TECHNICAL SCIENCES

CLEANING OF THE INNER SURFACE OF THE OIL PIPELINE

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Abstract
The work is devoted to the issues of cleaning the inner surface of the pipeline. Here are the types of contamination, the main methods of cleaning pipelines and the features of the use of various cleaning devices.

Keywords: cleaning, inner layer, pipeline, pollution, corrosion, deposits, scrapers.

When transporting crude oil, various problems arise that significantly complicate the pumping of petroleum products and require effective technologies to prevent them.

One of the most frequent problems in the transportation of hydrocarbons is the problem of contamination of the pipe space with various sediments.

The problem is not given due attention, which leads to negative consequences and causes a decrease in system performance, a decrease in throughput, and an increase in pressure. Pollution can lead to the formation of blockages, as a consequence, to serious damage to the linear part and equipment on oil pipelines, ultimately, to deterioration of technical and economic indicators of transportation and huge losses. This determines the urgency of the problem of high-quality cleaning of sediments inside the pipes of main oil pipelines. During operation, the consumption of pipelines is gradually reduced due to: accumulation of paraffin deposits, increased roughness of the walls of pipelines due to their internal corrosion and accumulation of corrosion products and mechanical impurities; as well as accumulation of water in the lower points of pipes and blockages in the upper points of pipes. In addition, the collection of contaminants in oil pipelines will lead to a deterioration in the productivity of the pumped product due to their deposition by mechanical impurities [1].

The composition of deposits in the network also differs from the duration of the pipeline operation, as well as from the physic and chemical properties of the oil product. Deposits on the inner walls of pipes most often include paraffin, resinous substances, oils, mechanical impurities such as (corrosion products and clay, lime inclusions, sand particles, etc.). Some other substances: low molecular weight resins, naphthenates, and other polar oil compounds, as well as surface-active, demulsify that pass into the oil phase during oil preparation, emulsify the outer layer of the sludge.

When pumping paraffin oils, impurities accumulate on the walls of the pipeline, reducing the flow section of the pipeline, affecting the pumping performance, and can lead to complete blocking of the pipeline and stopping pumping. The main factors affecting the deposition of paraffin are: physical and chemical properties of the pumped oil product; change in temperature (cooling) of the oil during pumping; change in dissolved gases; the nature of pumping modes (pressure change and stop) [2].

The solidification process begins especially at the walls of the pipes and systematically expands towards the center. The deposition of paraffin along the diameter of the pipelines is also abrupt: there is a small amount of paraffin at the bottom of the tube than on the road. This is due to the fact that the upper part of the pipe has the lowest temperature and mechanical impurities remove paraffin from the lower walls of the pipeline. To maintain the flow in the pipeline, it is necessary to take preventive measures in order to avoid paraffin deposits or to clean oil pipelines from other contaminants. Currently, almost both methods are used.

Preventive measures include : exclusion of injection of paraffin suspension accumulated in the collectors into the pipe; perform annual cleaning of tanks from oil residues; use of heat treatment with a high amount of paraffin oil, consisting in heating the oil to a certain temperature at each degree and its gradual cooling; mixing oil with a high content of paraffin with oil that has low viscosity ; mechanical mixing and pumping of supercoiled oil so that paraffin crystals together with the resins adsorbed in them could not stick, stick to the walls of the pipeline and be transported by oil flows.

The most advanced and effective way to clean the inner surface of the pipeline for paraffin deposits is mechanical cleaning with special scrapers, the cleaning elements of which are all types of discs, knives, and wire brushes. Scrapers of various structural schemes differ in the efficiency of removing deposits from the walls of pipes in terms of wear resistance and permeability. Wear resistance is characterized by an effective cleaning length of the tube. Today, with regular cleaning of pipelines, metal scrapers can cover a distance of up to 100 km without excessive wear. The permeability of the scraper is characterized by the ability to pass through various obstacles inside the pipeline: flanges, junctions, reinforcing rings, valves, and so on. Rubber spherical separators have good maneuverability. Such a cleaning scraper is made of wear-resistant rubber with rounded plastic and metal cutters that are pressed into the outer shell of the scraper. The scraper has a valve through which the working fluid is pumped. Under the influence of the pressure of the working medium, the

outer diameter of the scraper increases, and the cutters begin to protrude above the surface. The cutters are arranged in such a way that the scraper, located independently of the place of the pipeline excavation, can clean the entire inner cavity of the pipes from contamination. It also uses braided rubber balls with a metal steel chain [3].

For the continuous passage of the scrapers, a certain pressure and a flow rate of at least 1.2 - 1.5 m/s are required. Therefore, the staff on duty should carefully monitor the pumping mode. He also needs to constantly monitor the progress of the scraper along the length of the pipeline. Various monitoring devices are usually used to control the movement of the scraper.

Basically, there are three types of cleaning of the inner surface of the oil pipeline: periodic - for removal of paraffin deposits, including accumulation of water and gases in order to preserve the capacity of oil pipelines and prevent increased internal corrosion of pipelines; targeted - are intended to remove various sealing residues after the end of repair work on the linear part of the main oil pipelines; preliminary diagnostics - designed to ensure the necessary degree of cleaning of the inner surface of oil pipelines in accordance with the technical characteristics of flow control devices.

Cleaning is carried out according to the instructions developed and approved by the chief engineer or the chief personnel of the operating organization for each section of the main oil pipelines. Regular and prediagnostic cleaning of the pipeline is carried out mainly by passing at least two cleaning devices in accordance with the regulations for cleaning the inner surface of oil trunk pipelines [4-5].

One of the main tasks of in-line pipeline cleaning is to increase the processing capacity, as well as to increase the reliability of main pipelines. There are several ways to implement this technology: one of them is to purge the main oil pipeline with a gas flow using purge plugs, and you can also use the flushing method. The next method is to clean the inner cavity of oil pipelines using special in-pipe devices, these include the following (cleaning piston, scrapers, separator piston, etc.). Any oil pipeline used in oil production is subject to corrosion, so special inhibitors will be introduced to prevent chemical influences. An important step in the effective conduct of in-line washing is the choice of a cleaning device.

The method of selection depends on the types of pollution of the main oil pipeline. The main direction and principles of the scrapers' work are cleaning the inner surface from debris and dirt residues during the overhaul of the main pipeline. Such debris can be: slag, electrodes, etc.).

Cleaning pistons are used after commissioning and during operation. These cleaning pistons have special polyurethane cuffs and discs designed to reduce the load on the piston from the inner wall of the pipeline [6].

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