in turn become a permanent source of pollution.

Oil pollution does not allow sunlight to pass into the upper five-ten centimeters of the water surface, where a wide variety of organisms exist and develop, and these organisms in turn are the nutrient medium of invertebrates and the young growth of very many fish species. Soluble elements of oil are very poisonous, become a cause of death of birds, impair the taste of meat of commercial sea animals and fish, which can not be used for food because of the smack and oil smell.

The water environment is polluted as a result of man-caused, environmental disasters, natural flow, as well as economic and industrial activities of man.

Half of the oil produced on the world shelf is transported by the tanker fleet. At the same time, its transportation on tankers does not do without accidents, which leads to pollution of beaches, the death of a significant number of living inhabitants of the oceans and seas. Every year, up to 10 million tons of oil and oil products enter the waters of the world's oceans, and this danger multiplies with the increase in the number and tonnage of tankers. Modern tankers belong to the number of the largest vessels (length more than 350 m., full load capacity up to 500 thousand tons). In addition, oil spills cause great damage as a result of accidents on offshore drilling platforms.

Oil and oil products into the waters of the world ocean naturally come from cracks and crevices in the seabed. Among industrial pollutants of the environment, a special place is occupied by wastewater, in which the most widespread polluting elements are oil products: oil, fuel oil, kerosene, oils and their impurities, which may be present in the sewage composition in two states: emulsion, consisting of water droplets distributed between oil molecules and in a state of stratified liquid, located on the water surface with a layer of various thicknesses.

Stratification of the flow can be achieved without special structures, and then it is possible to separate oil or its products from the surface of the water by filtration, adsorption, separation in the field of centrifugal forces [1]. However, due to a number of reasons related to the presence of

a large number of facilities, and also because waste water containing petroleum products is a multiphase liquid, which complicates the regeneration of filters, the use of these methods is not widely used.

Materials and methods

The method of mechanical collection from the surface of water using the viscosity of the liquid is considered the most preferable. This method is promising and environmentally friendly.

Consideration of the designs of oil skimmers offered by domestic and foreign authors [2, 3, 4, 5, 6, 7] showed:

- most of the known devices are designed for operation in stationary conditions for the collection of petroleum products in a limited water area;
- the design drawbacks of the known devices include low mobility, limited surface of the oil products collection by the operating parts of devices, the complexity of operation, inadequate effective methods of dehydrating oil products;
- outfitting of oil companies it is characterized by an insufficient number of specialized tools such as skimmers. At the same time, available means, mainly foreign-made, are not entirely suitable for the localization and collection of oil products from the surface of storage facilities, storage tanks and natural water areas.

Results and discussion

To ensure a more efficient separation of the treated oil-containing slurry, a "Mobile equipment for collecting oil and oil products" has been developed (Fig. 1). With a view to possibly separating the grease-oil products, a perforated drop-shaped collection is installed inside the standard cylindroconical hydrocyclone, similar to the form of the section of the internal ascending and external descending streams (surfaces of zero axial speeds). The feed tube of the hydrocyclone is connected to the pressure tube of the pump, and to the suction tube connected funnel of the pump. To prevent clogging of the elements of the device with hardened oil particles, pre-heating the slurry, a high-speed heater is connected to the suction tube of the pump. The device for movement on the water surface is installed on the boat.

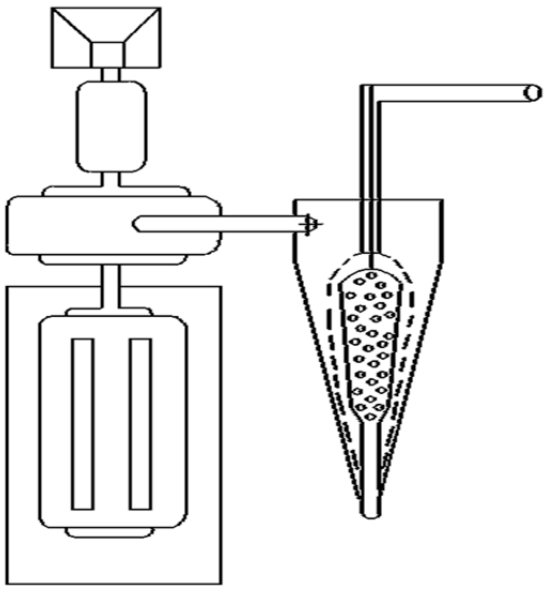

Figure 1 - Mobile equipment for collecting oil and oil products

When the pump is switched on, the oil products taken by the receiving funnel are preheated in the heater and enter the hydrocyclone where, under the action of centrifugal forces, the heavier phase-water is withdrawn through the slurry nozzle, and the light phase-the mixture of oil products with water-comes through the surface of the ascending and descending flows in the drainage branch of the hydrocyclone, and the oil products into the drop-shaped collection, from where it is taken to the temporary storage receiver. The efficiency of phase separation of the water-oil mixture is carried out by means of vertical displacement of the collector by an adjusting screw.

In order to improve the properties and characteristics of existing devices for collecting oil products from the water surface (providing mobility of the device, increasing the width of the working body, reducing the energy required to rotate the reel, and increasing the separation efficiency of the separated suspension in phases), a "Device for collecting oil and oil products from a water surface" was developed (Fig. 2).

Depending on the thickness of the layer of oil products on the water surface, the oil collection reel is installed at a certain height. When the device moves, rigid blades attached to the reel begin to rotate the reel and the light phase (oil products) collected by the oil collection channels enters the collecting tank. When the pump is switched on, the mixture of water and petroleum products in the tank enters the hydrocyclone in which two streams are formed - ascending and descending. With the help of the hydrocyclone installed inside, coaxial with the interface between the ascending and descending streams of the drop-shaped perforated collector, equipped with an adjusting screw, ensuring its movement along the axis of the apparatus, due to centrifugal forces more heavier, a high-density phase (water, heavy impurities) is discharged through the slurry nozzle, and the light phase (oil) through the flow boundary tends towards the drainage branch and into the perforated collector, drop-shaped form of which contributes to a more complete entry into the collection of a light phase, which is discharged through a branch pipe into a container for temporary storage of oil products. The quality and quantity of impurities entering the light phase is regulated by a screw. To ensure unimpeded withdrawal of the separation products, the hydrocyclone is installed with the possibility of changing the vertical position. The heavier part of the liquid (water and heavy impurities) released in the tank is pumped out by the pump with closed and open valves on the nozzles. To increase the productivity of the device, when the reel is mounted in the up position, a stopper is attached to the leading edge of the tank.

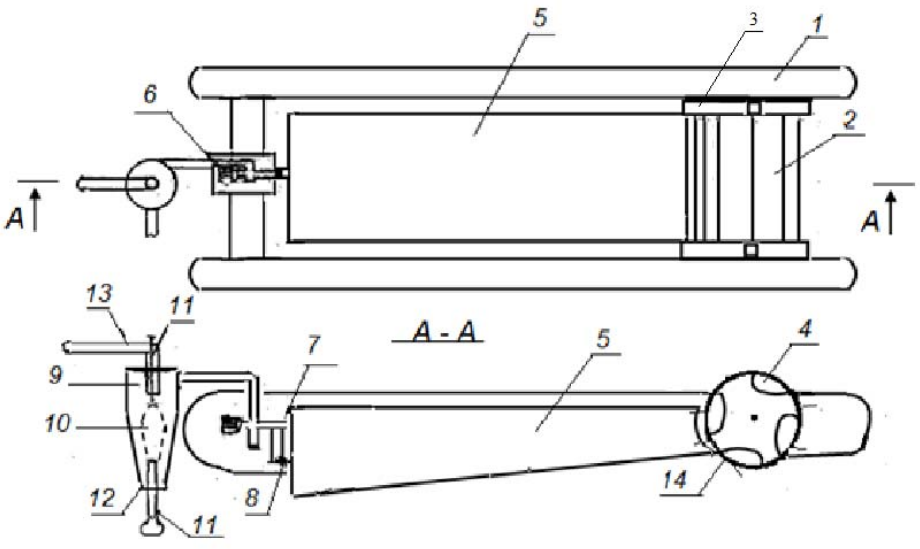

Figure 2 - Device for collecting oil and oil products from a water surface

Conclusion

The developed devices can be used as mobile means to accelerate the liquidation of accidental oil spills from the surface of natural water areas, solving the main tasks of the environment, as well as significantly improve the environmental situation in the places of storage and collection of sewage containing oil products.

The economic effect of using the device is defined as the difference from the sum of the value of the commodity output (collected by the oil product device), the benefits obtained from the reduction of environmental damage and allocated investments for research and development, production and operation of the device.

As part of the further development of work in this direction, it will be a question of creating a device that has a world-wide novelty. Guaranteed performance characteristics will be ensured through the use of scientifically based theoretical calculations and experiments.

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РАЗРАБОТКА ТЕХНИЧЕСКИХ СРЕДСТВ ДЛЯ СБОРА НЕФТИ И НЕФТЕПРОДУКТОВ С ВОДНОЙ ПОВЕРХНОСТИ

Аннотация

В статье рассматриваются проблемы загрязнения водной поверхности нефтью и нефтепродуктами. Предлагается конструкция нового устройства позволяющее ликвидировать аварийные разливы нефтепродуктов с поверхности естественных водных акваторий, а также существенно улучшить экологическую обстановку в местах хранения и сбора сточных вод содержащих нефтепродукты.

Ключевые слова: нефть, нефтепродукты, сточная вода, хранилища, накопители, сорбенты, нефтесборщики-скиммеры.

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СУ БЕТІНЕН МҰНАЙ ЖӘНЕ МҰНАЙ ӨНІМДЕРІН ЖИНАУҒА АРНАЛҒАН ТЕХНИКАЛЫҚ ҚҰРАЛДАРДЫ ДАЙЫНДАУ

Аңдатпа

Мақалада су бетінің мұнай және мұнай өнімдерімен ластану мәселелері қарастырылған. Табиғи су акваторияларынан апаттық жағдайда мұнай өнімдерінің төгілуін жоятын, сонымен қатар құрамында мұнай өнімдері бар сарқынды суларды жинауға және сақталатын орындарда экологиялық жағдайды жақсартатын жаңа құрылғы конструкциясы ұсынылған.

Кілт сөздер: мұнай, мұнай өнімдері, сарқынды сулар, сақтағыш, жинақтағыш, сорбенттер, мұнай жинағыш-скиммер.

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ВЛИЯНИЕ БИОУДОБРЕНИИ НА РОСТ И РАЗВИТИЯ СОРТОВ ДОННИКА НА ЗАСОЛЕННЫХ ПОЧВАХ КЫЗЫЛОРДИНСКОЙ ОБЛАСТИ

Аннотация

Изучено содержаниеводнорастворимых солей вразных глубинах почвы мелко деляночного опыта в весений период. Исследовано влияние отечественных биологических удобрений на рост и развитие сортов донника на засоленных почвах Кызылординской области. Биологическими удобрениями являются «Фитобацирин» и «Ризовит АКС», разработанные в РГП «Институт микробиологии и вирусологии» КН МОН РК. Выявлено, что обработка семян как целлюлоза разлагающей бактерией, так и нитрагином существенно повышает урожайность зеленой массы сортов донника. При совместном внесении биоудобрении они показали лучший результат. Урожайность при этом повышается существенно по сравнению с раздельной обработки семян. Обработка семян с Ризовит АКС и целлюлозоразлагающими бактериями обеспечивает достоверную прибавку на количество стеблей (367-841 шт/м^2) и урожая (293-347 ц/га).

Ключевые слова: Фитомелиорация, донник, биоудобрения, севооборот.

Введение

Агроэкологическая обстановка орошаемых земель в Казахстанском Приаралье взаимосвязана с минерализацией коллекторно-дренажного стока воды, которая изменяется в пределах от 2 до 5 г/л и имеет тенденцию к увеличению. За последние 10 лет она повысилась на 60%. Это свидетельствует о продолжающихся процессах вторичного засоления территории, обусловленных с одной стороны ростом минерализации оросительных и грунтовых вод, а с другой – недостаточной дренированностью территории [1,2].

В результате агромелиоративного обследования инженерно-подготовленных орошаемых земель и наблюдений за уровенно-солевым режимом грунтовых вод были