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New Technology with Geological and Technical Measures to Increase Production of Highly Viscous Oil

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ABSTRACT: It is known that the process of oil recovery mainly covers the crest of the reservoir, and the residual oil is concentrated in the periphery, drilling new wells is not economically feasible. Therefore, the intensification of oil production should be carried out using methods to increase the productivity of existing wells. Given the high viscosity of reservoir oil, for these purposes, it is recommended to introduce new technology andnew technological and technical solutions for oil production in difficult conditions with the use of sucker rod pumps.

KEYWORDS: viscosityoil, oil recovery, field deposits, reservoir, submersible pump, development, residual oil, rocks, pressure, mining, demulsifier, high viscosity, liquid

I. INTRODUCTION

Administratively, the South Mirshadi field is located in the Shurchinsky district of the Surkhandarya region of the Republic of Uzbekistan.The Denau - Tashkent railway and the Termez - Tashkent railway pass in the immediate vicinity of the deposit. The area around the deposit is densely populated. The nearest large settlement is the regional center Shurchi, where the railway station and the oil loading rack are located.Orographic structure South Mirshadi is a hilly plain covered with alluvial-proluvial deposits. The terrain has a general slope eastward towards the Surkhandarya River. The absolute marks of the relief are 473-780 m, in the north-west in the valley of the Surkhandarya River they decrease to 450-435 m.

Properties and composition of oil

Employees of O'ZLITINEFTGAZ JSC from 10.11.2007 to 16.11.2007 in well No. 2 took samples of reservoir oil from the interval 1461-1471 m, the tubing running depth - 1457 m. The formation pressure was 22.55 MPa, reservoir temperature 58 ° C. Selected samples of depth samples of reservoir oil were investigated by the method of one-time degassing on a phase equilibrium device manufactured by Alstom-Atlantik. As a result of experimental studies, the main parameters of reservoir oil were obtained (table 1)

- saturation pressure at reservoir temperature - 8.0 MPa;
- gas content - 8.5 m3 / m3; 9.2 m3 / t;
- volumetric coefficient - 1.042;
- density of stable oil - 925.3 kg / m3, reservoir - 896.4 kg / m3.

Comparison of the saturation pressure (Rnas - 8.0 MPa) with the value of reservoir pressure (Ppl = 22.55 MPa) allows us to conclude that the reservoir oil of the South Mirshadi field is unsaturated with gas.

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Physicochemical properties of oil

Table 1

Saturation pressure, MPa	Volume ratio	Gas content m3 / t	Density of oil in reservoirs. conditions in std. conditions kg / m3	Dynamic viscosity mPas kinematics. viscosity μm2 / s	Pour point, ° C	Temperature of the beginning of boiling of degassed oil, ° C	Content of light fractions, volume%, at temperature, ° C		Content, wt%		
							200	300	silica gel resins	sulfur	water
8.0	1,042	9.2	925.3 896.4	289.2 311.5	-18.5	220	nine	23	17.5	1.96	26

II. METHODOLOGY

New technological and technical solutions for oil production in complicated conditions with the use of sucker rod pumps

Normal conditions include practically vertical wells with low GOR and no noticeable harmful effect of gas on the operation of submersible pumps of any type, without sanding, producing medium viscosity oil, without active corrosion of underground equipment, without significant deposits of inorganic salts and paraffin.

In the presence of one or more of the listed factors that complicate the operation, the well passes into another category corresponding to the complicated factor: oblique (horizontal), sandy, with gas showings, prone to salt deposition, etc.

The most significant factors complicating the operation of sucker rod pumping units are: large curvature of the wellbore, high viscosity of the pumped liquid (oil and gas mixture), the presence of sand, the formation of deposits of inorganic salts and paraffin, the harmful effect of associated gas on the operation of the sucker rod pump.

According to high-viscosity oils, oils whose viscosity in reservoir conditions exceeds 30 mPa.s. It is noted that outside this viscosity, complications occur during oil production. High viscosity oils are classified into three groups. The first group consists of oils with a viscosity of 30-100 mPa s, the second - 100-500 mPa s, and the third - over 500 mPa s. The overwhelming number of high-viscosity oil fields in the Orenburg region belong to the first group. However, oils from a number of fields are characterized by a sufficiently high viscosity or oil production is accompanied by the formation of highly viscous emulsions.

Currently, the problem of lifting a high-viscosity liquid using sucker-rod pumping units is solved in several ways. One is to reduce the viscosity of the fluid in the formation, production casing, or tubing. The methods used are different in technical design and can be divided into two groups: supplying the well with chemical reagents - demulsifiers and solvents and heating the liquid before entering the pump.

The theoretical and practical aspects of the use of demulsifiers are considered in the work of a number of authors. The supply of demulsifiers into the well is used quite effectively in the practice of oil production. So, at USPTU, methods of supplying a chemical reagent both to the outside of the pipe space of the well and directly to the intake of the sucker rod pump have been developed and tested with a positive effect.

Methods have become widespread, consisting in mechanical action on the structure of a liquid or oil in order to destroy it. This method was developed and applied at NGDU Tuimazaneft (Bashkortoston) during the operation of the ESP wells.

For this purpose, VNII Petroleum used the "Auger" mounted in the liner before receiving the sucker rod pump.

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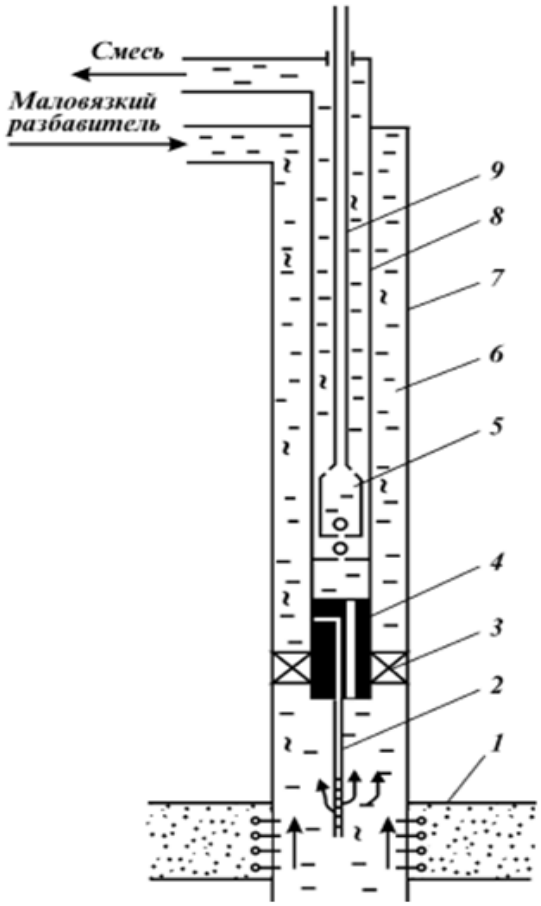

Sucker rod pumps for lifting viscous oil, developed at Orenburgneft

Taking into account the imperfection of existing technological schemes and equipment for lifting high-viscosity liquids to the day surface, in NPU JSCOrenburgneft ”developed and implemented several of our own equipment designs.

BoreholeThe sucker rod pump (Fig. 2), like the VNIISPT oil unit, is focused on the use of a diluent. The fundamental design difference is that the diluent is supplied not to the pump outlet, but to the intake area, and, therefore, the main drawback of the previous design is eliminated: the pump operates in a mixture environment, i.e. in a liquid of low viscosity. This was achieved by installing mixer 4 under the pump intake 5 and forming a channel for hydraulic connection behind the pipe space with the sub-pump area (see Fig. 2).

Figure: 2. Principal technological scheme of high-viscosity liquid supply with the help of sucker rod pump, developed in Orenburgneft JSC

The diluent according to this scheme is supplied through the tubular space, and the mixture of well fluid and diluent rises along the tubing.

One of the main elements of the considered scheme is a mixer of special design. The mixer (Fig. 3) is a system of channels through which the diluent is supplied to the pump intake area, and its mixture with a highly viscous liquid enters the pump. The dosage of the diluent into the well is controlled by the liquid level in the annulus and by changing the diameter of the hole in the choke 2. The valve 5 of the mixer allows it to be closed behind the tubular space during various technological operations, for example, flushing through tubing.

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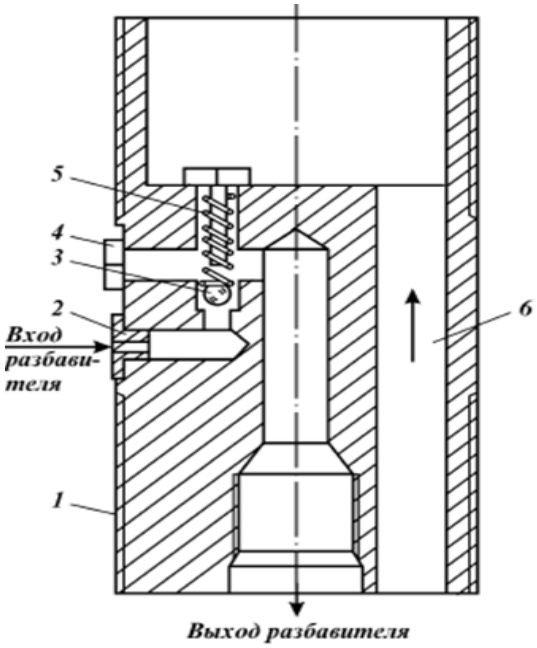

Figure: 3. Diagram of a diluent mixer with a high-viscosity downhole fluid:

The possibility of reducing the viscosity of a high-viscosity fluid by mixing it with less viscous oil has been experimentally confirmed in the field at Tananykskoe field.

III. CONCLUSION

Recommendation to use a new technology at the highly viscous South Mirshadi field

On project "Analysis and development of geological and technical measures to stabilize oil production at the South Mirshadi field" shows the calculations of the main indicators of thermal acid treatment of wells, steam-thermal treatment of the formation, increasing the productivity factor of wells in high-viscosity oil deposits using the technology of electrical impact. By calculations on project it can be seen that the period of operation of wells No. 2,6,11,14,15,16 with increased production rate is maximum 522 days, but the cost of material and technical with the scarcity is large enough.Deposits of high-viscosity oils South Mirshadi belong to the second group. Therefore, in order to increase the period of well operation with increased production rates, it is necessary to introduce new technologies developed and applied at NGDU Tuimazaneft, constant impact on the bottomhole formation zone, for such a conclusion high oil viscosity 289.2 MPa·from.

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