DEVELOPMENT OF METHODS FOR EXTRACTION OF OIL IN CLEANING OIL WASTE USING DEVICES EQUIPPED WITH SOLAR CONCENTRATING ELEMENTS

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ABSTRACT

This paper describes the use of solar energy prospects of the oil industry. A device for cleaning oil-contaminated waste. The results of studies on the treatment of waste oil with the use of solar energy.

Keywords: solar energy, device, oily waste, treatment of waste oil, solar concentrator.

The oil industry because of the specificity of its activity is potentially dangerous for the environment. This toxicity is due to the hydrocarbons and the substances used in of oil production processes. In the operation of oil fields inevitably formation of persistent oil-water emulsions, the properties of which are variable in time and depend on many factors: the amount of gas and water production of oil wells, formation water salinity, surface mining, component composition, physico-chemical and colloid-chemical properties of oils and their natural stabilizer particles having solids and composition, temperature, etc. The stability of such systems increases strongly with their long-term storage in open barns and ponds. This is due to the "aging" of emulsions, sealing and hardening time booking the shells on the drops of water, evaporation of light fractions, tar oils, petroleum products, increasing the solids due to atmospheric dust, etc.

The accumulation of waste oil in the exploitation of oil fields is due to:

- discharges of oil in the preparation;
- discharges during cleaning of oil tanks;
- oil-containing drilling fluids used in the manufacture of drilling operations;
- discharges during the test and workover;
- spills in production and transportation of oil.

Among the oily waste generated at the enterprises are the most environmentally hazardous sludge, which are very stable three-component system: solid - oil - water, stabilized by the presence of a gaseous phase - products biodegradation of organic matter. Components of sludge - oil, petroleum products and mineral salts are the most dangerous components of soil. Evaporation of hydrocarbons leads to pollution of the air, drain the excess of the barns of strongly water (sulfates, chlorides) reduces soil fertility and negatively affects the upper fresh water aquifers. Only sludge concentration not

exceeding 0.1 g / kg of soil, is not reflected in its agro-chemical properties and does not cause mutagenesis in the plant community. Low molecular weight alkanes of the normal structure and exert toxic narcotic effect can penetrate cell membranes, causing severe impact on the living organisms [1].

Oily waste and petroleum products are a major environmental pollutants. They are formed by the transport of crude oil and refined products, accidents, transport, refining and transportation capacities in other cases.

The main consumers of petroleum products are concentrated in large industrial centers. This transport enterprises and various industries: machine building, chemical, electrochemical, light, metallurgical and many others using fuel, lubricating oils, cleaning fluids and other petroleum products.

An integrated approach to the processes of processing of oily waste is paramount. Seems the most appropriate comprehensive utilization, ie processing of oily waste with maximum regard for the properties and use of all components, resulting in the waste becomes raw materials, reagents or excipients in the production of products or participate in the recycling of other waste. From our point of view, the system of waste of oil production is an organization of certain process steps, passing the oil that undergoes successive transformation in a "withdrawal - a by-product - a commodity product" with minimal loss and maximum safety for the environment. The problem of processing and the resulting oily waste has accumulated leads to the development of new innovative technologies in this field. Interested in this as our scientists, as well as Russian and foreign companies, and the exchange of scientific experience will lead to more rapid solution to the problem. Processing of oil sludge and oil-contaminated soils using innovative methods to solve some specific problems - environmental, economic and social. In our opinion, this has a certain influence on the ways to determine the effectiveness of the implementation of innovation and investment projects in the processing of oily waste. Selection of processing depends on the quality and composition of the slurry contained therein oil and solids.

Basically waste oil must be disposed of by incineration. However, burning of waste oil from the point of view of the economic and energy-and resource-saving policy is incoherent. The combustion of waste oil, first destroyed with difficulty extracted from the bowels of petroleum products, and secondly, are costly process lines, and thirdly, the environment is additionally subjected to pollution, as this stand out more dangerous and harmful substances than the extraction and processing of the oil itself.

The volume of oil contaminated soil generated for the year is 510 million tons, while the rate of oil sludge formation - 3 million tons. To date, the effectiveness of the measures for disposal of waste oil is very low: the volume of existing and newly generated waste ten times the amount of recyclable waste. The accumulation and storage of waste oil is carried out in an open ground tanks - sludge pits, which have a negative impact on the environment (soil, water, atmosphere, biosphere).

In world practice, recovery and disposal of waste oil used thermal, chemical, biological and physico-chemical methods. Most of the known technology of waste disposal (incineration, thermal degradation, pyrolysis, etc.), basically, destroy the hydrocarbons contained in the oil waste.

While developed method maximizes hydrocarbon emissions without compromising their chemical structure.

For the separation of the organic and the mineral oil waste has been developed method for thermal processing of oil waste and device for its implementation. Developed a method of heat processing oil waste comprises supplying the feedstock into the heating zone and out of the solid residue, wherein a heating zone maintained at a temperature above 150 ° C to obtain a flowable state materials with the organic liquid followed by separation of the solid from [2,3].

After preheating the cooled heating zone producing the inner tubular member filling the hopper, and a starting material include a feedstock feeder. Raw moving out of the cold portion of the inner tubular member and into a heating zone where the melt down of the organic portion. The molten organic phase then pops up, and heavy soil particles coming down. Since the inner and outer tubular members are connected together and mounted at an angle of 10-45 ° respect to the horizontal plane, the flow of liquid phase occurs from the heating zone to the feed hopper for a drain pipe. The organic part flows through the tube into the tank and the solid spiral screw is released from the free end of the drive in the warehouse. Consumption of propane-butane mixture of 130 cm3/min, air - 5000 cm3/min. The temperature in the luminous flame zone reaches 800-900 ° C. The temperature of the flowing organic 150-200 ° C, the temperature of the solid residue 180 ° C. The advantage of the device is the simplicity of the design. In the apparatus for the dry thermal processing of waste oil as a heat carrier may be any heat carrier agent (heat from a gas burner, combustion flue gases, steam, hot water) [4].

In this regard, we propose a device with solar concentrating elements, ensuring maximum focus of direct and diffuse solar radiation, and a new method of extracting oil, providing energy savings and traditional fuels, environmental clean environment, free from smoke emissions [5].

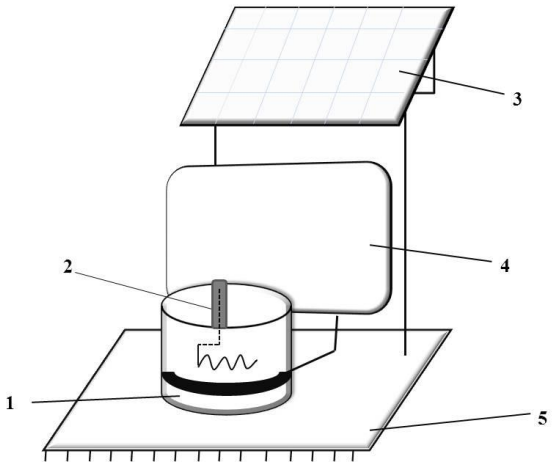
The developed device using solar energy are the required conditions for the extraction of oil from the ground. As can be seen from the above data, the product of oily waste is a valuable hydrocarbons, which can be recycled or used for other purposes.

In our opinion, this has a certain influence on the ways to determine the effectiveness of the implementation of innovation and investment projects in the processing of oily waste. Selection of processing depends on the quality and composition of the slurry contained therein oil and solids.

A device with a concentrating solar radiation elements is a key element of the facility in which the energy of solar radiation is converted into another form of usable energy. Unlike conventional heat exchangers, in which there is an intensive transfer of heat from one fluid to another, and the radiation is not essential to develop a device for the transfer of energy from the remote receiver is a source of radiant energy. Without concentration of sunlight incident radiation flux density is at most about 1100 W/m2 is variable. Wavelengths lie in the range 0.3-3.0 microns. They are much smaller than the values intrinsic emission wavelengths of most surfaces that absorb radiation. Thus, the study of devices with elements of concentrating solar energy due to the unique problems of heat transfer at low and variable energy flux density and a relatively large role of radiation.

Cleaning of contaminated soil and sludge is carried out in an apparatus equipped with a cylinder (1) fixed inside the solar radiator (2). Radiator made of a tube made of copper and is used for circulating coolant (a mixture of antifreeze and water) having an inner diameter of 15 mm or more. The device for cleaning up oil waste is further provided with solar panel (3) made of concentrator photovoltaic modules placed on a mechanical system that provides extra warmth missing in the overcast and cold season, as well as the parabolic concentrator (4), which in turn almost lossless collects all incident solar energy on him to the point of focus, where the copper pipe, with a focus on the Sun. Thus, a device for collecting solar heat facilitates maximum heat the coolant in a period of time.

Developed device operates as follows (Fig. 1). To create a condition of oil displacement of soil contaminated soils or oil sludge mixed with water, which is poured first into the water and laid on top of oil-contaminated soil or slime. After saturation of the soil water channels are formed through which, during heating by solar energy, become prominent petroleum fractions. The resulting productive oil is drained through a pipe into the tank for collecting oil.



1 - a cylindrical container, 2 - copper tube, 3-cell battery, 4 - parabolic concentrator, 5 - base made of steel;
Figure 1. The device for cleaning contaminated soils and sludges

When heated oil-contaminated soil and sludge in the device temperature is 75-85 ° C at ambient temperature 25-32 ° C, heating is carried out during daylight hours. Loading and unloading of oil-contaminated soil and sludge is carried out manually or mechanically, although not ruled out automation of the process. The main purpose of this device consists of exposure to natural solar radiation flux density varying with significant participation in the process of petroleum oil as focusing the sun's rays. In this case, a mixture of oil-contaminated soil or sludge with water are absorbing and accumulating element.

Developed an effective method of cleaning contaminated soils and sludges using solar energy provides the desired temperature in the environment and to achieve high levels

of productivity in the preparation of oil. The decisive factor in determining the direction of sludge disposal and neutralize their harmful effects on the objects of the natural environment is the composition and physico-chemical properties.

The experiments were carried out with oily waste in the developed device. To determine the influence of the thermal effects of solar energy on the properties of hydrocarbons was investigated component of oil-contaminated soil and sludge and solid residues after pre-treatment with the use of solar energy in the developed device. Component composition of contaminated soils and solid residues after pretreatment using solar energy are shown in Table 1.

Table 1

Component composition of waste oil and solid residues before and after pre-treatment with the use of solar energy

Oily waste	The composition of the masses. %		
	The organic part	Mechanical impurities	Water
Before cleaning			
Oil sludge	76,8	8,0	15,2
Oil-contaminated soil	30,5	67,4	2,1
After cleaning			
The solid residue sludge and sand	6,79	85,21	8,0
The solid residue of oil-contaminated soil	6,65	86,35	7,0

Thus, after pre-treatment of waste oil by using the solar energy in the ground solids residues does not exceed 6,65-6,79%. After cleaning molecular weight hydrocarbons is close in magnitude to the bitumen, and the ratio of carbon to hydrogen varies according to the given row, bitumen (6.29 - 10.7)> oil-contaminated soils or slime (6.65 - 6.79). The advantages of this method of purification of waste oil in order to separate the oil and mineral parts of the device are its simplicity, its high performance and relatively low cost.

When using solar energy are the required conditions for the extraction of oil from the ground. As can be seen from the above data, the product of oily waste is a valuable hydrocarbons, which can be recycled or used for other purposes.

To reduce energy costs, an apparatus with concentrating the elements in which solar energy is the most used in the purification of contaminated soils and sludge, which increases the efficiency of the device used.

The developed method of cleaning oil-contaminated waste solves an important environmental problem of disposal of oily waste, the recovery and prevention of the degradation of natural systems, reduce pollution soil and water bodies. This will dispose of oil pits and ponds or around the oil-producing region. So kept for a limited mineral resources, and significantly reduces the amount of harmful substances into the environment.

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