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APPLICATION OF EFFECTIVE METHODS IN THE TRANSPORTATION OF HIGH-VISCOSITY OILS

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Abstract:

Objective. The article examines the effect of various components and the addition of chemical reagents (depressant additives) to improve the flowability of paraffin oils. The introduction of the additive significantly changes the crystallization process in paraffin oils. The development and application of new, more efficient and cheaper additives significantly contribute to the technological progress of pipeline transport of high-paraffin oils and heavy oil products. All these measures will reduce the wear and tear of equipment during transport and increase economic performance.

Methods. The paper used methods to determine the surface tension, component composition, density and dynamic viscosity of oil.

Results. The addition of temperature and chemical reagent in paraffin and high paraffin oils has resulted in reduced viscosity and thus increased oil transport capabilities.

Conclusion. Reagents are used to reduce the viscosity and solidification temperature during oil extraction and transportation. When used as an additive for pipeline transport, the coagulation regulator reduces the working and starting pressure of oil pipelines, as well as the energy consumption to drive oil.

Keywords: oil, viscosity, surface active substance, drive, concentration, installation, equipment, corrosion, oil products.

Introduction. Extraction of high-viscosity oils consists of complex processes and is organized according to projects based on calculations made based on several factors. Also, commercialization and transportation of the extracted oil also creates some difficulties. It is possible to choose the optimal method by performing hydraulic calculations of the flow when the transportation is carried out through a pipeline. The composition and properties of oil directly affect this.

Methods. At the level of Uzbekistan, a large share of high-viscosity oils is mainly accounted for by oil fields in the Amudarya region. The oils of these fields are considered heavy oils, and their properties are listed in the table 1.

31.6% of the extracted oil is accounted for by the Mirshodi field, 18.2% by the Lalmikor field, 6.5% by the Qoshtar field, 1.0% by the South Mirshodi field, 17.1% by the Amudarya field, 14.4% by the Kokaydi field, 7.3% by the Khauzak field, 3.8% by the Uchkizil and Jairankhana fields.

The collection and transportation of heavy oil extracted from this group of deposits is carried out together. In order to use the method of joint collection and transportation of heavy oils, it is necessary to improve the rheological properties of high-viscosity paraffin oils [1,4,5].

Table 1.

Properties of heavy oil fields of Uzbekistan

№	Fields	Horizon	Again count coefficient	Density , at 20 ^{0}C, g/cm ^{3}	Viscosity , at 20 ^{0}C , mPa *s	Quantity , % Sulfur	Paraffin	Resin
1	Xauzak	I II III IV	0.890	0.930	9.99	2.80	3.50	54.20
2	Kokaydi	I II III	0.841	0.940	129.0	3.80	3.20	70.0
3	Lalmikor	I II III IV V	0.938	0.849	27.0	3.53	3.20	79.6
4	Amudarya	I II	0.950	0.980	30.0	5.60	5.95	80.0

Results. In improving the rheological properties of paraffin oils, let's consider the colloidal-chemical indicators of oil, which are most important in the formation of an emulsion. This is the surface tension coefficient associated with other parameters of the process. We have studied these coefficient variation ranges depending on the density of light, medium, paraffic and high paraffic native oils.

Learning the results are shown in Figure 1:

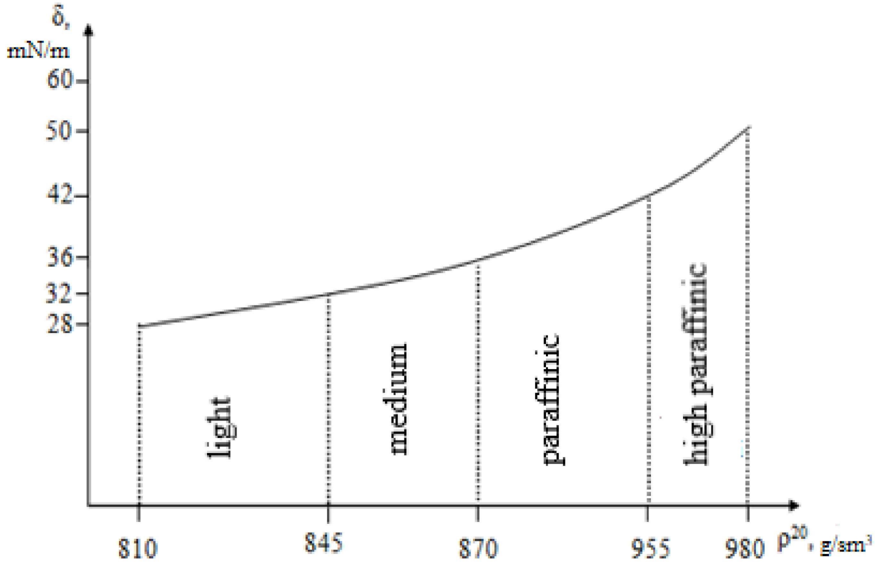

Figure 1. Intervals of variation of the surface tension coefficient depending on the density of light, medium, paraffinic and high paraffinic oils

The surface tension coefficient and density in Figure 1 show that light (1) and Medium (2) oil have nearly the same value. This does not allow to accurately assess their effect on the appearance and elimination of WOE. Conversely, paraffin (3) and high paraffin (4) oils significantly increase the value of their surface tension coefficient, depending on the increase in their density.

The viscosity of oil transported through pipelines depends on its temperature. Figure 2 below shows the viscosity indicators of heavy oils of Uzbekistan.

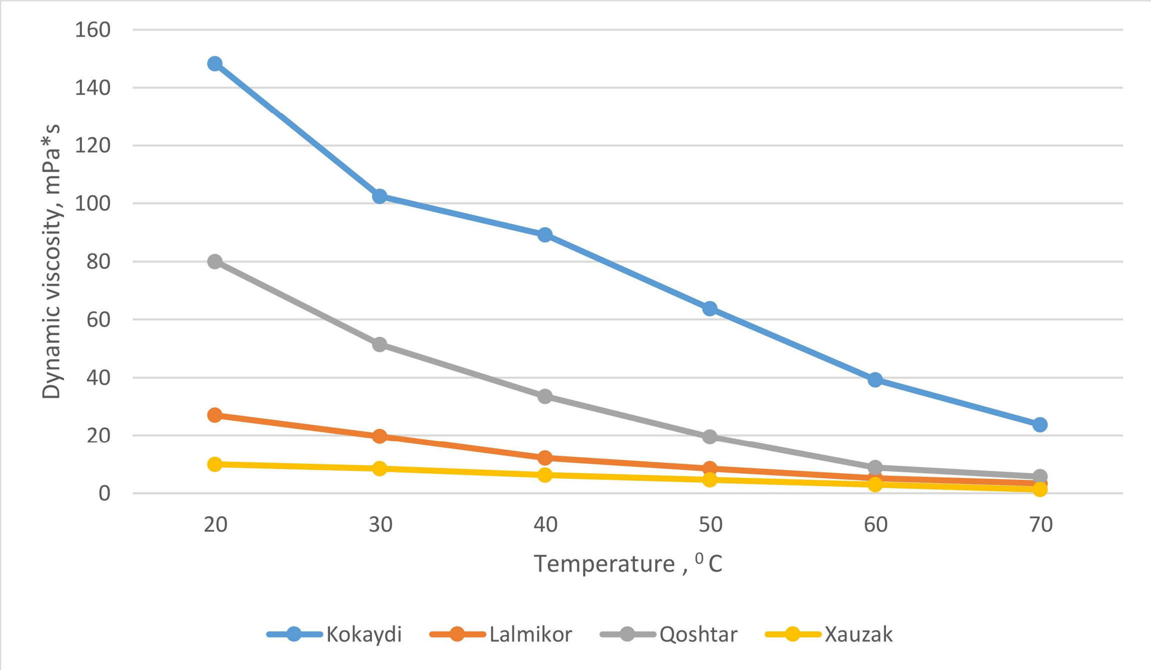

Figure 2. Temperature dependence indicators of viscosity of heavy oils in Uzbekistan

The permeability and economic efficiency of an oil pipeline depends on the characteristics of the oil that is pumped through it. The main obstacle to ensuring the desired speed of driving is agility. Reducing the viscosity of arable oil reduces the hydraulic resistance of the pipeline network, which reduces the energy consumption of the drive. In areas with low environmental temperatures, the viscosity of arable oil in oil production reaches such a level that the energy consumption in driving increases the cost of oil, in some cases it becomes almost impossible to drive it. To improve the efficiency of the transportation process, primary processing is given to both meltwater and high meltwater oils. There are many methods of oil treatment with the aim of reducing its viscosity. All known methods can be divided into several groups:

1. Thermal heating;
2. Emulsifier-creating an oil emulsion in water using substances;
3. Exposure to liquid by different types of electromagnetic radiation and their combination;
4. Oil treatment by applying high intensity ultrasonic waves;
5. Addition of chemical reagents [2,16,21].

One of the main ways to reduce the viscosity of oil is to heat it thermally.

Heating is carried out using:

- a boiler that emits heat when coal, natural gas or oil is burned from the same oil pipeline;

- transfer of heat that is released in the work of pumps when driving oil at oil driving stations;

- electric heating of the oil pipeline.

The heat treatment process ends with the oil heating the solid paraffin hydrocarbons in it to a melting temperature, reaching a cooling temperature at a set rate under certain conditions (in motion or at rest). For paraffin oils, there is an optimal heating temperature at which the effect of heat treatment is highest. This temperature is always higher than the melting temperature of paraffin in oil. With an increase in the heating temperature, the hardening temperature first increases, then decreases and becomes minimal to a certain heat treatment temperature [3,8,15].

The properties of heat treated oil are greatly influenced by oil cooling conditions. The size, number, and shape of paraffin crystals depend on the ratio of two rates: the rate at which paraffin hydrocarbons come from crystallization centers, and the growth rate of their separated crystals. If the rate of origin of the centers of crystallization is higher than the rate of growth of crystals, then a large number of small crystal systems are obtained, otherwise large crystals are formed in the system, and the strength of such a structure is much lower than that of a small crystal. For high paraffin oil, the optimal cooling rate under static conditions is 10-20 °C/H. At this rate, a favorable ratio of the origin of the crystallization centers and the growth rate of paraffin crystals is created, and most of the paraffin goes to form large crystals forming structures. As a result, a significant effect is achieved to improve the fluidity properties of oil [6,9,14].

The next way to reduce turbidity is the addition of chemical reagents (stationary landings). Stationary landings for oil and heavy oil products are synthetic polymer products that dissolve in oil and have the ability to change its viscosity and surface tension when adding a small amount to high paraffin oil. Adding a landing significantly changes the crystallization process in paraffin oils. A decrease in oil strength and an increase in plasticity with a stabilizer is explained by the formation of a complex from the molecules of tar and paraffin, the formation of bonds with crystal gel forms an intermediate barrier and a decrease in their order. In this case, stationary-paraffin mixed crystals are formed, which prevent the integration of particles into the intermediate network. The desired concentration of the stabilizer in oil depends on the purpose and specific conditions of use. So, in order to effectively drive oil through the trunk pipeline, it is enough to insert a landing into it with a mass concentration of 0.1-0.2%. This concentration can be reduced when transporting a high-hardness oil mixture with a low-viscosity landing.

The development and application of new, more efficient and inexpensive landings can greatly contribute to the technical progress of the transportation of high-paraffin oil and heavy oil products in pipelines. A characteristic feature of high - frequency electromagnetic interaction from other thermal methods is the appearance of volumetric heat sources in heap thicknesses. Due to dielectric losses, the energy of electromagnetic waves is converted into thermal energy, as a result of which the temperature rises and reduces the viscosity of the fluid in formation. Broad classes of fluids determine the property of changing the viscosity under the influence of external loading, which exhibits the coagulant-tensile properties known as nonuyutonic fluids. In such liquids, as the effects normally applied increase, the environmental viscosity decreases-the environment shifts along the solid surface. This effect will be useful to reduce oil turbidity that is driven through the pipeline [7,10,19,20].

Table 2

Classes of solvents that reduce oil viscosity

Classes of solvents	Solvents
Separately solvents	Toluol; 2-methyl-methyl-bisamine; 4,1,1-propylene-1,3-dioxane; 4,4-methyl-5,6-dihydrophin; 2-methylfurin; hydrogen sulfide; dichloropropane
Solvents of different classes of organic compounds of natural description	Gasocondensate; gas gasoline; liquefied petroleum gases; pyrocondensate; MON-47D; D-13; hydrocarbon shell;
A mixture of one or more classes of organic compounds-chemical and petrochemical processing products	Light oil; kerosene fraction; chlorinated hydrocarbons; piperylene fraction; soedinenia acetate compound; alpha olefins fraction; White-alcohol; kerosene
Organic compounds with SAS additives	Gas gasoline SAS; saromated gasoline piperylene fraction and SYK; flavored neftecondensate and sulfanol or SAS OP-10; OP-10 and I-1-Ali isobethylene diameters and trimers; oxyethylephrine compound alkyralir solutions; catalyst solutions; SNPX-7R-1; sulfonate sodium isoparafins.
Organic compositions focused on chemical and petrochemical coupling	Acetone paraffin distillate; acetone paraffin fraction; gasoline fraction perchloroethylene; paraffin alcohols and ketones; SNPX-7R-2; ML-72; polyethylene solution; light emulsion
Multicomponent compounds and water-based solutions	Oxyalkylation products solutions; aluminum, magnesium, calcium chlorine , emulsions and organic solvent alkalis; alkaline lignin aqueous solution; disulfide carbon benzene, ethylene glycol ether, alcohol, salty acid or another acids; a lot atomic and lower ethers of atomic alcohol, aliphatic and aromatic hydrocarbons compounds; SAS-1, SAS-2; alkaline solvents and emulsifiers; caustic _

In fact, during the winter period, the oil quickly solidifies and acquires a jelly-like structure. At the same time, the oil acts like an elastic body-compresses in proportion to the applied effect. A decrease in the pressure generated by the drive pump is spent on static deformation of the hardened oil. In such conditions, it is impossible to use a standard pump – the pumps cannot withstand thickened oil, since during the movement of the jelly mass through the pipe, the meltwater losses increase significantly. This method, unlike the different types of pipe heating currently used, is very economical and has very little work. In fact, the effect of acoustic vibrations in the pipeline at a point with a small capacity allows to significantly reduce the viscosity to a thin, adjacent pipe wall, jelly-oil layer, tens and hundreds of meters long, due to the speed of propagation of acoustic vibrations in the pipeline [11,13,18].

Discussion. A reagent is proposed to reduce the viscosity of heavy oil, a new type of emulsion liquid of heavy oil. The introduction of this reagent at the stage of the formation of a water – oil emulsion reduces the viscosity of the system. Especially effective use of this product for oil raw materials, its viscosity is measured in tens of Pa*s and is reduced by 90% under the influence of reagent. Recommendations for use: the product is perfectly adapted for use at normal or low temperatures. It can be used as a reducing agent, depressant, in extraction in thermal methods, and as an additive in others. Before application, an aqueous solution of 1 – 2% of the reagent is prepared and then normalized to match the oil. The optimal ratio between oil and reagent solution is 7:3. The optimal addition of the reagent is determined by the results of the density test. The jet is driven directly into the well or pipe with a normative pump. Packaging and storage: delivered in metal barrels weighing 200 kg, stored in a dry, cool, dark, air-circulation place. Warranty period of storage-1 year [3,8,12,17]. Table 3 lists reagent indicators that reduce oil viscosity.

Table 3.

Reagent for reducing oil viscosity - Pralt-16 indicators

Indicators	Required value
Appearance	Yellow or light yellow liquid
Solubility	In the water soluble
1 % aqueous of the solution pH indicator	6-8
Density, at 30 ^{0}C, kg/m ^{3}, not less	852
Kinematic viscosity at 50 ^{0}C, mm^2/s, not much	45
Hardening temperature, ^{0}C, not high	25

Pralt-16 is designed to reduce high paraffin oil viscosity and solidification temperature, which controls oil viscosity.

Conclusion. Reagents are used to reduce the viscosity and solidification temperature during oil extraction and transportation. The main function of viscosity regulators is to effectively prevent the formation of paraffin compounds on the surface of oil field equipment, pipes and heaters for the transport of high-viscosity oils. When used as an additive for pipeline transport, the coagulation regulator reduces the working and starting pressure of oil pipelines, as well as the energy consumption to drive oil.

From the above, it can be concluded that for any heavy oil, a special approach is required to reduce its viscosity and improve its rheological properties. It is through the application of the optimal method or combination of methods for this type of oil that the intended efficiency will be achieved.

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