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Study of methods of purification and neutralization of liquid fuels in the form of raw materials from minerals.

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Abstract: This article discusses the methods of purification of raw fuels, ie petroleum products from mineral salts using effective methods and the purpose of purification, as well as methods of neutralization after purification.

Keywords: Fuel, mineral salts, raw materials, oil, demineralizer, hydrocarbons, electrcoagulation, emulsion, condensate.

Currently, one of the priority directions of development of the economy of the Republic of Uzbekistan is the fuel and energy sector. Naturally, as in any industry, there are problems in this area, one of which is the occurrence of corrosion processes and rapid destruction under the influence of mineral salts in machines and technologies during the use, processing, transportation and so on of liquid fuel. Below we will discuss several ways to solve these problems.

Demineralization of liquid fuels is one of the main ways to reduce its corrosiveness by maximizing the separation of mineral salts from liquid fuels as raw materials.

Mineral salts in oil are of two types:

- crystals with an admixture of hydrocarbons;
- occurs in the form of an emulsion of water-soluble salts in oil.

The purpose of the demineralization process is to separate all mineral salts in the liquid fuel feed. This process is carried out in demineralizers and consists of the following sequential stages:

- Transfer of mineral salts to "demineralized water" through a thin layer of "oil-water";
- an increase in salty water droplets by electrocoagulation under the influence of an electric field;
- separation of water from liquid fuel raw materials under the action of gravitational forces.

An overview of the demineralizer is shown in figure 1.1.

The principle of its operation is as follows:

a) Providing water diffusion of salts in liquid fuels. For this, boiling water is sprayed into the fuel from several places and the emulsified oil-water mixture is sent to the demineralizer. The total amount of water is 3-6% and is mixed with a mixer.

b) Electrocoalescence of water droplets. A water-in-oil emulsion consists of 1/9 micron particles formed by dispersing water droplets in a continuous oil phase. To separate these particles from the fuel composition, the water turns into a layer, increasing it by gravity.

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The coalescence of water droplets is called coalescence.

This can be influenced by the following factors:

- stable emulsion formation as a result of mixing oil and water at very high speeds;
- accumulation of substances (naphthenes and iron sulfide) around the droplets that impede the interaction of water droplets;
- in most cases, electrocoalescence is used to separate water and salt in order to reduce the influence of the above factors.

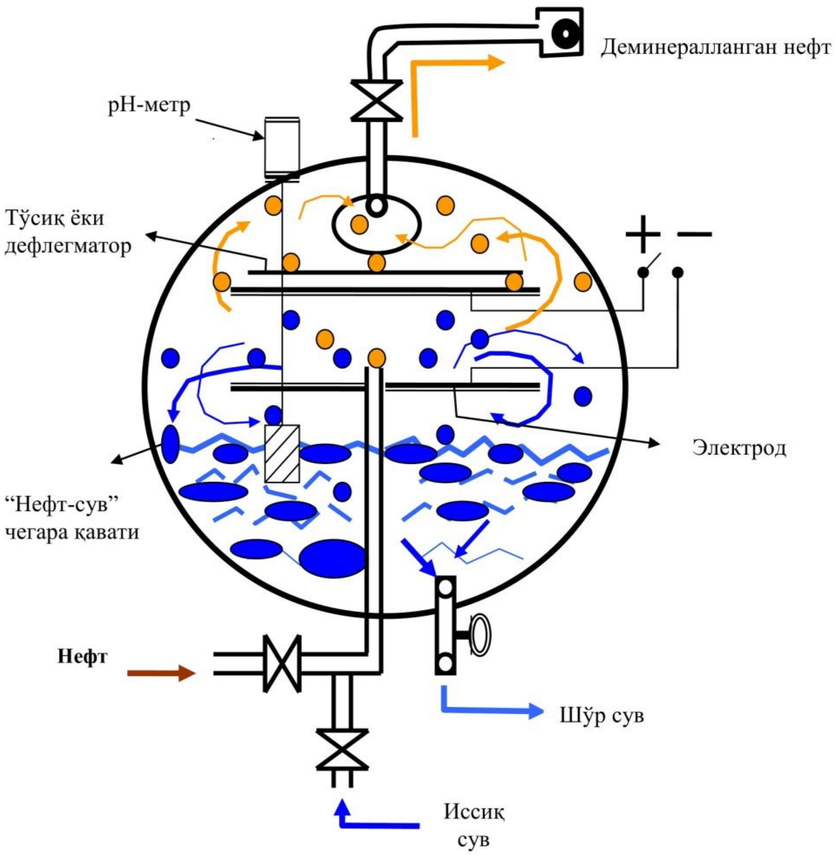

Figure 1.1. Schematic diagram of an electro-mineralizer.

The main function of electrocoalescence is to combine water molecules using their polarity. In water molecules, the oxygen atom has a negative charge, and the hydrogen atoms have a positively charged polar structure. Due to the dissolution of Na +, Mg + 2, Ca + 2, Cl ions in water, its polarity increases and the interaction of drops is accelerated due to the "dipole-dipole" interaction under the action of an external electric field:

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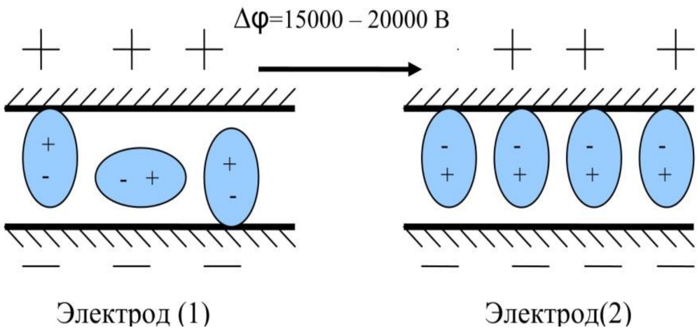

Figure 1.2. Drip addition scheme.

The addition of droplets is facilitated and occurs due to the displacement and movement of water droplets under the action of alternating current and the mutual attraction of water droplets.

The high percentage of water in the fuel oil and the magnitude of the electric field strength increase the amount of demineralized water.

Liquid fuel in the form of an emulsion, that is, water droplets dispersed in oil, is added under the action of various forces and collects at the bottom of the demineralizer, since its specific gravity is higher than that of the oil layer (p = 2 g/cm^3). This process takes place over a period of time.

This gap:

- increase in the diameter of water droplets;
- an increase in the density difference between the water and oil phases;
- It is planned to separate the mixture with a viscosity of 2-5 mm2 / centistokes within 20-30 minutes.

The demineralized oil is collected in pipes located horizontally at the top of the tank.

The water is drained through the devices at the bottom of the tank. The main operating parameters of the demineralizer are the temperature, the amount of flushing water, the water spray point, the power (pressure) reduction in the mixing valve, the source of demineralization water, and the oil and water boundary level.

In mineral oil, up to 2-7% of water remains, but the amount of salt in the water is significantly reduced. However, the salt in the residual water hydrolyzes to form HCl. Under the influence of this substance, corrosion begins in the upper part of the drive column. Therefore, the demineralized oil is re-neutralized (optional).

The purpose of the neutralization process is to release the remaining salts ($MgCl_2$, $CaCl_2$) in the form of Mg $(OH)_2$ and $CaCO_3$ by injecting a soda solution (Na_2CO_3) into the mineral-free fuel oil.

Factors impeding the effectiveness of this process:

- The complexity of the interaction of small amounts of salts with a neutralizing reagent in an "oil-water" environment;
- to determine the amount of soda needed to prevent damage to equipment due to excess soda.

After taking the above measures, the demineralized fuel is collected in a condenser at the top of the atmospheric propulsion tower. It consists of a mixture of hydrocarbons and a

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small amount of water and condenses easily.

To prevent the formation of condensation, the following two methods are used.

1. Neutralization of HCl in an aqueous medium.
2. Spraying amino compounds forming a protective film on the metal surface.

HCl neutralization: Before concentrating all components, HCl is neutralized in two ways:

A) Neutralization with ammonia. In this method, gaseous ammonia is directed into the system and HCl is converted to gaseous ammonium chloride salt. This salt dissolves in condensed water to form HCl and is quantified pH-metrically to determine the amount of CHl neutralized.

The disadvantages of this method are:

When the amount of HCl in the system is large, a large amount of salt is formed, which passes from a gaseous state to a crystalline substance, and before condensation, the salt precipitate settles to the bottom of the column, which leads to a very dangerous type of corrosion.

When ammonia is introduced into the system, the solubility of H_2S gas in water increases with increasing pH. This leads to corrosion with the addition of H_2S. To prevent this, it is necessary to heat demineralized water and evaporate the dissolved ammonia.

B) Use of neutralizing amino compounds.

Morpholine is a heterocyclic amino compound $O(CH_2\text{-}CH_2)_2NH$, used to neutralize hydrogen chloride in an atmospheric driving column. Under its influence: $O(CH_2)_2NH+HCl=O(CH_2CH_2)NH_2+Cl$ forms a water-soluble stable salt.

Advantages:

– does not form corrosive deposits on the bottom (wall) of the vessel;

– Allows you to accurately and easily control the pH of the output product in the column.

Usage method:

A neutralizing amine compound is sprayed into the column prior to condensation. The amount of amine sprayed is calculated in a special way.

The control over the neutralization process is carried out on the basis of the readings of the device, which measures the pH of the water installed in the upper part of the column. For an optimal process, the pH should be 7, so that during neutralization:

- pH should not be too low. Otherwise, acid corrosion will occur due to the large amount of HCl. Therefore, the pH of the water level in the "basin" should be less than the pH at the moment of condensation of water vapor:

- pH should not be too high. Otherwise, the solubility of H_2S increases, the corrosion rate increases, and "black water" is formed due to the corrosion products ($FeCl_2$, FeS).

Experiments show that the optimal environment for the working process is pH = 5.5 - 6.0.

When using protective amines - inhibitors - they are sprayed so that water vapor settles on the walls of the tank before condensation. Amine is constantly sprayed to keep the safety curtain stable.

The corrosion process is controlled by the following methods:

A) Measurement of the amount of chlorides in the basin of the basin. These are chlorides: amino chlorides formed during the neutralization of HCl, ferric chloride and HCl in water. As a result, a total of no more than 10 ppm is required to obtain the amount of

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chloride.

B) Control of the amount of iron ion. The amount of iron ions in the solution determines the degree of corrosion processes. Its low content indicates a low level of corrosion, and its amount is expressed in units of ppm.

C) Watch for signs of corrosion.

Corrosion indicators are used for this.

Depending on the type of corrosion, its origin, the specifics of the transient process, the following main types of corrosion protection are distinguished:

1. Increasing the chemical resistance of structural metals;
2. Reducing the aggressiveness of the environment using technology or metals;
3. Coating the metal surface with a protective layer against the effects of aggressive environments;
4. Control of the electrical potential of the protected metal.

To protect equipment and facilities of the oil and gas industry from corrosion, it is recommended to use the following basic methods:

Preservation of the initial low-corrosive properties of the extracted products (oil, gas, water), that is, preventing the ingress of corrosive substances (H_2S and O_2) into oil, gas and water or the application of technological measures to protect against corrosion under the operating equipment;

The use of techniques such as the application of corrosion inhibitors, protective curtains, mirror materials, corrosion protection.

The most widely used and effective of these measures is the technological combination of methods for changing the parameters of metals or alloys and the use of inhibitors.

Improving the chemical resistance of construction materials. This method mainly consists of alloying structural materials with the addition of corrosion-resistant metal-alloy additives to metal alloys. These chemically resistant additives include chromium, nickel, titanium, silicon.

In conclusion, we can say that the purification of liquid fuel in the form of raw materials, that is, oil products, from mineral salts using an electro-mineralizer is effective and cost-effective. In electrodineralizers, we achieve high results due to the neutralization of HCl, formed as a result of residual water after treatment, which, in turn, allows us to use production methods and technologies efficiently and for a long time.

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