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CHEMISTRY AND CHEMICAL TECHNOLOGY

DEVELOPMENT OF ASPHALT-RESIN-PARAFFIN DEPOSITS SOLVENT

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Abstract. *A solvent which is a mixture of aromatic hydrocarbons of the C9 fraction and aliphatic alcohols in a 1:1 ratio, a nonionic surfactant in an amount of 1 - 3% by weight has been developed. It leads to an increase in the dissolving and washing capabilities of the solvent for more than 2 times in relation to paraffin-type AS. The ability of the chemical composition, which is a solvent composition, to have a depressant-dispersing effect in relation to paraffin-type AS has been determined.*

Despite a large number of studies devoted to the development of technologies for the removal of organic deposits in oilfield equipment (they mainly solved individual tasks for the removal or prevention of ARPD in wells), little research has been carried out on the creation of an integrated technology for the removal and prevention of organic deposits in wells, providing physicochemical impact on a single hydrodynamic system "well-PZP ".
The aim of this work is to improve the efficiency of wells operation at the late stage of oil field development in conditions of asphalt-resin-paraffin deposits formation.

Keywords: *solvents, asphalt-resin-paraffin deposits, pyrolysis distillate, nonionic surfactant, aliphatic alcohols surfactants*

Introduction.Today, most of the oil fields are at an advanced stage of development. This stage is accompanied by a number of complications in the production of reservoir products, including the formation of organic deposits in the system of “well bottom formation zone”. Many years of experience in the development and operation of oil fields shows that asphalt-resin-paraffin deposits (ARPD) are formed in downhole equipment and in the bottomhole formation zone (BHZ) mainly in fields whose oils are characterized by an increased content of paraffins and asphaltenes, for example, in oil fields owned by the UE Mubarekneftegaz. The problem of the formation of ATPD is especially relevant for the fields of this region (for example, the oil fields Mingbulak and Northern Urtabulak), which are at the final stage of development, which are characterized by deterioration of thermobaric reservoir conditions (decrease in reservoir temperature), oil weighting, high water cut (more than 80 - 90%).

The main research efforts on the study of the composition, mechanism and conditions of formation, methods of removing organic deposits were carried out in the 60s of the last century. Since that time, the thermodynamic state and features of the geological and physical characteristics of hydrocarbon deposits have changed, well production rates have decreased, the water cut of the produced products has increased, methods of enhanced oil recovery and intensification of oil production have begun to be widely used in oilfield practice, the zone of formation of organic deposits has expanded, their composition and structure have changed. Considering these, the question arose about the need for a systematic approach to the study of this problem, taking into account the influence of various factors, as well as significant changes in the conditions of the functioning of the oil production system.

Despite a large number of studies devoted to the development of technologies for the removal of organic deposits in oilfield equipment (they mainly solved individual tasks for the removal or prevention of ATPD in wells), little research has been carried out on the creation of an integrated technology for the removal and prevention of organic deposits in wells, providing physicochemical impact on the unified hydrodynamic system "well-bottomhole zone".

The aim of this work is to improve the efficiency of wells operation at the late stage of oil field development in conditions of asphalt-resin-paraffin deposits formation.

It is known that the fight against ARPD in oil production is carried out in two directions: 1) removal of already formed deposits; 2) safety precautions or prevention of deposits. Methods for removing ARPD include: thermal methods (steam injection, flushing with hot oil or water as a heat carrier, use of electric furnaces, induction heaters, etc.), mechanical methods (use of scrapers, scrapers-center-tori mounted on rods), chemical methods (use of organic solvents or detergents to remove ARPD) [1 - 4].

The most common among the methods for removing ARPD are chemical extraction methods, namely the use of organic solvents ARPD [5 - 16].

In the fields of the Republic of Uzbekistan, in the conditions of upper devonian terrigenous beds, oils with high content of paraffin and asphaltenes prevail in order to achieve the most effective dissolution and removal of ARPD from the walls. It is necessary to select a hydrocarbon solvent with the optimal composition of paraffin and aromatic hydrocarbons for well equipment. The addition of a nonionic surfactant to the solvent increases its dispersion, washing and dissolving ability relative to ARPD.

The rectification product of pyrolysis distillate - fraction 70-180°C was used as a source of hydrocarbon raw materials.

Pyrolysis distillate - an oily liquid, dark brown in color, unpleasant odor is a secondary product of polyethylene production by JV-JSC "Uz-KorGasChemical". Qualitative and quantitative analysis of pyrolysis distillate shows that the composition of this product is dominated by aromatic hydrocarbons of mono- and bicyclic structure.

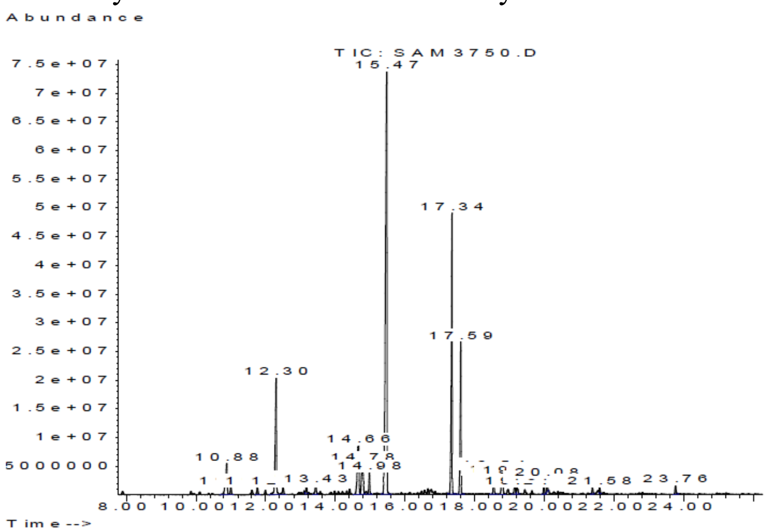

Figure.1. Mass spectrogram of a heavy pyrolysis product JV-JSC “Uz-KorGasChemical”.

As a nonionic surfactant in the solvent, it was proposed to use a depressant-dispersant additive "DDA-10", which is a composition of a depressant additive based on a copolymer of ethylene with alpha-olefins, capable of reducing the pour point of oil, and an amide-type paraffin dispersant, which prevents the growth of crystals paraffins in the extraction, transportation and storage of oil.

The composition of ARPD depends not only on the geological and physical conditions of well stability, but also on the nature and properties of the oil. Based on this, we studied the chemical composition of the oil extracted from the Mingbulak field (Table 1).

Table 1

Composition of oil in the Mingbulak field

Water, %	Sulfur, %	Pyrobitumen, %	Resins, %	Conradson carbon residue, %	Parrafins, %	Silica gel resins, %	Chlorides, g/l	Ash amount, %
75,0	0,23	3 - 6	58 - 60	8,8	6 - 9	15,3968	110,0	0,61

The object of the study was oil from the Mingbulak field, bituminous at 20°C, the oil density is equal to 932 kg/m3, low-sulfur oil - 0.44% class - 1, super-high-viscosity oil (SVO) more than 30 MPa <35 mPa·s.

On the basis of the obtained fraction, industrial surfactant DDA-10, and aliphatic alcohols (methanol, isopropanol, isobutanol), various compositions of solvents were prepared, conventionally named OPMAS-X (Table 2).

Table 2

Component composition of solvents ARPD (OPMAS-X)

Additives	Amount, % mass
Hydrocarbon fraction, temperature range 70 - 180 °C	80,0 - 90,0
Surfactant	1,0 - 3,0
Aliphatic alcohols	10,0 - 20,0

As shown by experimental data, when removing ARPD, a synergistically effective composition is hydrocarbon fraction 80.0 - 85.0%, surfactants 1.0 - 2.0% and aliphatic alcohols 15.0 - 20.0%.

As an example, we took the procedure for determining the effectiveness of reagents for removing asphalt-resin-paraffin deposits. Laboratory studies were carried out in static and dynamic modes at a temperature of 20°C. In the dynamic mode, magnetic stirrers were used, which were placed in flasks with a solvent, into which baskets with ARPD were dropped.

Paraffin-type ARPD samples were heated to a plastic state, then small balls of 10 mm in diameter were prepared. The prepared ARPD samples were weighed and dropped into steel baskets. The diameter and height of the basket is 20 mm, the size of the holes is 1.5×1.5 mm. Baskets with ARPO balls were dropped into a sealed glass flask, into which the ARPO solvent was poured in a volume of 100 ml. The solvent must completely cover the ARPO balls. At regular intervals, baskets with deposits were periodically lifted from the solvent and lowered back. The weight of the ARPD and solvent was weighed with an accuracy of ± 0.005 g.

On the next day, the contents of the flask are filtered onto a pre-weighed filter. The filtered residues of ARPD together with the filter are placed in an oven, then in a desiccator, after which the filter with the remaining deposits is weighed until the mass is constant. The content of the remaining ARPD on the filter is determined by the difference between the mass of the filter with the filtered ARPD and the mass of the clean filter before the experiment with an accuracy of ± 0.005 g.

The ARPO solvent was prepared by mixing the calculated amounts of the components in a separate container. The heavy hydrocarbon fraction was mixed with aliphatic alcohols. DDA-10 was heated without boiling, and then it was added to a mixture of a heavy hydrocarbon fraction and aliphatic alcohols. The resulting solvent was thoroughly mixed for 10 minutes until smooth at room temperature.

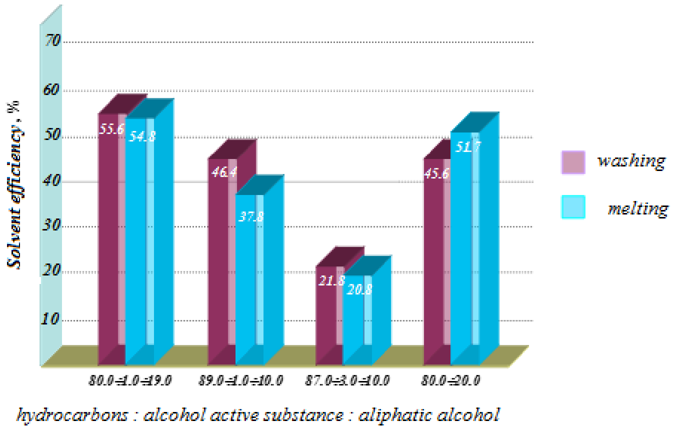

Figure. 2. Selection of optimal concentrations of chemical components for the removal of ARPD

The results of studies on the selection of optimal concentrations of chemical components for the removal of ARPO showed that the greatest efficiency of the solvent is observed when 80 - 89% of a mixture of aromatic hydrocarbons and 15 - 20% of aliphatic alcohols are added (Fig. 2).

DDA-10 was added from 0.1 to 3% of the mass and evaluating the washing, dispersing and dissolving properties of the solvent with and without the addition of an additive. Figure 3 shows the efficiency indicators of the ARPD solvent depending on the various concentrations of DDA-10 in its composition.

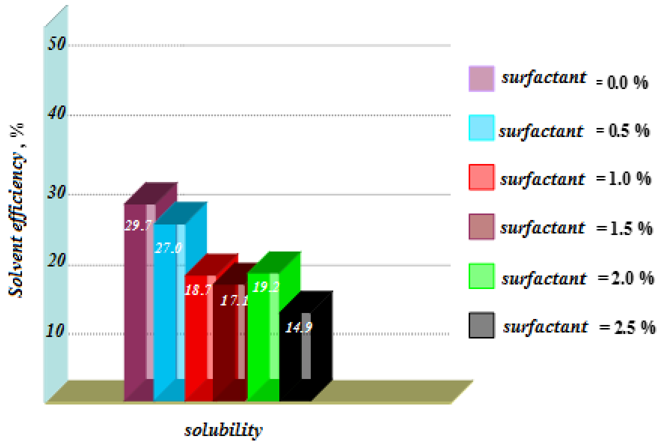

Figure. 3. Efficiency of the ARPD solvent with and without the addition of DDA-10

As can be seen from the figure, the highest efficiency, at which the values of the washing ability show the highest values, is achieved with the addition of 3% of the mass. DDA-10 into a solvent. The washing ability of the solvent with the addition of 3% of the mass. DDA-10 increased by almost 1.8 times, compared to the solvent, in which the depressant-dispersing additive was absent. The dispersing power increased by 11.8 times, but the dissolving power decreased by 6.3 times.

After determining the optimal concentrations of the ARPD solvent components, its efficiency was assessed using the “baskets” method in a static mode (Fig. 4) and in a dynamic mode using magnetic stirrers at a temperature of 20°C (Fig. 5).

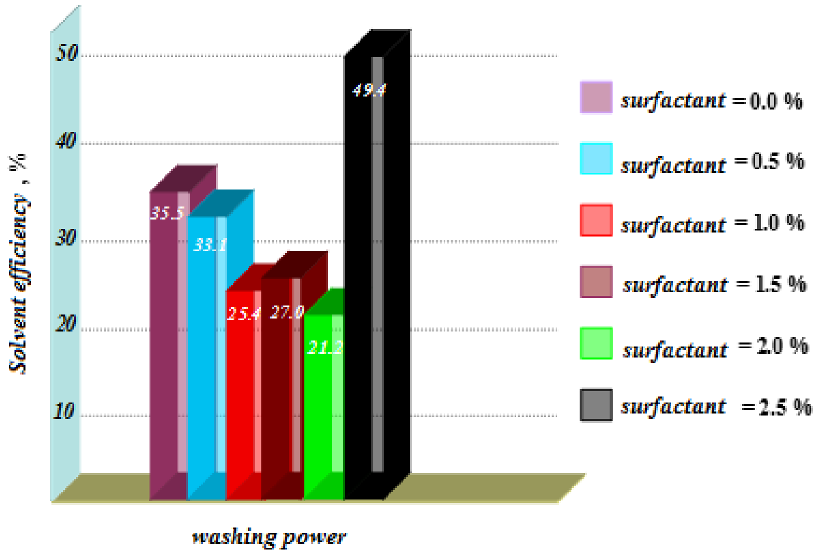

Figure. 4. Diagram for determining the efficiency of a solvent by the "baskets" method in a static mode

As can be seen from the figure, the values of the ARPD washing solvent are greater than the values of the dissolving power. The maximum washing power means that this solvent can only be used for washing tubing (tubing) under dynamic conditions. It can be assumed that the use of this solvent for treatment of bottomhole formation zones is not recommended, since there is a high probability that dispersed particles of ARPD can clog the pore space of the formation.

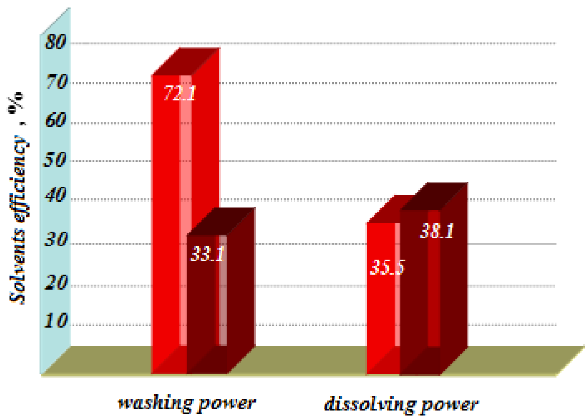

Figure. 5. Diagram for determining the efficiency of a solvent by the "baskets" method in dynamic mode

However, if we consider well conditions, then in the production well there is a continuous movement of the formation fluid to the wellhead. Therefore, in order to create a simulation of the well operation, magnetic stirrers were used. The dissolving power according to the “basket” method using magnetic stirrers simulating the dynamic regime, in comparison with the studies carried out in the static regime, increased by almost 7 times.

Conclusion. Thus, as shown by the results of the experiments, the developed solvent is distinguished by high washing and dispersing powers in relation to ARPD, which makes it possible to recommend it for removing deposits in oil wells (for flushing of well equipment from deposits).
The optimal concentration of DDP was 3% of the mass. After adding this additive to the solvent, there is a significant increase in its detergent and dispersing powers, thereby increasing the surface activity of the solvent and the dispersion effect of ARPD. By reducing the surface tension, the solution wets the ARPD sample, penetrating into cracks and pores, while the adhesion of its particles decreases.

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PREDICTING THE QUALITY OF FLEXOGRAPHIC PRINTING WITH REGARD TO THE PROPERTIES OF POLYETHYLENE FILM

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Abstract. *The article used multifactor planning to predict the quality of flexographic printing on polyethylene film, which contains pellets of low molecular weight polyethylene of the Shurtan gas chemical complex, one of the largest enterprises in the Republic of Uzbekistan. Physical-mechanical and deformation properties of the investigated polyethylene film produced from pellets on extrusion equipment "FULL AUTOMATIC" (Korea) in conditions of enterprises LLC "Briz" and PE "ASILBEK NURLI KELAJAK" by sleeve extrusion method belong to the highest grade, which allows using them in a wide range, including as a packaging material in various branches of the national economy, for manufacturing consumer goods. To evaluate the quality of printing in terms of obtaining clear prints and accurate color reproduction, test objects were printed on the films under study using flexographic printing method. The correlation between the optical density of the print and the film properties, in this case thickness, gloss and thermal stability, was determined using the methods of mathematical statistics. The analysis of obtained results allows forecasting printing quality, for example for getting a print with optical density 1.485 it is necessary to use films with thickness of 70g/m2, glossiness 26%, thermal stability 38%. The mathematical model obtained on the basis of modern mathematical apparatus using probability theory and mathematical statistics can be used to control the quality of flexographic printing, taking into account the properties of polyethylene film.*

Keywords: *quality of flexographic printing, optical density, polyethylene film, film properties, correlation relationship, mathematical model*

Introduction. When creating finished products, increasing the efficiency of production and the issue of guaranteed product quality are the most important issue of any